भारतीय मानक

चिनाई और कंक्रीट वाले बाँधों में प्रयोग में आने वाले अनुप्रस्थ संकोच जोड़ों पर पी वी सी जल रोधक — विशिष्टि

Indian Standard

PVC WATER-STOPS AT TRANSVERSE CONTRACTION JOINTS FOR USE IN MASONRY AND CONCRETE DAMS — SPECIFICATION

ICS 23.040.45; 93.160

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

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Price Group 3

FOREWORD

This Indian Standard was adopted by the Bureau of Indian Standards, after the draft finalized by the Dams and Reservoirs Sectional Committee had been approved by the Water Resources Division Council.

The contraction joints in masonry and concrete dams provide passages through the dam which unless sealed, would permit the leakage of water from the reservoir to the downstream face. To check this leakage, water-stops are installed in the joints adjacent to the upstream face. The recent advances in the manufacturing of PVC have increased confidence in the use of this material for water-stops in dams. This standard has been formulated to cover the complete specification for PVC water-stops used in the masonry and concrete dams. The method of use of such water-stops has been covered in IS 12200 : 2001 'Code of practice for provision of water-stops at transverse contraction joints in masonry and concrete dams'.

There is no ISO standard on the subject. This standard has been prepared based on the data received from indigenous manufacturers' and also taking into consideration the practices prevalent in the field in India.

The Composition of the Committee responsible for the formulation of this standard is given in Annex E.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*).' The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

PVC WATER-STOPS AT TRANSVERSE CONTRACTION JOINTS FOR USE IN MASONRY AND CONCRETE DAMS — SPECIFICATION

I SCOPE

This standard covers the requirements for PVC water-stops used in masonry and concrete dams to check leakage of water.

2 REFERENCES

The Indian Standards listed below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards given below:

IS No.	*Title*
8543 (Part 4/Sec 1) : 1984	Methods of testing plastics : Part 4 Short term mechanical properties, Section 1 Determination of tensile properties
9766 : 1992	Flexible PVC compounds
13360 (Part 5/Sec 11): 1992	Methods of testing plastics : Part 5 Mechanical properties, Section 11 Determination of indentation hardness of plastics by means of durometer (Shore hardness)

3 PVC WATER-STOPS

3.1 Materials

The water-stop should be fabricated from a plastic compound, the basic resin of which shall be polyvinyl chloride. The compound shall contain additional resins, plasticizers, inhibitors or other materials such that when the material is compounded, it shall meet the requirements given in this standard.

3.2 Test Requirements

PVC water-stops shall meet the requirements specified in Table 1.

3.3 The colour of water-stops shall be black or white.

Table 1 Requirements for PVC Water-Stops

(*Clause* 3.2)

Sl No.	Characteristic	Requirements	Method of Test, Ref to
(1)	(2)	(3)	(4)
i)	Tensile strength, *Min*	13.8 Mpa	IS 8543 (Part 4/Sec 1)
ii)	Elongation, *Min*	285%	IS 8543 (Part 4/Sec 1)
iii)	Hardness (Shore A), *Min*	65	IS 13360 (Part 5/Sec 11)
iv)	Water absorption, percent by mass, *Max*	0.6	Annex A of this standard
v)	Cold bend temperature at which samples does not crack, *Min*	–25°C	Annex G of IS 9766
vi)	Accelerated extraction test:		Annex B of this standard
	a) Tensile strength, *Min*	10.3 Mpa	
	b) Elongation, *Min*	280%	
vii)	Stability in effects of alkalies test:		
	a) Weight increase at 7 days, percent by mass, *Max*	0.25	
	b) Weight decrease at 7 days, percent by mass, *Max*	0.10	
	c) Change in hardness at 7 days (Shore A)	± 5	Annex C of this standard
	d) Weight increase at 28 days, *Max*	0.40%	
	e) Weight decrease at 28 days, *Max*	0.30%	
	f) Dimension change	± 1%	

4 SHAPE AND DIMENSIONS

4.1 The cross-section of PVC water-stops shall vary depending upon the water head and site conditions. However a typical cross-section of PVC water-stops is given in Fig. 1.

NOTE — The length shall be as per user's requirement to ensure minimum number of joints.

