

TECHNICAL SPECIFICATION (MEDIUM VOLTAGE) AAA COVERED CONDUCTOR & ACCESORIES.



Maharashtra State Electricity Distribution Company Limited

MATERIAL SPECIFICATIONS CELL

TECHNICAL SPECIFICATION

FOR

(MEDIUM VOLTAGE) AAA COVERED CONDUCTOR & ACCESORIES

**TECH. SPEC NO.
CE/MMC/MSC-I/ AAA COVERED CONDUCTOR/2018
Date : 12.06.2018**

TECHNICAL SPECIFICATION (MEDIUM VOLTAGE) AAA COVERED CONDUCTOR & ACCESORIES.

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MAHARASHTRA STATE ELECTRICITY DISTRIBUTION CO. LTD.

TECHNICAL SPECIFICATION FOR

(MEDIUM VOLTAGE) AAA COVERED CONDUCTOR & ACCESSORIES

SPECIFICATION NO: CE/MMC/MSC-I/AAA COVERED CONDUCTOR 2018

1. SCOPE :

This specification covers details of All Aluminium Alloy Stranded Covered Conductors for use on 33 kV , 22 kV, 11 kV distribution system. The conductor covered insulation shall mark EN 50397-1:2006 by embossing/printing on it at every meter throughout the length.

2. SERVICE CONDITIONS :

The conductor to be supplied against this specifications shall be suitable for satisfactory continuous operation under the following tropical conditions.

a) Maximum ambient temperature (Degree C)	----- 50
b) Minimum temperature of air in shade (Degree C)	----- 3.5
c) Relative Humidity (%)	----- 10 to 100
d) Maximum Annual Rainfall (mm)	----- 1450
e) Maximum Wind Pressure (kg/sq.m.)	----- 150
f) Maximum altitude above mean sea level (meter)	----- 1000
g) Isoceraunic level (days/ year)	----- 50
h) Seismic level (Horizontal acceleration)	----- 0.3g

3. CONDUCTOR SIZES :

- a) 7/ 2.00 mm (22 sq.mm)
- b) 7/ 2.50 mm (34 sq.mm)
- c) 7/ 3.15 mm (55 sq.mm)
- d) 7/ 3.81 mm (80 sq.mm)
- e) 7/4.26 mm (100 sq.mm)
- f) 19/ 3.15 mm (148 sq.mm)
- g) 19/ 3.94 mm (232 sq.mm)

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4. APPLICABLE STANDARDS :

Unless otherwise stipulated in this specification , the conductor shall conform to the following Indian/International Standards (amended upto date).

SR. NO.	INDIAN/INTERNATIONAL STANDARDS	TITLE
1	IS : 398 (Part IV) / 1994	Specification for aluminium conductors for overhead transmission purpose
2	EN 50397-1:2006	Covered Conductor Specification for voltage 1KV to 33KV.
3	IS : 10418	Reels and drums for bare conductors.

5. PROPERTIES OF CONDUCTOR :

The properties of stranded all aluminium alloy conductors of various sizes shall be as in Table - I.

TABLE - I ALUMINIUM ALLOY STRANDED CONDUCTOR

Actual Area	Stranding & wire dia.	Approx. overall dia.	Approx. mass	Calculated resistance at 20 d.c. (max.)	Approx. calculated Breaking Load	Reactance per km	Current Rating
1	2	3	4	5	6	7	8
mm.sq.	mm	mm	Kg/km	Ohm/km	kN	Ohms	Amps
22	7/ 2.00	6.0	60.16	1.5410	6.45	0.3556	115
34	7/ 2.50	7.5	94.00	0.9900	10.11	0.3556	150
55	7/ 3.15	9.45	149.20	0.6210	16.03	0.3556	234
80	7/ 3.81	11.43	218.26	0.4250	23.41	0.3394	270
100	7/ 4.26	12.78	272.86	0.3390	29.26	0.3394	325
148	19/ 3.15	15.75	406.91	0.2290	43.50	0.3238	440
232	19 / 3.94	19.70	636.67	0.1471	68.05	0.3146	520

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6 (a) PROPERTIES OF WIRES :

The properties of aluminium alloy wires to be used in the construction of the Stranded conductors shall be as in Table - II.

TABLE -

II ALUMINIUM ALLOY WIRES USED IN THE CONSTRUCTION
OF STRANDED ALUMINIUM ALLOY CONDUCTORS.

Diameter		Cross sectional area of nominal dia. wire	Mass	Minimum breaking load after stranding	Resistan ce at 20 deg.c.
Nom.	Max.				
mm	mm	mm.sq.	kg/km	kN	Ohm/k m
2.00	2.02	3.142	8.482	0.92	10.653
2.50	2.53	4.909	13.25	1.44	6.845
3.15	3.18	7.793	21.04	2.29	4.290
3.81	3.85	11.400	30.78	3.34	2.938
3.94	3.98	12.190	32.92	3.58	2.746
4.26	4.30	14.250	38.48	4.18	2.345

6 (b) TOLERANCE ON NOMINAL SIZES :

No negative tolerance shall be permitted on the nominal diameter aluminium wire used in the manufacture of AAA COVEREDDC COVERED. However , positive tolerance in this respect shall be as provided in IS: 398 (Part IV)/1994 (amended upto date).

7. FREEDOM FROM DEFECTS :

The wire shall be smooth and free from all imperfections such as spills , splits, slag inclusion , dia. marks scratches, fittings, blow holes, 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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8. JOINTS. IN WIRES :

8.1 Conductors containing seven wires :-

There shall be no joint in any wire of a stranded conductor containing seven wires , except those made in the base rod or wire before final drawing.

8.2 Conductors containing more than seven wires :-

In conductors containing more than seven wires, joints in individual wires are permitted in any layer except the outermost layer (in addition to those made in the brass rod or wire before final drawing) but no two such joints shall be less than 15 m apart in the complete stranded conductor, such joint shall be made by resistance or cold pressure butt welding. They are not required to fulfill the mechanical requirement of unjointed wires. Joints made by resistance butt welding shall, subsequent to welding , be annealed over a distance of at least 200 on each side of the joint.

9. STRANDING :-

9.1 The wires used in the construction of a stranded conductor shall , before stranding satisfy all the relevant requirements of this standard .

9.2 The lay ratio of the different layers shall be within the limits given in the Table-III .

TABLE - III : LAY RATIOS FOR ALUMINIUM ALLOY STRANDED CONDUCTORS

No. of wires in Conductors	Lay Ratio in			
	6 - wire layer		12 - wire layer	
	Min.	Max.	Min.	Max.
7	10	14	-	-
19	10	16	10	14

9.3 In all constructions, the successive layers shall have opposite directions of lay, the outer most layer being right handed . The wires in each layer shall be evenly and closely stranded .

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- 9.4 In aluminium alloy stranded conductors having multiple layers of wires, the lay ratio of any layer shall not be greater than the lay ratio of the layer immediately beneath it.

