

**PRODUCT MANUAL FOR
ALUMINIUM CONDUCTORS FOR OVERHEAD
TRANSMISSION PURPOSES PART 2
ALUMINIUM CONDUCTORS- GALVANIZED STEEL REINFORCED
ACCORDING TO IS 398 (PART 2):1996**

This Product Manual shall be used as reference material by all Regional/Branch Offices & licensees to ensure coherence of practice and transparency in operation of certification under Scheme-I of Bureau of Indian Standards (Conformity Assessment) Regulations, 2018 for various products. The document may also be used by prospective applicants desirous of obtaining BIS certification license/certificate.

1.	Product	:	IS 398 (PART 2):1996	
	Title	:	Aluminium Conductors, Galvanized Steel Reinforced for Overhead Transmission Purposes	
	No. of Amendments	:	3	
2.	Sampling Guidelines:			
a)	Raw material	:	EC Grade Aluminium rods	IS 5484
			Zinc	IS 209
b)	Grouping guidelines	:	Please refer ANNEX-A	
c)	Sample Size	:	Before Stranding	Aluminium Wire- 5m Steel Wire- 5m
			Stranded conductor	Min. 10m (stress-strain test) Min. 5m (Surface Condition test & Ultimate breaking test & all other tests)
3.	List of Test Equipment	:	Please refer ANNEX – B	
4.	Scheme of Inspection and Testing	:	Please refer ANNEX – C	
5.	Possible tests in a day	:	Please refer ANNEX – D	
6.	Scope of the Licence :			
	<p>“License is granted to use Standard Mark as per IS 398 (Part 2):1996 with the following scope:</p> <p>Aluminium Conductors, Galvanized Steel-Reinforced for overhead power transmission purposes, for sizes up to and including _____mm² (Nominal Aluminium Area)</p> <p style="text-align: center;"><i>and/ or</i></p> <p>Galvanized Steel wire for the core of ACSR, for sizes up to and including_____mm²”</p>			

ANNEX A**Grouping Guidelines**

1. IS 398 (Part 2): 1996 covers Aluminium conductors, Galvanized Steel reinforced used for Overhead Power transmission purposes. The standard also covers the requirements of Galvanized Steel wire for the core of ACSR.
2. For considering GoL/CSoL of ACSR, conductor of any size (Nominal Aluminium Area), preferably the largest in each group, intended to be covered in the license shall be drawn for testing.

Sl.no.	Group	Nominal Aluminium Area (mm²)
1	A	Up to and including 100
2	B	Above 100

3. Galvanized steel wires manufactured for cores of such Aluminium conductors shall be considered as a separate variety in the same License. For considering CSoL (or GoL if only this variety is applied for), galvanized steel wire of any size, preferably the largest intended to be covered in the Licence shall be tested.
4. The firm shall declare the sizes of conductors/ steel wires they intend to cover in the license. The scope of license may be restricted based on the manufacturing and testing capabilities of the manufacturer.
5. During the operation of the Licence, BO shall ensure that all the Varieties covered in the Licence are tested in rotation to the extent possible.

ANNEX B**List Of Test Equipment***Major test equipment required to test as per the Indian Standard*

Sl. No.	Test Equipment	Tests used in with Clause Reference	
		Cl. Ref.	Tests
1	Micrometer	14.1(d), 14.2(a), 14.2(b), 13.2	Measurement of Diameter
2	Vernier Callipers	14.1(f), 14.2(c), 13.3, 14.1(g), 14.2(d), 13.4.2, 14.1(a), 13.9 14.1(b), 13.10	Breaking Load Test, Test for Elongation, Surface Condition Test, Ultimate breaking load test
3	Steel Scale		
4	Tensile Testing machine		
5	Micro-Ohm Meter	14.1(j), 14.2(f), 13.6	Resistance Test
6	Torsion Testing Setup and tensile loads	14.1(g), 14.2(d), 13.4.1	Torsion Test
7	Mandrels	14.1(h), 14.2(e), 13.5	Wrapping Test
8	Wrap Tester		
9	Cold Chamber	14.1(k), 14.2(g), 13.7	Galvanizing Test
10	Stop Watch		
11	Burner with tripod		
12	Brush		
13	Burette with stand		
14	Weighing Balance		
15	Pipette		
16	Measuring Cylinder		
17	Beakers		
18	Conical Flask		
19	Thermometer		
20	Hydrometer		
21	Clean cotton cloth		
22	Vernier Callipers	14.1(c), 13.11	Stress-strain test
23	Steel Scale		
24	Tensile Testing machine		
25	Strain gOcte		
List of Chemicals for Galvanizing Test:			
Distilled Water, Naphtha or trichloroethylene or any other suitable organic solvent for washing, Alcohol, Antimony trioxide (Sb ₂ O ₃) or Antimony trichloride (SbCl ₃), Hydrochloric acid (sp. gr 1.16), Technical Grade Copper Sulphate Crystals, Copper Carbonate (Laboratory Grade) Or Copper Hydroxide (Laboratory Grade)			

The above list is indicative only and may not be treated as exhaustive.

ANNEX C

Scheme Of Inspection And Testing

1. LABORATORY - A laboratory shall be maintained which shall be suitably equipped (as per the requirement given in column 2 of Table 1) and staffed, where different tests given in the specification shall be carried out in accordance with the methods given in the specification.

1.1 The manufacturer shall prepare a calibration plan for the test equipment.

2. TEST RECORDS – The manufacturer shall maintain test records for the tests carried out to establish conformity.

3. LABELLING AND MARKING – As per the requirements of IS 398 (Part 2):1996.

4. CONTROL UNIT – Every production length of Stranded conductor shall constitute a control unit.

5. LEVELS OF CONTROL - The tests as indicated in column 1 of [Table 1](#) and the levels of control in column 3 of [Table 1](#), shall be carried out on the whole production of the factory which is covered by this plan and appropriate records maintained in accordance with paragraph 2 above.

5.1 In case of galvanised steel wires manufactured for core of such conductors, only applicable tests on the steel wire shall be carried out.

5.2 All the production which conforms to the Indian Standard and covered by the licence should be marked with Standard Mark.

6. REJECTIONS – Disposal of non-conforming product shall be done in such a way so as to ensure that there is no violation of provisions of BIS Act, 2016.

Table 1

(1)			(2)	(3)				
Test Details			Test equipment requirement R: required (or) S: Sub-contracting permitted	Levels of Control				
Cl.	Requirement	Test Methods		No. of Sample	Frequency	Remarks		
		Clause	Reference					
Aluminium Wire Before Stranding								
7	Freedom from defects	7	IS 398 (Part 2)	-	-	If any sample fails in respect of any requirement, two more samples from the same bobbin shall be tested for that requirement and if there is any further failure in retesting, the bobbin shall be rejected.		
14.2(a)	Diameter	8.1.1, 13.2		R	One		Every bobbin of Aluminium wire drawn/ received.	
14.2(c)	Breaking Load	13.3		R				
14.2(e)	Wrapping Test	13.5.1		R				
14.2(f)	Resistance	13.6		R				
Steel wire before stranding								
6.2	Purity of Zinc	6.2	IS 398 (Part 2)	S	One	Each Consignment	#	
7	Freedom from defects	7		R	-	One	Each coil of Steel wire received/ drawn.	No further testing is required if Galvanized Steel wire is ISI marked. If any sample fails in respect of any requirement, two more samples from the same coil shall be tested for that requirement and if there is any further failure in retesting, the coil shall be rejected.
14.2(a)	Diameter	8.1.1, 13.2		R				
14.2(c)	Breaking Load	13.3		R				
14.2(d)	Ductility	13.4		R				
14.2(e)	Wrapping	13.5.2		R				
14.2(g)	Galvanizing	13.7		R				

(1)				(2)	(3)		
Test Details				Test equipment requirement R: required (or) S: Sub-contracting permitted	Levels of Control		
Cl.	Requirement	Test Methods			No. of Sample	Frequency	Remarks
		Clause	Reference				
Stranding							
9	Joint in wires	9.1-9.3	IS 398 (Part 2)	R	Complete length of stranded wires		
14.2(b)	Lay ratio	13.8, 10.2-10.5		R	One	Each Control Unit	
Stranded conductor							
14.2(a)	Size	8.2.1	IS 398 (Part 2)	R	One	Each Control Unit	
14.2(f)	Resistance	8.2.2, 13.6		S	One	Once in three years	For any one size, preferably the largest size of the conductor manufactured
14.1(a)	Surface condition test	13.9		S	One		
14.1(b)	Ultimate breaking load	13.10					
14.1(c)	Stress-strain test	13.11		As per agreement between purchaser and manufacturer.			

No further testing is required if accompanied with the Test Certificate or ISI marked.

Note-1: Sub-contracting is permitted to a laboratory recognized by the Bureau or Government laboratories empanelled by the Bureau.

Note- 2: Levels of control given in column 3 are only recommendatory in nature. The manufacturer may define the control unit/batch/lot and submit his own levels of control in column 3 with proper justification for approval by BO Head.

ANNEX D

Possible Tests in a day

1. Aluminium Wire

- (i) Freedom from defects
- (ii) Diameter
- (iii) Breaking load
- (iv) Wrapping test
- (v) Resistance

2. Steel Wire

- (i) Freedom from defects
- (ii) Diameter
- (iii) Breaking load
- (iv) Ductility test
- (v) Wrapping test
- (vi) Galvanizing test

3. Stranding

- (i) Lay Ratio
- (ii) Ratio of nominal dia. of Al to Steel Wire
- (iii) Joints in Wires

4. Complete Conductor

- (i) Size
- (ii) Resistance