

## Tests on a liquid retaining barrier mounted on Metacon doors

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Product name	METACON Liquid Retaining Barrier
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## 1. INTRODUCTION

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The Special Testing Team of Efectis Nederland BV, Bleiswijk the Netherlands, has performed tests on liquid retaining barriers designed to be applied on doors manufactured by Metacon B.V. Gouda the Netherlands.

At the moment of testing a European standard was not available for this type of construction. Therefore the tests have been carried out according to a test protocol written by Efectis Nederland BV that is given in chapter 3.

The reason for investigating a liquid retaining barrier has been instigated by the fact that on June 2004 the new PGS 15<sup>1</sup> standard took effect, with a revision in December 2011:

PGS 15:2011. In the PGS 15 fire resistant doors should have, in the case of storage of dangerous liquids, a liquid retaining barrier to prevent liquid from flowing from one compartment to the other, creating an extra requirement for fire resistant door-sets when applied as liquid barrier doors.

The tested construction is universal in the sense that it can be installed on multiple types of doors given certain restrains. These restrains will be described and explained in chapter 4.

## 2. TIME & PLACE

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The tests on the 300 mm liquid barrier have been carried out in the laboratory of Efectis Nederland BV, Bleiswijk the Netherlands, on July 16 and July 17 of 2013.

The test on the 1000 mm liquid barrier has been witnessed at Metacon Branddeuren, Waddinxveen the Netherlands on the 11<sup>th</sup> of June 2015.

The tests on the 500 mm liquid barrier have been witnessed at Metacon Branddeuren, Waddinxveen the Netherlands on the 31<sup>st</sup> of August and the 3<sup>rd</sup> of September 2015.

## 3. DESCRIPTION INVESTIGATION

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### 3.1 TEST SETUP

The tests were performed in a wooden container with an open top. The watertight container was separated in two sections by a wooden partition comprising a complete liquid retaining barrier. In annex C photos can be found of the test setup.

### 3.2 TEST PROTOCOL

The test protocol consisted of the following steps:

- The segment is lowered into the guides
- A dead weight generated with metal cylinders with a weight of 17.8 kg each are distributed evenly on top of the barrier
- One compartment is filled with water to a height of 300 mm, 500 mm and 1000 mm;
- Every hour the barrier is checked for leakage
- The test is stopped after 4 hours of testing.

This protocol is repeated for the other side of the barrier.

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<sup>1</sup> <http://www.publicatiereeksgevaarlijkstoffennl/publicaties/PGS15.html>

### 3.3 PERFORMANCE CRITERIUM

According to § 3.2.6 of the PGS 15:2011 a liquid retaining barrier is mandatory if a door is installed between two or more liquid storages in combination with fire resistant compartments. No maximum allowed leakage rate is mentioned in this standard. The maximum allowed leakage rate of 0.5 l/m/hr. has been established between the manufacturer and Efectis.

## 4. RESULTS INVESTIGATION

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### 4.1 LIQUID BARRIER 300 MM SEAL LENGTH 1.6 M

The results of the tests are as follows:

- At the side of the partition with the water against the inside of the liquid retaining barrier and guiding system no leakage occurred after 4 hours of testing
- At the side of the partition with the water against the outside of the liquid retaining barrier and guiding system the liquid retaining barrier showed a leakage of less than 1 ml after 4 hours of testing.

### 4.2 LIQUID BARRIER 500 MM SEAL LENGTH 2.0 M

The results of the tests are as follows:

- At the side of the partition with the water against the inside of the liquid retaining barrier and guiding system no leakage occurred after 4 hours of testing
- At the side of the partition with the water against the outside of the liquid retaining barrier and guiding system the liquid retaining barrier showed a leakage of 1.7 l after 4 hours of testing.

### 4.3 LIQUID BARRIER 1000 MM SEAL LENGTH 3.0 M

The results of the tests are as follows:

- At the side of the partition with the water against the inside of the liquid retaining barrier and guiding system no leakage occurred after 4 hours of testing
- The other side has not been tested.

## 5. CRITERIA ON THE LIQUID RETAINING BARRIER

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A number of criteria determine the performance of the liquid retaining barrier. Also the applicability of the test results depends on a number of factors. In this chapter the relevant parameters are identified and enumerated. This chapter starts with the requirements and ends with a description of the tested construction and the doors.

### 5.1 EFFECTS ON THE FIRE RESISTANCE

The liquid retaining barriers are mounted on fire resistant doors that separate compartments housing different kinds of chemicals. These chemicals can range from being not dangerous to aggressive. In the case of an incident the liquid retaining barrier should confine the compartment and prevent liquids from flowing to other compartments. The liquid retaining barrier should not influence the fire resistance of the door-set in a negative manner.

