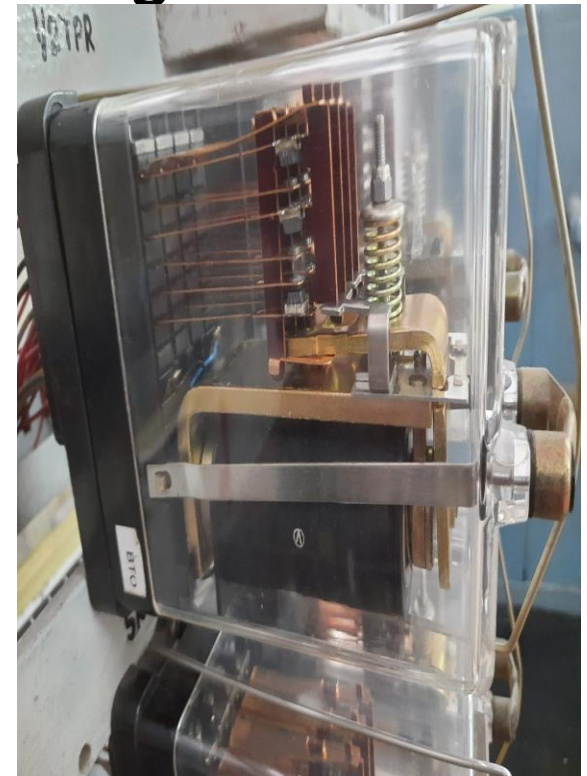


RELAY (ST-19)

A relay is an electromagnetic device, which is used to convey information from one circuit to another circuit through a set of contacts i.e. front or back contact.



Relays can be classified based on type of contacts material used .

a) Metal to Metal contact relays

(b) Metal to Carbon contact relays

Based on the usage, the relays can be classified as

(a) Line relays

(b) Track Relays

(c) Lamp Proving Relays

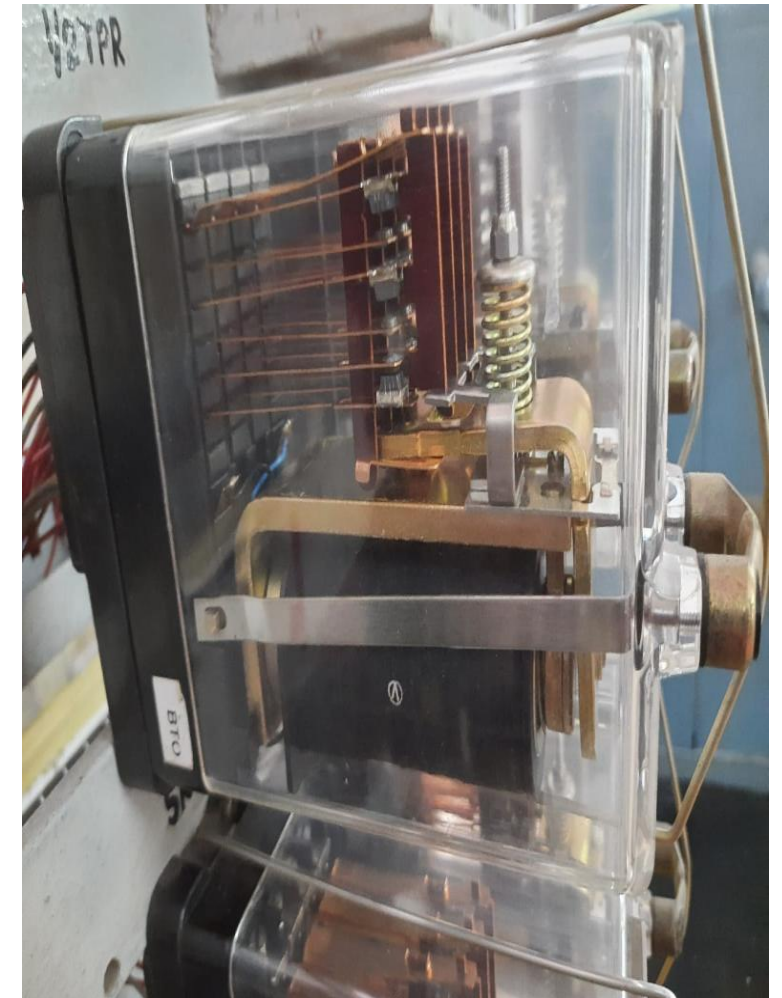
(d) Time Element Relays

(e) Flasher Relays

(f) Contactor Relays

Classification of relay on polarity basis

- Based on polarity requirement relays can be classified as –
- (a) Neutral Relays
- (b) Polarised Relays



CLASSIFICATION OF SIGNALLING RELAYS:

(a) According to the method of their mounting or fixture, they are classified as:

(i) Shelf type: Relays, which are loosely kept on shelves.

(ii) Plug in type: Relays, which are plugged in to a pre- wired plug boards.

(b) According to their connection and usage, they are classified as:

(i) Track relays: Relay, which is directly connected to the track, to detect the presence of vehicle.

(ii) Line Relays: Other than track relay, all are line relays. Relays connected to the selection circuit.

CLASSIFICATION OF SIGNALLING RELAYS(CONT...)

(c) According to their vitality or importance in ensuring train working safety, they are classified as:

- (i) Vital Relays: All relays, directly used for train control such as signal, point, controls, track detection etc.**
- (ii) Non-vital Relays: Relays, which operate control aids and accessories like warnings, buzzers, Indications etc.**

(d) According to their special provisions to ensure reliability of their contacts, they are classified as:

- (i) Proved type: are those whose normalization after each operation shall be proved in circuit controlled by their contacts. They may get fused due to high sparking current across them during operation. To avoid this, proving of relay normalization after each operation is necessary.**
- (ii) (ii) Non - proved type: Need not to be proved to have been normalized after each operation as their contacts have at least one non-fusible contact (carbon contact)**

According to their feed source, relays are broadly classified as:

- **DC relays:** The relay, which requires DC power supply for its operations are, called DC relays. Among the DC relays.
 - **DC neutral relays:** This relay closes the same set of contacts on energization, with Normal polarity or Reverse polarity supply.
 - **Polar Relays:** This relay closes different set of contacts when energized with Reverse polarity supply. They may or may not have contact to close when deenergized.
- (ii) **AC Relay:** AC Induction motor type track relays. Time element relays, flashing indication control relay etc..

According to their feed source, relays are broadly classified as:

AC Relay: AC Induction motor type track relays. Time element relays, flashing indication control etc.

