

SN-2993

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सत्यमेव जयते

**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS**

**TECHNICAL SPECIFICATION
FOR
ZERO HALOGEN LOW SMOKE LIMITED FIRE
SURVIVAL
FLEXIBLE ELASTOMERIC CABLE WITH COPPER
CONDUCTORS
FOR
METRO COACHES**




**(WORKING VOLTAGE UPTO AND INCLUDING 1500
VOLTS)**

**SPECIFICATION NO. SPEC/E-14/04 (REV.2)
May- 2021**

APPROVED BY	SIGNATURE
PEDSE	 31/5/21




Issued by

**RESEARCH DESIGNS & STANDARDS ORGANISATION
MANAK NAGAR, LUCKNOW-226 011**

Prepared by	Checked by	Issued by
 JE/D/15 31.5.2021	 A. Reddy 31.5.2021 JDSE	 31.5.2021 EDSE

Status of Revision

S. N.	Date of Revision	Clause No.	Revision	Reasons for Revision
1	31.05.2021	Following clauses of existing Spec , Rev '1' has been revised: 1.1.1.2.1.3, 2.1.5.2.5.3 7.0- New clause	2	In compliance to i) Vigilance Cell Note no. CVO/RDSO/Confdl/2020 dtd.20/03/2020. ii) AML (Traction) letter no.97/Elect (TRS)/113/4 dated 05.06.2020 iii) DG Secretariat's Note no. DG/Misc. dtd.10/06/2020. iv) QA/Mech Dte. Note No. QAM/Spl.DG/Misc.dtd 15.06.2020. v) Electrical Dte. Note no. EL/8.1.10 dated 22.06.2020. vi) Vigilance Cell Note no. CVO/RDSO/Confdl/2020 dtd. 23.06.2020. vii) Vigilance Cell Note no. CVO/RDSO/Confdl/2020 dtd.21/08/2020. viii) Spl. DG(VD) note no. Spl.DG(VD)/Misc.(20) dated 27.08.2020

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TECHNICAL SPECIFICATION FOR HALOGEN FREE, LIMITED TOXIC FUME EMITTING, LOW SMOKE, FIRE SURVIVAL FLEXIBLE ELASTOMERIC CABLES WITH COPPER CONDUCTOR FOR METRO COACHES

1.0 SCOPE

- 1.1 This specification covers the design/performance requirement of flexible copper cables for voltages up to & including 1500 Volts for use in Metro Coaches of IR.
- 1.2 The cables covered are zero halogen, low smoke, low toxic fume emission and limited fire survival type.

2.0 TESTS

The tests are classified as type test, acceptance tests and routine tests.

2.1 TYPE TESTS

These tests are carried out to prove the conformity with the requirements of specification and general quality/design features of the cable. Complete type tests on one size of cable from each voltage grade shall be carried out.

2.2 ACCEPTANCE TEST

Tests carried out on samples of cables taken from a lot for the purpose of acceptance of the lot. Acceptance test shall not be carried out on a particular size from the lot on which type test has already been conducted.

2.3 ROUTINE TEST

This test shall be carried out by the manufacturer on all finished cable length to demonstrate the integrity of the cable. The purchaser may however carry out these tests on samples selected at random as per Appendix 'A' of IS: 9968 (Pt. 1) of latest version to verify the results observed by the manufacturer.

3.0 MATERIALS

3.1 CONDUCTOR

- 3.1.1 The conductor shall be made up with circular tinned annealed copper wires complying with IS:8130 (latest version). For composition, Class-5 (Flexible) and Class-6 (Extra Flexible), nominal cross-sectional area, nominal dia of wires in conductor, no. of wires and maximum resistance of conductor at 20 deg.C shall be as per Table-I of E-14/01(latest version).

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3.1.2 Unless specifically indicated, it may be presumed that the cables to be supplied are as per composition Class-5.

3.2 INSULATION

The insulation shall be heat resisting Ethylene Propylene Rubber(EPR) based material suitable for voltage above 1100 Volts complying with requirement of type IE-3 serial No (ii)(b) of Table 1 of IS:6380 (latest version).

3.3 SHEATH

The elastomeric base sheathing material suitable for continuous operating temperature of 90 deg. C shall be generally Polyolefin, Zero Halogenated compound similar to Ethylene Propylene Diene Monomer (EPDM), Ethylene-Vinyl Acetate (EVA) and Ethylene Acrylic (EA) complying with the requirement of type SE-4, Table 1 of IS:6380 (latest version). The sheathing material shall have Low smoke, Low toxic fume emission, heat resistant, oil resistant and limited fire survival properties. Infrared spectrograph shall be submitted by the manufacturer to identify the polymer used in the sheathing compound.

