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Don't Let Your Concrete Waterproofing Slip Through the Cracks

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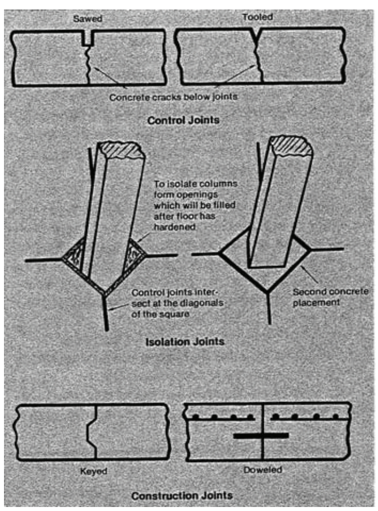
Concrete is the world’s most commonly utilized building material. It’s used in residential and commercial construction, bridges and roadways, water containment, sidewalks, driveways and a myriad of other applications.

The reason for concrete’s popularity? It’s versatile and flexible enough for use in many forms, including precast, cast-in-place and shotcrete. Concrete is economical and structures can be built quickly, reducing construction timelines and labour costs. Concrete is durable and highly resistant to fire, explosion and impact. It’s also energy-efficient, sustainable and recyclable.

While concrete provides numerous benefits, it also presents challenges that must be managed to ensure quality results. One of the greatest challenges in working with concrete is cracking. Concrete cracks generally occur for one of three reasons: changes in volume due to drying shrinkage, direct stress due to applied loads or flexural stress due to bending. Whenever the stress within concrete to pull apart exceeds the strength of the concrete to hold itself together, the concrete will crack.

Controlling Cracking With Concrete Joints

While concrete cracks cannot be prevented entirely, they can be controlled and minimized through proper jointing practices. A concrete joint is essentially a pre-planned crack. Properly spaced joints in a concrete wall, slab or pavement help to accommodate shrinkage and contraction and prevent unsightly random cracking.



Essentially, there are three types of concrete joints: crack-inducement joints, isolation joints and construction joints.

Crack-Inducement Joints

Also known as control joints or contraction joints, crack-inducement joints create a plane of weakness and induce straight-line cracking at controlled, pre-selected locations. Formed using a saw, hand-finishing tool or pre-molded strip, crack-inducement joints extend to a depth of roughly one-quarter of the concrete’s thickness. These joints are commonly used in sidewalks, driveways, pavements, floors and walls.

Isolation Joints

Isolation joints, also known as expansion joints, separate concrete slabs from structural elements such as walls, footings or columns, and permit movement between the abutting faces of the slab and the structural elements. Intended to be dynamic, isolation joints prevent the restraint of movement that can lead to cracking.

Isolation joints are commonly used to separate driveways and patios from sidewalks, garage slabs or stairs. They extend the full depth of the slab and include a flexible, pre-formed joint filler.

Construction Joints

Construction joints are those that occur at the end of a day’s work. Also known as cold joints, construction joints provide stopping places during construction and separate sections of concrete, such as slabs or walls that are placed at different times. Although a true construction joint permits neither horizontal nor vertical movement, construction joints may align with, and function as, control or isolation joints.

The Importance of Waterproofing Joints

While joints play a vital role in fortifying concrete structures, they represent the most vulnerable part of the structure from a waterproofing perspective. Without an effective joint waterproofing system (known as a waterstop system), it’s not a matter of if a joint will leak, but when. A leaking concrete joint is more than simply a costly inconvenience. In the case of residential or commercial structures, incoming water or moisture can lead to the growth of mold or fungus. A leak in a concrete water tank can contaminate potable water or facilitate the escape of waterborne contaminants into the surrounding environment. Incoming water or contaminants can corrode steel reinforcement, jeopardize structural safety and shorten the lifetime of a concrete structure.

