

AMENDMENT NO.1 NOVEMBER 1997

TO

RDSO SPECIFICATION NO.E-14/01(Part-I)
REV.II:1993 FOR FLEXIBLE ELASTOMERIC CABLES
WITH COPPER CONDUCTORS FOR POWERED ROLLING
STOCK APPLICATIONS

ADDENDUM

(Table-I, S.No.7 at Page No.12) - Add the following
in the S.No.7 of Table-I at Page No.12 :

- " Put * Asteric mark at S.No.7 of Table-I giving
details as mentioned below at the bottom of the
page.
- * The composition of conductor for jumper cables
being used as inter coach coupler connections on
EMUs shall be 56/0.30 mm, 19 core, multibunched
Rope Stranded Construction 8/0.30 mm. i.e.
 $(1 \times 8 + 6 \times 8) = 8 + 48 = 56$

AMENDMENT NO.2 OF APRIL 1998

TO

RDSO SPECIFICATION NO.:E-14/01(PART-1)

REV.II : 1993 FOR FLEXIBLE ELASTOMERIC

CABLES WITH COPPER CONDUCTOR FOR POWERED

ROLLING STOCK APPLICATIONS.

ADDENDUM

(Section IV, Acceptance Tests Clause 11.2,

Test No.(d) High Voltage Test) - Correct

the Test No.(d) as under :-

Test	Reference Specn. for requirements	Reference Specn. for Test method
(d)High Voltage Test	Clause 22.2.2 of IS 9968-I- 1988.	Part 45 of IS 10310-1984.

AMENDMENT N o.3 OF APRIL 2000

TO

RDSO SPECIFICATION No. E -14 / 01 (Part - 1) Rev.II-1993

FOR FLEXIBLE ELASTOMERIC CABLES WITH COPPER
CONDUCTOR FOR POWERED ROLLING STOCK APPLICATIONS .**ADDENDUM**

(Section II , Material Clause 4.1)

In the third line of clause 4.1, replace " Serial No. (ii) (e)" WITH

"Serial No. (ii) (c)".

AMENDMENT NO.4 OF SEPTEMBER-2003

TO

RDSO SPECIFICATION NO.E-14/01(PART 1) REV.II – 1993 FOR FLEXIBLE
ELASTOMERIC CABLES WITH COPPER CONDUCTOR FOR ROLLING STOCK
APPLICATION

ADDENDUMS

1.0 SECTION IV, TYPE TEST CLAUSE 11.1 & ACCEPTANCE TEST
CLAUSE 11.2

- (a) Add the following "Strippability Test" in Type as well as Acceptance Tests :

Test	Reference specification for requirement	Reference specification for test method
Strippability for section 2.5 to 06 mm. sq.	The admissible stripping force shall be between the minimum and maximum values. The conductor shall not be damaged and shall be free of residues.	Appendix clause 9 of this specification.

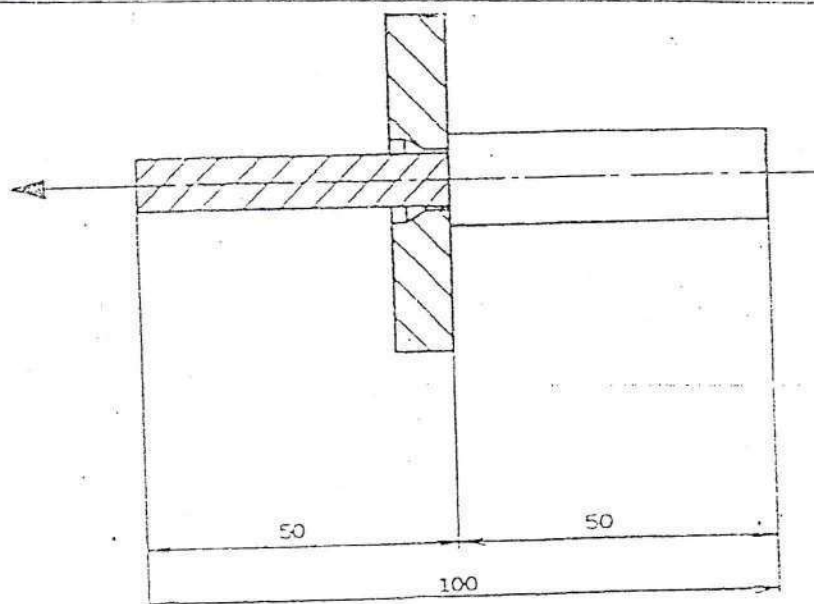
- (b) Add a new clause 9 in Appendix as under :-

