

PLUG IN TYPE RELAY

1. Introduction

A relay is an electromagnetic device, which is used for closing or opening of an electrical circuit. The relay may be classified as Shelf type and Plug-In-Type

Plug-in-type relays which are plugged in to pre-wired terminal boards. It works on electromagnetic principle. Each relay has a base electromagnet, armature, contact spring, contacts, transparent cover, and handle. A non-magnetic residual pin is fixed on the inner face of armature, in all relay except magnetic latch relays.

When current is applied through the coil, it sets up a magnetic flux through the bar magnet, core, L shape heelpiece and armature.

The flux causes armature to attract towards the pole face. Armature picks up and front contact closes. The residual pin maintains small air gap in attracted position.

When current interrupts, magnetic flux collapses the contact spring fixed above the armature helps in restoring to its full released position thus front contacts open.

1.1. Classification of Signaling Relays

Relays may be classified into various ways depending upon the following factors:

i) Mounting of relay

- Shelf Type
- Plug –in type

ii) Feed source

- DC Relay
- AC Relay
- Electronic Relay

DC relays are further classified as under

- Neutral
- Polar
- Neutral Polar

iii) Contact material

- Proved Type
- Non proved Type

iv) Application

- Track
- Line
- Special

v) Importance / vitality

- Vital
- Non Vital

Now a days Electronic relays are also used in signalling circuit to achieve time delay.

1.2 Definition**i) Non – fusible contacts**

A pair of contacts in which one contact element comprises of non – fusible material which present practically no risk of welding of contacts.

ii) Carbon contacts

“Carbon” in the expression “ Carbon to metal contacts” is used as a general term covering graphite and compounds and mixtures of carbon and metals.

iii) Metal contacts

Metal in the expression “Carbon to metal contacts” and “Metal to Metal contacts” is used as a general term covering the use of silver, silver cadmium oxide, tungsten, platinum or any other suitable material to an approved specification.

iv) **Front contact**

That contact which is made with the arm contact when the relay is energised.

v) **Back contact**

That contact which is made when the relay is de-energised.

vi) **Arm contact (Armature contact)**

That contact which is the movable part of the pair of contacts and makes with front contact when the relay is energised and with back contact when the relay is de-energised.

vii) **Arm**

The movable part of the pair of contacts.

viii) **Dependent contact**

The condition in which a movable arm contact connects to a front contact when the relay is energised. And the same arm contact connects to a back contact when the relay is de-energised.

ix) Independent contact

The condition in which the movable arm contact connects to either a front or a back contact but not to both.

x) Pickup value (Operate value)

The value of the current or ampere turns which is just sufficient to close all the front contacts of relay under specified conditions.

xi) Drop –away (release) value

The value of the current or ampere turns at which all the front contacts of relay get open under specified conditions.

xii) Proved type Relay

Means a relay having Metal to Metal contacts. They are used for controlling non vital circuits and hence also called as non vital relays.

xiii) Non proved Relays

Means a relay having Metal to Carbon contacts, as front contact. They are used for controlling vital circuits and hence also called as vital relays.

1.3 Comparison between Shelf and Plug in type relays

| Sr. | Shelf type relays | Plug - in -type relays |
|-----|--|--|
| 1 | Mounted on Shelf | Plugged in to the board. |
| 2. | Heavy and Large | Light and compact. |
| 3. | More space required | Less space required. |
| 4. | Less No. of contacts | More no. of contacts. |
| 5. | Replacement takes more time | Quicker and easy. |
| 6. | Circuit must be tested after replacement, due to chances of dislocation of wiring. | Circuit need be tested for contact is making after replacement. |
| 7. | Coding arrangement is not required. | Coding is needed on the relay to avoid interchangeability with relay of different contact configuration. |
| 8. | Anti tilting arrangement is required | Not required |
| 9. | Pre- wiring is not possible. | Pre- wiring is possible. |

Table-1

1.4 Metal to carbon & Metal to metal Relay

◆ Metal to carbon Relay

All shelf type relays, “Q” series relays and all “G” type relays except S1 type are metal to carbon relays.

◆ Metal to metal Relay

These relays are also known as Proved type relays.

1.5 Track and Line Relay

◆ Track Relay

Track relays are relays, which is directly connected across the rails of the track to detect the occupation of track.

◆ Line Relay

Line relays are used for any other purposes other than track circuit.

■ **Difference between track and line relays**

| Sr. | Track Relay | Line Relay |
|------------|---|---|
| 1 | Directly connected across the track circuit. | Any relay other than track. Such as HR, DR, NWKR etc. |
| 2 | Functions with less or more current. | Functions either with normal supply voltage or with no supply at all. |
| 3 | Always associated with loss of energy. Preferably should work with low power consumption. | Not so. |
| 4 | More sensitive to variation in supply so percentage release should be high. | Comparatively low in percentage Release. |
| 5 | Reliability of operation is very important since the facility to prove the de-energisation of the relay is not available. | Back contacts are proved in the circuits. |
| 6 | Non fusible contact for front contact is Necessary. (carbon) are used. | Not necessary. |

| Sr. | Track Relay | Line Relay |
|-----|--|---|
| 7. | Coil resistance is low permitting low working voltage which reduces ballast leakage current. | Coil resistance is high to work on low current which reduces line voltage drop. |

Table-2

2. Plug In Type Relays

These are Miniature, Proved/ Non Proved, plug -in type relays. Some of the commonly used Plug-in type relays in Signaling are listed below

Non proved Type

- 2.1 Style "Q" Relays (Metal to Carbon)
- 2.2 Style "G" Relays(Metal to Carbon)
- 2.3 "P" Type Relays (Metal to Carbon)

Proved Type

- 2.1 Siemen 's Relays (Metal to Metal)
- 2.2 IHC'S relay (Metal to Metal)
- 2.3 Hytronicis Relays (Metal to Metal)

Note- Siemen 's (k-50 Relays) are M to M type and all other type relays mentioned above are M to C relays except SI relays of type G relay. Out of these relays "P" type relays are obsolete now.

