PRODUCT MANUAL FOR ORIENTED UNPLASTICIZED POLYVINYL CHLORIDE (PVC-O) PIPES FOR WATER SUPPLY ACCORDING TO IS 16647 : 2017

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 16647 : 2017
	Title	:	ORIENTED UNPLASTICIZED POLYVINYL CHLORIDE (PVC-O) PIPES FOR WATER SUPPLY
	No. of Amendments	:	NIL
2.	**Sampling Guidelines:**		
a)	**Raw material**	:	a) PVC resin – Clause 5.1 of IS 16647 b) Additives – IS 10148
b)	**Grouping guidelines**	:	Please refer ANNEX – A
c)	**Sample Size**	:	5 pipes of 6 mtr length for complete test
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 :** Please refer ANNEX – E		

ANNEX A

Grouping Guidelines

1. Oriented Unplasticized Polyvinyl Chloride (PVC-O) pipes for water supply as per IS 16647 : 2000 are categorized into following groups for the purpose of GoL/CSoL:

a) ***Based on Size and Pressure rating classification of pipes***:

Pressure rating of Pipe	Working Pressure MPa	Group-1	Group-2	Group-3	Group- 4
PN 10	1.0	63-110	125-315	355-630	710 -1200
PN 12.5	1.25	63-110	125-315	355-630	710 -1200
PN 16	1.6	63-110	125-315	355-630	710 -1200
PN 20	2.0	63-110	125-315	355-630	710 -1200
PN 25	2.5	63-110	125-315	355-630	710 -1200

b) ***Based on pipe material classification and design coefficient***

Sl No	Material classification	Design coefficient (C)
1	450	1.4
2	450	1.6
3	500	1.4
4	500	1.6

c) ***Based on ends of pipe*** :

- Plain ended pipes
- Integrally Socketed for elastomeric sealing ring jointing

2. For considering GoL/CSoL, testing shall be done as follows:

a) Pipe of any size from each size group and Pressure rating shall be tested for all requirements to cover pipes of all sizes in that size group and pressure rating of pipe tested.

b) Separate pipes from each material classification and design coefficient (c) shall be tested to cover pipes with that particular material classification and design coefficient. However, if pipe from same material classification having higher design coefficient is tested, pipe of same material classification having lower design coefficient may also be covered in the scope of the licence.

c) Separate pipes for each ends shall be tested. However, if socket ended pipe is tested, plain ended pipe in that size group and pressure class may also be covered.

d) If plain ended pipe is covered in the licence and extension of Scope is requested for socket ended pipe, only applicable tests for socket shall be carried out.

3. The Firm shall declare the varieties of Pipes intended to be covered in the Licence. The Scope of Licence may be restricted based on the Manufacturing and Testing capabilities of the Manufacturer.

4. During the operation of the Licence, BO shall ensure that all the types and sizes 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.	Tests used in with Clause Reference	Test Equipment
1	Density (Clause 5.5)	- Balance - Thermometer - Demineralized water - Beaker - Corrosion resistant wire
2	Opacity (Clause 7.2)	- Opacity Test Apparatus - Standard sample of opacity 0.2 %
		or Apparatus for Test Method-2 - Source of light (halogen lamp 1000 W), - Photo-electric cell (with filter correction to match eye response), - Adjustable power arc or Incandescent lamp - Diaphragm and optical lens - Digital current meter. - Standard sample of opacity 0.2 %
3	Diameter (Clause 8.1.1)	- Vernier Calipers or outside calliper - Pi Tape or flexible tape
4	Wall Thickness (Clause 8.1.2)	- Dial Gauge Method or - Micrometer - Ultrasonic gauge
5	Effective length (Clause 8.1.3)	- Measuring tape
6	Dimension of Integral Socket (Clause 8.2)	- Vernier Caliper or Vernier depth gauge - Inside Caliper - Micrometer
7	Pipe Ends (Clause 8.3)	- Angle Protractor
8	Resistance to Hydrostatic Pressure (Clause 9.1)	- Hydrostatic pressure testing apparatus with pressuring unit and multiple outlets - Water bath with temperature control - Thermometer - End plugs
9	Resistance to external blows at 0 °C (Clause 9.2)	- Falling Weight testing machine from height 2000 mm - Striker of weight 0.25, 0.50 & 1.00 kg - Digital watch - Liquid bath or freezer for conditioning of samples

