

Waterstops



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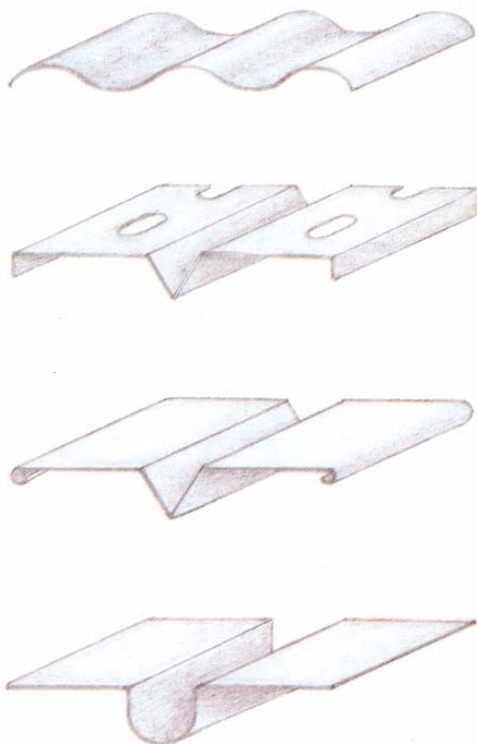
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Waterstop – a Definition

A strip of flexible, impervious material, cast into or against a joint in a concrete structure to provide a *PRIMARY SEAL* against the ingress or egress of water/liquids.

Waterstops - a History

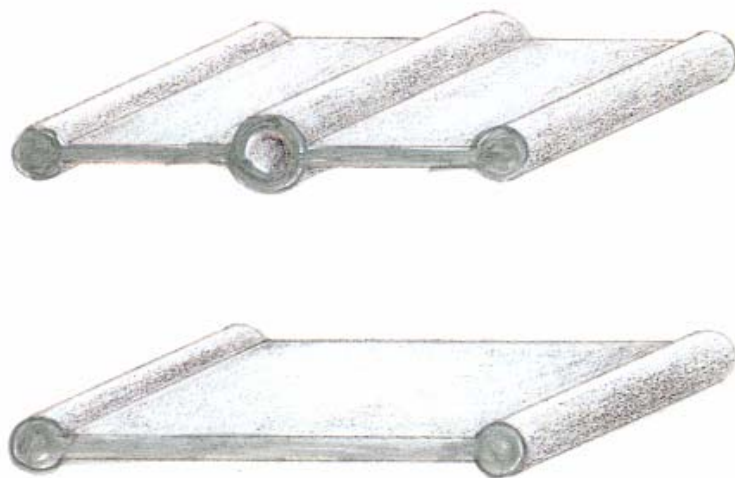


Earliest recorded use of waterstops was by the Romans.

Strips of lead, iron or copper were used.

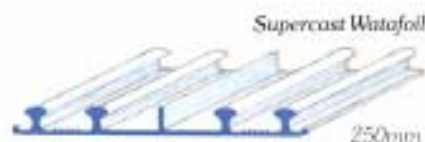
20th. Century Developments

rubber waterstops



First major waterstop was formed from natural rubber and used in the Hoover Dam in Colorado, USA, during the 1930's.

20th. Century Developments



Supercast Rearguard R

During 1950's a range of Pvc Waterstops made their first appearance.

Initially only centrally placed.

Later followed by an external range.

20th. Century Developments



The latest developments have been in the field of water swellable or ‘Hydrophilic’ waterstops.

Waterstops

Principle Features

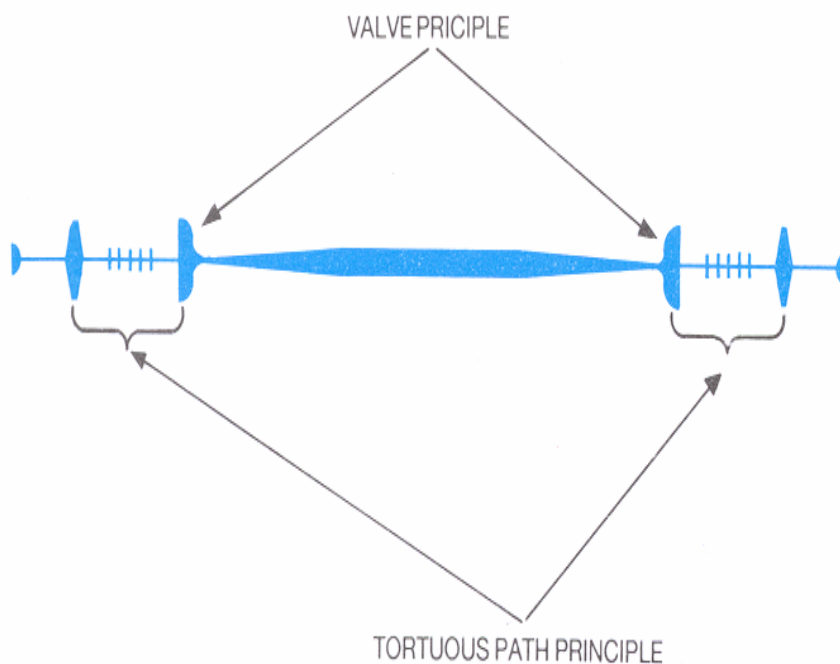
Forms integral part of the concrete.

Is installation friendly.

Is able to maintain position during placement and vibration of concrete.

Retains flexibility and elasticity necessary for the specific joint it is protecting.