■ **Common features of plugging type relay.**

- ◆ Standard plug boards are used for each type of relays for mounting the same.
- ◆ Pre-wiring facilities are available for each type of relay.
- ◆ Facilities are available for terminating the wiring on plug board connectors both by crimping or soldering.
- ◆ All relays are provided with registration devices with specified coding combination to prevent plugging in wrong relay
- ◆ Unless code pins are correctly engaged no electrical connection between the relay and the plug board connector is possible.

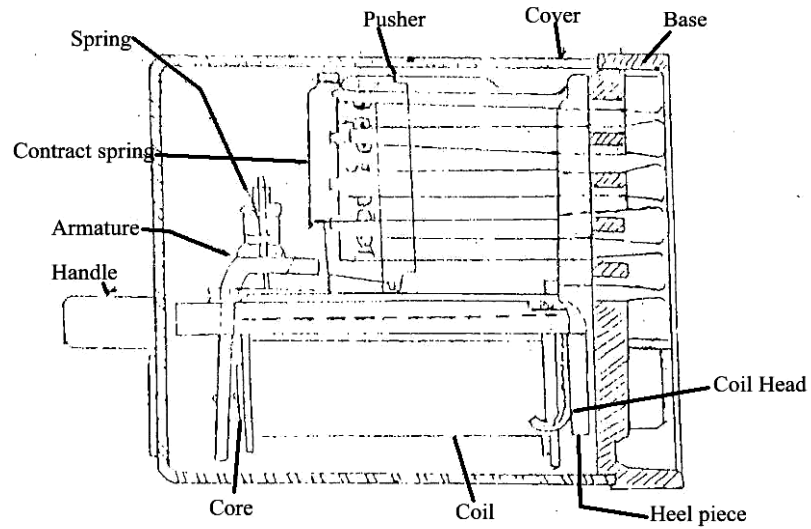
■ **Non Proved Type Plug- In -Relay**

For their front contacts, these relays make use of M to C contact. Normally following two styles of relays are in use under this group :

- ◆ Style “Q”
- ◆ Style “G”

2.1 “Q”- Series Relays

- This series of plug –in relay consists of more than 25 varieties. Out of which about 12 varieties are very commonly used on Indian Railways.
- These relays normally Operate on 12,24 or 50V DC and can be provided with a max. of 16 independent contacts.



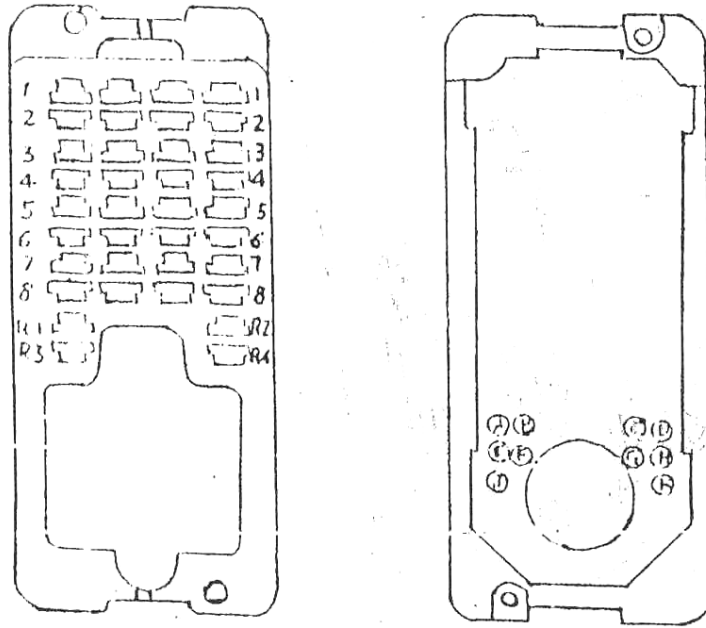
(Figure-1)

■ Plug board for “Q” series relay

- This is divided into 4 vertical columns (A.B.C.D.) and 10 horizontal rows numbered as 1 to 8 from top to bottom.
- The 9th and 10th rows are for coil terminals (R1,R2,R3 & R4) .
- Plug board is a one piece molding of the same material as that of the relay base.
- It is supplied with a wire clip, the purpose of which is to retain the relay on the plug board tightly by engaging with a groove provided in the handle of the relay.

■ Registration Device

- Each relay is fitted with code pins commonly known as Registration Device to prevent against plugging of relay in a wrong base.
- For this purpose 10 pin positions numbered as A,B,C,D,E,F,G,H,J,& K are assigned on the relay base for fixing the pin.
- Plug board is provided with corresponding hole position which allows the relay base pins to fit while plugging.
- Out of the ten only five pins are used on the relay base & corresponding holes are drilled in the plug board for the purpose of providing passes to the pins fitted in the relay base.
- Under this arrangement 252 different codes can be formed.
- Relays of the same type having different contact arrangement will have different code numbers.
- Plug board front & rear view is shown in the fig. given below.



Rear View Front View
(Plug Board for 'Q' Series Relay)
(Figure-2)

- **Contact Arrangement**
 - QN 1 Relay can be have max. 16 Nos. of independent contacts.

