

Test report no. 203309

Rev. 1

1st copy of 20 July 2020

Principal: Tremco CPG Germany GmbH
Werk Bodenwöhr
Werner-Haepf-Straße 1
92439 Bodenwöhr

Date of commission: 08.05.2020

Subject of commission: Tests of air permeability (DIN EN 12114) and
impermeability to driving rain (DIN EN 1027) according to
DIN 18542 - MF 1 on the joint sealing tape:
"TP654" dim (58/6-20)
dim (58/10-30)

The test report contains 12 pages.

To the extent that the test material is not used up, it will be disposed of after 4 weeks.
A longer retention period requires an agreement in writing.

With the release of this revision all previous versions lose their validity.
Only this version may be used.



The test report shall be published unabridged. Any partial publishing requires written allowance by the testing institute. The test results refer only to the tested material.

1. General

The company Tremco CPG Germany GmbH produces, among other things, joint sealing tapes made of impregnated foam plastics. For the production mainly open-cell foam is impregnated with appropriate materials.

The finished joint sealing tape impregnated in partial areas is sold as joint sealing tape "TP654".

General information about the product:

Manufacturer	Tremco CPG Germany GmbH
Designation	Joint sealing tape DIN 18542 - MF 1
Trade name	„TP654“
Foam base	Flexible polyurethane foam
Type of impregnation	Acrylates
Type of self-adhesive	Acrylic adhesive
Special feature	The belt consists of several horizontal layers of partly impregnated foam. An airtight barrier layer runs inside the belt

Information from the manufacturer on the sealing tape dimensions tested:

Tape dimensions	Cutting width of the tape (t_F) mm	Minimum joint width (b_{min}) mm	Maximum joint width (b_{max}) mm	Tape thickness uncompressed state (b_0) mm	Average volumetric weight (¹) kg/m ³
58/6-20	58	6	20	28 (4+20+4)	75
58/10-30	58	10	30	43 (4+35+4)	75

(¹ impregnated foam without self-adhesive coating)

Dimensions of the sealing tapes tested here:

Tape dimensions	Color	Cutting width of the tape (t_F) mm	Tape thickness compressed state (b_L) mm	Tape thickness decompressed state (b_d) mm	Tape length m	Volume weight (³) kg/m ³
58/6-20 (¹)	grey + anthrazit + grey	58,06	4,61	21,3	--	93,4
58/10-30 (²)	grey + anthrazit + grey	58,26	7,48	38,6	--	81,0

(¹ Charge-no: Z-20762)

(² Charge-no: Z-20759)

(³ Volume weight with self-adhesive)

2. Scope

Air permeability (DIN EN 12114) and impermeability to driving rain (DIN EN 1027) are to be tested on the sealing tape in accordance with DIN 18542 - Stress group MF 1.

3. Installation of the sample

3.1 Test specimen with longitudinal joints

The joint sealing tapes were installed on 13.08.2019 in the client's test laboratory in Bodenwöhr in the presence of Dr. Schnatzke, Material Testing Institute.

Between the joints formed by aluminium rectangular profiles arranged in parallel, the joint sealing strips listed below were installed at the specified test joint widths.

Joints	Dimension on the sealing tape	Tape width	Joint width
1 - 3	58/6-20	58 mm	20 mm
4 - 6	58/10-30	58 mm	30 mm

The joint widths were adjusted at the upper and lower ends with rigid, fixed spacers. The test specimens were each screwed together by two threaded rods arranged at the ends of the profiles and passing through the hollow chamber profiles and the spacers (Figures 4 to 5).

After screwing the test specimens together and checking the joint widths, dated seal marks from the testing institute were affixed to the two outermost strips of sealing tape.

The sealed test specimen was then stored in the manufacturer's air-conditioned (23/50) test laboratory until testing.

3.2 Test equipment

The test device consists of a box, dimensions s. Figure 1, with an opening in front of which the test specimens with the installed specimens are mounted.

The device for generating a controllable air pressure difference between the chamber interior and the external environment, as well as devices for measuring the pressure difference and the supplied air volume are provided (see Figures 3a, 3b). The measuring devices for measuring the supplied air quantity are calibrated at regular intervals by the manufacturer of the measuring devices. The air pressure difference is displayed digitally and controlled via a U-pipe manometer connected in parallel.