Dynamic or moving joints such as isolation joints are waterproofed by virtue of the flexible, pre-formed joint filler that is inserted in the joint. With construction joints, however, an effective waterstop system must be used. Traditionally, waterstop systems have relied on physical barriers to block water from penetrating through joints. In the past quarter-century, however, more advanced and economical systems and materials have been developed to provide easier and more efficient application and longer-lasting protection.

TYPES OF CONCRETE WATERSTOP SYSTEMS

PVC Waterstops

PVC waterstops are flat strips of high-quality PVC that are embedded into both sides of a construction joint to provide a physical barrier. Specially shaped to create a better bond with concrete, PVC waterstops are available in a variety of thicknesses, widths and sizes.

Unlike hydrophilic waterstop systems such as bentonite or urethane, PVC waterstop can be installed during rainy or wet conditions. Some brands feature chemical or oil-resistant properties.

And, relative to other waterstop systems such as bentonite, PVC waterstops have a long useful life.

PVC waterstop systems present two key challenges. Because they must be embedded and maintained in an upright position during concrete pours, they're time-consuming to install. PVC can easily become damaged during a concrete pour and it's virtually impossible to know whether damage has occurred until the joint begins leaking. For best results, PVC waterstops should be installed by skilled trades people.

While PVC itself is highly affordable, the need for experienced, specialized labour results in installation costs of approximately $5 per linear foot.

Bentonite

Bentonite is a swellable clay waterproofing compound that is glued or nailed in strips into construction joints. Known as a hydrophilic waterstop system, bentonite expands up to sixteen times its dry volume when it comes into contact with water, forming a compression seal in concrete joints. Betonies' ability to swell enables it to fill small cracks and voids in concrete, preventing the ingress of water around joints. And since clay is a natural material, bentonite is a popular waterstop choice for potable water applications.

As with other hydrophilic waterstop systems, bentonite must be kept dry prior to installation and concrete must be poured immediately after the bentonite is applied. Exposure to rain or moisture can cause bentonite to expand prematurely, damaging joints and weakening concrete as it cures. As with PVC waterstops, bentonite can be displaced or damaged during subsequent concrete pours and extra care must be taken to ensure an effective application.

Another consideration with bentonite systems is that the clay eventually dries out and deteriorates. Bentonite waterstops have a finite number of wet-and-dry cycles, making them less suitable for extreme weather conditions or environments that frequently become wet.

While bentonite is relatively economical, application can be labour intensive. A bentonite system will cost approximately $3.75 per installed linear foot.

Urethane Waterstops

Similar to bentonite, urethane waterstops are spongy, hydrophilic compounds that, when exposed to water, swell up to 350 per cent of their original volume, forming a compression seal in concrete joints. Urethane waterstops can be applied in strips or with a caulking gun, which can help to reduce application time.

As with other hydrophilic waterstop systems, exposure to moisture can lead to premature hydration and expansion of urethane waterstops, which can crack concrete or cause blowouts. Once applied, urethane waterstops must be allowed to cure for 24 hours before concrete is poured, and keeping the applied urethane dry in the interim is essential.

Like bentonite and other physical barrier systems, urethane waterstops should only be installed by qualified professionals. Special care must be taken to ensure proper placement and avoid damaging or displacing the urethane during concrete pours. Similar to other swellable waterstop systems, urethane waterstops will eventually dry, crack and deteriorate. Depending on the type of urethane used, a urethane waterstop system will cost $7 to $15 per installed linear foot.

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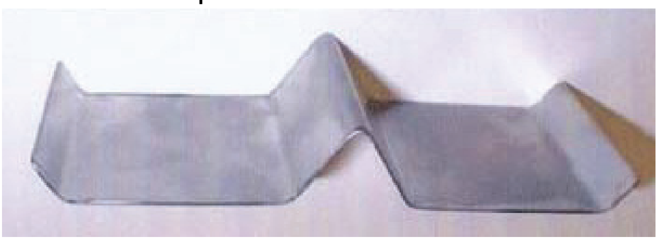
Metallic Waterstops



Made of steel, copper, bronze or lead, metallic waterstops are embedded in concrete across joints to form a continuous, fluid-tight barrier. Metallic waterstops are used in specialized applications such as in dams or heavy construction projects where additional strength is required, or where exposure to chemicals or extreme temperatures could damage conventional physical waterstops.

