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Institute of Building Materials, Concrete Construction and Fire Protection | Braunschweig Civil Engineering Materials Testing Institute

General Building Code Test Certificate

- Translation -

Test Certificate No.:	P-5204/944/08 MPA-BS
Test item:	**Pluraflex C11 injection hose in connection with the Pluraflex PU two-component polyurethane injection resin or WEBAC 1405** for joint sealing for concrete members with a high water penetration resistance against pressing and non-pressing water and against ground moisture in compliance with Bauregelliste A, Part 2, No. 2.53
Client:	H-Bau Technik GmbH Am Güterbahnhof 20 D 79771 Klettgau
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This General Building Code Test Certificate (abP) consists of 7 pages and 5 annexes.

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Notified body (0761-CPR) -
Approved as a civil engineering testing, inspection and certifying body as well as notified as a civil engineering testing and certifying body.

A General provisions

(1) This General Building Code Test Certificate (abP) attests that the construction product can be used within the meaning of federal state building code regulations.

(2) The General Building Code Test Certificate (abP) does not replace any of the building permits, approvals and certificates required by law for the performance of building projects.

(3) The General Building Code Test Certificate (abP) is issued without prejudice to the rights of third parties, in particular private property rights.

(4) Producers and distributors of the construction product shall, without prejudice to any additional regulations set out under the special provisions below, furnish the user of the construction product with copies of the General Building Code Test Certificate (abP), and they shall in addition point out that the General Building Code Test Certificate (abP) must be available at the place of use of the construction product. Copies of the General Building Code Test Certificate (abP) shall be made available to the authorities concerned upon request.

(5) The General Building Code Test Certificate (abP) may not be copied unless as a complete text. Excerpts of the Certificate may only be published with the prior permission of the Braunschweig Materials Testing Institute (MPA). The wording of, or drawings used in, advertising brochures must not be in conflict with the contents of the General Building Code Test Certificate. Translations of the General Building Code Test Certificate shall bear the note "translation of the German original not checked by the Braunschweig Materials Testing Institute".

(6) The General Building Code Test Certificate (abP) is subject to revocation. The provisions may be subsequently amended or revised, in particular if and when required as a result of new technical findings.

B Special provisions

1 Test item and field of application

1.1 Test item

This General Building Code Test Certificate (abP) applies to the fabrication and use of the Pluraflex C11 injection hose in connection with the Pluraflex PU injection resin or WEBAC 1405.

The Pluraflex C11 injection hose is a single-wall PVC-based hose into which material can be injected once; it is provided with slots that taper slightly conically to the outside. The Pluraflex PU polyurethane injection resin and the WEBAC 1405 are a 2-component resin that is injected into the hose with commercial injection pumps for polyurethane resins.

1.2 Field of application

The normal-flammability sealing system corresponds to Bauregelliste A, Part 2, No. 2.53 (as amended). It is used to seal construction joints in concrete elements with a high water penetration resistance against pressing and non-pressing water and against ground moisture.

The injection hose shall be installed in compliance with the specifications in 4(Execution). The immersion depth in water must not exceed 10 metres.

The sealing principle is based on subsequent injection of the PU resins, which will emerge from the injection hose in case of defects and cracks in the construction joint region and thus ensure adequate sealing of the joint.

The sealing system is suited for zones with changing water levels, and complies with utilisation-class A requirements for application classes 1 and 2 as set forth in the regulations for watertight structures (WU-Richtlinie) [1].

2 Provisions concerning the construction product

2.1 Properties and characteristic values

The green coloured Pluraflex C11 injection hose is made from soft PVC and has a smooth surface. It has an inside diameter of 5.8 mm and an outside diameter of 11.8 mm. The outlet openings (slots) are 5 mm long and arranged with four slots each on the circumference at a spacing of 12 mm, so there are 24 outlet openings along a length of 10 cm.

The hose perforation makes sure that a uniform material flow is maintained at an injection pressure of less than 0.5 bar (pump-end pressure gauge). The hose is designed so that at a 5-metre concrete column no cement grout can enter the hose and that it will not deform in any significant way.