The test chamber also has a water-spraying device (nozzles). The position of the nozzles is shown in figure 2. The presence of a continuous film of water on the entire test surface can be checked by means of lighting and glass panes in the spray chamber of the sprinkler system.

4. Tests and test results

4.1 Air permeability

The air permeability test was carried out on 13.09.2019 in the test rooms of the manufacturer on the samples installed in the test body on 13.08.2019, see section 3.1 of this test report. According to the company, the test specimen was stored in the test laboratory of the manufacturing plant until the test.

The dated seal marks of the Material Testing Institute, see section 3.1 Specimen installation, show no damage.

The following persons were present:

- | | | |
|----------------------|--------------------------|----------------------------|
| 1. Mr Hübschmann, | product development | } tremco illbruck GmbH |
| 2. Mr Schießl, | laboratory assistant | } |
| 3. Mr Dr. Schnatzke, | experimental management, | Material Testing Institute |

The test equipment was prepared for the air permeability test by fixing the test specimen in front of the test rig (Figure 4, 5).

The air temperature in the test room was 22.0°C at an air pressure of 103.3 kPa and a relative humidity of 51%.

In order to determine the test stand leakage, the joints were sealed with the joint sealing tapes installed between the aluminium profiles by means of adhesive tape which was stuck over the joints. After being subjected to three pressure surges of approx. 660 Pa for at least 3 seconds, the leakage of the test stand was determined with this test specimen (see Table 1). The test rig leakage is shown graphically in diagram 1.

Air permeability: Dimension 58/6-20 Joint width 20 mm

To determine the air permeability of the 58 mm wide joint sealing tapes in the 20 mm wide joints, all other joints except the three test joints were covered with adhesive tape.

After being subjected to three pressure surges of around 660 Pa for at least 3 seconds, the air permeability of the test joints was determined. The sequence of the pressure stages - increasing in steps up to 600 Pa - was carried out according to DIN 18542. Diagram 2 shows the length-related air permeability converted to standard conditions ($T_0 = 293 \text{ K}$, $p_0 = 101.3 \text{ kPa}$) against the pressure differences (deducting the test stand leakage).

The results of the test rig leakage and the air permeability are summarized in Table 1.

Table 1: Air permeability longitudinal joints (58 mm tape width; 20 mm joint width)

Test bench leakage		Air permeability		
[Pa]	[m ³ /h]	Test pressure [Pa]	Net [m ³ /h ¹]	Net [m ³ /(h m)] ¹
50	--	50	0.42	0.138
100	0.30	100	0.62	0.206
150	0.38	150	0.84	0.280
200	0.50	200	0.99	0.331
250	0.58	250	1.11	0.371
300	0.68	300	1.25	0.415
450	0.91	450	1.58	0.527
600	1.10	600	1.84	0.614

¹) Each converted to standard conditions ($T_0 = 293 \text{ K}$, $p_0 = 101.3 \text{ kPa}$) (DIN EN 12114)

Test rig leakage

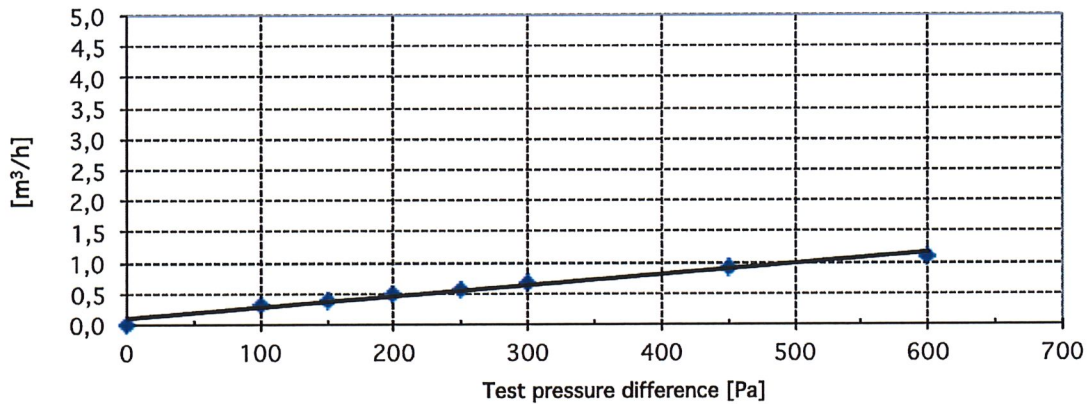


Diagram 1: Graphical representation of test rig leakage (longitudinal joints)