Strippability Test

Test Method

A sample of 100 mm. length shall be stripped 50 mm. carefully, so that remaining portion of 50 mm. is not moved or deformed. The stripped end shall be slipped into the bush according to the figure given bellow. The diameter of the bore hole shall slightly exceed the diameter of the conductor. The conductor shall be pulled out from the insulation with constant speed by means of an elongation test equipment. The admissible stripping force for sizes 2.5 to 06 mm. sq. cable shall be between the min. and max. values indicated as under :

Nominal cross-section mm. sq.	Pull Force	
	Minimum in N	Maximum in N
2.5	25	80
4.0	30	100
6.0	30	100



STRIPPABILITY TEST DEVICE

2.0 TABLE OF MULTI CORE CABLE

2.1 In the table of multicore cables at S.No.7 (19 core, 4 sq.mm. jumper cable), the tolerance on the overall nominal external diameter given in the last column as " ± 1.5 mm" to be changed as "+ 0.5mm. & - 1.5mm."

2.2 Add the following para in the end of the table of multicore cables (Page No.15) :

"The numbering of cores in multicore cables (except 3 cores) shall commence from the outer layer and end at the central core. The increasing numbers in all the layers shall be in the same direction."

No. SPEC/E-14/01 (Part-II) - REV-II - 1993.

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2-2-94GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS
(RAILWAY BOARD)INDIAN RAILWAYS
TECHNICAL SPECIFICATION
FORFLEXIBLE ELASTOMERIC CABLES WITH COPPER CONDUCTORS
FOR POWERED ROLLING STOCK APPLICATIONSPART - IIFOR WORKING VOLTAGES ABOVE 750 VOLTS UPTO
AND INCLUDING 3000 VOLTSSPECIFICATION No. SPEC/E-14/01 (PART-II): REV - II

(FEBRUARY 1993)

ISSUED BY

RESEARCH DESIGNS & STANDARDS ORGANISATION

LUCKNOW - 226 011

10.8.94

**Technical Specification for flexible
Elastomeric Cables with copper conductors
for powered rolling stock applications.**

0 FOREWORD

0.1 Indian Railway Technical Specification No. 3-13/03 for flexible cables with copper conductors for powered rolling stock applications was issued by RDSO in December-1977. The above specification covered both Thermoplastic (PVC) insulated cables as well as Elastomer insulated cables for use on electric locos, Diesel hydraulic and diesel electric locos and Electrical Multiple Units. Three amendments to this Specification have already been issued and various IS and other Specifications on which the specification was based have also been revised since the issue of this specification.

0.2 PVC insulated cables are being kept out of the Scope of this specification, as they are no longer considered suitable for rolling stock applications on account of their low life and low current densities.

0.3 Specification 3-14/01 was prepared in 1988 due to certain additions/modifications in the earlier specification 3-13/03. 3-14/01 was in 3 parts. Part-I was covering cables of 750V grade and Part-II those above 750V upto and including 3000V. Part-III was covering ERPVC cables. 3-14/01 had to be revised once again due to certain additions/alterations which were considered necessary in this specification.

0.4 This revised Specification supersedes earlier specification No. 3-14/01 (Part-II) : 1988 and 3-14/01 (Part-II) : REV - I and deals with Elastomeric Cables of 750V upto and including 3000V.

0.5 The following voltage grades are recognised for the purpose of this Specification :-

- (i) 1500V : This shall be used on AC circuits where the nominal voltage to earth does not exceed 1500V RMS and on DC circuits where the voltage does not exceed 1800 volts.
- (ii) 3000V : This shall be used on AC and DC circuits where the nominal voltage to earth does not exceed 3000V RMS in AC circuits and 3600V in DC circuits.

Industrial frequency 50-Hz shall be taken as frequency for all the AC applications mentioned above.

0.6 To fall in line with Indian Standards for Elastomeric cables, the Specification has been based on Indian Standard Specification for Elastomer Insulated Cables IS : 9968 (Part-I) of 1988 and IS:9968

SECTION - IGENERAL1 SCOPE

- 1.1 The Specification covers the requirement of copper flexible cables for use on electric locos, diesel electric locos, diesel hydraulic locos, diesel rail cars, battery locomotives and electrical multiple units.
- 1.2 The Specification covers requirements of cables for power circuits for voltages above 500 Volts.

2 TERMINOLOGY

- 2.1 For the purpose of this specification, the definition given in IS : 1885 (Part XXXII) - 1971 and the following shall apply.

2.2 Routine tests.

This test shall be carried out by the manufacturer on all finished cable lengths 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 : 2968 (Part-I) : 1968 to verify the results observed by the manufacturer.