Waterstops – how they work

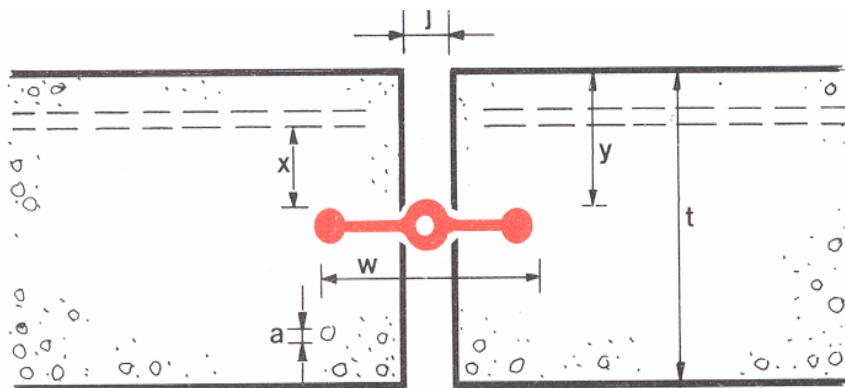


Pvc

Valve action

Tortuous path

Waterstops – how they work



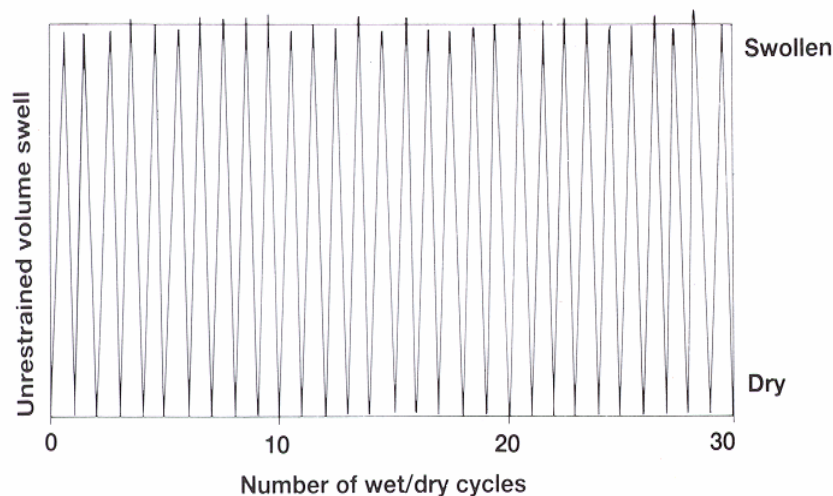
- 1 w not greater than t
- 2 w not less than $6a + j$
- 3 y not greater than $1/2 (w - j)$
- 4 x not less than $2a$

a = largest size aggregate

Rubber

Bonds integrally with
the concrete

Waterstops – how they work



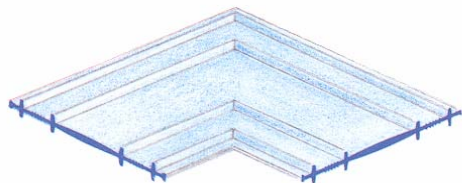
Graphic showing reproducibility of volume swell with wet/dry cycling

Hydrophilic

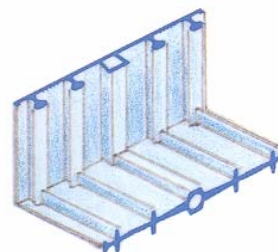
Swells in contact with water.

Must withstand repeated wet/dry cycling.