- **Types of Q- Series Relays**

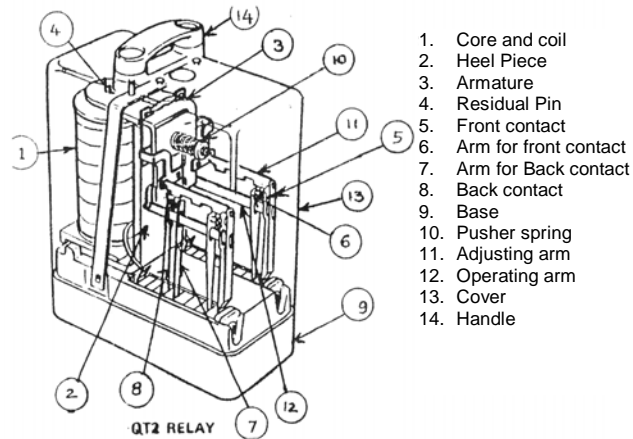
Q – Series relays are following type.

- 2.1.1 Track Relay
- 2.1.2 Line Relay

2.1.1 Track Relay

◆ QT2 Style Relay

- The construction of this relay is similar to that of a Q – Series line relay except that its contact load is reduced drastically.
- The relay is more sensitive and workable on a low voltage.
- Earlier version of this type is QT1 relay.
- QT1 relay has a double core magnet with 2Fcontacts while QT2 relay has only one core and 2F – 1B contacts.
- The back contact is used for cross protection for TPR circuit. This has a single coil unlike the shelf type relay, which has two coils with open ends.



(Figure-3)

■ QTA 2 relay (AC Immunised Relay)

- This is similar to QT2 relay except a copper slug.
- This copper slug is provided on the core to achieve AC immunity.
- Its AC immunity is not less than 75 Volt.
- QTA2 relays are available in 9 Ohms coil resistance.
- This relay requires more D.C. operating power and it take more time to pick up and drop due to the copper slug.

■ QBAT relay

- This relay has a A.C. immunity level of 80 Volt A.C.
 - This is achieved by the provision of a biasing permanent magnet on its core along with its copper slug.
 - This is made to RDSO specification. No. 84 / 88.
- ◆ The particulars of the Q- series track relay (plug-in-types) are tabulated as under.

■ Data Sheet For Q-Series Track Relays (Plug –In Type)

| S.No | Relay Style | Description | B. R.B Spec. No. | Relay Spec. No. | Contacts | Coil Res. (ohms) | Code Pin Position | Nominal PU Volts |
|------|-------------|---|------------------|-----------------|----------|------------------|-------------------|------------------|
| 1 | QT2 | Plug In Type Non – Imm. DC Track. Relay | 938 A | 26/6 | 2F. 1B | 9 | --- | 1.4 |
| 2 | „ | „ | „ | „ | „ | 4 | EHJK X | 0.5 |
| 3 | QTA2 | Plug In Type Non – Imm. DC Track. Relay | 939 A & 966 F2 | 27/7 | „ | 20 | ---- | 2.0 |
| 4 | „ | „ | „ | | | 9 | FGH KX | 1.4 |
| 5 | QBAT | „ | „ | 84/88 | 2F. 2B | 9 | ABEJ X | 1.75 |

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| S.No | Relay Style | Max P.U. Volts | Max P.U. Current (MA) | Min P.U. Volts | Min. P.U. Current (MA) | Max. Permissible Volt | Min. regd. Volts |
|------|-------------|----------------|-----------------------|----------------|------------------------|-----------------------|------------------|
| 1 | QT2 | 1.158 | 117 | 0.834 | 103 | 300% PUV | 125% PUV |
| 2 | „ | 0.515 | „ | 0.370 | „ | „ | „ |
| 3 | QTA2 | 2.020 | 92 | 0.460 | 81 | „ | „ |
| 4 | „ | 1.380 | 140 | 0.970 | 120 | „ | „ |
| 5 | QBAT | 1.733 | 175 | 1.134 | 140 | 235 % PUV | 122% PUV |

| S. N | Relay Style | Min. % Rel. | P.U. Time (mS) | D.A. Time (ms) | A . C. Imm. (Volts) | Usage |
|------|-------------|-------------|----------------|----------------|---------------------|--|
| 1 | QT2 | 68 | | 60 | -- | in non – RE Areas. |
| 2 | „ | „ | | „ | -- | in non – RE Areas. |
| 3 | QTA2 | „ | | 120 | 50 | Upto 450 meters track Circuit Lengths in RE Areas. |
| 4 | „ | „ | | | 50 | „ |
| 5 | QBAT | „ | 100 | | 80 | Upto 750 meters track Circuit Lengths in RE Areas. |

Table-3

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2.1.2 Line Relay

◆ QN1 Style Relay

- This is used for all control and detection circuit except in external circuits of AC RE area.
- Its specification No is B.R. No: 930A.
- Though it is immune to 300 Volt AC 50Hz but only in emergencies can be used in RE area with protection against AC Interface.

◆ QS3 Style Relay

- This is sensitive line relay.
- It works on a low current. It works on 12V DC. QB3 relay is also of this type.
- It is made to B.R. Specification 930A.
- QB3 relay is biased neutral line relay.
- Two relays of this type is used in parallel on Tokenless block instrument to detect the line current polarity in place of a polar relay.
- Biasing stands good for 240 Volt DC.

◆ QNN1 Style Relay

- This comprises two neutral line relays whose contacts and magnets are mounted side by side with a common heel piece on a base.
- BR specification 960.
- These two relays operate independently to each other.

- They have equal number of front and back contacts.

■ **AC Immunised DC neutral line relay**

- This is made to IRS Specification No. S60 –78. Some important provisions are as under
- The relay design shall be inherently such that the immunisation is achieved intrinsically without use of any external means.
- The relay shall not make any of its front contacts when 1000 V (r. m. s) of 50 Hz AC is applied at any instant to the terminals of relay coils.
- The relay shall not break any of its back contacts when 300 V (r. m. s) of 50 Hz AC is applied at any instant to the terminals of relay coils.