10 FILLING (WATER BLOCKING):

The Stranded Conductor shall be longitudinally water tight by means of a water blocking material incorporated during the extrusion process. The use of grease /water swellable tape / water swellable powder etc is not permitted. The water blocking material shall be stable at maximum operating conductor temperature of 90 Deg. Cent.

The water blocking compound shall be compatible with the conductor material as well as the semi conducting polymer screen layer above it and not adversely affect its electrical or mechanical properties.

11 INSULATION:

The Insulation should be dual layered with the Inner Layer being XLPE with a nominal thickness of 1.2 mm for Voltages up to 11 KV , **1.32 mm for Voltages for 22 KV** and 2.43 mm for 33 KV and the Outer Layer being a suitable XLPE which is UV Resistant, Non Tracking and Erosion Resistant with a nominal wall thickness of 1.1 mm for Voltages up to 22 KV and 1.2 mm for 33 KV. The minimum combined Insulation Thickness of both Layers should be 2.0 mm for Voltages up to 22 KV and 3.0 mm for Voltages upto 33 KV minimum.

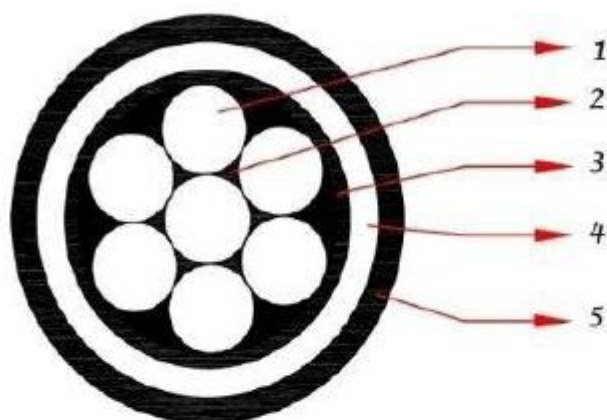
The conductor manufacturing and stranding process shall incorporate the longitudinal water blocking also.

The Semi Conducting Screen, Inner Insulation and Outer Insulation should be extruded in one step ie 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.

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Figure 1 shows the Cross Section of a AAA COVERED Conductor.



Nos.	Description	Unit	Nominal Thickness		
			11 KV	22 KV	33 KV
1	Aluminium Alloy Wire	Sq.mm	AS PER REQUIREMENT		
2	Extruded Longitudinal Water Blocking Layer	mm	AS REQUIRED TO MAKE WATER BLOCKED ARRANGEMENT		
3	Extruded Semi conductive layer	mm	0.3	0.3	0.4
4	Inner Insulation of XLPE, without carbon black	mm	1.2	1.32	2.43
5	Outer Insulation with UV & Track Resistant XLPE	mm	1.1	1.1	1.2

12 TYPE TEST:

All the following type tests in accordance with EN 50397-1 : 2006 shall be performed on MVCC samples drawn by purchaser..

12.1 Electrical tests

12.1.1 Conductor resistance

12.1.2 High voltage test

12.1.2.1 For CC without conductor screen:

Test voltage (a.c.)	1U
Number of specimen	1
Length of specimen (minimum)	5m
Duration of immersion in water (minimum)	1h
Temperature of water	(20 ± 5) deg C
Test duration	15 min (S) 1 h (T)

12.1.2.2 For CC with conductor screen or upon agreement between customer and producer:

Test voltage (a.c.)	1U
Number of specimen	1
Length of specimen (minimum)	5m
Duration of immersion in water (minimum)	1h
Temperature of water	(20 ± 5) deg C
Test duration	4 h (S) 48 h (T)

12.1.3 Spark test on the covering

Test voltage: a.c. 0,7 U or dc 1 U

12.1.4 Leakage current

Test voltage: a.c. 0,7 U

12.1.5 Tracking resistance

12.2 Construction and dimensions

12.2.1 Compliance with the designs requirements

12.2.2 Thickness of the covering

12.3 Construction and mechanical properties of the conductor

12.3.1 Rated tensile strength

12.3.2 Construction and dimensions

- 12.4 Non-electrical tests on the covering
 - 12.4.1 Mechanical properties
 - a) before ageing of sample
 - b) after ageing of sample
 - 12.4.2 Carbon black content
 - 12.3.2 Resistance to UV rays
- 12.5 Tests of compatibility
 - Ageing of complete product sample
- 12.6 Thermal properties of the covering
 - 12.6.1 Shrinkage test
 - Distance “L” between marks: (200± 5) mm
 - 12.6.2 Hot-set-test
 - 12.6.3 Pressure test at high temperature (For PE cables)
- 12.7 Further tests on the covering
 - 12.7.1 Water absorption
 - 12.7.2 Shore D hardness

12.8 Test of the longitudinal water tightness

12.8.1 With heat cycle

Number of specimen	1
Length of specimen	3m
Test duration	24 h
Bending radius	20 D

12.8.2 Without heat cycle

Number of specimen	1
Length of specimen	1m
Test duration	1h

- 12.9 Marking
 - 12.9.1 Content, legibility
 - 12.9.2 Durability
- 12.10 Slippage test

13 ROUTINE TESTS:

All the Routine tests as per EN 50397-1 : 2006 amended upto date shall be carried out on each and every delivery length of MVCC . The result should be given in test report.

The details of facility available in the manufacturer's works in this connection should be given in the bid.

14 ACCEPTANCE TESTS:

All Acceptance tests as per EN 50397-1 : 2006 as amended upto date including the optional And should offered Anti tracking testing on selective samples in manufacturer's work during acceptance test.

15 TESTING FACILITIES AND DETAILS OF EQUIPMENTS :

The supplier / tenderer shall clearly state as to what testing facilities are available in the works of manufacturer and whether the facilities are adequate to carry out type, routine and acceptance tests And Anti Tracking as mentioned in EN 50397-1 : 2006 on the MVCC. The facilities shall be provided by the bidder to purchaser's representative for witnessing the tests in the manufacturer's works. If any test cannot be carried out at manufacturer's works reason should be clearly stated in the tender.

13 END SEALING :-

Heat Shrinkable end caps with sealant shall be used for effectively sealing the end terminals of the covered conductor. The inner diameter range of cap shall be such that it shall tightly fit to the covered conductors to prevent moisture ingress.

14 PACKING AND MARKING :

The conductors shall be wound in reels or drums conforming to the latest versions of IS : 10418 (amended upto date), ' Specification for Drums for cables .

14.1 PACKING :

- 14.1.1 The gross mass of packing for various conductors shall not exceed by more than 10% of the values given in the following table .

Conductor Size in sq.mm.	Gross Mass in kg
22 (7/ 2.00 mm)	1100
34 (7/ 2.50 mm)	1100
55 (7/ 3.15 mm)	1500
80 (7/ 3.81 mm)	1600
100 (7/ 4.26 mm)	2000
148 (19/ 3.15 mm)	2000
232 (19/ 3.94 mm)	2400

14.1.2 The normal length of various conductors shall be as given in the following table:

Conductor Size in sq.mm.	Normal Length in km
22 (7/ 2.00 mm)	2.0
34 (7/ 2.50 mm)	2.0
55 (7/ 3.15 mm)	2.0
80 (7/ 3.81 mm)	1.0
100 (7/ 4.26 mm)	1.0
148 (19/ 3.15 mm)	1.0
232 (19/ 3.94 mm)	1.0

14.1.2.1 LENGTHS AND VARIATION IN LENGTHS :

The standard length of AAA COVERED DC Covered shall be as per mentioned in clause. No 14.1.2 Tolerance of +/- 5%(plus or minus five percent)shall be permitted in this standard length. All the lengths outside these limits of tolerances shall be treated as random length.