4.0 CONSTRUCTION OF CABLE

The construction of a Single Core 1500 V Grade Flexible cable is given in Annexure-1 for guidance. Conductor formation insulation/sheath thickness, their tolerances and colour etc. shall be as per details given in the Section III of E-14/01(latest version).

5.0 TEST, TEST METHOD AND REQUIREMENTS

5.1 The type tests, acceptance tests, routine tests and test methods as laid down in RDSO's specification No. E-14/01 (latest version) shall be applicable except fire characteristic tests which shall be as under:

5.2 FIRE CHARACTERISTIC TESTS

SN	TEST	REQUIREMENTS	TEST METHOD
5.2.1	Oxygen Index	Index (29 to 30)% minimum	ASTM-D-2863
5.2.2	Smoke Density Rating	% age absorption maximum 20	ASTM-D-2843
5.2.3	Temp. Index	Between 250 deg. C to 300 deg. C	ASTM-D-2863
5.2.4	Corrosivity of combustion gases	pH-Index ≥ 4.3 Electrolytic conductivity ≤ 100 micro s/cm.	IEC-60754-2
5.2.5	Toxicity index	Maximum 5 Gases to be extracted HCL , HBr, HF, CO,	NES-713 HCL shall be

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		CO2, NO, SO2, HCN	the first gas to be extracted.
5.2.6	Fire survival temp.750deg.C duration 20 minute(minimum)	To withstand the rated voltage during and after the test.	IEC-60331
5.2.7	Swedish chimney	Unaffected length from the top 300 mm (minimum)	SS-4241475 (Class-F3)
5.2.8	Fire Test	Unaffected length from the lower edge of the top clamp 50 mm (minimum)	IEC-60332-1

5.3 Requirements for Tensile/Elongation properties as received and after ageing in air oven shall be as under:

5.3.1	Tensile strength as received	$\geq 10 \text{ N/mm}^2$
5.3.2	Elongation as received	$\geq 125\%$
5.3.3	Alteration after ageing in air Oven for 10 days, 150 deg.C	$\pm 30 \%$
5.3.4	Tear resistance of Insulation & Sheath Tearing Force	$\geq 2.5 \text{ N/mm}$

6.0 IDENTIFICATION, PACKING AND MARKING

The instructions as laid down in Section V of E-14/01 (latest version) shall be followed.

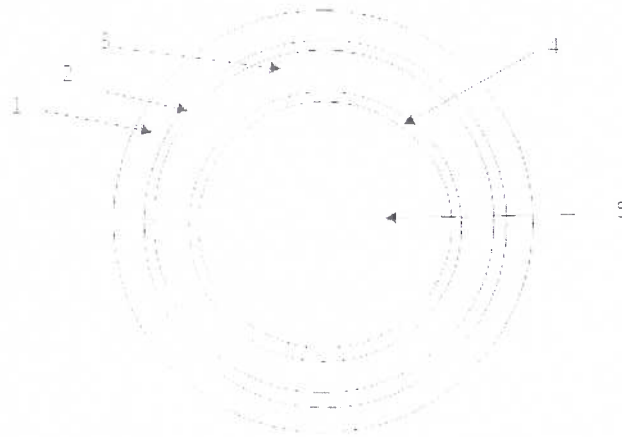
7.0 TEST FORMATS

The standard format for various test(s) is enclosed under Annexure-II.

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ANNEXURE-I

CONSTRUCTIONAL DETAILS OF SINGLE CORE,
ZERO HALOGEN, LOW SMOKE, FIRE RETARDANT
FLEXIBLE CABLE OF 1500V GRADE
FOR USE IN METRO COACHES



Legend:

- 1- Zero Halogen, Low Smoke, Low Toxicity, Fire Retardant, Elastomeric Sheath
- 2- Glass Fibre Tape
- 3- Ethylene Propylene Rubber (EPR) Insulation
- 4- Glass Mica Tape
- 5- Annealed Tinned Copper (ATC) Stranded Class-5 (Flexible) Conductor

Dimensions shall be as per E-14/01(Latest Version)

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Annexure-II

TEST DATA RECORD		
Name of Test:		
Customer :		
Drum No. :		
Sample Details:		
Tabulation of observations		
No. of Specimens :		
Starting Date & time :		
Final Date & time :		
SN	Parameters of test as per Specification	Observed values
Results / Remarks		
Specified		Observed
TESTED BY		WITNESSED BY

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