

## Part 642 – Specifications

### Chapter 3 – National Standard Material Specifications

#### Material Specification 537—Nonmetallic Waterstops

A. Scope

This specification covers nonmetallic waterstops for use in joints of concrete structures.

B. Classification

- (1) Classes—Nonmetallic waterstops shall be of the following classes, as specified:
  - (i) Class I shall be fabricated of either natural or synthetic rubber.
  - (ii) Class II shall be fabricated of vinyl chloride polymer or copolymer.
- (2) Types—Nonmetallic waterstops may be either split or solid and shall conform to the following types, as specified (see Fig. 537–1):
  - (i) Type A shall have ribbed anchor flanges and a smooth web. Flanges may be of uniform thickness or may have either a converging or a diverging taper toward the edges.
  - (ii) Type B shall have ribbed anchor flanges and a smooth web containing a hollow tubular center bulb having a wall thickness equal to at least one-half the web thickness, and the inside diameter (D) specified in the specifications or shown on the drawings. Flanges may be of uniform thickness or may have either a converging or a diverging taper toward the edges.
  - (iii) Type C shall have a single, circular bulb-type anchor flange at each edge and a smooth web.
  - (iv) Type D shall have a single, circular bulb-type anchor flange at each edge and a smooth web containing a hollow tubular center bulb having a wall thickness equal to at least one-half the thickness of the web, and the inside diameter (D) specified in the contract.
  - (v) Type E shall have ribbed anchor flanges and a web molded or extruded in the form of a round or U-shaped bulb of the dimensions specified in the contract or shown on the drawings. The web bulb shall be connected at the open-end of the U by a thin membrane having a minimum thickness of 1/64 inch and a maximum thickness of 1/5 of the web thickness and design to prevent infiltration of wet concrete into the bulb and to tear when expansion of the joint occurs. Flanges may be of uniform thickness or may have either a converging or a diverging taper toward the edges. Auxiliary positioning or nailing flanges may be provided as long as the functioning of the web bulb is not altered.
  - (vi) Type F shall have ribbed anchor flanges with at least two extra heavy ribs designed to resist displacement of the waterstop during concrete placement on each flange, and a smooth web having a positioning or nailing flange attached at the center.
  - (vii) Type G shall be of special design conforming to the details shown on the drawings.
- (3) Sizes—Waterstops of types A through F shall be of the sizes specified in the specifications or shown on the drawings and listed in Table 537–1 of this specification. Type G waterstops shall have the dimensions shown on the drawings.

Figure 537-1 Types of Nonmetallic Waterstops

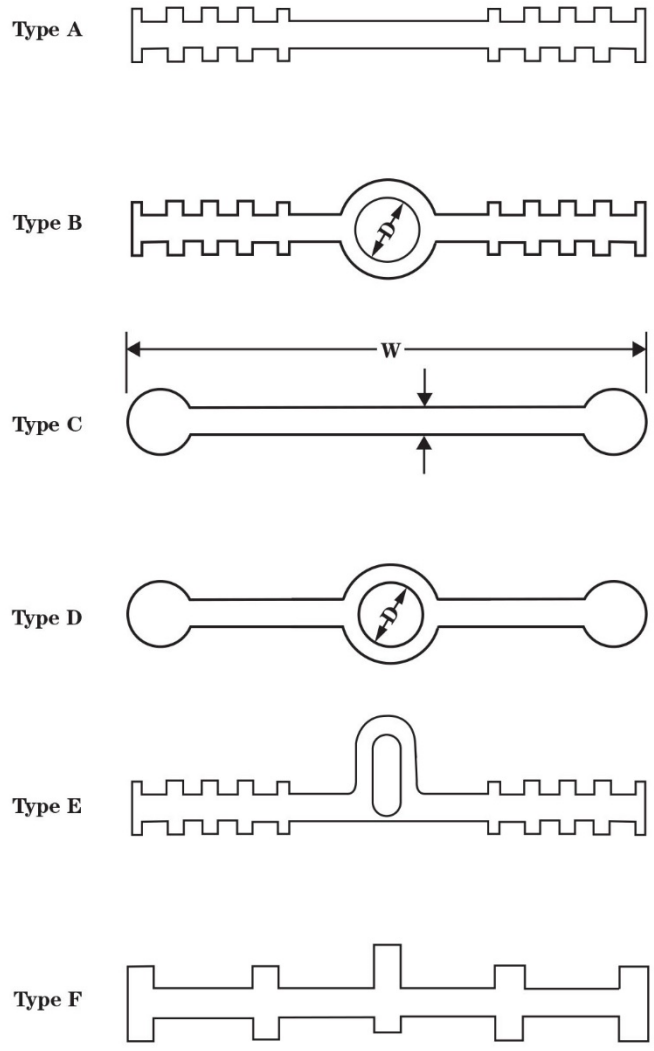


Table 537-1 Sizes of Waterstops

Size designation	Web thickness (T) (inches)	Width (W) (inches)
1	1/16	5 1/4
2	3/32	3 3/4
3	3/32	4
4	3/32	5 1/4
5	3/32	6
6	1/8	4
7	1/8	5 1/4
8	1/8	6
9	5/32	4
10	5/32	4 1/2
11	5/32	9
12	3/16	4
13	3/16	5
14	3/16	6
15	3/16	9
16	1/4	6
17	1/4	9
18	3/8	5
19	3/8	6
20	3/8	9
21	1/2	6
22	1/2	9
23	1/2	12

C. Physical Requirements

The extruded or molded material shall exhibit the properties specified herein when tested by the methods specified in section 4 of this specification.