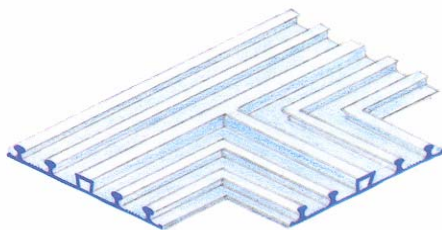
Waterstops - intersections



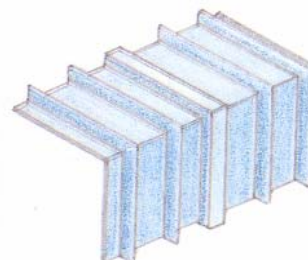
flat mitre



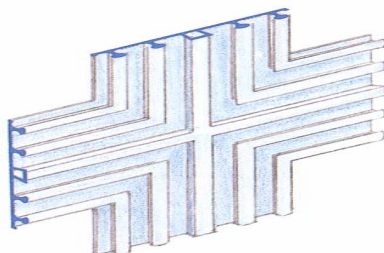
*90° mitre
on edge
(internal)*



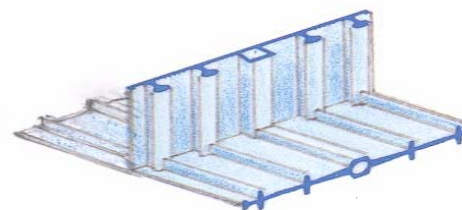
*3 way
on flat*



*270° mitre
on edge
(external)*



*4 way
on flat*



T-piece on edge

Waterstops – selection guide

Conventional movement joints	Pvc
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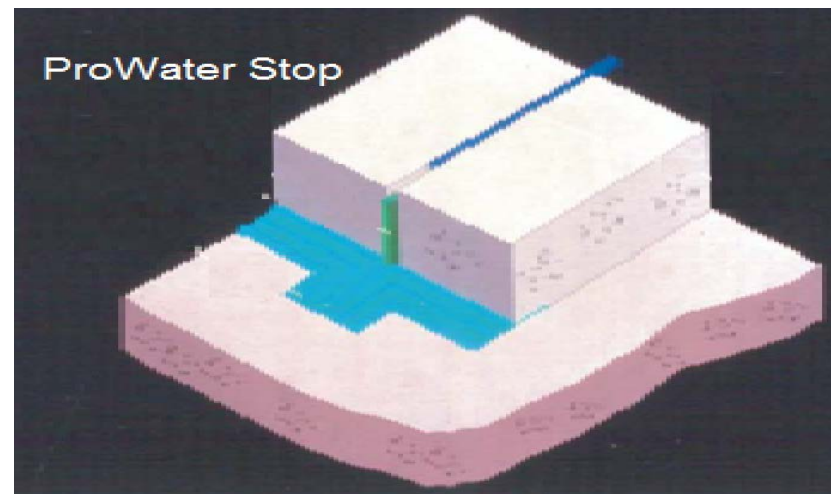
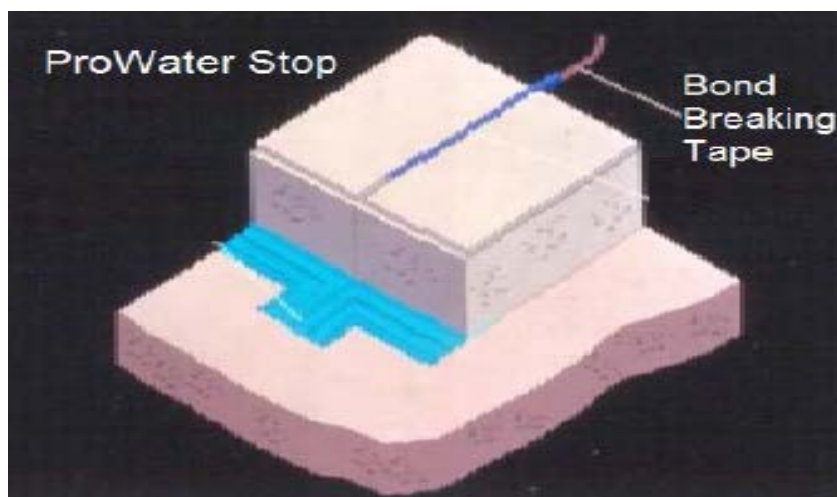
High movement/hydrostatic head	Rubber
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Complex shapes / repairs	Hydrophilic
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Typical Floor Details

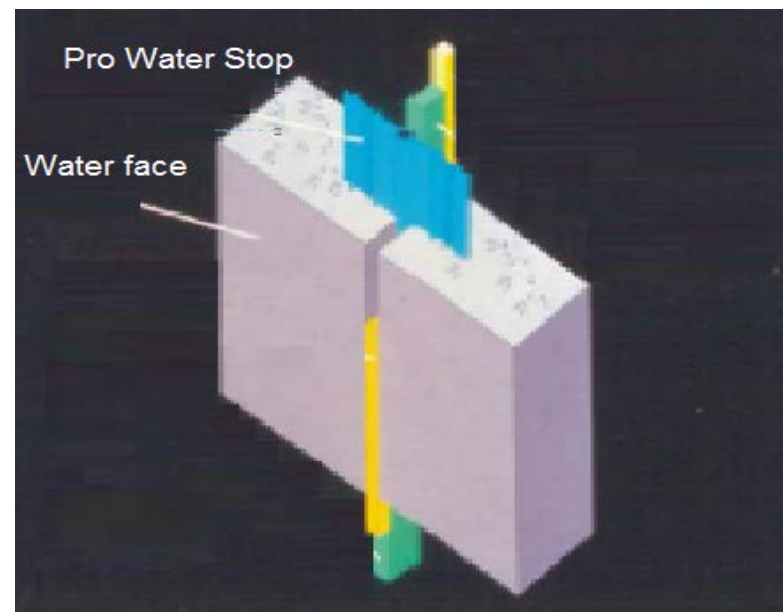
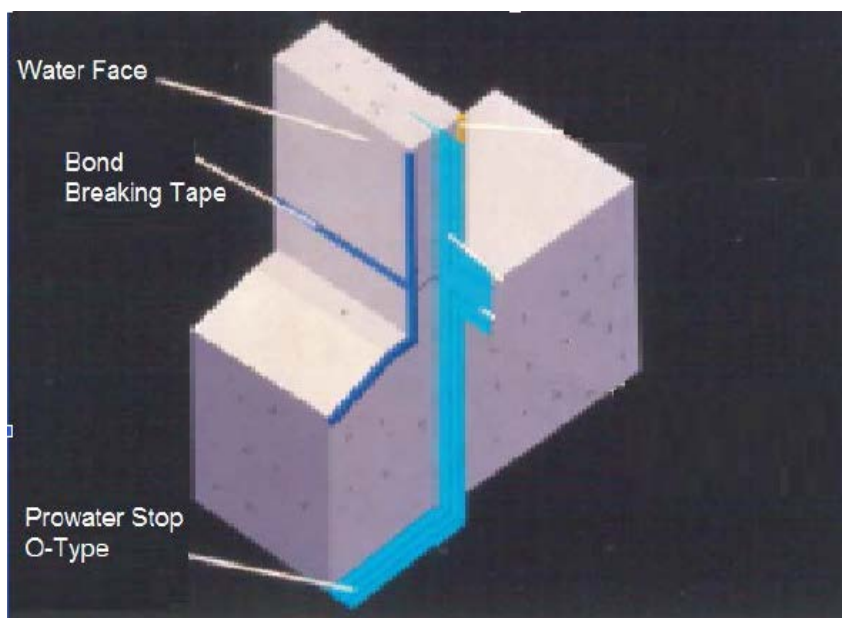
construction joint

