



भारत सरकार GOVERNMENT OF INDIA
रेल मंत्रालय MINISTRY OF RAILWAYS

केवल कार्यालयीन उपयोग हेतु
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TRAINING PACKAGE
ON
EARTH FAULT RELAYS
OF
AC ELECTRIC LOCOMOTIVES

TARGET GROUP – TECHNICIANS OF AC ELECTRIC LOCO SHEDS/ WORKSHOPS

CAMTECH/E/2006/TP-EFR/1.0

March, 2006

Centre
for
Advanced
Maintenance
TECHnology



Excellence in Maintenance

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LESSON PLAN

SN	TOPIC	MINUTES	TECHNICAL AIDS
1.	<ul style="list-style-type: none">• Basic terminology• Protective relays used in ac electric locomotives• Constructional details of DU type relays• Technical details	60	OHP, Wall chart
2.	<ul style="list-style-type: none">• Earth fault protection for power circuit• Earth fault protection for auxiliary circuit	60	OHP, Wall chart
3.	<ul style="list-style-type: none">• Maintenance• Trip inspection• IA/ IB/ IC inspections• AOH inspection• IOH/ POH inspection	60	OHP, Wall chart
4.	<ul style="list-style-type: none">• Check points for QOP drop case in shed• Check points for QOA drop case in shed	60	OHP, Wall chart

1. BASIC TERMINOLOGY

Some of the important terms used for relays are defined below.

1.1 Protective Relay

An electrical device designed to initiate isolation of a part of an electrical installation or to operate an alarm signal, in the event of an abnormal condition or a fault.

1.2 Characteristic Quantity

The quantity to which the relay is designed to respond viz. current in an over current relay, impedance in an impedance relay, phase angle in a directional relay, over voltage relay etc. Some relays have a calibrated response to one or more quantities, such quantities are called characteristic quantities.

1.3 Setting

The actual value of the energizing or characteristic quantity at which the relay is designed to operate under given conditions.

1.4 Pickup

A relay is said to pickup when it moves from the off position to the on position. The value of the characteristic quantity above, which this change occurs, is known as pickup value.

1.5 Dropout or Reset

A relay is said to dropout when it moves from the on position to the off position. The value of the characteristic quantity below which this change occurs is known as dropout or reset value.

1.6 Primary Relays

Relays which are connected directly in the protected circuit, are called primary relays.

1.7 Secondary Relays

Relays which are connected to the protected circuit through current or potential transformers, are called secondary relays.

1.8 Flag or Target

A device used for indicating the operation of a relay, it is usually spring or gravity operated.

2. PROTECTIVE RELAYS USED IN AC ELECTRIC LOCOMOTIVES

There are three main types of protective relays used in AC electric locomotives:

- i. Over current relay (DI type), current operated utilized for overload protection such as QLM, QRSI, QE, QF, QLA, etc..
- ii. Over voltage relay (DU type), voltage operated utilized for earth fault protection such as QOP, QOA.
- iii. No-voltage relay (DU type), voltage operated utilized for no-voltage/ low voltage protection such as Q30.

3. CONSTRUCTIONAL DETAILS OF EARTH FAULT RELAYS (QOP/ QOA)

This type of relay consists of a rotating armature with a setting cylinder on which the desired pickup values can be adjusted, the block of contacts and front plate, all fitted in a plug in housing. The housing made of pressed material is flush mounted in the control panel (relay panel). When the relays are inserted into the housing, their contact plugs fit into the contact sockets of the housing.

This is also provided with a flag indicator signaling the operation of the relay, which can be observed through the front plate. Resetting of the flag indicator is done by turning a small knob provided on the front plate. However, the relay gets reset automatically even if the flag remains dropped.

The different parts of the relay are shown in figure 1.1 given on next page:

1	Front plate
2	Armature
3	Preset disc
4	Pinion
5	Hub
6	Bracket with hub and support
7	Bracket with preset disc comp. & moving coil pivot
8	Moving coil pivot
9	Cross arm
10	Shielding plate
11	Lamination
12	Electromagnet without coil
13	Buffer set screw
14	Coil
15	Shunt
16	Plate with connector
17	Plate with connector plate
18	Contact block
19	Case assembly