Random length shall not be less than 80%(eighty percent) of the standard length specified as above and the total acceptable quantity of such random lengths shall be within 7%(seven percent) quantity of the allotted quantity to each consignee of the respective size of the conductor.

14.2 MARKING :

IDENTIFICATION MARKS ON COVERED CONDUCTOR:

The following particulars shall be properly legible embossed/Printing on the covered conductor at the intervals of not exceeding one meter through out the length of the cable. The covered conductor with poor and illegible embossing/Printing shall be liable for rejection.

- Manufactures name and/or Trade name.
- Voltage grade.
- Year of manufacture.
- M.S.E.D.C.L.
- Successive Length.
- Size of cable
- EN 50397-1 : 2006

Also The following information be marked on each package :

- a) Manufacturer's name
- b) Trade mark ,if any
- c) Drum or identification number
- d) Size of conductor Number and lengths of conductors
- e) Gross mass of the package
- g) Net mass of conductor
- h) EN 50397-1 : 2006.

15 . INSPECTION :

All tests and inspection shall be made at the place of manufacturer unless otherwise especially agreed upon by the manufacturer and purchaser at the time of purchase. The manufacturer shall afford the inspector representing the purchaser all reasonable facilities without charges , to satisfy him that the material is being furnished in accordance with this specification.

16 . VERIFICATION OF LENGTH OF CONDUCTOR :

- i) The Company shall ascertain the length of AAA COVERED Conductor at supplier's works and at the receiving store centers by measuring the actual length by length measuring machine used for the purpose. The supplier should ensure that length measuring machine is available for measurement of the length by our inspecting officer.
- ii) Both ends of the AAA COVERED Conductor will be sealed by the supplier and seals will be contained in the drum and not exposed out of drum.
- iii) The declared length will be measured between manufacturer's seals at both ends of AAA COVERED Conductor.
- iv) The weight of AAA COVERED Conductor will also be checked for ensuring correct lay and length of the AAA COVERED Conductor .
- v) For the verification of the length of the conductor, 10 %of total lot (in Drums) should be selected at the works. The physical verification of the length of the conductor should be carried out for maximum up to 5 (five) drums. If there are anymore drums left for verification, then weight of each verified drum should be carried out and average weight may be calculated.

Then the weight of each of all the remaining selected drums may be taken and if these weights are matching with the average weight, then that particular lot may be accepted otherwise rejected.

- vi) Verification of length of conductor will also be carried out at each stores center for two drums out of each lot. If the average length is found correct or more, the lot will be accepted. If the average length is found to be less than the declared, the percentage of such short length will be applied for reduction for the entire quantity supplied in the lot at respective stores for acceptance.
- vii) In case of dispute, joint inspection alongwith the representative of the supplier shall be carried out after giving 10 (ten) days notice to the supplier to remain present at stores center for the purpose. If the representative fails to attend on stipulated date for joint inspection, the decision of the consignee shall be final and binding.

17 REJECTION :

- i) While measuring the length , the sample piece from each length shall be taken for carrying out the test as per IS: 398 (Part IV) / 1994 (amended upto date) & EN 50397-1 : 2006 . All the values of each sample should not exceed the value as per the relevant specification. In case of deviation , whole lot will be rejected at works.
- ii) Specific resistivity of Aluminium Alloy wire used should not exceed 0.0328 ohm sq.mm./m at 20 degree centigrade as prescribed in IS: 398 (Part IV)/1994 (amended upto date). If the results are at variance , whole lot shall be rejected.

18 EN CERTIFICATION MARK :

The AAA COVERED Conductor with EN marking only is required by the MSEDCL against this tender specification and as such , only those tenderer who hold valid EN license for AAA COVERED Conductor need quote against this invitation of tender.

19 SCHEDULES :

The tenderer shall fill in the following schedules which form part of the tender specification and offer.

Schedule ' C '----- Schedule of Tenderer's Experience.

SCHEDULE 'C '

SCHEDULE OF TENDERER'S EXPERIENCE

Tenderer shall furnish here a list of similar orders executed/under execution by him to whom a reference may be made by Purchaser in case he considers such a reference necessary. -----

Sr. Name of Client Value Period of supply Name & Address to No. & Description.
of order and commissioning whom reference may be made

-----	-----	-----	-----	-----
1	2	3	4	5
-----	-----	-----	-----	-----

NAME OF FIRM _____

NAME & SIGNATURE OF TENDERER _____

DESIGNATION _____

DATE _____

SEAL & SIGNATURE OF THE TENDERER

**TECHNICAL SPECIFICATIONS FOR 11/22/33 KV MEDIUM VOLTAGE COVERED
CONDUCTOR (MCCC) ACCESSORIES**

INDEX

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1 SCOPE:

This specification covers design, manufacture, assembly, testing and supply of Accessories for All Aluminium Alloy Stranded Covered Conductors for use on 33 kV , 22 kV, 11 kV distribution system.

2 SERVICE CONDITIONS :

The Accessories to be supplied against this specifications shall be suitable for satisfactory continuous operation under the following tropical conditions.

- i) Maximum ambient temperature (Degree C) ----- 50
- j) Minimum temperature of air in shade (Degree C ----- 3.5
- k) Relative Humidity (%) ----- 10 to 100
- l) Maximum Annual Rainfall (mm) ----- 1450
- m) Maximum Wind Pressure (kg/sq.m.) ----- 150
- n) Maximum altitude above mean sea level (meter) ----- 1000
- o) Isoceraunic level (days/ year) ----- 50
- p) Seismic level (Horizontal acceleration) ----- 0.3g

3 APPLICABLE STANDARDS :

Unless otherwise stipulated in this specification , the accessories of conductor shall conform to the following Standards (amended upto date).

