

Gujarat Power Research & Development Cell  
(A Govt. of Gujarat Initiative)  
Gujarat Urja Vikas Nigam Ltd  
CIN: U40109GJ2004SGC045195,  
IIT Gandhinagar Research Park, IIT Gandhinagar,  
Palaj-382355, Gandhinagar, Gujarat, India  
[www.guvnl.com](http://www.guvnl.com); [www.gprd.in](http://www.gprd.in); [guvnlrnd@gprd.in](mailto:guvnlrnd@gprd.in)



**TECHNICAL SPECIFICATIONS  
OF  
11 KV AL-59 ACS RABBIT COVERED  
CONDUCTOR AND ACCESSORIES**

**Tender No : PGVCL/GPRD/SD-MVCC/04**

**:: TECHNICAL SPECIFICATIONS::**

Sr. No	Technical Specification No./Revision	Date of revision
1.	<b>GUVNL/GPRD/TS/SD-MVCC</b>	06.04.2018
2.	<b>GUVNL/GPRD/TS/SD-MVCC/01</b>	06.06.2018
3.		

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**1. SCOPE:**

This specification covers design, Engineering, manufacturing, Testing, Inspection before dispatch, Forwarding, transportation to sites, Erection, supervision, testing & commissioning of AL 59 Rabbit ACS type covered conductor by replacing the existing rabbit conductor of Agriculture feeder under Mangrol Division of PGVCL, Gujarat.

The conductor should conform to latest Standards. The AL 59 ACS RABBIT Conductor shall be conforming to SS 424 08 13 & SS 424 08 14 with latest amendment and the insulation conforming to requirement given in Table-1 of EN50397-1:2006 with latest amendments.

The AL 59 ACS Covered conductor shall conform in all respects to highest standards of Engineering, design, workmanship, this specification and the latest revisions of relevant standards at the time of offer and the authorized person of DISCOM have power to reject any work or material s, which his judgment , is not in full accordance therewith.

**2. SPECIAL INSTRUCTIONS TO BIDDER:**

- 2.1. The Bidder shall execute the work on TURN KEY basis i.e. design, engineering, manufacturing of Covered Conductor from core to finish in-house, testing at manufacturer's works, supply and delivery, erection, testing and commissioning of 11 kV AL 59 ACS rabbit covered conductor with relevant accessories on Existing Distribution feeder by replacing Existing rabbit conductor.
- 2.2. The bidder is required to impart training in view of manufacture, assembly, erection, operation and maintenance for offered item, at his works and, to the person/s identified by the DISCOMs, in the event of an order, free of cost. In the training session, bidder shall confirm that he has to impart the all the aspects of Installation method with accessories, objective of the individual components, possible defects and corrections etc.
- 2.3. The bidder shall bring out all the technical deviation/s only at the specified annexure.
- 2.4. Before proceeding with the execution of the aforesaid work, the bidder shall require to fully familiarize himself with the site conditions. If the existing span length between successive two poles is found to be more than 50 MTRs then in that case the bidder shall erect the single 8 MTR PSC Pole in the center of the span with relevant accessories and earthing. The PSC poles with all support insulators, fabrications shall be supplied by the buyer and successful bidder shall withdraw the material from divisional store- Mangrol.
- 2.5. It shall be the responsibility of the successful bidder to arrange all inputs required for detailed engineering and execution. The Bidders are advised to visit the installation site, may arrange the feeder survey, collect all necessary inputs and acquaint themselves with the topography, infrastructure etc. The Successful bidder shall be fully responsible for providing all equipment, materials, system and services specified

or otherwise which are required for complete implementation of the pilot project of installation of covered conductor.

- 2.6. The bidder shall submit Quality Assurance Plan for manufacturing process and Field Quality Plan with the technical bid.
- 2.7. The Bidder should be a manufacturer of covered conductors in India and must have a minimum experience of 5 years as a manufacturer of covered conductor. (the Bidder should have a covered conductor manufacturing facility in India for the past 5 years )
- 2.8. The bidder shall have to submit all the required type test reports should not be older than 07 years for the offered item. All the required type test of any equal or higher size item must have been conducted in the span of one year only. However, in the event of partial submission of reports older than specified limit, bidder must submit his confirmation for those type test reports to be submitted in the event of an order, without affecting delivery schedule, before commencement of supply, free of cost. In absence of this confirmation, the evaluation shall be carried out accordingly as non-submission of type test reports.
- 2.9. It is not the intent to specify completely here in all the details of design & construction of material. However the material shall conform in all respects to high standards of Engineering, design and workmanship operation in manner acceptable to the purchaser, who will interpret the meanings of drawings and specification and shall have the power to reject any work or material which in his judgment is not in accordance therewith. The offered material shall be complete with all components necessary for their effective and trouble free operation. Such components shall be deemed to be within the scope of bidders supply irrespective of whether these are specifically brought out in his specification and / or purchaser order or not.

### 3. SYSTEM PARTICULARS/DISTRIBUTION NETWORK PARAMETERS :

The normal system parameters of the distribution network are as below.

<b>Network</b>	3Phase-3wire
<b>Max. System Voltage</b>	12 kV
<b>Nominal System Voltage</b>	11 KV
<b>No of phases</b>	Three
<b>System Frequency</b>	50 Hz±3%
<b>Neutral earthing</b>	Solidly Grounded
<b>Method of earthing</b>	Effectively earthed
<b>Fault Level (Minimum)</b>	20 KA For 3 sec.

**4. ATMOSPHERIC PARTICULARS:**

Maximum Ambient Air Temperature	50° C
Minimum Ambient Air Temperature	5° C
Maximum daily average ambient air temperature	40°C
Maximum temperature attained by an object exposed to sun	70°C
Maximum humidity	99%
Altitude above M.S.L. (maximum)	1000Mtr
Average annual rainfall (mm)	925
Max. wind pressure(Kg/sqm)	260
Average number of rainy days per Annum	90
Seismic level (Horizontal accn.)	0.3 g
Iso-ceraunic level(Days per Year)	50
Average thunder storm days per annum	50
Note: The climatic conditions are prone to wide variations in ambient conditions and hence the equipment shall be of suitable design to work satisfactorily under these conditions.	

**5. APPLICABLE STANDARDS:**

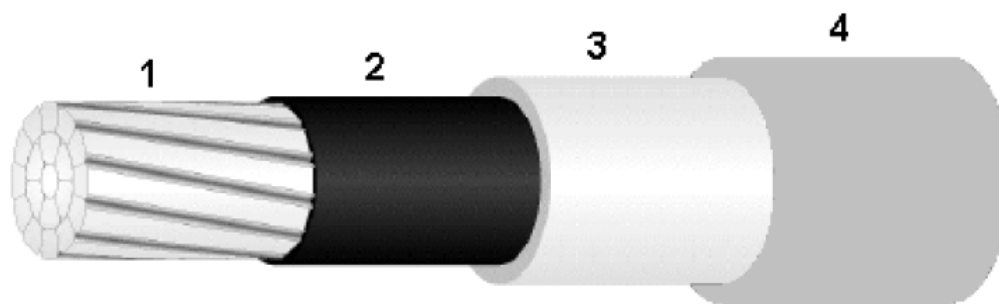
Sr No	Applicable IEC/IS	Description
1	IS 398(PART-2,4):1996	Specification for Aluminum conductor for overhead Transmission purpose
2	SS 424 08 13/ SS 424 08 14	Aluminum Alloy stranded conductors
3	IS 1521 :1972	Method of Tensile testing of steel wire
4	EN 50397-1:2006	Covered conductors for overhead lines and the related accessories
5	EN 50397-2:2009	Accessories for Covered Conductors - Tests and Acceptance Criteria
6	IEC 61232:1993	Aluminum-clad steel wires for electrical purposes
All Indian Electricity Rules/ Bills amended up to date applicable for clearances, safety and operation of the equipment		

## 6. TECHNICAL REQUIREMENT:

### 6.1. Constructional requirement:

The covered conductor shall conform in general to EN 50397-1/2006.

#### 6.1.1. Basic features :



**1-Longitudinally water tight conductor**

**2-Extruded semi-conducting compound**

**3-XLPE insulation**

**4-HDPE having UV protection and anti-tracking properties**

#### 6.1.2. Conductor :

The material offered shall be of the best quality and workmanship. The Insulated / Covered conductor shall be formed longitudinally watertight and constructed from AL59 Aluminium & Aluminium Clad Steel Reinforced (AL59 ACS) which have the mechanical and electrical properties specified in SS 424 08 13 ,SS 424 08 14 / GTP & IEC 61232 and properties of the covering material specified in Table 1 EN 50397-1:2006 of with latest amendment, if any.

#### 6.1.3. Conductor screen

Conductor shall be provided with semi-conducting screen comprising of water swellable semi conducting tape (provided if required) followed by extruded semi-conducting compound.

#### 6.1.4. Insulation

The insulation shall be as per standard EN 50397 -1 comprising of two layers. The Average thickness of the covering insulation shall not be less than that stipulated in the Technical Requirements. The physical and electrical properties of insulating compounds shall be as specified in the EN 50397-1.

1- The inner layer of main XLPE insulation shall be unfilled and shall not contain Carbon black.

2- The outer covering insulation which also serves as protective covering shall be UV Stabilized, weather resistant and Track resistant HDPE.

Properties of covering material shall meet the requirements specified in Table-1 & 2 of EN 50397-1:2006. Tracking resistance as per EN 50397-1 shall be applicable. Manufacturer should have in-house test facility to conduct tracking resistance test as per EN 50397-1. This test shall be conducted on one sample of each size of covered conductor and test report shall be submitted.

Conductor screen, inner XLPE insulation and outerHDPE insulation shall be manufactured simultaneously using triple extrusion process in a single operation. The three layers shall be bonded together.

**6.1.5. Tolerance on normal sizes:**

The tolerance in diameter of Aluminium wires and steel wire used in the manufacture of Insulated / Covered AL-59 ACS Conductor shall be allowed as per SS 424 08 13, SS 424 08 14, IEC 61232& EN 50397-1:2006, amended up to date.

**6.1.6. Stranding:**

The wires used in the construction of a galvanized steel reinforced Aluminium conductor AL59 Aluminium Alloy & Aluminium Clad Steel reinforced of conductor shall before stranding, satisfy all the relevant requirements of this specification and relevant IS.

**7. 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.

Sl.No	Description	Application
3	Suspension Clamp (SC)	<p>For supporting a length of MVCC at an intermediate pole in a length, with large angle of deviation with a disc insulator.</p> <p>The suspension clamp consists of an "Assembly with one locking type Suspension clamp with provision to fix in Insulators.</p>
4	Insulation Piercing Connector for "Bare to Covered interconnection" (IPC – Type 1)	<p>For main (Bare) to main (MVCC) networking connection.</p> <p>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.</p>
5	Insulation Piercing Connector for Networking / Branching / Looping (IPC – Type 2)	<p>For main (MVCC) to main (MVCC) networking or branching of MVCC to another MVCC Or Branch Cable or Looping for transformer junctions.</p> <p>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.</p>
6	Insulation Piercing Connector with Aluminum Bail for earthing (IPC – Type 3)	<p>For Temporary Earthing Provision from MVCC Cable for maintenance purpose.</p> <p>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.</p>
7	Tension Joints (TJ)	Mid-span tension joints for jointing MVCC over a span
8	Lightning / Surge Arrestor Kit (with provision to connect with Covered Conductor)	Protection for the Network and transformer under lighting condition.



**7.1. INSULATION PIERCING CONNECTORS :**

- 7.1.1. Piercing Connectors (IPC) are used for making Tee / Tap-off/ connections to an MVCC / Bare Overhead Line. The main purpose of a connector is to transmit electricity from one conductor to another. From the electrical point of view the connector should transmit electricity with smallest possible losses. From the mechanical point of view the connector should be able to hold conductors together without causing damages to them and sustain climatic loading. Connectors shall be UV Resistant, corrosion resistant and inert to bimetallic electrochemical reactions. It endures varying mechanical tensions and other forces detrimental to the connection. Connectors shall be capable of carrying the load current, and fault current if any.
- 7.1.2. The connector shall be water proof and the water tightness shall be ensured by appropriate elastomer materials and not by grease, gel or paste alone.
- 7.1.3. Insulation Piercing Connector should have a design such that there is no stripping of insulation on the covered conductor. It shall be able to get the lowest contact resistance & Superior insulation as well as sealing performance.
- 7.1.4. The superior material and process technology ensure operation regularity in corrosive environment.
- 7.1.5. Material of Insulation Piercing Connector should withstand for all routine & acceptance test as per NFC 33 020- listed below:
1. Flashover - 15 kV for 1 min in water.
  2. Short circuit test,
  3. Heat cycle test
- 7.1.6. The following type tests shall be conducted on connector as per relevant standard EN 50397-2:2008, with latest amended.
- 1) Electrical ageing test
  - 2) Water tightness test
  - 3) Mechanical tightening test
  - 4) Environment test
    - Corrosion test
    - Climate ageing test
- 7.1.7. The following routine/acceptance tests shall be conduct on connector as per relevant standard EN 50397-2:2008, with latest amended.
- 5) Visual examination
  - 6) Dimension and material verification.

**7.2. Alignment Ties:**

The Alignment 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.

- 7.2.1. The following type tests shall be conducted on Alignment Ties as per relevant standard EN 50397-2:2008, with latest amended.
- 1) Mechanical and failure load test
  - 2) Slip Load Test
  - 3) Lift / Side Load Test
  - 4) Thermal Test under load
  - 5) Environmental tests
    - a. Corrosion test
    - b. Climate ageing test
  - 6) Resistance against Tracking in heavy Polluted Areas
- 7.2.2. The following routine/acceptance tests shall be Alignment Ties on connector as per relevant standard EN 50397-2:2008, with latest amended.
- 7) Visual examination
  - 8) Dimension and material verification.

### 7.3. 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.

- 7.3.1. The following type tests shall be conducted on Suspension clamp as per relevant standard EN 50397-2:2008, with latest amended.
- 1) Mechanical and failure load test
  - 2) Slip Load Test
  - 3) Lift / Side Load Test
  - 4) Thermal Test under load
- 7.3.2. The following routine/acceptance tests shall be Tension clamp on connector as per relevant standard EN 50397-2:2008, with latest amended.
- 5) Visual examination
  - 6) Dimension and material verification.

### 7.4. Tension Clamp

Tension clamp used For the purpose of terminating covered conductors over the covering fitting shall include, but are not limited to, the following:

Wedge type clamp;

The fittings shall be able to withstand the specific minimum failure load (SMFL), shall not damage the covering, and shall be designed to prevent the ingress of moisture during service.

- 7.4.1. The following type tests shall be conducted on Tension clamp as per relevant standard EN 50397-2:2008, with latest amended.

- 1) Damage and failure load test
- 2) Tensile test at ambient temperature
- 3) Tensile test at low temperature
- 4) Tensile test at high temperature
- 5) Shear head function test
- 6) Water tightness test
- 7) Environmental tests for clamps
  - Corrosion test
  - Climate ageing test

7.4.2. The following routine/acceptance tests shall be Tension clamp on connector as per relevant standard EN 50397-2:2008, with latest amended.

- 8) Visual examination.
- 9) Dimension and material verification.
- 10) Tensile Test at Ambient Temperature
- 11) Slippage Test at Ambient Temperature.
- 12) Check for Permanent Marking.

#### **7.4 Tension Joints (Mid Span Jointing Sleeves)**

The mid span Insulated jointing sleeves should be Pre-Insulated type. Sleeve should be made of Aluminum and their current rating shall not be less than that of the covered conductors, 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. The tensile strength of the mid span jointing sleeve after crimping/compression shall not be less than 95% of the strength of the covered conductors.

7.4.1 The following type tests shall be conducted on Suspension clamp as per relevant standard NFC 33 021, with latest amended.

- 1) Voltage Test
- 2) Water Tightness Test
- 3) Climatic Ageing Test
- 4) Corrosion Test

7.4.2 The following routine/acceptance tests shall be Tension clamp on connector as per relevant standard NFC 33 021, with latest amended.

- 1) Visual examination
- 2) Dimension and material verification.

#### **7.5 Lightning / Surge Arrestors :**

The surge arresters shall be capable of discharging over voltages occurring due to switching on unloaded transformer, reactors and long lines. The reference current of surge arresters shall be high enough to eliminate the influence of grading and stray capacitance on the measured reference voltage. Values and calculations shall be furnished with offer. The surge arrester shall be fully stabilized thermally to give a life expectancy of one hundred (100) years under site conditions and take care of effect of direct solar radiation. The surge

arresters shall protect transformers and cable with insulation level specified in the specifications. The surge arresters shall be capable of withstanding meteorological and short circuit forces under site conditions.