length-related air permeability

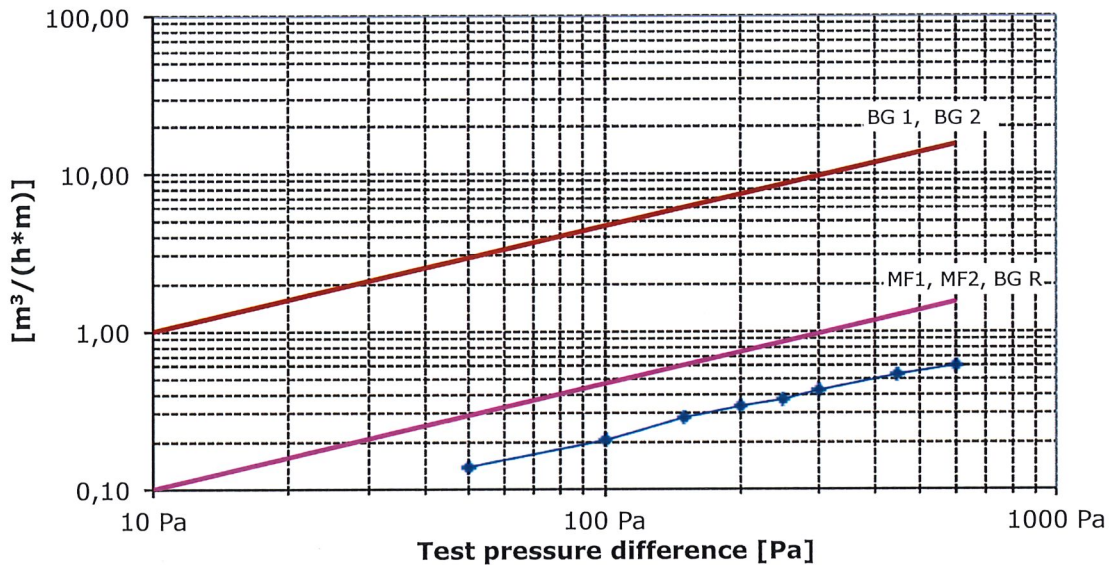


Diagram 2: Representation of the length-related air permeability (tape width 58 mm; joint width 20 mm) and the upper class limits according to DIN 18542

Requirements according to DIN 18542: 2020-04

For joint sealing tapes of stress group MF 1, the joint permeability coefficient (a-value) determined from the regression line must be less than $0.1 \text{ m}^3/(\text{h} \cdot \text{m} \cdot (\text{daPa})^n)$. Furthermore, the measured air permeabilities must not exceed the limit line ($a < 0.1 \text{ m}^3/(\text{h} \cdot \text{m} \cdot (\text{daPa})^{2/3}$) (see diagram 2).

Test result:

The joint permeability coefficient was calculated according to DIN 18542. The joint permeability coefficient (at 10 Pa) is $0.053 \text{ m}^3 / (\text{h} \cdot \text{m} \cdot (\text{daPa})^{0.61}$, the exponent is 0.61. The limit line ($a < 0.1 \text{ m}^3/(\text{h} \cdot \text{m} \cdot (\text{daPa})^{2/3}$) is not exceeded up to a pressure of 600 Pa. The requirements of stress group MF 1 according to DIN 18542 are fulfilled.



Air permeability: Dimension 58/10-30 Joint width 30 mm

To determine the air permeability of the 58 mm wide joint sealing tapes in the 30 mm wide joints, all other joints except the three test joints were covered with adhesive tape.

After being subjected to three pressure surges of around 660 Pa for at least 3 seconds, the air permeability of the test joints was determined. The sequence of the pressure stages - increasing in steps up to 600 Pa - was carried out according to DIN 18542. Diagram 3 shows the length-related air permeability converted to standard conditions ($T_0 = 293\text{ K}$, $p_0 = 101.3\text{ kPa}$) against the pressure differences (deducting the test stand leakage).

The results of the test rig leakage and the air permeability are summarized in Table 2.

