

MODULAR TERMINAL BLOCKS, FUSE TERMINAL BLOCKS & MINIATURE FUSE LINKS OF INTERNATIONAL
STANDARD FOR RAILWAY SIGNALLING



**TECHNICAL SPECIFICATION FOR
MODULAR TERMINAL BLOCKS, FUSE TERMINAL
BLOCKS & MINIATURE FUSE LINKS
OF INTERNATIONAL STANDARD
FOR RAILWAY
SIGNALLING**

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Abstract This document specifies technical specification and acceptance criteria for Modular Terminal Blocks and Fuse Terminal Blocks of International Standard for Railway Signalling.			

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FOR
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0. FOREWORD

0.1 This specification is issued under the fixed serial number RDSO/SPN/ 189/2004.

0.2 This specification requires reference to the following Indian Railway Standard and International Standard specifications:

IEC 60947-7-1 Low-voltage switchgear and controlgear - Part 7-1:
Ancillary equipment - Terminal blocks for copper
conductors.

IEC 60947-7-3 Low-voltage switchgear and controlgear - Part 7-3:
Ancillary equipment - Safety requirements for fuse terminal
blocks.

IEC 60715 International Standard specification for standardized
mounting on rails for mechanical support of
electrical devices in switchgear and controlgear
installations

IEC 60127-1 International Standard specification for miniature
fuses- Part 1: Definition for miniature
fuses and general requirements for
miniature fuse links

IEC 60127-2 International Standard specification for miniature
fuses- Part 1 & 2: Cartridge fuse links

IEC 60127-6 International Standard specification for fuse holders for
miniature cartridge fuse-links.

EN 10151 Stainless Steel Strips for springs

RDSO/SPN/ 144/ 2006: RDSO specification for safety and reliability requirement
of electronic signalling equipment

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0.3 Wherever in this specification any of the above mentioned specification is referred to by number only without mentioning the year of issue, the latest issue of that specification is implied, otherwise the particular issue referred to is meant.

0.4 This specification is intended to cover the technical provisions and it does not include all the necessary provisions of a contract.

0.5 This specification has two parts. Part 'A' covers various types of modular terminal blocks and fuse terminal block. Part 'B' covers miniature cartridge type fuse links suitable for railway signaling. RDSO will consider approval of vendors separately for both the product types, i.e., Part 'A' and Part 'B' of this specification.

1.0 SCOPE

1.1 **PART 'A'** of this specification covers technical and other requirements and test & inspection criteria for various types of modular terminal blocks of International Standard with screwless type terminals and fuse terminal blocks to provide good electrical and mechanical connection between round copper conductors for railway signaling.

1.2 **PART 'B'** of this specification covers technical requirements, test & inspection criteria for miniature cartridge type fuse links for railway signalling.

2. TERMINOLOGY

2.1 For the purpose of this specification, the terminology given in International Standard specifications IEC 60947-7-1, IEC60127-1, 2 & 6 shall apply.

2.2 If the word 'terminal block' is used in this specification, it shall include disconnect type and fuse terminal blocks.

3. ABBREVIATIONS:

RDSO : Research Design & Standards Organization

IEC : International Electro technical Commission

UL : Underwriters Laboratories

ISO : International Organization for Standardization

OEM : Original Equipment Manufacturer

NABL: National Accreditation Board for Testing and Calibration Laboratories

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PART 'A'

MODULAR TERMINAL BLOCKS & FUSE TERMINAL BLOCKS

4. TECHNICAL REQUIREMENTS

The following types of terminal blocks are covered in this specification.

4.1 Disconnect Terminal Block:

Conductor Size	:	0.2 to 2.5 sq. mm. (with or without lug)
Type of Terminals	:	Screwless Type
No. of IN and OUT wires	:	2 conductor, 1-1 type (1 IN, 1 OUT) 4 conductor, 2-2 type (2 IN, 2 OUT) (as per requirement of purchaser)
Construction of Disconnect link	:	Hinged isolation link with tin plated Knife Edge type
Rated Current	:	16 Amp (continuous)
Rated Voltage	:	400 V (min.)