7.5.1 The following type tests shall be conducted on Earth parking device as per relevant standard IEC 60099 -4:2014 /IS-3070 part III, with latest amended.

- 1) Insulation withstand test(Lightening Impulse withstand test, Dry & Wet power frequency withstand test, Shear head function test)
- 2) Residual voltage test(Steep current Impulse Residual voltage test, Lightning Impulse Residual voltage test and switching current Impulse Residual voltage test).
- 3) Accelerated ageing test
- 4) Long duration current impulse withstand test
- 5) Operating duty test
- 6) Partial discharge test.
- 7) Weather Ageing Test

7.5.2 The following routine/acceptance tests shall be on each single surge arrester in accordance with IEC 60099-4/ IS-3070 part III, with latest amended.

- 1) AC Reference Voltage Test (final arrester)
- 2) Partial Discharge Test (final arrester including hardware/accessories)
- 3) Residual Voltage Test (final arrester or metal-oxide resistors)

#### **7.5. Arc protection devices :**

The arc protection devices shall be supplied to protect insulator sets and covered conductors against damage caused by power arcs (arcing horns, arcing rings).

It shall withstand maximum short-circuit current 10 kA for 1 s (As per clause 4.2.4 of En 50397-2:2008).

It shall withstand a mechanical load in order to support the installation strengths.

7.5.1. The following type tests shall be conducted on Arc protection as per relevant standard EN 50397-2:2008, with latest amended.

- 1) Clamp bolt tightening test
- 2) Shear head function test
- 3) Hot dip galvanizing test
- 4) Damage to the main conductor test
- 5) Water tightness test
- 6) Short circuit test
- 7) Power arc test(only in connection with a complete insulation set)
- 8) Corrosion ageing test

7.5.2. The following routine/acceptance tests shall be arc protection device on connector as per relevant standard EN 50397-2:2008, with latest amended.

- 9) Visual examination
- 10) Dimension and material verification.

**7.6. Earth parking Device/Insulation Piercing Connector with Aluminum Bail for earthing :**

The earth parking device shall be capable of carrying the short circuit current. The maximum short circuit current shall be 10 kA for 1 s.

These fittings shall withstand a mechanical load in order to support the installation strengths.

7.6.1. The following type tests shall be conducted on Earth parking device as per relevant standard EN 50397-2:2008, with latest amended.

- 1) Clamp bolt tightening test
- 2) Shear head function test
- 3) Hot dip galvanizing test
- 4) Damage to the main conductor test
- 5) Water tightness test
- 6) Short circuit test
- 7) Mechanical test
- 8) Corrosion ageing test

7.6.2. The following routine/acceptance tests shall be Earth parking device on connector as per relevant standard EN 50397-2:2008, with latest amended.

- 1) Visual examination
- 2) Dimension and material verification.

**7.7. Marking of accessories:**

All accessories mentioned above shall mark with the following:

- Manufacturer's trade mark or logo;
- product code or reference;
- The minimum and maximum cross section for which the unit is suitable.
- Batch number & Year of manufacturing.

**7.8. Acceptance criteria of accessories:**

**Note-Type Test Reports for 11 KV covered conductor accessories:**The bidder shall furnish valid and authenticated type test certificate from a Govt. approved / a Govt. recognized / NABL Accredited laboratory / ILAC i.e. International laboratory Accreditation Corporation (In case of foreign laboratory) of similar rating and design of tendered material / equipment.

Acceptance criteria of all accessories of 11 KV AL 59 ACS rabbit covered conductor as per relevant standard EN 50397-2:2008.

**8. PRINCIPAL PARAMETERS:**

8.1. The details of Insulated / Covered AL 59 ACS Rabbit conductor are tabulated below:

Sr no.	Particulars	Unit	value
1	Stranding and diameter of aluminium Alloy AL59	-	6/3.35
2	Stranding and diameter of Aluminum Coated steel wire	-	1/3.35
3	Sectional area of aluminium alloy	mm <sup>2</sup>	52.88
4	Total sectional area	mm <sup>2</sup>	
5	Approximate diameter	mm	10.05
6	Approximate mass(without insulation)/with insulation	Kg/km	214/366
7	Calculated resistance at 20°C (max)	Ω	0.5272
8	Approximate breaking load(without insulation)	KN	22.55

8.2. The details of Insulation are as follows:

Sr no.	Particulars	Unit	value
1	Nominal thickness of conductor screen	mm	0.3
2	Nominal thickness of XLPE insulation inner Layer	mm	2.3
3	Nominal thickness of insulation outer layer(HDPE)	mm	1.1

8.3. The lay ratio of the different layers shall be within the limits given

Sr no.	Particulars	Unit	value	
1	Number of wires	Aluminium	Nos	6
		Steel		1
2	Lay ratio of Al. wire Outer most layer	Min	-	10
		max		14
3	Ratio of aluminium wire diameter to steel wire diameter			1.0

## 9. TESTS (FOR INSULATED / COVERED AL 59 ACSRABBIT CONDUCTOR):

9.1. **TESTS BEFORE DESPATCH:** The Covered AL 59 ACSRABBIT Conductor shall be subjected at manufacturer's works before dispatch, to the tests mentioned hereunder as per SS 424 08 13, SS 424 08 14/ GTP & IEC 61232 & EN 50397-1:2006, with latest amended.

### 9.2. TYPE TESTS:

The following TYPE tests shall be conducted on each drum of the **conductor** by the manufacturer at his works as per relevant standards.

- 1) Surface condition test.
- 2) Measurement of diameter of individual aluminium and steel wires.
- 3) Measurement of lay ratio.
- 4) Breaking load of individual wires.
- 5) Elongation test.
- 6) Wrapping test.
- 7) Resistance test.

Beside this the following type tests as per requirement of EN 50397-1:2006, with latest amended, shall also be conducted for covered conductor.

- 8) High voltage test(No.1.2 of Table -2)
- 9) Leakage current test (No.1.4 of Table -2)
- 10) Tracking resistance test(No.1.5 of Table -2)
- 11) Rated tensile strength(No.3.1 of Table -2)
- 12) Mechanical properties(No.4.1 of Table -2)
  - a) Before ageing of sample
  - b) After ageing of sample
- 13) Carbon black content test(No.4.2 of Table -2)
- 14) Resistance to UV rays test(No.4.3 of Table -2)
- 15) Test of compatibility(No.5 of Table -2)
  - 1) Ageing of complete product sample
- 16) Pressure test at high temperature(No.6.3 of Table -2)
- 17) Hot-set-test(No.6.2 of Table -2)
- 18) Shrinkage test(No.6.1 of Table -2)
- 19) Water absorption(No.7.1 of Table -2)
- 20) Shore D hardness(No.7.2 of Table -2)
- 21) Test of the longitudinal water tightness(No.8 of Table -2)
- 22) Slippage test(No.10 of Table -2)

The bidder shall furnish valid and authenticated type test certificate from a Govt. approved / a Govt. recognized / NABL Accredited laboratory / ILAC i.e. International laboratory Accreditation Corporation (In case of foreign laboratory) of similar rating and design of tendered material / equipment.

**9.3. ROUTINE TEST:**

The following routine tests shall be conducted after covering as per sampling plan of QAP/Relevant specifications of the Covered conductor by the manufacturer at his works as per relevant standards.

- 1) Visual & dimensional check on drum as per specification.
- 2) Visual check for joints, scratches etc. and length of conductor by re-winding of conductor on empty drum as per Specification.
- 3) Measurement of dia-meter of individual Aluminium Alloy and ACS wires.
- 4) Measurement of Lay Ratio
- 5) Breaking load of individual wires
- 6) Elongation Test
- 7) Wrapping Test
- 8) Resistance Test

Beside this the following routine tests as per requirement of EN 50397-1:2006, with latest amended, shall also be conducted for covered conductor.

- 9) Spark Test on the Covering.
- 10) Construction and Dimension (No. 2 of Table 2)/GTP
  - Compliance with design requirement (No. 2.1 of Table 2)/GTP
  - Thickness of covering (No. 2.2 of Table 2)/GTP
- 11) Marking. (No. 9 of Table 2)/GTP
  - Content, legibility (No. 9.1 of Table 2)/GTP

**9.4. ACCEPTANCE TESTS:**

The following tests shall be conducted on samples taken at random from a lot as per relevant standard in presence of purchaser's representative.

- 1) Visual & dimensional check on drum as per specification.
- 2) Visual check for joints, scratches etc. and length of covered conductor by re-winding of conductor on empty drum as per Specification / IS.
- 3) Measurement of dia-meter of individual Aluminium and steel wires.
- 4) Measurement of Lay Ratio
- 5) Breaking load of individual wires
- 6) Elongation Test
- 7) Wrapping Test
- 8) Resistance Test

Beside this the following test as per requirement of EN 50397-1:2006, with latest amended, shall also be conducted for covered conductor.

- 9) Conductor Resistance & High Voltage Test
- 10) Construction and Dimension (No. 2 of Table 2)/GTP
  - a. Compliance with design requirement (No. 2.1 of Table 2)/GTP
  - b. Thickness of covering (No. 2.2 of Table 2)/GTP
- 11) Construction and Mechanical Properties of the conductor
  - a. Rated Tensile Strength
  - b. Construction and Dimension



- 12) Hot Set Test
- 13) Tracking resistance test
- 14) Test of the Longitudinal water tightness
- 15) Marking.  
Content, legibility

#### 9.5. **SAMPLING PLAN:**

Samples for Acceptance Tests: Samples shall be taken as per relevant EN 50397-1:2006 with latest version as the case may be.

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

#### 9.6. **TOLERANCE ON TEST RESULTS:**

Tolerance on test results shall be allowed as per relevant IS/EN/Spec. whichever is more stringent.

### 10. **INSPECTION:**

- 10.1. The conductor shall be manufactured in accordance with latest edition of EN 50397-1:2006 & GTP with all subsequent amendments issued from time to time for Covered Al 59 ACS Rabbit Conductor. All the tests as laid down in the above mentioned specification on individual AL59 Aluminium alloy wire and ACS wire shall be carried out. The testing shall also include the tests on manufactured finished conductor. Moreover the supplier shall also furnish test certificate(s) of raw materials to the inspecting officer at the time of inspection.
- 10.2. The Manufacturer shall provide all adequate facilities at his works for inspection of at least one number conductor drum or 5% conductor drums offered for inspection whichever is higher selected at random by the authorized representative of the purchaser for checking / verification of conductor length/ manufacturing defects by transferring the conductor from one drum to the another empty drum and at the same time measuring the length and lay ratio of each conductor length so transferred by means of the standard calibrated and sealed meter.
- 10.3. The supplier shall provide adequate facilities for weightment of all the drums offered for inspection.
- 10.4. The supplier shall present the latest Calibration Certificate(s) of testing instruments / equipments to be used for the testing of the material covered in the Purchase Order to the authorized inspecting officer / inspecting agency of the purchaser. The testing instruments / meters/ apparatus etc. should be got calibrated by the supplier from time to time from Govt. Lab or Independent test laboratory / house having valid accreditation from National Accreditation Board for Testing and Calibrating

Laboratories for the testing equipments or original manufacturer having traceability to NABL / NPL or equivalent accredited lab.

- 10.5. The calibration certificate(s) should not in any case be older than one year at the time of presenting the same to the inspecting officer / inspecting agency of the purchaser. The testing instruments / equipments should be duly sealed by the Calibrating Agency and mention thereof shall be indicated in the calibration certificate(s).
- 10.6. All tests and inspections shall be made at the place of manufacturer unless otherwise specifically agreed upon by the purchaser. The manufacturers shall afford the Inspector representing the purchaser all reasonable facilities, without charge, to satisfy him that the material is being furnished in accordance with this specification. The purchaser has the right to have the tests carried out at his own cost by an independent agency whenever in dispute regarding the quality of supply.
- 10.7. The supplier shall furnish the following documents as proof of purchase of RAW material along with each inspection offer.
- a) Invoice of the supplier b) Supplier Test Certificate c) Packing List d) Bill of Landing e) Description of material, electrical analysis, physical inspection, certificate of surface defects, thickness and width of material wherever applicable.

#### **11. 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 the cap shall be such that it shall tightly fit to the covered conductors to prevent moisture ingress.

#### **12. Standard length & variation in lengths :**

The Covered / Insulated AL 59 ACS Rabbit conductor shall be supplied in the standard length. The standard length of Covered / Insulated AL 59 ACS Rabbit Conductor shall not less than the value specified below with a tolerance of (-) 5%. More than the standard length shall be acceptable.

- a) 11 KV Covered / Insulated AL 59 ACS Rabbit - Minimum 1000 Mtrs.

Short length(s), if any shall not measure less than 80% of standard length as specified above in any case. The total quantity of such short length(s) shall not exceed 5% of the quantity of the lot offered for inspection.

The maximum permissible length per drum shall be as under subject to condition that the manufacturer while packing the conductor in drum shall ensure that after winding complete quantity of conductor in drum a uniform space of not less than 100 mm. remains between outer layer of conductor and inner surface of the external protective lagging of the drum. This is essential to ensure that the conductor does not get closer to the lagging and to avoid damaged during transportation/ reeling / unreeling or rolling on the undulated ground / fields:

**13. QUALITY ASSURANCE PLAN:**

The successful bidder shall submit following information along with the bid:

- 13.1. Test certificates of the raw materials and bought out accessories.
- 13.2. Statement giving list of important raw material, their grades along with names of sub-suppliers for raw materials, list of standards according to which the raw materials are tested. List of tests normally carried out on raw materials in presence of bidder's representative.
- 13.3. List of manufacturing facilities available.
- 13.4. Level of automation achieved and lists of areas where manual processing exists.
- 13.5. List of areas in manufacturing process, where stage inspections are normally carried out for quality control and details of such tests and inspections.
- 13.6. List of testing equipment available with the bidder for final testing of equipment along with valid calibration reports.
- 13.7. The manufacturer shall submit Manufacturing Quality Assurance Plan (QAP) for approval & the same shall be followed during manufacture and testing.
- 13.8. The successful bidder shall submit the routine test certificates of bought out raw materials/accessories and central excise passes for raw material at the time of inspection.
- 13.9. The Company may at its option order the verification of these plans at manufacturer's works as a pre-qualification for technically accepting the bid. During verification if it is found that the firm is not meeting with the quality assurance plan submitted by the firm, the offer shall be liable for rejection.
- 13.10. The material for final inspection shall be offered by the Supplier only under packed condition. The owner shall select samples at random from the packed lot for carrying out acceptance tests.
- 13.11. The Supplier shall keep the Owner informed in advance of the time of starting and the progress of manufacture of material in their various stages so that arrangements could be made for inspection.
- 13.12. No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested unless the owner in writing waives off the inspection. In the later case also the material shall be dispatched only after satisfactory testing specified here in has been completed.

**14. PACKING AND MARKING :**

- 14.1. The packing shall have to be done as per standard practice worthy of road transport. The covered conductor shall be wound in strong wooden drums so as to withstand all stresses due to transportation, handling and stringing operation so that the conductor surface is not cut, dented, scratched or damaged in any way during manufacture,

- Transport & Stringing. The wooden drums shall be non-returnable and shall generally conform IS: 10418/1982 with latest amendments. The packing of accessories shall be sufficient to withstand, without limitation, rough handling during transit and exposure to extreme temperatures, salt and precipitation during transit, and open storage.
- 14.2. The covered conductor drum should be suitable for wheel mounting, before reeling, the cardboard or other suitable material shall be secured to the drum and inside flanges of the drums. After reeling, the exposed surface area of conductor shall be nearly wrapped with suitable soft material to protect the conductor from dirt and grit.
- 14.3. However, use of seasoned wood shall not be insisted, provided wood used should be of good quality to withstand transportation hazards. The drums shall be having inside flanges painted with Aluminium Paint and with Ordinary White Enamel paint from outside. The conductor on each drum shall be securely fastened at each end. The outer end of the covered conductor shall be fastened inside the drum against one of the sides of the flanges while it is under tension and shall be such that no looseness is transmitted to the internal layers. The covered conductor shall be snugly, tightly and uniformly spooled on the drums. The wrapping of covered conductor on the drums shall be laid snugly against side of the preceding wrap and the first and last wrap in each layer shall fit snugly against the sides of the flanges. Drums shall be lagged with sufficient strong wooden laggings to support the full drum without crushing. The wooden drums after providing lagging shall be fastened by two steel tapes over the lagging on the two sides of adequate size to keep the lagging intact and to prevent the drum from crushing/ damage.
- 14.4. Although the various dimension of the drums such as flanges, stretches, traverse and barrel diameter shall depend on the quantity of covered conductor as offered and agreed upon, on one drum. The manufacturer while packing the covered conductor in drum shall ensure that after winding complete quantity of covered conductor in drum a uniform space of not less than 100 mm. remains between outer layer of covered conductor and inner surface of the external protective legging of the drum. This is essential to ensure that the covered conductor does not get closer to the legging and to avoid damaged during transportation/ reeling / unreeling or rolling on the undulated ground / fields.
- 14.5. Water proof material shall be wrapped round the barrel and inner surface of flange before winding the covered conductor and also wrapped round over the covered conductor completely wounded and under the laggings.
- 14.6. Following details of identification shall be embossed at interval of length of One Meter of outer sheath.
- (a) Name of Manufacturer (b) Year of Manufacture (c) Voltage Grade (d) Name of Purchaser " PGVCL " .

14.7. The drums shall be marked clearly in block letters with water proof mark having the marking attached to them so that there is no possibility of goods being lost or wrongly dispatched due to faulty marking. The marking shall constitute the following:-

- i. Name & full address of the consignee.
- ii. Destination station.
- iii. Serial number of drum.
- iv. Size of covered conductor
- v. Total length of Conductor in drum, with individual length (s).
- vi. Number of length(s) in each drum.
- vii. Gross mass of drum including the tare mass of drum.
- viii. Net mass of conductor.
- ix. Name of the supplier.
- x. Purchase order reference/TN number.

Besides above, an arrow shall be put on the drum so as to indicate the direction in which the drum can be unwound.

Beside this covered conductor shall also carry marking at regular interval as below:

Name of Manufacture or Trade Mark, Voltage Grade Covered AL 59 ACS Conductor size in sq. mm. Year of Mfg., Standard EN 50397-P1 & IS 398-P2.

**15. Annexure –I**  
**Guaranteed technical particulars**

To be submitted along with Tender documents in triplicate as per format annexed herewith Technical characteristic shall be guaranteed by the bidder. In case of failure of materials to meet the guarantee, Purchaser (DISCOM) shall have right to reject the material.

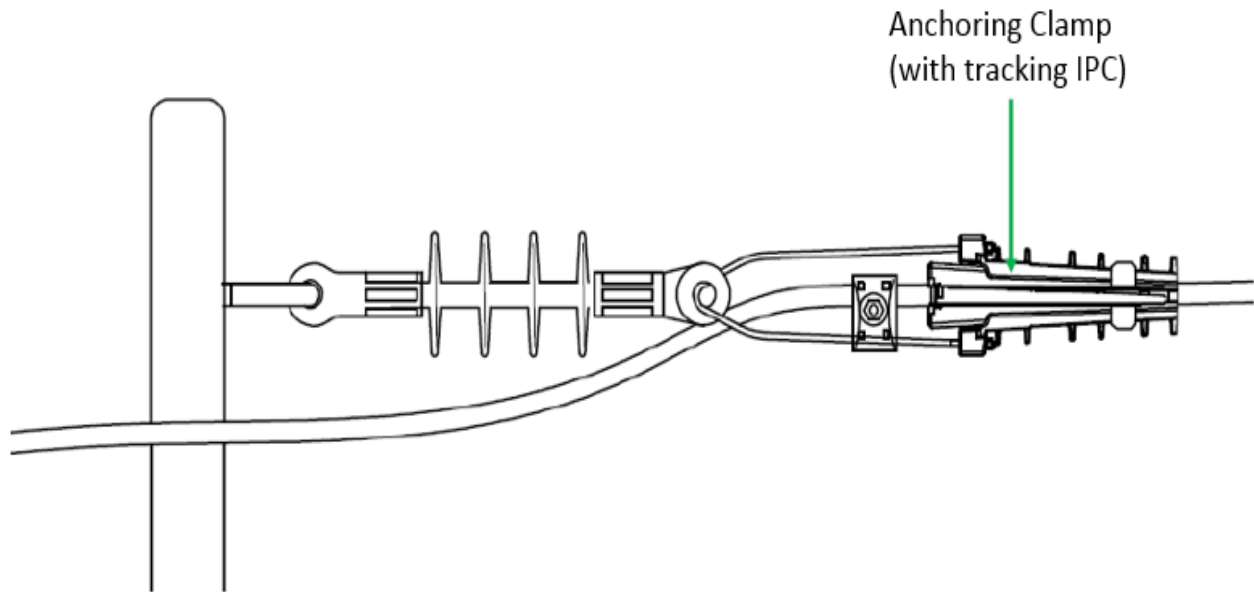
Sr No	Parameter Name	Parameter value/Name
<b>1.</b>	<b>GENERAL:</b>	
1.1	Brand Name or Trade Mark	
1.2	Manufacturer's Name & Address	
1.3	Lists of Standard applicable.	
<b>2.</b>	<b>PHASE CONDUCTOR:</b>	
2.1	Material	
2.2	Class / Grade	
2.3	Nominal cross section area (mm Sq.)	
2.4	Approximate dia. of conductor (mm)	
2.5	Maximum DC resistance at 20° C OHM /KM	
2.6	Maximum Continuous Conductor Temperature (in °C)	
2.7	Maximum Short time Conductor Temperature (in °C)	
<b>3.</b>	<b>CONDUCTOR SCREENING:</b>	
3.1	Material	
3.2	Minimum thickness (mm)	
<b>4.</b>	<b>INSULATION:</b>	
4.1	Material (Inner/Outer)	
4.2	Nominal thickness (mm) (Inner/Outer)	
4.3	Tolerance on thickness (Inner/Outer)	
4.4	Colour of Insulation (Inner/Outer)	
4.5	Method of application of Insulation	
4.6	Type of curing of XLPE Insulation Completed Cable.	
<b>5.</b>	<b>COMPLETE CABLE:</b>	
5.1	Maximum operating voltage of the Cable	
5.2	Rated Voltage of the Cable	
5.3	Neutral to Phase voltage	

5.4	Continuous current carrying capacity in air at Ambient Temp.40° C (Amp)	
5.5	Maximum short circuit current for 1 Sec. (KA)	
5.6	Approximate overall diameter of cable(mm)	
5.7	Approximate overall cross section area of cable(mm <sup>2</sup> )	
5.8	Approximate total weight of cable KG / KM.	
5.9	Allowable sag as a percentage of span length at 40°C ambient temperature	
<b>6.</b>	<b>DRUM:</b>	
6.1	Standard drum length (Mtr)& tolerance of each drum	
6.2	Dimension of Drum	
6.3	Shipping Weight.	
6.4	Bending radius of the cable	
6.5	Overall quantity tolerance	

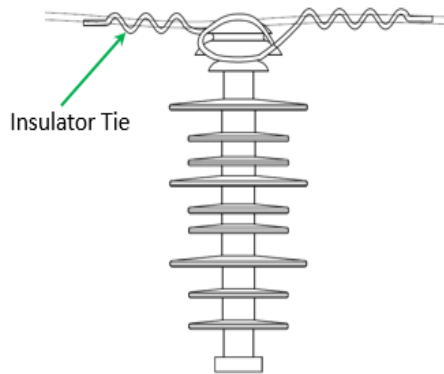
## 16. ANNEXURE II: - TYPICAL GENERAL ARRANGEMENT DIAGRAM AND DRAWINGS

### 1. Tension Assembly (TA) with Anchoring clamp and one Tracking protection IPC

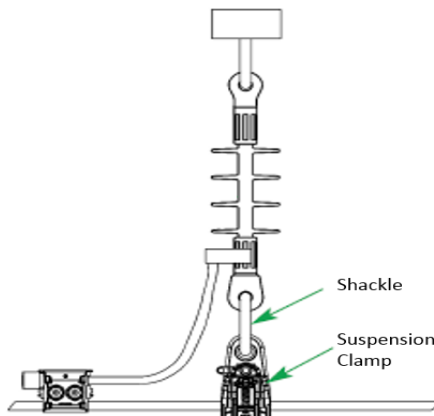
Anchoring with protection against Tracking.



### 2. Insulator Clamp / Tie (IC)

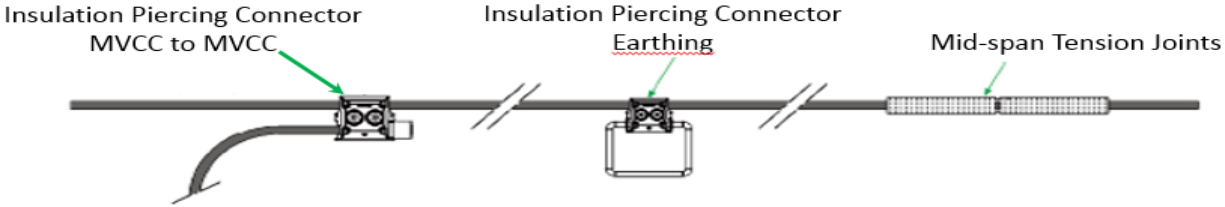


### 3. Suspension Clamp (SC)

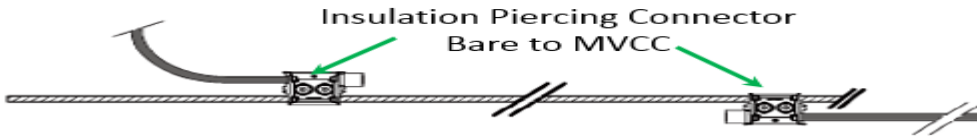




**4. TYPE-1 : Insulation Piercing Connector for Networking / Branching /Looping, TYPE -3: Insulation Piercing Connector with Aluminum Bail for earthing and Tension Joints (TJ)**



**5. Insulation Piercing Connector for Bare to Covered interconnection**



**TYPICAL DRAWINGS**

**1. Tension Assembly (TA) with Anchoring clamp and one Tracking protection IPC**

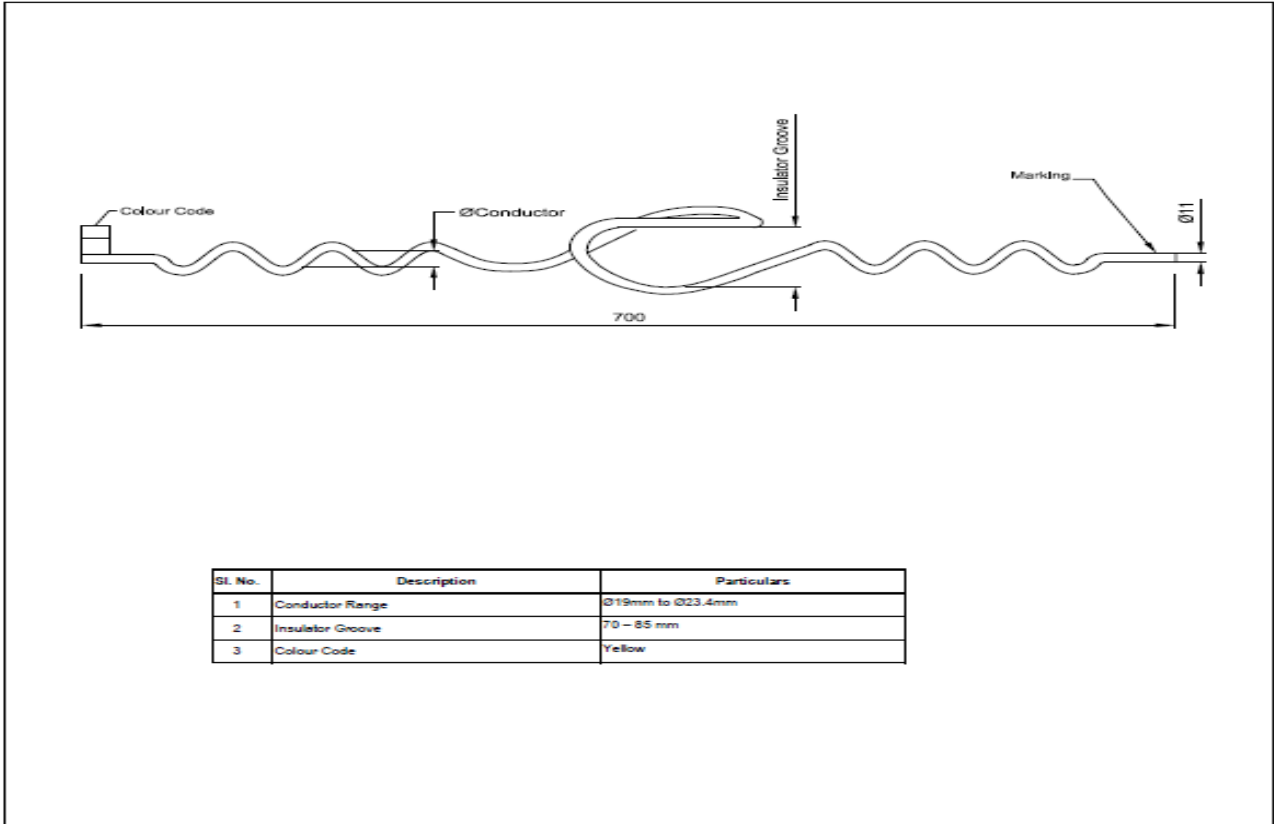
The technical drawing shows a side view of a Tension Assembly (TA) with dimensions: 100 (height), 93 (width of the tracking protection), and 588 (total length). It includes a 'Batch Number (Years + XXXX)' and 'Marking to install the connector'. The drawing is numbered 1 through 7.

STANDARD: EN 50397-2  
 CABLE RANGE: Suitable for Ø12mm - Ø16mm  
 Medium Voltage Covered Conductor  
 WARNING:

7	2	Washer	Galvanized Steel
6	2	Lock Nut	Galvanized Steel
5	1	SS Rod	Galvanized Steel
4	1	Tracking IPC	-
3	1	Right Wedge	Heat and UV stabilized Thermoplastic
2	1	Left Wedge	Heat and UV stabilized Thermoplastic
1	1	Body	Aluminium Alloy
Part	Qty	Description	Material

MATERIAL: SEE TABLE		TREATMENT:
VOLUME: vms3		GENERAL TOLERANCE: ±5%
ORIGINE LAYOUT: A4	SCALE: 0.300 ALL DIMENSIONS IN MM	PART NO.
		DRG NO.

2. Insulator Clamp / Tie (IC)

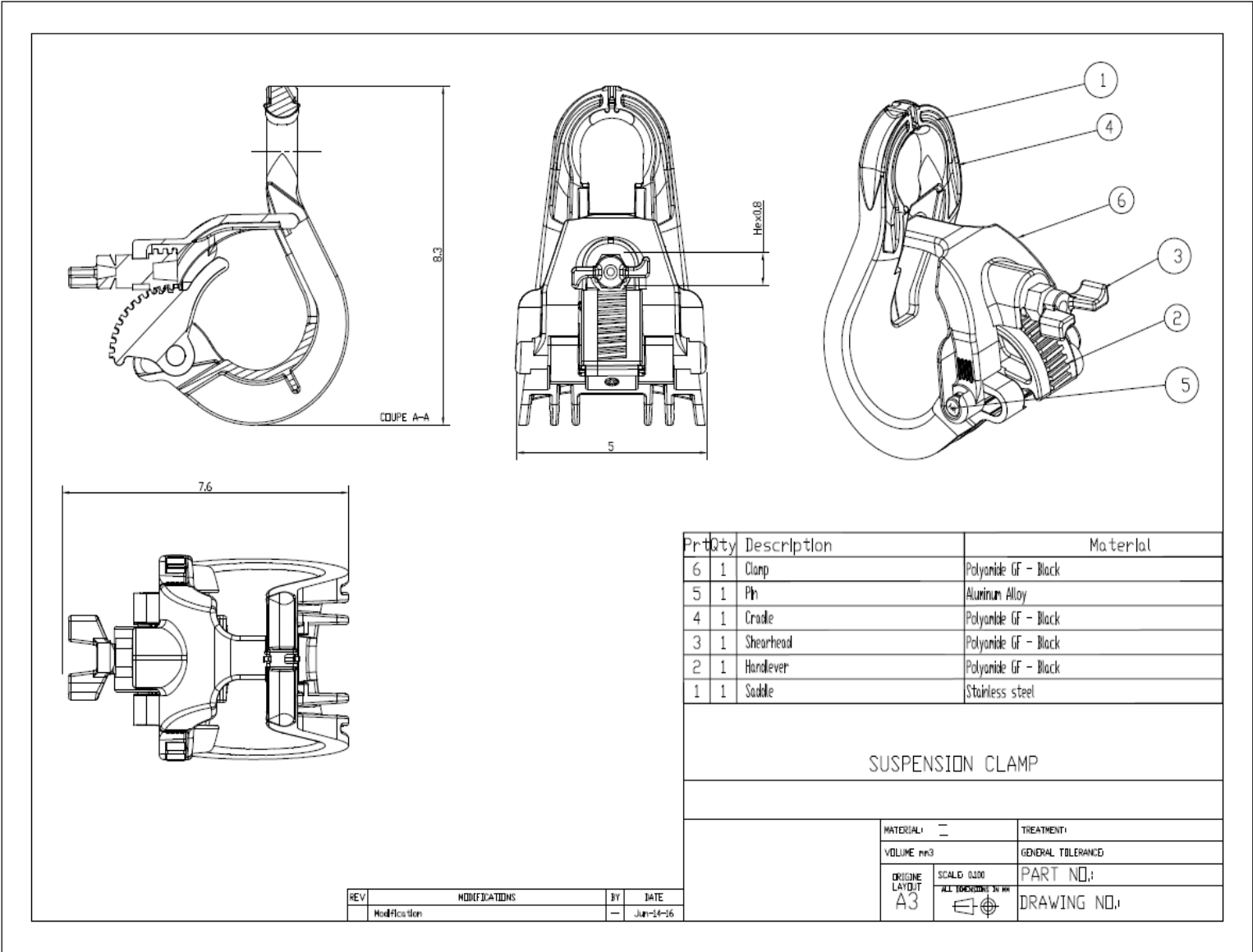


Sl. No.	Description	Particulars
1	Conductor Range	Ø19mm to Ø23.4mm
2	Insulator Groove	70 – 85 mm
3	Colour Code	Yellow

**ALIGNMENT TIE**

	MATERIAL: PVC	TREATMENT: - -
	WEIGHT: - -	GENERAL TOLERANCE: ±5 %
	<b>A4</b> <small>ALL DIMENSIONS IN MM</small> 	SCALE: NTS
		<b>PART NO :</b>
		<b>DRG NO :</b>

3. Suspension Clamp (SC)



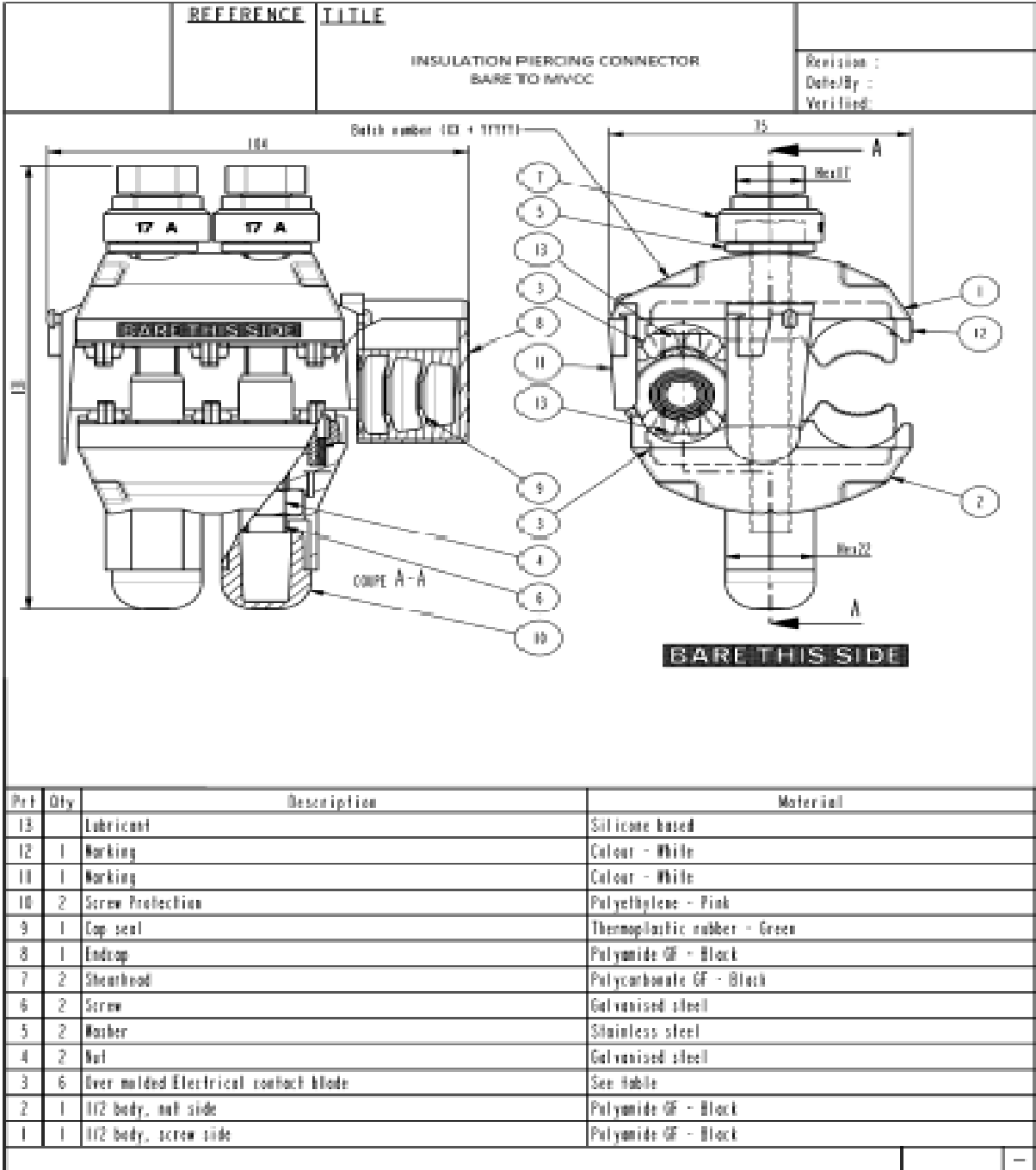
Pr	Qty	Description	Material
6	1	Clamp	Polyamide GF - Black
5	1	Pin	Aluminum Alloy
4	1	Crackle	Polyamide GF - Black
3	1	Shearhead	Polyamide GF - Black
2	1	Handlever	Polyamide GF - Black
1	1	Saddle	Stainless steel

SUSPENSION CLAMP

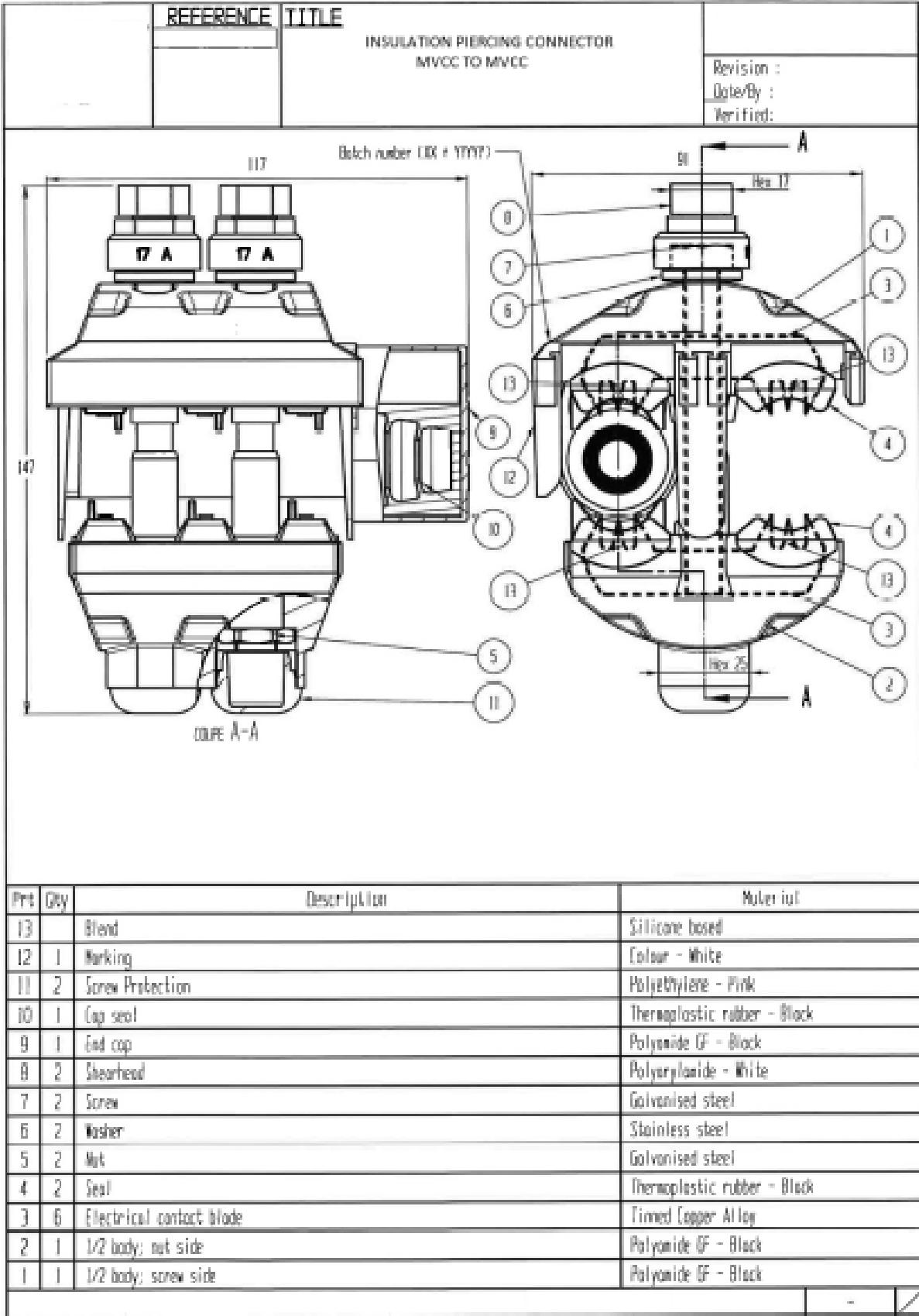
MATERIAL:	—	TREATMENT:
VOLUME mm3		GENERAL TOLERANCE:
ORIGINE LAYOUT A3	SCALE: 0.000	PART NO.:
	ALL DIMENSIONS IN MM	DRAWING NO.:

REV	MODIFICATIONS	BY	DATE
—	Modification	—	Jun-14-16

4. Insulation Piercing Connector for Bare to Covered interconnection



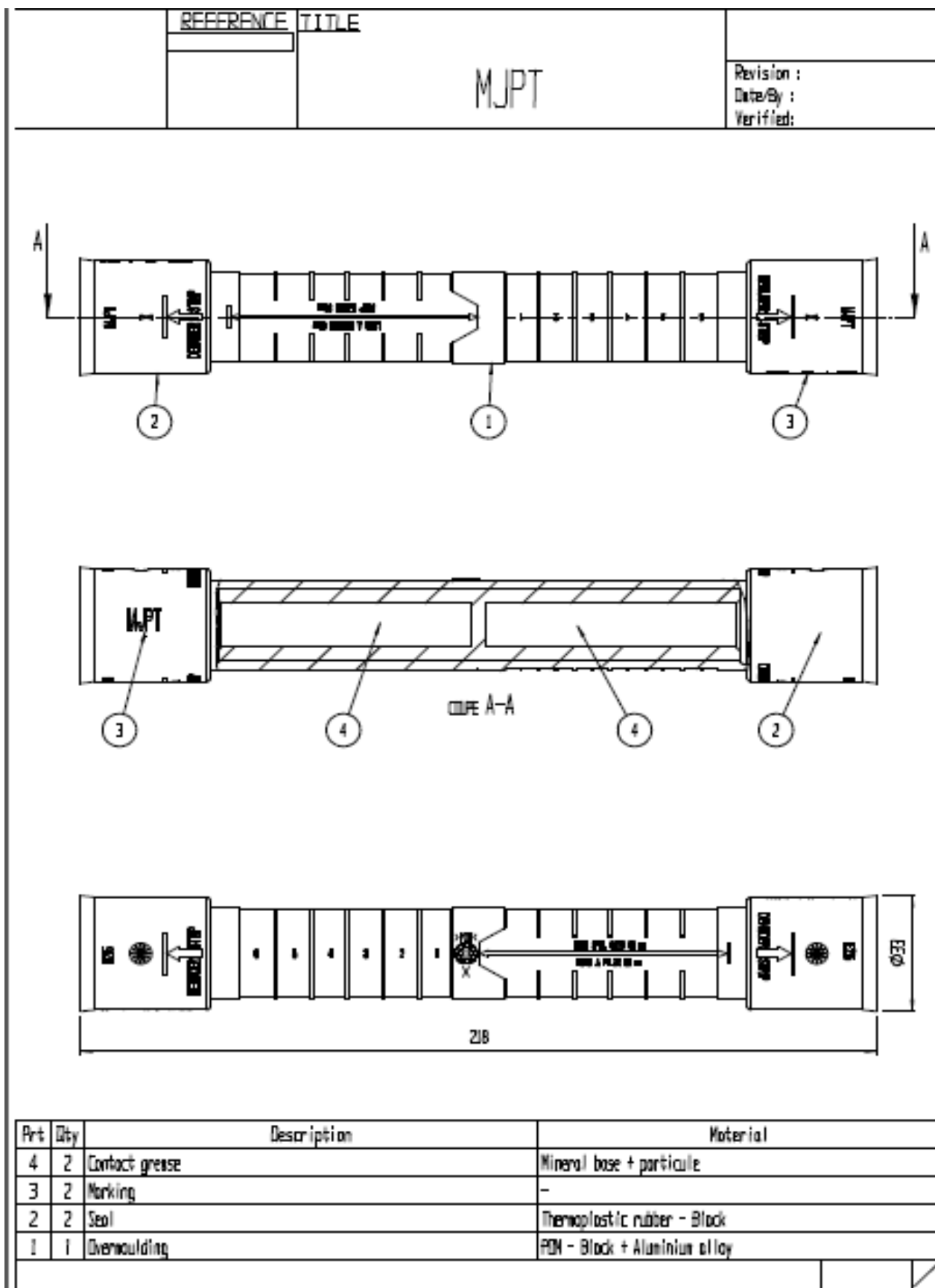
5. Insulation Piercing Connector for Networking / Branching / Looping



6. Insulation Piercing Connector with Aluminum Bail for earthing

REFERENCE		NOMENCLATURE		
		INSULATION PIERCING CONNECTOR - EARTHING		
		Indice de modification : Dessiné/Par : Vérifié/le :		
<b>TRAITÉ EN SILICIUM</b>				
Rep	Qte	Designation	Plan N°	Matiere
13		Melange 191	E99 999 02X	Base silicone
12	1	Marquage topographique TROC 45401 FABI ...	F94 720 41	Couleur blanc
11	1	Bail BI ... ALU/E.SURMOULE (Voir Tableau)	F91 200 02	Voir Tableau
10	2	Protection de vis	F91 701 28	Polyéthylène - Noir
9	2	Limiteur de couple F17 25N	E97 404 27	Polycarbonate FV - Noir
8	2	Vis M3x9090/8.82N	F11 900 02	Acier galvan
7	2	Rondelle HL10.5x22x3X	F91 610 17	Acier inox
6	2	Ecran COHN162N	E91 701 09	Acier galvan
5	1	Sarmilage TTD 45401 code extra	F94 720 08	Elastomere thermoplastique - Noir
4	1	Sarmilage TTD 45401 code nls	F94 720 09	Elastomere thermoplastique - Noir
3	6	Lame TROC 45401	F94 720 07	Alliage de cadme étain
2	1	1/2 corps code extra TTD 40/43 V1	E96 701 02	Polyamide FV - Noir
1	1	1/2 corps code nls TTD 40/43 V1	E96 701 01	Polyamide FV - Noir

7. Tension Joints (TJ)



**ANNEXURE-III - Guaranteed technical particular of accessories****1. GTP for Tension Clamp**

<b>Sl. No.</b>	<b>Description</b>	<b>Particulars</b>
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 Alignment Tie**

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

**3. GTP for Suspension Clamp**

SI. 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**

SI 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 MID SPAN JOINTS**

SI. 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