■ **AC Immunised Q- style line relays**

AC Immunised Q- style line relays, commonly used in signaling are as under.

◆ **QNA 1 Relay**

- The immunisation is achieved by provision of a copper slug on the core at its armature end.
- In all other respects, it is similar to QN 1.
- Its Specification is BR specification no. 931A.

◆ QBA1 Relay

- This is a DC biased AC immune neutral line relay.
- A copper slug is provided on the core for immunisation and a permanent magnet is provided on the core for Biasing.
- It does not operate if 20 times of the rated voltage is applied in reverse direction.
- It's specification is BR Specn No. 932 A.

◆ QBCA 1 Relay

- This is similar to QBA 1 relay but having two heavy-duty front contacts.
- Its Specification is BR specification no. 943A.

◆ QSPA 1 relay

- This made to BR specification no. 933A.
- Only this relay is permitted to be used as the repeater for immunised 'Q' series track relays, due to its slow to pickup character.
- Provision of a copper slug between the core and the heel piece behind and a magnetic shunt between the core and the armature at the front contact make this relay

➤ **Feature of QSPA1 relay is as under.**

- Slow to pick up by 540 /600 seconds.
- Less slow to release by 140 / 200 seconds and immune to AC.

◆ **QSRA 1 relay**

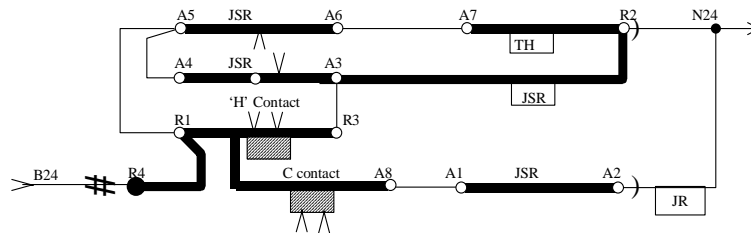
- This is made to B.R. Specification No. 934 A.
- By provision of a copper slug it is made AC immunised and by a magnetic shunt delayed release feature is obtained.
- The copper slug and magnetic shunt are provided in the same rear side of the core.

■ **Time Element Relay**

- ◆ Relays used for getting time lag are called as TIME ELEMENT RELAY.
- ◆ These relays are used in the signaling circuits to release interlocking after certain period of time to ensure safety.
- ◆ Normally following types of Time Element Relays are in use.
- ◆ DC Thermal type
- ◆ Siemens Motorised Clock Work time relay
- ◆ Motor type
- ◆ Electronic type
- ◆ Out of the above 4 types of Time Element Relay DC Thermal and Electronic type are most commonly used.

◆ **DC Thermal Type Element Relay (QJ1)**

- This type of relay employs heat operated contact associated with an ordinary DC Neutral Relay.
- It has a heating element (H) and a neutral line relay (R) which together energise an external line relay after a pre –set time delay.
- One of such type is “QJ1” type relay.
- The details of this relay is given below :
 - Rated Voltage 24 V DC or 50 V DC
 - Heat coil resistance 40 to 42 Ohms
 - Max. heating power 15 Watt at rated supply Voltage.
- The Maximum numbers of operations should be restricted to 100 / day otherwise characteristics of the heating element may change.
- An increase of 10 % in applied voltage may result in a time decrease of up to 10% .
- An decrease of 10% in applied voltage may result in a time decrease of up to 20% .



**Circuit for time element relay
(Figure-4)**

◆ **Fail safe Electronic Timer**

- Now a days fail safe Electronic Timer are being used to achieve time delay either by charge, discharge method or counting by clock pulse or integrated circuits.

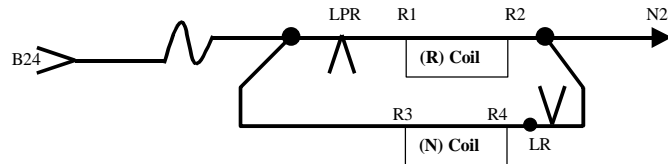
◆ **Siemens Motorised Clockwork Timer**

- This relay works on 11 OV A.C. +/- 10%.
- It has a time range of 1 to 5 minutes.
- The time can be adjusted.
- Its reseating is automatic.
- A synchronous motor drives and switches over contacts after the lapse of preset time.
- If the energising circuit is prematurely interrupted, the mechanism returns to its normal position before actuating the contacts.
- Two or three helper relays of K 50 type (AJTR1, AJTR2 AND AJTR3) are used Along with this relay for time control of circuits.

◆ **QL1 relay**

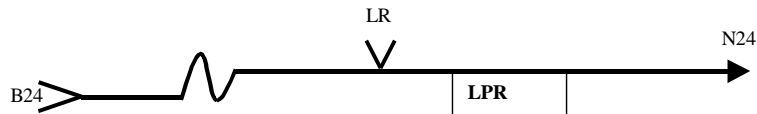
- This made to BR specification no. 935A.
- This is a magnetically latched DC line relay. This relay remains in full operated condition though the feed to the relay is cut off.
- This relay has two coils namely operate coil (R) and release coil (N) and a permanent magnet.

- When feed to “R” coil is applied the relay get energised.
- As soon as it is energised the feeds to this coil cuts off through the back contact of repeater relay.
- The relay remain in pick up condition due to the permanent magnet, provided near the core, because the magnet flux in the core is just sufficient to hold the armature against the pusher sparing pressure.



(Figure-5)

- To release the relay feed is applied to the “N” coil. This sets up a flux in the core which is equal and opposite to the permanent magnetic flux and neutralises it.
- The pusher spring and gravity normalise the armature.
- Feed to the “N” coil gets cut off after the release of armature due to the inclusion of a front contact of the relay in series with the release coil.