4.1.1 *Tolerances on Dimensions*

The permissible to tolerance on width and thickness shall be as follows:

Width	—	± 10 mm
Thickness	—	+ 2 mm − 0

5 WORKMANSHIP AND FINISH

5.1 The surface of water-stop shall be ribbed. The outside edges shall be at the level of the central bulb.

5.2 The water-stops shall be free from blisters, pinholes, cracks and embedded foreign matters.

6 SAMPLING AND CRITERIA FOR CONFORMITY

The sampling procedure to be adopted and criteria for conformity shall be as given in Annex D.

7 PACKING

The water-stop shall be packed in coil form, the inside diameter of which shall not be less than 300 mm.

8 MARKING

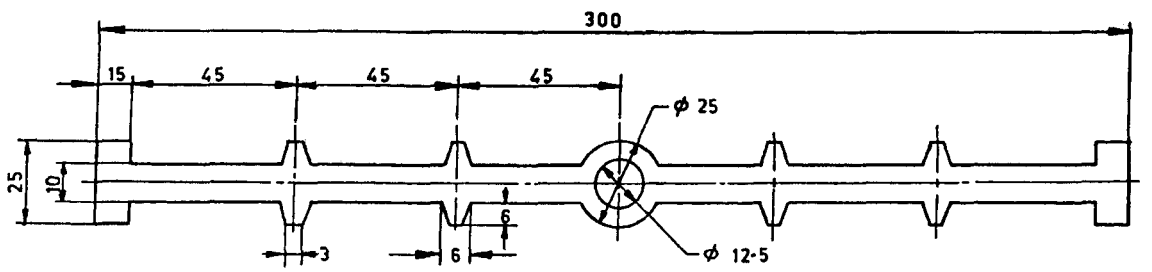
8.1 The water-stops shall be marked with the following information:

a) Size of the water-stops;
b) Name of manufacturer or trade-mark, if any; and
c) Month and year of manufacture.

8.2 BIS Certification Marking

The PVC water-stops may also be marked with the Standard Mark.

8.2.1 The use of the Standard Mark is governed by the provisions of the *Bureau of Indian Standards Act*, 1986 and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of the Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.



All dimensions in millimetres.

FIG. 1 TYPICAL CROSS-SECTION OF PVC WATER-STOP

ANNEX A

[*Table* 1, *Sl No.* (iv), *col* 4]

TEST FOR WATER ABSORPTION

A-1 TEST SPECIMENS

Three specimens shall be tested. The specimen shall be of size 50 mm × 20 mm and of full thickness. The specimen shall be taken from the flat portion between any two ribs of the water-stops.

A-2 APPARATUS

A-2.1 Balance, with an accuracy of ±1 mg.

A-2.2 Oven, capable of being controlled at 50 ± 2°C.

A-2.3 Containers, containing distilled water, or water of equivalent purity.

A-2.4 Desiccator

A-2.5 Vernier Caliper

A-3 PROCEDURE

A-3.1 Dry the specimens for 24 ± 1h in the oven controlled at 50 ± 2°C, allow to cool to ambient temperature in the desiccator and weigh each specimen to the nearest 1 mg (m_1). Then place the specimen in a container containing distilled water controlled at 27 ± 2°C.

A-3.2 After immersion for 24 ± 1 h, take the specimens out from water and remove all surface water with a clean, dry cloth or with filter paper. Re-weigh the specimens to the nearest 1 mg within 1 min of taking them out from water (m_2).

A-4 RESULTS

Calculate the water absorption for each specimen as a percentage by mass of initial mass, by the following formula:

$$= \frac{m_2 - m_1}{m_1} \times 100$$

where

m_1 = mass of dry specimen, and

m_2 = mass of specimen after immersion in water.

Take the average value of water absorption for three specimens.

ANNEX B

[*Table* 1, *Sl No.* (vi), *col* 4]

ACCELERATED EXTRACTION TEST

B-1 Conformance shall be determined on the average tensile strength and elongation values for 5 specimens that have been subjected to the accelerated extraction treatment.

B-2 The extraction treatment shall be done as follows:

a) The specimens shall be weighed and then totally immersed, in a solution consisting of 5.0 g CP (crystalline pure) sodium hydroxide and 5.0 g CP potassium hydroxide dissolved in a litre of distilled water. The solution, which shall be renewed daily, shall be maintained at 60-66°C and shall have air bubbled through it at the rate of approximately 380 bubbles per minute. After 14 days of this treatment, the specimens shall be removed daily, rinsed with water, surface dried, air dried for 10 min and weighed, and then placed again in a fresh solution maintained at 60-66°C temperature. The daily treatment shall be continued either for the period necessary for the weight to become constant (constant weight shall be assumed if the weight change in 3 consecutive days does not exceed 0.05 percent of original weight, or for a total period of 90 days (inclusive of first 14 days), whichever period is shorter.

b) After this treatment, tensile strength and elongation test shall be carried out as described in IS 8543 (Part 4/Sec 1).

