



SUPPLY CHAIN MANAGEMENT

THIRUVANANTHAPURAM

SPECIFICATION

ACSR RABBIT & RACCOON CONDUCTORS

APPLICABLE TO KSEBL	Rev#0	DOC. NO.: SCM-SPEC/XH/ACSR Rabbit & Raccoon Conductors
		EFF. DATE: 15/12/2021

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Technical Specification and Evaluation Committee for Distribution Material



SUPPLY CHAIN MANAGEMENT

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Effective Date 15/12/2021

(i) Document Approval & Control Status

	Compiled by	Verified by	Approved by
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Position	Assistant Executive Engineer (Supply Chain Management)	Executive Engineer (Supply Chain Management)	Chief Engineer (Supply Chain Management)
Date	07/09/21	13/12/2021	15/12/2021
Signature	Sd/-	Sd/-	Sd/-

(ii) Amendments and History

Sec. #	Rev. #	Date	History of Change



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

TECHNICAL SPECIFICATION

ACSR RABBIT & RACCOON CONDUCTORS

Doc. #: **SCM-SPEC/XH/ACSR Rabbit & Raccoon Conductors**

Rev.#: 0

Effective Date 15/12/2021

1. PURPOSE:

Purpose of this document is to document updates & history, upkeep and publish the specifications related to **ACSR Rabbit & Raccoon Conductors** in a professional manner

2. SCOPE:

The Scope of this document is to inform and alert all relevant stakeholders including KSEBL. Public, KSERC etc regarding the current specifications and historical changes adopted in specifications of **ACSR Rabbit & Raccoon Conductors** used in field by KSEBL

3. RESPONSIBILITY:

The Executive Engineer (H), Office of Chief Engineer, Supply Chain Management shall compile and take necessary steps to publish the specification in KSEBL website and shall inform relevant stakeholders regarding updates and revisions

4. PROCEDURE FOR REVISION:

Modifications if any, in the technical specification will be incorporated as **Revisions**. Any changes in values, minor corrections in pages, incorporation of small details etc. will be considered as Minor Modification. **The Revisions due to minor modifications will be assigned as Rev. No.0.1, 0.2 etc.**



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

TECHNICAL SPECIFICATION

ACSR RABBIT & RACCOON CONDUCTORS

Doc. #: **SCM-SPEC/XH/ACSR Rabbit & Raccoon
Conductors**

Rev.#: 0

Effective Date 15/12/2021

A complete updation of the technical specification will be considered as Major modification. **The Revisions due to major modifications will be assigned as Rev. No.1.0, 2.0 etc.**

All the details of regarding the revisions (both minor and major) will be incorporated in **“(ii)-Amendments and history”** above.

The concerned officers, in consultation with the Technical Committee will review and suggest changes required and the revision suggestion will be approved by **Chief Engineer (SCM)**. Those who notice any discrepancy or have any suggestion regarding revision, may bring the matter to the attention of Chief Engineer (SCM) in writing or through e-mail id:**cescm@kseb.in**



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

TECHNICAL SPECIFICATION

ACSR RABBIT & RACCOON CONDUCTORS

Doc. #: **SCM-SPEC/XH/ACSR Rabbit & Raccoon
Conductors**

Rev.#: 0

Effective Date 15/12/2021

CONTENTS

1) Scope:	7
2) Standards	7
3) Materials	7
4) Sizes	8
5) Tolerances	8
6) Mechanical Properties	8
7) Technical Specification for ACSR Raccoon, Rabbit Conductors	8
8) Surface Conditions	8
9) Stranding	9
10) Conductor Drums	9
11) Lengths and Variation in Lengths	12
12) Rejection	13
13) Tests and Test Certificate	13
14) Wrapping Test	14
15) Galvanizing Test	14



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

TECHNICAL SPECIFICATION

ACSR RABBIT & RACCOON CONDUCTORS

Doc. #: **SCM-SPEC/XH/ACSR Rabbit & Raccoon
Conductors**

Rev.#: 0

Effective Date 15/12/2021

16) Torsion Test	14
17) Resistance Test	15
18) Specific Resistivity	15
19) Guaranteed Technical Particulars	16



