BICS METHOD

Balloon Injection for Concrete Structures (BICS) - A method that enables absolutely perfect repair of cracks

BICS METHOD

High polymer materials such as epoxy resin have been used in the civil engineering field ever since 1955. Today, they have firmly established their position as “the Third Raw Materials.” Their applications, notably in the field of maintenance work, are numerous: should we attempt to describe them all, it would require a great number of pages.

A typical example of application is seen in the Resin Injection Method used for repairing cracks developed in concrete structures.

Owing to the fact that we have no means to perform internal checks when repairing cracks in concrete structures, the need to achieve positive injection of materials is truly of prime importance.

Broadly divided, injection methods can be grouped into two types, the first in which injection is performed at high pressure, high speed and within a short span of time, and the other in which it is carried out at low pressure, low speed, taking time. Both methods, however, were not without their share of disadvantages. In the former, the sealant is liable to get punctured, and instead of reaching the innermost parts of cracks, the material is apt to spread out near the inlet, failing to reach the innermost corners.

Meanwhile, the latter method ensures positive injection, but calls for a high degree of expertize in addition to time. As a result, workability is poor.

Now this drawback has been overcome by the BICS METHOD developed by SHO-BOND's technical team. The new method is based on a unique concept which assigns the job of low-pressure, low-speed injection, that had up to now relied on manpower, to the pressure created by the shrinking action of the rubber tube.

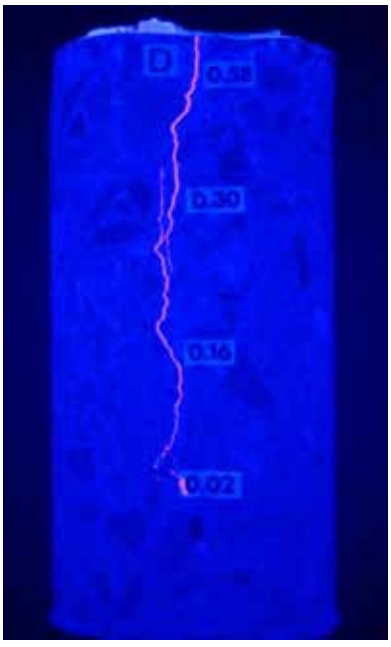
The BICS (Balloon Injection for Concrete Structures) METHOD is executed using a tool known as the “BLINJECTOR” and“ BL-GROUT”, an epoxy resin-based injection material.

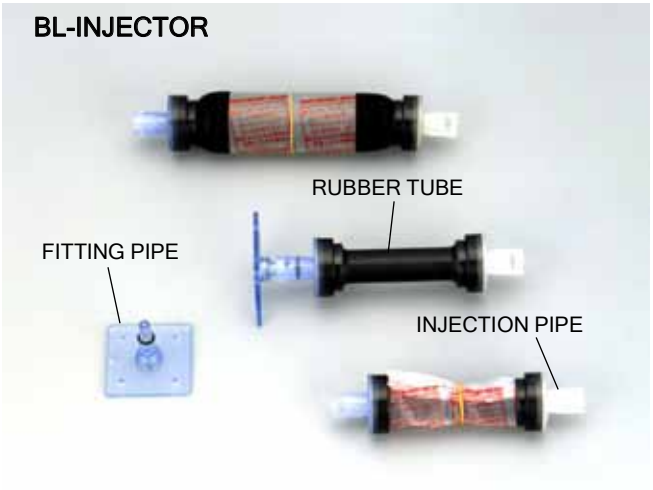
The BICS METHOD ensures positive injection of material even into minute cracks.

Though injection is performed at low pressure and low speed, it permits vast reduction in injection work time.

This is because the part of injection work that requires manpower can be executed in quite a short time : the rest is performed slowly at low pressure, utilizing the pressure of the BL-INJECTOR's rubber tube (Approx. 340 kPa.)

As you have rightly guessed by now, the BICS METHOD's prime merit is that grout material can be positively injected into the innermost portions of cracks, while permitting vast labor savings.





PATENTS

Patented in : Japan, the U.S., U.K., Taiwan, Korea, Singapore, Malaysia and Hong Kong.
Pending in : West European countries (excepting the U.K.)