ANNEX C

[*Table* 1, *Sl No.* (vii), *col* 4]

STABILITY IN EFFECTS OF ALKALIES TEST

C-1 Conformance shall be determined from the result of tests on specimens each 2.5 ± 0.2 mm thick, 20 mm wide and approximately 150 mm long. The number of specimens shall be such that the total weight of the specimen material is between 75 gm and 125 gm.

C-2 For the test the specimens shall be weighed together, not singly, to the nearest milligram. Hardness shall be measured in accordance with IS 13360 (Part 5/Sec 11).

C-3 The alkali treatment shall be done as follows:

The specimens shall be totally immersed in a solution consisting of 5.0 g CP (crystalline pure) sodium hydroxide and 5.0 g CP potassium hydroxide dissolved in one litre of distilled water. The solution shall be maintained at 21-24°C and shall be replaced every 7 days with fresh solution at the same temperature. At 7 and at 28 days the specimens shall be removed, rinsed with water, surface dried, air dried for 10 min, and then checked for changes in weight and dimension. At 7 days, it shall also be checked for any change in hardness. Weight changes shall be recorded as a percentage of the original weight and hardness change in durometer units.

ANNEX D

(*Clause* 6)

SAMPLING AND CRITERIA FOR CONFORMITY

D-1 SCALE OF SAMPLING

D-1.1 Lot

In a consignment all the PVC water-stops of the same size and colour manufactured under essentially similar conditions of production shall be grouped together to constitute a lot.

D-1.2 Samples shall be selected and tested from each lot separately for ascertaining its conformity or otherwise to the requirements of this specification.

D-1.3 The number of PVC water-stops to be selected at random from a lot for different tests shall depend upon the size of the lot and shall be in accordance with col 1 and 2 of Table 2.

Table 2 Scale of Sampling and Permissible Number of Defectives

No. of PVC Water-Stops in the Lot	For Dimensions, Workmanship and Finish		No. of Samples, for Hardness, Tensile Strength, Elongation, Water Absorption and Cold Bend Temperature Tests	No. of Samples, for Accelerated Extraction Tests and Stability in Effect of Alkali Tests
	Sample size	Permissible No. of Defectives		
N	*n*			
(1)	(2)	(3)	(4)	(5)
Up to 100	5	0	3	1
101 to 150	8	0	3	1
151 to 300	13	0	3	1
301 to 500	20	0	3	1
501 to 1 000	32	1	5	2
1 001 and above	50	2	8	3

D-1.3.1 The PVC water-stops to selected from the lot shall be chosen at random. In order to ensure the randomness of selection, random number tables shall be followed. In case random number tables are not available, the PVC water-stops may be selected from the lot in the following manner:

Starting from any PVC water-stops in the lot, the PVC water-stops shall be counted as 1.2.....,*r* and so on in one order, where *r* is the integral part of *N/n* (*N* and *n* being the lot size and sample size respectively). Every *r*th PVC water-stops thus counted shall be withdrawn to constitute the samples.

D-2 NUMBER OF TESTS AND CRITERIA FOR CONFORMITY

D-2.1 All the PVC water-stops selected according to **D-1.3** shall be examined for dimensions, workmanship and finish. Any PVC water-stops failing in one or more of these characteristics shall be considered as defective. If the number of defectives found in the sample is less than or equal to the corresponding permissible number of defectives given in col 3 of Table 2, the lot shall be declared as conforming to these requirements, otherwise not.

D-2.1.1 In the case of those lots which have been found unsatisfactory according to **D-2.1** all the PVC water-stops may depending upon the agreement between the purchaser and the supplier, be inspected for these characteristics and the defective ones removed.