At temperatures of down to 0 °C, the hose offers adequate elasticity in bending to ensure proper installation and functionality (bending radius ≥ 5 cm).

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[1] German committee for RC directive "Wasserundurchlässige Bauwerke aus Beton" (watertight structures made from concrete), 2017-12

The two-component Pluraflex PU polyurethane injection resin consists of polyetherester polyolen and additives (component A), as well as modified polyisocyanate (component B). The mixing ratio is 1 : 1 parts by volume. The two-component WEBAC 1405 polyurethane resin complies with EN 1504-5 and must be marked according to EN 1504-5, Annex ZA 3.a (System 2+), CE. The lowest temperature at which it may be applied is 5°C.

The sealing system has the characteristic values or properties that are shown in table 1 and annexes 4 and 5, which must be complied with.

Because of the declaration furnished by the client there was no cause for checking the PU resin in the applied state for compliance with requirements of health and environmental protection.

The fitness for use of the sealing system has been demonstrated in tests performed in compliance with the test principles for the preparation of General Building Code Test Certificates for joint sealing solutions in concrete members with a high water penetration resistance against pressing and non-pressing water and against ground moisture.

2.2 Packaging, transport, storage and identification

(1) The injection hoses will be packed in a plastic film and cardboard box. The construction products have to be handled and stored so they will neither be deformed nor damaged. They must also be protected against frost and must not be exposed to permanent sunlight.

(2) The PU resin is subject to the regulations set forth in the relevant codes of practice and safety data sheets.

(3) The material shall be packed, transported and stored in compliance with the manufacturer's specifications.

(4) The information provided on the packaging regarding other legal areas shall be observed.

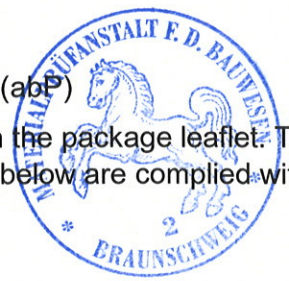
(5 The manufacturer's specifications regarding storage periods shall be complied with. System components that have to be used together shall be clearly marked and marketed together. The delivery notes for the product must be marked with the conformity mark (Ü mark) in compliance with the conformity regulations of the federal states. This marking may be provided only, if the conditions set forth in section 3 below (declaration of conformity) are complied with.

2.3 Conformity mark

(1) The manufacturer shall mark the construction products with the conformity mark (Ü mark) in compliance with the conformity marking regulations of the federal states. The conformity mark with the details that have to be provided on the packaging:

- Name of manufacturer
- Number of the General Building Code Test Certificate (abP)

shall be shown on the packaging or, if this should not be possible, in the package leaflet. This marking may be provided only if the conditions set forth in section 3 below are complied with.



(2) The following details must be shown on the packaging of the construction product or in the package leaflet:

- Product name
- Lot number
- Intended use
- Reference to application requirements

3 Declaration of conformity

(1) General

In accordance with Bauregelliste A Part 2, No. 2.53, conformity of the construction product with the requirements set forth in this General Building Code Test Certificate (abP) is demonstrated by the manufacturer's declaration of conformity (ÜHP), which shall be issued on the basis of factory production control (FPC) and construction product inspection before the conformity (initial type test) is confirmed by an inspection body approved for such inspections.

(2) Initial type test of the construction product performed by an approved inspection body

For initial type testing, the characteristic values must be verified on the basis of table 1. The obtained values must not differ from reference values by more than the tolerances shown in that table.

An initial type test is not required for the product, when the samples used for testing were taken from a normal production run in the production plant as part of the general type approval procedure.

If the conditions under which the product is manufactured should change, an initial type test must again be made.

(3) Factory production control (FPC)

DIN 18200 requires that factory production control (FPC) be established for, and be performed in the production plant.

Factory production control must be performed in compliance with the specifications shown in table 1, which reflect the special features of the product and the conditions for producing this product. The requirements made are based on the results of the initial type test.