Table 2: Air permeability longitudinal joints (58 mm tape width; 30 mm joint width)

Test bench leakage		Air permeability		
[Pa]	[m ³ /h]	Test pressure [Pa]	Net [m ³ /h] ¹⁾	Net [m ³ /(h m)] ¹⁾
50	--	50	0.19	0.064
100	0.30	100	0.30	0.101
150	0.38	150	0.48	0.159
200	0.50	200	0.52	0.172
250	0.58	250	0.62	0.206
300	0.68	300	0.71	0.236
450	0.91	450	0.90	0.300
600	1.10	600	1.09	0.365

¹⁾ Each converted to standard conditions ($T_0 = 293\text{ K}$, $p_0 = 101.3\text{ kPa}$) (DIN EN 12114)

length-related air permeability

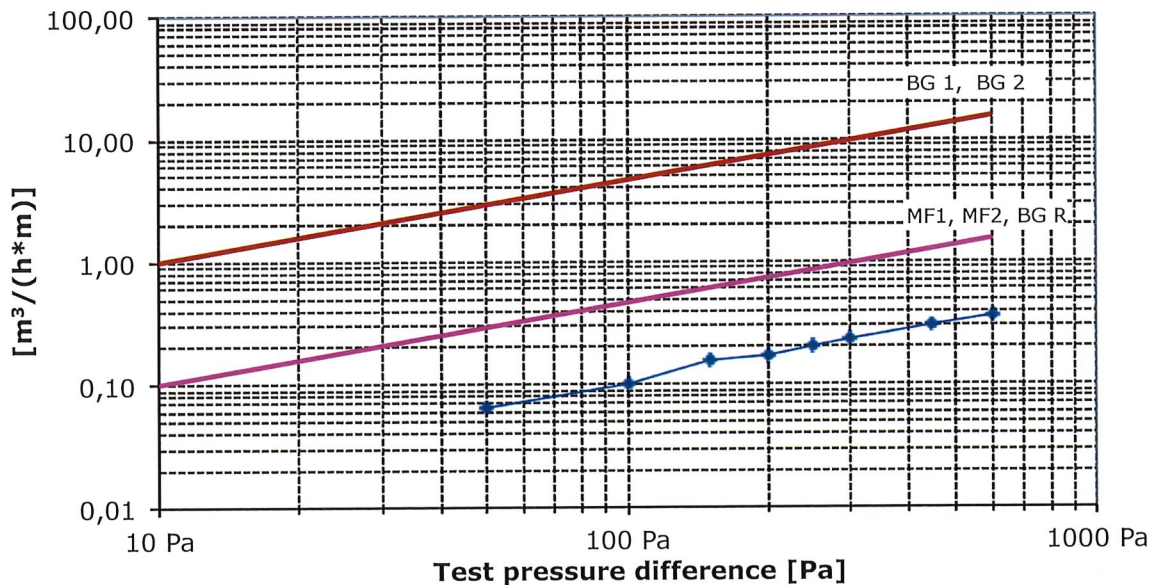


Diagram 3: Representation of the length-related air permeability (tape width 58 mm; joint width 30 mm) and the upper class limits according to DIN 18542

Requirements according to DIN 18542: 2020-04

For joint sealing tapes of stress group MF 1, the joint permeability coefficient (a-value) determined from the regression line must be less than $0.1 \text{ m}^3/(\text{h} \cdot \text{m} \cdot (\text{daPa})^n)$. Furthermore, the measured air permeabilities must not exceed the limit line ($a < 0.1 \text{ m}^3/(\text{h} \cdot \text{m} \cdot (\text{daPa})^{2/3}$) (see diagram 3).

Test result:

The joint permeability coefficient was calculated according to DIN 18542. The joint permeability coefficient (at 10 Pa) is $0.021 [\text{m}^3 / (\text{h} \cdot \text{m} \cdot (\text{daPa})^{0.70}]$, the exponent is 0.70. The limit line ($a < 0.1 \text{ m}^3/(\text{h} \cdot \text{m} \cdot (\text{daPa})^{2/3}$) is not exceeded up to a pressure of 600 Pa. The requirements of stress group MF 1 according to DIN 18542 are fulfilled.