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

TECHNICAL SPECIFICATION

ACSR RABBIT & RACCOON CONDUCTORS

Doc. #: **SCM-SPEC/XT/ACSR Rabbit & Raccoon Conductors**

Rev.#: 0

Effective Date 15/12/2021

Technical Specification of ACSR Rabbit & Raccoon conductors

- 1) **Scope:-** This specification provides for the manufacture, testing before despatch, supply and delivery including unloading of ACSR Rabbit & Raccoon conductors at site as per the technical specification & GTP attached. The steel cored Aluminium conductor and galvanised steel wire shall have Mechanical and Electrical properties specified in IS.398 Part-II and latest Amendments.
- 2) **Standards:-**
 - 2.1) The conductor shall comply in all respects with the Indian Standards specification (ISS) 398-1996/British Standard 215/IEC Publication No.209 with latest amendments or any other authoritative standard. The specification and working shall be marked in the flat sides of the drum.
- 3) **Materials:-**
 - 3.1) The materials offered shall be of best quality and workmanship. The steel cored aluminium conductor strands will consist of hard-drawn aluminium wire manufactured from 99.6% pure electrolytic aluminium rods of E.C.Grade, conform to IS:5484. The steel wire shall be made from materials produced either by the acid or base open hearth process or by electric process. No steel wire drawn from Bessmar process steel shall be used. The steel wire shall not exceed the limits of sulphur or phosphorus as stipulated in the IS:398 (Part-2).The raw material Aluminium rods shall be purchased from M/s.National Aluminium Company Limited, M/s.Hindalco Industries Limited and M/s.Vedanta Aluminium Company Limited.
 - 3.2) The steel wire shall be evenly and uniformly treated with zinc complying with Indian Standard 209-1992 specification with latest amendments for zinc (Revised) or BS or any other authoritative standard. The uniformity of zinc coating and the weight of coating shall be in accordance with technical specifications and shall be tested and determined according to Indian Standard IS:4826 or any other authoritative standard.The zinc used for galvanising shall be electrolytic high grade zinc not less than 99.95% purity.The raw material steel wire rods shall be purchased from M/s.Tata SSL Limited, Mumbai, M/s.Ramsarup Industrial Corporation,Kolkata or other reputed companies.



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

TECHNICAL SPECIFICATION

ACSR RABBIT & RACCOON CONDUCTORS

Doc. #: **SCM-SPEC/XH/ACSR Rabbit & Raccoon Conductors**

Rev.#: 0

Effective Date 15/12/2021

- 4) **Sizes:-** The size of steel cored aluminium conductors shall be as given in technical specifications & GTP attached. The resistance and weights shall be in accordance with the values given in the same.
- 5) **Tolerances:-** No negative tolerance shall be permitted on the nominal diameter of aluminium & steel wires used in the manufacture of ACSR. However positive tolerance in this respect shall be as provided in IS.398 (Part- II)
- 6) **Mechanical Properties:-** The value of the final modulus of elasticity for steel cored Aluminium conductor is the average of values obtained from actual stress strain tests. The co-efficient of linear expansion for steel cored Aluminium Conductors has been calculated on the basis of co-efficient of linear expansion of 23×10^{-6} per degree centigrade for Aluminium at 0°C and 11.5×10^{-6} per degree centigrade for steel and represent only the average values. These values shall, however, be given by the tenderer under the guaranteed technical particulars.
- 7) **Technical Specification for ACSR Raccoon, Rabbit Conductors.**

Sl No	Name of conductor	Raccoon	Rabbit
1)	Nominal Aluminium Area in mm ²	80	50
2)	Stranding and Wire diameter		
	a) Aluminium	6/4.09	6/3.35
	b) Steel	1/4.09	1/3.35
3)	Sectional Area of Al. in mm ²	78.83	52.88
4)	Total Sectional Area in mm ²	91.97	61.70
5)	Approximate Mass Kg/km	319	214
6)	Approximate Over All diameter in mm	12.27	10.05
7)	Calculated Resistance at 20°C in Ω /km	0.3712	0.5524
8)	Approx. Calculated breaking load in KN	26.91	18.25