Electronic Relays: DC relays with electronic components in them are called electronic relays. e.g. Electronic Timer

DC NEUTRAL RELAY

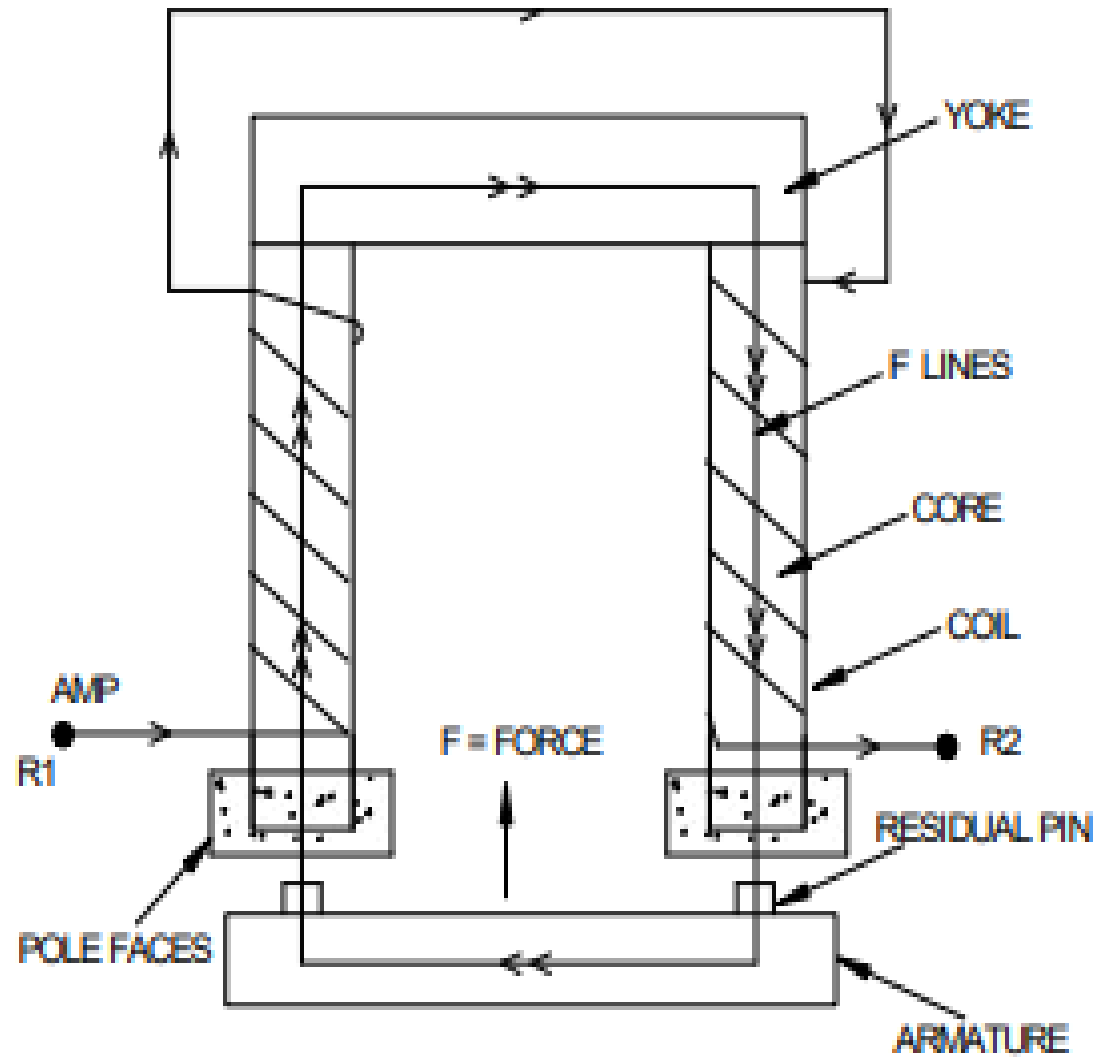
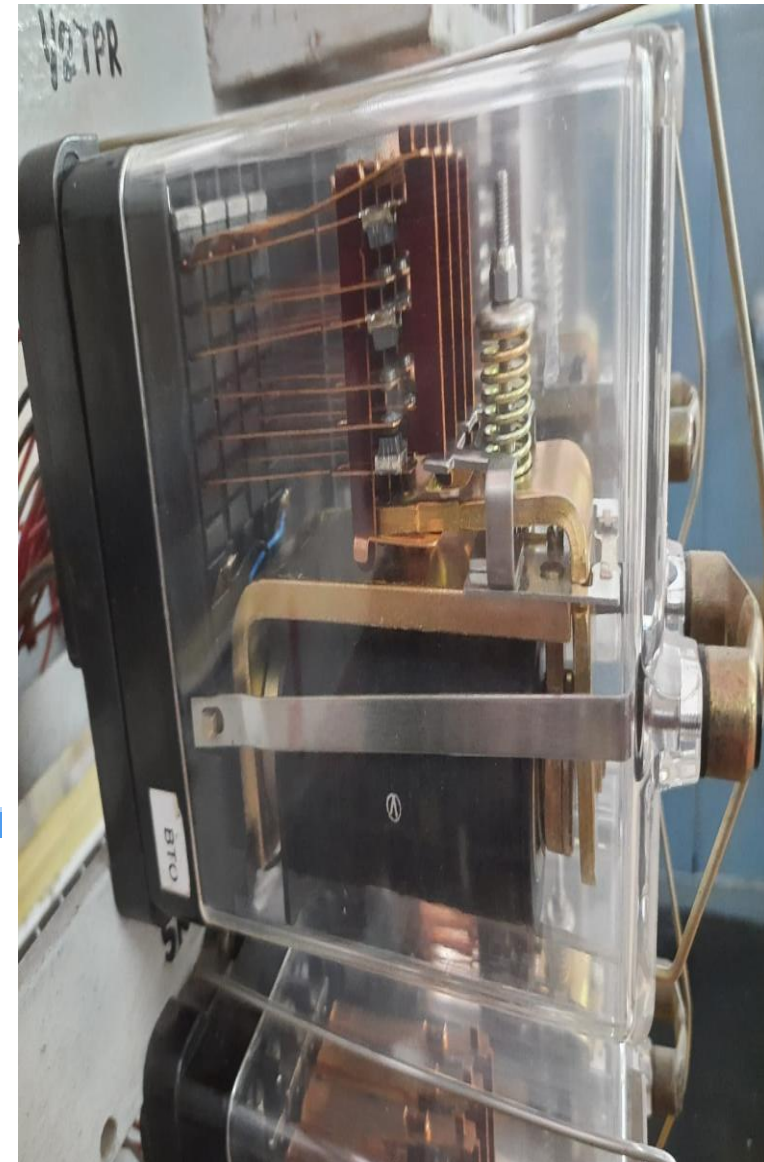


Fig: 2.1 DC NEUTRAL RELAY

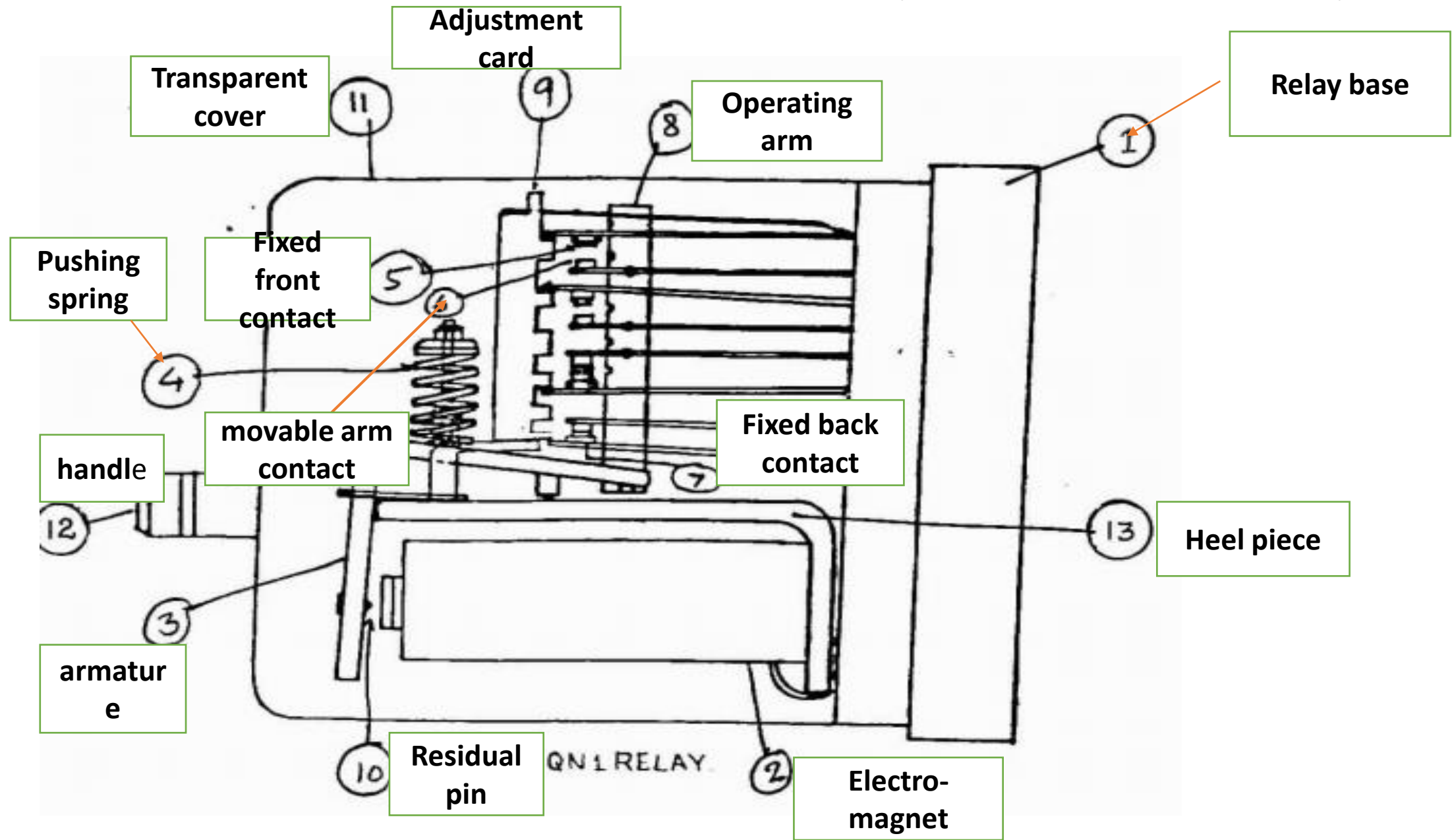


Application of DC neutral line relay

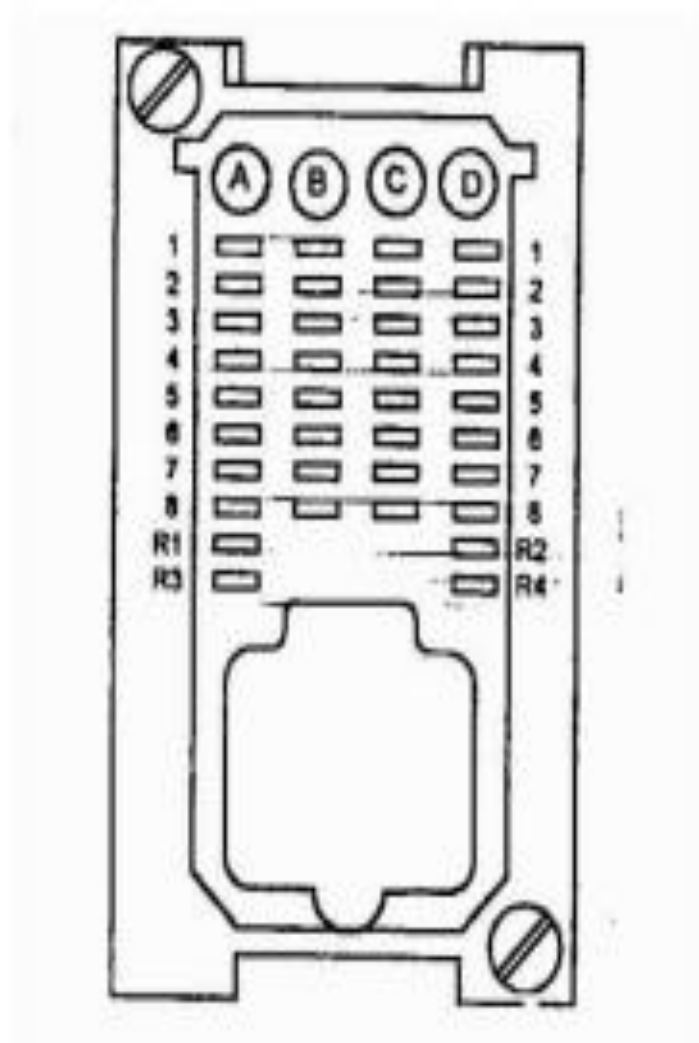
- (a) Delayed operation (Slow to pick up & slow to release)**
- (b) Biased DC control**
- (c) DC control unaffected by AC interference currents**
- (d) Getting latched in last operated condition till further feeding and others.**

Usage of DC polar relays is mostly in conjunction with block instruments that control traffic between stations.

PLUG IN TYPE DC NEUTRAL LINE RELAYS (NON-PROVED TYPE)



Plug Board (Back view)



Contact details of DC neutral relay

A1 B1 C1 D1

A2 B2 C2 D2

(a) Fixed Front contacts (08 No's)

A3 B3 C3 D3

A4 B4 C4 D4

A5 D5 A6 D6

(b) Fixed back contacts (04 No's)

A7 D7 A8 D8

B5 C5

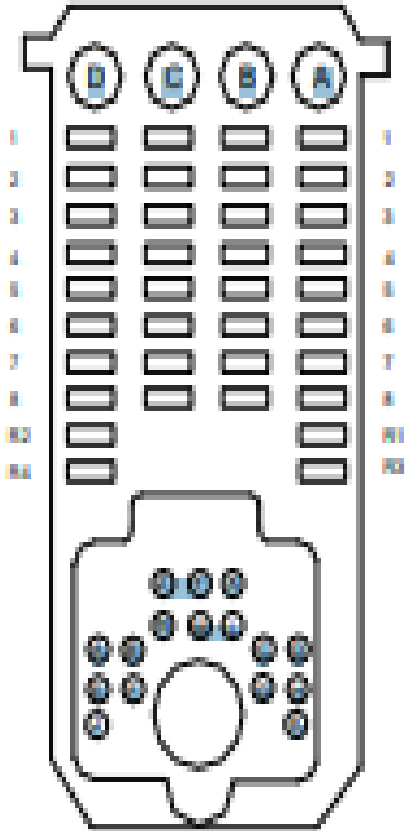
Interchangeable contacts (04 No's) (Front/Back)

B6 C6

B7 C7

B8 C8

Registration Device (Coding pins / Sockets)



Each relay is provided with code pins, which prevent a relay being plugged in to wrong plug board.

Pin position coding is provided for plug-in type relays.

This ensures that a front contact does not get connected to the circuit wiring of a back contact or a back contact does not get connected to the wiring of a front contact in the base, which may cause unsafe conditions.



Contact arrangements

‘Q’- Series relays are provided with a maximum of 16 independent contacts, and the standard contact configurations are:

(a) Line relays: -- 12F / 4B, 8F / 8B, 8F / 4B, 6F / 6B, 6F/ 2B, 4F / 4B etc.

(b) Track relay: -- 2 F /1B, 2F / 2B, 4F/2B

(c) ECRs : -- 3F / 3B , 4F /4B etc.

	A	B	C	D
1	F	F	F	F
2	A	A	A	A
3	F	F	F	F
4	A	A	A	A
5	A	F	F	A
6	B	A	A	B
7	A	F	F	A
8	B	A	A	B
	R1	12F/4B		R2
	R3			R4

Types of Q Series Relays

Q-series relay are provided with a maximum of 16 independent contact ,the standard contact configuration are:-

a) line relay: 12F/4B, 8F/8B, 8F/4B, 6F/6B, and 4F/4B).

b)Track relay:-2F/1B,2F/2B

c)ECRs:-3F/3B,4F/4B

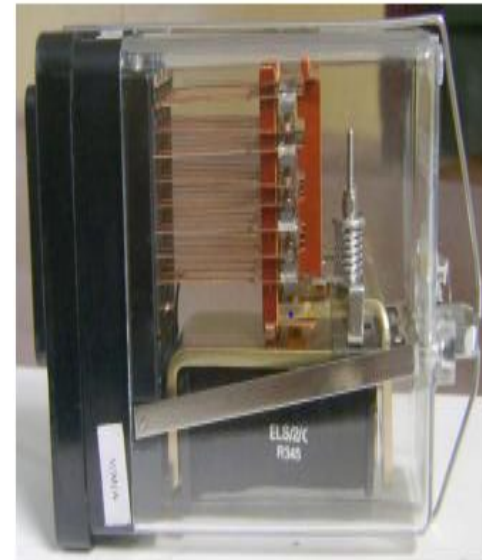
QN1 RELAY:-

Coil resistance: 400 Ohms for 24V relays.

Operating current: 60mA. Max P.U is 19.2 V, Min. DA is: 3.6V.

P.U time: 150milli seconds, DA time: 20milli seconds.

Application: All control and detection circuits of Non RE area and Internal Circuits in RE area.



QNN1 DC Twin Neutral Line Relay

- **QNN1: DC Twin Neutral Line Relay. (Spec: BRS 960) Two neutral relays with common heel piece, common base. Both relays are independent of each other and can be used for two different circuits. (Unrelated)**
- **Contact combination: 6F/2B, 4F/4B each.(Both relays will have same contact combination). LH - 4F/4B, RH - 4F/4B, R2, R4 - LH side Relay C, D - Column for LH Relay R1, R3 - RH side Relay A, B – Column for RH Relay (viewing the relay from the front side)**
- **Coil Resistance: 470 ohms Normal working voltage: 24v Max PU: 19.2V, Min DA: 3.6V.**
- **Application: All circuits of Non RE area and Internal circuits of RE area. Saving of space and used in circuits needing less number of contacts. They have equal number of contact on both the relay.**

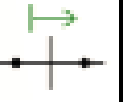
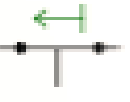
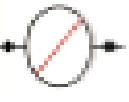
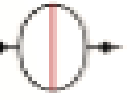
QNAI AC immunized DC Neutral Line Relay. (Spec: BR 931A)

- **A/C Immunisation is achieved by the provision of copper slug at the armature end of the core. No magnetic shunt is used. A/C immunization principle is same as in the case of shelf type relay.**
- **In all other aspects it is same as QN1. AC immunity level: 1000V (R.M.S) 1-phase 50 Hz**
- **Voltage: 24VDC. PU time: 220milli seconds, DA time: 70milli seconds.**
- **Application: All external control and detection circuits in RE area.**

SYMBOLS AND NOMENCLATURE

Sl. No.	Symbol	Description / Nomenclature
1		Point Contactor Relay
2		Push Button Pressed Contact
3		Panel Key IN Contact
4		Neutral Relay
5		Interlocked Relay Reverse Coil (Top Relay)
6		Interlocked Relay Normal Coil (Bottom Relay)
7		Track Relay
8		Track Repeater Relay
9		Time element Relay
10		Block Relay in Automatic Territory
11		Normal Position of Neutral Relay Is Picked up
12		Normal Position of Neutral Relay Is Dropped
13		Normal Position of Interlocked Relay Is Picked up (Normal Coil)

SYMBOLS AND NOMENCLATURE

Sl. No.	Symbol	Description / Nomenclature
14		Normal Position of Interlocked Relay is Dropped (Reverse Coil)
15		Make Contact
16		Break Contact
17		Neutral Relay, Normally Picked up, Make Contact (Front Contact)
18		Neutral Relay, Normally Picked up, Break Contact (Back Contact)
19		Neutral Relay, Normally Dropped, Make Contact (Back Contact)
20		Neutral Relay, Normally Dropped, Break Contact (Front Contact)
21	c	Interlocked Relay, Normally Picked up, Make Contact (Front Contact)
22		Interlocked Relay, Normally Picked up, Break Contact (Back Contact)
23		Interlocked Relay, Normally Dropped, Make Contact (Back Contact)
24		Interlocked Relay, Normally Dropped, Break Contact (Front Contact)
25		Diagonal line inside the relay circle from left top to right bottom indicates that the relay is used in Point circuit
26		Horizontal line inside the relay circle indicates that the relay is used for Route circuit.
27		Diagonal line inside the relay circle from right top to left bottom indicates that the relay is used in Signal circuit

SIEMENSE RELAY(M to M contact)

Sr.no	class	capacity
1	Mini Group	2 Neutral control relays, 1 interlocked relay or 1 ECR with power conversion unit.
2	Minor Group	15 Neutral Relays (with one interlocked relay replacing two neutral relays, one contactor relay replacing four neutral relays, or one resistor or condensor fixed in place of one neutral relay in some units
3	Major Group (used only in RRI).	Up to 30 neutral relays (with replacements by other relays as in a minor group)

MINI GROUP RELAY

Mini Groups: Different types of Mini groups available are:

- 1. Mini Groups with Two Nos. K-50 Neutral Relays.**
- 2. One AC Immunized and one Non – AC Immunized K-50 Neutral relays or Two AC Immunized K-50 Neutral relays.**
- 3. Two Nos. K–50 Inter Locked Relays.**
- 4. Lamp proving relays (3F/3B) for ON and OFF aspect and (5F/1B) for Route Indicator lamps. Relay Coils and contacts are numbered as shown in figures below.**



Code pins for Mini groups – Control Relays

Code pins in 8 positions prevent the plugging of wrong group . Positions for various relays are :

Neutral:

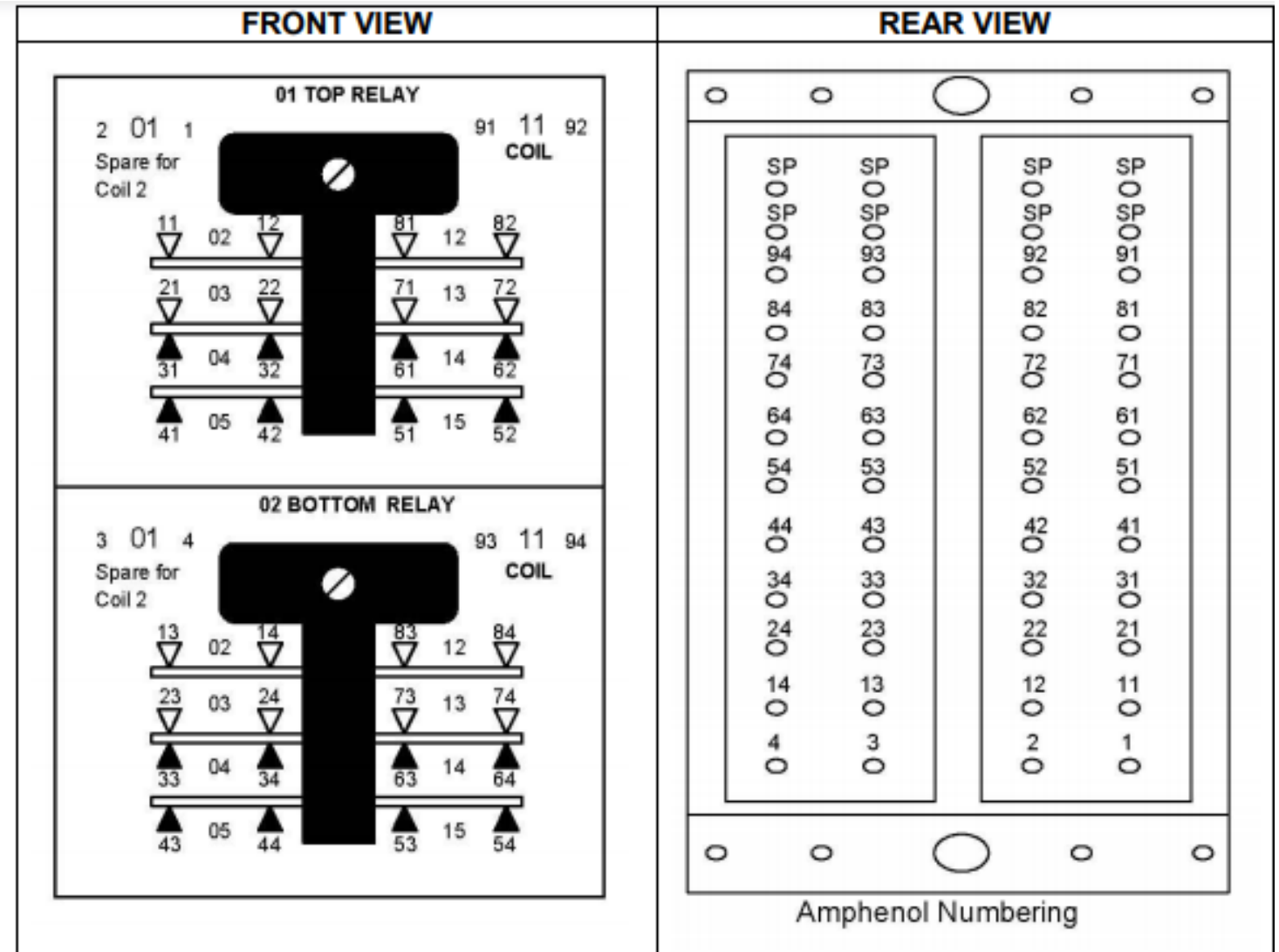
5F/3B	(1260 ohms)	1 & 6
4F/4B	(1260 ohms)	1 & 7
6F/2B	(1840 ohms)	1 & 5

Inter Locked:

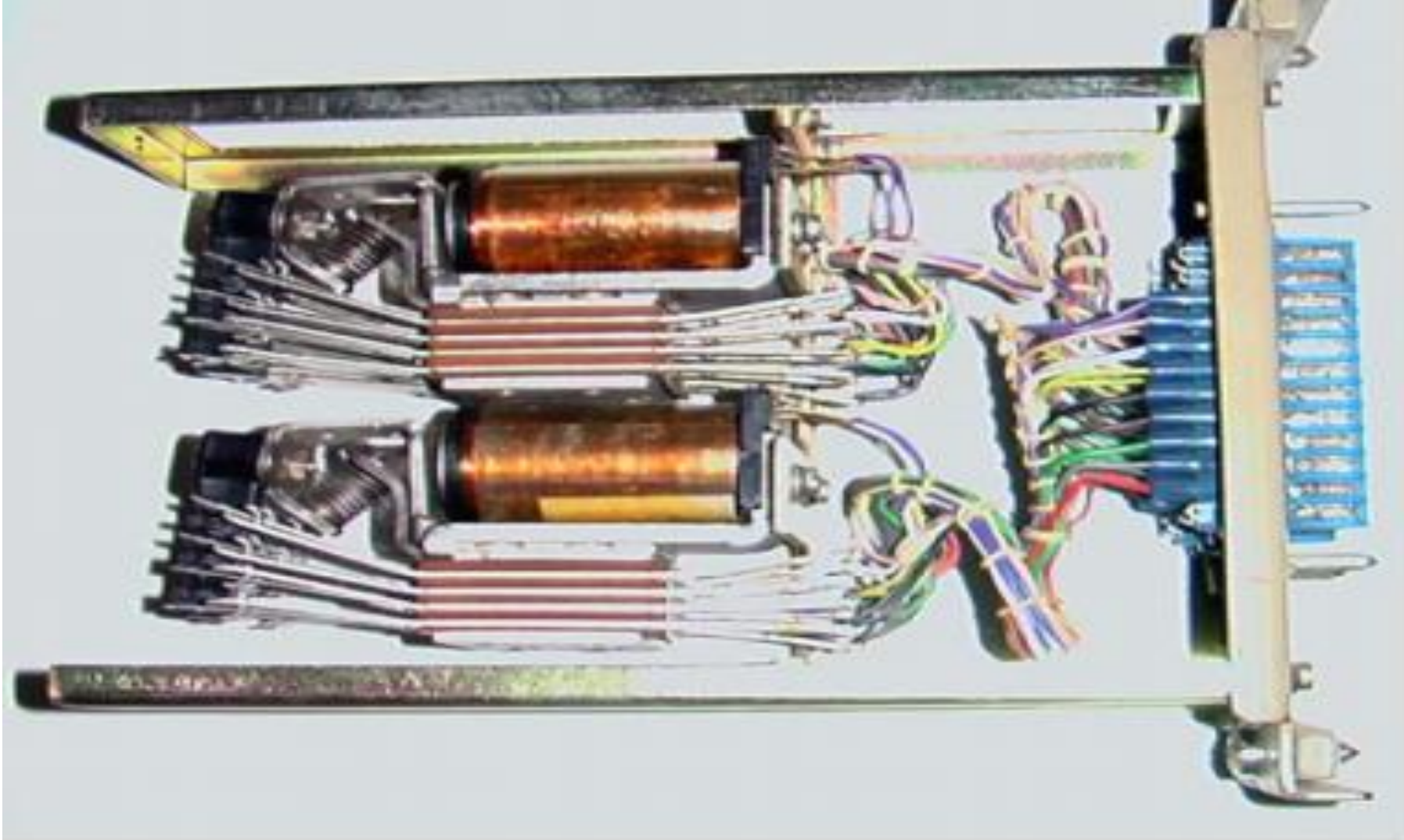
4F/4B	(615 ohms)	3 & 7
5F/3B	(615 ohms)	3 & 6
6F/2B	(615 ohms)	3 & 5
One ACI and one Non AC (5F/3B)	2 & 5	
Group of two ACI (5F/3B)	2 & 6	

FRONT VIEW AND REAR VIEW OF MINI GROUP RELAY

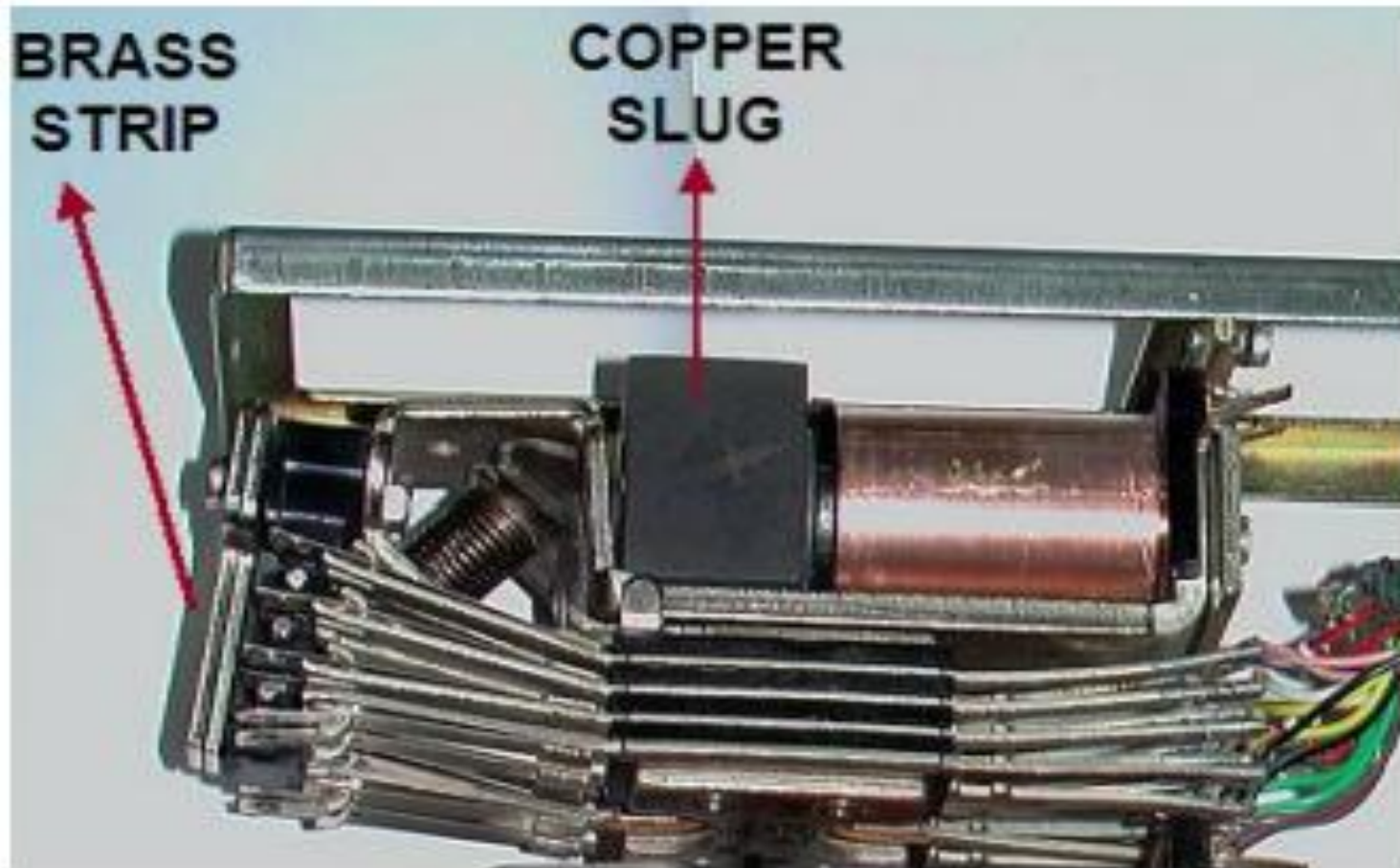
02-12	always Front contact
05-15	always Back contact
03-13	inter changeable contact
04-14	inter changeable contact



Mini group with Neutral Relay-Non AC Immunized



Mini group with AC Immunized K-50 Neutral relays



K50 - A.C IMMUNISED RELAY

MINOR GROUP RELAY

- 1. Main Signal Group : 3 Aspect Signal Group, 2 Aspect Signal Group.**
- 2. Shunt Signal Group : It caters two shunt signals.**
- 3 Aspect main signal group :**

In this group 13 Relays & 2 condenser and resistor units are provided.

FRONT VIEW

RKE		DKE	
RECR 1	○ GR1 2	HECR 3	
DECR 4	○ GLSR 5	GNR 6	
EGNR 7	GLSR 8	GR1 9	
GPR1 10	GR2 11	RECPR 12	
DECPR 13	GR3 14	HECPR 15	

REAR VIEW

	99	98	97	96	95	94	93	92	
100	--	--	--	--	--	--	--	--	-- 91
90	--	--	--	--	--	--	--	--	-- 81
80	--	--	--	--	--	--	--	--	-- 71
70	--	--	--	--	--	--	--	--	-- 61
60	--	--	--	--	--	--	--	--	-- 51
50	--	--	--	--	--	--	--	--	-- 41
40	--	--	--	--	--	--	--	--	-- 31
30	--	--	--	--	--	--	--	--	-- 21
20	--	--	--	--	--	--	--	--	-- 11
10	--	--	--	--	--	--	--	--	-- 01
	09	08	07	06	05	04	03	02	

Main signal group, shunt signal group, route group



Front view of shunt signal group, Route group relay

 RKE  HKE  RKE  HKE		
RECR 1	HECR 2	GLSR 3
GNR 4	EGNR 5	GR1 6
GR2 7	 GR1 8	GR2 9
GNR 10	 GR1 11	GR1 12
RECR13	HECR14	GLSR 15

FRONT VIEW		
 RKE		 HKE
AU(R)S 1	2	BU(R)S 3
AU(N)S 4	5	BU(N)S 6
7	'A' DUCR 8	'B' DUCR 9
U(R)LR 10	11	UDKR 12
U(N)LR 13	UYR1 14	UYR2 15

Point Major Group (R.R.I.)

HKE		HKE		RKE	
Z1WR1	Z1NWR	Z1RWR	Z1WR	WLR	WKR1
W(R)R	(R)WLR1	(R)WLR2	(R)WLR3	W(R)LR	WKR2
W(N)R	(N)WLR1	(N)WLR2	(N)WLR3	W(N)LR	
W R		WJR	Z2WR1	Z2WR2	
		TP'R	TP'P'R	WKR3	



SIGNALLING CABLES

- **PVC insulated PVC sheathed and armored signalling cables to specification IRS S. 63 shall be used for carrying signalling circuits. The conductors used shall be of copper and of approved size.**

The cables used

(a) Indoor cables.

(b) Outdoor cables.

(c) Power cables. signalling installations are broadly classified as:

Only pvc insulated underground, unscreened cable is used for railway signalling(specification no: S 63-2007,Revision 3.0)

Cross Section view of signalling cable

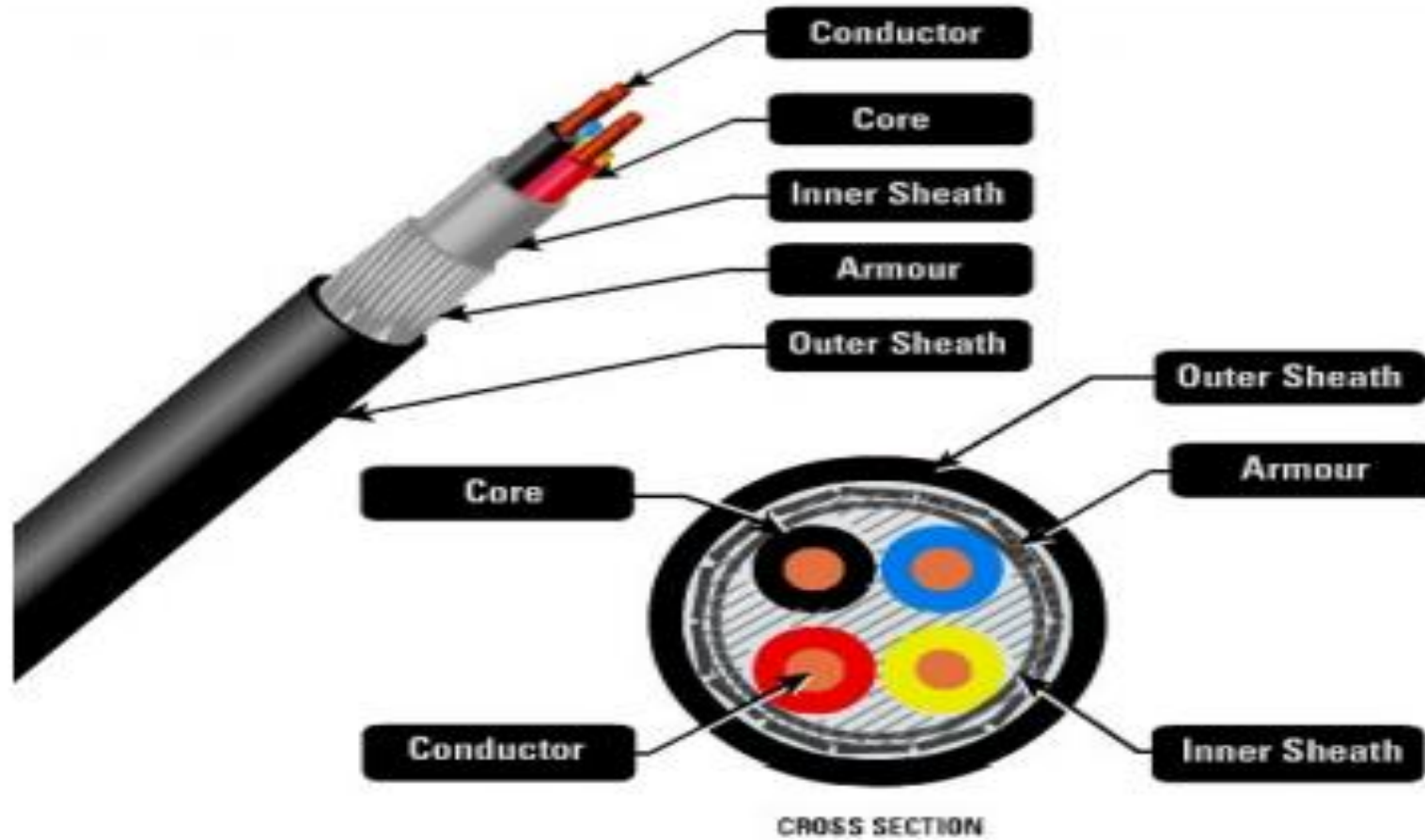


Fig 12.1 SIGNAL CABLE

Indoor cables

- Indoors cables are without Armor wire. In this, all the PVC insulated conductors are bunched and kept in thin PVC insulation tube. In addition to indoor cables, wires are also used for internal wiring. Indoor Cables normally used are 60 core(C), 40C, 24C, 20C and 16C cables.
- In any cable, all the conductors have equal cross section/diameter($\emptyset$). In these cables, all the conductors used are copper conductors.

Indoor cable conductors can be numbered according to colour code as shown below

1	2	3	4	5	6	7	8	9	10
Blue	Red	Grey	Green	Brown	Black	Yellow with Red dots	White	Pink	Violet

Indoor cables contd...



Fig 12.2 INDOOR CABLE

- 1mm. dia ($\emptyset$) copper-single strand wire is used for high current circuits such as signal lamp circuit, point operation circuit, gate circuit, etc.
- 0.6mm.dia($\emptyset$) copper-single strand wire is used for relay wiring.
- 0.4mmdia($\emptyset$) copper-single strand wire is used for indication lamps and panel wiring.
- 16 strand 0.2mm.dia($\emptyset$) flexible loose wire is used for Q-Series relay wiring.

Outdoor Cables

- In outdoor cables, all conductors used are copper conductors having equal diameter with PVC insulation.
- On the circumference of this tube, galvanized iron rectangular or circular cross section wires called Armour is provided to give the mechanical strength and to protect the cable from damages. On this Armour PVC insulated thick tube is provided to give the more mechanical strength and good insulation resistance in addition to preventing the water entering inside the cable.
- Generally, used conductor core sizes are 1.5 sq.mm, 2.5sq.mm..
- Most commonly used cores are 2C, 6C, 12C, 19C, 24C and 30C.
- Numbering of conductors in an Outdoor Cable: In these cables, conductors bunched in the form of layers.
- Numbering is generally started from outer most layers of conductors. Each layer starts from blue conductor and ends with yellow conductor.

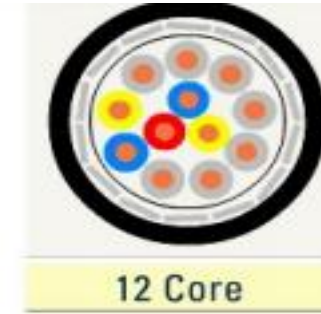
Outdoor Cables



2.5 Sq.mm



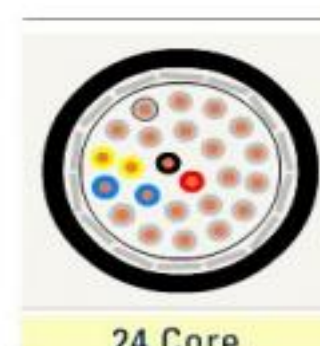
1.5 Sq.mm



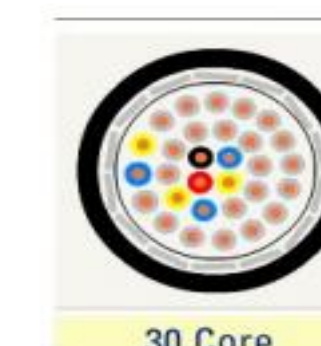
1.5 Sq.mm



1.5 Sq.mm



1.5 Sq.mm



1.5 Sq.mm

Power Cables:

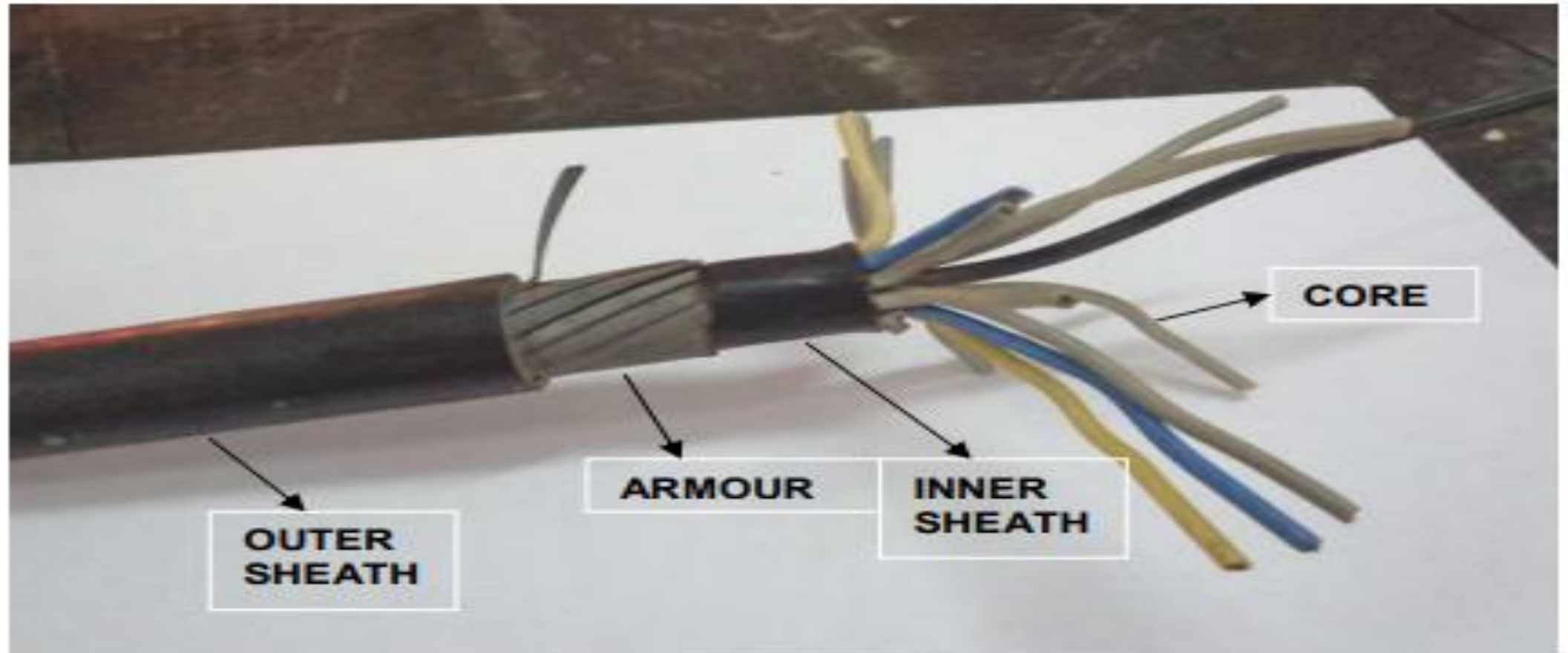
Generally used power cables are -

- **70 Sq.mm. aluminum core single strands - 3 & 3 1/2 core cable.**
- **50 Sq.mm. aluminum core single strands - 3 & 3 1/2 core cable.**
- **25 Sq.mm. aluminum core single strands - 3 & 3 1/2 core cable.**
- **25 Sq.mm. (Multi-strand-7) aluminum conductor core, also available in 2C, 3C, 3½C, 4C.**
- **10 Sq.mm. aluminum single strand - 2C.**
- **08 Sq.mm. copper conductor single strand - 2C.**
- **06 Sq.mm. copper conductor single strand - 2C.**

Difference between Screened cable and unscreened cable

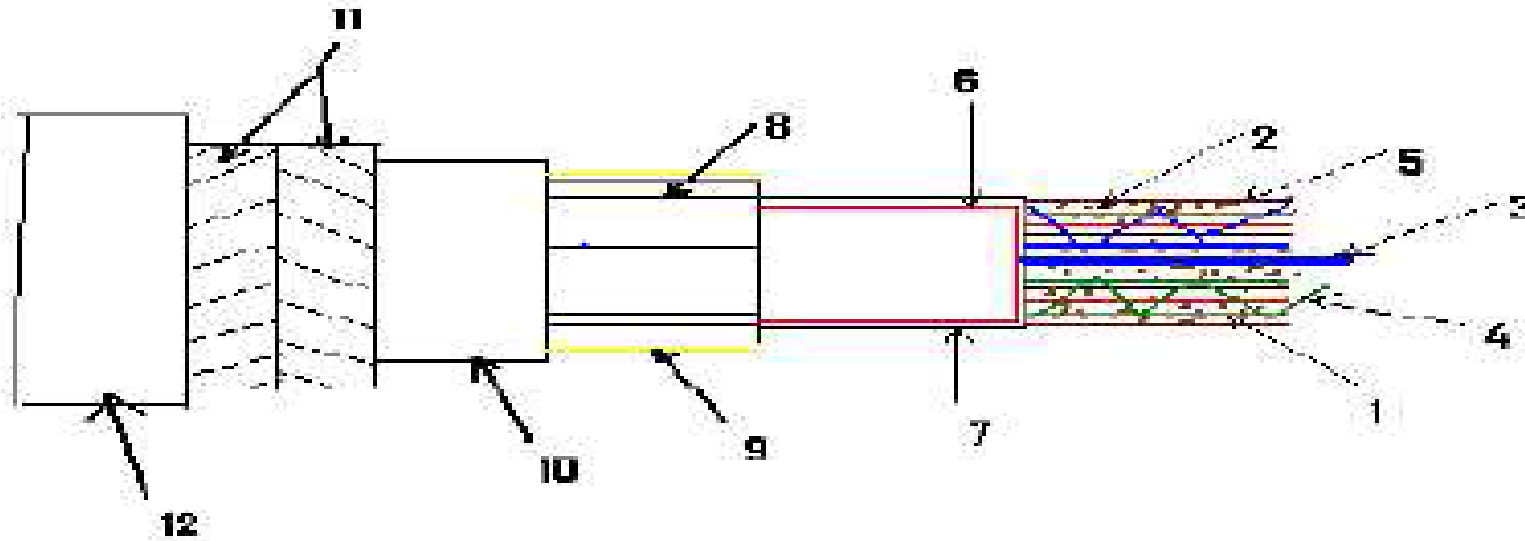
sno	Screened cable	Unscreened cable
1	IRS specification S-35/93	IRS specification S-63/07
2	It is PVC insulated metal sheathed armoured cable	It is a PVC insulated armoured cable
3	Cable screening factor 0.4	No screening factor
4	Manufacturing cost more	Manufacturing cost less
5	No more use in future Installation	In future installation only to be used Unscreened cable

Un screened cable



UN SCREENED CABLE

Telecom Cables



1. Conductor, 2. Petroleum jelly, 3. Dummy tube, 4. Binder, 5. Polyester tape 6. Poly aluminum tape, 7. PVC inner jacket, 8. Aluminum wire/tape screen 9. Woven tape (yellow colour), 10. PVC intermediate jacket, 11. G.I. Steel armour 12. PVC outer jacket



Telecom Cables

- OFC cables