expansion joint

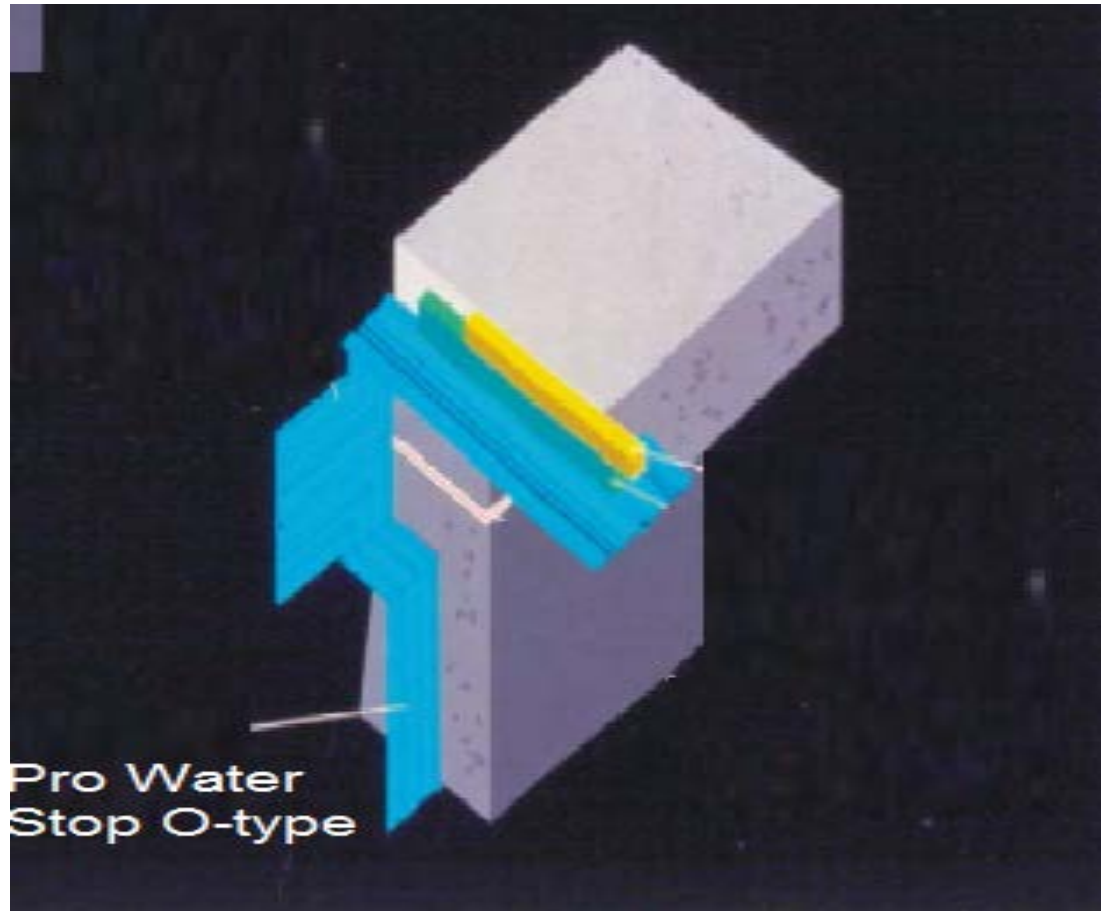


Typical Wall Details

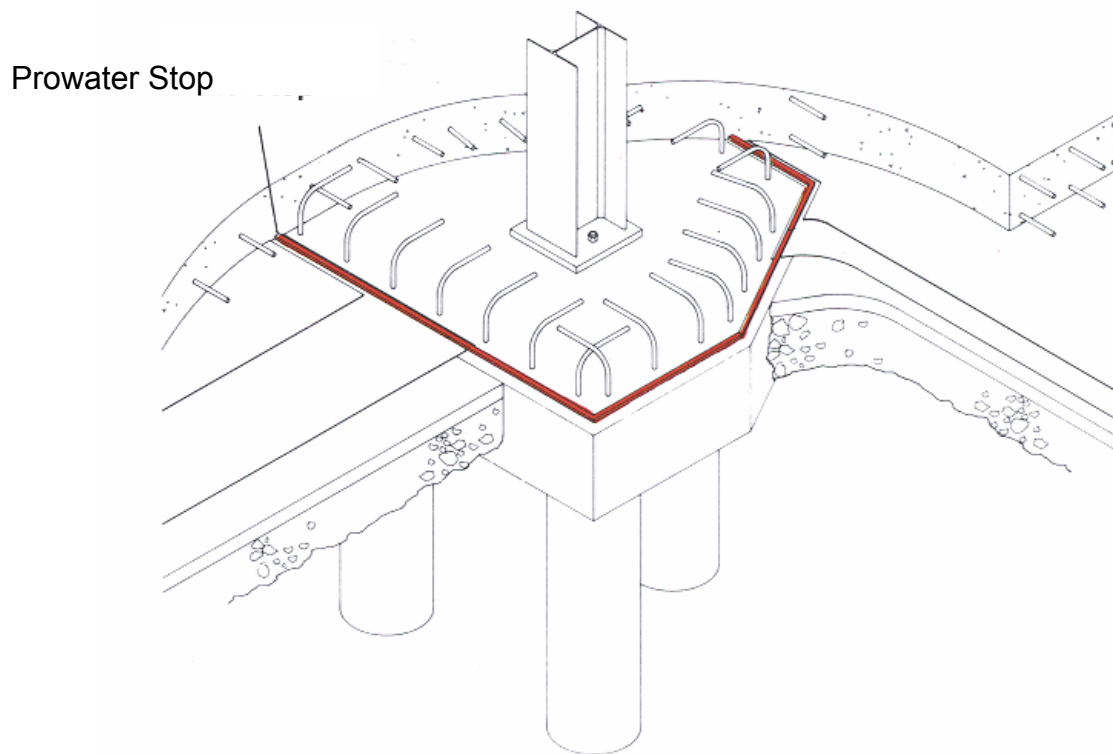
construction joint expansion joint



Typical sliding joint at roof



Waterstops – Typical Details



Pile cap detail using Prowater Stop

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■ A waterstop system is deemed to have failed if water gets past it from the positive pressure side to the 'neutral' side.