2.3 Type tests.

This test is carried out to prove the conformity with the specification and intended to prove the general quality and design. The type test results shall be valid for a maximum period of 3 years.

2.4 Acceptance tests.

Tests carried out on samples taken from a lot for the purpose of acceptance of the lot.

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SECTION - IIMATERIALS3 CONDUCTOR

- 3.1 The conductor shall be made up with circular tinned annealed copper wires complying with IS : 3130-1984. For composition, Class 5 (flexible) and Class 6 (Extra-flexible), nominal cross sectional area, nominal diameter of wires in conductor, number of wires and maximum resistance of conductor at 20°C as per Table-1 of this Specification will be followed.
- 3.2 The composition Class 5 or 6 as desired by the user may be separately specified. Unless specifically indicated, it may be presumed that the cables to be supplied are as per composition Class 5.
- 3.3 The separator tape of red or any other distinguishing colour polyester shall be applied over the conductor.

4 INSULATION

- 4.1 The insulation shall be heat resisting EPR based material suitable for voltages above 1100 volts complying with requirement of Type IX-3 Serial No. (ii) (b) of Table 1 of IS : 6380-1984.

5 PROOFED TAPE

- 5.1 Proofed tape shall be closely woven cotton, without selvedge, proofed on one side with rubber. The thickness of the tape shall be approximately 0.15 mm.

6 ELASTOMERIC SHEATH

- 6.1 The sheath shall be of heavy duty, heat resisting, oil resisting and flame retardant CSP based elastomeric sheathing material complying with requirement of Type SE-4, Serial No. (v) (b) of Table 1 of IS : 6380-1984.

p.t.o. 4.

SECTION - IIICONSTRUCTION.7 CONDUCTOR

- 7.1 The conductor formation shall be according to Table-1 of this Specification for flexible and extra-flexible cables.

8 INSULATION

- 8.1 The conductor with separator shall be provided with elastomeric insulation in accordance with Table-2 and 3.

8.2 Thickness of insulation

The average thickness of elastomeric covering shall not be less than the value 'tc' specified in Table 2 and 3.

8.3 Tolerance on thickness of insulation (tc) :

The smallest of the measured value of thickness of elastomeric covering shall not fall below the value 'tc' specified in Table 2 and 3 by more than $0.1\text{mm} + 0.1'tc'$.

8.4 Application of insulation

The insulation shall be so applied by extrusion that it fits closely on the conductor but shall not adhere to it. A proofed cotton tape may be applied over the insulation at the discretion of the manufacturer.

8.5 Colour

The colour of elastomeric insulation shall be the natural colour of the insulating material.

9 OUTER SHEATH

- 9.1 The outer sheath shall be applied by extrusion in accordance with Table 2 and Table 3.

9.2 Thickness of sheath

- 9.2.1 The average thickness of the sheath shall not be less than the value 'ts' specified in Table 2 and 3.

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9.3 Tolerance on thickness of sheath 'ts'

9.3.1 The smallest of the measured values of thickness of sheath shall not fall below the value 'ts' specified in Table 2 & 3 by more than $0.2 \text{ mm} + 0.2 \text{ 'ts'}$.

9.4 Colour

9.4.1 The colour of outer sheath shall be black or any other colour as agreed to between the Purchaser and the Supplier. When the cable is intended for exposure to sunlight, the colour of sheath shall be black only. Unless specifically indicated, it may be presumed that the outer sheath shall be of black colour.

9.5 The material of finished covering shall be uniform and free from voids. It shall be possible to remove the covering/sheath without any difficulty.

SECTION - IVTESTS10 CLASSIFICATION OF TESTS10.1 Type tests

The following shall constitute type tests :-

<u>Test</u>	<u>Reference Specification for requirements</u>	<u>Reference Specification for Test Method</u>
(a) Tests on conductor		
1) Composition of conductor	Table-1 of this Specification	As per Appendix - Clause 6 of this Specification.
11) Persulphate test (for copper)	6.1.1 of IS:8130-1984	Part-4 of IS : 10810-1984
111) Annealing Test (for copper)	6.1.2 of IS:8130-1984	Part-1 of IS : 10810-1984
17) Resistance Test	Table-1	Part-5 of IS : 10810-1984
(b) Test for thickness of insulation and sheath	Table 2 & 3	Part-6 of IS : 10810-1984
(c) Physical tests for elastomeric insulation and sheath	Table 2 & 3 of IS : 6380-1984	Respective Parts of IS:10810-1984 as mentioned in IS:6380-1984 Table 2 & 3
(d) Cone resistance test	IEC 395-OR-1976	Appendix-3 of IEC 395-OR-1976
(e) High voltage test (Water immersion test)	1500V Grade Cables 6 KV (RMS) for 15 Min. 3000V Grade Cables 12 KV (RMS) for 15 Min.	Part 45 of IS : 10810-1984
(f) Insulation resistance test (Insulation resistance constant)	Table 2 of IS : 6380-1984	Part 43 of IS : 10810-1984
(g) Destructive puncture test	Appendix Clause 5	Appendix Clause 5
(h) Resistance to cracking test	Appendix Clause 1	Appendix Clause 1