Metallic barriers must be embedded and maintained in an upright position across the joint while pouring concrete to ensure they do not fall over or become damaged during pours. Skilled labour is required and the material and labour costs for these waterstop systems is extremely high.

Crystalline Waterstops

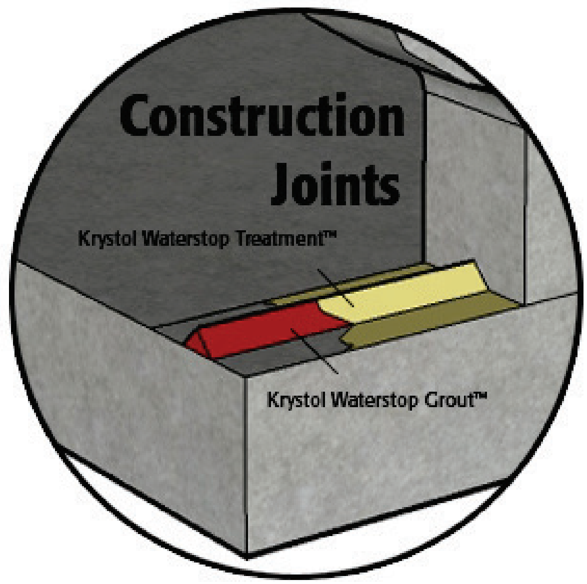
Crystalline waterstop systems utilize advanced integral crystalline waterproofing (ICW) technology to block the movement of water through concrete joints. When applied to concrete, ICW chemicals cause microscopic crystals to grow, permanently sealing the spaces between concrete particles and blocking the movement of water. In a crystalline waterstop system, a cementitious mixture containing highly concentrated ICW chemicals is applied to the joint site before a new wall is poured.

Crystalline waterstops are growing dramatically in popularity because they offer several crucial advantages over other systems. They're quick and easy to install and do not require skilled labour. Premium crystalline waterstop systems have the ability to self-seal small cracks. When micro-cracks form in crystalline-treated concrete, incoming water causes additional ICW crystals to grow, filling the crack and maintaining a watertight seal.

Some crystalline waterstops combine two levels of protection – a virtually indestructible physical barrier and a crystalline chemical barrier. Many crystalline waterstop manufacturers also produce waterproofing systems for walls and slabs, offering one-manufacturer accountability for an entire structure.

Unlike some other waterstop systems, crystalline technology lasts the lifetime of the concrete structure. And unlike the vast majority of waterstops, crystalline technology can be used to retrofit areas where no waterstop system was installed, or where the installed system has become damaged or deteriorated over time.

Crystalline waterstops are highly affordable and can cost up to 50 per cent less than bentonite or PVC waterstops. An average crystalline waterstop system will cost about $2.50 per linear foot, installed.



Choosing the Right Waterstop System

With so many different types of waterstop systems available, it's important to choose the one that's right for each concrete construction project. Since costs and installation times vary widely between systems, budget and construction timeline should be key considerations. Consider also what's at stake if the waterstop fails – if a leak jeopardizes zero-tolerance areas such as electronics or computer rooms, you may want to choose a waterstop system that's less likely to become damaged during concrete pours. Ask about the life expectancy of the system you're considering – some have finite lifecycles while others last the lifetime of the structure.

The best way to protect a concrete structure and achieve an effective, watertight seal is to combine a reliable waterstop system with an effective concrete waterproofing system. Your concrete supplier can provide assistance in the concrete waterproofing system that's best for your project.

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Sources

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