1	EN 50397-1:2006	Covered Conductor Specification- Up to 33 KV
2	EN 50397-2:2006	Covered Conductor Accessories Specification- UP to 33 KV
3	NF C 33-041 (SEPTEMBER 2013)	Insulated cables and their accessories for power systems – Anchoring devices for overhead distribution with bundle assembled cores, of rated voltage 0.6/1 kV.
4	EN 50483-4 (MARCH 2009)	Test requirements for low voltage aerial bundled cable joints
5	EN 50397-2 (MARCH 2010)	Covered conductors for overhead lines and the related accessories for rated voltages above 1kV a.c. and not exceeding 36kV a.c. PART 2 : Accessories for covered conductors : tests and acceptance criteria
6	EN 50182	Conductors for overhead lines- Round wire concentric lay conductors

4 TYPE OF MEDIUM VOLTAGE COVERED CONDUCTOR ACCESSORIES:

The Accessories of Medium Voltage Covered Conductor (MVCC) are specified below and shall consist of the following:

Sl.No	Description	Application
1	Tension Assembly (TA)	For fitting onto a pole for tensioning at the beginning or end of a length of MVCC, or for anchoring while a major change in direction. The Tension assembly consists of one wedge type Tension / anchoring clamp and one Tracking protection IPC.
2	Insulator Clamp / Tie (IC)	For supporting and aligning MVCC at an intermediate pole in a length, with small angle of deviation. The Insulator Clamp hold the MVCC in its position on top of the pin or post insulator. Insulator Tie consists of either an “Insulated Plastic” or “Metallic helical” Type for Line Alignment.
3	Suspension Clamp (SC)	For supporting a length of MVCC at an intermediate pole in a length, with large angle of deviation with a disc insulator. The suspension clamp consists of an “Assembly with one locking type Suspension clamp with provision to fix in Insulators.
4	Insulation Piercing Connector for “Bare to Covered interconnection” (IPC – Type 1)	For main (Bare) to main (MVCC) networking connection. This connector is to ensure the electrical characteristics with in the required limits, while ensuring necessary insulation protection against tracking and water penetration on MVCC.
5	Insulation Piercing Connector for Networking / Branching / Looping (IPC – Type 2)	For main (MVCC) to main (MVCC) networking or branching of MVCC to another MVCC Or Branch Cable or Looping for transformer junctions. This connector is to ensure the electrical characteristics with in the required limits, while ensuring necessary insulation protection against tracking and water penetration on MVCC.
6	Insulation Piercing Connector with	For Temporary Earthing Provision from MVCC Cable for maintenance purpose.

	Aluminum Bail for earthing (IPC – Type 3)	This connector is to ensure the electrical characteristics within the required limits, while ensuring necessary insulation protection against tracking and water penetration on MVCC.
7	Tension Joints (TJ)	Mid-span tension joints for jointing MVCC over a span

4.1 Tension / Anchoring Clamp:

Anchoring assemblies are used to firmly hold the MVCC to a concrete or steel pole and transmit the mechanical tension.

at the end of a run

at a major change in direction of over 20 degrees.

The clamp should consists of an Aluminum alloy corrosion resistant casted body, Rigid sling (“bail”) of stainless steel with Tracking IPC and self-adjusting plastic wedges which shall anchor/hold the cable. The following key criterion to be followed for the design of the same

There shall be no losable part (except Tracking IPC and bail) in the process of clamping arrangement

Locking mechanism should be wedge type self-locking. Wedges are to be made of high strength, climatic resistance Engineering Plastic with glass fibre.

The fittings shall be able to withstand the specific minimum failure load (SMFL) and shall not damage the covering. SMFL is the minimum load specified by the purchaser or declared by the supplier at which mechanical failure will not take place.

4.1.1 Rigid Sling (Bail) of Anchor Assembly

The Anchoring assembly shall be supplied with a Galvanized steel rod to connect the Tension Clamp to the Insulator clamp on the pole.

The Rigid Bail forming part of clamp should have sufficient distance between bracket and body of clamp and shall have sufficient mechanical strength to withstand the mechanical test for the complete assembly tests in this specification.

Flexible bail is not acceptable due to the reason to withstand the load.

Rigid Bail should be fitted with provision to remove from the clamp to have easy installation.

4.1.2 Wedge Type Tension Clamp for Anchoring Assembly

Wedge type clamps shall be used for clamping the MVCC without damaging the insulation and shall be capable of clamping an uncut MVCC so that it can continue without break to the connecting point or next span.

The clamp shall be of aluminum with fully insulating type of mechanical and weather resisting thermoplastic wedges.

No tools shall be needed for fitting the MVCC into the clamp.

Type tests as per IEC and specification shall be conducted from NABL accredited independent Lab of India/the International Laboratory Accreditation corporation, Mutual Recognitions Arrangement (ILAC, MRA) signatory Laboratory like COFRAC.

4.1.3 Testing Requirements for an Anchoring Assembly.

The following tests are intended to establish design characteristics as per EN 50397 – 2 and NFC 33-041.

#	Test	Type test	Acceptance Test	Routine test
1	Visual examination	x	x	x
2	Dimensional verification	x	x	x
3	Mechanical tests	x		
3.1	Tensile test at ambient temperature	x	x	
3.2	Tensile test at low temperature	x		
3.3	Tensile test at high temperature	x		
3.4	Slippage test at ambient temperature	x	x	
4	Environmental tests			
4.1	Corrosion test	x		
4.2	Climate ageing test	x		
4.3	Resistance against tracking in heavy polluted areas	x		
5	Check for permanent marking	x	x	

4.2. Insulator Clamps / Ties

The Clamps / ties shall be designed suitably to hold the MVCC in its position on top of the insulator. The Clamps is preferred to be made of Insulating Plastic materials or protected with Insulating Plastic material to ensure tracking resistance and to avoid any insulation damage to covered conductor due abrasion while mechanical or wind induce vibration.

4.2.1 Testing Requirements for an Insulator Clamps / Tie.

Tests shall meet the requirement of EN Standard 50397 - 2

Sl. No.	Test	Type test	Acceptance Test	Routine test
1	Visual examination	x	x	x
2	Dimensional verification	x	x	x
3	Check for Marking	x	x	x
4	Mechanical tests	x	x	x
4.1	Failure Load Tests	x	x	x
4.2	Slip Load Tests	x	x	x
4.3	Lift / Side Load Tests	x	x	x
4.4	Thermal Tests under load	x		
4	Environmental tests			
4.1	Corrosion test	x		

4.2	Climate ageing test	x		
4.3	Resistance against tracking in heavy polluted areas	x		

4.3. Suspension Clamps

The Suspension Clamps shall be made of Insulating Plastic to ensure tracking resistance and to avoid any insulation damage to covered conductor due abrasion while mechanical or wind induce vibration.

4.3.1 Testing Requirements for Suspension Clamps

Tests shall meet the requirement of EN Standard 50397 - 2

Sl. No.	Test	Type Test	Acceptance Test	Routine test
1	Visual examination	x	x	x
2	Dimensional verification	x	x	x
3	Check for Marking	x	x	x
4	Mechanical tests	x	x	x
4.1	Failure Load Tests	x	x	x
4.2	Slip Load Tests	x	x	x
4.3	Lift / Side Load Tests	x	x	x
4.4	Thermal Tests under load	x		

4.4 Insulation Piercing Connectors for MVCC .

Insulation Piercing Connectors (IPC) are used for making Tee / Tap-off/ connections to an MVCC / Bare Overhead Line.

Insulation Piercing Connectors are designed to make a connection between the uncut main conductor and a branch cable conductor without having to strip either cable to expose the conductor. Instead, the tightening action of the IPC will first pierce the Insulation, then make good electrical contact between the main and branch conductor while simultaneously insulating and sealing the connection.

The insulation piercing connectors shall be of the following type(s) depending on the applications.

4.4.1 Insulation Piercing Connectors

The connector bodies shall be made entirely of mechanical and weather resistant plastic insulation material made of weather & UV resistant reinforced polymer and no metallic part outside the housing is acceptable except for the tightening bolt or nuts. Any metallic part that is exposed must be free from potential during or after connector installation.

Screws or nuts assigned for fitting with IPC (Insulating Piercing connector), must be fitted with torque limiting shear heads to prevent over tightening or under tightening. While the min & max torque values are to be specified by Manufacturer, these should not exceed 27 N mtr for IPC for main conductor < 95 sq mm, and 42 Nmtr for main conductor >95, but < 240 sq mm.

The IPC must perform piercing and connection on Main and Branch cable simultaneously using single bolt for tightening as multiple bolts do not ensure even tightening. The shear bolt/nut shall be suitable for tightening with a hexagonal socket of 13 mm or 17mm.

The contact teeth or blade of the connector is made of tinned copper with equivalent cross

Section with respect to %IACS to suit the max branch cable size declared.

The IPCs shall be water proof and the water tightness shall be ensured by appropriate elastomeric materials and not by grease, gel or paste alone. Grease can be applied to protect the contact blade alone and shall not be visible on the outer surface of the connector. Connector should not be dipped in grease.

Each IPC should be provided with a cap to seal the cut end of the Branch cable. It should be of a design that once the connector is installed, it shall not be possible to remove the cap without dismantling the connector.

All the metallic parts of the connector should be corrosion resistant and there should not be any appreciable change in contact resistance & temperature after overloads & load cycling and should conform to the long duration tests specified in this standard.

4.4.2 Testing Requirements for Suspension Clamps

The following tests are intended to establish design characteristics as per NFC 33-003, 004, 020 and EN 600068 - 1

Sl. No.	Test	Type test	Acceptance Test	Routine test
1	Visual examination		x	x
2	Dimensional verification		x	x
3	Mechanical tests	x	x	x
4	Voltage and Water Tightness test	x	x	x
5	Climatic Ageing Test	x		
6	Corrosion Test	x		
7	Electrical Ageing Test	x		
8	Check for marking	x	x	

4.5 Mid Span Insulated Jointing Sleeves

The sleeves should be Pre-Insulated type. Sleeve should be made of Aluminum, insulated with an Anti-UV black thermoplastic tube hermetically sealed two ends with 2 flexible rings. Strip length, Hexagonal crimping die reference and size to be marked on the outer surface of plastic sleeve.

Reference standard, type test and design requirements as per NFC 33 021

Sl. No.	Test	Type Test	Acceptance Test	Routine test
---------	------	-----------	-----------------	--------------

1	Visual examination	x	x	x
2	Dimensional verification	x	x	x
3	Check for Marking	x	x	x
4	Voltage and Water Tightness test	x	x	x
5	Climatic Ageing Test	x		
6	Corrosion Test	x		
7	Electrical Ageing Test	x		

4.5.1 Heat Shrinkable End Cap

The Insulated End Cap with sealant shall be suitable for effectively sealing the end terminal of the covered conductors. The inner diameter range of the Cap shall be such that it shall tightly fit to the covered conductors to prevent entry of moisture.

5.0 MARKING:

5.1 On Covered Conductor

The covered conductors shall carry the following marking as per CENELEC 50397-1 or as agreed.

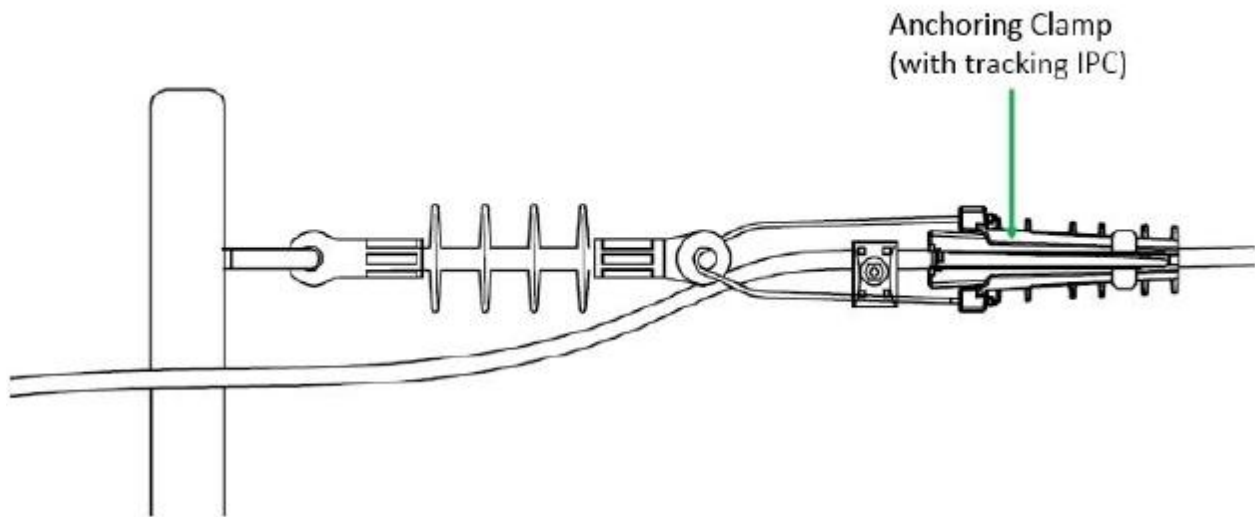
5.2. On Accessories

Manufacturer's name with designation if any.

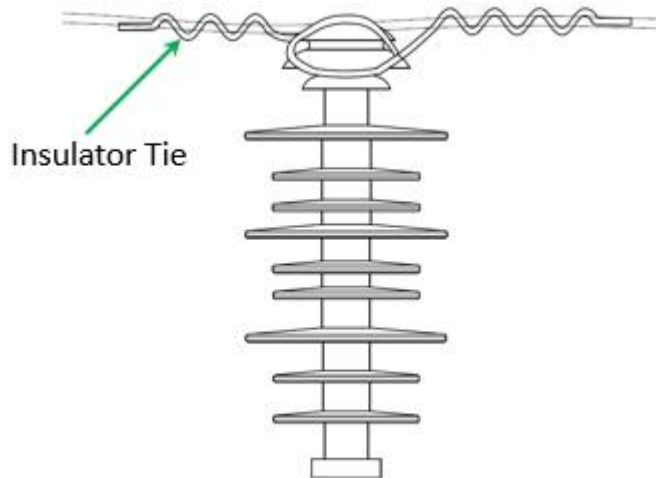
Batch code and Manufacturing period (MM/YY) is to be marked.

ANNEXURE I : - TYPICAL GENERAL ARRANGEMENT DIAGRAM AND DRAWINGS
Tension Assembly (TA) with Anchoring clamp and one Tracking protection IPC

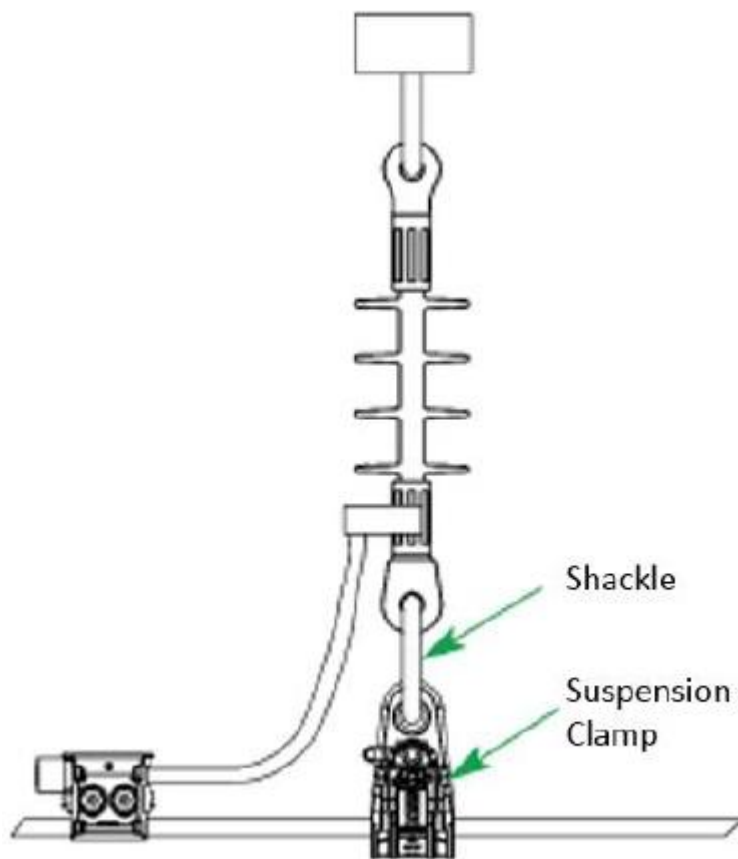
Anchoring with protection against Tracking.



2. Insulator Clamp / Tie (IC)



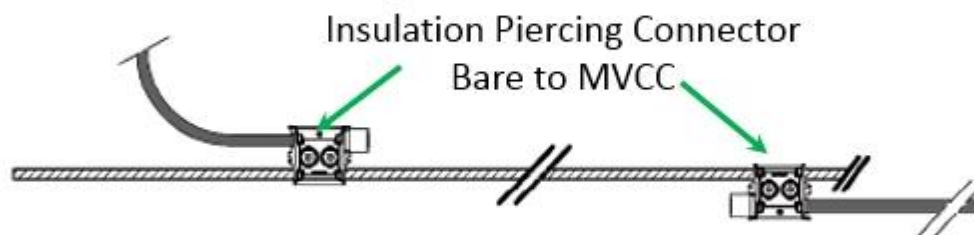
3. Suspension Clamp (SC)



4. TYPE-1 : Insulation Piercing Connector for Networking / Branching / Looping, TYPE - 3: Insulation Piercing Connector with Aluminum Bail for earthing and Tension Joints (TJ)



5. Insulation Piercing Connector for Bare to Covered interconnection



5 TYPICAL DRAWINGS

5.1 Tension Assembly (TA) with Anchoring clamp and one Tracking protection IPC

7	2	WASHER	GALVANIZED STEEL
6	2	LOCK NUT	GALVANIZED STEEL
5	1	SS ROD	GALVANIZED STEEL
4	1	TRACKING IPC	-
3	1	LEFT WEDGES	HEAT AND UV RESISTANT THERMOPLASTIC
2	1	RIGHT WEDGES	HEAT AND UV RESISTANT THERMOPLASTIC
1	1	BODY	ALUMINIUM ALLOY
PART	QTY	DESCRIPTION	MATERIAL

NOTE:
 STANDARD: EN 50397-2
 CABLE RANGE : SUITABLE COVERED CONDUCTOR
 MARKING : PRODUCT REFERENCE,
 MANUFACTURER LOGO,
 BATCH CODE, MANUFACTURING PERIOD
 General Tolerance : $\pm 5\%$

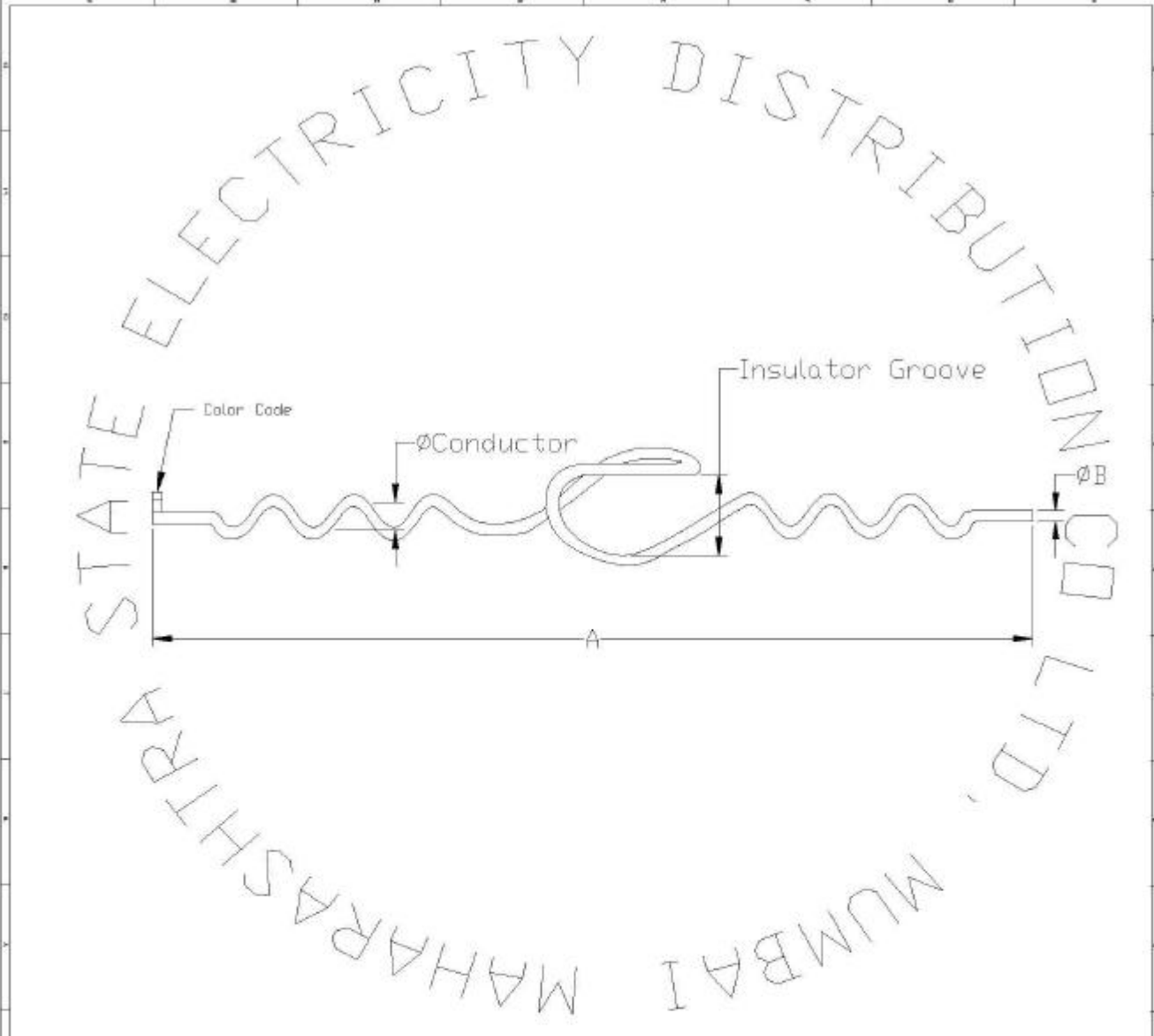
NAME OF THE CUSTOMER :
 A/T . NO :
 QUANTITY :
 DETAILS OF COVERED CONDUCTOR ACCESSORIES :

NAME OF THE MANUFACTURE & SYMBOL

DATE		SCALE NTS	DRG. NO.
DRN			
CHD			
APPD			

5.2. Insulator Clamp / Tie (IC)

STATE ELECTRICITY DISTRIBUTION CD LTD. MAHARASHTRA MUMBAI

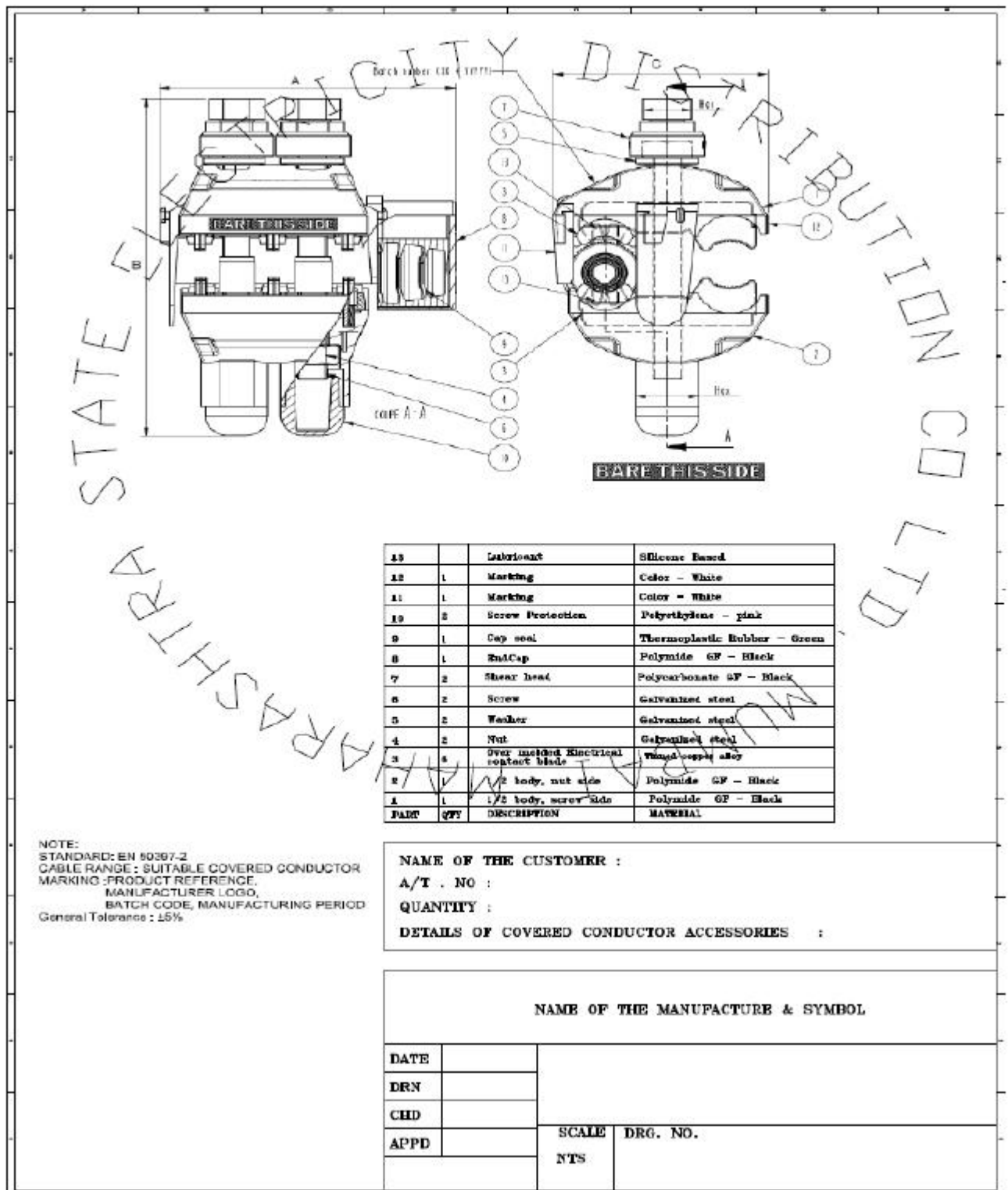


The diagram shows a cross-section of a conductor with a wavy line representing the conductor and a solid line representing the insulator groove. A color code is indicated on the left. The diameter of the conductor is labeled as ϕ Conductor. The diameter of the insulator groove is labeled as ϕB . The length of the insulator groove is labeled as A.

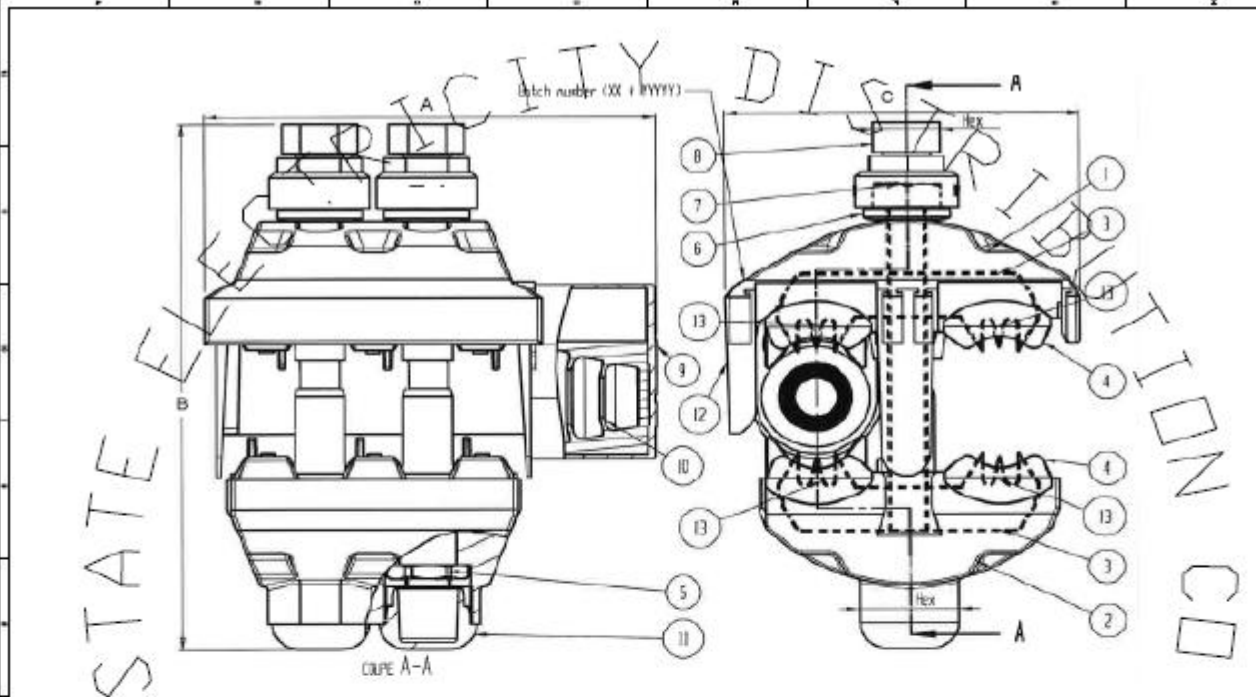
NOTE:
 STANDARD: EN 50397-2
 CABLE RANGE : SUITABLE COVERED CONDUCTOR
 MARKING : PRODUCT REFERENCE,
 MANUFACTURER LOGO,
 BATCH CODE, MANUFACTURING PERIOD
 General Tolerance : $\pm 5\%$

NAME OF THE CUSTOMER :			
A/T . NO :			
QUANTITY :			
DETAILS OF COVERED CONDUCTOR ACCESSORIES :			
NAME OF THE MANUFACTURE & SYMBOL			
DATE		SCALE NTS	
DRN			
CHD			
APFD			
		DRG. NO.	

5.4 Insulation Piercing Connector for Bare to Covered interconnection



5.5 Insulation Piercing Connector for Networking / Branching / Looping



NO	QTY	DESCRIPTION	MATERIAL
13		Blend	Silicone Based
12	1	Marking	Color - White
11	2	Screw Protection	Polyethylene - pink
10	1	Cap seal	Thermoplastic Rubber - Green
9	1	EndCap	Polyimide GF - Black
8	2	Shear head	Polycarbonate GP - Black
7	2	Screw	Galvanized steel
6	2	Washer	Galvanized steel
5	2	Nut	Galvanized steel
4	2	Seal	Thermoplastic Rubber - Black
3	6	Electrical contact blade	Electrical contact blade
2	1	1/2 body, nut side	Polyimide GP - Black
1	1	1/2 body, screw side	Polyimide GP - Black
PART	QTY	DESCRIPTION	MATERIAL

NOTE:
 STANDARD: EN 50397-2
 CABLE RANGE : SUITABLE COVERED CONDUCTOR
 MARKING : PRODUCT REFERENCE,
 MANUFACTURER LOGO,
 BATCH CODE, MANUFACTURING PERIOD
 General Tolerance : ±5%

NAME OF THE CUSTOMER :
A/T . NO :
QUANTITY :
DETAILS OF COVERED CONDUCTOR ACCESSORIES :

NAME OF THE MANUFACTURE & SYMBOL

DATE		SCALE NTS	DRG. NO.
DRN			
CHD			
APPD			

5.6 Insulation Piercing Connector with Aluminum Bail for earthing

PART	QTY	DESCRIPTION	MATERIAL
10		Lubricant	Silicone Based
12	1	Marking	Color - White
11	1	Ball (See Table)	See Table
10	2	Screw Protection	Polyethylene - Pink
9	2	Shear head	Polycarbonate GF - Black
8	2	Screw	Galvanized steel
7	2	Washer	Galvanized steel
6	2	Nut	Galvanized steel
5	1	Seal : nut side	Thermoplastic Rubber - Black
4	1	Seal : screw side	Thermoplastic Rubber - Black
3	6	Electrical contact blade	Brass/Phosphor
2	1	1/2 body, nut side	Polyimide GF - Black
1	1	1/2 body, screw side	Polyimide GF - Black

NOTE:
 STANDARD: EN 50397-2
 CABLE RANGE : SUITABLE COVERED CONDUCTOR
 MARKING : PRODUCT REFERENCE,
 MANUFACTURER LOGO,
 BATCH CODE, MANUFACTURING PERIOD
 General Tolerance : $\pm 5\%$

NAME OF THE CUSTOMER :
 A/T . NO :
 QUANTITY :
 DETAILS OF COVERED CONDUCTOR ACCESSORIES :

NAME OF THE MANUFACTURE & SYMBOL

DATE		SCALE	DRG. NO.
DRN			
CHD			
APPD			
		NTS	

ANNEXURE-II - Guaranteed technical particular format

1. GTP for Dead-End / Anchoring Assembly (Dead-End Clamp with Bracket)

Sl. No.	Description	Particulars
1	Name of the Supplier	
2	Type of Design	
3	Weight	
4	Cable Range	Range to in line with this specification
5	Material	
6	Ultimate Tensile Strength	For conductor range of 50 - 70 sqmm = 20 KN For conductor range of 70 - 120 sqmm = 30 KN For conductor range of 120 - 200 sqmm = 30 KN
7	Installation(With/Without disassembly)	Ready- to-use (Without disassembling)
8	Marking	
9	Dimensions	

2. GTP for Insulator Clamp / Tie (IC)

Sl. No.	Description	Particulars
1	Name of the Supplier	
2	Length	
3	Weight	
4	Cable Range	Range to in line with this specification
5	Material	
7	Installation(With/Without disassembly)	Ready- to-use (Without disassembling)
8	Marking	

3. GTP for Suspension Clamp

Sl. No.	Description	Particulars
1	Name of the Supplier	
2	Cable Range	Range to in line with this specification
3	Material	
4	Minimum Breaking Load - Vertical	
5	Installation(With/Without disassembly)	Ready- to-use (Without disassembling)
6	Marking	
7	Dimensions	
8	Weight	

4. GTP for INSULATION PIERCING CONNECTOR

Sl No	Particulars	
1	Name of supplier	
2	Type of connection required	Bare to Covered conductor Covered conductor to Covered conductor Tapping connector
3	Are torque limiting shear heads provided to tightening bolts	
4	Range of cable sizes accommodated for Main & Branch	Range to in line with this specification
5	Tightening Torque	
6	Torque for establishing connection between main and Tap (Nm)	70% of min torque specified
7	Marking and embossing on the connector	

5. GTP for INSULATED TENSION / MIDPSAN JOINTS

Sl. No	PARTICULARS	
1	Name of Supplier.	
2	IS manufacturer of Accessories an ISO 9001-2000 Company?	
3	Type No & Size Range	Range to in line with this specification
4	Is any metallic part carrying potential in operation exposed during installation	
5	Installation	Crimping by Hexagonal Compression