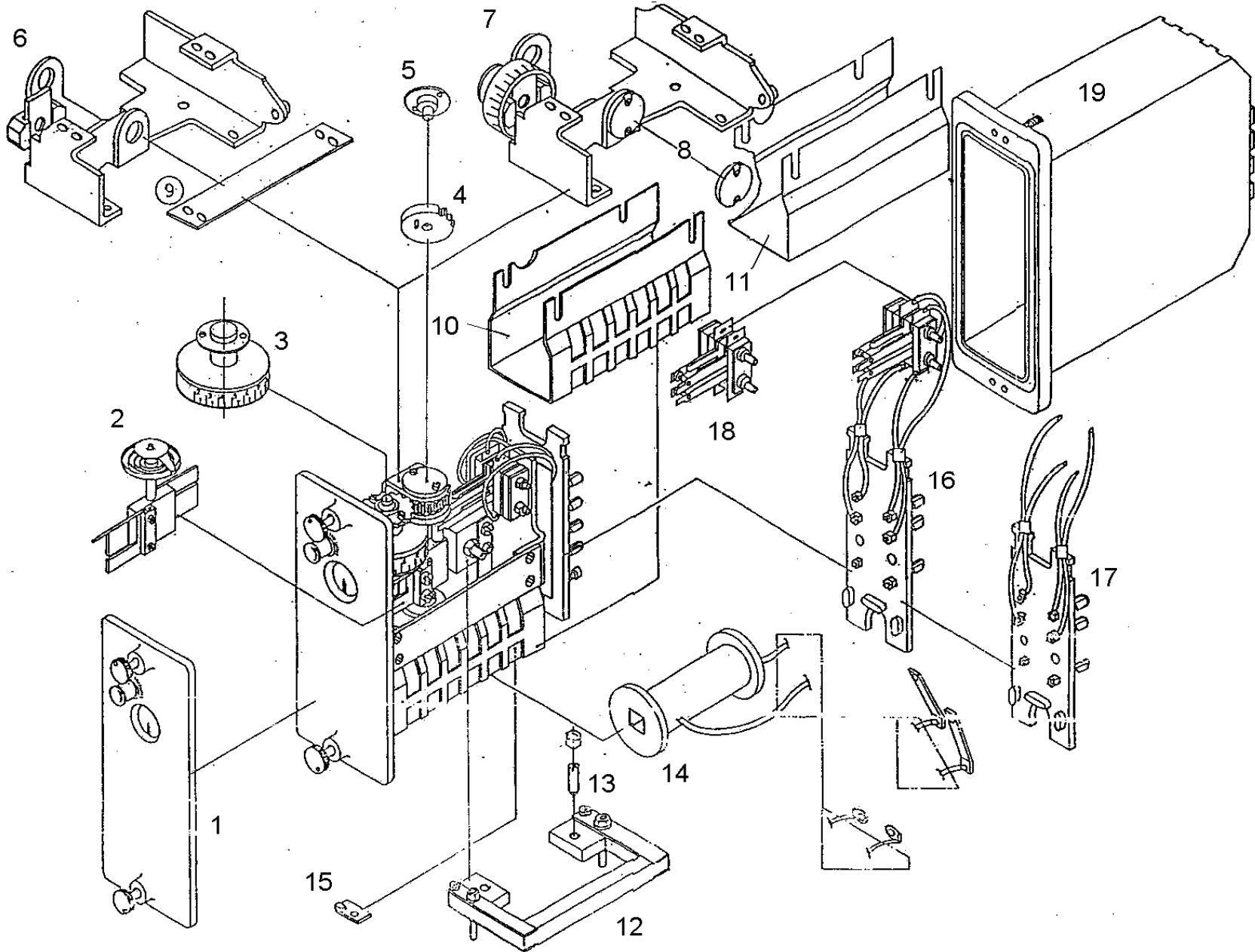


Figure 1.1 EXPLODED VIEW OF EARTH FAULT RELAY (QOP/ QOA)

4. TECHNICAL DETAILS

4.1 DU Type Relays (QOP/ QOA)

Apparatus	Main circuit earth protection relay	Auxiliary circuit earth protection relay
Reference	QOP	QOA
Type	DU	DU
Number for one locomotive	2	1
Voltage of utilization circuit	0-865 V, DC momentary	0-485V, AC momentary
Min. pick up voltage	50V DC	50V DC
Range of operating voltage	70-125 V, DC	70-125 V, DC
Coil resistance at 20° C	1800 ohms \pm 8%	1800 ohms \pm 8%
Coil no.of turns	15500	15500
Contact pressure	12 \pm 25% gms	12 \pm 25% gms
Contact gap	0.6 \pm 0.1mm	0.6 \pm 0.1mm
Contact configuration	2 N/C	2 N/C
Weight	1.2 Kgs	1.2 Kgs

4.2 Earthing Resistances

Apparatus	Earthing resistance	Earthing resistance
Reference	RQOP	RQOA
Number for one locomotives	6	2
Used for	Earthing of power circuit	Earthing of auxiliary circuit.
Resistance in ohms AT 20°c	3200 \pm 5%	680 \pm 5%
Continuous output	75 W	75W
Circuit voltage	110V DC	110V DC
Weight per unit	0.1 Kg	0.2 Kg

4.3 Permanent Resistance

Apparatus	Permanent resistance	Permanent resistance
Reference	RPQOP	RPQOA
Number for one locomotives	2	1
Used for	QOP	QOA
Resistance in ohms at 20°C	150 \pm 5%	150 \pm 5%
Operating time	Continuous	Continuous
Continuous output	75W	75W
Circuit voltage in volts	110V DC	110V DC
Weight per unit	0.18 Kg	0.18Kg

5. EARTH FAULT PROTECTION FOR POWER CIRCUIT

Relay QOP protects traction power circuit in the event of earth fault by tripping of DJ instantaneously. In case of failure of insulation of traction power circuit to earth or flash over in the traction motor circuit, the relay coil which is connected across a permanent resistor (RPQOP) monitors the voltage drop across this resistor through which the fault current established by the 110 V loco battery flows. The DJ (air blast circuit breaker/ vacuum circuit breaker) gets tripped instantaneously no sooner the voltage drop across this resistor reaches a pre-determined minimum pick up value of the relay coil. This limits the damage at the fault location and prevents the effects of the fault spreading into the power circuit.

It should be noted that this protective relay QOP does not prevent the appearance of earth fault and it operates only after the earth fault has occurred. Two relays QOP1 and QOP2 are provided for both power circuits respectively.

5.1 Connection of Relay QOP1-2 In Power Circuit

As shown in figure 1.2 given on next page, relay QOP1 and QOP2 coils are connected to power circuit to their negative leads HO1 & HO2 at one end respectively. The other ends of the coils are connected to the battery supply positive lead 003.

Relay QOP1 provides the protection in case of earth fault in power circuit 1 i.e. from power circuit secondary winding 1 (a5-a6 terminals) to complete power circuit of TM1, 2, 3.

Relay QOP2 provides the protection in case of earth faults in power circuit 2 i.e. from power circuit secondary winding 2 (a3-a4 terminals) to complete power circuit of TM 4, 5, 6.

Permanent resistances RPQOP1 and RPQOP2 of 150 ohms/ 75 watts are connected in parallel to operating coils of relays QOP1 and QOP2 respectively.

Earthing resistances RQOP1 and RQOP2 of 3 x 3200 ohms/ 75 watts are connected in the circuit through switches HQOP1-2 as shown in figure.