(Figure-6)

◆ **QBCA1 relay**

- It is made to the specification to specn No. 943. It has two heavy duty front contacts and four back contacts of standard contact rating. The front contacts can carry and switch upto 30A inductive current at 110V.DC. Spark quenching is done by two blow out (natural magnet) magnet provided on a bracket by the side of the front contacts.
- These relays can be used for 24 V DC as well as 110V DC point machine. These relays are immune to 120V, 50HZ abrupt application for AC Voltage. The minimum front contact pressure is 56 grams instead of 28 grams for the c to m contacts of other relays.

■ **The operating characteristics of the relays, which are commonly used under this series, are tabulated as under.**

| SN | Description | style | Contact Arrangements | Rated Voltage | Reg. Ohms |
|----|-------------------------------|-------|-------------------------------|---------------|-----------|
| 1 | Neutral | QN1 | 12F/4B,8F/8B, 6F/6B, 8F/4B | 24 V. DC | 400 |
| 2 | Neutral | QN1 | 12F/4B,8F/4B, 8F/8B | 50 V. DC | 1600 |
| 3 | AC Immunized DC Neutral | QNA1 | 12F/4B,8F/8B, 8F/4B | 24 V. DC | 195 |
| 4 | AC Immunized DC Neutral | QNA1 | 12F/4B,8F/8B, 8F/4B | 50 V. DC | 1079 |

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| SN | Description | style | Contact Arrangements | Rated Voltage | Reg. Ohms |
|----|------------------------|-------|----------------------|------------------------------------|------------------|
| 5 | Magnetically Latch | QL1 | 11F/4B, 8F/6B | 24V DC | PU 145 TD 680 |
| 6 | Magnetically Latch | QL1 | 11F/4B, 8F/6B | 50V DC | PU 670 TD 754 |
| 7 | AC Lamp Proving | QECX1 | 4F | 0.25 Amp. AC | 39 |
| 8 | DC Track | QT1 | 2F | 0.5V DC | 4 |
| 9 | AC Immunized | QTA1 | 2F | 1.4V DC | 9 |
| 10 | Thermal Time Element | QJ1 | 2F/1B | 24V DC | 360 |
| 11 | Thermal | QJ1 | 2F/1B | 50V DC (1640) (174 - 182) | N# T# |
| 12 | Neutral | QN1 | 12F/4B | 24 VDC | 400 |
| 13 | Neutral | QN1 | 8F/8B | 24 VDC | 340 |
| 14 | AC Immune Neutral | QNA1 | 12F/4B | 24 VDC | 200 |
| 15 | AC Immune Neutral | QNA2 | 4F/2B | 24 VDC | 1112 |
| 16 | AC Immune Biased Track | QBA1 | 2F/2B | 1.75V DC | 9 |

(Table-4)

- The particulars for Q- series neutral line relay is shown table below.

Data sheet for 'Q' series neutral line relay

| S. No | Relay Style | Description | B.R.B Spec. No. | Relay Spec. No. | Contact Arrangement. | Code No. | Code Pin Positions |
|-------|-------------|-------------------------------|-----------------|-------------------------|----------------------------|----------|--------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 1 | QNI | D.C. Neutral Line Relay | 930A | 01/16 01/18 | 12F. 4B 8F. 4B | 001 | ABC DE |
| 2 | „ | „ | „ | 01/17 01/19 01/20 | 8F. 8B 6F. 6B 4F. 4B | 002 | ABC DF |
| 3 | „ | „ | „ | 01/21 01/23 | 12F. 4B 8F. 4B | 003 | ABC EF |
| 4 | „ | „ | „ | 01/22 01/24 01/25 | 8F. 8B 6F. 6B 4F. 4B | 004 | ABD EF |
| 5 | QS3 | „ Sensitive | „ | | 4F. 4B | | CDE KX |
| 6 | QNNI | „ (2-relay unit) | 960 | 19/1 | 6F. 2B | 092 | ACD EK |
| 7 | „ | „ | | 19/2 19/3 | 4F. 4B 2F. 2B | 057 | ACE HJ |
| 8 | QB3 | D.C. Blassed Line Relay (N/I) | -- | PTJ/ QB3 | 6F. 2B | -- | ABF GX |

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| S. No | Relay Style | Description | B.R.B Spec. No. | Relay Spec. No. | Contact Arrangement. | Code No. | Code Pin Positions |
|-------|-------------|--------------------------------|-----------------|-------------------------|----------------------------|----------|--------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 9 | QNAI | A.C. Immune DC/NL Relay | 931A | 05/11 05/13 | 12F.4B 8F . 4B | 021 | ABD FH |
| 10 | „ | ” | „ | 05/12 05/14 05/15 | 8F. 8B 6F. 6B 4F. 4B | 022 | ABD GH |
| 11 | QBAI | D.C. Biassed ACI (N/L) Relay | 932A | | 12F.4B 8F . 4B | | |
| 12 | „ | ---do--- | „ | | 8F . 4B | | |
| 13 | QBCAI | DC biassed ACI contactor Relay | 943 | | 2F (HD) 4B | 170 | BCE JK |
| 14 | QSPAI | Slow Pick Up ACI N/L Relay | 933A | 11/ 1 | 8F. 4B | 041 | ABD EJ |

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| S. No | Relay Style | Description | B.R.B Spec. No. | Relay Spec. No. | Contact Arrangement. | Code No. | Code Pin Positions |
|-------|-------------|-------------------------------|-----------------|-----------------|----------------------|----------|--------------------|
| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| 15 | QSRAI | Slow Release ACI N/L Relay | 934A | 08/ 13 | 8F. 4B | 061 | ADE FJ |
| 16 | QLI | DC Magnetic Latch Relay | 935 | 09/ 05 | 8F. 6B | 007 | ABC EG |
| 17 | „ | -Do- | „ | 09/ 03 | 11F. 4B | 009 | ABDE G |
| 18 | QJI | DC thermal Time element Relay | 937 | | 2F-1B | | AFGH K |

