



Design Guide for PVC Waterstops

Basic Use: PVC waterstops are designed for use in concrete joints subjected to hydrostatic pressure. Embedded in concrete, waterstops span the joint, forming a continuous, watertight diaphragm that prevents the passage of fluid.

In concrete structures, waterstops must be designed to accommodate joint expansion, contraction and other lateral and transverse movements. In addition to accommodating expected movements, the waterstop material must also be compatible with the concrete system and the liquids or chemicals contained in the structure.

Typical concrete structures requiring waterstops include: water and waste water treatment plants, reservoirs, locks, dams, canals, aqueducts, tunnels, storage tanks, foundations or any concrete structure where liquids are to be contained or controlled.

WATERSTOP SELECTION GUIDELINES

□ MATERIAL SELECTION

PVC SPECIFICATION GRADE WATERSTOPS (-40°F/-40°C) meet or exceed the performance required in the most stringent specifications, including the U.S. Army Corps of Engineers CRD-C-572-74.

The industry standard, PVC Specification Grade is manufactured from virgin materials, specially compounded to be tough, flexible, resilient, weather-resistant, unaffected by low temperatures or constant immersion in water and resistant to many chemicals. The product is easy to install and splice and can accommodate joint movements while preventing water movement through the joint.

PVC ARCTIC GRADE WATERSTOP (-58°F/-50°C) is specially formulated to retain its physical properties and performance in excessively cold environments.

TYPES OF CONCRETE JOINTS

- **Contraction Joints** are designed planes of weakness to control the location of cracks due to drying shrinkage of concrete.
- **Expansion or Isolation Joints** separate or isolate abutting concrete structures (walls, slabs, footings, columns), protecting them from compressive stresses that may be developed by thermal expansion, settlement, creep, live load deflections, drying shrinkage or crush. Differential movement at these joints can be both lateral and transverse.
- **Construction Joints** are determined by interruptions in the placement of concrete.

WATERSTOP DESIGNS FOR NON-WORKING JOINTS

◇ Ribbed Flat



Use where little or no movement is expected. Ribbed shapes provide a more watertight seal than dumbbell.

◇ Dumbbell



Use where little or no transverse movement is expected.

◇ Labyrinth®



Split form bulkhead not required. Use in vertical joints where little or no differential movement is expected. Horizontal joints may be difficult to form properly. Quality splicing is difficult at intersections and changes in direction.

◇ Base Seal



Use at joints of slab-on-grade or walls that will be back-filled. This design is easy to form and ensures accurate functional placement.

◇ Split



Eliminates split formwork in long straight runs. Do not use where design of the forms or location of reinforcing prohibits opening of the split flange. Quality splicing is extremely difficult at intersections and changes in direction.

WATERSTOP DESIGNS FOR WORKING JOINTS

◇ Ribbed with Center Bulb



The most versatile design available. The center bulb accommodates lateral, transverse and shear movement. Larger center bulbs accommodate greater movements mechanically without significantly stressing the material. Ribbed shapes provide a more watertight seal than dumbbell.

◇ Dumbbell with Center Bulb



Accommodates transverse, lateral and shear movements. Use 6 inch widths for joints up to 1 inch and 9 inch widths for joints up to 2 inch.

◇ Tear Web

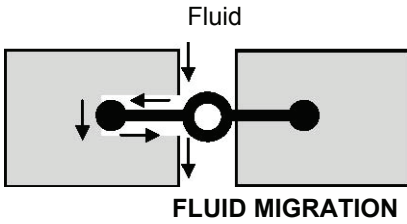


Use where large movements are expected. Tear web keeps concrete out of the bulb during concrete placement. Upon joint movement, the thin tear web ruptures allowing substantial mechanical deformation of center bulb without stressing the material.

PVC WATERSTOP DESIGN CONSIDERATIONS:

Waterstop failures are rarely the result of a ruptured waterstop due to hydrostatic pressure. Typically, a 3/8" thick PVC waterstop in a joint width of 1/2" can be calculated to have a safety factor of 17 when subject to 200 ft. of head pressure.

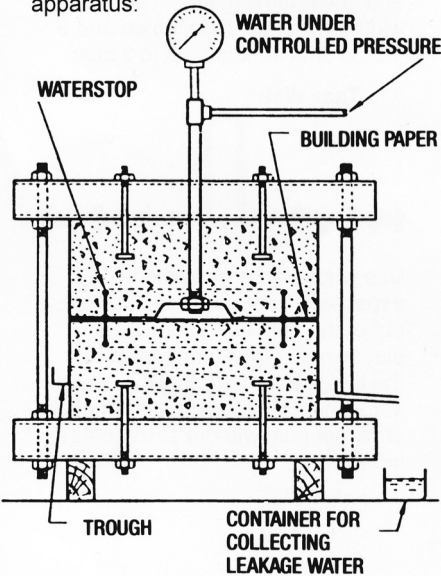
Failures are more commonly the result of fluid migration around the waterstop as shown.