The switch HQOP1-2 makes it possible to isolate the relay QOP1 or 2 and replaces it through a resistance RQOP1 or 2 in order to limit the fault current. Now it will be possible to resume back the traction

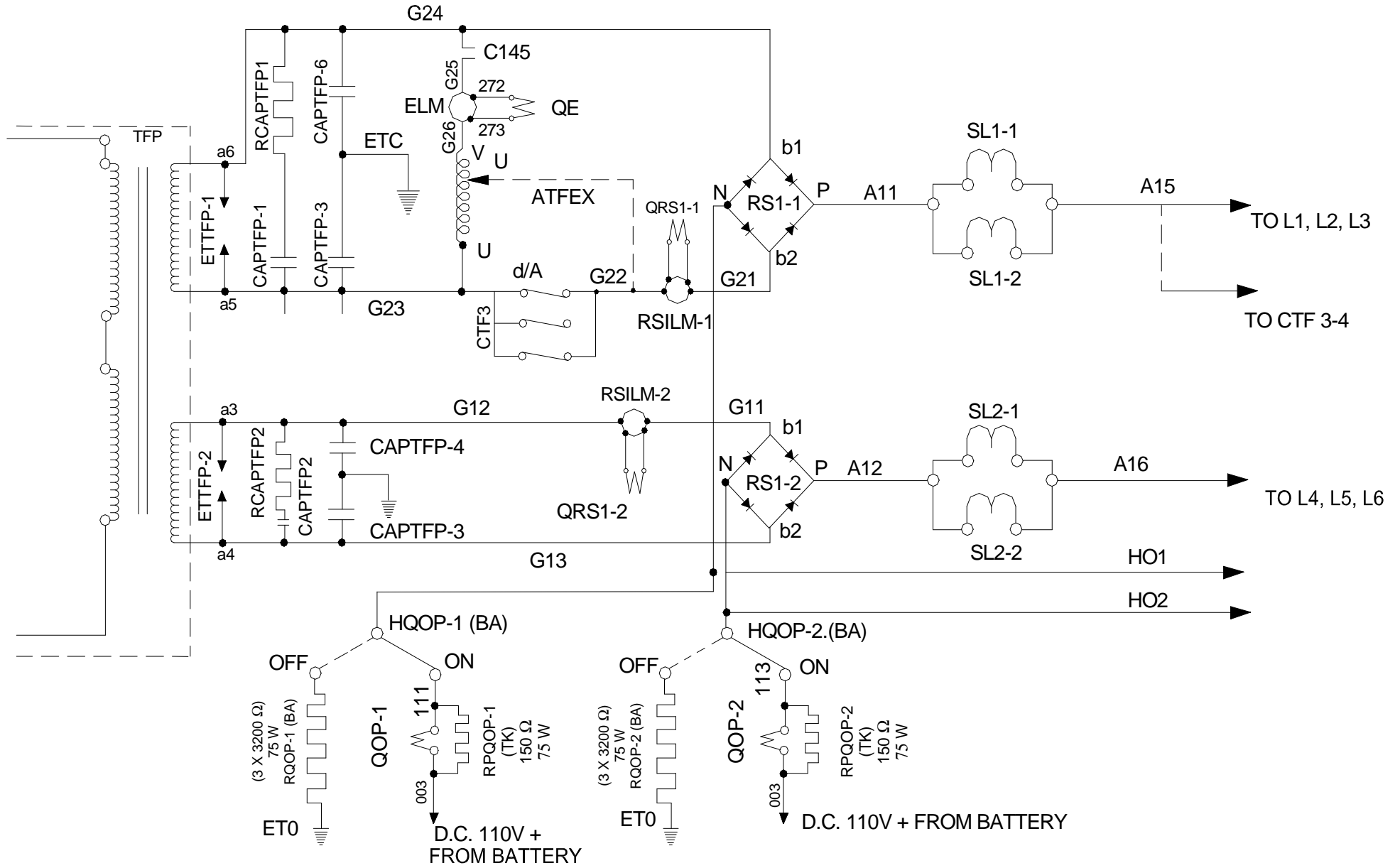


Figure 1.2 CIRCUIT DIAGRAM OF RELAY QOP 1 - 2

5.2 Relay QOP1-2 Interlocks In DJ Control Circuit

Two parallel normally closed (NC) interlocks of each relay are connected in series in high voltage circuit breaker (DJ) holding coil (MTDJ) circuit as shown below.