4.2 Fuse Terminal Block:

Conductor Size	:	0.2 to 2.5 sq. mm. (with or without lug)
Type of Terminals	:	Screwless Type
No. of IN and OUT wires	:	2 conductor, 1-1 type (1 IN, 1 OUT) 4 conductor, 2-2 type (2 IN, 2 OUT) (as per requirement of purchaser)
Rated Current	:	upto 10 Amperes
Rated Voltage	:	400V (min.)
Blown Fuse Indication	:	LED indication for 110 V AC.
Compatibility	:	suitable for 5x20 mm cartridge type (glass or ceramic fuses of 400 mA, 630 mA, 1A, 1.6A, 2A, 4A, 6.3 A, 8A & 10A ratings as per IEC 60127-2.

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5. GENERAL REQUIREMENTS

- 5.1 Disconnect terminal blocks shall comply International Standard IEC-60947-7-1.
- 5.2 Fuse terminal blocks shall comply International Standards IEC 60747-7-1 & IEC-60947-7-3, as applicable and shall be suitable for fuse-links as per International Standard IEC 60127-2.
- 5.3 A terminal block shall have provision for identification marks or numbers for each wire termination. Such provision may consist of separate marking items, such as marking tags, identification labels, etc.
- 5.4 Terminal blocks shall be provided with means that allow them to be securely attached to mounting rail as per Cl. 5.5
- 5.5 Mounting rail shall be 'Top hat' section rail TH 35 – 7.5 as per appendix 'A' of IEC 60715 of 35 $\pm$ 0.3 mm wide, 7.5 (+0, -0.4) mm high and 1 $\pm$ 0.04 mm thick perforated/ slotted rail of required length. Material of rail shall be cold – rolled carbon steel galvanised and yellow chromate passivated having >10 micron thickness. A line shall be marked along the center of the rail as guide for drilling of mounting holes. Marking of the manufacturer by embossing/ engraving/ punching, shall be there on the rail to help identification.
- 5.6 Every individual terminal block shall be modular in design. It shall be feasible to add terminal blocks one after another on the mounting rail.
- 5.7 Normally, terminal blocks shall be supplied in group of 12 terminal blocks and accessories (except mounting rail) suitable to form a cohesive group of 12 terminal blocks referred to as '**terminal assembly**'. However, number of terminal blocks in a terminal assembly may vary as per requirement of the purchaser. The type of terminal blocks in one terminal assembly should be same.
- 5.8 **ACCESSORIES:**
Unless otherwise required and specified by the purchaser, accessories for one terminal assembly shall comprise of 12 terminal blocks, 1 end plate, 2 end brackets with provision of group marking, 12 marking tags, 2 group marking tags and any other accessory (except mounting rail), as applicable. In case of any requirement of accessories other than this, purchaser shall clearly mention the requirement for different accessories.

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- 5.9 Terminal blocks shall be suitable for termination of rigid (solid/stranded)/flexible conductors. It shall be possible to connect conductor of 0.2 sq. mm in the terminal block. Use of lugs is desirable in case flexible conductors are used.
- 5.10 Any metallic parts of a terminal assembly including termination shall not be accessible from outside.
- 5.11 The insulating material of terminal block and accessories shall be Polyamide 6.6. This shall withstand continuous operation at temperature ranging from -10°C to 100°C. This shall be self-extinguishing and shall meet UL (Underwriters Laboratories Inc.) -94 flame classification 'V0'. Material should have protection against damage by ozone or ultraviolet light. Presence of anaerobic earth bacteria, mould fungus and enzymes should not cause degradation of the material. Material should be resistant to corrosion, termites and should not offer a source of oxygen or other biogenic elements to microorganisms.
- 5.12 **Terminal Material:**
- For screwless type terminals, the clamping spring shall be made of high quality high strength chrome nickel spring steel (CrNi) of grade 1.4310 as per EN 10151 which has proven corrosion resistance through long term use. The current bar used in the terminals should be of electrolytic grade copper and should have tin coating of thickness not less than 3 microns. Details and test certificates for materials shall be submitted at the time of type approval.
- 5.13 Disconnect terminal block shall have female test point of at least 2.3 mm diameter for every termination.
- 5.14 Manufacturing unit shall be ISO (International Organization for Standardization) certified and should have requisite manufacturing and test infrastructure for conducting tests as per IEC 60947-7-1 to produce a reliable and quality product as per this specification.
- 5.15 Manufacturer shall arrange for any other test and / or documents considered necessary to establish quality and performance of the product.
- 5.16 Manufacturer shall give a guarantee that no recycled materials will be used in the manufacturing.
- 5.17 Manufacturer shall give a guarantee that maintenance support and supply of spares shall be assured for a period of at least 10 years.