10	Ring Stiffness (Clause 9.3)	- Compression testing machine of constant rate of crosshead movement type with deflection indicator and force measuring arrangement and loading plates.
11	Orientation factor (Clause 9.4)	- Thermostatically Control oil bath or Hot air oven - Mono-polyethylene glycol, glycerol or mineral oil free from aromatic hydrocarbons - Vernier Calipers - Stop watch
12	Vicat Softening temperature (Clause 10, Table 13)	- Oil heating Bath equipped with means to raise the temperature at uniform rate of 50 ± 5° C/hr. with suitable stirrer. - Rod with loading plate, load and indenting tips - Micrometer dial gauge - Thermometer or temperature measuring equipment
13	Effect on water (Clause 10, Table 13)	- Distilled water - Air conditioner - pH meter - Testing reagent and equipment for determination of cadmium, mercury, lead, tin and other toxic substances.
14	Resistance to Di-chloromethane at a specific temperature (Degree of gelation) (Clause 10, Table 13)	- Chamfering machine - Glass or SS container with thermostatically heating and cooling arrangement with grating and lid, stirrer. - Fuming hood - Dichloromethane – AR grade
15	Alternate test to resistance to Di-chloromethane test - Uni-axial tensile test (Clause 10, Table 13)	- Tensile testing machine with load and extension indicator with adjustable speed - Micrometer
16	Short term pressure test for leak tightness of assemblies (Clause 11.2)	- Hydrostatic pressure testing apparatus with pressuring unit and multiple outlets Water bath with temperature control - Thermometer - End plugs - Frame work to allow angular deflection
17	Short term negative pressure test for leak tightness of assemblies (Clause 11.3)	- Hydrostatic pressure testing apparatus with vacuum pump and control device and multiple outlets and with isolation valve. - Water bath with temperature control - Thermometer - End plugs - Frame work to allow angular deflection

18	Long term pressure test for leak tightness (Clause 11.4)	- Hydrostatic pressure testing apparatus with pressuring unit and multiple outlets Water bath with temperature control - Thermometer - End plugs - End restraining device.
19	Sealing Ring (Clause 12)	- Vernier caliper - Micrometer - Radius gauge - Shore hardness tester

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 16647 : 2017.

4. CONTROL UNIT – Pipes of same size, material classification, pressure rating and design coefficient extruded from same compound 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 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				
5	**MATERIAL**						
	Polyvinyl Chloride Resin a) VCM Content b) K-Value	5.1 5.3 5.4	IS 16647 IS 10151 IS 4669	S	1	Each consignment	#
	Additives	5.1	IS 16647	S	1	Each consignment	#
5.5	Density	5.5	IS 16647 IS 12235 (Part 14)	R	1	Each control unit	-
5.6	**Material classification**						
	MRS Value	5.6.1 9.1.1 Table 10	IS 16647 IS 16465/ ISO 9080	S	1	Three months	Each material classification shall be tested once in a year
7	**GENERAL REQUIREMENTS OF PIPES**						
7.1	Visual Appearance	7.1	IS 16647	-	Each pipe	-	-
7.2	Colour	7.2	IS 16647	-	Each pipe	-	-
7.3	Opacity	7.3	IS 16647 IS 12235 (Part 3)	S	1	Once in three months	Thinnest wall thickness shall be tested $

