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1. SCOPE

This specification covers the technical requirements of design, manufacture, testing at manufacturer's works, packing, forwarding, supply and unloading at site/store of 11kV All Aluminum Alloy - AL59 Stranded XLPE Covered Conductors. The material shall be complete with all components, which are necessary or usual for their efficient performance and trouble-free operation.

2. APPLICABLE STANDARDS

The equipment covered by this specification shall unless otherwise stated, be designed, manufactured and tested in accordance with the latest editions of the following Indian, International Standards and shall conform to the regulations of the local authorities:

Ref. IS	Description
IS 398 (Part IV)	Specification for aluminum conductors for overhead distribution purpose
EN 50397-1:2006	Covered Conductor Specification for voltage 1KV to 33KV
IS: 10418	Reels and drums for bare conductors
IS 7098 part 2	Cross-linked Polyethylene Insulated Thermoplastic Sheathed Cables
IS 8130	Conductors for insulated Electric cables and Flexible Cords
IEC 61284	Overhead lines – Requirements and tests for fittings
IEC 60587	Test methods for evaluating resistance tracking and erosion of electrical insulating materials used under ambient conditions
IEC 60811	Methods of tests
ICEA T 31-610	Test method for conducting longitudinal water penetration resistance tests on blocked conductors
EN 50182	Conductors for overhead lines – Round wire concentric lay stranded conductors
EN 50356	Method for spark testing for cables
HD 605	Electric cables - additional test methods
SS 424 08 13	Aluminium alloy wire for stranded conductors for overhead lines – AL59 Wires
SS 424 08 14	Aluminium Alloy Stranded Conductors for Overhead Lines – AL59 Conductors
SS- EN-50397-1	Covered Conductors for Overhead Lines for rated voltages above 1 kV A.C. and not exceeding 36 kV A.C.
SS-EN 50397- 2	Covered conductors and the related accessories for rated voltages above 1kV and not exceeding 36 kV.
SS-EN 50397- 3	Covered conductors and the related accessories -Guide to use

3. CLIMATIC CONDITIONS OF THE INSTALLATION:

SL.NO.	CONDITONS	VALUES
1	Max. altitude above sea level	1000m
2	Max. Ambient Temperature	50 °C
3	Max. Daily average ambient temp	40 °C
4	Min Ambient Temp	0 °C
5	Maximum temperature attainable by an object exposed to sun	60 °C

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6	Maximum Humidity	100%
7	Minimum Humidity	10%
8	Average No. of thunderstorm days per annum	70
9	Average Annual Rainfall	2380 mm
10	Average No. of rainy days per annum	120
11	Thermal Resistivity of soil	150 Deg. Ccm/W
12	Wind Pressure	126 kg/sq. m up to an elevation of 10 meter.
14	Earthquakes of intensity in horizontal direction	equivalent to seismic acceleration of 0.3g
15	Earthquakes of intensity in vertical direction	equivalent to seismic acceleration of 0.15g
16	Wind velocity	300 km/hr.
17	Seismic level (horizontal ground acceleration)	0.3 g

Environmentally, some of the regions, where the work will take place include coastal areas, subject to high relative humidity, which can give rise to condensation. Onshore winds will frequently be salt laden. On occasions, the combination of salt and condensation may create pollution conditions for outdoor insulators. Some places are in heavily industrial polluted areas. Therefore, Outdoor material and equipment shall be designed and protected for use in exposed, heavily polluted, salty, corrosive and humid coastal atmosphere. The atmosphere is generally laden with mild acid and dust in suspension during the dry months and is subjected to fog in cold months. The design of equipment and accessories shall be suitable to withstand seismic forces as mentioned above.