The results of factory production control must be recorded and evaluated by the manufacturer. The records must include the following details as a minimum:

- Name of the product
- Type of test or inspection
- Date when produced and date of test
- Test results and comparison with requirements
- Signature of person in charge of factory production control

The records must be kept for a minimum of five years and must be presented upon request.

Should testing supply inadequate results, the manufacturer must take immediate action to remedy any deficiencies noted. Non-conforming construction products must be handled so that confusion with conforming and faultless construction products is positively prevented. Once the deficiency has been corrected, the required test must be repeated to the extent that is necessary to prove adequate correction.

Table 1: Type and frequency of tests to be performed as part of factory production control

Properties	Test conditions	Requirements	Frequency
Pluraflex C11			
Inspection of base material	Manufacturer's declaration or suitable tests	No signs of change	Per shipment lot
Geometry	-	Inside diameter 5.8 mm Outside diameter 11.8 mm ± 0.2 mm	Per lot
Number of slots	-	24 per 10 cm each	Per lot
Weight	-	106 g/m ± 3 g/m	Per lot
Transmission	Visually	No flaws	Per lot
Pluraflex PU injection resin			
Density (A+B)	DIN 51757 (method B)	Comp. A 0.978 g/cm³ Comp. B 1.121 g/cm³ ± 1.0 %	Per lot
Isocyanate content (comp. B)	DIN EN ISO 11909	18.7 % NCO ± 0.6 %	Per lot
Hydroxyl number (comp. A)	DIN 53 240-2	260 mg KOH/g ± 20 mg KOH/g	Per lot
Viscosity and viscosity increase (mixture)	DIN EN ISO 11909 at 23°C under isothermal conditions[1)]	180 mPa·s ± 50 mPa·s After 55 min 1000 mPa·s ± 150 mPa·s	Per lot

4 Execution

Execution and installation are subject to the DBV code of practice for grouted injection hoses for construction joints ("Verpresste Injectionsschläuche für Arbeitsfugen", January 2010), as well as the codes of practice furnished by the manufacturer (annexes 1 to 5). The processing instructions of WEBAC Chemie GmbH apply to the processing of the polyurethane resin WEBAC 1405.

The hose may not be filled until after the end of the hydration process and when the construction joint is almost fully loaded. The PU resin should, moreover, not be injected unless first leaks have appeared. At the time of injection and before final hardening of the resin (min. 48 hours), the construction joint must not be exposed to any water pressure.

Due care must, in particular, be taken that the individual length of the injection hose does not exceed 10 metres. The injection hose shall be fixed by means of the offered metal clips (20 mm wide, 1.5 mm thick, minimum spacing 15 cm) and the hammer-driven anchors (SD1 5 x 35 FB). The hose ends must be completed as specified by the manufacturer. Any secondary injection has to be provided within the processing times specified (subject to temperature).

5 Legal basis

This General Building Code Test Certificate (abP) is issued on the basis of article 19 of the building code of Niedersachsen (NBauO) in conjunction with Bauregelliste A, Part 2, No. 2.53.

6 Legal remedy

This General Building Code Test Certificate (abP) is subject to objection. Objections must be lodged in writing or stated orally on the record of the management of Materialprüfanstalt für das Bauwesen, Beethovenstraße 52, 38106 Braunschweig within a period of one month after it has been issued. The date on which the Testing Laboratory receives the notice of objection shall decide on whether the objection was made timely.

This document is the translated version of General Building Code Test Certificate (abP) P-5204/944/08 MPA-BS dated 24/07/2018. The legally binding text is the aforementioned German Buiilding Code Test Certificate.

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Deputy Head of Testing Laboratory

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i. A.

M. Pankalla
Engineer/official in charge

Manufacturer's Technical Code of Practice

Pluraflex C11 injection hose (page 1)

The Pluraflex C11 injection hose product

Single-walled PVC-based hose with openings (slots) that taper slightly conically to the outside and through which pressure-fed injection material can exit. Used for construction joint sealing in subterranean construction. The openings close because of their geometry and thus effectively prevent cement paste from entering the inner duct.