## 5.2 CRITERIA ON THE NONMOVING PARTS

### 5.2.1 Floor & guides

The floor should be level and free from any irregularities that may influence the liquid retaining capabilities of the barrier. The transition between the floor, the guides and the moving parts should be smooth. The connection between the floor, the wall and guides should be sealed with an appropriate sealant. The sealant between the guides and the wall should be applied to a height of at least the tested height. The opening and closing of the door-set has to work properly without any restriction due to the fact that a liquid retaining barrier has been added to the construction.

## 5.3 CRITERIA ON THE MOVING PARTS

### 5.3.1 Criteria on the barrier

The barrier should be watertight and be made of materials that can withstand the chemicals that are stored.

The barrier should have at least the intended retaining height i.e. should not have any hinged parts under the water line. If that is not the case the hinged construction should be tested for water tightness. Also the rubber strip should be made of one of piece. If that is not the case a joint should be tested for water-tightness.

## 5.4 APPLICABILITY OF THE TEST RESULTS

During testing a number of parameters are chosen to test the liquid retaining barrier. These are the height of the liquid level being 300 mm, 500 mm and 1000 mm and the pressure on top of the movable partition part of the construction. Both parameters determine the applicability of the test results:

- The test results are only valid for liquid levels lower or equal to the tested height
- The test results are only valid for equal or larger amounts of mass per meter of barrier, i.e. the pressure on the barrier should be equal or larger. Also the width of the rubber strip at the underside of the barrier should be equal or larger than the tested width. When the rubber strip is made larger the pressure should increase proportionally to the width increase.

## 6. DESCRIPTION OF THE CONSTRUCTIONS

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### 6.1 DETAILS OF THE TESTED CONSTRUCTION

The tested construction consisted of two mirrored guides and a segment with the liquid retaining seal at the bottom. The seal was made of a rubber strip of neoprene and had dimensions of 29 mm x 50 mm whereas the long side was used as the bottom side. A datasheet of the material is given in annex A. The rubber strip was made of one piece and ran along the sides and the bottom of the segment i.e. the rubber strip did not get interrupted under the liquid level. The transition between the segment and rubber strip was sealed with the sealant given in annex A.

The segment is made of sheet metal and has a clear width of 1 m. A drawing of the segment is given in annex A figure A.1.

The guides were made of galvanized steel and sealant was applied between the bottom and the floor and the sides and the wall to prevent leakage. A drawing of the guide is given in annex A figure A.2

## 6.2 EQUIVALENCE TO METACON RGS EI(1) 60 / EW180 & RGS EI(1) 120

The EI-60 / EW180 and EI-120 doors are of a similar construction and are therefore examined together. Both doors use guiding systems of similar design and dimensions as the tested construction so they are equivalent. It is important that the guides are sealed to the wall and floor according to the manufacturer's instructions. The guides should be sealed with the sealant of Appendix A to the minimum height i.e. at least 300 mm, 500 mm or 1000 mm from the floor.

The bottom segments of these doors are lower than 300 mm, 500 mm or 1000 mm so a segment similar to the one tested is mounted over these panels to get to the required height of at least 300 mm, 500 mm or 1000 mm.

The rubber strip at the bottom is similar to the tested strip, i.e. is of the same material and has the same dimensions. Also the strip is sealed with the sealant mentioned in Appendix A.

### 6.2.1 300 mm Barrier

The weight of the door-set / construction should generate a pressure of at least 200 kg on the liquid retaining barrier with every clear meter of the door leaf. If the rubber strip at the bottom is made wider than 50 mm the pressure should increase proportionally to the width increase. Also the rubber strip should be made of one piece.

If the construction of this type of door shall be identical as tested, the expectation of Efectis is that the liquid retaining barrier does not have a negative influence on the fire resistance.

### 6.2.2 500 mm Barrier

The weight of the door-set / construction should generate a pressure of at least 220 kg on the liquid retaining barrier with every clear meter of the door leaf. If the rubber strip at the bottom is made wider than 50 mm the pressure should increase proportionally to the width increase. Also the rubber strip should be made of one piece.

If the construction of this type of door shall be identical as tested, the expectation of Efectis is that the liquid retaining barrier does not have a negative influence on the fire resistance.

### 6.2.3 1000 mm Barrier

The weight of the door-set / construction should generate a pressure of at least 280 kg on the liquid retaining barrier with every clear meter of the door leaf. If the rubber strip at the bottom is made wider than 50 mm the pressure should increase proportionally to the width increase. Also the rubber strip should be made of one piece.

If the construction of this type of door shall be identical as tested, the expectation of Efectis is that the liquid retaining barrier does not have a negative influence on the fire resistance.

