



VOLUME-II

SECTION – 2.3

AL 59 (EQUIVALENT TO MOOSE) CONDUCTORS



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SECTION – 2.3

AL 59 (EQUIVALENT TO MOOSE) CONDUCTORS

1.0.0 INTENT OF SPECIFICATION

This section provides the technical details of AL59 (Equivalent to Moose) of 587.00 sq. mm cross sectional area (with positive tolerance as per relevant IEC/IS standard) Conductors with highest ampacity for this transmission lines package. The material and services under this specification shall be performed as per the requirements of the latest revisions and amendments available at the time of placement of order of all the relevant Indian Standards/Codes listed in Clause No. 2.0.0 here under or equivalent International Standards, except as modified in this document.

The materials covered here under this specification shall be supplied complete in all respects, including all components, fittings and accessories which are necessary or are usual for their efficient performance and satisfactory maintenance under the various operating and atmospheric conditions prevailing at site. Such parts shall be deemed to be within the scope of the Contract, whether specifically included or not in the Specification or in the Contract Schedules.

2.0.0 CODES AND STANDARDS

Sl. No.	Standard	Title
1.	SS 42 40814	Aluminium alloy stranded Conductors for overhead lines Al59 specifications
2.	SS 42 40813	Aluminium alloy wire for stranded Conductors for overhead lines- Al 59 wires
3.	IS 1778	Reels and drums for bare conductor
4	CEA	Guidelines for Rationalized use of High-Performance Conductors February 2019.
5.	IS 2121	Specification for Conductors and Earth wires accessories for Overhead power lines (Part-1 & Part 2)
6.	IS:398	Alum. Condr. galvanised steel reinforced.
7.	IS:1521- 1972	Method of Tensile Testing of Steel wire



Material meeting with the requirements of other authoritative standards, which ensure equal or better performance than the standards mentioned above, shall also be considered. When the material offered by the bidder conforms to other standards, salient points of difference between standards adopted & the standards specified in this specification shall be clearly brought out in the relevant schedules. Three copies of such standards with authentic translation in English shall be furnished along with the bid.

3.0.0 TECHNICAL REQUIREMENTS

3.1.0 MATERIAL & WORKMANSHIP

- 3.1.1 The material offered shall be of best quality and workmanship. The conductors shall be of homogenous alloy conductors of Aluminium + Magnesium + Silica Alloy type.
- 3.1.2 The conductors shall have a conductivity of 59% and hence shall have lesser DC resistance and higher current carrying capacity
- 3.1.3 AL59 conductors shall have high corrosion resistance (high saline zone), so that suited for coastal region installations.
- 3.1.4 The finished conductor shall be smooth, compact, uniform and free from all imperfections including kinks (protrusion of wires), wire cross over, over riding, looseness (wire being dislocated by finger/hand pressure and/or unusual banglenoise on tapping), material inclusions, white rust, powder formation or black spot (on account of reaction with trapped rain water etc.), dirt, grit etc.

3.2.0 DESIGN TEMPERATURES.

The following temperature range for the conductors and ground wires shall adopted for line design as below or as per given temperature in conductor data sheet.

- a) Minimum Temperature: 0 deg.C
- b) Everyday Temperature of conductor: As per site meteorological data.
- c) Maximum Temperature of Conductor: Maximum temperature corresponding to actual loading
- d) Maximum temperature of Earth wire exposed to sun : 53 deg.C.

3.3.0 JOINTS IN WIRES

During stranding, no Al59 wire welds shall be made for the purpose of achieving the required conductor length.

No joints shall be permitted in the individual wires in the outer most layer of the finished conductor. However, Joints in the inner layers are permitted in addition to those made in the base rod or wire before final drawing, but no two such joints shall be less than 15 meters apart in the complete stranded conductor. Joints shall be made by cold pressure butt welding and shall withstand a stress of not less than the breaking strength of individual strand guaranteed.

3.4.0 STRANDING

For all constructions, each alternate layer shall be stranded in opposite directions. The wires in each layer shall be evenly and closely stranded round the under laying wire or wires. The final layer of wires shall have a right hand lay.

3.5.0 STANDARD LENGTH



- 3.5.1 The standard length of the conductor shall be 2000 meters. A tolerance of $\pm 5\%$ on the standard length offered by the Bidder shall be permitted. All lengths outside this limit of tolerance shall be treated as random lengths.
- 3.5.2 Random lengths shall be accepted provided no length is less than 70% of the standard length and the total quantity of such random lengths shall not be more than 10% of the total quantity ordered.
- 3.5.3 Bidder shall also indicate the maximum single length, above the standard length, he can manufacture in the guaranteed technical particulars of offer. The Owner reserves the right to place orders for the above lengths on the same terms and conditions applicable for the standard lengths during the pendency of the Contract.

3.6.0 TOLERANCES

Manufacturing tolerances on the dimensions to the extent of one per cent shall be permitted for individual strands and the complete conductor.

4.0.0 TEST ON CONDUCTORS

The following tests should have been conducted for conductor in last five year for which offer is made.

In the event of any discrepancy in the test report (i.e., any test report not applicable due to any design/ material/manufacturing process change including substitution of components or due to noncompliance with the requirement stipulated in the Technical Specification) the tests shall be conducted by the Contractor at no extra cost to the GIPCL.

4.1.0 Type Tests

I) On Complete Conductor

- | | |
|--|------------------------|
| a) DC resistance test on stranded conductor | : As per Annexure-2.3A |
| b) UTS test on stranded conductor | : As per Annexure-2.3A |
| c) Stress- Strain test on stranded conductor and core at room temperature | : IEC 1089 |
| d) Stress-strain test on stranded conductor and core at elevated temperature | : As per Annexure-2.3A |
| e) Crush Strength Test | : As per Annexure-2.3A |
| f) Torsional Ductility & Wrapping Test | : As per Annexure-2.3A |
| g) Corona Extinction Voltage | : As per Annexure-2.3A |
| h) Radio Interference Voltage Test | : As per Annexure-2.3A |

II) On Conductor Strand/ Core

- | | |
|--|------------------------|
| a) Heat resistance test on Al59 strands | : As per Annexure-2.3A |
| b) Bending test on core | : As per Annexure-2.3A |
| c) Compression test on core | : As per Annexure-2.3A |
| d) Coefficient of linear expansion on core/core strand | : As per Annexure-2.3A |



4.2.0 Acceptance Tests

- | | | |
|----|--|------------------------|
| a) | Visual and dimensional check on drum | : As per Annexure-2.3A |
| b) | Visual check for joints, scratches etc. and length measurement of conductor by rewinding | : As per Annexure-2.3A |
| c) | Dimensional check on Al59 strands | : As per Annexure-2.3A |
| d) | Torsion and Elongation tests on core strand/composite core | : As per Annexure-2.3A |
| e) | Breaking load test on core and strands | : As per Annexure-2.3A |



- f) Wrap test on core & strands : IEC: 888 & 889
- g) Minimum conductivity test on conductor strands. : IEC 889
- h) Minimum conductivity test on core strands (if applicable) : As per Annexure-2.3A
- i) Procedure qualification test on welded joint of Al59 strands: As per Annexure-2.3A

Note: All the above tests except (g) shall be carried out on Al59 strands after stranding only.

4.3.0 Routine Test

- a) Check to ensure that the joints are as per Specification
- b) Check that there are no cuts, fins etc., on the strands.
- c) Check that drums are as per Specification
- d) All acceptance test as mentioned above to be carried out on 10% of drums

4.4.0 Tests during Manufacture

a)	Chemical analysis of Al59 conductor	As per Annexure-2.3A
b)	Chemical analysis of core strand	As per Annexure-2.3A

4.5.0 Test Reports

- 4.5.1 Copies of type test reports shall be furnished in at least two (2) copies along with one (1) original. One copy will be returned duly certified by the Owner only after which the commercial production of the material shall start.
- 4.5.2 Record of routine test reports shall be maintained by the Supplier at his works for periodic inspection by the Owner's representative.
- 4.5.3 Test Certificates of tests during manufacture shall be maintained by the Supplier. These shall be produced for verification as and when desired by the Owner.

4.6.0 Inspection

- 4.6.1 The Owner's representative shall at all times be entitled to have access to the works and all places of manufacture, where conductor shall be manufactured, and representative shall have full facilities for unrestricted inspection of the Supplier's works, raw materials and process of manufacture for conducting necessary tests as detailed herein.
- 4.6.2 The Supplier shall keep the Owner informed in advance of the time of starting and of the progress of manufacture of conductor in its various stages so that arrangements can be made for inspection.
- 4.6.3 No material shall be dispatched from its point of manufacture before it has been satisfactorily inspected and tested, unless the inspection is waived off by the Owner in writing. In the latter case also, the conductor shall be dispatched only after satisfactory testing for all tests specified herein have been completed.



- 4.6.4 The acceptance of any quantity of material shall in no way relieve the Supplier of any of his responsibilities for meeting all requirements of the Specification and shall not prevent subsequent rejection if such material is later found to be defective.

4.7.0 Test Facilities

- 4.7.1 The following additional test facilities shall be available at the Supplier's works:
- a) Calibration of various testing and measuring equipment including tensile testing machine, resistance measurement facilities, burette, thermometer, barometer etc.
 - b) Standard resistance for calibration of resistance bridges.
 - c) Finished conductor shall be checked for length verification and surface finish on separate rewinding machine at reduced speed (variable from 8 to 16 meters per minute). The rewinding facilities shall have appropriate clutch system and free of vibrations, jerks etc. with traverse laying facilities.

5.0.0 PACKING

- 5.1.0 The conductor shall be supplied in non-returnable, strong, wooden drums provided with lagging of adequate strength, constructed to protect the conductor against all damage and displacement during transit, storage and subsequent handling and stringing operations in the field. The Supplier shall be responsible for any loss or damage during transportation handling and storage due to improper packing. The drums shall generally conform to IS: 1778, except as otherwise specified hereinafter.
- 5.2.0 The drums shall be suitable for wheel mounting and for letting off the conductor under a minimum controlled tension of the order of 5 KN.
- 5.3.0 The Bidder should submit their proposed drum drawings along with the bid.
- 5.4.0 For conductor, one standard length shall be wound on each drum.
- 5.5.0 All wooden components shall be manufactured out of seasoned soft wood free from defects that may materially weaken the component parts of the drums. Preservative treatment shall be applied to the entire drum with preservatives of a quality which is not harmful to the conductor.
- 5.6.0 The flanges shall be of two ply construction with each ply at right angles to the adjacent ply and nailed together. The nails shall be driven from the inside face flange, punched and then clenched on the outer face. The thickness of each ply shall not vary by more than 3mm from that indicated in the figure. There shall be at least 3 nails per plank of ply with maximum nail spacing of 75mm. Where a slot is cut in the flange to receive the inner end of the conductor the entrance shall be in line with the periphery of the barrel.
- 5.7.0 The wooden battens used for making the barrel of the conductor shall be of segmental type. These shall be nailed to the barrel supports with at least two nails. The battens shall be closely butted and shall provide a round barrel with smooth external surface. The edges of the battens shall be rounded or chamfered to avoid damage to the conductor.
- 5.8.0 Barrel studs shall be used for the construction of drums. The flanges shall be holed, and the barrel supports slotted to receive them. The barrel studs shall be threaded over a length on either end, sufficient to accommodate washers, spindle plates and nuts for fixing flanges at the required spacing.
- 5.9.0 Normally, the nuts on the studs shall stand protruded of the flanges. All the nails used on the inner surface of the flanges and the drum barrel shall be counter sunk. The ends of barrel shall generally be flush with the top of the nuts.



- 5.10.0 The inner cheek of the flanges and drum barrel surface shall be painted with a bitumen-based paint.
- 5.11.0 Before reeling, card board or double corrugated or thick bituminized water-proof bamboo paper shall be secured to the drum barrel and inside of flanges of the drum by means of a suitable commercial adhesive material. After reeling the conductor, the exposed surface of the outer layer of conductor shall be wrapped with water proof thick bituminized bamboo paper to preserve the conductor from dirt, grit and damage during transport and handling.
- 5.12.0 A minimum space of 75 mm for conductor shall be provided between the inner surface of the external protective tagging and outer layer of the conductor.
- 5.13.0 Each batten shall be securely nailed across grains as far as possible to the flange, edges with at least 2 nails per end. The length of the nails shall not be less than twice the thickness of the battens. The nails shall not protrude above the general surface and shall not have exposed sharp, edges or allow the battens to be released due to corrosion.
- 5.14.0 The nuts on the barrel studs shall be tack welded on the one side in order to fully secure them. On the second end, a spring washer shall be used.
- 5.15.0 Outside the protective lagging, there shall be minimum of two binders consisting of hoop iron/galvanised steel wire. Each protective lagging shall have two recesses to accommodate the binders.
- 5.16.0 The conductor ends shall be properly sealed and secured on the side of one of the flanges to avoid loosening of the conductor layers during transit and handling.
- 5.17.0 As an alternative to wooden drum Bidder may also supply the conductors in non-returnable painted steel drums. After preparation of steel surface according to IS:9954, synthetic enamel paint shall be applied after application of one coat of primer. Wooden/Steel drum will be treated at par for evaluation purpose and accordingly the Bidder should quote in the package.

6.0.0 MARKING

Each drum shall have the following information stenciled on it in indelible ink along with other essential data:

- (a) Contract/Award letter number.
- (b) Name and address of Owner as "GIPCL".
- (c) Manufacturer's name and address.
- (d) Drum number
- (e) Size of conductor
- (f) Length of conductor in meters
- (g) Arrow marking for unwinding
- (h) Position of the conductor ends
- (i) Distance between outer-most Layer of conductor and the inner surface of lagging.
- (k) Barrel diameter at three locations & an arrows marking at the location of the measurement.
- (l) Number of turns in the outer most layer.
- (m) Gross weight of drum after putting lagging.



- (n) Tear weight of the drum without lagging.
- (o) Net weight of the conductor in the drum.
- (p) CIP/MICC No.

The above should be indicated in the packing list also.

7.0.0 VERIFICATION OF CONDUCTOR LENGTH

The Owner reserves the right to verify the length of conductor after unreeling atleast ten (10) percent of the drums in a lot offered for inspection.

SCHEDULE -1			
GUARANTEED TECHNICAL PARTICULARS OF AL59 MOOSE CONDUCTOR (The list is indicative, any other details , parameters required during detail engineering shall be provided by EPC contractor)			
Sl.	Description	Unit	Value guaranteed by the Bidder
1	Name & address of Manufacturer		
2	Construction of conductor/ Designation of conductor as per SS 42 40814 & SS 42 40813		
3	Particulars of raw materials		
3.1	For Centre Wire and Different Layers	%	
	a) Applicable Standard (if any)	%	
	b) Type of Aluminum alloy	%	
	c) Minimum purity of aluminium	%	
	d) Maximum Magnesium content	%	
	e) Silica Alloy content	%	
	• Maximum	%	
3.1	• Minimum	%	
	f) Other elements-----	%	
	e.g.i) -----	%	
	e.g.ii) -----	%	
4.	STRANDS OF OUTER CONDUCTING PART (AFTER STRANDING)		
4.1	Number of outer layers	Nos.	
4.2a	Number of strands		
	a) 1st Layer from core	Nos.	
	b) 2nd Layer from core	Nos.	
	c) 3rd Layer from core	Nos.	
4.2b	Diameter of strands		
	a) Nominal	mm	
	b) Maximum	mm	
	c) Minimum	mm	

SCHEDULE -1			
GUARANTEED TECHNICAL PARTICULARS OF AL59 MOOSE CONDUCTOR (The list is indicative, any other details , parameters required during detail engineering shall be provided by EPC contractor)			
4.3	Minimum Breaking load of strand		
	a) Before stranding	kN	
	b) After stranding	kN	
4.4	Resistance of 1m length of strand at 20 deg C	Ohm	
4.5	Final Modulus of elasticity	Kg/sq. mm	
4.6	Final Coefficient of linear expansion	Per °C	
5	INNER CORE STRANDS/ INNER CORE (AFTER STRANDING)		
5.1	Number of layers in inner core (excluding central wire)		
5.2	Number of strands		
	a) 1st Layer from centre (excluding central wire)	Nos.	
	b) 2nd Layer from centre	Nos.	
	c) 3rd Layer from centre	Nos.	
5.3a	Diameter		
	a) Nominal	mm	
	b) Maximum	mm	
	c) Minimum	mm	
5.3b	Minimum Breaking load of strand / Core		
	a) Before stranding	kN	
	b) After stranding	kN	
5.4	Resistance of 1m length of strand at 20 deg.C	Ohm	
5.5	Final Modulus of elasticity	Kg/sq. mm	

SCHEDULE -1			
GUARANTEED TECHNICAL PARTICULARS OF AL59 MOOSE CONDUCTOR (The list is indicative, any other details , parameters required during detail engineering shall be provided by EPC contractor)			
5.6	Final coefficient of linear expansion	Per°C	
5.7	Aluminum cladding of core (if applicable)		
	a) Thickness of cladding		
	i) Maximum	mm	
	ii) Minimum	mm	
	b) Minimum no. of twists in a gauge length equal to 100 times diameter of wire which the strands can withstand in the torsion test		
	a) Before stranding	Nos.	
	b) After stranding Nos.	Nos.	
	c) Minimum elongation of strand for a gauge length of 250 mm	%	
	d) Resistance of 1m length of strand at 20 deg. C	Ohm	
6	COMPLETE AL59 MOOSE CONDUCTOR		
6.1	Cross section drawing of the offered conductor enclosed	Yes / no	
6.2a	Diameter of conductor		
	a) Nominal	Mm	
	b) Maximum	Mm	
	c) Minimum	Mm	
6.2b	Cross sectional area of conductor	Sqmm	
6.3	UTS (minimum) of Conductor	kN	
6.4	Lay ratio of conductor		Max.
	a) 1st layer from center (excluding central wire)		
	b) 2nd Layer		

SCHEDULE -1			
GUARANTEED TECHNICAL PARTICULARS OF AL59 MOOSE CONDUCTOR (The list is indicative, any other details , parameters required during detail engineering shall be provided by EPC contractor)			
	c) 3rd Layer d) 4th Layer		
6.5	DC resistance of conductor at 20°C		
6.6	Final Modulus of elasticity		
	a) Up to transition temperature	Per deg C	
	b) Above transition temperature	Per degC	
6.7	Coefficient of linear expansion		
	Up to transition temperature	Per deg C	
	Above transition temperature	Per deg C	
6.8	Calculation for transition temperatureEnclosed	Yes/no	
6.9	Maximum permissible conductor temperature for continuous operation	Deg. C	
6.10	Maximum permissible conductor temperature forshort term operation	Deg. C	
6.11	Permissible duration of above short-term Operation	Minutes	
6.12	Steady state conductor temperature at specifiedconductor current of.....A and under Ambient conditions.		
6.13	AC resistance at maximum continuous operating temperature corresponding to specified maximum operating current	Ohm/ km	
6.14	AC resistance at continuous operating temperature corresponding to specified operatingcurrent	Ohm/ km	
6.15	Details of Creep characteristic for AL59 MOOSE conductor enclosed	Yes/No	
6.16	Sag Tension Calculation		
6.16.1	Sag Tension Calculation enclosed	Yes/No	

SCHEDULE -1			
GUARANTEED TECHNICAL PARTICULARS OF AL59 MOOSE CONDUCTOR (The list is indicative, any other details , parameters required during detail engineering shall be provided by EPC contractor)			
6.16.2	Tension at 32 deg. C & no wind	Kg	
6.16.3	Sag & tension at maximum continuous operating temperature	Meters& Kgs	
	i. Tension for following conditions:		
	32 deg. C & full wind condition	kg	
	32 deg. C & Nil wind condition	kg	
	Minimum tempt. & 36% of full wind condition		
	32 deg. C & 75% of full wind condition		
6.17	Linear mass of the Conductor		
	a) Standard	Kg/km	
	b) Minimum	Kg/km	
	c) Maximum	Kg/km	
6.18	Standard length of conductor	Mtr	
6.19	Maximum length of conductor that can be offered as single length	Mtr	
6.20	Tolerance on standard length of conductor	%	
6.21	Drum is as per specification	Yes/No	
6.22	No. of cold pressure butt welding equipment available at works	Nos.	

ANNEXURE-2.3A TESTS ON CONDUCTOR

1.1 UTS Test on Stranded Conductor

Circles perpendicular to the axis of the conductor shall be marked at two places on a sample of conductor of minimum 5 m length between fixing arrangement suitably fixed by appropriate fittings on a tensile testing machine. The load shall be increased at a steady rate up to 50% of minimum specified UTS and held for one minute. The circles drawn shall not be distorted due to relative movement of strands. Thereafter the load shall be increased at steady rate to minimum UTS and held for one minute. The Conductor sample shall not fail during this period. The applied load shall then be increased until the failing load is reached, and the value recorded.

1.2 Corona Extinction Voltage Test

One sample of conductor of 5m length shall be strung. In case of Quad conductor, four samples shall be arranged with the actual sub-conductor spacing between them. This sample assembly when subjected to power frequency voltage shall have a corona extinction voltage of not less than 320 kV (rms) for 400 kV line to ground voltage under dry condition. There shall be no evidence of corona on any part of sample when all possible sources of corona are photographed in a darkened room. The test shall be conducted without corona control rings. The voltage shall be corrected for standard atmospheric conditions. However, small corona rings shall be used to prevent corona in the end fittings.

1.3 Radio Interference Voltage Test

Under the conditions as specified under (1.2) above, the insulator string along with complete hardware fittings shall have a radio interference voltage level below 1000 micro volts at one MHz when subjected to 50 Hz AC voltage of 154kV line to ground under dry condition for 400kV AC line. The test procedure shall be in accordance with IS: 8263/ IEC: 60437. The Test may be carried out with corona control rings and arcing horns.

1.4 D.C. Resistance Test on Stranded Conductor

On a conductor sample of minimum 5m length two contact-clamps shall be fixed with a predetermined bolt torque. The resistance shall be measured by a Kelvin double bridge or using micro ohm meter of suitable accuracy by placing the clamps initially zero meter and subsequently one meter apart. The test shall be repeated at least five times and the average value recorded. The value obtained shall be corrected to the value at 20°C as per IS: 398 (Part-IV)/(Part-V). The resistance corrected at 20deg C shall conform to the requirements of this Specification.

1.5 Coefficient of linear expansion for core/core strands

The temperature and elongation on a sample shall be continuously measured and recorded at interval of approximately from 15°C to maximum designed continuous operating temperature corresponding to rated current as of specification by changing the temperature by suitable means. Coefficient of linear expansion shall be determined from the measured results.

1.6 Breaking load test on Aluminium Alloy & Core strands and D.C Resistance test on Aluminium Alloy wire

The above tests shall be carried out as per IEC: 888/889 and the results shall meet the requirements of the specification.

1.7 Heat Resistance test on Aluminium Alloy wire (If Applicable)

Breaking load test as per clause 1.5 above shall be carried out before and after heating the sample in uniform heat furnace at 280 °C (+5/-3 °C) temperature for one hour. The breaking strength of the wire after heating shall not be less than the 90% of the breaking strength before heating.

1.8 Chemical Analysis of Aluminium Alloy and Core

Samples taken from the Aluminium and core coils/strands shall be chemically/ spectrographically analyzed. The same shall be in conformity to the particulars guaranteed by the bidder so as to meet the requirements stated in this Specification.

1.9 Visual and Dimensional Check on Drums

The drums shall be visually and dimensionally checked to ensure that they conform to the approved drawings.

1.10 Visual Check for Joints, Scratches etc.

Conductor drums shall be rewound in the presence of the Owner. The Owner shall visually check for scratches, joints etc. and that the conductor generally conform to the requirements of this Specification. Ten percent (10%) drums from each lot shall be rewound in the presence of the Owner's representative.

1.11 Dimensional Check on Core Strands and Aluminium Alloy Strands

The individual strands shall be dimensionally checked to ensure that they conform to the requirement of this Specification.

1.12 Procedure Qualification test on welded Aluminium Alloy strands.

Two Aluminium Alloy wire shall be welded as per the approved quality plan and shall be subjected to tensile load. The breaking strength of the welded joint of the wire shall not be less than the guaranteed breaking strength of individual strands.

1.13 Chemical Analysis of Zinc

Samples taken from the zinc ingots shall be chemically/ spectrographically analyzed. The same shall be in conformity to the requirements stated in the Specification.

1.14 Torsion and Elongation Tests on Core Strands

The test procedures shall be as per clause No. 10.3 of IEC: 888.0. In torsion test, the number of complete twists before fracture shall not be less than 18 on a length equal to 100 times the standard diameter of the strand. In case test sample length is less or more than 100 times the stranded diameter of the strand, the minimum number of twists will be proportioned to the length and if number comes in the fraction then it will be rounded off to next higher whole number. In elongation test, the elongation of the strand shall not be less than 1.5% for a gauge length of 250 mm.

1.15 Bending test on conductor core strand

A sample of conductor core strand measuring 30 cm in length shall be subject to bending with help of a vise. The vised length of wire should be 5 cm and radius of bend 4.8 mm. The bending should be first 90 degrees left and 90 degrees right. After this operation the strand should cut at the bending point. There should be no separation of core and aluminium at the bending point after this operation.

1.16 Minimum conductivity test on thermal resistant aluminum alloy strands

Resistivity test as per IEC-468/IEC 889 shall be conducted to confirm minimum conductivity as per specification requirement.

1.17 Stress-strain test at elevated temperature

Stress-strain test as per IEC-1089 shall be conducted keeping conductor temperature at designed maximum temperature. The guaranteed Core UTS shall be considered for performing

the test.

1.18 High Temperature endurance & creep test

A conductor sample of length equal to at least $100 \times d + 2 \times a$ (where, d is the conductor diameter and a is the distance between the end fitting and the gauge length) shall be strung at tension equal to 25 % of conductor UTS. The distance, a, shall be at least 25 % of the gauge length or 2 m whichever is the smaller. The conductor sample shall be subjected to two tests as indicated below:

- (i) The conductor temperature shall be maintained at 20 deg C for 1000 hours. The elongation/creep strain of the conductor during this period shall be measured and recorded at end of 1 hour, 10 hour, 100 hour and subsequently every 100 hour up to 1000 hours' time period.
- (ii) The conductor temperature shall be increased to design maximum temperature in steps of 20 deg. C and thermal elongation of the conductor sample shall be measured & recorded at each step. The temperature shall be held at each step for sufficient duration for stabilization of temperature. Further, the temperature of the conductor shall be maintained at maximum designed continuous operating temperature (+10 Deg. C) for 1000 hours. The elongation/creep strain of the conductor during this period shall be measured and recorded at end of 1 hour, 10 hour, 100 hour and subsequently every 100 hour up to 1000 hours' time period. After completion of the above, the core of the conductor sample shall be subjected to UTS test where the conductor core should achieve 95% of the guaranteed core UTS. The supplier shall plot the thermal elongation with temperature. In case of polymer composite core conductor, the flexural strength & glass transition temperature of the core shall also be evaluated and the same shall not be degraded by more than 10 % over the initial value. The supplier shall plot the thermal elongation with temperature.

The supplier shall furnish details of creep characteristic in respect of the conductor based on laboratory test and other laboratory investigations/ experimental conducted on similar type of conductor and shall indicate creep strain values corresponding to 1 month, 6 month, 1 year, 10 year & 20 year creep at everyday tension & continuous designed temperature as well as room temperature.

1.19 Axial Impact Test

The conductor sample shall be suspended vertically and load applied by dropping a 650 Kg from an elevation of 4 meters above the sample. The impact velocity shall be not less than 8 m/sec. with an initial pre-tension of 200 kgs. The curve for load vs time shall be recorded and recorded load of failure for core shall not be less than UTS of core.

1.20 Crush Strength Test

A section of conductor is to be crushed between two six inch steel plates. Load shall be held at 350 Kgs for 1 minute and then released. All the core strands shall be subsequently disassembled and tensile tested. All the core strands shall exhibit full strength retention

1.21 Torsional Ductility Test

The conductor sample of 10-15m shall be loaded to 20% of UTS and then loaded in increasing steps of +/-180 deg, the core shall withstand at least 16 such rotation for core and there shall be no damage to core wires and in case of trapezoidal shaped conductor or composite conductor, after 4 rotations and after separation of aluminum strands, the aluminum wires shall be cut and removed from the conductor and the exposed core shall be twisted and shall withstand up to 16 rotations.



1.22 Sheaves Test (if required)

The conductor sample of minimum length of 35 meter shall be tensioned at 22 % of the UTS and shall be passed through pulleys having diameter of 32 times that of the conductor with angle of 20 deg. between the pulleys. The conductor shall be passed over the pulleys 36 times at a speed of 2 m/sec. After this test UTS test on the conductor shall be carried out.