Pluraflex C11 injection hose

The injection hose is used for sealing construction joints that are permanently or temporarily exposed to the loads resulting from the effects of ground, slope and/or surface water.
The structurally required construction joints can be designed for resistance against artesian water.

Product features

- Easy injection
- Product certified on the basis of DIN EN ISO 9001
- Injection hose continuously provided with code number

Benefits of the Pluraflex C11 injection hose technology

- Adequate cross section of inner duct and outer duct and of outlet openings alter concreting
- No ingress of cement paste while placing the concrete
- Sturdiness for installation under site conditions, including mounting system
- Easy handling; simple and quick installation
- Round hose cross section prevents uncontrolled twisting when installing from the reel
- Injection material emerges from the hose system in the concreted state already at an adequate pressure, thus safeguarding material discharge to all sides
- Outlet openings taper conically to the outside; therefore the opening resistance that has to be overcome is very low.

The smooth surface prevents uncontrolled bonding between injection hose and concrete. This facilitates material injection with the Pluraflex C11 injection hose system and injection is also possible after several years, because the smooth surface counteracts potential caking of the system.

Pluraflex C11 injection hose product characteristics

Material:	soft PVC
D_{inside}:	6 mm
$D_{outside}$:	12 mm
Injection media:	Pluraflex- PU injection resin
Injection length:	max. 10 m
Outlet opening in the hose:	5 mm
Openings in the hose:	arranged with four slots each on the circumference at a spacing of 12 mm, i.e. 24 outlet openings along a length of 10 cm
Weight:	106 g/m

Packaging, shelf life

Reels of 30 m each, sealed in shrink-foil
Box each with 75 reels of 30 m each, sealed in shrink-foil. One pallet = 2,250 m
Colour: green
Storage period: 5 years, when stored under frost-free conditions and protected from permanent solar radiation

Manufacturer's Technical Code of Practice

Pluraflex C11 injection hose (page 2)

Instructions for preparation, installation, injection

Preparation

Before installation, the injection hose has to be provided with filling and venting ends on both sides.
Procedure details:
Determine hose length required for the structural conditions. The different hose sections should, however, not be longer than 10 m, as otherwise the necessary injection pressure will be too high.
Cut the hose apart with cutting pliers.
Now fit the plastic wing connector into the injection hose and lock it with a two-lug clip.
Fit the filling and venting hose to the other end of the wing connector and also lock it with a two-lug clip.
Use plugs to protect the injection connection ends from water infiltration and contamination.
The injection hose may now be placed into the construction joint.

Preparing the base

Before placing the topping, clean the concrete surface. The surface should be smooth and free from any foreign matter.

Installation

Place the hose into the construction joint in a central position, inside the reinforcement, and fix it in this position.
For members with a wall thickness > 60 cm, the injection hoses are installed max. 25 cm from the water end, but a at least 10 cm from the concrete outside edge.
The hose has to be fixed so that it is in contact with the concrete / the steel plate waterstop.
To prevent the hose from floating, the mounting clip spacing should be between 10 and 15 cm.
Successive injection loops have to overlap to ensure continuous joint injection. The overlap should be about 10 cm.
To prevent uncontrolled hose interconnection when filling the joint, the injection hose should be laid at a minimum clearance of 5 cm at points of overlap.
In corners, the hose should be laid so that bends or loops with very short radii are prevented. Otherwise risk of kinking!
The most frequent type of injection connection are hose protection boxes, because they offer perfect accessibility. In this case, the filling and venting ends of the precut hose extend by approx. 10 to 20 cm into the hose protection box.

Mount the protection boxes on the reinforcement by means of wire. The filling and venting ends have to be carefully fixed on the reinforcement to prevent them from being damaged, or torn out of the protection box, when placing the concrete.
Another type of injection connection is the nail packer. In this case, the ends of the injection hose are mounted on the wood-screw thread of the nail packer and secured with a two-lug clip. The nail packers are then nailed with their flanged end to the formwork, about 30 cm above the construction joint.