## 6.3 EQUIVALENCE TO METACON OHD EI(1) 60 / EW 90

The door uses guides of a similar construction and dimensions as the tested construction so are equivalent. It is important that the guides are sealed to the wall and floor to the manufacturer's instructions. The guides should be sealed with the sealant of Appendix A to the minimum height i.e. at least 300 mm, 500 mm or 1000 mm from the floor. The bottom segments of these doors are higher than 300 mm, 500 mm or 1000 mm so only a profile width the same width of the tested profile is installed at the bottom. A drawing of such a profile width a clear width of 1 m is given in annex G. This profile should be adequately sealed to prevent leakage. The rubber strip at the bottom is similar to the tested strip, i.e. is of the same material and has the same dimensions. Also the strip is sealed with the sealant mentioned in Appendix A.

For the necessary minimum seal pressures see § 6.2.1 to § 6.2.3. If the rubber strip at the bottom is made wider than 50 mm the pressure should increase proportionally to the width increase. Also the rubber strip should consist of one piece so without any interruptions.

If the construction of this type of door shall be identical as tested, the expectation of Efectis is that the liquid retaining barrier doesn't have a negative influence on the fire resistance.

## 7. CONCLUSION

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The Special Testing Team of Efectis Nederland BV, Bleiswijk the Netherlands, has performed tests on a liquid retaining barrier designed to be applied on doors manufactured by Metacon B.V. Gouda the Netherlands.

The liquid retaining barrier is tested for 4 hours at each side of the barrier with a water height of 30, 50 and 100 cm. After the test time the amount of leakage is measured. The maximum leakage may amount to a maximum of 0.5 l/m/hr. i.e. the construction may leak 0.5 liters for every meter of barrier per hour.

The liquid retaining barrier is of a universal construction and can be mounted to different kinds of doors. To determine if mounting the barrier to different kinds of doors gives an equivalent construction, i.e. a construction that gives the same performance, a number of criteria should be met which are given in chapter 5.

Metacon B.V. would like to use the tested construction on the following doors:

METACON RGS EI(1) 60 / EW 180, RGS EI(1) 120 and METACON OHD EI(1) 60 / EW 90. Drawings of these doors are given in Appendix B. The construction of these doors complete with barrier is compared to the tested construction. In chapter 6 the tested construction and doors are compared. When the requirements of chapters 5 and 6 are fulfilled the liquid retaining barrier may be used on the METACON RGS EI(1) 60 / EW180, RGS EI(1) 120 and METACON OHD EI(1) 60 / EW 90 doors.

Based on the small scale test the opinion of Efectis is that the liquid retaining barrier is allowed to be mounted on Metacon roller shutters and overhead door constructions under the next conditions:

- The liquid retaining barrier may only be applied to Metacon METACON RGS EI(1) 60 / EW180, RGS EI(1) 120 and METACON OHD EI(1) 60 / EW 90 door-sets
- Maximum allowed height of the liquid retaining barrier of 300 mm, 500 mm or 1000 mm, the latter only for the scenario liquid at the inside of the liquid barrier and the guiding system
- The seal between the guiding system /floor and the moving segment shall be a rubber strip consisting of one piece so it has no interruptions
- The floor shall be free of obstacles.

