

WATERSTOP CONNECTORS

This invention relates to waterstop connectors for joining together a waterstop of non-water swellable material such as plasticised polyvinyl chloride and a waterstop of a water swellable material.

Waterstops are used at joints in concrete structures to prevent the passage of water. Early waterstops were made from steel or copper strip, the latter often crimped to give greater flexibility. Composites of rubber with mild steel plates projecting from the rubber were also used. More recently strips of flexible water proof material, having two or more keying ribs extending along and projecting from the strip for keying the strip to the concrete at the two sides of the joint to be sealed have been used. Such waterstops are commonly made of a rubber or plastics material and the most widely used material is at present plasticised polyvinyl chloride. Even more recently waterstops of a hydrophilic or water swellable material have come into commercial use. These waterstops rely on the swelling capacity of the material on contact with water to prevent the passage of water at joints or discontinuities in a concrete structure. Materials which are used for water swellable waterstops include water swellable polyurethane elastomers, a combination of butyl rubber and sodium bentonite and rubber containing particles of a water swellable resin.

Water swellable or hydrophilic waterstops are unsuitable for use in expansion joints in concrete wall or floor structures because the rate and magnitude of movement of the structures exceed the performance of



the water swellable or hydrophilic material. When such materials are used it is necessary to use waterstops of non-water swellable material such as plasticised polyvinyl chloride or rubber at expansion joints and it is therefore necessary to provide some means of joining the two types of waterstop together to form a watertight joint.

Waterstops of non-water swellable material such as plasticised polyvinyl chloride or rubber are of two types, one usually called an internal waterstop or centrally placed waterstop having ribs or projections on two opposite faces of the strip and the other usually called an external waterstop or a rear fixed waterstop having ribs or projections on one face only.

The present invention relates to connectors for both internal or centrally placed waterstops and external or rear fixed waterstops.

According to the invention there is provided a waterstop connector for joining together two waterstops, one of a non-water swellable material and the other of a water swellable material the connector comprising a strip of flexible water swellable material having an open end comprising a pair of jaws interconnected by a throat, each of the jaws having a contact surface having a profile such that the jaws may be located around and contact a rib on a waterstop of non-water swellable material.

In one embodiment of the invention the contact surface of the jaws comprises two interconnecting sections, the first section adjacent the open end of the strip having a flat or preferably a substantially



convex surface and the second section comprising a notch, and the throat is recessed to maximise the opening capacity of the jaws.

The jaws of such a connector are suitable for contacting a rib on one face of an external or rear fixed waterstop of non-water swellable material.

In a preferred embodiment of the invention the contact surface of the jaws comprises four interconnecting sections, the first section adjacent the open end of the strip having a flat or preferably substantially convex surface, the second section comprising a notch, the third section having a flat surface and the fourth section having a substantially concave surface.

The connector of the preferred embodiment is suitable for making connections to both external or rear fixed waterstops and internal or centrally placed waterstops. Water stops usually have flanges at each end to prevent tearing through when the waterstop is fixed to concrete by nails hammered through the waterstop just inside the flanges. All of the contact surfaces of the jaws can be utilised to locate the jaws around and contact an end flange and two opposite ribs of a centrally placed waterstop, while the first and second sections can be utilised to locate the jaws around and contact a rib of a rear fixed waterstop.

Non-water swellable waterstops of rubber or polyvinyl chloride commonly have bulb shaped ribs, and the preferred embodiment of the invention is particularly adapted to location on and connection to such ribs.



When the surface of the first section of the contact surface of the jaws is flat the two surfaces may be parallel with each other or alternatively they may be such that the gap between them flares out towards the open end of the strip.

The notched surface of the second section may be a V-shaped notch or a substantially U-shaped notch.

The flat contact surfaces of the third sections of the jaws are preferably parallel with each other.

The surface of the throat is preferably arcuate and the surfaces of the fourth sections interconnect with the throat to form a substantially circular surface.