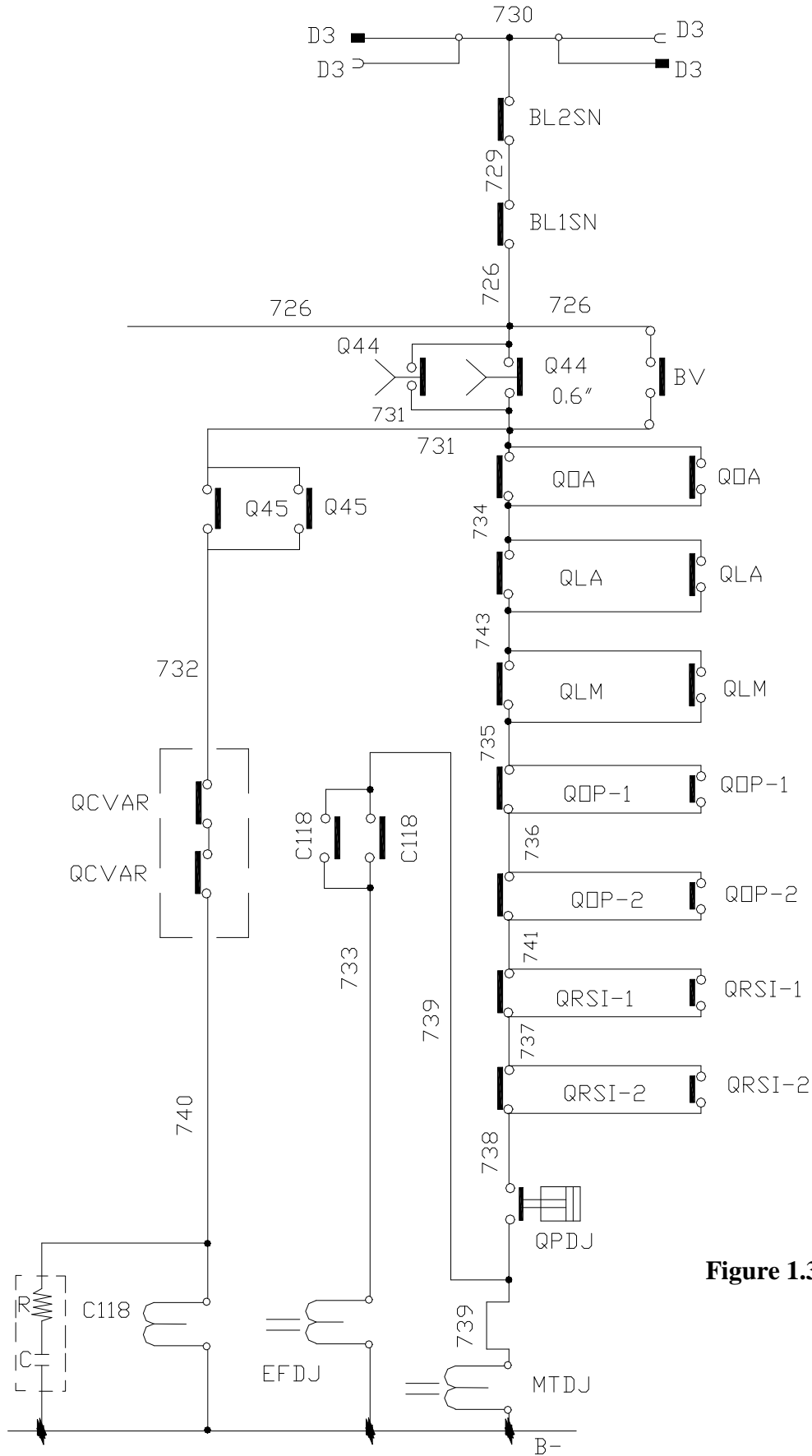


Figure 1.3

Relay QOP1 coil and permanent resistor (RPQOP1) which are connected to battery positive at one end, get connected to battery negative through earth fault and its coil get energized by sensing the voltage drop across permanent resistor (RPQOP1) as soon as this voltage drop reaches a pre-determined minimum pick up value of the relay coil.

On energisation of relay, its normally closed interlocks in DJ holding coil (MTDJ) circuit get opened and resulted in instantaneous tripping of circuit breaker and lamp LSDJ lights up (ON), which gives the indication of DJ tripping. Relay flag indicator also drops which gives the indication of relay tripping to the driver.

If earth fault is taken place in traction motor power circuit, the concerned traction motor can be isolated by putting the HMCS switch on appropriate position. If earth fault lies in SL, RSI block or in other power circuit equipments before the traction motor, the fault can not be isolated with the help of HMCS switch and concerned HQOP (1or 2) switch will have to be operated in OFF position for isolation of QOP relay and introduction of high value resistance RQOP to limit the fault current.

6. EARTH FAULT PROTECTION FOR AUXILIARY CIRCUIT

Relay QOA is provided in A.C. electric locomotive to sense any earth fault in auxiliary circuit. In case of failure of insulation of auxiliary circuit to earth, relay QOA picks up and in turn open the high voltage circuit breaker. It should be noted that this earth fault relay QOA, does not prevent the occurrence of earth fault and it operates only after the earth fault has occurred.

6.1 Connection Of Relay QOA In Auxiliary Circuit

As shown in figure 1.5 given below, relay QOA coil is connected to auxiliary circuit to its wire no. 960 at one end through switch HQOA. The other end of the coil is connected to the battery supply positive lead 003.

Permanent resistance RPQOA of 150 ohms/ 75 watts is connected in parallel across relay coil. Earthing resistance RQOA of 2 x 680 ohms/ 75 watts is connected in the circuit through switch HQOA as shown in figure.

The switch HQOA makes it possible to isolate the relay QOA and replaces it through earthing resistance RQOA in order to limit the fault current.