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6. MARKING:

- 6.1 Marking shall be as per clause 5.1 & 5.2 of IEC 60947-7-1.
- 6.2 Markings on fuse terminal blocks shall also have Blown fuse indication voltage clearly marked on it.

7. TESTS & PERFORMANCE CRITERIA

- 7.1 Disconnect terminal blocks shall comply constructional and performance requirements as per Cl. 7 of IEC 60947-7-1.
- 7.2 Disconnect terminal blocks shall pass tests as per Cl. 8 of IEC 60947-7-1.
- 7.3 Disconnect terminal blocks shall pass service life test for minimum 1000 cycles as per clause D 7.2.6 & D 8.5.1 of IEC 60947-7-1. The disconnect/ connect cycle shall be performed on a test zig at a rate of approx. one cycle in 5 seconds. The hinge of the disconnecting link or the grip of the knife edge shall not get loose.
- 7.4 Fuse terminal blocks shall comply constructional, performance and test criteria as per IEC 60947-7-1, 7-3 & IEC 60127-6, as applicable.
- 7.5 Terminal blocks mounted on rails shall pass vibration test as per Sl. No. 12 of Cl.9.3 of RDSO/SPN/144/2006 applicable for outdoor electronic equipments. Terminations should not become loose after completion of test. During the vibration test, there shall not be any electrical interruption and voltage drop across the terminal blocks should be steady.
- 7.6 Terminal assembly blocks and fuse terminal blocks duly fitted with fuse links mounted on rails shall pass climatic test as per Sl. no. 1, 2, 3, 4, 5, 6 of Cl. 9.3 applicable for outdoor track side electronic equipment and insulation resistance test as per Cl. 9.5(c) of RDSO/SPN/144/2006. The terminal block shall pass shock test for severity 1 as per Sl. No. 11 of Cl. 9.3 of RDSO/SPN/144/2006.

8 INSPECTION CRITERIA

- 8.1 TYPE TEST:** 42 no. of samples of every type of Modular terminal blocks and 2 samples of mounting rails 30 cm. of length shall be submitted. These shall be subjected to following type tests. (The requirement of terminal blocks against each test is shown below in brackets). Each test is made on new specimens unless otherwise specified.

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i) Visual inspection & dimensional checks (on all samples)

- a. Visual inspection (on 5 samples)
- b. Dimensions of mounting rails as per Appendix A of IEC 60715 for TH 35-7.5 (on 2 samples of mounting rails)
- c. Marking as per clause 6.1 & 6.2 (on same samples as in 'a' above)

ii) Verification of Mechanical characteristics

- a. Attachment of terminal block as per cl. 8.3.2. of IEC 60947-7-1 (set of 5 terminal blocks)
- b. Verification of mechanical stability of terminals as per clause 8.3.3.1 of IEC 60947-7-1 (set of 5 terminal blocks).
- c. Flexion Test as per clause 8.3.3.2 of IEC 60947-7-1 (on 1 sample)
- d. Conductor Pull out test as per clause 8.3.3.3 of IEC 60947-7-1 (on same sample as in 'c' above)
- e. Verification of rated cross section & rated connection capacity as per cl. 8.3.3.4 of IEC 60947-7-1 (on same 2 samples tested for markings)