8	**GEOMETRICAL CHARACTERISTICS OF PIPES**						
8.1	**DIMENSIONS OF PIPES**						
	Diameter	8.1.1 Table 3	IS 16647 IS 12235 (Part 1)	R	10	Each control unit	-
	Wall thickness	8.1.2 Table 4 to 8	IS 16647 IS 12235 (Part 1)	R	10	Each control unit	-
	Length	8.1.3	IS 16647	R	10	Each control unit	-
8.2	Dimensions of integral socket	8.2, Table 9	IS 16647	R	10	Each control unit	-
8.3	Pipe ends	8.3	IS 16647	R	10	Each control unit	-
9	**MECHANICAL CHARACTERISTICS OF PIPES**						
9.1	**RESISTANCE TO HYDROSTATIC PRESSURE**						
9.1.1	Pipes						
	For period 10 h at 27 °C	9.1.1 Table 10	IS 16647 IS 16465/ ISO 9080	R	1	Each control unit	-
	For period 1000 h at 60 °C	9.1.1 Table 10	IS 16647 IS 16462/ ISO 9080	R	1	Once in three month	One sample of each material classification and pressure rating shall be tested once in two year
9.1.2	Pipes with integral socket (For period 10 h at 27 °C)	9.1.2	IS 16647 IS 12235 (Part 8)	R	1	Each control unit	-
9.2	Resistance to external blows at 0°C	9.2	IS 16647 IS 12235 (Part 9)	R	Adequate pieces	Each control unit	-

9.3	Ring Stiffness	9.3 Table 12	IS 16647 IS 12235 (Part 18)	R	1	Each control unit	-
9.4	Orientation factor	9.4 Annex- E	IS 16647	R	3	Each control unit	*
10	**PHYSICAL AND CHEMICAL CHARACTERISTICS**						
	Vicat softening temperature	10, Table 13	IS 16647 IS 12235 (Part 2)	S	1	Once in three months	$
	Effect on water	10, Table 13	IS 16647 IS 12235 (Part 4) IS 12235 (Part 10)	S	1	Once in six months	Smallest size pipe produced shall be tested @
	Resistance to Di-chloromethane at a specific temperature (Degree of gelation)	10, Table 13	IS 16647 IS 12235 (Part 11)	R	1	Every 10 th control unit	Any one test to be carried out
	Uni-axial tensile test	10, Table 13	IS 16647 IS 12235 (Part 13)	R	1	Every 10 th control unit	
11	**MECHANICAL CHARACTERISTICS OF ASSEMBLIES INCLUDING JOINTS**						
11.1	**Assemblies with non – end - load bearing joints**						
11.2	Short term pressure test for leak tightness of assemblies	11.2 Table 14	IS 16647 IS 12235 (Part 8/ Sec 2)	R	1	Each control unit	-
11.3	Short term negative pressure test for leak tightness of assemblies	11.3 Table 15	IS 16647 IS 12235 (Part 8/ Sec 3)	R	1	Each control unit	-
11.4	Long term pressure test for leak tightness	11.4 Table 16	IS 16647 IS 12235 (Part 8/ Sec 4)	R	1	Every 10^{th} control unit	-

12	Elastomeric seals	12	IS 16647 IS 5382	S	10	Each consignment	#

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

$ Additional test shall be carried out whenever there is a change in formulation/composition. Sampling shall be done in such a way that pipes from all extrusion machine shall be tested once in a year.

@ Additional sample shall be tested whenever there is a change in formulation/composition. Pipes from each material classification shall be tested in one year.

* In case of failure, additional six samples from same control units shall be tested and control unit shall be accepted if all retested samples pass.

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

(i) Dimensions of pipes and socket (Clause 8)
(ii) Dimensions of elastomeric seal (Clause 12)
(iii) Pipe ends (Clause 8.3)
(iv) Visual appearance (Clause 7.1)
(v) Opacity (Clause 7.3)
(vi) Vicat softening temperature (Clause 10)
(vii) Density (Clause 5.5)
(viii) Hydrostatic characteristics – Acceptance test (Clause 11.2)
(ix) Short term negative pressure test for leak tightness of assemblies (Clause 11.3)
(x) Resistance to external Blows (Clause 9.2)

ANNEX-E

Scope of the Licence :	
"Licence is granted to use Standard Mark as per IS 16647 : 2017 with the following scope:	
Name of the product	ORIENTED UNPLASTICIZED POLYVINYL CHLORIDE (PVC-O) PIPES FOR WATER SUPPLY
Material classification	
Design coefficient (C)	
Class of pipes (Pressure rating)	
Nominal Size	
End of pipes	a) Plain ended pipes b) Integrally Socketed for elastomeric sealing ring jointing