4.2 Testing of tightness against driving rain

The driving rain test took place on 13.09.2019 directly after the determination of the air permeabilities (para. 4.1) in the test rooms of the manufacturer on the samples installed in the test body on 13.08.2019, see para. 3.1 of this test report. According to the company, the test specimen was stored in the air-conditioned (23/50) test laboratory of the manufacturing plant until the test.

The dated seal marks of the Material Testing Institute, see section 3.1 Specimen Installation, show no damage.

The following persons were present:

- | | | |
|----------------------|--------------------------|----------------------------|
| 1. Mr Hübschmann, | product development | } tremco illbruck GmbH |
| 2. Mr Schießl, | laboratory assistant | } |
| 3. Mr Dr. Schnatzke, | experimental management, | Material Testing Institute |

The test parameters were in accordance with DIN EN 1027 (spraying method 1A), section 7.

1. The air temperature in the test room before the test started was 22.0°C.
2. The air humidity in the test room before the start of the test was 51% relative.
3. The air pressure in the test room before the test was 103.3 kPa
4. The water temperature (drinking water) was measured at 23.5°C before the test began.
5. The spraying performance of the three nozzles was (l/m/r) 1.8 / 2.2 / 2.1 l/min.

The test was started with an initial load by 3 pressure surges of 660 Pa each. The time sequence, spraying and increase of the test pressure up to a final pressure of 600 Pa was carried out in accordance with the standard DIN EN 1027, section 7.2 and figure 4, driving rain tightness - test method.

The testing of the watertightness against driving rain was apparently carried out from the beginning of the irrigation for water that had passed through the samples by constantly illuminating the samples with a lamp.

Request:

According to DIN 18542: 2020-04, no water or moisture penetration must be detectable for joint sealing tapes of stress group MF 1 up to a test pressure of 600 Pa.

Test result:

Joints	Dimension of the sealing tape	Band width	Joint width	driving rainproof
1 – 3	58/6-20	58 mm	20 mm	≥ 1050 Pa
4 – 6	58/10-30	58 mm	30 mm	≥ 1050 Pa

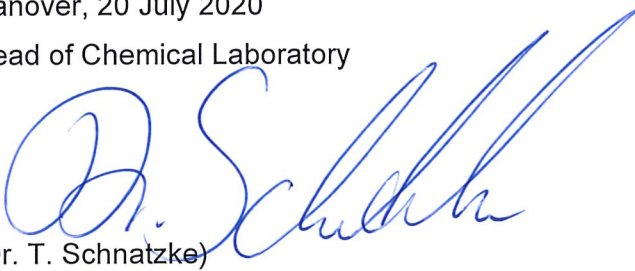
The requirements of DIN 18542 - MF 1 regarding impermeability to driving rain were fulfilled by all installed tape samples.

Hint:

This is followed by pages 9 to 12 with figures 1 to 5.

Hanover, 20 July 2020

Head of Chemical Laboratory

A handwritten signature in blue ink, appearing to read 'Dr. Schnatzke'. The signature is fluid and cursive, written over a light blue circular stamp.

(Dr. T. Schnatzke)





Figure 1: Open test bench without the test body used



Figure 2: Open test bench with arrangement of the three water spray nozzles



Figure 3a: Test bench control (pressure control)

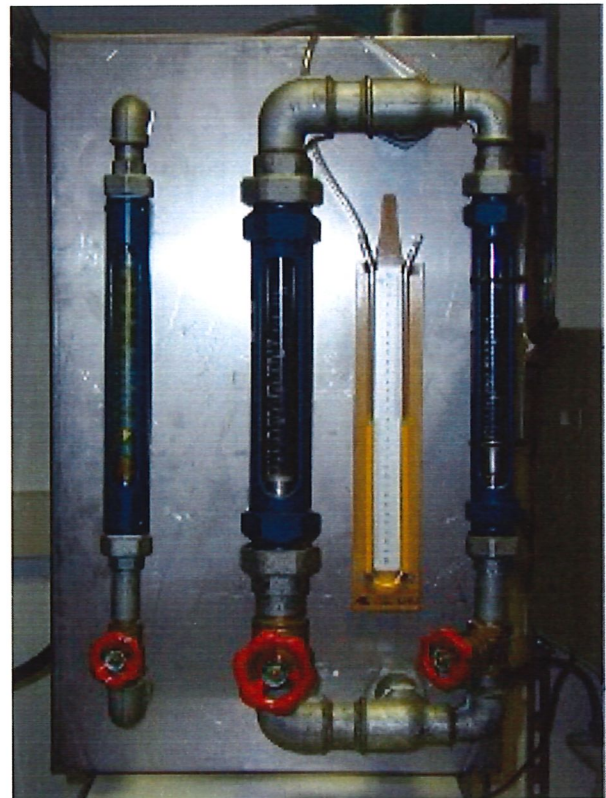


Figure 3b: Test bench control (water and air volume)