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| S. No | Relay Style | Coil Res. (Ohms) | Wkg. Volt. (volts) D.C. | Max. PUV (volts) | Min. PUV (volts) | Min. DAV (volts) | A.C. Immunity (volts) |
|-------|-------------|------------------|-------------------------|------------------|------------------|------------------|-----------------------|
| 1 | 2 | 9 | 10 | 11 | 12 | 13 | 14 |
| 1 | QNI | 340 to 470 | 24 | 19.2 | -- | 3.6 | 300 |
| 2 | " | " | " | " | -- | " | " |
| 3 | " | 1000/1500 | 50 | 40.0 | -- | 7.5 | -- |
| 4 | " | " | 50 | " | -- | " | -- |
| 5 | QS3 | 1000 | 12 | 9.35 | 7.5 | 3.75 | -- |
| 6 | QNNI | 470 | 24 | 19.2 | -- | 3.6 | -- |
| 7 | " | " | 24 | 19.2 | -- | 3.6 | -- |
| 8 | QB3 | 200 | 12 | 9.6 @ (45mA) | 8.0 | -- | -- |
| 9 | QNAI | 208 | 24 | 19.2 | -- | 3.6 | 300 |
| 10 | " | 208 | 24 | " | -- | " | " |
| 11 | QBAI | " | 24 | " | -- | " | 300 |
| 12 | " | " | " | " | -- | " | " |
| 13 | QBCAI | 208 | 24 | 19.2 | -- | 3.6 | 300 |
| 14 | QSPAI | " | " | " | -- | " | 120 |

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| S. No | Relay Style | Coil Res. (Ohms) | Wkg. Volt. (volts) D.C. | Max. PUV (volts) | Min. PUV (volts) | Min. DAV (volts) | A.C. Immunity (volts) |
|-------|-------------|------------------|-------------------------|------------------|------------------|------------------|-----------------------|
| 1 | 2 | 9 | 10 | 11 | 12 | 13 | 14 |
| 15 | QSRAI | „ | „ | „ | -- | „ | 120 |
| 16 | QLI | R-150 N-680 | „ | „ | 9.6V | -- | -- |
| 17 | „ | „ | „ | „ | „ | -- | -- |
| 18 | QJI | H-40 JSR-400 | „ | „ | -- | -- | -- |

| S. No | Relay Style | P.U. Time (m. sec) | D.A. Time (m. sec) | Contact Rating Contiu Ous | Current (Amps) Switching | Usage & other Remarks |
|-------|-------------|--------------------|--------------------|---------------------------|--------------------------|--|
| 1 | 2 | 15 | 16 | 17 | 18 | 19 |
| 1 | QNI | 150 | 20 | 3 | 2 | All ccts. Of Non-RE & Internal ccts. Of RE. In Emergency ccts. Of RE area. |
| 2 | „ | „ | „ | „ | „ | „ |
| 3 | „ | „ | „ | „ | „ | Used as Track Relays with AFTC |
| 4 | „ | „ | „ | „ | „ | „ |

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| S. No | Relay Style | P.U. Time (m. sec) | D.A. Time (m. sec) | Contact Rating Contiu Ous | Current (<u>Amps</u>) Switching | Usage & other Remarks |
|-------|-------------|-----------------------|-----------------------|---------------------------------|--------------------------------------|--|
| 1 | 2 | 15 | 16 | 17 | 18 | 19 |
| 5 | QS3 | -- | -- | .. | .. | In place of shelf type relays : Ex: EVR & SUPR of AXC's |
| 6 | QNNI | -- | -- | .. | .. | All ccts. Of non- RE & Internal ccts of RE Area |
| 7 | .. | -- | -- | .. | .. | |
| 8 | QB3 | 380 | 20 | .. | .. | CRRS of PTJ make T/less Blpck Instt. |
| 9 | QNAI | 220 | 70 | .. | .. | External circuits Of R.E. Area |
| 10 | .. | .. | .. | .. | .. | |
| 11 | QBAI | | | .. | .. | ---do--- |
| 12 | .. | | | .. | .. | |
| 13 | QBCAI | | | 30A-F 3A-B | 30A -F 2A-B | Point Machine Control in R.E. area. |
| 14 | QSPAI | 540 / 600 | 140/ 200 | 3A | 2A | For TPRs with QTA26 OBAT Track Relays. |
| 15 | QSRAI | -- | 260 0 19.2 V | .. | .. | For use in AC RE area |

Plug in type Relay

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| S. No | Relay Style | P.U. Time (m. sec) | D.A. Time (m. sec) | Contact Rating Contiu Ous | Current (<u>Amps</u>) Switching | Usage & other Remarks |
|-------|-------------|---------------------------------|-----------------------|---------------------------------|--------------------------------------|---|
| 1 | 2 | 15 | 16 | 17 | 18 | 19 |
| 16 | QLI | -- | -- | „ | „ | TCFR and TOTR of PTJ make T/less Block |
| 17 | „ | -- | -- | „ | „ | |
| 18 | QJI | 30/ 60/ 90/ 120 Sec | -- | „ | „ | |

(Table-5)

2.1.3 Q- style lamp proving relays

- ◆ These relays are used in the signaling circuits for proving the intactness of the filament of signal lamp.
- ◆ Normally following types of lamp proving Relays in use are shown in table below.