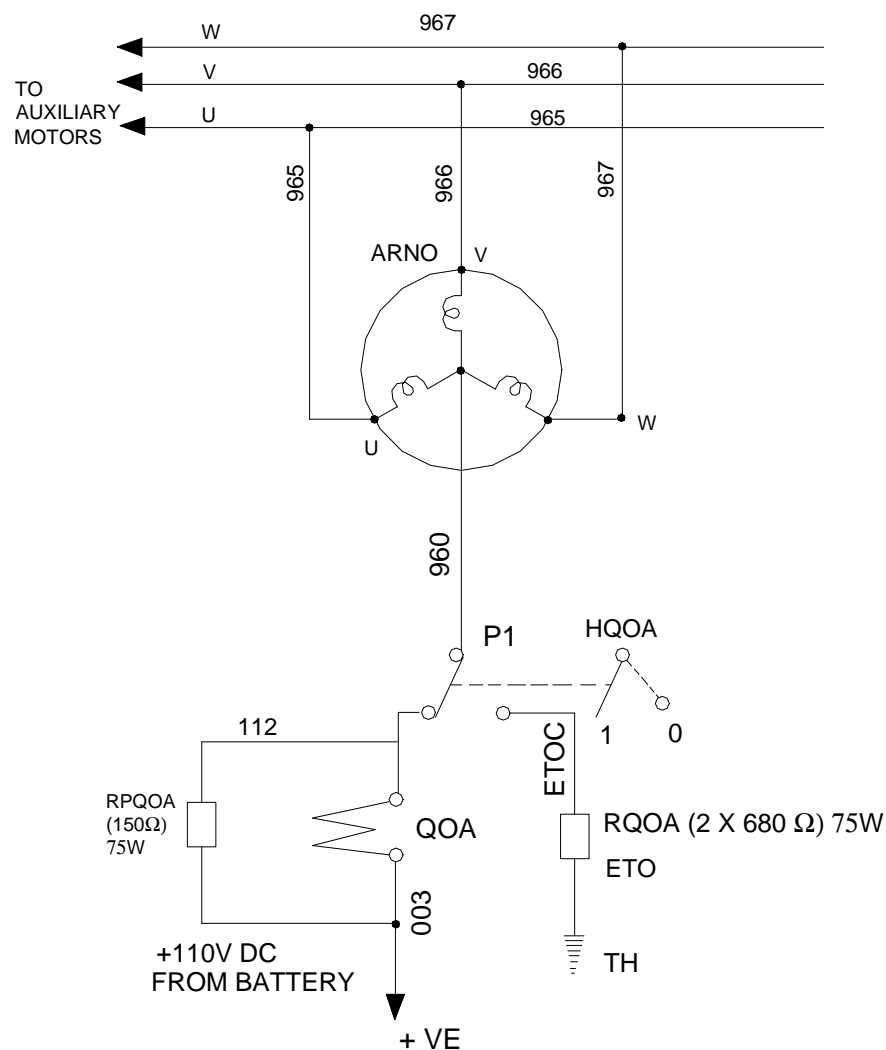


Figure 1.5 CIRCUIT DIAGRAM OF RELAY QOA

6.2 Relay QOA Interlocks In DJ Control Circuit

Two parallel normally closed (NC) interlocks of relay QOA are connected in series in high voltage circuit breaker (DJ) holding coil (MTDJ) as shown in figure in section 5.2.

6.3 Actuation of Relay QOA

Whenever any earth fault takes place in auxiliary circuit, relay QOA coil get energized due to completion of fault current circuit as shown in figure 1.6 given below and sensing the voltage drop across permanent resistor (RPQOA).

Suppose any earth fault takes place in winding of MCP1, then the QOA coil circuit completes as shown below.

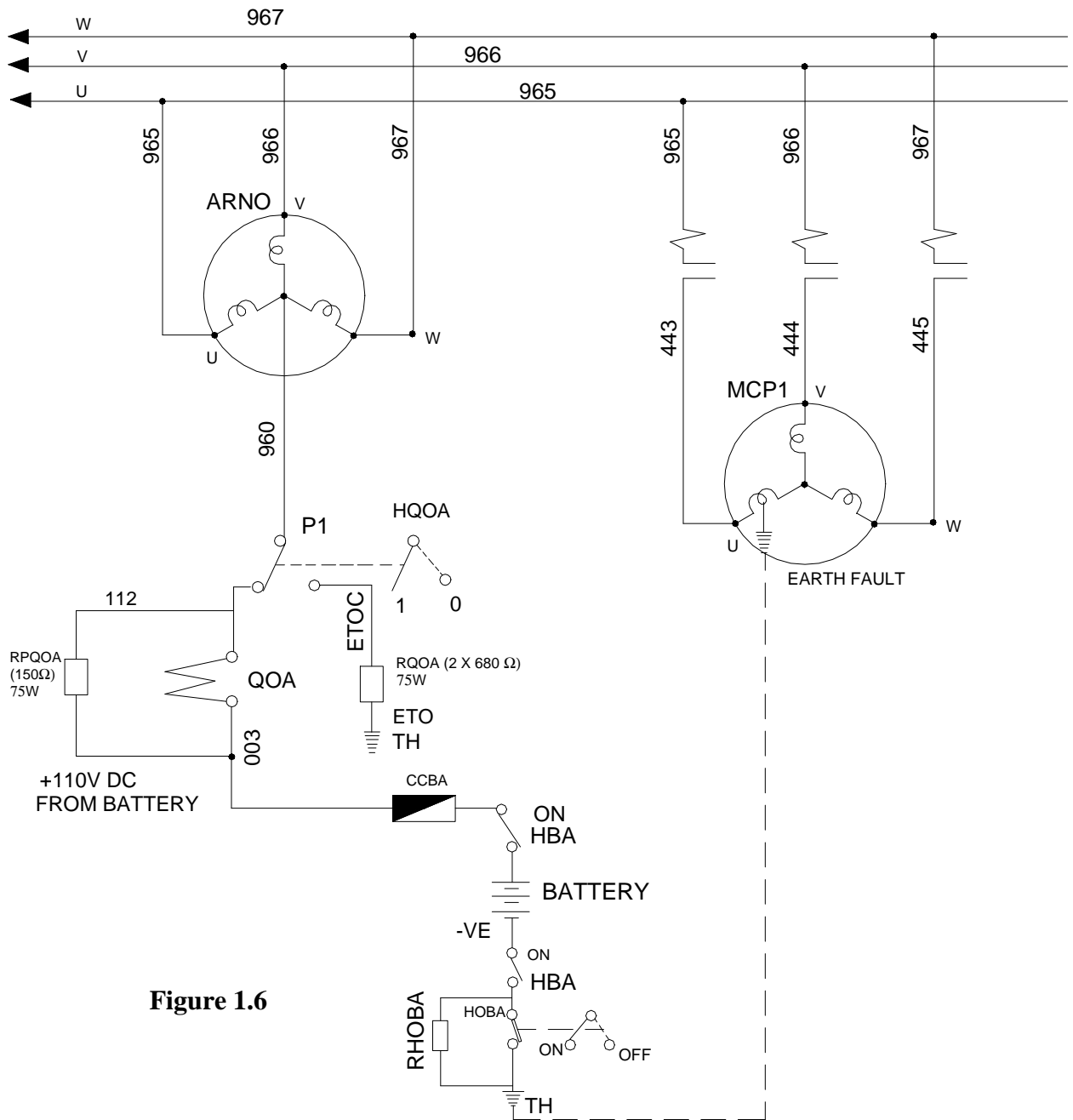


Figure 1.6

Relay QOA coil and permanent resistor (RPQOA) which are connected to battery positive at one end, get connected to battery negative through earth fault and its coil get energized by sensing the voltage drop across permanent resistor (RPQOA) as soon as this voltage drop reaches a pre-determined minimum pick up value of the relay coil

On energisation of relay, its normally closed interlocks in DJ holding coil (MTDJ) circuit get opened and resulted in instantaneous tripping of circuit breaker and lamp LSDJ lights up (ON), which gives the indication of DJ tripping. Relay flag indicator also drops which gives the indication of relay tripping to the driver.