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	Test	Reference Specification for requirements	Reference Specification for Test Method
(i)	Flexibility (Bending) test	Appendix Clause 2 ✓	Appendix Clause 2
(j)	Fire resistance Test	Appendix Clause 3	Appendix Clause 3
(k)	Resistance to sur- face tracking	Appendix Clause 4	Appendix Clause 4
(l)	Slippage test	Appendix Clause 7	Appendix Clause 7
(m)	Tests for identi- fication of rubber polymers	ASTM D-3677-83	ASTM D-3677-83
(n)	Life cycle test	Clause 22 of British Railway Board Specification TDE/76/P/16.	

10.1.1 Should a sample fail in Life Cycle Test, the test shall be repeated in three samples selected from the same batch. Should any of these samples fail, the batch shall be deemed not to comply with British Railway Board Specification No. TDE/76/P/16 and will not be accepted.

10.2 Acceptance tests

The following shall constitute Acceptance Tests :-

(a) Test on conductor

- | | | |
|--|--|---|
| (i) Composition
of conductor | Table 1 of
this Spec-
ification. | As per Appendix
Clause 6 of
this Specn. |
| (ii) Persulphate
test (for
copper) | Cl. 6.1.1 of
IS: 8130-1984 | Part-4 of IS :
10810-1984 |
| (iii) Annealing
test (for Cu) | Cl. 6.1.2 of
IS: 8130-1984 | Part-1 of IS :
10810-1984 |
| (iv) Resistance
test | Table-1 | Part-5 of IS :
10810-1984 |

- | | | |
|---|-------------|------------------------------|
| (b) Test for thick-
ness of insula-
tion & sheath | Table 2 & 3 | Part-6 of IS :
10810-1984 |
|---|-------------|------------------------------|

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(c) Physical tests
as indicated
below for Elasto-
meric Insulation
and Sheath

Table 2 & 3
of IS :
5380-1984

Respective
Parts of
IS : 10810-
1984 as
mentioned
in IS :
5380-1984
Table 2 and
3

For Insulation

(i) Without
ageing
Elongation
& Tensile
strength

- do -

- do -

(ii) Hot set
test

For Sheath

(i) Without
ageing -
Elongation
& Tensile
strength

- do -

- do -

(ii) Tear
resistance
test

(iii) Hot set
test

p.t.o. 9

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Test	Reference Specification for requirements	Reference Specification for Test Methods
(d) High voltage test (Water immersion test)	1500V Grade Cables: 6 kV RMS for 15 Min. 3000V Grade Cables: 12 kV (RMS) for 15 Min.	Part-45 of IS: 10810-1984
(e) Insulation resistance test (Insulation resistance constant)	Table 2 of IS : 6380-1984.	Part 43 of IS: 10810-1984
(f) Destructive puncture test	Appendix Clause 5	Appendix Clause 5
(g) Resistance to cracking test	Appendix Clause 1	Appendix Clause 1
(h) Flexibility (Bending test)	Appendix Clause 2	Appendix Clause 2
(i) Fire resistance test	Appendix Clause 3	Appendix Clause 3
(j) Resistance to surface tracking	Appendix Clause 4	Appendix Clause 4
(k) Slippage test	Appendix Clause 7	Appendix Clause 7
(l) Ozone resistance test	UIC 895-OR-1976	Appendix 3 of UIC-895-OR-197
(m) Tests for identification of rubber polymers	ASTM D-3677-83	ASTM D-3677-83

10.2.1 A recommended sampling plan for acceptance tests is given in Appendix-A of IS : 9968 (Pt.I) - 1988.

10.3 Routine tests

The following shall constitute routine test :-

(a) Conductor resistance test	Table 1	Part 5 of IS : 10810-1984
(b) High voltage test	1500V Grade Cables: 6 kV (RMS) for 5 Min. 3000V Grade Cables : 12 kV (RMS) for 5 Min.	Part 45 of IS: 10810-1984