EFFECTS OF INJECTION WITH BL-INJECTOR

As injection of the BL-GROUT (epoxy resin-based ultra-low viscosity injection material) proceeds, the internal pressure gradually rises, making the rubber tube swell up little by little. Injection work by hand is continued until the outside diameter of the rubber tube reaches the specified value. It is so designed that the BL-INJECTOR's internal pressure will be maintained constant when the rubber tube's outside diameter becomes equal to, or exceeds, the specified value. Once the internal pressure builds up to the specified level, the job of injecting the grout material is left to the BL-INJECTOR, which goes on performing the job for long hours, causing the grout material to penetrate into the innermost portions of the cracks.

FEATURES OF THE BICS METHOD

● POSITIVE INJECTION OF GROUT MATERIAL INTO EVERY NOOK AND CORNER OF CRACKS

By utilizing the internal pressure generated inside the rubber tube, injection can be continued over long hours without the aid of human hands.
Thus, the injection material will penetrate perfectly into the innermost parts of cracks including such parts as gaps developed by the separation of reinforcing bars from concrete.

●VAST REDUCTION IN INJECTION WORK TIME

Injection work is simple as it consists merely of pumping up the BL-INJECTOR to the specified diameter, and can be accomplished in no time regardless of whether the worker is a skilled, or an unskilled worker.

Conventional Methods	Base treatment	Sealing work	Fitting of pipes	Injection work		Finishing work
BICS METHOD	Base treatment	Sealing work	Fitting of pipes	Injection work	Rubber pressure	Finishing work

(Labor savings)

● EVEN AND POSITIVE PRESSURE CONTROL

When the BL-INJECTOR's outside diameter swells up to 25mm, that is, twice its original size, the rubber hose is disconnected. From thereon, injection work will be continued by the pressure generated by the even shrinking action of rubber, thus enabling simple and positive pressure control.

● EASY CONFIRMATION OF HARDENING OF INJECTED MATERIAL

Simple and perfect work control is ensured as the hardened state of the injected material can be checked simply by checking the state of the resin remaining inside the rubber tube.

APPLICATION OF THE BICS METHOD

The BICS METHOD can be applied to the repair of cracks in all kinds of concrete structures.

1. ROADS AND RAILWAYS
   a. Concrete structures associated with ordinary and elevated bridges (Abutments, piers, beams, slabs, railings, telephone poles, etc.)
   b. Concrete linings for tunnels and underpasses
   c. Concrete structures associated with subways
2. BUILDINGS
   a. Concrete structures associated with buildings, warehouses and housing complexes (Beams, pillars, floors, walls, etc.)
   b. Concrete structures associated with factories and plants (Buildings, various silos, various storage tanks, flues, foundations for machinery, etc.)
3. WATERWORKS, SEWERAGES AND IRRIGATION FACILITIES
   a. Concrete structures associated with purification plants and distributing basins (Various water tanks and waterways)
   b. Concrete structures associated with sewage treatment works (Various treatment tanks, waterways, etc.)
4. ELECTRIC POWER
   a. Concrete structures associated with hydro-electric, thermal and nuclear power plants (Dams, waterways, pure water neutralizing tanks, waste water treating systems, etc.)

5. PORTS, HARBORS AND RIVERS
   a. Concrete structures such as revetments, breakwaters, landing piers, etc.
   b. Concrete structures such as gates, dam embankments, beams, etc.
6. OTHERS
   Concrete structures such as pools, airstrips, retaining walls, etc.

CONSTRUCTION METHOD

1. SUBSTRATE PREPARATION
   Using a disc sander, wire brush or the like, remove all laitance, dust, etc. from the area along the crack for a width of about 5cm. Oil and grease should be wiped off with a piece of waste cloth moistened with thinner.
2. ADHESION OF FITTING PIPE
   Using BL-SEAL, attach the fitting pipe to the crack center. As the spacing at which the fitting pipes are to be attached differs depending on the width and depth of the crack, it is necessary to investigate the crack in advance.
3. SEALING
   Using the BL-SEAL, seal the area around the fitting pipe together with the front edges of the crack for a width of 5cm and a thickness of about 3mm.
4. CURING OF SEALANT
   Let the BL-SEAL cure until it hardens.
5. FITTING OF BL INJECTOR
   Screw in the connector terminal of the BL-INJECTOR fully into the fitting pipe.
6. INJECTION
   After mixing the BL-GROUT's base agent with the hardener at the specified mix proportion, pour the mixture into the pump. Injection work is performed by fitting the hose of the injection pipe to the injection port of the BL-INJECTOR. Stop injection when the outside diameter of the BL-INJECTOR has swollen to about 25mm (roughly twice its original size.) Then, move over to the next injection port.
7. CURING OF INJECTED MATERIAL
   Cure the injected material until the BL-GROUT has hardened, which can be told by the feel of the rubber tube.
8. FINISHING
   Remove the fitting pipe, hammering it off, and finish the repaired portion to a flat surface, using a disc sander.