The water swellable material which is used to make the waterstop connector may be for example a rubber or flexible plastics material containing dispersed particles of a water swellable resin but the preferred material is a polyurethane elastomer which is produced preferably from an aliphatic or alicyclic polyisocyanate as an isocyanate component and which is rendered water-swellable due to the presence of hydrophilic groups within its chemical structure. Such polyurethane elastomers show a stable swelling ratio in water containing metallic ions and the ratio does not decrease in a long period of time, so that they show an excellent water stop effect. Such polyurethane elastomers are sold under the trade mark AQUAPRENE by Sanyo Chemical Industries, and are produced having a range of degrees of swelling and rate of swelling when



in contact with water. Among such polyurethane elastomers, one which has a swelling ratio of 1.2 - 2.5 times, is preferable.

If desired the strip of flexible water swellable material may have embedded in it spring steel wire in order to improve the performance of the connector by enhancing the ability of the connector to make contact with the ribs of the non water-swellable waterstop. Alternatively the same effect may be achieved by forming the strip as a laminate of two water swellable materials, one being harder than the other.

When the connector of the invention has been placed in position and the jaws are in contact with the rib the other end of the connector can be linked to a waterstop of water swellable by means of an adhesive bonding agent and the connector can be fixed to the concrete by nailing or by means of an adhesive bonding agent. When the jaws of the connector come into contact with water in use the connector material swells and a water impermeable seal is formed around the rib.

The invention is illustrated by way of example with reference to the accompanying drawings in which

Figure 1 is a plan view of a waterstop connector according to the invention

Figure 2 is an isometric section through the waterstop connector of Figure 1

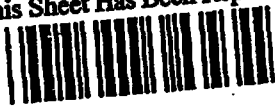


Figure 3 is a diagrammatic representation of a concrete wall expansion joint showing the use of the waterstop connector of Figures 1 and 2 to connect waterstops of water swellable polyurethane to a rear fixed plasticised polyvinyl chloride waterstop and

Figure 4 is a diagrammatic representation of a concrete wall expansion joint showing the use of the waterstop connector of Figures 1 and 2 to connect waterstops of water swellable polyurethane to a centrally placed plasticised polyvinyl chloride waterstop.

Referring to Figures 1 and 2 a waterstop connector consists of a strip 1 of flexible water swellable polyurethane elastomer having an open end 2 comprising a pair of jaws 3, 4, interconnected by a throat 5, each of the jaws 3, 4 having a contact surface 6. The contact surface 6 is made up of four sections, the first section adjacent the open end 2 having a convex surface 7, the second section having a U-shaped notch 8, the third section having a flat surface 9 and the fourth section having a concave surface 10.

Referring to Figure 3 a concrete wall 11 has an expansion joint 12 filled with closed cell joint filler sealed with an elastomeric sealant. Two sections of water swellable polyurethane elastomer waterstop 13, 14 are located on the upper surface of the wall 11, one on each side of the joint 12 and are fixed into position by adhesively bonding or nailing. A plasticised polyvinyl chloride waterstop 15 having four bulb shaped ribs 16, a central flat top box 17 to allow movement to be accommodated in the joint and to provide



a seating to support the joint filler and end flanges 18 is located vertically at the rear of the wall 11. Two waterstop connectors 19, 20 of the type illustrated in Figures 1 and 2 are located on the wall 11 so that the contact surfaces of the jaws 3,4 of each of the strips 1 are located around and contact a bulb shaped rib 16 on the polyvinyl chloride waterstop 15 and the closed ends 21, 22 of the connectors 19, 20 abut waterstop sections 13, 14. The connectors 18, 19 are fixed in position, on the wall 11 by adhesive bonding.