In case of QOA drop, all auxiliary machines should be checked visually for any smoke emission/burning smell. If there is any sign of smoke/ burning, concerned auxiliary machine should be isolated by putting its switch on 'O' position. However for isolating relay QOA, switch HQOA should be operated on 'O' position, this will introduce high value resistance RQOA to limit the fault current.

7. MAINTENANCE

7.1 Trip Inspection

- i. Check the HQOP1-2 switch position, they should be on position “ON”.
- ii. Check the HQOA switch position, it should be on position “1”.

7.2 IA/ IB/ IC Inspections

- i. Following tests should be carried out before and after inspection of a locomotives during L.T. testing (with 25 kV supply off)
 - a. Test functioning of Auxiliary circuit earth relay (QOA) by creating an earth fault.
 - b. Test functioning of power circuit earth relay QOP1 & 2 by creating an earth fault.
- ii. Check all relays (QOP 1 & 2, QOA) for proper fitment and seal. If seal is found in broken condition, relay to be checked and calibrated and to be sealed.
- iii. Check resistances (RQOP1&2, RPQOP1&2, RQOA, RPQOA) for any crack and over heated marks.
- iv. Tighten the nuts and fixing screws of wiring terminals from back side (In IC schedule only).

7.3 AOH Inspection

In addition to all checks of IC schedule, carry out following works.

- i. Check and clean resistances (RQOP1&2, RPQOP 1&2, RQOA, RPQOA) for any abnormality.
- ii. Check connection tightness of all resistance terminals and their lug crimping for any looseness.

7.4 IOH/ POH Inspection

During IOH/POH inspections, all relays (QOP1&2, QOA) to be overhauled. The guidelines for overhauling are given below.

7.4.1 General

- The relays should be overhauled and calibrated by skilled and experienced staff.
- Follow all the special maintenance instructions (SMIs) issued by RDSO.
- Repairs or overhauling of the relays are to be carried out in the relay test room.
- The relay test room should be air conditioned or at least pressurized with filtered air.

7.4.2 Incoming inspection and testing

- Check visually all the parts of the relay for any defect and deficiency and record the same.
- Fit the relay in plug in housing on testing panel.
- Check the pick up value and humming noise etc. record the pick up value.
- Check the coil resistance and record it. It should be $1800 \text{ ohms} \pm 8\%$ i.e. $1656 - 1944 \text{ ohms}$ at 20 degree C .
- Dismount relay from testing panel.
- Check insulation resistance with 500 volts megger between.
 - a. Coil to body &
 - b. Contacts to body.It should be minimum 10 Mega ohms.
- Check the condition of contact tips for any flashing.

7.4.3 Dismantling

- Unscrew 4 nos. screws and 2 nos. nuts and remove coil protection cover.
- Unscrew 2 nos. nut and bolt and remove coil.
- Unscrew the nuts of contact carrier.
- Unscrew terminal plate foundation screws and remove plate with contact carrier.
- Unscrew the screws of lower bearing and remove bearing.
- Unscrew upper bearing screws.
- Remove circlip of contact tension spring setting gear and remove upper bearing, gear armature.
- Remove coil covers from their foundation.
- Remove the circlip of red ring holding lever.
- Remove the armature setting screws and drum.

7.4.4 Cleaning and Checking

- Clean all parts of relay body with petrol and blow with dry compressed air.
- Clean lower and upper bearing with petrol and check the condition of Jewel. Replace if required.
- Clean armature with petrol and check visually for any defect.
- Clean armature adjusting screws and drums and remove colour sealing.
- Clean the contact spring and check the tension and bends etc.
- Clean contact carrier, contact tips and terminal plate with petrol.

- If contact tips are flashed, clean them with contact burnishing tools and cleaning agent dispensers. The burnishing tool should also be dipped in degreasing fluid before use.
- Tighten the terminal connections.
- Clean coil protection cover with petrol.
- Clean coil and core with petrol.
- Prepare the minilex paper cover for metallic protection cover of coil.
- Clean the gear and other hard-wares with petrol.

7.4.5 Assembly

- Assemble all the parts of the relay in reverse order of dismantling.
- Put minilex paper cover into the coil protection cover.

7.4.6 Testing

- Fit the relay in plug in housing on testing panel.
- Check the relay for humming noise and rectify if required.
- Set relay for its minimum pick up value i.e. at 50V DC by moving the drum and test for its correctness.
- Dismount the relay from testing panel.
- Make colour sealing on drum and gear.
- Check the insulation resistance with 500V megger between
 - a. Coil to body and
 - b. Contact to body.It should be minimum 10 mega ohms.
- Check the contact gap in energized condition, it should be 0.6 ± 0.1 mm approx.
- Check the contact pressure in de-energised condition, it should be $12 \pm 25\%$ gms.

8. CHECK POINTS FOR QOP DROP CASE IN SHED

On arrival of the loco in the shed for QOP-1 or QOP-2 dropping, check the locomotive as per the guidelines given below.

- Refer the loco log book for the driver's remarks about the failure.
- Check the relay QOP-1 or 2 for their flag condition and reset the flag if found in dropped condition.
- Check the HQOP 1 or 2 switch position and put them on position 'ON' if found on 'OFF' position.
- Put the HBA switch on 'ON' position and check the relay QOP-1 or 2 as the case may be for dropping, if the earth fault in the power circuit is of permanent nature, the concerned relay will operate and its flag indicator will drop.
- Investigate the case as per the power circuit diagram and observations.

8.1 In Case Of QOP-1 Dropping

Put the battery switch HBA on 'OFF' position and reverser J1, J2 and HQOP1-2 switch in neutral position.

Item no.A

Megger the power circuit with 1000V megger from top side connections of line contactors L1, L2, L3. If the top & side circuit showing good then proceed to item no. B.

If the top side circuit showing '0' (earth), then

- i. SL1 cables and coils to be meggered. If it is found good then
- ii. Cable of Q-20 relay, RQ-20 to be checked and meggered. If it is found good then
- iii. RSI-1 block cover to be opened and to be checked thoroughly for any abnormality and to be meggered. If it is found good then
- iv. All concerning cables of SL1, RSI-1 to be checked and meggered. If it is found good then
- v. ATFEX and C145 and their cables to be checked and meggered. if it is found good then
- vi. RCAPTFP-1 and CAPTFP-1 panel to be checked and meggered.

Item no.B

Megger the power circuit from bottom side of the line contactors L1, L2 and L3. If the bottom side circuit showing good then proceed to item no. C.

- i. If L1 showing '0' (earth) then
 - a. TM1 inspection cover to be opened and to be checked visually for any flashing, carbon brushes pig tails broken etc.
 - b. TM-1 cable connections (armature side) to be removed and TM and its cables to be meggered.
 - c. If TM-1 armature showing 'O' (earth), then TM-1 to be got checked thoroughly by TM section staff. If TM-1 cables showing 'O' (earth), then cables to be checked.

- d. If TM-1 and its cables showing good then U1, RU1 and their cables to be checked and meggered.
- e. If DBR existing, then RF1, MVRF, QF1 shunt and CTF-1 to be checked & meggered.
- ii. If L-2 or L-3 showing '0' (earth), then TM-2 or TM-3 and their associated circuit to be checked and meggered respectively, in the same pattern as mentioned in L-1 case above.

Item no. 'C'

If item no. A and B showing good then

- i. Megger the circuit from reverser-1 (J-1) fingers (ensure J-1 in neutral position)
- ii. If J-1 finger no. 2, 7 showing 'O' (earth) then field winding RPS, shunting resistance, SJ relating to TM-1 and their cable to be checked and meggered.
- iii. If J-1 finger no.4, 9 or 6, 11 showing 'O' (earth) then same procedure to be adopted for TM-2 or TM-3 respectively as mentioned above in C-(ii).

Item no 'D'

If item no. A, B, C showing good then

- i. QD-1 relay and its connections, ammeters and connections and their shunts to be checked and meggered.
- ii. Copper links, line contactors insulating bars to be checked and meggered.

Item no. 'E'

If everything found normal in item no. A, B, C, D then

- i. Relay QOP1, RPQOP1 and RQOP1 and connection cables to be checked and meggered.
- ii. All the TM & i.e. TM 1, 2, 3 cables underneath to be checked visually for any insulation failure or rubbing with TM/Bogie etc. Any flashing or tracking in cable or in junction box and terminal box to be examined thoroughly.

Item no. 'F'

If everything found normal in item no. A, B, C, D & E then-

- i. Loco to be energized, movement to be taken with TM 1, 2, 3 in service, if found no QOP drop then,
- ii. Loco to be moved with only one TM in service one by one. If found no QOP drop then,
- iii. All traction motors to be isolated by opening their line contactors EP valve connections and then loco to be energized and take 32 notches.

- iv. All TMs i.e. 1, 2, 3 inspection covers to be opened and check them thoroughly inside for any flashing, tracking or burning marks etc. If there is any doubt then rocker of above TMs to be rotated for thorough checking.
- v. RPS and SL-1 covers to be opened and to be checked for any flashing, tracking or burning marks.
- vi. HT compartment to be checked thoroughly for any flashing, tracking or burning marks etc. or any foreign material.
- vii. TM 1, 2, 3 main field and IP to be meggered by 2.5 kV megger.

8.2 In Case Of QOP-2 Dropping

Check the locomotive in the same pattern as mentioned in 8.1 as per traction power circuit of TM 4, 5 and 6.

9. CHECK POINTS FOR QOA DROP CASE IN SHED.

On arrival of the locomotive in the shed for QOA dropping, check the locomotive as per guide lines given below.

- Refer the loco log book for the driver's remark about the failure.
- Check the relay QOA for their flag condition and reset the flag if found in dropped condition.
- Check the HQOA switch position and put it on position 1, if found on position '0'.
- Check all the auxiliary motors, MPH, ARNO, R118, C118 visually for any smoke emission marks, burning smell etc.
- Check TK panel, all electro magnetic contactors and their cable connections etc. visually for any flashing marks etc.
- Check all auxiliary motors pacco (program) switches for their position, ensure all switches are on position 1.
- Put the HBA switch on position 'ON' and if the relay QOA flag indicator drops, then the earth fault in auxiliary circuit is of permanent nature and before the EM contactors. Reset the relay flag.
- Put the battery switch HBA on position 'OFF' and switch HQOA in neutral position.
- Megger the auxiliary circuit cables at TK panel with 500V megger and investigate the case as per the auxiliary circuit diagram and observations.

10. MODEL QUESTIONS

A. OBJECTIVE TYPE

1. The minimum pick up voltage of QOP/QOA relay is
 - a. 110V dc
 - b. 50V dc
 - c. 75V dc
 - d. 750V dc

2. The type of the earth fault relay is
 - a. DI type
 - b. Differential type
 - c. DU type
 - d. None of the above.

3. Earth fault relay QOP is used for the protection of
 - a. Auxiliary circuit
 - b. Power circuit
 - c. Control circuit
 - d. All of the above.

4. Earth fault relay QOA is used for the protection of
 - a. Auxiliary circuit
 - b. Power circuit
 - c. Control circuit
 - d. All of the above.