■ The possible causes of waterstop system failure may be listed as follows:

- Misplacement of waterstops during concrete pouring.
- Poor consolidation and compaction of concrete round waterstop profile.
- Failure of welds in P.V.C. at intersections or butt welds,
- Structural failure of P.V.C. due to large movements stressing P.V.C. beyond tensile strength limits.

From the onset it must be stressed that if we could analyze the causes of waterstop failure, on a percentage basis to any single cause (rather than a combination of two or more causes) it would be of the order :-

- | | | |
|----------------------|---|-----|
| ➤ Misallocation | - | 50% |
| ➤ Poor consolidation | - | 25% |
| ➤ Weld failure | - | 15% |
| ➤ Excessive Stress | - | 10% |

- It is therefore obvious that proper fixing of waterstop and concrete compaction can eliminate 75% of waterstop system failures.
- The pertinent question arises – How can a difference in waterstop profile help if 75% of the problems are not really waterstop, but concrete related?
- This is where the profile features show their advantages and benefits.



1. FEATURES – EYELETS IN DEDICATION FIXING LUG @ 500mm crs

This is a Pro Water Stop feature, enabling the waterstop to be properly and firmly located during concrete placement, a unique advantage over opposition plain profiles which have to be fixed by metal clips fixed to the outer flange or .bulb

In fixing these clips the outer flange is weakened and tensile stress often causes the clip to break away – taking a small piece of waterstop with it and leading to a total misplacement in the cured concrete.

We are therefore saying that this one feature, used properly, can probably prevent 50% of waterstop system failures.



2. FEATURE – DOUBLE FIXING LUGS AND TORTUOUS PATH

- On all Pro Water stop waterstop excepting the 150mm there are two fixing lugs .and a tortuous path feature
- Since we are saying that the second most common reason for waterstop system failure is poor contact between concrete and the P.V.C. of the waterstop it follows that the more lugs gripping the concrete the better (see valve principal Feature 3/). Prowater Stop has two – the plain profiles only one.
- In order to leak past the waterstop under pressure, water must be forced along a path round the profile. Since this leakage is pressure driven it follows that the longer this path the better. It is a geometric fact that the path length on Prowater Stop is 33% more than that of plain profile on 200mm and 250mm sizes! Effectively, if path length was the only consideration then 200mm Pro Water Stop is better than a 250mm plain profile.

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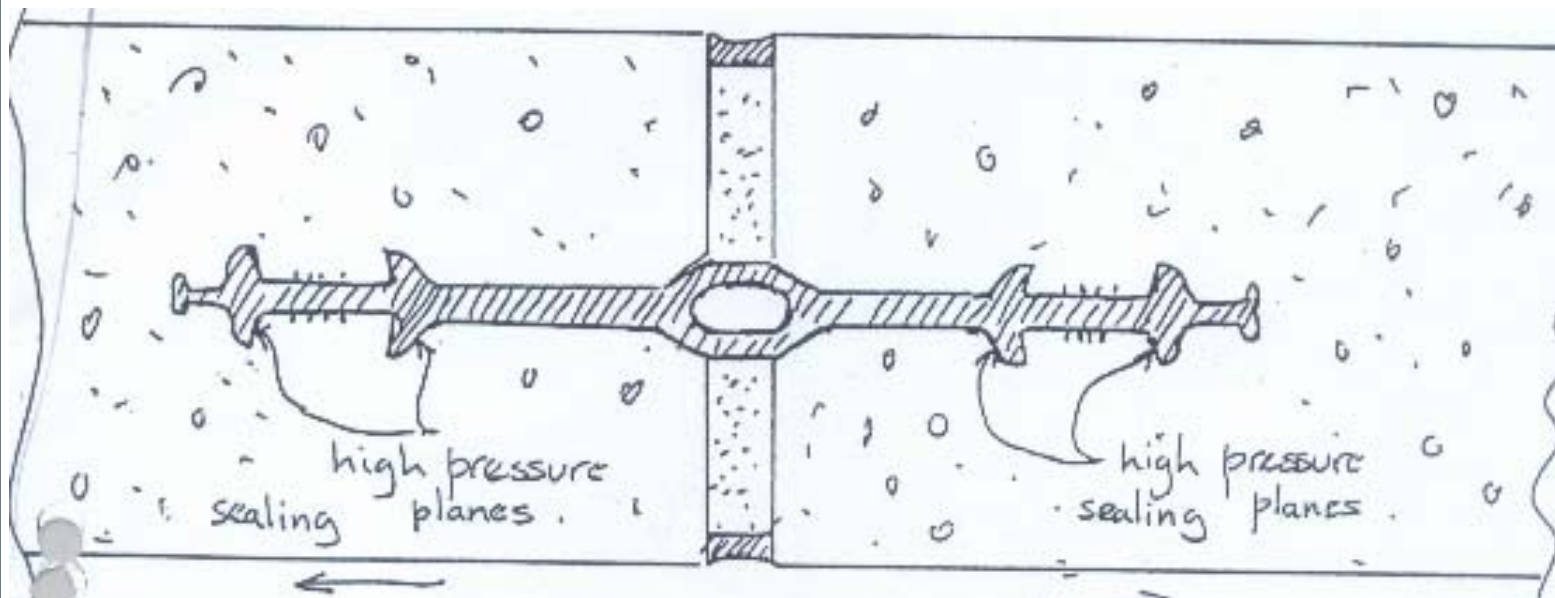


3. FEATURE – DOUBLE FIXING LUGS AND VALVE PRINCIPAL

- All waterstops rely on the ‘Valve Principal’ for their operation, but this is the predominant of the Pro water stop profile. This briefly means that the fixing lugs operate as valves when the concrete joints open and close by sealing on their inside faces during opening movements of concrete and on their outside faces during closing concrete movements. Since the inner lugs are closer to the source of the stress they act as valves more than outer lugs which, though partly acting as valve lugs are more ‘anchoring’ in their function.