iii) Verification of Electrical characteristics

- a. Clearances & Creepage Distances as per Cl. 8.4.2 of IEC 60947-7-1 (on 2 terminal blocks)
- b. Dielectric Test as per cl. 8.4.3 of IEC 60947-7-1 (5 terminal blocks)
- c. Voltage Drop Test as per cl. 8.4.4 of IEC 60947-7-1 (before and after mechanical stability test, temperature rise test, short time withstand current test & aging tests on same samples)
- d. Temperature Rise Test as per cl. 8.4.5 of IEC 60947-7-1 (on 5 samples)
- e. Short Time Withstand Current Test as per cl. 8.4.6 of IEC 60947-7-1 (on 1 sample)
- iv) Service Life test (only for disconnect type terminal blocks) as per clause 7.3 (on 5 samples which have taken voltage drop test after mechanical stability test)
- v) Contact Resistance test (for fuse terminal block): (The contact resistance between each terminals and standard fuse link of 5x20 mm as per IEC 60127-6 shall not exceed 15 mΩ for individual measurements and 10 mΩ on average after 10 insertions of the fuse link. Test shall be done on 5 samples tested for visual inspections and markings.
- vi) Needle flame test as per Cl. 8.5 of IEC 60947-7-1 (on 3 terminal blocks).
- vii) Climatic test (S. no. 1, 2, 3, 4, 5, 6 and 11 (severity 1) of cl. 9.3 of RDSO/SPN/144/2006 (latest). These tests shall be conducted on 4 samples.
- viii) Insulation resistance test as per cl. 9.5(c) of RDSO/SPN/144/2006 (latest). This shall be done on 4 samples before & after climatic tests.

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- ix) Material test for Polyamide 6.6 as per UL94 standard for inflammability grade as per clause 5.11 (on 1 sample).
- x) Material test for spring for screw less terminals as per clause 5.12 (Test reports from NABL accredited govt. Labs and invoice to be made available) (to be conducted on same sample as that for polyamide material test)
- xi) Vibration test as per clause 7.5 (on one sample after climatic tests)
- xii) Ageing Test (for 192 temperature cycles as per clause 8.4.7 of IEC60947-7-1. This test shall be done on 5 terminals and is applicable for screwless type terminal blocks only.

8.1.1 Test certificates for above shall be submitted by the OEM.

8.1.2 Out of tests mentioned in clause 8.1 above, tests for which adequate test facility is not available at RDSO, samples shall be picked up randomly by RDSO's representative which shall got tested by the manufacturer either at firm's premises or NABL accredited govt. laboratories to the satisfaction of RDSO. Expenses for such tests shall be borne by the manufacturer.

8.2 ACCEPTANCE TEST:

Out of a lot, number of samples as per table given in clause 12 shall be subjected to following tests. Each test is made on new specimens unless otherwise specified.

- i) Visual inspection & dimensional checks
 - a. Visual inspection (on all samples)
 - b. Dimensions of mounting rails (Appendix 'A' of IEC 60715 for TH 35-7.5) (To be conducted on 2 samples).
 - c. Marking (as per clause 6.1 & 6.2) (on all samples).
- ii) Verification of Mechanical characteristics
 - a. Verification of rated cross section & rated connection capacity (cl. 8.3.3.4 of IEC 60947-7-1), to be conducted on all samples.
 - b. Verification of mechanical stability of terminals (clause 8.3.3.1 of IEC 60947-1-1), to be conducted on set of 5 terminal blocks
 - c. Flexion Test (as per clause 8.3.3.2 of IEC 60947-7-1) on 1 sample.
 - d. Conductor Pull out test (as per clause 8.3.3.3 of IEC 60947-7-1) on same sample which has been through Flexion Test.
 - e. Attachment of terminal block (as per cl. 8.3.2. of IEC 60947-7-1), to be done on set of 5 terminals.

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iii) **Verification of Electrical characteristics**

- a. Voltage Drop Test (cl. 8.4.4 of IEC 60947-7-1) (to be done on 5 samples before and after Mechanical Stability test)
 - b. Temperature Rise Test (cl. 8.4.5 of IEC 60947-7-1) 5 samples
 - c. Short Time Withstand Current Test (cl. 8.4.6 of IEC 60947-7-1) 1 sample
- iv) Service Life test (only for disconnect type terminal blocks): as per clause 7.3 (on 5 samples which have taken voltage drop test after mechanical stability test)
- v) Contact Resistance test (for fuse terminal block only)
(The contact resistance between each terminals and standard fuse link of 5x20 mm as per IEC 60127-6 shall not exceed 10 mΩ for individual measurements and 5 mΩ on average after 10 insertions of the fuse link. Test shall be done on a min. of 5 samples tested for visual inspections and markings.
- vi) Needle flame test (Cl. 8.5 of IEC 60947-7-1). This test shall be conducted on min. one sample at random out of samples which have passed all above tests. To be done on clamping unit of 3 terminal blocks
- vii) Raw Material for housing and spring for screwless terminals: Invoice to be checked.