4. GENERAL TECHNICAL REQUIREMENTS:

Sl. No.	Technical Parameters	Desired Values
1	Name of the manufacturer	To be furnished by Bidder
2	Applicable Standard	EN 50397-1, SS 424 08 13, SS 424 08 14 & IS 398-4
3	Type of Conductor	AL59 TYPE XLPE Covered Conductor
4	Frequency	50 Hz
5	Variation in frequency	± 5%
6	Rated Voltage/Operating voltage	12kV/11kV
7	Conductor	AAAC AL59 Type conductor
8	Longitudinal water sealing	Conductor shall be longitudinally water tight, by means of water blocking material i.e. water blocking compound/ non-conductive water swellable yarn/ non-conductive water swellable tape/ in combination shall be provided in between interstices of conductor.
9	Conductor screen	Extruded semi-conducting screen
10	Inner Insulation	XLPE
11	Outer Insulation	Black UV & Non- tracking Erosion Resistant XLPE
12	Maximum continuous operating temperature	90 °C

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5. GENERAL CONSTRUCTIONS:

A. CONDUCTOR

Sl. No.	Technical Parameters	Desired Values					
1	Conductor	SS 424 08 13 , SS 424 08 14 & IS 398-4					
2	Class	II					
3	Material	AAAC AL59 TYPE					
4	Shape	Stranded Circular					
5	Conductor	Rabbit	Raccoon	Dog	Dog up	Coyote	Panther
i.	Nominal cross sectional area of conductor	55	80	100	125	148	232
ii.	No. / Diameter of wire	7/3.15	7/3.81	7/4.26	19/2.89	19/3.15	19/9.34
iii.	Approx. Conductor diameter (mm)	9.45	11.43	12.78	14.45	15.75	19.70
iv.	Max. DC resistance @20 Deg C (ohms/km)	0.543	0.371	0.297	0.239	0.201	0.129
v.	Minimum Breaking load (KN)	12.96	18.20	21.80	29.60	35.17	52.82
vi.	Approx. mass of conductor kg/km	149.20	218.26	272.86	342.51	406.91	636.67
viii.	Resistance Temperature co-efficient	0.0036 /°C					
6	Longitudinal water blocking of conductor	a) Conductor shall be longitudinally water tight, by means of water blocking material i.e. water blocking compound/ non-conductive water swellable yarn/ non-conductive water swellable tape/ in combination shall be provided in between interstices of conductor. b) The water blocking material shall be stable at maximum operating conductor temperature as per EN 50397-1. c) The water blocking compound shall be compatible as per EN 50397-1 standard.					
7	Cleanliness and uniformity	a) Before stranding, the cross-section of the Aluminium conductor shall be circular, and shall have uniform smooth surface, free from sharp edges and free from any defects. b) Stranded Conductor shall be free from oil traces & aluminum dust c) Traces of aluminum dust on conductor or conductor screen shall not be acceptable.					
8	Tolerance on nominal sizes	No negative tolerance shall be permitted on the nominal diameter of aluminium wires used in the manufacture of Covered Conductor. Positive tolerance in this respect shall be as provided in IS: 398 latest edition.					
9	Raw material supplier	Conductor raw material shall be procured from reputed suppliers viz., BALCO/ HINDALCO/ NALCO/ Vedanta/ APAR only.					
10	Freedom from defects	The wires shall be smooth and free from all imperfections such as spills, splits, slag, marks, scratches, projections, looseness, overlapping of strands, chipping of aluminium layers etc. and all such other defects which may hamper the mechanical and electrical properties of the conductor. Special care should be taken to keep away dirt, grit etc. during stranding.					

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11	Joints in wire	The wires shall be drawn in continuous length, without joints.
12	Lay ratio	The lay ratio shall comply as per IS 398 part-IV
13	Weight of conductor/km (approx.)	To be specified by the bidder.

