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भारत सरकार - रेल मंत्रालय
अनुसंधान अभिकल्प और मानक संगठन
लखनऊ - 226011

Government of India - Ministry of Railways
Research, Designs & Standards Organization,
LUCKNOW - 226011
Dated 28.02.2011

No. EL/3.1.35/2 (Electrical)

Chief Electrical Engineers,

- Northern Railway, Baroda House, New Delhi-110 001
- East Central Railway, Hazipur - 844 101 (Bihar)
- Central Railway, 2nd floor, Parcel Office Bldg., Mumbai CST-400 001
- South Central Railway, Rail Nilyam, Secunderabad - 500 071.
- West Central Railway, Jabalpur-482001
- South East Central Railway, Bilaspur-495004
- South Eastern Railway, Garden Reach, Kolkata-700 043
- Chittaranjan Locomotive Works, Chittaranjan-713 331 (WB)

MODIFICATION SHEET NO. RDSO/2011/EL/MS/ 0395, Rev.'0' Dated 28.02.11.

1.0 Title:

Replacement of 10 sq. mm cable type 4GKW-AX (Cable no. 1147, 1148 and 1149) of oil cooling unit with 16 sq.mm cable type 4GKW-AX to improve the reliability of three phase electric locomotives.

2.0 Object:

- 2.1** South Central Railway vide their letter No. E.221/3Phase/Vol-IX/9738 dated 11-11-10 informed that in loco no. 30250 (WAP7), three cases of burning of OCB motor have taken place since commissioning of the locomotive on 10.06.10.. After 3rd failure the power supply cables were examined by SCR and found that 10 sq.mm E. beam cable supplying 415 V, 3 phase, AC power has badly perished and at many places the insulation of cable given away due to melting, causing short circuit among phases intermittently. At other places also the insulation became very hard. SCR further informed that the rating of OCB is 25 kW and the size of cables for similar rating motor on conventional locomotive is 25 sq. mm and therefore the cable of 10 sq.mm seems to be just adequate for rated current of 41.5 Amps.

2.2 Based on above , the calculations of cable size has been reviewed:

A. Calculation of cable cross section as per ABB design documents:

Nominal current

Motor rating 25 kW. Cos ϕ = 0.92, efficiency = 0.91 & Voltage = 415 V

Motor current = $25000 / (\sqrt{3} \times 415 \times 0.92 \times 0.91) = 41.5 \text{ Amps.}$

Calculation of cross section

Conductor temperature $T_{CU} = 120^\circ \text{C}$

Derating factor due to ambient temp. of 55°C in machine room, $f_T = 0.83$.

Three cables in bunch, with one circuit, so derating factor due to bunching of cable, $f_n = 1$

Demanded current after derating factors = Nominal current / ($f_T \times f_n$) = $41.5 / (0.83 \times 1)$
= 50 Amps.

Cable selected 10 sqmm keeping current rating of the cable in accordance with table of OEM (Huber & Suhner) considering cable laying in open tray, as 77 Amps.

Hence margin in current = $(77 - 50) / 50 = 54\%$

B. Actual cable cross section required:

Measurements were done in various make of OCB motors and sometimes the actual current was found as high 60 Amps at 50 Hz. Therefore, the calculations are required to be done taking nominal current as 60 Amps.

Nominal current = 60 Amps.

The derating factor f_T is 0.79 considering maximum temperature in machine room as 60 °C

Demanded current = $60/(0.79 \times 1) = 76$ Amps.

For 76 Amps of current, the cross section of cable should be at least 16 sqmm., which as per OEM table can take 82.8 Amps of current in close duct lay out (actually the duct in the locomotive is closed and not open).

Hence margin in current = $(82.8-76)/76 = 9\%$

3.0 Existing Arrangement with cross-references of respective design document:

The existing E. beam cable of 10 sq. mm from XK32A:03 to 59.A/1 in Bunch no. 228 (length 15 m) from HB1 to OCB1 and from 59.A/2 to XK67A:03 in Bunch no. 242 (length 16 m) from HB2 to OCB2 is available. Please refer ABB document No. 3EHP330302 (Cabling Aux. Ckt) and ABB document no. 3EHP431533 (Connection Cable bunch)

4.0 Modified Arrangement to replace existing arrangement: The existing E beam cable as detailed in para 3.0 is required to be replaced by E beam 16 sq.mm 4GKW-AX cable.

5.0 Application to class of locomotives:
WAP5, WAP7, WAG9 and WAG9H locomotives.

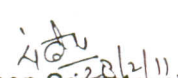
6.0 Material Required Per Loco:
31 m, 16 sq.mm 4GKW-AX E. beam cable , cable lugs for 16 sq.mm. cable size 12 Nos..

7.0 Material Rendered Surplus:
31m, 10 sq.mm 4GKW-AX E. beam cable

8.0 Reference:
South Central Railway vide their letter No. E.221/3Phase/Vol-IX/9738 dated 11-11-10

9.0 Modification Drawing:
NIL

10.0 Agency of Implementation:
CLW shall immediately start implementing the above modification. However, the Electric loco sheds shall replace the cable depending upon the condition of cable. Sheds shall observe the condition of cables critically during schedules. The modification shall also be implemented during POH of the locomotive by workshops.


(Sandeep Srivastava)
for Director General/Elect.

Encl: As above

Copy to:-

1. **Secretary (Electric Traction)**, Railway Board, Rail Bhavan, New Delhi-110 001
2. **Chief Electrical Loco Engineers**,
 - Central Railway, 2nd floor, Parcel Office Bldg., Mumbai CST-400 001
 - East Central Railway, Hazipur – 844 101 (Bihar)
 - Northern Railway, Baroda House, New Delhi-110 001
 - South Central Railway, Rail Nilyam, Secunderabad – 500 071.
 - West Central Railway, Jabalpur-482001
 - South East Central Railway, Bilaspur-495004
 - South Eastern Railway, Garden Reach, Kolkata-700 043

3. **Sr. DEE (TRS), Electric Loco Sheds,**

- Central Railway, Ajni (Nagpur)-440008
- East Central Railway, Gomoh-828 401
- Northern Railway, Ghaziabad (UP)- 201001
- South Central Railway, Lalaguda, Secunderabad – 500 017.
- West Central Railway, Tughlakabad, New Delhi- 110 044.
- South East Central Railway, BMY Complex, Bilai, Durg-490 025.
- South Eastern Railway, Tatanagar-831 002.

4. **Chief Works Manager,**

- Electric Loco Workshop, Central Railway, Bhusaval- 425 201.

Encl: As above


28/2/11
(Sandeep Srivastava)
for Director General/Elect.