Cleaning of surface


Adhesion of fitting pipe


Sealing along crack edges


Injection of BL-GROUT with pump and state of BL-INJECTOR during pressurized injection of grout material


Curing after injection


Confirmation of hardening


Finishing with sander

BL-GROUT

BL-GROUT, an adhesive designed exclusively for use by injection into concrete cracks, uses as its base component epoxy resin having powerful adhesive force and excellent durability. Giving full play to its superior formulation technology, SHO-BOND has succeeded in developing an ultra-low-viscosity adhesive that boasts outstanding penetration properties. To provide the grout material with optimum physical properties, improvements were made from diverse angles, such as ensuring that a viscosity that permits injection will be retained over long hours.

FEATURES OF BL-GROUT

● POWERFUL ADHESIVE FORCE

As epoxy resin possesses excellent mechanical strengths including exceptionally strong adhesive force, it ensures perfect integration of cracked concrete structures.

● STRONG PENETRATING POWER

Developed exclusively for use by injection into concrete cracks, BL-GROUT has been endowed with ultralow viscosity to provide increased penetrating power.

● OPTIMUM FLEXBILITY

It retains toughness even after it has hardened, which prevents it from being stripped off in the event some impact or vibrations may occur inside the crack.

● CONTAINS NO VOLATILE SOLVENT

Though being an ultra-low-viscosity formulation, it contains no solvent such as thinner so that it is practically free of shrinkage.

QUALITY STANDARD OF MATERIALS USED

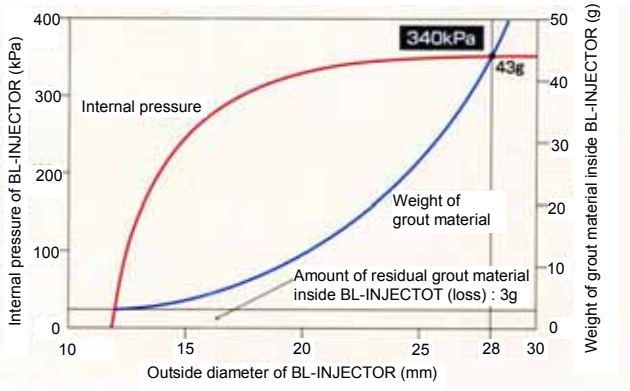
Test Item	Testing Method	Test Conditions	Unit	BL-SEAL	BL-GROUT	DD-GROUT	WB-GROUT	DD-GROUT 50	BL- GROUT 100
Specific gravity (Hardened material)	JIS K 7112	20℃, 7days	-	1.70 ± 0.10	1.15 ± 0.10	1.10 ± 0.10	1.15 ± 0.10	1.15 ± 0.10	1.10 ± 0.10
Viscosity	JIS K 6833	20℃	mPa•s	Putty	300～700	5 ± 1※	5000, or blow	4 ± 1※	100～1000
Pot life	Temperature rise Method	20℃	minute	50, or more	30, or more	-	30, or more	30, or more	30, or more
Tensile shear bonding strength	JIS K 6850	20℃, 7days	N/mm^2	7, or more	10, or more	10, or more	10, or more	-	-
Tensile strength	JIS K 7113	20℃, 7days	N/mm^2	-	-	30, or more	30, or more	3, or more	3, or more
Tensile elongation	JIS K 7113	20℃, 7days	%	-	-	-	-	50, or more	100, or more

●The product specifications are subject to change without notice for quality improvement.

※Thixotropic index

RELATIONSHIP BETWEEN OUTSIDE DIAMETER OF BL-INJECTOR AND WEIGHT OF GROUT MATERIAL

- Even when the BL-INJECTOR's outside diameter becomes more than 25mm, the internal pressure remains constant and will not exceed the neighborhood of 340 kPa.
- In this particular case, pressure injection was performed with the BL-INJECTOR containing approximately 40g of grout material.



■Manufactured by

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