Data sheet for Q-series lamp proving relays.

| S. No | Relay Style | IRS Spec . No. | Relay Type No. | Contact Arrange- Ment | Pin Code No. |
|-------|--------------------|----------------|-----------------------------|--------------------------|--------------|
| 1 | QECX1 (OFF/ ON) | 941 A | 13/1 (WSF) | 4F | 071 |
| 2 | QECX12 (OFF) | ” | 13/11 (WSF) | 4F | -- |
| 3 | QECX13 (ON) | ” | 13/12 (WSF) | 4F | -- |
| 4 | QECX14 | ” | 13/13 (WSF) | 4F – 4B | -- |
| 5 | QUCX1 | 942 A | 13/9 (WSF & Crompton) | 2F – 2B | -- |
| 6 | QECX51 | 941 A | Crompton make | 4F – 4B | -- |
| 7 | QECX51 | ” | ” | 4F – 4B | -- |

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| S. No | Relay Style | Code Pin Position | Coil Res. (Ohms) | Rated current | Voltage Drop @250 mA Current | Max Full Operate Current |
|-------|----------------------|-------------------|------------------|---------------|------------------------------|--------------------------|
| 1 | QECX 1 (off / on) | ABCDK | 35 | 400 mA | 9 ± 0.6 V.A.C | 180 mA |
| 2 | QECX 12 (off) | „ | 4.7 | „ | -- | 120 mA |
| 3 | QECX 13 (on) | CFKMX | „ | „ | -- | 225 mA |
| 4 | QECX 14 | CFJKM | „ | 650mA | -- | 220 mA |
| 5 | QUC X1 | CFKLX | 0.76 | 1400 mA | 3.3 V.A.C | 780 mA |
| 6 | QECX 51 | -- | -- | 400 mA | 9 V.A.C | 180 mA |
| 7 | QECX 51 | -- | -- | „ | | 75 mA |

Plug in type Relay

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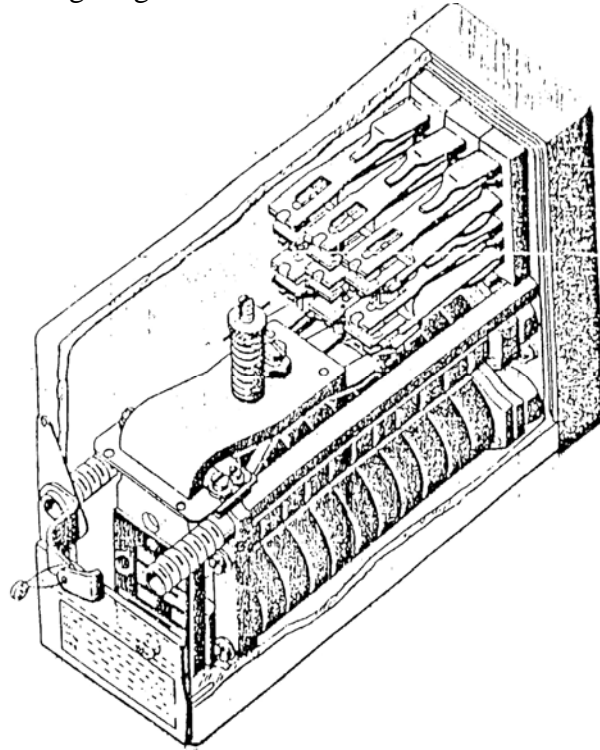
| S. No | Relay Style | Min. Release Current | Max. Release Current | Typical Interruption Time | Usage |
|-------|-----------------|----------------------|----------------------|----------------------------------|-------------------------------------|
| 1 | QEC X1 (off/on) | -- | 110 mA | 100 ms @180 mA 200ms @ 250 mA | SL 35 Lamp |
| 2 | QEC X12 (off) | -- | 60 mA | 100 ms @110 mA | SL,17/SL,21 (DECR) |
| 3 | QEC X13 (on) | -- | 120 mA | 100 ms @120 mA | SL,17/SL,21 (RECR) |
| 4 | QEC X14 | -- | 70 mA | ” | SL,17/SL,21 (DECR) |
| 5 | QUC X1 | 590 mA | 520 mA | -- | SL, 33 Direction Type R/1 (4F . 4B) |
| 6 | QEC X51 | -- | 110 mA | -- | SL,17/SL,21 (RECR) |
| 7 | QEC X51 | -- | 35 mA | -- | SL,17/SL,21 (DECR) |

(Table-6)

2.2. Style “G” plug in Relays

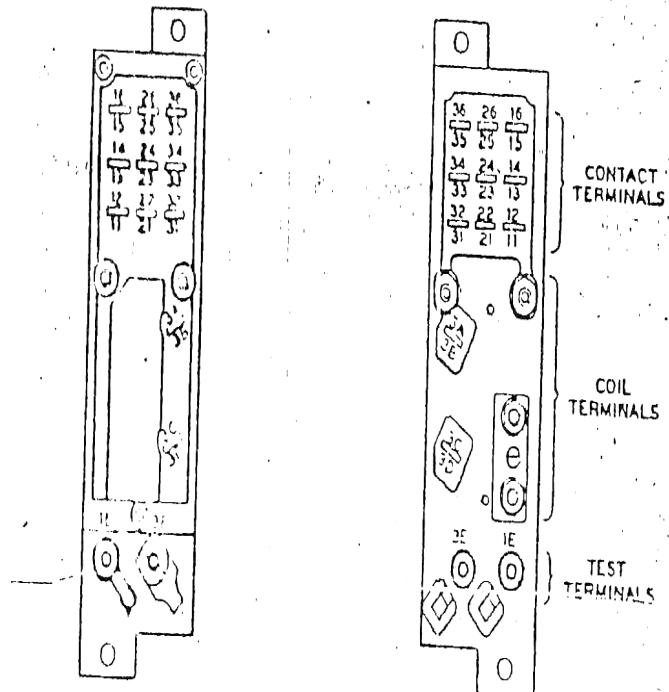
◆ Plugging arrangement

- Correct plugging arrangement is achieved by means of providing holes in the base plate and the corresponding code pins in the plug-board.
- Rear and the front view of the plug-board is shown in the figure given below.