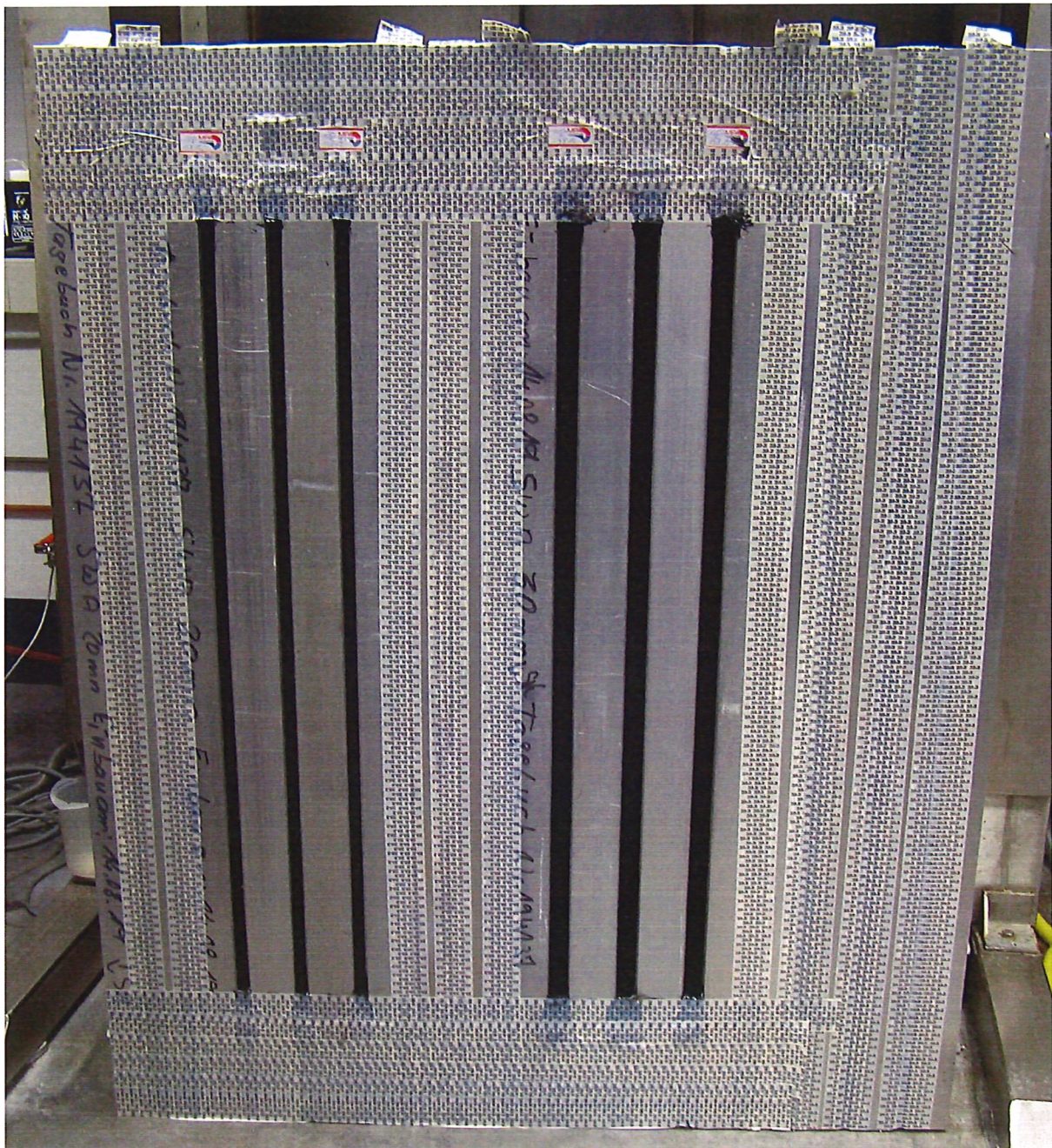


Figure 4: Test specimen with the installed joint sealing tapes (View of driving rain-soaked side)

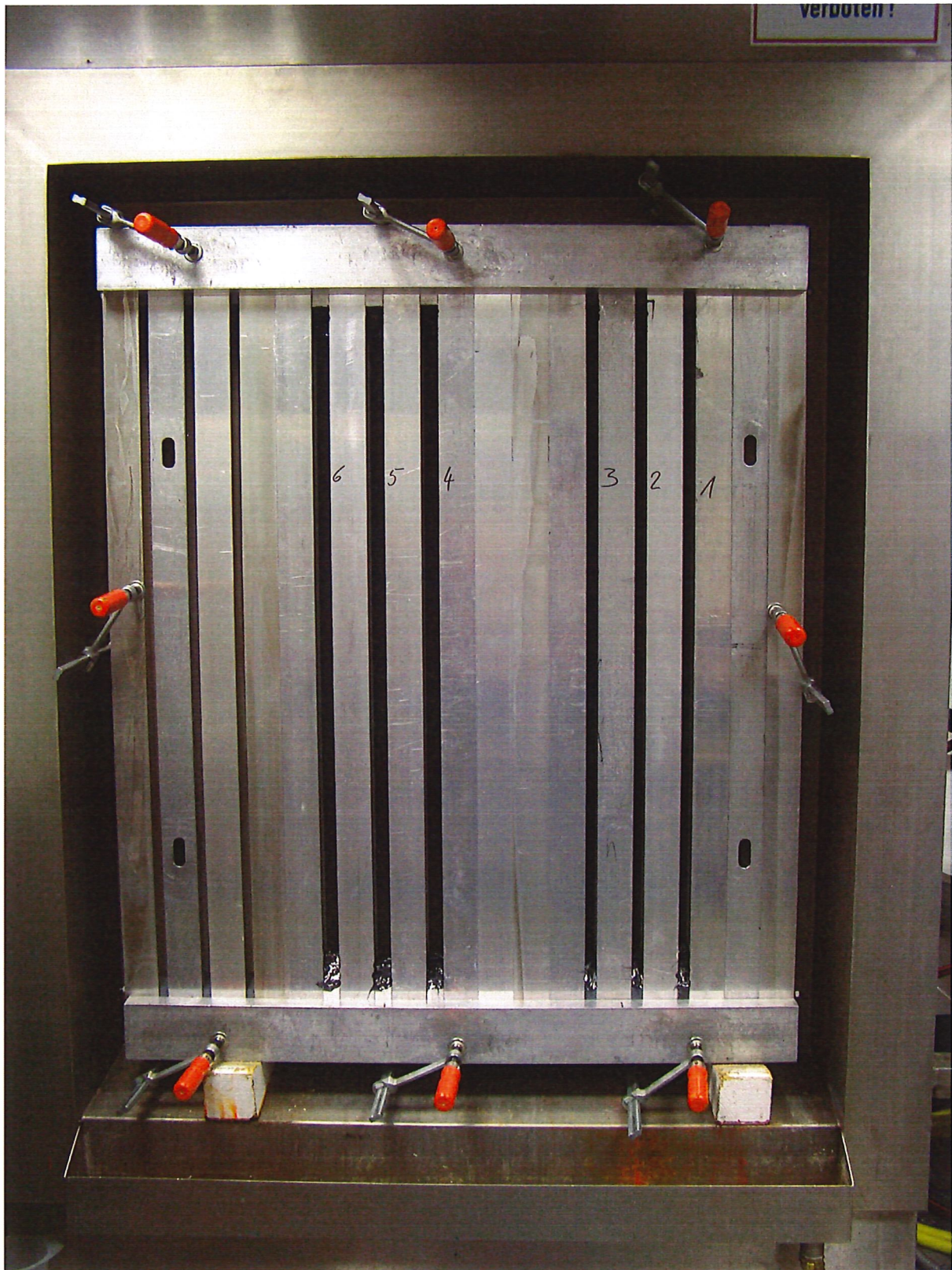


Figure 5: Test body installed in the test bench