-----END of PART 'A'-----

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PART 'B'
MINIATURE CARTRIDGE TYPE FUSE LINKS

9 GENERAL REQUIREMENTS

- 9.1 Fuse link shall be reliable and safe in operation and consistent in performance at any current up to the breaking capacity rating at any voltage up to the rated voltage, when used within the limits of this standard.
- 9.2 During normal use of the fuse link and within the condition given in the specification, no permanent arc, no external arcing, nor any flame that can endanger the surroundings, shall be produced.
- 9.3 During the tests, the fuse link shall not have suffered damage hindering its replacement and the marking shall still be legible.
- 9.4 The fuse links shall comply requirements of IEC 60127-1 & 2 (latest).
- 9.5 Each fuse shall be marked with:
- a) Rated current in mA for rated currents < 1 Amp., and in Amp for rated currents of ≥ 1 Amp. The marking of the rated current shall precede and be adjacent to the marking of the rated voltage.
 - b) Rated voltage in volts (V).
 - c) Maker's name or trade mark.
 - d) A symbol 'T' denoting 'time lag' type indicating the related pre-arcing time/current characteristic. This symbol shall be placed before and adjacent to the rated current. A symbol 'H' denoting the rated breaking capacity. This symbol shall be placed between the marking for the rated current and the marking for the rated voltage.
- 9.6 Marking shall be indelible and easily legible.

10 TECHNICAL REQUIREMENTS

- 10.1
- | | |
|---------------|--|
| Construction | : Cartridge type (Ceramic fuse) |
| Size | : 5 mm x 20 mm. |
| Rated voltage | : 250 V (min.) |
| Rated current | : 400 mA, 630 mA, 1A, 1.6 A, 2 A,
4 A, 6.3 A, 8A, 10A |

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- 10.2 Fuse-links shall be cartridge type with time-lag (surge proof) and high rated breaking capacity of 1500 Amp.
- 10.3 Fuse-links shall have at each end a metallic cap of cylindrical form. There should not be any crookedness.
- 10.4 Fuse-link contacts shall be made of non-corroding material or of material suitably protected against corrosion. Nickel or silver plating is deemed to be adequate protection for brass end caps.
- 10.5 The end caps shall be firmly attached so that it is not possible to remove them without damaging the fuse-link. The end metallic caps and the body of the fuse-link shall be in reasonable alignment. The outer ends of the cylindrical caps shall be substantially flat and at right angles to the axis.
- 10.6 The fuse links shall pass test criteria as per IEC 60127-1 and 50127-2.
- 10.7 The manufacturer should have all facilities for conducting required tests as per IEC 60127-1 and 60127-2 with them.

11 TEST AND INSPECTION CRITERIA

11.1 Type test:

For type tests, the no. of fuse links required of each rating shall be 48 as per clause 7.2.1 of IEC 60127-2 (ed. 2.2) b.

- (a) Marking and Dimensions (as per clause 6.1 of IEC 60127-1 and 60127-2) - on all 48 samples.
- (b) Voltage drop test (as per clause 9.1 of IEC 60127-1) – on all 48 samples
- (c) Following tests shall be done as per test schedule given in Table 1, clause 7.2.1 of IEC 60127-2 (ed. 2.2)b.
 - (i) Endurance Test
 - (ii) Test at elevated temperature
 - (iii) Time- current characteristics
 - (iv) Breaking capacity test
 - (v) Termination (end cap test)
 - (vi) Soldered joints
 - (vii) Legibility of marking

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(d) Insulation resistance test shall be done after breaking capacity test (cl. 9.3.3 of IEC 60127-1)

Tests for which facilities are not available at RDSO, shall be got done by RDSO representative either at firm's premises or NABL accredited government laboratories to the satisfaction of RDSO. Expenses for such tests shall be borne by the manufacturer.