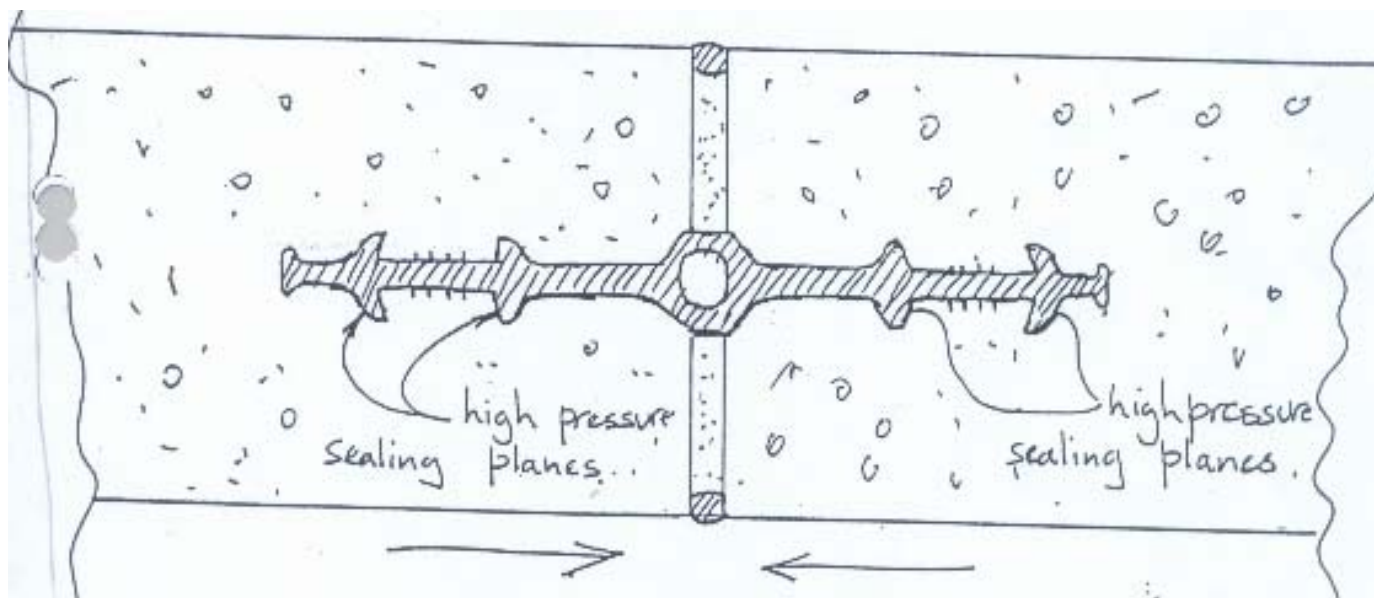
Feature :3

VALVE PRINCIPLE DURING JOINT OPENING



Pro Water stop in tensile state

VALVE PRINCIPLE DURING JOINT CLOSING



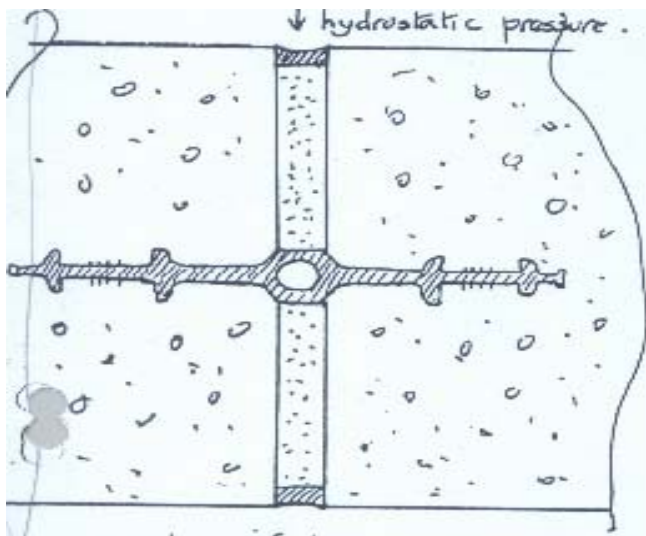
Pro Water Stop in compressive state

Thus the additional benefit of the double lugs, apart from increasing the water path, is to provide an additional ‘valve principal’ action, thereby increasing the chances of a watertight joint, even if the concrete compaction is poor closer to the joint plane.

FEATURE – SQUARE OUTER PROFILE ROUND CENTRE BLUB

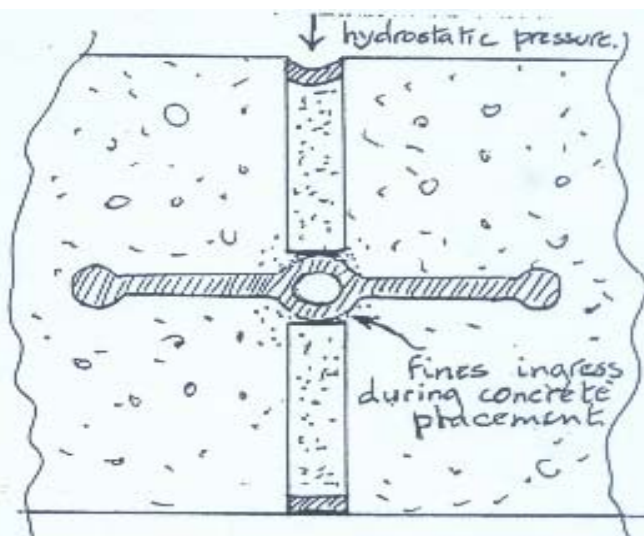
This feature enables joint formers to fit snug and tight to the flat on the outer profile of the centre bulb.