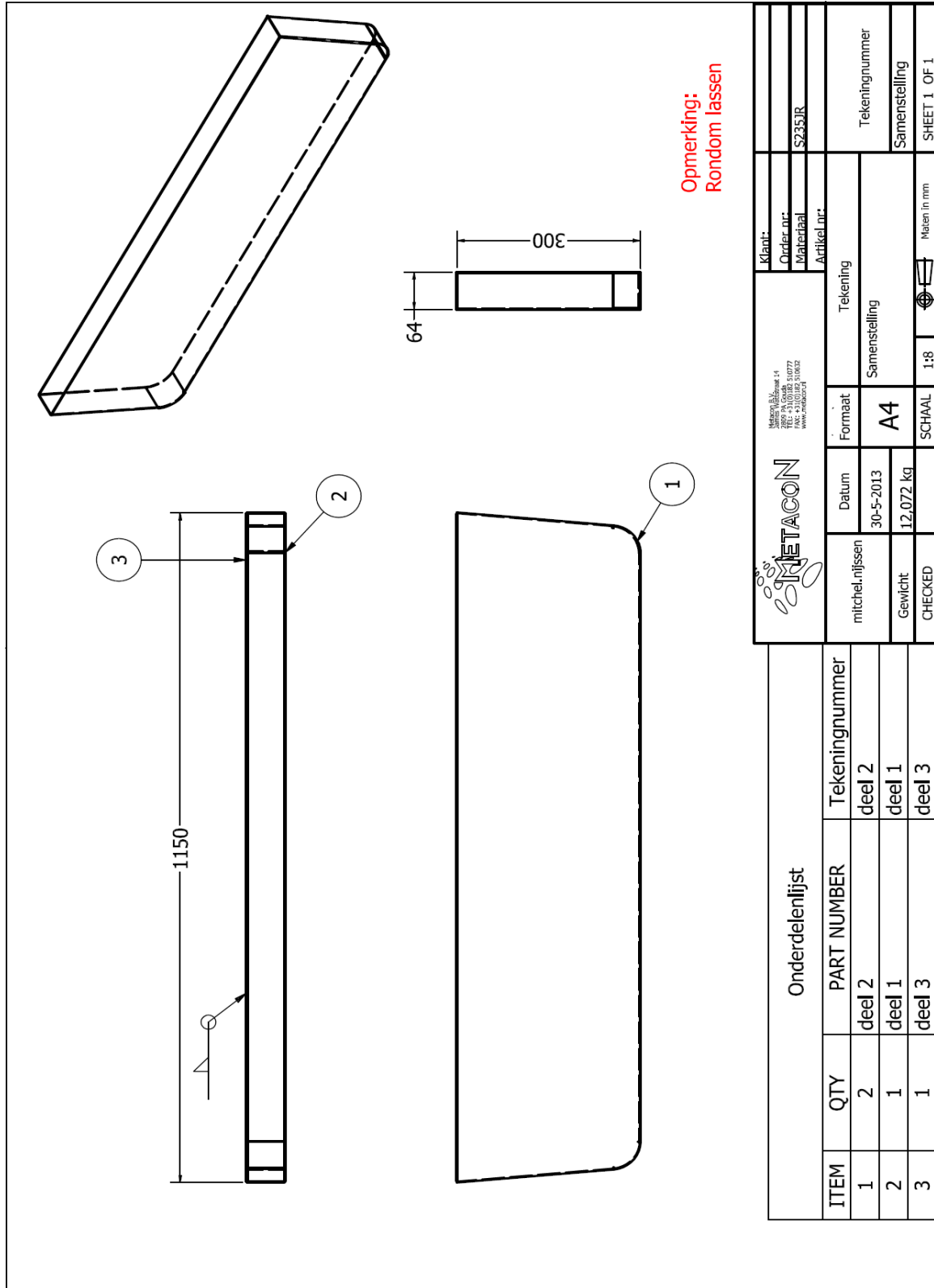


S. Lutz  
Project leader smoke control and fire resistance



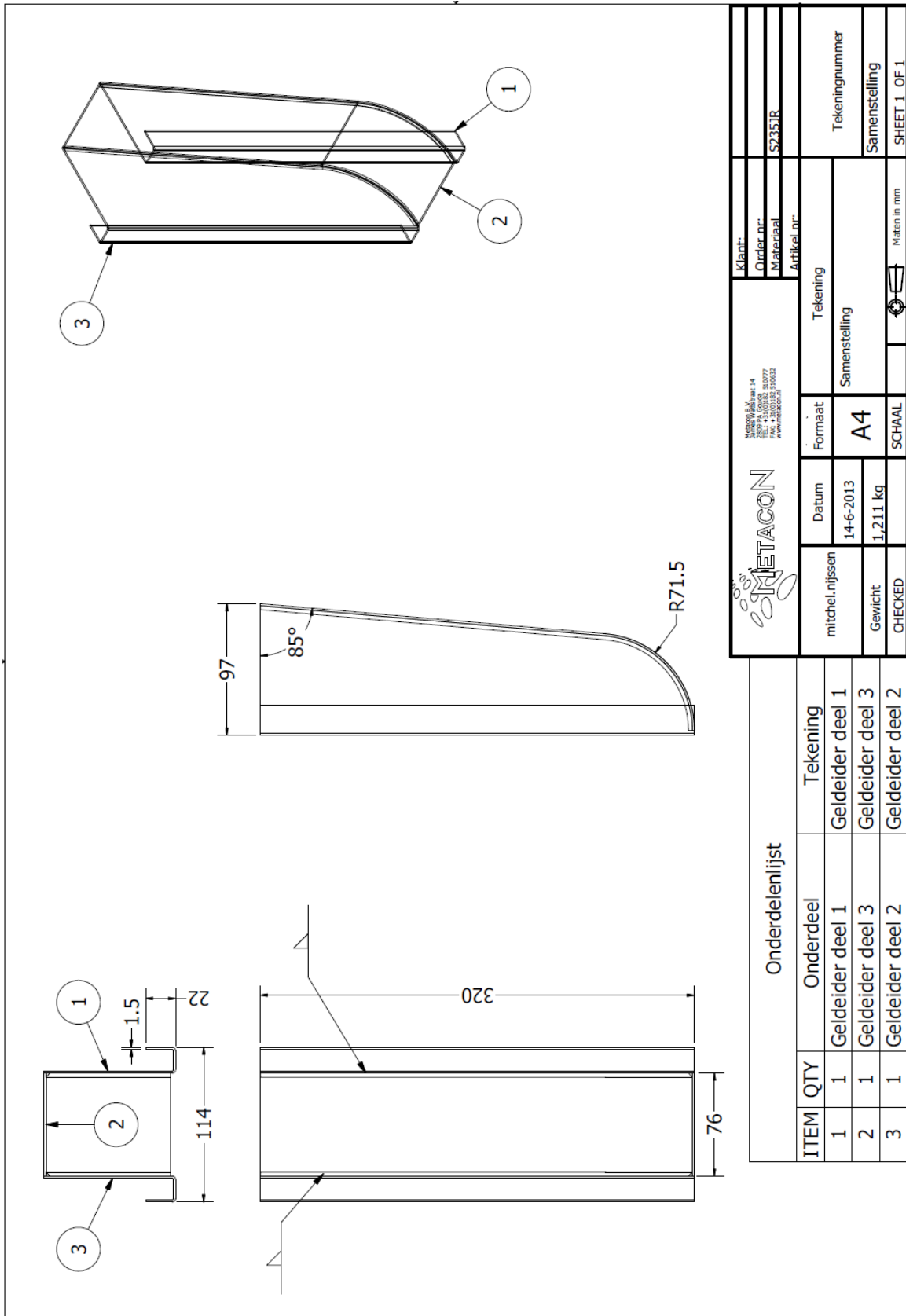
J. Bienefeld B.Eng.  
Project leader special testing