This type of failure can only be predicted by testing and is affected by the following factors:

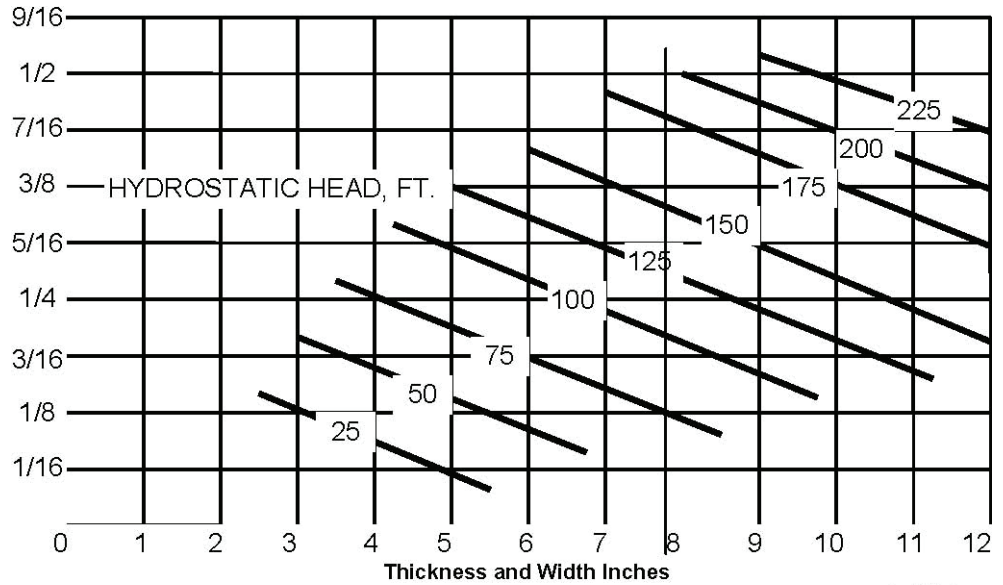
- Waterstop formula and profile
- Joint gap with waterstop in tension
- Quality of waterstop installation and splices
- Quality of concrete placement

Testing for this failure can be conducted using the following apparatus:



LEAKAGE TEST SETUP

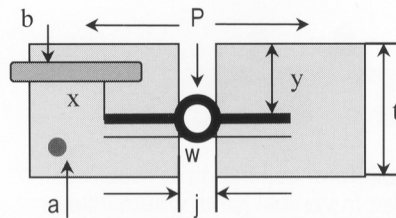
NON-METALLIC WATERSTOPS; SIZE VS. HYDROSTATIC HEADS



Adapted from Corps of Engineers "Waterstops and other joint materials" EM1110-2-2102

Based on test results for fluid migration, the U.S. Army Corps of Engineers recommends use of the conservative guidelines above for waterstop size selection.

Additional factors must be considered beyond fluid migration when selecting a waterstop. These factors include the thickness of the concrete, location of reinforcement and mix design. Follow the parameters shown below.



- a=largest aggregate size
- b=reinforcement
- w not greater than t
- d=differential movement
- ID ≥ d (conservative)
- w not less than 6a+j
- x not less than 2a
- y not less than .5(w-j)
- ID=inside diameter of centerbulb

Final selection is made after the following items have been determined:

- Type of concrete joint
- Direction and magnitude of movement
- Waterstop location in the joint
- Waterstop design and size

Sizes range from 4 to 12 inches in width and from 1/8 to 1/2 inch in thickness. Contact Vinylex Waterstop & Accessories for assistance in selecting the appropriate profile or to request a supplement illustrating the majority of profiles available.

FACTORY MADE FITTINGS: Vinylex PVC waterstop may be easily spliced in the field with a thermostatically controlled heating iron. However, experience has shown that field welded mitered fittings are seldom done correctly. For this reason, it is recommended that fittings be fabricated at our factory, leaving only straight butt splices for the field.

Ells, Tees and Crosses are available in vertical and flat styles.

ANCHORING: Waterstops should be properly positioned prior to concrete placement. Hog Rings or grommets, which are factory applied to the outermost edge of the waterstop provide the installer a convenient and economical means of wire tying the waterstop to adjacent reinforcement. This procedure should be required for all PVC waterstop installations.