Referring to Figure 4 a plasticised polyvinyl chloride waterstop 23 is centrally placed across an expansion joint 24 filled with closed cell joint filler sealed with an elastomeric sealant in a concrete wall 25. The waterstop 23 has a central bulb 26 of hexagonal design, end flanges 27 and four ribs 28 on each face 29 of the waterstop 23. Two waterstop connectors 30, 31 of the type illustrated in Figures 1 and 2 are placed on the wall 25 so that the contact surfaces of the jaws 3, 4 are located around and contact end flange 27 and ribs 28. The closed ends 32, 33 of the connectors 30, 31 abut waterstop sections 34, 35 of water swellable polyurethane elastomer located on the wall 25 in line with waterstop 23.



CLAIMS



1. A waterstop connector for joining together two waterstops, one of a non-water swellable material and the other of a water swellable material, characterised in that the connector comprises a strip (1) of flexible water swellable material having an open end (2) comprising a pair of jaws (3, 4) interconnected by a throat (5), each of the jaws (3, 4) having a contact surface (6) having a profile such that the jaws (3, 4) may be located around and contact a rib on a waterstop of non-water swellable material.
2. A waterstop connector according to Claim 1, characterised in that the contact surface (6) of the jaws (3, 4) comprises two interconnecting sections, the first section adjacent the open end (2) of the strip (1) having a flat surface and the second section comprising a notch (8), and the throat (5) is recessed to maximise the opening capacity of the jaws (3, 4).
3. A waterstop connector according to Claim 1, characterised in that the contact surface (6) of the jaws (3, 4) comprises two interconnecting sections, the first section adjacent the open end (2) of the strip (1) having a substantially convex surface (7) and the second section comprising a notch (8), and the throat (5) is recessed to maximise the opening capacity of the jaws (3, 4).
4. A waterstop connector according to Claim 1, characterised in that the contact surface (6) of the jaws (3, 4) comprises four interconnecting sections, the first section adjacent the open end (2) of the strip (1) having a flat surface, the second section



comprising a notch (8), the third section having a flat surface (9) and the fourth section having a substantially concave surface (10).

5. A waterstop connector according to Claim 1, characterised in that the contact surface (6) of the jaws (3, 4) comprises four interconnecting sections, the first section adjacent the open end (2) of the strip (1) having a substantially convex surface (7), the second section comprising a notch (8), the third section having a flat surface (9) and the fourth section having a substantially concave surface (10).

6. A waterstop connector according to Claim 2 or Claim 4, characterised in that the flat first sections of the contact surface (6) of the jaws (3, 4) are parallel with each other.

7. A waterstop connector according to Claim 2 or Claim 4, characterised in that the gap between the flat first sections of the contact surface (6) of the jaws (3, 4) flares out towards the open end of the strip (1).

8. A waterstop connector according to any one of Claims 2 to 7, characterised in that the second section of the contact surface (6) on the jaws (3, 4) is a V-shaped or a substantially U-shaped notch (8).

9. A waterstop connector according to any one of Claims 4 to 8, characterised in that the flat third sections (9) of the contact surface (6) of the jaws (3, 4) are parallel with each other.



10. A waterstop connector according to any one of Claims 4 to 9, characterised in that the throat (5) has an arcuate surface and the surfaces (10) of the fourth sections interconnect with the throat (5) to form a substantially circular surface.

11. A waterstop connector according to any one of Claims 1 to 11, characterised in that the connector is made from a rubber or plastics material containing dispersed particles of a water swellable resin.

12. A waterstop connector according to any one of Claims 1 to 11, characterised in that the connector is made from a polyurethane elastomer having hydrophilic groups in its chemical structure.

13. A waterstop connector according to Claim 12, characterised in that the polyurethane elastomer has a swelling ratio in water of 1.2 to 2.5 times.

14. A waterstop connector according to any one of Claims 1 to 13, characterised in that the strip (1) has embedded within its spring steel wire.

15. A waterstop connector according to any one of Claims 1 to 14, characterised in that the strip (1) is in the form of a laminate of two water swellable materials, one being harder than the other.

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