B. INSULATIONS:

Sl. No.	Technical Parameters	Desired Values
1	Material	1st layer: Semiconducting compound for conductor screen 2nd Layer: super cleaned XLPE compound for Insulation 3rd Layer: Black UV & Non-Tracking Erosion Resistant XLPE compound for outer covering
2	Configuration	The Insulation shall be applied in 3 layered by triple extrusion Process. a) 1st layer: Semi-Conducting Screen of thickness 0.3 mm (Minimum at any point of measurement) b) 2nd Inner layer: XLPE insulation of thickness 1.2 mm (Nominal insulation thickness) c) 3rd outer covering layer: Black XLPE insulation layer with UV Resistant, Non-tracking and Erosion resistant properties complied to EN 50397 -1 latest edition. Nominal Thickness of outer covering is 1.1 mm. The Semi Conducting Screen, Inner Insulation and Outer Insulation should be extruded in one step i.e. triple extrusion to ensure a good, permanent bond between the three layers and also with the conductor. It shall be possible to remove the Semi Conducting Screen, Inner and Outer Insulation Layers without damage to the conductor. Mandatory : d) Eccentricity of insulation shall not exceeds 15%. e) Max. elongation of XLPE under loading (Hot set test) shall be as per EN 50397-1 f) Max. Residual elongation (Hot set test) shall be as per EN 50397-1
3	Raw material supplier	a) XLPE compound shall be super cleaned and procured from reputed raw material suppliers viz., Dow/Borealis/Hanwa only. b) Semi conductive compounds shall be used from Dow/Borealis/Hanwa/ Shakun Polymers (India) / Ddev Plastiks Industries Limited (India)
4	Thermal stability	The insulation properties shall be stable under thermal conditions arising out of continuous operation and short circuiting condition as per EN 50397 -1.

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5	Cleanliness And uniformity	Interfacial region between all layers shall be uniform. Protrusion/convolution/ other defects are not acceptable. Covered conductor shall be free from void and contamination.
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C. Sealing end cap:

Sl. No.	Technical Parameters	Desired Values
1	Material	Adhesive coated polyolefin heat shrinkable
2	Configuration	Adhesive coated polyolefin heat shrinkable end cap shall be provided at both ends of the cable.
3	Additional requirements	2 nos. additional cable end caps shall be provided with each drum and placed in the drum.

D. Other requirements

Sl. No.	Technical Parameters	Desired Values
1	Overall diameter of covered conductor	To be provided by bidder
2	Weight of Overall covered conductor	To be provided by bidder
3	Current rating of covered conductor in air @40°C ambient temperature	To be provided by bidder

6. MARKING:

The Covered Conductor shall be wound on non-returnable steel drums conforming to IS 10418. Drum shall be free from sharp edges and visual defect. Stencil plate on one flange side of the drum and laminated paper sheet on other side flange of drum. Covered Conductor length on one drum shall be 1000 meters max. +/- 5%.

The following particulars shall be properly legible printed on the covered conductor at the intervals of not exceeding one meter throughout the length of the Conductor. The covered conductor with poor and illegible printing shall be liable for rejection.

- Name of manufacturer
- Voltage Grade
- Month & Year of manufacture
- Size of Covered Conductor
- EN 50397-1: 2020
- PO/RO Number
- Property of TPNODL/TPSODL/TPWODL/TPCODL/TPDDL/TPC

Note: - Sequential meter marking shall be printed (after each meter)

Printed markings shall be durable. Durability shall be checked by the test according to HD 605, Subclause 2.5.4. The markings shall be legible after this test. OEM to conduct the test at its own lab or NABL lab.

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Following details shall be provided on flanges of drum through stenciling:

- Name of manufacturer
- Type of Covered Conductor
- Size of Covered Conductor
- Voltage Grade
- Length of the covered conductor on the drum
- Direction of the rotation of the drum
- Gross mass
- Country of manufacture
- Year and month of manufacture
- PO/RO Number
- Drum No.
- Property of TPNODL/TPSODL/TPWODL/TPCODL/TPDDL/TPC

7. TESTS:

A type test shall be performed on every covered conductor type, irrespective of the cross- sectional area. All the type test, Routine test and acceptance test should be as per EN 50397- 1 and latest amendment. The bidder shall be required to submit complete set of the following test reports along with the offer: -