- 8) **Surface Conditions:-** The wires shall be smooth and free from inequalities, spills and splits. The surface conductor shall be free from points, sharp edges, abrasions or other departures from smoothness or uniformity of surface contour, that would increase radio interference and corona



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

TECHNICAL SPECIFICATION

ACSR RABBIT & RACCOON CONDUCTORS

Doc. #: **SCM-SPEC/XH/ACSR Rabbit & Raccoon Conductors**

Rev.#: 0

Effective Date 15/12/2021

losses. When subjected to tension upto 50% of the ultimate strength of the conductor, the surface shall not depart from its cylindrical form, not any part of the component parts or strands, move relative to each other in such a way as to get out of place and disturb the longitudinal smoothness of the conductor.

9) **Stranding:-**

- 9.1) The wires used in construction of a stranded conductor shall before stranding, satisfy all requirements of IS.398/BS.215/IEC-209. For steel cored aluminium conductor the lay ratio of the different layers shall be within the limits given in the relevant IS.
- 9.2) For all construction, each alternate layer shall be stranded in opposite directions. The wires in each layer shall be evenly and closely stranded round the underlying layer of wires. The final layer of wires shall have a right hand lay.
- 9.3) The steel core inner Aluminium layer shall be protected by a suitable compound before application of the aluminium strands. The type of coating used shall be lithium soap grease corresponding to Grade II of IS.7623/1993.

10) **Conductor Drums:-** The conductor to be supplied shall be packed in the drums.

The drums used shall conform to IS specification No.1778/1981 amended upto date applicable for reels and drums for bare wire and the dimensions of the conductor drums (wooden reel) shall be such that after accommodating suitable number of lengths of the conductor, the total weight of the drum with conductor on it should not exceed the values given below.

ACSR Raccoon	1,400 Kg
ACSR Rabbit	1,400 Kg

The supplies effected with the gross weight of drum exceeding the above values shall not be accepted.

The conductor drum shall bear the following marking and shall conform to the specifications IS – 1778-1981.



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

TECHNICAL SPECIFICATION

ACSR RABBIT & RACCOON CONDUCTORS

Doc. #: **SCM-SPEC/XH/ACSR Rabbit & Raccoon
Conductors**

Rev.#: 0

Effective Date 15/12/2021

10.1) Specification of Drum:-

- | | |
|--|-------------------------------|
| 1) Materials and construction | : Soft wood or seasoned wood. |
| 2) Flange diameter | : 1220mm. |
| 3) Barrel diameter | : 600 mm. |
| 4) Traverse | : 710mm. |
| 5) Flange thickness | : 2X32mm. |
| 6) Bore diameter | : 80mm. |
| 7) Nail Circle | : 5mm. |
| 8) Nail length | : 75mm. |
| 9) Nail size minimum | : 3.25mm. |
| 10) Thickness of Barrel and supports | : 38mm. |
| 11) Thickness of Barrel end lagging | : 38mm. |
| 12) No. of stretchers | : 4 Nos. |
| 13) Stretcher size | : 100 X 38 mm. |
| 14) No. of bolts | : 4 Nos. |
| 15) Diameter of Bolts (minimum) | : 12mm. |
| 16) Size of square washer | : 50mm X 6mm |
| 17) Size of spindle plate | : 150 X 150 X 6mm. |
| 18) Diameter of spindle plate holes | : 90mm. |
| 19) No. of spindle plate bolt | : 4 nos |
| 20) Spindle plate bolt diameter | : 12mm. |
| 21) Thickness of external lagging | : 38mm. |
| 22) No. of Binders over the external lagging | : 2 nos. |
| 23) Materials used for lining the barrel of the drum | : Water proof materials. |
| 24) Material used for lining over the last layer of conductor | : Water proof material. |
| 25) Material used for painting the barrel surface and inner surface of flanges | : Bitumen based paints |



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

TECHNICAL SPECIFICATION

ACSR RABBIT & RACCOON CONDUCTORS

Doc. #: **SCM-SPEC/XH/ACSR Rabbit & Raccoon
Conductors**

Rev.#: 0

Effective Date 15/12/2021

10.2) Details to be marked on the Drum:-

- 1) Drum No. : To be marked.
- 2) Roll this way making : An arrow shall be marked on the sides of the drums with the word "Roll this way".
- 3) Manufacturer's name or trade marks :
- 4) Size & Type of conductor :
- 5) Net weight of conductor : In kg.
- 6) Bare weight of conductor : In kg.
- 7) Gross weight of conductor and drum : In kg.
- 8) No. of pieces and length of each piece : In m.
- 9) Total length on the drum : In m.
- 10) Name and address of the consignee :
- 11) Year of manufacture :
- 12) ISI certification mark :
- 13) Position of top conductor finishing end : Should be marked.
- 14) Tests to be conducted on the drum :
- 15) Barrel batten strength : Should be twice the winding tension.

The supplier shall forward along with the Test Certificates particulars of the drum as required in ISI 1778—1981. Painting shall be carried out and all protection as per IS 398 Part-II and latest amendments provided.

After reeling the conductor, the exposed surface of the outer layer of the conductor shall be wrapped with water proof thick bituminised bamboo paper to preserve the conductor from dirt, grit and damages during transport and handling. Either soft wood or seasoned wood should be used for the manufacture of drums, spindle plate and its accessories should be fixed. The minimum space of 50mm shall be provided between the inner surface of the external protective lagging and outer layer of the conductor.

The conductor ends shall be properly sealed and secured with the help of nails or bolts on the side of one of the flanges to avoid loosening of the conductor layers during transit and handling. The supplies effected without complying the above packing conditions shall not be accepted.



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

TECHNICAL SPECIFICATION

ACSR RABBIT & RACCOON CONDUCTORS

Doc. #: **SCM-SPEC/XH/ACSR Rabbit & Raccoon
Conductors**

Rev.#: 0

Effective Date 15/12/2021

11) Lengths and Variation in lengths:-

11.1) The standard length of ACSR Conductor shall be 1000 Metre and lengths bigger than the standard lengths also allowed. Short length shall not be less than 80% (Eighty percent) of the standard length specified as above and the total acceptable quantity of such short lengths shall be within 5% (Five percent) of the allotted quantity to each consignee of the respective size of the conductor.

11.2) Verification of length of conductor:-

- i) KSEB Limited shall ascertain the length of ACSR Conductor at supplier's works and at the receiving store centers by measuring the actual length by length measuring machine used for the purpose. Marking should be made for each 1km length of the conductor. The supplier should ensure that length measuring machine is available for measurement of the length by our inspecting officer.
- ii) The supplier shall produce before the inspecting officer documents showing that good quality raw materials have been procured for the manufacturing of conductors.
- iii) Both ends of the ACSR Conductor shall be sealed by supplier and the seals shall be contained in the drum and not exposed out of drum.
- iv) The declared length will be measured between manufacturer's seals at both ends of ACSR Conductor.
- v) Weight of the ACSR Conductor will also be checked for ensuring correct lay and length of the ACSR Conductor. The supplier should have the facility to take weights from 50mg. upto 500gms. He should also have facility for rewinding so that the weight of the drum and conductor can be taken separately. The supplier should have the facility to conduct tests as per IS on the strand, conductor and drum.
- vi) Verification of length will be carried out on 10% of total lot at works and two drums at any store out of the lot.
- vii) If the length is found correct or more the lot will be accepted. If the 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 various stores for payment.



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

TECHNICAL SPECIFICATION

ACSR RABBIT & RACCOON CONDUCTORS

Doc. #: **SCM-SPEC/XH/ACSR Rabbit & Raccoon
Conductors**

Rev.#: 0

Effective Date 15/12/2021

viii) **In case of dispute, joint inspection along with the representative of the supplier shall be carried out after giving 10days notice to the supplier to remain present at store for the purpose. If the representative fails to attend on stipulated date for joint inspection, the decision of consignee shall be final and binding.**

12) Rejection:- While measuring the length the sample piece from each length shall be taken for carrying out the test as per IS-398 Part – II. All the values of each sample should not exceed the values of the relevant BIS read with specification. In case of deviation, whole lot will be rejected at works.

13) Tests and Test Certificate:-

13.1) Individual wire and finished steel cored Aluminium conductor shall be subjected before dispatch from the works to the tests as specified in the Indian Standard Specification 398-1996 or any other authoritative standard.

13.2) Samples of individual wires for test shall be taken before stranding from not less than 10% of the spools in the case of aluminium wire and ten percent of the wire coils in the case of steel wires. If samples are taken after stranding they shall be obtained by cutting 1.2 metre from the outer end of the finished conductor, from not more than 10% of the finished reels.

13.3) The mechanical tests shall be carried out on single wires only.

13.4) The tensile test shall apply to wires of all diameters forming part of steel cored aluminium conductors. If it is not possible to test the component wires before stranding, the test may be made on wires taken from stranded conductors. In such cases the tensile strength of any of the wires shall not be less than 95 percent of the minimum values given in technical specifications attached.

13.5) Tensile testing machine shall be used, the accuracy of which can easily be checked and the machine adjusted if necessary. The test samples, before being placed in the machine, shall be straightened, if necessary, in such a way as to cause the minimum alteration in its physical properties. When an automatic tensile testing machine is issued, the load shall be applied gradually and rate of separation of the jaws of the testing machine shall not be less than 25mm/min. greater than 100mm/min. When a hand operated lever testing machine is used, 90 % percent of the breaking load shall be applied quickly and the load shall then be increased steadily until the specimen breaks. The time taken to apply the last ten percent of the load shall

	SUPPLY CHAIN MANAGEMENT Thiruvananthapuram			
	TECHNICAL SPECIFICATION			
	ACSR RABBIT & RACCOON CONDUCTORS			
	Doc. #: SCM-SPEC/XH/ACSR Rabbit & Raccoon Conductors	Rev.#: 0		Effective Date 15/12/2021

be approximately 15 seconds and the total time from the application of the load to the break shall be approximately 20 seconds.

- 13.6) The breaking load of steel cored aluminium conductor in terms of the sum of the strength of the individual components wires may be taken to be as follows.
- 98 percent of the sum of the strength of the aluminium wires plus 89 percent of the sum of the strengths of the steel wires when taken from the stranded conductor and tested or
 - 98 percent of the sum of the strength of the aluminium wires plus 85 percent of the sum of the strengths of the steel wires, based on the strengths of the component wires before stranding, that is, in the coil

The value of approximate calculated breaking load of conductor has been given in the technical specification attached.

14) Wrapping Test:-

- 14.1) Samples of aluminium wires shall be wrapped round a wire of its own diameter to form a close helix of eight turns. Six turns shall then be unwrapped and again closely wrapped in the same directions as before. The wire shall not break.
- 14.2) Samples of galvanized steel wires shall be wrapped around a mandrel of diameter six times round a mandrel of diameter equal to four times the wire diameter to form a close helix of 8 turns. Six turns shall then be wrapped and again closely wrapped in the same direction as before. The wire shall not break.

15) Galvanizing Test:-

- 15.1) The uniformity of galvanizing and the weight of coating shall be in accordance with IS:4826/1979 and shall be determined according to Indian Standard Specification. Indian Standard No.2633-1072 and 6745-1972 respectively or any other authoritative standard.
- 15.2) This test shall be made whenever practicable on wires before stranding and before the specimen has been bent, straightened or tested in any other way.

- 16) Torsion Test:-** The sample of steel wire shall be gripped in two vices exactly 15cm apart. One of the vices shall be made to revolve at a speed not exceeding one revolution per second and the other shall be capable of moving longitudinally to allow for contraction or expansion during testing. The test shall be continued until fracture occurs and the fracture shall show a smooth surface at right angles to the axis of the wire. After fracture, the specimen shall be free from



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

TECHNICAL SPECIFICATION

ACSR RABBIT & RACCOON CONDUCTORS

Doc. #: **SCM-SPEC/XH/ACSR Rabbit & Raccoon
Conductors**

Rev.#: 0

Effective Date 15/12/2021

helical splits. The samples shall withstand a number of twists equivalent not less than 16 on a length equal to 100 diameters.

- 17) **Resistance Test:-** The measurement of resistance shall be made on solid Aluminium conductors, and shall be carried out to an accuracy of at least one part in a thousand. The length of the sample wire selected for this test shall be sufficient to give the accuracy required and shall be suitable for the method of testing, employed. Certificates as to the accuracy of the apparatus shall be provided and either party shall have the right to satisfy himself that the apparatus and methods of testing are correct.
- 18) Specific resistivity of Aluminium used should not exceed 0.028264 ohm sq.mm/m at 20 degree centigrade as prescribed in IS.398. If the results are at variance, the whole lot shall be rejected.
- 19) **Guaranteed Technical Particulars:-** The tenderer shall fill in the guaranteed technical particulars in the proforma in Annexure-II and submit the same with his tender.
- 20) Routine test Certificate shall be furnished while offering inspection.

Sd/-

Chief Engineer (SCM)



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

TECHNICAL SPECIFICATION

ACSR RABBIT & RACCOON CONDUCTORS

Doc. #: **SCM-SPEC/XH/ACSR Rabbit & Raccoon Conductors**

Rev.#: 0

Effective Date 15/12/2021

GUARANTEED TECHNICAL PARTICULARS

Sl. No	Description	KSEBL's Requirement	
		Rabbit	Raccoon
1)	Code word	Rabbit	Raccoon
2)	Makers Name & Address		
a)	Aluminium rods.	M/s.National Aluminium Company Limited, M/s.Hndalco Industries, Limited, M/s.Vedanta Aluminium Company Limited.	
b)	Steel wire rods	M/s.Tata SSL Limited, Mumbai, M/s.Ramsarup Industrial Corporation, Kolkatta or other reputed companies.	
c)	Complete conductor		
3)	Stranding and wire diameter		
a)	Aluminium	6/3.35	6/4.09
b)	Steel	1/3.35	1/4.09
4)	Calculated equivalent aluminium area in sq.mm	52.21	77.83
5)	Actual aluminum area in sq.mm	52.88	78.83
6)	Standard area of cross section in sq. mm		
a)	Aluminium strand	8.814	13.14
b)	Steel strand	8.814	13.14
c)	Conductor	61.70	91.97
7)	Diameter of complete conductor in mm	10.05	12.27
8)	Minimum Ultimate tensile stress of strand in Kg/ sq.mm		
a)	Aluminium strand	16.52	16.17
b)	Steel strand	134	134
9)	Guaranteed ultimate tensile strength of conductor in kg.	1860	2746
10)	Minimum breaking load in KN for		
a)	Aluminum strand		



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

TECHNICAL SPECIFICATION

ACSR RABBIT & RACCOON CONDUCTORS

Doc. #: **SCM-SPEC/XH/ACSR Rabbit & Raccoon Conductors**

Rev.#: 0

Effective Date 15/12/2021

	Before stranding	1.43	2.08
	After stranding	1.36	1.98
b)	Steel strand		
	Before stranding	11.58	17.27
	After stranding	11.00	16.4
11)	Purity of aluminum rods	99.60%	
12)	Zinc coating of steel strand		
a)	Uniformity of coating and duration of dips (No.1 Min. x No)	1 min – 3 dip, 1/2 min-1 dip	1 min – 3 dip, 1/2 min-1 dip
b)	(Preece test) with strand (No.2 Min. x ... No)		
c)	Minimum weight of coating (gm/sq.mm)	250gm/m ²	275gm/m ²
13)	Maximum working tension	50% of ultimate tensile strength	
		930	1373
14)	Weight in Kg. per Km		
a)	Aluminium.	23.82*6	35.51*6
b)	Steel.	68.75	102.48
c)	Conductor	214	319
15)	Resistance in ohms per Km at 20°C	3.265	2.19
16) a)	Continuous maximum current rating of conductor in still air at 32°C ambient temperature. Amps.	As per IS:398 – Part-2	
		157	200
b)	Temperature rise for the above current °C	As per IS:398 – Part-2 -30	
17)	Modulus of elasticity of conductor	79 GN/m ²	
18)	Coefficient of linear expansion per degree centigrade of		
a)	Aluminium strand.	23 x 10 ⁻⁶	
b)	Steel strand.	11.5x 10 ⁻⁶	
c)	Conductor	19.1x 10 ⁻⁶	



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

TECHNICAL SPECIFICATION

ACSR RABBIT & RACCOON CONDUCTORS

Doc. #: **SCM-SPEC/XH/ACSR Rabbit & Raccoon Conductors**

Rev.#: 0

Effective Date 15/12/2021

19)	Percentage of carbon in steel wire rods.	0.5 to 0.85%	
20)	Standard length of each piece in Km.	1000 mts and above	
21)	Tolerance, if any, on standard length.	800-1000 mtrs short length to a maximum of 5%	
22)	No. of standard lengths in one reel.	2 or 3	
23)	Dimensions of the reel in cms.	122 *60*71cm	
24)	Weight of the conductor in one reel in Kg.	1100+/- 10%	
25)	Weight of the reel in Kg.	200kg Approximate	
26)	Gross weight of the reel including weight of the conductor.	Approx.1400 kg	
27)	Standard according to which the conductor will be manufactured and tested.	IS:398 (Part-2):1996	
28)	Lay ratio.	Min10 and Max.14	
	Mini. Max.		
29)	Diameter of strands in mm		
	Aluminium		
	a) Nominal	3.35	4.09
	b) Minimum	3.32	4.05
	c) Maximum	3.38	4.13
	Steel		
	a) Nominal	3.35	4.09
	b) Minimum	3.28	4.01
	c)Maximum	3.42	4.17
30)	Calculated maximum D.C resistance at 20 ^o C for Aluminium wires.	3.265	2.194
31)	Approximate calculated breaking load of conductor KN.	18.25	26.91
32)	Number of twists, which the steel wire can	Before – 18 – After -16	



SUPPLY CHAIN MANAGEMENT

Thiruvananthapuram

TECHNICAL SPECIFICATION

ACSR RABBIT & RACCOON CONDUCTORS

Doc. #: **SCM-SPEC/XH/ACSR Rabbit & Raccoon Conductors**

Rev.#: 0

Effective Date 15/12/2021

	withstand in the torsion test.	
33)	Minimum stress in the steel wire corresponding to 10% elongation in Kg/sq.mm	As per IS:398 (Part-2):1996
34)	Drum.	
	Constructional details:	
a)	Type of wood used.	Seasoned/ Soft Wood
b)	Number and thickness of plies forming the flange	2*32 mm
c)	No. and diameter of barrel bolts.	4 * 12mm
d)	Thickness of barrel battens in mm	38mm
e)	Thickness of external logging in mm	38mm
f)	Spindle hole diameter in mm.	90mm
g)	Details of protective wrapping.	Painting will be carried out and all protection as per IS:398 (Part02):1996
h)	Weight of the empty drum with protective wrapping and external loggings.	Approx. 250kg
i)	Standard to which the conductor drums conforms	IS:1778:1980 and latest amendment
j)	Licence No. and date for using ISI Certification (or mark if any)	
35)	Other particulars, if any	Nil

Sd/-

Chief Engineer (SCM)