Prowater Stop



Sealant failure unlikely

PLAIN PROFILE



Sealant failure very likely

The advantage of this feature is that it spreads hydrostatic pressure over the whole face of the joint former, allowing the joint former to support the sealant as it should. If the hydrostatic load is applied to a curved surface as in the case of plain profiles, then the deformation of the joint former is often such that the sealant (the first line of water defense in the joint) deforms sufficiently to fail, either in adhesion sheer or cohesively because its elastic limit is exceeded.

A further advantage of the square profile is that it does not allow a recess for concrete fines ingress during concrete placement. This ingress, when set, inhibits the movement of the bulb during cyclical flexing of the expansion joint causing undue stress in the P.V.C. which could easily lead to failure of in the bulb area.

Product Data Sheet
Edition 07.2014
Identification No. JT - 28



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WATERSTOP

Flexible PVC Waterstop For Construction And Expansion Joints

Description

Flexible PVC (Thermoplastic) water-stops to seal contraction, construction and expansion joints in concrete structures. Waterstops are available in different sizes and area-selections, depending on their use.

WATER STOP is complying with to A.S.T.M D-412, D-624, D-746, D-2628 and B.S.2571, B.S.2782

Where to use

WATER STOP is used in concrete for the sealing of contraction, construction and expansion joints and differs from actual sealant in that it is already installed in its pre-planned position when the concrete is made, taking up its function as sealing material as seen as the concrete has hardened. Depending on the type of Waterbar it can be used for contraction, construction and very small expansion joints or, for joints of medium to large expansion.

Advantages

Multi-rib selection, providing tortuous and impenetrable water checks. Clips facilitate easy fixing. Material and cross-section allow extremely easy on site welding. PROKEM quality is in high strength polyvinyl chloride material. Steel reinforced WATER STOP is also available on request.

P.V.C. Waterstop is resistant to Sea water, Salt solution, Potable and Sewage water

Properties

Type	P.V.C.
Colour	yellow, blue
Specific gravity	1.3
% elongation at break	>500%
Service temp.	-35° C – +65° C

How to use

Application

Welding

•Waterstops are made from thermoplastic PVC and can therefore be welded. The ends are heated with a welding equipment until the PVC gets plastic and then immediately pressed together.

•Pro-Waterstops are allowing a easy on site welding, including the prefabrication of cross, T, L and corner pieces.

•A wide range of standardized junction pieces are available. All have a 30 cm free leg, allowing easy site welding to Prokem Waterbars. In case non-standardized junction pieces are required, drawing must be provided, giving exact details of angles.

Packaging:

Rolls at 15 and 30 Lm

Shelf life & Storage:

Open shelf life as long as it is stored away from heat and fires sources

Additional Information

PROKEM provides the construction industry with a comprehensive range of construction chemicals and specialty products answering the queries of modern engineers for trouble free durable structure. PROKEM designs tailor made products should there be critical application that requires specific properties rather than our main range.

For our customer's satisfaction, Prokem extends technical services to include after sales support to assist users in a proper handling of our products.

Quality Needs Quality





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Identification No. JT - 28

WATER STOP

Flexible PVC Water Stop For Construction And Expansion Joints

1 .Description:

Flexible PVC (Thermoplast) water-stops to seal contraction, construction and expansion joints in concrete structures. **WATER STOP** are available in different sizes and area-selections, depending on their use.

Standards:

WATER STOP is complying with to A.S.T.M D-412, D-624, D-746, D-2628. And B.S.2571, B.S.2782

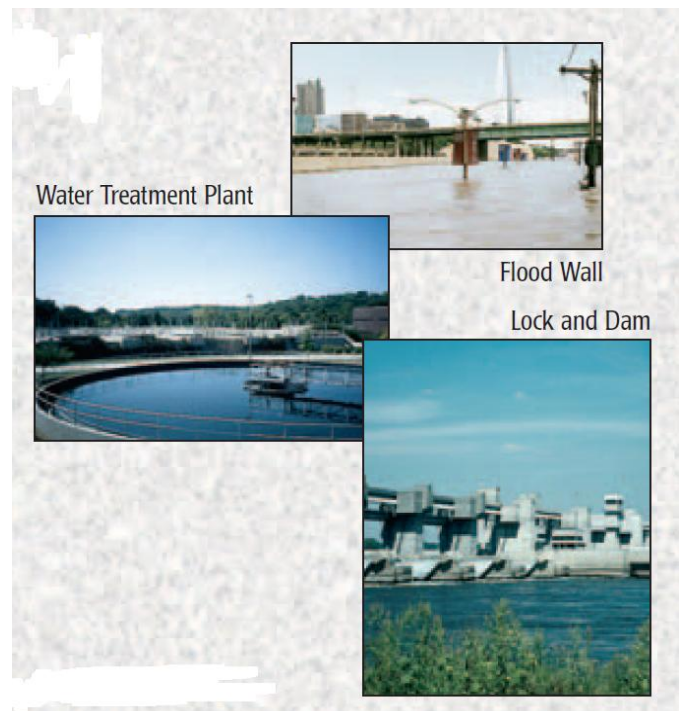
2 .Scope:

Concrete structures are only as watertight as the water stops that join them. *Prokem* water stops stop leaks before they start... in the joints of concrete structures.

Since 1997, *Prokem* has served the general and architectural concrete construction industry. Innovation, engineering and quality craftsmanship are combined to produce products of choice for the industry's owners, designers and contractors.

Prokem maintains its position of industry leadership by responding to the unique needs of our customers.