A. TYPE TESTS

S.No	Test	Specific value		Test method	
		Clause No.	Reference Standard	Clause No.	Reference Standard
Tests on covering					
1	Tensile strength & Elongation at break (before ageing)	Table 1	EN 50397-1	9.1	IEC 60811-1-1
2	Tensile strength & Elongation at break (After ageing)	Table 1	EN 50397-1	8.1	IEC 60811-1-2
3	Tests for thickness of insulation	5.B1	Specification	8.1	IEC 60811-1-1
4	Hot set test	Table 1	EN 50397-1	9	IEC 60811-2-1
5	Shrinkage test	Table 1	EN 50397-1	10	IEC 60811-1-3
6	Gravimetric test (Water absorption)	Table 1	EN 50397-1	10	IEC 60811-1-3
Tests on conductor					
7	Tensile strength of conductor	Table A.1	EN 50397-1	5.5	IEC 50182
Tests on complete covered conductor					
8	High Voltage test	Table 2	EN 50397-1	3.1.1	HD605
9	Conductor Resistance test	Table 2	EN 50397-1	3.2.2.2	HD605
10	Leakage current	Table 2	EN 50397-1		Annexure – B EN-50397-1
11	Tracking resistance	Table 2	EN 50397-1		Annexure – C EN-50397-1

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12	Conductor water penetration test	ICEA T- 31-610	ICEA T- 31-610		ICEA T- 31-610
13	Test of compatibility including Strand filling water tight compound compatible test	Table 2	EN 50397-1	Sub clause 8.1.4	IEC 60811-1-2
14	Slippage test	Table 2	EN 50397-1	11	Annexure – D EN-50397-1
15	UV resistance test	Table 2	EN 50397-1	2.4.23	ASTM G 154

B. ROUTINE TEST

S.No	Test	Specific value		Test method	
		Clause No.	Reference Standard	Clause No.	Reference Standard
Tests on complete covered conductor					
1	High Voltage test	Table 2	EN 50397-1	3.1.1	HD605
2	Conductor Resistance test	Table 2	EN 50397-1	3.2.2.2	HD605
3	Spark Test on the covering	Table 2	EN 50397-1		EN 50356

C. ACCEPTANCE TEST

S.No	Test	Specific value		Test method	
		Clause No.	Reference Standard	Clause No.	Reference Standard
Tests on covering					
1	Tensile strength & Elongation at break (before ageing)	Table 1	EN 50397-1	9.1	IEC 60811-1-1
2	Tests for thickness of insulation	5.B1	Specification	8.1	EN 50397-1
3	Eccentricity and Ovality of insulation	5.B1	Specification	Annexure A	IS 7098 part 2
4	Hot set test (Max. Elongation under load & Max. residual elongation)	100% & 10%	Specification	9	EN 50397-1
Tests on conductor					
5	Breaking load of conductor	Table A.1	EN 50397-1	5.5	IEC 50182
Tests on complete covered conductor					
6	High Voltage test	Table 2	EN 50397-1	3.1.1	HD605
7	Conductor Resistance test	Table 2	EN 50397-1	3.2.2.2	HD605
8	Spark Test on the covering	Table 2	EN 50397-1		EN 50356
9	Leakage current	Table 2	EN 50397-1		Annexure – B EN-50397-1
10	Tracking resistance	Table 2	EN 50397-1		Annexure – C EN-50397-1
11	Conductor water penetration test	ICEA T- 31-610	ICEA T- 31-610		ICEA T- 31-610
12	Slippage test upto 240 sqmm size	Table 2	EN 50397-1	11	Annexure – D EN-50397-1

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13	Slippage test above 240 sqmm size	Greater than 15KN
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8. TYPE TEST CERTIFICATES:

The Bidder shall furnish the type test certificates for the tests as mentioned above as per the corresponding standards. All the tests shall be conducted at CPRI / ERDA as per relevant IS/ IEC standard and as per CEA guidelines. Type tests should have been conducted during the period not exceeding 10 years or as per latest CEA Guideline from the date of opening the bid. In the event of any discrepancy in the test reports, i.e. any test report not acceptable, same shall be carried out without any cost implication to TPNODL/TPSODL/TPWODL/TPCODL/TPDDL/TPC/TPADL.