For metal or sliding formwork, nail packer stands are used. The nail packer is in this case fitted to an approx. 25-cm long plate, which is bent in a special way and which may simply be mounted on the concrete with hammer-driven anchors. Because of the plate curvature, the nail packer stands are preloaded and thus pressed against the formwork.

Manufacturer's Technical Code of Practice

Pluraflex C11 injection hose (page 3)

Installation

After removal of the formwork, the nail packer is readily accessible. Once the injection nipple has been mounted and the concrete has been allowed to harden as required, it is available for injection.

Important: The injection hose itself must not extend to the outside edge of the concrete. The injection duct is led to the outside only by means of the non-perforated filling and venting ends or packers. The structural members should be provided with a concrete cover of no less than 5 cm. Otherwise resin may exit in an uncontrolled manner, thus making it impossible for the required pressure to be built up.

Important: Due care shall be taken to ensure that the hose ends are neither clogged nor damaged while placing the concrete. Neither must the connection between injection hose and packer be interrupted.

Exact details on the position of the protection boxes or the nail packers, as well as the arrangement of the injection loops are furnished in the layout diagram.

Injection

The proper injection time depends on a number of conditions, such as fluctuations of the water level, ground water lowering, leaks or access to the structure. The injection work may, however, not commence any earlier than after 4 to 6 weeks, when concrete shrinkage and first settlement of the structure have come to an end.

For injection, the injection material exits through the slots in the injection duct and seals the construction joint. The injection pressure required to open the slots is less than 0.5 bar.

Procedure details

Preparing the injection connection:

As a first step, the hose ends in the protection boxes are exposed and the sealing stoppers are removed. The next step is to provide the injection connection. At the other end, the venting end, only the connection sleeve is provided for the time being.

Filling/venting the injection hose:

The injection system is used to fill the injection hose (with the venting end open) with injection material until the material starts to exit without any bubbles. Now injection is interrupted.

Close the hose end by mounting an injection nipple, and start the injection process. Use a low volumetric flow rate and moderate pressure for this purpose. The actual injection pressure depends both on the quality of the concrete and the type of the joint, but also on the injection material itself. As a general rule, a low pressure maintained for a longer period produces better results than a short-term high pressure (PU injection approx. 20 to 30 bar). Injection is successively made at both hose end.

During the processing time for the injection material, material has to be re-injected into the hose at least once. Provided there is no uncontrolled material discharge, the quality of the sealing process will rise with the amount of the injected injection material.

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Pluraflex PU injection resin (page 1)

Slow-reaction, highly elastic two-component PU resin

Field of application

Construction joint sealing in in-situ concrete in conjunction with the Pluraflex C11 injection hose.

Pluraflex PU injection resin may be injected as a one- or a two-component material. Thanks to the mixing ratio of 1 : 1 parts by volume, Pluraflex PU-injection resin lends itself ideally for two-component injection. Pluraflex PU injection resin is injected into the structure by means of concrete embedded injection hoses.
Pluraflex PU injection resin adheres on a dry as well as on a moist structural base.
Pluraflex PU injection resin has a particularly low vitrification temperature, which means that it sustains winter temperatures without becoming brittle, and it does not tear open when cracks expand at low temperatures.

Application temperatures: between 8 °C and 30 °C

Technical data

The details shown are laboratory values. They may differ under real conditions as a result of the heat exchange that takes place between the injection material and the structure, moisture or other factors.