D-2.2 The lot having been found satisfactory for workmanship, finish and dimensions according to **D-2.1** shall then be examined for hardness, tensile strength, elongation, water absorption and cold bend temperature tests. The number of samples to be taken for each of these characteristics is given in col 4 of Table 2 and they shall be selected from those already selected under **D-1.3** and if necessary, from the lot. For each of the characteristics the various tests shall be conducted on independent test pieces. The lot shall be declared as satisfactory if it satisfies the relevant requirements and none of the tests fails.

D-2.3 The lot which has been found satisfactory according to **D-2.2** shall then be subjected to accelerated extraction tests and stability in effect of alkali tests. The number of samples for each of the characteristics is given in col 5 of Table 2 and they shall be selected from those which have been tested and found satisfactory under **D-2.2**. The lot shall be declared satisfactory with respect to accelerated extraction tests and stability in effect of alkali tests if none of the test fails.

ANNEX E

(Foreword)

COMMITTEE COMPOSITION

Dams and Reservoirs Sectional Committee, WRD 9

Organization	*Representative(s)*
Central Water Commission, New Delhi	DR B. K. MITTAL (***Chairman***)
Bhakra Beas Management Board, Chandigarh	CHIEF ENGINEER (BHAKRA DAM) DIRECTOR (DESIGN) B&B DESIGN DIRECTORATE (*Alternate*)
Central Board of Irrigation & Power, New Delhi	SHRI S. P. KAUSHISH SHRI T. S. MURTHY (*Alternate*)
Central Soil & Material Research Station, New Delhi	DIRECTOR SHRI A. K. DHAVAN (*Alternate*)
Central Water & Power Research Station, Pune	SHRI R. M. KHATSURIA SHRI P. B. DEOLALIKAR (*Alternate*)
Central Water Commission, New Delhi	DIRECTOR (CMDD-NW&S) DIRECTOR RESERVOIR, OPERATION DIRECTORATE (*Alternate*)
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Indian Institute of Technology, New Delhi	HEAD OF THE CIVIL ENGINEERING DEPARTMENT
Irrigation & Waterways Directorate, Government of West Bengal, Kolkata	SHRI A. DASGUPTA SHRI H. P. CHAKRABARTI (*Alternate*)
Irrigation Department, Government of Andhra Pradesh, Hyderabad	CHIEF ENGINEER (I&CAD) SUPERINTENDING ENGINEER (DAMS) (*Alternate*)
Irrigation Department, Government of Haryana, Chandigarh	CHIEF ENGINEER (PROJECTS) DIRECTOR (ENGINEERING) (*Alternate*)
Irrigation Department, Government of Maharashtra, Nasik	SUPERINTENDING ENGINEER (MD) EXECUTIVE ENGINEER (MD-4) (*Alternate*)
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Irrigation Department, Government of Uttar Pradesh, Roorkee	CHIEF ENGINEER (DAM DESIGN) SUPERINTENDING ENGINEER (DAM DESIGN CIRCLE 1) (*Alternate*)
Jaiprakash Industries Ltd, New Delhi	SHRI D. G. KADKADE SHRI NARENDRA SINGH (*Alternate*)
Karnataka Power Corporation Limited, Bangalore	SHRI P. R. MALTI KARJUNA SHRI S. M. CHEBBI (*Alternate*)
Kerala State Electricity Board, Thiruvananthapuram	SHRI GEORGE CHERIYAN
Narmada & Water Resources Department, Government of Gujarat, Gandhinagar	CHIEF ENGINEER (MEDIUM & MINOR) AND ADDL SECRETARY SUPERINTENDING ENGINEER (CDO) (*Alternate*)
National Hydroelectric Power Corporation Ltd, Faridabad	SHRI K. S. NAGARAJA
National Institute of Hydrology, Roorkee	DR S. M. SETH DR P. K. MAHAPATRA (*Alternate*)
North Eastern Electric Power Corporation Ltd, New Delhi	SHRI UTPAL BORA
Public Works Department, Government of Tamil Nadu, Chennai	ENGINEER-IN-CHIEF CHIEF ENGINEER (*Alternate*)
Tehri Hydro Development Corporation, Noida	SHRI L. K. BANSAL
Water Resources Department, Government of Madhya Pradesh, Bhopal	SHRI A. K. RISHI DIRECTOR (DAMS) (*Alternate*)
BIS Directorate General	SHRI S. S. SETHI, Director & Head (WRD) [Representing Director General (*Ex-officio*)]

Member-Secretary
SHRI R. S. JUNEJA
Joint Director (WRD), BIS

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Review of Indian Standards

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