9. PRE-DISPATCH INSPECTION:

The material shall be subject to inspection by a duly authorized representative of the TPNODL/TPSODL/TPWODL/TPCODL/TPDDL/TPC/TPADL. Inspection may be made at any stage of manufacture at the discretion of the purchaser and the equipment, if found unsatisfactory as to workmanship or material, the same is liable to rejection. Bidder shall grant free access to the places of manufacture to TPNODL/TPSODL/TPWODL/TPCODL/TPDDL/TPC/TPADL's representatives at all times when the work is in progress. Inspection by the TPNODL/TPSODL/TPWODL/TPCODL/TPDDL/TPC/TPADL or its authorized representatives shall not relieve the bidder of his obligation of furnishing equipment in accordance with the specifications. Material shall be dispatched after specific MDCC (Material Dispatch Clearance Certificate) is issued by TPNODL/TPSODL/TPWODL/TPCODL/TPDDL/TPC/TPADL.

Following documents shall be sent along with material:

- Test reports
- MDCC issued by TPNODL/TPSODL/TPWODL/TPCODL/TPDDL/TPC/TPADL
- Invoice in duplicate
- Packing list
- Drawings & catalogue
- Guarantee / Warrantee card
- Delivery Challan
- Other Documents (as applicable).

10. INSPECTION AFTER RECEIPT AT STORES:

The material received at TPNODL/TPSODL/TPWODL/TPCODL/TPDDL/TPC/TPADL, store will be inspected for acceptance and shall be liable for rejection, if found different from the reports of the pre-dispatch inspection and one copy of the report shall be sent to Engineering department.

11. GUARANTEE:

Requirement: Bidder shall confirm for guarantee towards design, material, workmanship & quality of process /manufacturing for integrated product delivered under the contract. In the event any defect is found by the Company, up to a period of at least 60 months from the date of commissioning or 72 months from the date of last supplies made under the contract whichever is later, bidder shall be liable to undertake to replace/rectify

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such defects at its own costs, within mutually agreed time frame, and to the entire satisfaction of the Company, failing which the Company will be at liberty to get it replaced/rectified at Bidder's risks and costs and recover all such expenses plus the Company's own charges (@ 20% of expenses incurred), from the Bidder or from 'Security cum Performance Deposit' as the case may be.

Free replacement – Bidder shall further be responsible for 'free replacement' for another period of THREE years from the end of the guarantee period for any 'Latent Defects' if noticed and reported by the company.

12. PACKING:

- a) **Standard length of Covered Conductor** – The Covered Conductor shall be supplied in continuous standard length of 1000 running meters with +/- 5% tolerance.
- b) **Filling condition** – Drum shall not be overfilled.
- c) **Covered Conductor drum** – The Covered Conductor shall be wound on non-returnable steel drums without any extra cost to TPNODL/TPSODL/TPWODL/TPCODL/TPDDL/TPC/TPADL as per IS 10418 and its latest amendments.
- d) **Sealing of Covered Conductor ends** – The ends of the Covered Conductor shall be sealed by means of heat shrinkable polyolefin end caps.
- e) **Requirements for Covered Conductor drums** – Covered Conductor drums shall be so constructed as to have required mechanical strength so that the drum flanges and other components do not break during transport, in actual use or in storage. The flanges and the outside surface of the barrel shall be free from protruding materials/projections/unevenness/ sharp edges that can damage the Covered Conductor or hands of the operator during rotation of drums.
A metal preservation shall be applied to the entire drum.
- f) Bottom end of Covered Conductor should be clamped on drum by jute or nylon rope.
- g) All ferrous metal parts used shall be treated with a suitable rust free finish or coating to avoid rusting during transit or storage. The drums shall withstand normal handling and transport.
- h) Rail/ Road transportation: The bidder shall ensure that the equipment covered under this specification shall be prepared for rail/road transport in a manner so as to protect the equipment from damage in transit.
- i) Packaging shall be as per climate change perspective. Covered Conductor wound on drum shall be covered by recyclable PVC sheet for dust proof. TPNODL/TPSODL/TPWODL/TPCODL/TPDDL/TPC/TPADL encourages to use environment friendly packaging.

13. TENDER SAMPLE:

NA

14. TRAINING

Training shall be conducted for TPNODL/TPSODL/TPWODL/TPCODL/TPDDL/TPC/TPADL employees for installation process at manufacturer's cost. At least two sessions shall be conducted by the manufacturer & related installed process documents shall be shared by manufacturer.

