

**PRODUCT MANUAL FOR  
ALUMINIUM CONDUCTOR FOR OVERHEAD  
TRANSMISSION PURPOSES — PART 5  
ALUMINIUM CONDUCTORS- GALVANIZED STEEL –REINFORCED  
FOR EXTRA HIGH VOLTAGE (400 kV AND ABOVE)  
ACCORDING TO IS 398 (Part 5):1992**

*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 licence/certificate.*

1.	<b>Product</b>	:	IS 398 (Part 5):1992	
	<b>Title</b>	:	Aluminium Conductors- Galvanized Steel –Reinforced for Extra High Voltage (400 kV and above), for Overhead Transmission Purposes	
	<b>No. of Amendments</b>	:	2	
2.	<b>Sampling Guidelines:</b>			
a)	<b>Raw material</b>	:		
b)	<b>Grouping guidelines</b>	:	Please refer <a href="#">ANNEX – A</a>	
c)	<b>Sample Size</b>	:	Before Stranding	Aluminium Wire- 5m Steel Wire- 5m
			Stranded Conductor	Corona & RIV test- 2x 5m (min.) + Breaking Load & Surface Condition test- 5m (min.) + all other tests- 5m
3.	<b>List of Test Equipment</b>	:	Please refer <a href="#">ANNEX – B</a> .	
4.	<b>Scheme of Inspection and Testing</b>	:	Please refer <a href="#">ANNEX – C</a> .	
5.	<b>Possible tests in a day :</b>	:	Please refer <a href="#">ANNEX-D</a>	
6.	<b>Scope of the Licence :</b>			
	<p>“Licence is granted to use Standard Mark as per IS 398 (Part 5):1992 with the following scope: “Aluminium Conductors-Galvanized Steel-Reinforced for Extra High Voltage overhead power lines (400 kV and above), for sizes _____mm<sup>2</sup> (Nominal Aluminium Area). <i>and/ or</i> Galvanized Steel wire for the core of ACSR, for sizes up to and including_____mm<sup>2</sup>”</p>			

**ANNEX A**

**Grouping Guidelines**

1. IS 398 (Part 5): 1992 covers Aluminium conductors-Galvanized Steel reinforced used for Extra High Voltage Overhead power lines (400 kV and above) with Nominal Aluminium area  $520\text{mm}^2$ ,  $560\text{mm}^2$  and  $690\text{mm}^2$ . 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 intended to be covered in the licence may be drawn for testing.
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 size of conductors/ steel wires they intend to cover in the licence. The Scope of Licence may be restricted based on the manufacturing and testing capabilities of the Manufacturer.
5. The Scope of Licence w.r.t the voltage may also be restricted based on the voltage(s) at which the Corona test has been carried out.
6. 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	13.1.2(b), 13.1.1(b), 13.3	Measurement of Diameter
2	Vernier Callipers	13.1.2(d), 13.1.1(d), 13.5, 13.1.2(e), 13.1.1(e), 13.6.2, 13.1.1(j), 13.10	Breaking Load Test, Test for Elongation, Surface Condition Test
3	Steel Scale		
4	Tensile Testing machine		
5	Micro-Ohm Meter	13.1.2 (g), 13.1.1(g), 13.8	Resistance Test
6	Torsion Testing Setup and tensile loads	13.1.2(e), 13.1.1(e), 13.6.1	Torsion Test
7	Mandrels	13.1.2(f), 13.1.1(f), 13.7	Wrapping Test
8	Wrap Tester		
9	Cold Chamber	13.1.2(h), 13.1.1(h), 13.9	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	Setup for Corona Test	13.1.1(k), 13.11	Corona Test
23	Setup for Radio Interference Voltage Test	13.1.1(m), 13.12	Radio Interference Voltage Test

**List of Chemicals for Galvanizing Test:**

Distilled Water, Naphtha or trichloroethylene or any other suitable organic solvent for washing, Alcohol, Antimony trioxide ( $Sb_2O_3$ ) 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 5):1992.

**4. CONTROL UNIT** – Every Standard 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					
<b>Aluminium Wire before Stranding</b>								
7	Freedom from defects	7	IS 398 (Part 5)	-	One	Every bobbin of Aluminium wire drawn	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	
8.1, 13.1.2(b)	Diameter	13.3		R				
13.1.2(d)	Breaking load	13.5.2		R				
13.1.2(f)	Wrapping test	13.7.1		R				
13.1.2(g)	Resistance	13.8		R				
<b>Steel Wire before Stranding</b>								
6.2	Purity of zinc	6.2	IS 398 (Part 5)	-	One	Each consignment	#	
7	Freedom from defects	7		-	-	One	Each coil of steel wire received	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 bobbin shall be tested for that requirement and if there is any further failure in retesting the bobbin shall be rejected
8.1, 13.1.2(b)	Diameter	13.3		R				
13.1.2(d)	Breaking load	13.5.2		R				
13.1.2(e)	Ductility test	13.6.1, 13.6.2		R				
13.1.2(f)	Wrapping test	13.7.2		R				
13.1.2(h)	Galvanizing	13.9		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				
<b>Stranding</b>							
9	Joint in Wires	9.1, 9.2	IS 398 (Part 5)	-	Complete length of stranded wires		
13.1.2(c), 10.2-10.5	Lay Ratio	13.4, 10.2-10.5		R	One	Each Control Unit	
<b>Complete Conductor</b>							
13.1.1(a), 13.1.2(a)	Visual Examination	13.2	IS 398 (Part 5)	-	Each Control Unit		
8.2	Size	8.2.1		R	One	Each Control Unit	
8.2	Resistance	8.2.2		R			
13.1.1	Breaking load test	13.5.1		S	One sample of each size	Once in a year	
13.1.1	Surface condition test	13.10		S			
13.1.1	Corona test	13.11		S			
13.1.1	Radio Interference voltage test	13.12		S			

# 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) Visual Examination
- (ii) Size
- (iii) Resistance
- (iv) Breaking load test
- (v) Surface condition test