D. Class I Waterstops

- (1) Hardness as determined by the Shore A durometer method shall be a minimum of 60.
- (2) Specific gravity shall be a maximum of 1.2.
- (3) Tensile strength shall be a minimum of 2,500 pounds per square inch.
- (4) Ultimate elongation shall be a minimum of 450 percent.
- (5) Compression set shall be a maximum of 30 percent.
- (6) Water absorption in weight measurements shall not exceed 5 percent.
- (7) Decrease in tensile strength and ultimate elongation after aging shall not exceed 20 percent.
- (8) There shall be no sign of failure due to brittleness at a temperature of minus 35 degrees Fahrenheit.

E. Class II Waterstops

- (1) Hardness as determined by the Shore A durometer method shall be a minimum of 60.  
Specific gravity shall be a maximum of 1.4.
- (2) Tensile strength shall be a minimum of 1,400 pounds per square inch.
- (3) Ultimate elongation of the web shall be a minimum of 280 percent, and the flanges shall be a minimum of 200 percent.
- (4) There shall be no sign of failure due to flange brittleness at a temperature of 0 degrees Fahrenheit nor of web brittleness at a temperature of minus 35 degrees Fahrenheit.
- (5) Decrease in either tensile strength or ultimate elongation after accelerated extraction shall not exceed 15 percent.
- (6) Results of alkali exposure:
  - (i) After immersion for 7 days, the sample shall exhibit no loss of weight and a maximum weight gain of 0.25 percent, and the hardness measured by the Shore A durometer method shall not vary more than 5 points either plus or minus from the untreated sample.
  - (ii) After immersion for 30 days, the sample shall exhibit no loss of weight and a maximum weight gain of 0.40 percent, and the dimensions of the treated sample shall not vary by more than 1 percent from the untreated sample.

F. Test Methods

- (1) Testing shall be conducted by the methods cited herein. All cited test methods are included in ASTM as follows:
  - (i) Hardness shall be determined by ASTM D2240.
  - (ii) Specific gravity shall be determined by ASTM D792.
  - (iii) Tensile strength shall be determined by ASTM D412 for Class I waterstops and ASTM D638 for Class II waterstops.
  - (iv) Ultimate elongation shall be determined by ASTM D412 for Class I waterstops and ASTM D638 for Class II waterstops.
  - (v) Compression set shall be determined by ASTM D395.
  - (vi) Water absorption shall be determined by ASTM D570.
  - (vii) Tensile strength and ultimate elongation after aging shall be determined by ASTM D412 for Class I waterstops and ASTM D638 for Class II waterstops.
  - (viii) Brittleness shall be determined by ASTM D746 for Class II waterstops.
- (2) Accelerated extraction shall be accomplished by procedures outlined by United States Army Corps of Engineers (USACE), Concrete Research Division (CRD) C572 under the following conditions:

- (i) Samples shall not be less than 1/16 inch nor more than 1/8 inch in thickness.
  - (ii) The immersion medium shall be a solution prepared by dissolving 5 grams of chemically pure sodium hydroxide and 5 grams of chemically pure potassium hydroxide in 1 liter of water.
  - (iii) The samples shall be immersed in the medium for 14 days at a temperature of 145 degrees Fahrenheit, plus or minus 5 degrees Fahrenheit.
  - (iv) During the period of immersion, air shall be gently bubbled through the medium from a 0.25-inch diameter glass tube at an approximate rate of one bubble per second.
  - (v) Fresh medium shall be provided each day.
  - (vi) Samples need not be dipped in acetone.
- (3) The effects of alkalis shall be determined by USACE CRD C572 under the following conditions:
- (i) Sample shall have a maximum thickness of 0.25 inch.
  - (ii) The immersion medium shall be as described for accelerated extraction above.
  - (iii) Fresh medium shall be provided every 7 days.
  - (iv) The samples shall be immersed in the medium for 30 days.
  - (v) Samples need not be dipped in acetone.

#### G. Condition

Waterstops shall be extruded or molded in such a manner that the material is dense and homogeneous throughout and free from voids, tears, thins, indentations, or other imperfections. Unless otherwise specified, waterstops shall be symmetrical in shape and uniform in dimensions and shall be furnished in continuous strips a minimum length of 50 feet. Factory splices shall have a minimum tensile strength of 50 percent of the unspliced section.

#### H. Packing and Storing

Waterstops shall be packaged and stored by methods that provide protection from prolonged exposure to direct sunlight and/or excessive heat.