Reaction data (typical values)

Initial temperature	8 °C	15 °C	23 °C
Initial viscosity of mixture	425 ± 60 mPa*s	270 ± 50 mPa*s	180 ± 50 mPa*s
Processing time (1-kg combination pack)	55'	45'	30'
1,000 mPa*s in the gap after	35 - 55'	45 - 65'	50 - 75'
Setting time	17.5 ± 2.0 h	15.0 ± 1.5 h	13.0 ± 1.0 h
Foam factor	approx. 1	approx. 1	approx. 1
Surface tension			37 mN/m
Transformation temperature, anhydrous hardening	- 15 °C		
Transformation temperature, hydrous hardening	- 41 °C		

Material characteristics

	COMPONENT A	COMPONENT B
Density at 23 °C	975 ± 15 kg/m³	1,122 ± 15 kg/m³
Colour	Honey-coloured	Brown
Viscosity at 23 °C	330 ± 60 mPa*s	60 ± 20 mPa*s
at 15 °C	500 ± 90 mPa*s	110 ± 30 mPa*s
at 8 °C	900 ± 150 mPa*s	170 ± 40 mPa*s

Mechanical data

Tensile strength (according to DIN 53455)	approx. 3 MPa
Elasticity (according to DIN 53 455)	110 – 150 %
Shore-A hardness	60 – 70

Composition and properties

Pluraflex PU injection resin, component A, consists of polyether ester polyolene and additives. Pluraflex PU injection resin, component B, is a modified polyisocyanate. The resin mixture yields a non-foamed, highly elastic polyurethane resin, which shows a slight intumescent reaction in the presence of water.

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Manufacturer's Technical Code of Practice

Pluraflex PU injection resin (page 2)

Preparation and application

Combination container: Component A is in the bottom part of the can, component B in the part above. To empty the container, pierce open the top can making sure that component B mixes completely with component A.
Separate containers: Identical volumes of each component are metered in a clean and dry graduated beaker and are then emptied into a clean and dry mixing vessel.
Mixing: The components are mixed to form a homogeneous mixture with a mechanical mixer that is driven by a drilling machine at 300 rpm, or manually with a suitable spoon. Mix for a minimum of 2 minutes until the solution is without any schlieren. Make sure that the components are mixed thoroughly also at the walls and the bottom of the mixing vessel. After that, refill the mixture into a separate mixing vessel (which may remain in continuous use), and again mix it carefully. The mixture is now is ready for use. Instead of the second mixing vessel, the vessel mounted on the pump may be used.
Pump conditioning: Fill the top vessel of the 1K diaphragm pump with Solv D, which is then drained down to the dregs. Now fill the mixed resin into the vessel (stir again if required) and then pump it off into a receiving vessel until at least 0.2 litres of resin have emerged from the injection hoses. This is to ensure that only pure product will actually be injected. In all other respects, the processing details specified for the injection hose apply.

Equipment, cleaning

Equipment to be cleaned, and possible contaminations to be removed, at once and in the fresh state, with Solv D.
Wear protective gloves and goggles.

Packaging, shelf life

Packaging: 20-kg container (A)
23-kg container (B)
1 kg in a combined container (466 g component A and 534 g component B)

Shelf life: In the original container, closed, for 12 months; if stored in a dry place 10 °C up to 30 °C

Safety, ecology, disposal

For further details regarding safe transport, storage and handling as well as disposal and ecology, reference is made to the safety data sheet (as amended).

Disposal: In Germany, completely emptied containers are collected on a no-cost basis at special points provided by the KBS system (returned-scrap system for metal packages and steel; addresses are available from Pluraflex C11 Verpressschlauch AG). To completely empty containers, use a pointed tool (e.g. a screw driver) to open one corner of the bottom of the top container once its contents has been used up. Place the container onto that comer and wait for any remnants to drip off. Fully hardened Pluraflex C11 may be disposed of like normal household refuse (refuse No.: 120105).

Hazard warning and instructions for safe handling of Pluraflex PU, component B

Symbol: Xn (harmful to health). Harmful to the health when inhaled. Irritates the eyes, respiratory organs and the skin. In case of eye contact, thoroughly rinse the eyes with water and consult a physician. In case of skin contact, wash away at once using a lot of water. Use a breathing apparatus in inadequately ventilated areas. In case of accidents or signs of sickness, immediately consult a physician.

Wear adequate protective clothing, gloves and goggles/face protection for work. People frequently or regularly handling Pluraflex PU or other PU resins, should have medical check-ups made as required by the trade association in compliance with G27. For details, reference is made to the safety data sheet.

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