Prokem dedicated technical and customer service staffs are active participants in the concrete industry to take advantage of the latest technological advances, communicate with our market and analyze trends





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Typical Structures Requiring Water stops Include:

- Dams, locks, canals, water reservoirs and aqueducts
- Water and waste water treatment facilities
- Primary and secondary containment structures
- Culverts and tunnels
- Storage Tanks
- Retaining walls
- Bridge and deck abutments
- Foundations
- Slabs-on-grade
- Parking garages



3. How to use:

3.1. Applications: (Welding Methods)

3.1.1. Butt welding using jig and copper „sword“



3.1.2. Overlap welding using electric “axe”



3.1.3. Overlap welding using hot air welder



3.1.4. Professionally executed, all 3 methods are of equal quality.

3.1.5. Whenever possible give preference to “jig and copper sword” method since it is very easy and few mistakes can be made.

3.1.6. Electric axe hot air welder methods are used when only a small number of welds are required, or where space is restricted



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3.2. Applications: (Butt welding using welding jig and copper sword)

3.2.01. Cut straight the waterbar sections to be welded. This is extremely important since the waterbar ends are butt welded.



3.2.02. Clamp waterbar ends into the appropriate welding jig.



3.2.03. Heat copper sword with a gas burner.

3.2.04. It is very important that the copper sword is heated to the correct temperature.

3.2.05. If the sword is too hot, the waterbar (PVC) will be burnt.

3.2.06. If the sword is not hot enough, the material will not be properly welded.

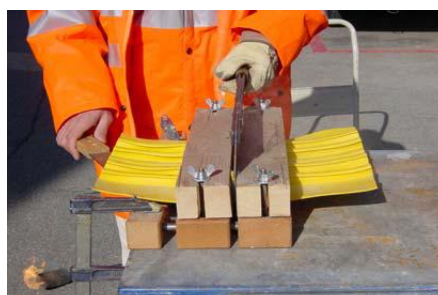
3.2.07. Heat copper sword until the flame appears greenish



3.2.08. Place heated copper sword between the waterbar ends to be welded and lightly press together the welding jig until the waterbar ends are touching the sword.

3.2.09. Move the copper sword backward and forward slowly for approx. 10 seconds.

3.2.10. Pull copper sword slowly out, and immediately and forcefully press the waterbar ends together with the clamping device (part of the welding jig).





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3.2.11. Press the clamping device forcefully together for approx. 10 seconds.

3.2.12. Remove the waterbar carefully from the welding jig.

3.2.13. The welding seam may only be stressed after having completed cooled down!



3.2.14. Across the whole welding seam, a welding bead must be visible.

3.2.15. If there is no continuous welding bead, the welding must be improved spot-wise:

3.2.16. The copper sword is heated again with the gas burner and the faulty areas worked over.



3.2.17. Finally, the copper sword is cleaned with a wire brush.



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3.3. Applications: (Overlap welding with electric axe)

3.3.1. If necessary, cut the waterbar ends to be joined.



3.3.2. Remove the ribs to approx. 3 cm on the inside of the waterbar ends which are to be welded.



3.3.3. Place the waterbar ends which are to be welded on top of each other. Overlap must be approx. 3 cm.



3.3.4. Using the electric axe, and exerting pressure on them, weld the waterbar ends together until a welding bead is produced (possibly using a roller and protective gloves).

3.3.5. Before the welding process is started, the electric axe is connected to the mains for approx. 5-10 minutes until the required temperature has been reached.

3.3.6. On the backside of the waterbar ends, welding must also be performed as described under 3.





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3.3.6. All welding seams are chamfered with the electric axe.

3.3.7. The welding seam may only be stressed after having completely cooled down.



3.3.8. Finally, the welding axe is cleaned with a wire brush.



3.4. Applications: (Overlap welding with a hot air welder)

3.4.1. If necessary, cut the waterbar ends to be joined.



3.4.2. Remove the ribs on the inside of the waterbar ends which are to be welded to the width of the hot air welder nozzle (approx. 3 cm).





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3.4.3. Place the waterbar ends on top of each other (overlap = nozzle width of the hot air welder).

3.4.4. Using the hot air welder and exerting pressure on them, weld the waterbar ends together until a welding bead is produced (possibly using a roller and protective gloves).

3.4.5. Depending on the welding speed, the hot air welder is set at level 4-6.

3.4.6. On the back side of the waterbar ends, welding must also be performed as described under 3.

3.4.7. All welding seams are chamfered with the hot air welder.
The welding seam may only be stressed after having completely cooled down!

3.4.8. Finally, the hot air welder is cleaned with a wire brush.

4. Packaging:

- Rolls at 15 and 30 Lm











SUMMARY

The weight/meter of Prowater Stop is significantly higher than in plain profile P.V.C. waterstops. The web thickness is tapered where it counts i.e. nearer to the joint where stresses increase. Pro water stop profiles need more care and time in extrusion than plain profiles

The extra material and time have to be reflected in the price. Remember the old but true adage “Joints cost 5% of the total cost in the average water retaining structure but give 95% of the problems.

The extra cost is a fraction of remedial costs in the event of Joint integrity failure.

DO YOU BUY CHEAP INSURANCE

!!By using Prowater Stop you give the structure the best chance to be problem free

Waterstops – in Summary

Specifications:

All Rubber and Pvc products, previously mentioned in this presentation, comply with the relevant CKS Specifications, which cover material quality, elongation at break, tensile strength and minimum cross sectional dimensions

Waterstops – in Summary

PROTECT YOUR STRUCTURE by choosing the correct waterstop for the application.

Waterstop failure is expensive to correct and the old adage of '*prevention is better than cure*' is very relevant.

Waterstops

Prokem can offer the following:

A full range – Rubber, Pvc & Hydrophilic.

The expertise and experience to assist in the correct selection of type and material.

Countrywide availability.

Thank you for your participation.