Plug in type Relay

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Front view

Rear view

GN 1 Relay

Plug Board

(Figure-7)

◆ **Registration Device**

- The registration feature prevents plugging of a relay in wrong place.
- It consists of two plates one with holes and other with pins.
- The female plate is attached with the base of relay while the plate with pins is attached to the plug-board.
- There are 33 positions for holes in the registration plate with corresponding pin position in the plug-board.
- Any four out of 33 position are drilled in the registration plate and corresponding four pins are fitted to the relay plug-board.

◆ **Insulators**

These are made of molded bakelite and fit into slots in the plu-bard. Each plug board is provided with 11 numbers of insulators, which are held in position tightly by nylon clip.

◆ **Special Features**

There are two test terminals on the plug board.

◆ **Current test terminal**

Two-check current flowing through the relay coil a current test terminal is provided on the plug-board directly under the relay. A special tool can be attached two the terminal to open the circuit to the coil insert a milli-ammeter.

◆ **Voltage Test Terminal**

To provide a simple means of checking Voltage across the relay coil a voltage test terminal is provided on the plug-board directly under the relay. Voltage can be read by connecting a voltmeter across the voltage test terminals.

◆ **Guide rods**

Two guide rods each 8.5” long extending from the face of plug-board helping & guiding the relay in correct alignment with the plugs on the plug-board.

Each rod has Knurled nut and a lock nut to screw the relay on its plug-board.

◆ **Contact arrangement**

A maximum of 6F/B dependent contacts can be accommodated in “G” series relay. In which back contacts are M to M and front contacts may be M to M or M to C.

Standard contacts arrangements are 6 F/B, 4F/B & 2F/B.

- ◆ In this series the following varieties of relays are available.

| S N | Descripti on | Style | Contact Arrange ments | Rated Volts | Coil Res. Ohms | Rem ark |
|----------------|---------------------------|--------------|--------------------------------------|------------------------|-------------------------------|-----------------------------|
| 1 | Neutral | GN1 | 6F / B | 12 DC | 500 | |
| 2 | Pt. Contactor Relay | S1 | 4F / B | 12 DC | 500 | |
| 3 | Over Load (OR) | GOL | 2F / B | ----- | PU 0. 064 HO 135 | Cure nt sensi tive |
| 4 | AC Immune Neutral | GNA 1 | 6F / B | 12 DC | 500 | |
| 5 | Track | GT1 | 4F / B | ----- | 9 | |
| 6 | Track | GTA 1 | 4F / B | ----- | 9 | |

Table-7

3. Maintenance Checks

3.1 During maintenance visit relays should be checked visually for the following.

- Cleaning shall be done regularly so that dust is not deposited on the relay.
- There is no loose connection on the terminals, plug in relays is fitted tightly & the sealing is intact.
- Metal contacts are not blackened due to arching.
- There is no pitting of carbon contacts.
- No foreign materials are inside the relay.
- There is no rusting or sulphation on the parts.
- Relays are not due for P.O.H.
- Track Relay drops properly with 0.5 Ohms shunt.
- Over energisation is not more than 300% of it's P.U. value for Plug in Type Relays.

3.2 Stipulations of S.E.M. on the requirements & schedule of periodical inspection and overhauling of relays.

All vital relays should be inspected visually once in every two and three years for Track & Line Relay respectively in respect of the following.

- Movement of armature and contact carriage,
- Wiping of contacts,
- Arching of contacts if any,
- Pitting or charring contacts,
- Dust on contacts,

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- Electroplating,
 - Corrosion rusting of contacts,
 - Cracks or breakage in components,
 - Presence of fungus,
 - Charring of cover near contacts,
 - Corrosion of label.
 - Presence of seal.
-
- All proved type relays should be checked and their contacts cleaned at site, if required, at the time of failure.
 - If failure persists, the relay should be removed and sent for overhauling.

3.3 Overhauling

- All types of track relays should normally be overhauled every 10 years subject to a maximum of 12 years.
- Date of overhauling should be counted from the date of manufacture.
- The Railways depending upon intensity of traffic and other local conditions may reduce the periodicity of overhauling of the relays.
- All metal to carbon contact plug-in type relays other than track relays should be overhauled only when they are removed from service after a failure.

4. Do's and Don'ts

4.1 Do's

- Use standard plug board as per registration device with specified code-pin of relay if required to replace any plug board.
- Wiring clip is properly locked in relay plug board.
- Ensure that QNA1 relay is used in external circuit and QN1 is in internal circuit.
- Check the sealing of relay.
- Replace the relay immediately if relay contacts are black or pitted.
- Retaining clips for holding the Q-type relay is intact properly and latches at relay handle.
- Store the relay in dry place and away from dust.
- Always carry the relay through its handle.
- Ensure that numbers of wires terminated in the relay are as per wire count register.
- After modification in any circuit the relay contact must be registered in wire count register.
- Replace the relay under proper disconnection memo.
- Write relay identification as per signal-vice and circuit-vice.
- Check the release time of slow acting or timer relay.

4.2 Dont's

- Do not drill any hole in plug board for plugging the deferent type code pin relay.
- Do not disturb the leasing of relay wiring.
- Do not by pass the relay contact at the time of failure.
- Do not replace any relay during train movement.
- Do not break the seal for cleaning of relay contact.
- Do not used QN1 relay in place of QNA1 relay.