11.2 Acceptance Tests: Out of a lot, number of samples as per table below in clause shall be subjected to following tests:

(a) Marking and Dimensions (as per clause 6.1 of IEC 60127-1 and 60127-2)

(b) Voltage drop test (as per clause 9.1 of IEC 60127-1)

(c) Test for fuse blowing time at 10 times, 4 times and 2.1 times the rated current (as per clause 9.2.1 of IEC 60127-2)

Note: The above test shall be done on one sample for each test current in a lot, if the lot size is less than or equal to 500 no. and on two samples if the lot size is more than 500 no. As this is a destructive test, the no. of components in a lot shall be increased accordingly.

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12 LOT & LOT SIZE:

Lot is a collection of components of one type, size and lot number manufactured by same process under similar conditions of production. In case components manufactured in a lot are offered for inspection in more than one similar lots, sampling plan for acceptance test may be adopted as per offered quantity. The samples to be selected from a lot for testing shall be in accordance with the following table. Samples shall be randomly picked up to ensure correct representation of the lot.

(A) TERMINAL BLOCKS & FUSE TERMINAL BLOCK

No.	LOT SIZE (Each type)	SAMPLE SIZE
1	0-1000	10
2	1001-5000	15
3	more than 5000	20

(B) MINIATURE FUSE LINKS

No.	LOT SIZE	SAMPLE SIZE
1	0-1000	10%
2	>1000-5000	7%
3	>5000	5%

If any defectives are found, the lot shall be considered as not conforming to the requirements of the specification and rejected.

13. DOCUMENTATION:

One copy of Installation & Maintenance Manuals with following information shall be supplied to each consignee against every inspection certificate.

- (i) Guaranteed performance data and other technical particulars.
- (ii) Part no., part list & mechanical drawings of all types of modules/components.
- (iii) Do's and Don'ts
- (iv) Installation check list
- (v) Requirement of tools
- (vi) Latest catalogue of the product with accessories.
- (vii) Any other relevant information.

14. PACKING & LABELLING:

Packing before shipment shall be done in such a way as to permit convenient handling and to protect against loss or damage during transit and storage.

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15. INFORMATION TO BE GIVEN BY THE PURCHASER

15.1 Terminal Blocks and Fuse Terminal Blocks

(i) Description and selection of terminal out of the following:

S. No	Type of terminal
1	Screw less type 2 Terminal (1IN- 1OUT) Disconnecting type Terminal Block
2	Screw less type 4 Terminal (2IN- 2OUT) Disconnecting type Terminal Block
3	Screw less type Fuse Terminal Block (1IN- 1OUT) with 110 V AC LED indication
4	Screw less type Fuse Terminal Block (2IN- 2OUT) with 110 V AC LED indication

(ii) Any additional requirement of accessories (clause 5.8)

15.2 **Fuse Links:** Rated current (400mA, 630mA, 1A, 1.6A, 2A, 4A, 6.3A, 8A or 10A) of fuse-link as per Clause 10.1.

16. SCOPE OF SUPPLY

16.1 Terminal Block & Fuse Terminal Block:

- (i) Terminal/ fuse assembly complete with all accessories (Cl. 5.8)
- (ii) Mounting rails of required length (Cl. 5.5)
- (iii) Additional accessories, if required by purchaser (Cl. 5.8).
- (iv) One set of required tools as per clause 13 (v) above for 500 no. of terminal blocks (total of all types) or part thereof.

16.2 Fuse Links as per rated current and requirement.

17. INFRINGEMENT OF PATENT RIGHTS

Indian Railways shall not be responsible for infringement of patent rights due to similarity in design, manufacturing process, use of components used in design, development of manufacturing of these terminal blocks and any other factor which may cause such dispute.

18. VENDOR-CHANGES IN APPROVED STATUS

All the provisions contained in RDSO's ISO procedures laid down in Document No. QO-D-8.1.11 dated 12.09.2018 (titled "Vendor-Changes in approved status") and subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contract floated by Railways to maintain quality of products supplied to Railways.

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SSE Signal	ADE/Signal	Director/Signal
Prepared By:	Checked By:	Issued By: