



उत्पाद मैनुअल
रेटेड वोल्टेज 1 500 डी. सी. की फोटोवोल्टिक प्रणालियों के लिए इलेक्ट्रिक केबल

IS 17293: 2020 के अनुसार

PRODUCT MANUAL FOR

**ELECTRIC CABLES FOR PHOTOVOLTAIC SYSTEMS FOR RATED
VOLTAGE 1500 V D.C.**

ACCORDING TO

IS 17293: 2020

विभिन्न उत्पादों के लिए भारतीय मानक ब्यूरो) अनुरूपता मूल्यांकन (विनियम, 2018 की योजना -I के तहत प्रमाणन के संचालन में एकरूपता और पारदर्शिता के लिए इस उत्पाद मैनुअल का उपयोग सभी क्षेत्रीय / शाखा कार्यालयों और लाइसेंसधारियों द्वारा संदर्भ सामग्री के रूप में किया जाएगा। दस्तावेज़ का उपयोग बीआईएस प्रमाणन प्राप्त करने के इच्छुक संभावित आवेदकों द्वारा भी किया जा सकता है।

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.	Product	:	IS 17293 : 2020
	Title	:	Electric Cables for Photovoltaic Systems for Rated Voltage 1500 V d.c.
	No. of Amendments	:	Nil
2.	Sampling Guidelines:		
a)	Raw material	:	Annealed tinned Copper wire as per IS 8130
b)	Grouping guidelines	:	Please refer Annex – A
c)	Sampling Guidelines During Operation of Licence	:	- One FS shall be drawn once in five years for complete testing of the product* - One FS (except every fifth year) shall be drawn once in a year and tested for all test except – a. Thermal endurance Test – Annex – B & Table 11 b. Damp Heat, Smoke emission of complete cable, Weathering / UV resistance on sheath, Ozone resistance on complete cable, Assessment of Halogens (Insulation & Sheath) – Cl. 11.1 & Table 3 - The other FS shall be drawn annually for Acceptance tests only - Two Market samples to be drawn annually and tested for Acceptance tests only.
3.	Sample Size	:	100 m
4.	List of Test Equipment	:	Please refer Annex – B

5.	Scheme of Inspection and Testing	:	Please refer Annex – C
6.	Possible tests in a day	:	Please refer Annex – D
7.	Scope of the Licence		
	Licence is granted to use Standard Mark as per IS 17293:2020 with the following scope:		
	Name of the product	:	Electric Cables for Photovoltaic Systems for Rated Voltage 1500 V d.c.
	Nominal Cross – Sectional area	:	sqmm to upto and including sqmm
	Conductor Class	:	Class 5 / Class 2

*- Report of the Factory Sample drawn for complete testing by BIS is to be shared with the manufacturer. For this variety, manufacturer may not be insisted for complete testing as per SIT. However, manufacturer shall carry out complete testing for other varieties as per SIT.

ANNEX A

Grouping Guidelines

1. Electric Cables for Photovoltaic Systems for Rated Voltage 1500 V d.c. as per IS 17293:2020 are classified based on the following:
 - a. Cross – section area
 - b. Conductor Class
2. Samples of Cable for each conductor class to be tested for GoL / CSoL.
3. When a cable with higher cross sectional area is tested, all the cable with lower cross sectional area may be covered in scope of licence, subject to the condition that class of conductor, insulation and sheath materials remain same.
4. The Firm shall declare the varieties and sizes of Cables 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. 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	Vernier Callipers	5.3, 7, 11.1	Measurement of thickness & Outer Dia.
2	Steel Scale	11.1	Elongation, flammability
3	Micrometer	11.1	Measurement of Wire Diameter.
4	Measuring Microscope	5.3, 7, 11.1	Measurement of thickness (insulation & sheath) and hot deformation test
5	Graduated Magnifying Glass	5.3, 7, 11.1	Measurement of thickness (insulation & sheath) and hot deformation test
6	Tensile Testing Machine	11.1	Tensile Strength, Elongation Test & Annealing Test
7	Dumb-Bell Cutting Machine with Die	11.1	Tensile Strength & Elongation Test
8	Hot Air oven with thermostatic Temperature controller	11.1	Heat Shock, Hot Deformation & Shrinkage Test
9	Thermal Ageing Oven with Thermostatic Temperature controller, Air flow Meter & Hour Meter	11.1	Tensile Strength & Elongation After ageing, Loss Of Mass Test
10	Water Bath with thermostatic temperature controller, Stirrer & Hour Meter	11.1, 11.2, 11.4	Water immersion A.C. & D.C. Test, Insulation Resistance Constant/ Volume Resistivity Test
11	Mega ohmmeter	6.3, 7, 11.1, 11.2.3, 11.3.3	Insulation Resistance Constant/ Volume Resistivity Test
12	Smooth metal Mandrels	11.1	Cold Bend Test
13	Low temperature Impact Apparatus	11.1	Cold Impact Test
14	Hot Pressure Test Apparatus with Weights	11.1	Hot Deformation Test
15	Physical Weighing Balance with Weights	11.1	Persulphate Test, Flammability Test

16	Kelvin Double Bridge with galvanometer, D.C. Source	11.1	Conductor Resistance Test
17	Flammability Test apparatus with burner, Gas cylinder, Scale, Stopwatch & 0.71 mm copper wire	11.1	Flammability Test
18	Conditioning chamber & Refrigerator with Humidity Indicator	11.1	Tensile Strength, Elongation Test, Cold Bend, Cold Impact & Thermal stability Test
19	AC Spark Tester	11.2.2	Spark Testing
20	D.C. High Voltage Test set	11.1	D.C. High Voltage Test
21	Glass Thermometer	6.3, 7, 11.1, 11.2.3, 11.3.3	Conductor Resistance & Insulation Resistance Test
22	Balance Digital	11.1	Flammability Test
23	Stop Watch	11.1	Flammability Test
24	Test setup for Ozone Resistance Test	11.1, Annex G	Ozone
25	Tube Furnace, Quartz Combustion Tube, Porcelain combustion boat, Wash Bottles, Glass Tubing and Silicon Rubber Stoppers, Air Flow Meter, Reagents	11.1, Annex J	Halogen Acid Gas Evolution Testing
26	Smoke density test apparatus	11.1, Annex A	Smoke density rating test

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

ANNEX C

SCHEME OF INSPECTION AND TESTING

1. QUALITY ASSURANCE PLAN

1.1 It is expected that manufacturers (licensees/applicants) will implement a Quality Assurance Plan i.e. a plan of regular testing and in-process controls, designed to ensure that the product bearing the Standard Mark conforms to all requirements of the Indian Standard.

1.2 The manufacturers shall define a Quality Assurance Plan defining the control unit (i.e. lot/batch etc.) and the levels of control (i.e. the frequency and number of samples for conducting the different tests as per the Indian Standard) and submit the same to BIS Branch Office for information. The manufacturer shall comply with the same and maintain test records in accordance with para 2.4.

1.3 RECOMMENDED LEVELS OF CONTROL/CONTROL UNIT:

For the guidance of manufacturers, the recommended definition of control unit is: *Cables of continuous length extruded under similar conditions of production for same nominal cross-sectional area and class of conductor in a day* shall constitute a control unit.

1.3.1 For the guidance of manufacturers in preparing the Quality Assurance Plan, recommended levels of control are given in Table 1.

1.3.2 The manufacturer shall ensure inspection and testing as per the Quality Assurance Plan submitted by them on the whole production of the factory which is covered by this plan. Alternatively, the manufacturer has the option of adherence to the quality plan as per levels of control recommended in column 3 of Table 1.

1.4 However, all manufacturers shall ensure compliance of their products to all the requirements of the Indian Standard.

2. ENSURING COMPLIANCE THROUGH TESTING-

It is expected that manufacturers (licensees/applicants) will establish a suitably equipped and staffed in house laboratory (In house testing facility) for testing at least those parameters of the Indian Standard which require routine testing for ensuring quality of the product. This includes in-process controls as may be defined and put in place by the manufacturer and testing parameters/requirements which can only be performed in the factory.

2.1 For the guidance of manufacturers, Table 1 giving the recommended levels of control is given below. Column 2 of Table 1 indicates routine tests where test equipment is required in house as “R” or other tests which can be subcontracted as “S”. Subcontracting is permitted to BIS recognized/empanelled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025.

2.2 For MSME manufacturers, the requirement of maintaining a laboratory/in-house testing facility for routine tests (indicated as “R” in Column 2 of Table 1) is also optional.

2.2.1 MSME manufacturers may utilize common cluster based facilities as per guidelines for the utilization of cluster based test facilities by MSMEs or the provisions of Sharing of testing facilities or get testing done from BIS recognized/empaneled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025.

2.3 Large Scale manufacturers shall maintain an in-house laboratory equipped at least with test facilities for routine tests (indicated as “R” in Column 2 of Table 1), where different tests given in the specification shall be carried out in accordance with the method given in the specification. They shall also implement a calibration plan for the in-house test equipment.

2.3.1 Alternatively, in lieu of an in-house laboratory, large scale manufacturers can also utilize the provisions of Sharing of testing facilities as per the Guidelines for Grant of Licence available on BIS website www.bis.gov.in. (Under Conformity Assessment>Product Certification Process). Even for subcontracted tests, provisions for sharing of testing facilities can be utilized.

2.4 TEST RECORDS- The manufacturers maintaining an in-house laboratory or utilizing common cluster based facilities or shared test facilities shall maintain test records for the tests carried out to establish conformity. For the tests being subcontracted to BIS recognized/empaneled laboratory or any other laboratory having valid NABL accreditation as per IS/ISO/IEC 17025, test reports issued by the laboratories shall be available for inspection by BIS.

3. MARKING - The Standard Mark as given in the Schedule of the licence shall be incorporated legibly and indelibly on the insulation in case of unsheathed cables and on the sheath in case of sheathed cables either by printing, indentation or embossing, provided always that the material so marked conforms to each requirement of the specification.

3.1 Packing and Marking shall be done as per Cl. 12 of IS 17293: 2020.

3.2 Additional Marking requirements: The following additional marking requirement shall be marked on each of the packaging of the cables

“For BIS certification details please visit www.bis.gov.in”

4. HYGIENIC CONDITIONS (if applicable) – NA.

5. REJECTION - All the production which conforms to the Indian Standard and covered under the scope of this licence shall be marked with the Standard Mark. 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	Levels of Control		
		Test Methods		R: required (or) S: Sub-contracting permitted			
Cl.	Requirement	Clause	Ref		No. of Sample	Frequency	Remarks
4.1	Conductor		IS 8130	S	One	Each Consignment	No further testing is required if accompanied with Test Certificate or with BIS Standard mark
11	Requirements for Completed Cables						
4	Conductor						
Table 3	Resistance	Part 5	IS 10810	R	Firm to have adequate in-process controls to check compliance of this parameter as per the tolerances given in the Indian Standard. However, appropriate records shall be maintained by the manufacturer for evidence of conformity		
	Maximum diameter of wire in conductor	Part 4	IS 10810	R			
	Persulphate test	Method B of Part 4	IS 10810	R	One	For each consignment	
5	Insulation						
5.2	Insulation Application	5.2	IS 17293	R	One	Each Control Unit	

						Each Control Unit	
5.3	Insulation Thickness	5.3	IS 17293	R	One		
Annex – B & Table 11 (Cl. 5.1 & 6.1)	Tensile strength before ageing	Part 7	IS 10810	R	One		
	Elongation at break before ageing	Part 7	IS 10810	R	One		
	Tensile strength after ageing	Part 11	IS 10810	R	One	Cable of each size and manufactured in a year from same type of cross linked compound	If there is a change in material/manufacturing process, then additional tests has to be carried out
	Elongation at break after ageing				One		
	Hot set test (Insulation)	Part 30	IS 10810	R	One		
	Bending at low temperature	Part 20	IS 10810	S	One		
	Elongation at low temperature	Annex F	IS 17293	S	One		
	Compatibility test	Part 11	IS 10810	S	One		
	6	Sheath					
6.2	Sheath application	6.2	IS 17293	R	One	Each Control Unit	
6.3	Sheath Thickness	6.3	IS 17293	R	One		
6.4 11.3.1	Sheath Colour	6.4	IS 17293	R	One		
Annex – B & Table 11 (Cl. 5.1	Tensile strength before ageing	Part 7	IS 10810	R	One		
	Elongation at break before ageing	Part 7	IS 10810	R	One		

& 6.1)	Tensile strength after ageing	Part 11	IS 10810	R	One	Cable of each size manufactured in a year from same type of cross linked compound	If there is a change in material/manufacturing process, then additional tests has to be carried out
	Elongation at break after ageing				One		
	Bending at low temperature	Part 20	IS 10810	S	One		
	Elongation at low temperature	Annex F	IS 17293	S	One		
	Compatibility test	Part 11	IS 10810	S	One		
	Sheath resistance against acid and alkaline solution	Annex I	IS 10810	S	One		
7	Overall Dimension	7	IS 17293	R	Firm to have adequate in-process controls to check compliance of this parameter as per the tolerances given in the Indian Standard. However, appropriate records shall be maintained by the manufacturer for evidence of conformity		
8	Cable Identification	8	IS 17293	R			
11.3.2	Continuity of Marking	8.1	IS 17293	R			
8.1	Durability	8.2	IS 17293	R			
8.2	Legibility	8.3	IS 17293	R			
8.3	Core Identification	9	IS 17293	R			
9	Packing and Marking	12.1, 12.2, 12.3	IS 17293	R			
11.2	Electrical Tests						
11.3.3	Overall Diameters & Ovality	11.3.3 & Table 1	IS 17293	R	Firm to have adequate in-process controls to check compliance of this parameter as per the tolerances given in the Indian Standard. However, appropriate records shall be maintained by the manufacturer for evidence of conformity		
Table 3	Test for vertical flame propagation on complete cables	Part 53	IS 10810	R	One	Each Control Unit	
11.2.1	Voltage test on completed cable	11.2.1	IS 17293	R	One		
11.2.2	Spark Test	Part 44	IS 10810	R	One		

11.2.3	Measurement of Insulation Resistance	Table 1	IS 17293	R	One	Each Control Unit	
11.2.4	Long-term Resistance of Insulation d.c.	11.2.4	IS 17293	S	One	Cable of each size and each class of conductor manufactured in a year provided there is no change in material and manufacturing process	If there is a change in material/manufacturing process, then additional tests has to be carried out
11.2.5	Surface Resistance of Sheath	11.2.5	IS 17293	S	One		
Cl. 11.1 & Table 3	Cold impact test	Part 21	IS 10810	S	One		
	Cold bend test	Part 20	IS 10810	S	One		
Cl. 11.1 & Table 3	Ozone resistance on complete cable	Annex G	IS 17293	S	One		
	Weathering / UV resistance on sheath	Annex E	IS 17293	S	One		
	Dynamic penetration test	Annex D	IS 17293	S	One		
	Damp heat test	Annex H	IS 17293	S	One		
	Shrinkage test on sheath	Part 12	IS 10810	S	One		
	Smoke emission of complete cable	Part 63	IS 10810	S	One		
	Assessment of Halogens	Annex J	IS 17293	S	One		
Annex – B & Table 11 (Cl. 5.1 & 6.1)	Thermal endurance Test		IS 8504 (Part 1) and (Part 2)	S	One sample of each class of conductor for any size manufactured in five years provided there is no change in material and manufacturing process (Refer Note-3)		

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

Note-3: Report of the Factory Sample drawn for complete testing by BIS is to be shared with the manufacturer. For this variety, manufacturer may not be insisted for complete testing as per SIT. However, manufacturer shall carry out complete testing for other varieties as per SIT.

ANNEX D

Possible tests in a day

1. Dimensions
 - a. Maximum Conductor diameter
 - b. Overall dimensions
 - c. Ovality
 - d. Thickness of sheath and insulation
 - e. Insulation Application
 - f. Insulation Thickness
 - g. Sheath application
 - h. Sheath Thickness
 - i. Sheath Colour
 - j. Cable Identification
 - k. Continuity of Marking
 - l. Durability
 - m. Legibility
 - n. Core Identification
2. Persulphate test
3. Conductor Resistance
4. Tensile Test (before ageing)
5. Insulation Resistance Test
6. HV Test (at Room Temperature)
7. Flammability Test