15. QUALITY CONTROL:

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The bidder shall submit with the offer Quality Assurance Plan indicating the various stages of inspection, the tests and checks which will be carried out on the material of construction, components during manufacture and bought out items and fully assembled component and equipment after finishing. As part of the plan, a schedule for stage and final inspection within the parameters of the delivery schedule shall be furnished. The Purchaser's engineer or its nominated representative shall have free access to the manufacturer's/sub-supplier's works to carry out inspections. The bidder shall ensure that the material supplied is as per the Guaranteed Technical Particulars as specified in the specifications.

Samples for Acceptance Tests: Samples shall be taken 5% of the offered lot or as per relevant EN 50397-1 with the latest version as the case may.

Apart from the sample selected for carrying out Acceptance Tests at the works of the firm during the inspection, one more sample from offered lot also selected under re-winding for carrying out various Acceptance Tests as per relevant IS/IEC/EN/ SS. If any of the sample so selected from each length failed in any acceptance test the entire lot under inspection is not acceptable

16. TESTING FACILITIES:

Bidder shall have adequate in-house testing facilities for carrying out all routine tests & acceptance tests as per relevant International / Indian standards.

17. MANUFACTURING ACTIVITIES:

The successful bidder will have to submit the bar chart for various manufacturing activities clearly elaborating each stage, with quantity. This bar chart should be in line with the Quality assurance plan submitted with the offer.

18. SPARES, ACCESSORIES AND TOOLS

NA

19. DRAWINGS AND DOCUMENTS

Following documents shall be submitted along with the bid for approval after award of RC/PO:

- a) Completely filled-in clause wise compliance of the specification.
- b) General description of the equipment and all components including brochures
- c) Type test Certificates for each specified test
- d) Experience List.
- e) Cross sectional drawing of the covered conductor.
- f) A detailed list of bought out items which got into the manufacture of Covered Conductor should be furnished indicating the name of the firms from whom these items are procured.

All the Documents and Drawings shall be in English Language.

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20. SCHEDULE- "A" GUARANTEED TECHNICAL PARTICULARS

Bidder has to submit clause wise compliance.

21. SCHEDULE "B" DEVIATIONS:

(TO BE ENCLOSED WITH TECHNICAL BID)

All deviations from this specification shall be set out by the Bidders, clause by Clause in this schedule. Unless specifically mentioned in this Schedule, the tender shall be deemed to confirm the purchaser's specifications:

SL. No	Clause No.	Details of deviation with justifications

We confirm that there are no deviations apart from those detailed above.

Seal of the Company:

Signature
Designation

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ANNEXTURE 1
Inspection test plan

S.No	Test	Specific value		Test method	
		Clause No.	Reference Standard	Clause No.	Reference Standard
Tests on covering					
1	Tensile strength & Elongation at break (before ageing)	Table 1	EN 50397-1	9.1	IEC 60811-1-1
2	Tests for thickness of insulation	5.B1	Specification	8.1	EN 50397-1
3	Eccentricity and Ovality of insulation	5.B1	Specification	Annexure A	IS 7098 part 2
4	Hot set test (Max. Elongation under load & Max. residual elongation)	100% & 10%	Specification	9	EN 50397-1
Tests on conductor					
5	Breaking load of conductor	Table A.1	EN 50397-1	5.5	IEC 50182
Tests on complete covered conductor					
6	High Voltage test	Table 2	EN 50397-1	3.1.1	HD605
7	Conductor Resistance test	Table 2	EN 50397-1	3.2.2.2	HD605
8	Spark Test on the covering	Table 2	EN 50397-1		EN 50356
9	Leakage current	Table 2	EN 50397-1		Annexure – B EN-50397-1
10	Tracking resistance	Table 2	EN 50397-1		Annexure – C EN-50397-1
11	Conductor water penetration test	ICEA T- 31-610	ICEA T- 31-610		ICEA T- 31-610
12	Slippage test upto 240 sqmm size	Table 2	EN 50397-1	11	Annexure – D EN-50397-1
13	Slippage test above 240 sqmm size	Greater than 15KN			