5. When earth fault relay actuates, the DJ trips
 - a. After 0.6 seconds.
 - b. After 5.6 seconds.
 - c. Instantaneously
 - d. None of the above.

6. Earth fault relay actuates
 - a. Before the appearance of earth fault
 - b. After the earth fault occurs.
 - c. Any time.
 - d. All of the above.

7. Switch HQOP/HQOA is used for
 - a. Isolating relay QOP/QOA.
 - b. Introducing high valve resistance in the earth fault current circuit.
 - c. Both of the above.
 - d. None of the above.

8. Permanent resistances RPQOP/RPQOA are connected
 - a. Across the relay coil
 - b. In series with relay coil
 - c. None of the above.

9. Relay QOP/QOA interlocks are provided in control circuit of
 - a. DJ holding coil (MTDJ) circuit
 - b. DJ closing coil (EFDJ) circuit.
 - c. Relay Q44 circuit
 - d. Relay Q118 circuit

10. Insulation resistance test of the relay during overhauling is to be done with
 - a. 1000 volt megger.
 - b. 500 volt megger
 - c. 2.5 kV megger
 - d. None of the above.

11. If TM-2 armature got earthed, the relay
 - a. QOP1 will actuate
 - b. QOP2 will actuate
 - c. QOA will actuate
 - d. No relay will actuate.

12. If main compressor motor got earthed, the relay
 - a. QOP1 will actuate
 - b. QOP2 will actuate
 - c. QOA will actuate
 - d. No relay will actuate

B. FILL IN THE BLANKS

1. Earth fault relay is a relay.
2. Number of QOP relays for one locomotive
3. Number of QOA relays for one locomotive
4. Coil resistance of QOP/QOA relay is at 20 degree C.
5. Contact pressure of QOP/QOA relay is gms.
6. Contact gap of QOP/QOA relay ismm
7. Contact configuration of QOP/QOA relay is
8. Earthing resistance for QOP relay is designated as
9. Earthing resistance for QOA relay is designated as
10. Resistance value of RQOP is at 20 degree C.
11. Resistance value of RQOA is at 20 degree C.
12. Continuous output of RQOP/RQOA resistance is watts.
13. Permanent resistance connected across relay QOP coil is designated as
14. Permanent resistance connected across relay QOA coil is designated as
15. Resistance value of RPQOP/RPQOA is at 20 degree C.
16. Switch HQOP has and positions.
17. Switch HQOA has and positions.
18. If earth fault occurs in SL-2, relay will actuate.
19. If earth fault occurs in MPH, relaywill actuate.
20. If earth fault occurs in the cable of relay QD-1, relay will actuate.

C. SAY 'TRUE' OR 'FALSE'

1. The minimum pick up value of QOP/QOA relay is 110V dc.
2. Primary relays are connected directly in the protected circuit.
3. No flag indicator is used in QOP/QOA relay.
4. Earth fault relay is a current operated (DI) type relay.
5. Relay QOP and QOA can be inter changed.
6. The flag indicator can be observed through the front plate of the relay.
7. The flag indicator of relay QOP/QOA can not be resetted from the front plate.
8. Relay QOP is provided for the protection of auxiliary circuit.
9. Permanent resistance RPQOP/RPQOA is connected across the relay coil.
10. Relay QOP can be isolated by putting switch HQOP on position 'Off'.
11. DJ trips instantaneously whenever relay QOP or QOA actuates.
12. Relay QOP/QOA actuates before the occurrence of earth fault in the concerned circuit.
13. Normally close (NC) interlocks of earth fault relays are used in DJ control circuit.
14. Lamp LSDJ lights up (ON) whenever DJ trips.
15. If armature of a traction motor got earthed, the faulty motor can not be isolated by HMCS switch.
16. When relay QOP is isolated by HQOP switch, and a high value resistance RQOP is introduced to limit the fault current.
17. If earth fault occurs in relay Q20, QOP-2 relay will actuate.
18. For investigation of QOA drop case in shed, auxiliary circuit meggering is to be done with 500V megger.
19. While meggering of power circuit, switch HQOP1-2 is to be kept in neutral position.
20. While meggering of auxiliary circuit, switch HQOA is to be kept in '1' position.

D. WRITE SHORT NOTES ON FOLLOWING

1. Important protective relays used in AC electric locomotives.
2. Function of permanent resistance in earth fault relay operation.
3. Function of HQOP and HQOA switch.
4. Check points during IA/IB/IC schedule of earth fault relays.
5. QOP relay
6. QOA relay

E. DESCRIPTIVE QUESTION

1. Describe the function of relay QOP and how it actuates, explain with a example and sketches?
2. Describe the function of relay QOA and how it actuates, explain with a example and sketches?
3. Write down the overhauling procedure of DU type relays and write important values to be checked.
4. Explain the investigation procedure for QOP drop case in the shed.
5. Explain the investigation procedure for QOA drop case in the shed.

REFERENCES

1. CLW Maintenance Manual Volume – I – 1993 of 25 kV, 50C/S AC Frieght Electric Locomotive Broad Gauge CO-CO Type WAG 5 Class.
2. CLW Maintenance Manual Volume – III – 1993 of 25 kV, 50C/S AC Frieght Electric Locomotive Broad Gauge CO-CO Type WAG 5 Class.
3. CLW Maintenance Manual Volume – I – 2000 of 25 kV, 50C/S AC Frieght Electric Locomotive Broad Gauge CO-CO Type WAG 7 Class.
4. Specification no. CLW/ES/R-27 for Relays Type: Sequence , Time lag, Protective for 25 kV AC Electric Locomotive.
5. Field study and literature collected from various AC Electric loco sheds/ workshops and manufacturers.



NOTES



OUR OBJECTIVE

To upgrade maintenance technologies and methodologies and achieve improvement in productivity, performance of all Railway assets and manpower which inter-alia would cover reliability, availability, utilisation and efficiency.

If you have any suggestions and any specific comments please write to us.

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