

Government of India  
(Ministry of Railways)  
Research Designs & Standards Organisation  
Manak Nagar, Lucknow-226 011

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S-14  
Modification Sheet No. ELRS/MS/0297-2000(Rev.'0')

(This supersedes RDSO Modification Sheet No. RDSO/WAG5/12  
Dated 2/8.2.1994)

**UTILIZATION OF NO-VOLT RELAY (Q30) FOR LOW VOLTAGE  
PROTECTION OF AUXILIARY MACHINES IN AC ELECTRIC LOCOMOTIVES**

**1.0 OBJECT**

- 1.1 In ac electric locomotives, the NO VOLT relay Q30 (DU type) is used for sensing and isolating the power circuit when the catenary voltage falls below 10 KV. This relay has been provided with a series resistance (RQ30) of  $3.9 \pm 10\%$  kilo ohms, 75 watts. The relay picks-up at 215 V ac without the resistance RQ30 which is being by-passed through normally open contact of Q45 during closing of circuit breaker. As soon as the relay Q45 de-energizes the resistance RQ30 comes in series with the operating coil of relay Q30. The relay drops out at 179 volts ac (with RQ30 in circuit) which corresponds to 9.7 KV catenary voltage with respect to nominal catenary voltage of 22.5 KV and transformer auxiliary winding voltage of 415 Volts ac.
- 1.2 Since the auxiliary machines in the locomotive are designed for satisfactory operation between 290 and 500 volts ac which corresponds to 15.7 KV & 27.1 KV catenary voltages respectively. In the event of the catenary voltage dropping below 15.7 KV(it can be as low as 9.7 KV before Q30 drops out), the auxiliary machines continue to draw power from the Arno at a voltage much lower than the minimum safe operating voltage of 290 volts ac.
- 1.3 In order to prevent the auxiliary machines to work under low voltage conditions i.e. voltages below 290 volts ac, it is proposed to utilize the existing NO

**VOLT relay Q30 as Low Voltage Relay.** For this purpose, the value of resistance RQ30 is required to be increased such that the relay Q30 drops out just below 290 V ac (say 285 volts) resulting in tripping of the circuit breaker and protecting the auxiliary machines from under voltage.

- 1.4 The dropout voltage (without series resistance) of Q30 relay varies from 140 volts AC to 170 volts AC from relay to relay; hence it is essential that each relay with its predetermined value of series resistance (RQ30) is tested on test bench before fitment on loco to ensure that it drops out correctly at 285 volts AC and protects the auxiliary machines from working under low voltage conditions.

## **2.0 WORK TO BE CARRIED OUT**

- 2.1 Disconnect and remove existing RQ30 (resistance value  $3.9 \pm 10\%$  kilo ohms, 75 watts or variable resistance of 3.5 to 5.0 kilo ohms, 75 watts. (Ref. RDSO MS No.WAG5/12)
- 2.2 Procure **RQ30 Resistance Unit** of rating 25.0 K Ohms, 25 Watt, 500 Volt AC. This resistance unit shall comprise series connected fixed resistance of value 10 K Ohms and a variable resistance of 15 K Ohms.
- 2.3 Make an arrangement on the **Test Bench** to connect the above resistance unit in series with the operating coil of Q30 with the provision of a suitable means to by-pass this resistance during picking-up of the relay.
- 2.4 Remove Q30 relay from the loco and connect it as per para 2.3 above. Keep the sliding clamp of the variable resistance at the minimum value so that only fixed resistance of 10.0 K Ohms is in series with the relay coil. By-pass the resistance, apply AC voltage across the operating coil to energize the relay. Increase this voltage to 285 Volts AC and release the by-pass switch. Adjust the variable resistance till the relay drops out. Tighten and secure the clamp on the variable resistance at this position to avoid any disturbance during service.

- 2.5 Remove the resistance unit and Q30 relay from the test bench and write the relay Serial No. on this resistance unit or by any other method ensure that only this combination i.e. relay with the value of particular series resistance (RQ30) is provided on loco.
- 2.6 Whenever, the relay or the variable resistance is to be replaced for any reason, it should be ensured that value of RQ30 is again checked and reset such that the relay drops out at 285 volts AC.
- 2.7 With the above pre-determined value of RQ30, the circuit breaker will trip as and when the catenary voltage drops below 15.7 KV corresponding to auxiliary circuit voltage falling below 290 volts, thus preventing the auxiliary machines from being subjected to under voltage.

### **3.0 APPLICATION**

All 25 KV AC electric locomotives fitted with DU type Q30 relays.

### **4.0 MATERIAL REQUIRED**

01 No. RQ30 Resistance Unit of rating 25.0 K Ohms, 25 Watt, 500 Volt AC for each relay. This 25 K ohms resistance unit shall comprise a fixed resistance value of 10 K Ohms and a variable range of 15 K Ohms.

### **5.0 MATERIAL RENDERED SURPLUS**

01 No. RQ30 of  $3.9 \pm 10\%$  kilo ohms fixed value.

OR

01 No. variable resistance of 3.5 to 5.0 K Ohms, 75 watt.

### **6.0 AGENCY FOR IMPLEMENTATION**

All electric loco sheds/POH shops and Production Units.

### **7.0 DISTRIBUTION**

As per mailing list enclosed.

**NOTE:-**

- (i) By adopting the revised value of RQ30, the relay Q30 will not allow auxiliary machines to work below 290 volts AC auxiliary circuit voltage and will trip the circuit breaker. In such cases, drivers may try to wedge the Q30 relay which will defeat the very purpose of implementation of this modification. **Railways are therefore requested to ensure that catenary voltage does not fall below 17.5 KV in any section so that the failures of auxiliary machines due to under voltage is minimised.**
- (ii) The drivers may be instructed not to re-close the DJ in the event of operation of relay Q30. Re-closer may be attempted after two minutes.
- (iii) The calculated values of series resistance for minimum and maximum drop out voltages of 145 ~~and~~ 160 volts (without series resistance) for auxiliary circuit voltage of 285 volts AC are 18.747 K Ohms and 16.2 K Ohms respectively.

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Encl: Mailing List

for Director General (Elect.)