APPENDIX A: DETAILS OF THE TEST SETUP



A.1 Tested segment, 300 mm



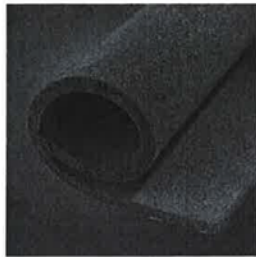


A.2 Guide, 300 mm

*off.*

# ERIKS

## elastomeren en celrubber platen



### **RX® CR Fest** Neoprene® celrubberplaat

**Materiaal** : CR  
**Kleur** : zwart  
**S.g. (kg/m³)** : 150-210  
**Temperatuurbereik (°C)** : -40 /max. +95

**Toepassing** : RX® CR Fest is 100% geschuimd met een gesloten celstructuur. De gesloten structuur maakt de RX® CR Fest geschikt voor vloeistof en gasafdichtingen. In combinatie met de zachte eigenschap is RX® CR Fest een dichtingsmateriaal dat bij geringe kracht een dichting creëert. De RX® CR Fest is op basis van Neoprene® en is dan ook toepasbaar voor water, oliën, gassen, lichte zuren en logen. Tevens is RX® CR Fest verouderingsbestendig.

**Tabel 1: Leveringsprogramma RX® CR Fest**

artikelnummer	zelfklevend	rollengte (mm)	breedte (mm)	dikte (mm)
10016564	-	1850	1000	2
10016565	-	1850	1000	3
10016566	-	1850	1000	4
10016567	-	1850	1000	5
10016568	-	1850	1000	6
10016569	-	1850	1000	8
10016570	-	1850	1000	10
10016571	-	1850	1000	12
10016572	-	1850	1000	15
10016573	-	1850	1000	20
10016574	-	1850	1000	25
10016575	-	1850	1000	30
10016576	ja	1850	1000	2
10016577	ja	1850	1000	3
10016578	ja	1850	1000	4
10016579	ja	1850	1000	5

*Afwijkende dikten op aanvraag leverbaar.  
 Pakkingen volgens tekening kunnen in eigen productie snel worden vervaardigd.*

# ERIKS

## elastomeren en celrubber platen

### Keuzetabel rubber

pag.	Materiaal		Specificaties									
	ISO-benaming	ERIKS benaming	temperatuur (°C)	Pmax (bar)	water	oliebestendig	zuurbestendig	loogbestendig	verouderingsbestendig	UV-bestendig	levensmiddelen	slijtvast
<b>Rubberplaat</b>												
5	NR/SBR	RX® Norma	- 10 / + 70	10	○	-	-	-	-	-	-	○
6	NR/SBR	RX® Standaard	- 10 / + 70	10	○	-	-	-	-	-	-	○
7	CR	RX® Neoprene®	- 20 / + 110	10	○	○	○	○	●	○	-	-
8	CR/SBR	RX® Neoprene® 642RV	- 30 / + 70	10	○	-	○	○	○	-	-	-
9	CR	RX® Neo 40	- 30 / + 100	8	○	○	○	○	○	-	-	-
10	EPDM	RX® EPDM	- 30 / + 130	10	●	-	●	●	●	●	-	-
10	EPDM	RX® EPDM wit	- 30 / + 130	10	●	-	○	○	●	●	○	-
11	EPDM	RX® EPDM KIWA	- 30 / + 130	10	●	-	○	○	●	●	-	-
12	NBR	RX® Superba	- 10 / + 80	10	○	●	-	-	-	-	-	-
13	NBR/SBR	RX® Oil	- 10 / + 70	10	○	○	-	-	-	-	-	-
14	NBR	RX® Ideaal	- 20 / + 100	10	○	○	-	-	-	-	-	-
15	NBR	RX® Orion	- 20 / + 100	10	○	○	-	-	-	-	○	-
16	NR/SBR	RX® Blanca	- 15 / + 80	10	●	-	-	-	-	-	○	○
17	Si of MVQ	RX® Silicone	- 60 / + 200	10	●	-	-	-	○	○	●	-
18	Si of MVQ	RX® Silicone Rood/Blauw	- 55 / + 235	10	●	-	-	-	○	○	-	-
19	FPM	RX® FPM	- 10 / + 200	10	○	●	●	●	○	○	-	-
20	FPM	RX® Viton® A	- 10 / + 200	10	○	●	●	●	○	○	-	-
21	CSM	RX® Hypalon®	- 20 / + 100	10	○	-	●	●	○	○	-	-
22	CIIR	RX® Butyl	- 40 / + 120	10	○	-	○	○	○	○	-	-
23	NR	RX® Luna Para	- 40 / + 70	8	○	-	-	-	-	-	-	●
24	NR/SBR	Para Black	- 30 / + 70	8	○	-	-	-	-	-	-	●
25	NR/SBR	Para Red	- 40 / + 70	8	○	-	-	-	-	-	-	●
26	NR/SBR	Blackstar	- 30 / + 70	8	○	-	-	-	-	-	-	●
27	NR/SBR	Redstar	- 40 / + 70	8	○	-	-	-	-	-	-	●
28	PVC	RX® Mipolam	- 40 / + 95	8	○	-	-	-	-	-	-	●
29	SBR	RX® Mines	n.v.t.	10	○	-	○	○	○	○	-	-
30	CR/kurk	RX® Ericork	n.v.t.	10	○	○	-	-	-	-	-	-
<b>Cel en sponsrubber</b>												
33	NR/SBR	RX® SW Weich	- 40 / + 70	drukloos	○	-	-	-	-	-	-	-
34	CR	RX® CR Fest	- 40 / + 95	drukloos	○	○	○	○	○	○	-	-
35	diversen	EPDM, NBR, CR	n.v.t.	drukloos	○	-	○	○	○	○	-	-
<b>Rubber doek</b>												
36	CR	RX® CR-Fabric	n.v.t.	10	○	○	○	○	○	○	-	-
36	NBR	RX® Oilco	n.v.t.	10	○	●	-	-	-	-	-	-
<b>Rubber matten &amp; vloerdelen</b>												
37	NR/SBR	RX® Ribloper breed	- 10 / + 70	n.v.t.	○	-	-	-	-	-	-	○
38	NR/SBR	RX® Ribloper fijn	- 30 / + 70	n.v.t.	○	-	-	-	-	-	-	○
39	NR/SBR	RX® Noppenloper	- 35 / + 70	n.v.t.	○	-	-	-	-	-	-	○
40	NR/SBR	RX® Hoogspanning	- 20 / + 70	n.v.t.	○	-	-	-	-	-	-	○

- = zeer goed bestendig
- = geschikt
- = niet geschikt

4

#### A.4 Rubber strip material, 300 mm, 500 mm and 1000 mm

1491357 - BISON SILICONENKIT BOUW WIT KOKER 300 ML NL

# SILICONENKIT BOUW

## NEUTRALE SILICONENKIT VOOR ALLE BOUW AFDICHTINGEN



### PRODUCTOMSCHRIJVING

Hoogwaardige neutrale, blijvend elastische, waterbestendige siliconenkit voor alle bouw afdichtingen.

### TOEPASSINGSGEBIED

Voor het afdichten van bewegende voegen, dilatatie- en aansluitvoegen, naden en kieren in de bouw, woning, auto, boot en caravan. Ideaal voor kunststoffen (PVC deur- en raamkozijnen, polycarbonaat en plexiglas koepels), steen en metselwerk en (gevoelige) metalen (koper, zink, ijzer, aluminium, messing, roestvrijstaal). Universele hechting zonder primer op alle gangbare bouwmaterialen zoals beton, steen, natuursteen, keramiek, emaille, glas, metalen, rubber, hout en kunststoffen (acryl, PVC, ABS, polystyreen, polyester). Geen hechting op bitumen, polyethyleen, polypropyleen en P.T.F.E.

### EIGENSCHAPPEN

- Neutraal, zuurvrij
- (Zee)waterbestendig
- 100% siliconen
- Blijvend elastisch
- Uitstekende hechting op alle materialen
- Chemicaliënbestendig
- Kleurvast
- UV- en weerbestendig
- Temperatuurbestendig van -50°C tot +120°C
- Makkelijk verwerkbaar

### VOORBEREIDING

**Verwerkingsomstandigheden:** Uitsluitend verwerken bij temperaturen tussen +5 en +40°C.

**Eisen oppervlakken:** De ondergrond moet goed droog, schoon en stof-, roest-

, verf- en vetvrij zijn.

**Voorbehandeling oppervlakken:** Voor een mooi resultaat schilderstape langs de randen van de voeg aanbrengen. Voorkom zonodig drievlakshechting door opvulschuimsnoer of PE folie in de voeg aan te brengen.

**Gereedschap:** Koker met Bison Click Gun verwerken. Bison Silicone Multi Tool voor het openen van de koker en het gladstrijken van de kit.

### VERWERKING

**Verbruik:** 1 koker voor ca. 8 meter voeg van 6 x 6 mm.

### Gebruiksaanwijzing:

Koker met kitpistool verwerken. Koker openen door plastic nippel aan bovenzijde met scherp mes tot bij schroefdraad af te snijden. De spuitmond erop draaien en op de gewenste opening schuin afsnijden. Zorg voor een minimale voegbreedte van 6 mm en maximaal 20 mm. De voegdiepte is afhankelijk van de voegbreedte. Tot 12 mm voegbreedte een voegdiepte aanhouden van 6 mm. Daarboven is de voegdiepte de helft van de voegbreedte. Kit gelijkmatig in de voeg spuiten en binnen 10 minuten met een met zeepoplossing bevochtigd plamuurmes of Bison Silicone Multi Tool gladstrijken. De aangebrachte schilderstape direct na gladstrijken verwijderen. Na ca. 15 minuten vormt zich een oppervlaktehuid. Uitgeharde siliconenkit is alleen mechanisch te verwijderen. Voor aquaria uitsluitend Bison Siliconenkit Glas gebruiken.

**Vlekken/resten:** Vlekken direct verwijderen met terpentijn. Uitgeharde kit is enkel mechanisch of met Bison Siliconenkitrestenverwijderaar te verwijderen.

**Aandachtspunten:** Siliconen harden uit onder invloed van luchtvochtigheid. Daarom is tijdens het uitharden beslist contact met luchtvochtigheid noodzakelijk. Alijd rekening houden met een voeg van minimaal 6 mm breed.

### DROOGTIJDEN\*

**Huidvormingstijd:** ca. 15 minuten

**Doorhardingssnelheid:** ca. 2 mm/24 uur

\* Droogtijden kunnen variëren afhankelijk van o.a. ondergrond, opgebrachte hoeveelheid product, vochtgehalte en omgevingstemperatuur.

### TECHNISCHE EIGENSCHAPPEN

**Waterbestendigheid:** Zeer goed

**Temperatuurbestendigheid:** Van -50°C tot +120°C.

**UV-bestendigheid:** Zeer goed

**Schimmelbestendigheid:** Niet

**Chemicaliënbestendigheid:** Zeer goed

**Overschilderbaarheid:** Niet overschilderbaar

**Elasticiteit:** Zeer goed

**Vullend vermogen:** Zeer goed

### TECHNISCHE SPECIFICATIES

**Basisgrondstof:** Siliconenelastomeer

**Kleur:** Wit

**Viscositeit:** Pasteus

**Dichtheid:** ca. 1.52 g/cm<sup>3</sup>

**Vlampunt:** K3 (>55°C)

**Hardheid (Shore A):** ca. 30

**Elasticiteit E-modulus:** ca. 0,35 MPa

**Rek bij breuk:** ca. 380 %

Onze adviezen zijn gebaseerd op uitgebreide onderzoeken en praktijkervaringen. In verband met de grote verscheidenheid van materialen en/of omstandigheden waaronder wordt gewerkt, kunnen wij geen aansprakelijkheid aanvaarden voor de verkregen resultaten en/of enige schade die het gevolg zou zijn van het gebruik van het product. Wij staan echter graag voor u klaar met advies.

Bison International B.V. - P.O. Box 160 - NL 4460 AD Goes

www.bison.net

BISON-007-ZE-001

## A.5 Sealant

## SILICONENKIT BOUW



### OPSLAGCONDITIES

Aangebroken verpakking beperkt houdbaar. Opslaan in goed gesloten verpakking op een droge plaats bij een temperatuur tussen +5°C en +25°C.

Onze adviezen zijn gebaseerd op uitgebreide onderzoeken en praktijkervaringen. In verband met de grote verscheidenheid van materialen en/of omstandigheden waaronder wordt gewerkt, kunnen wij geen aansprakelijkheid aanvaarden voor de verkregen resultaten en/of enige schade die het gevolg zou zijn van het gebruik van het product. Wij staan echter graag voor u klaar met advies.

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### A.6 Sealant

APPENDIX B: DRAWINGS

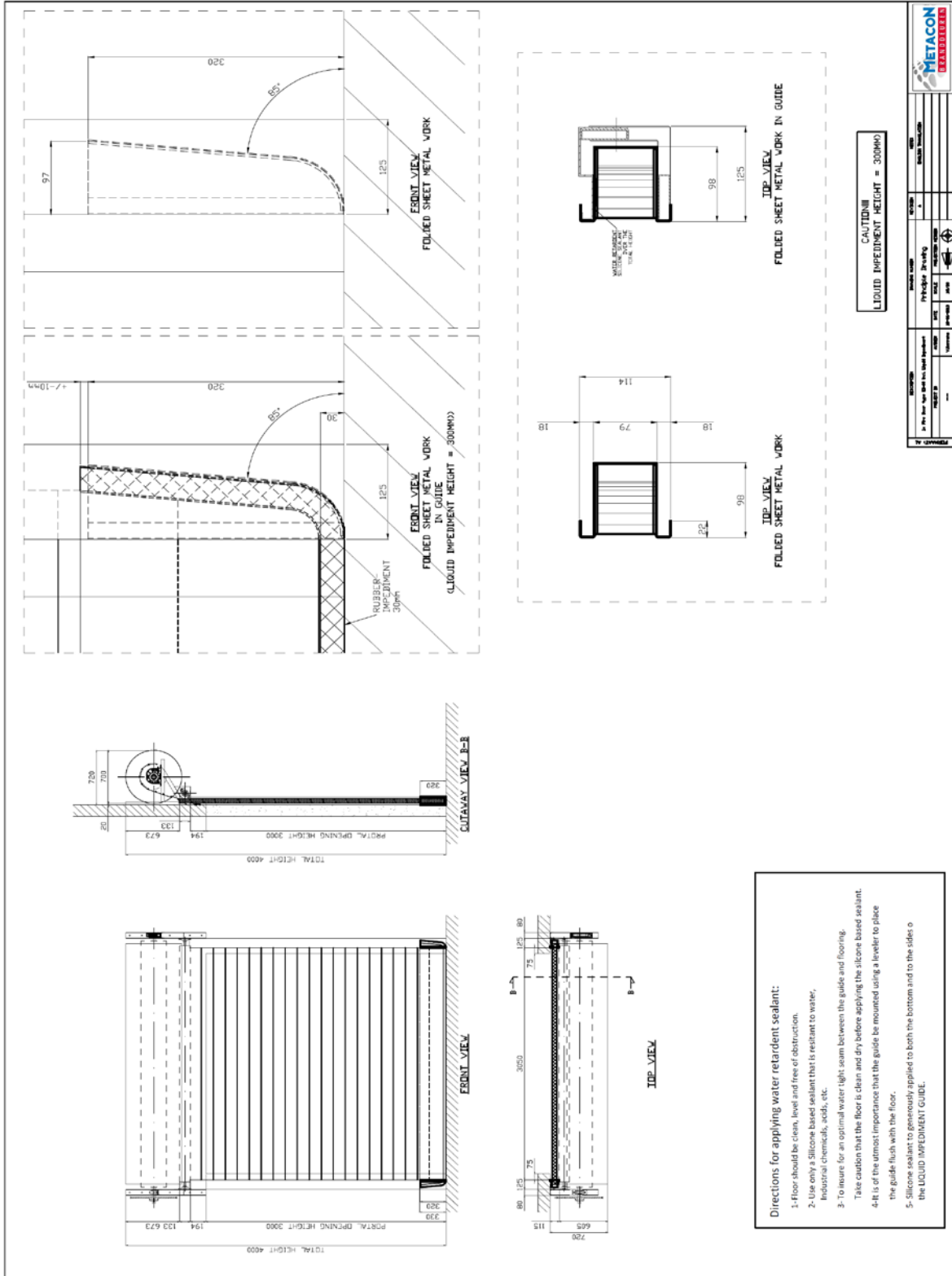


Figure B.1 Principle drawing EI-60

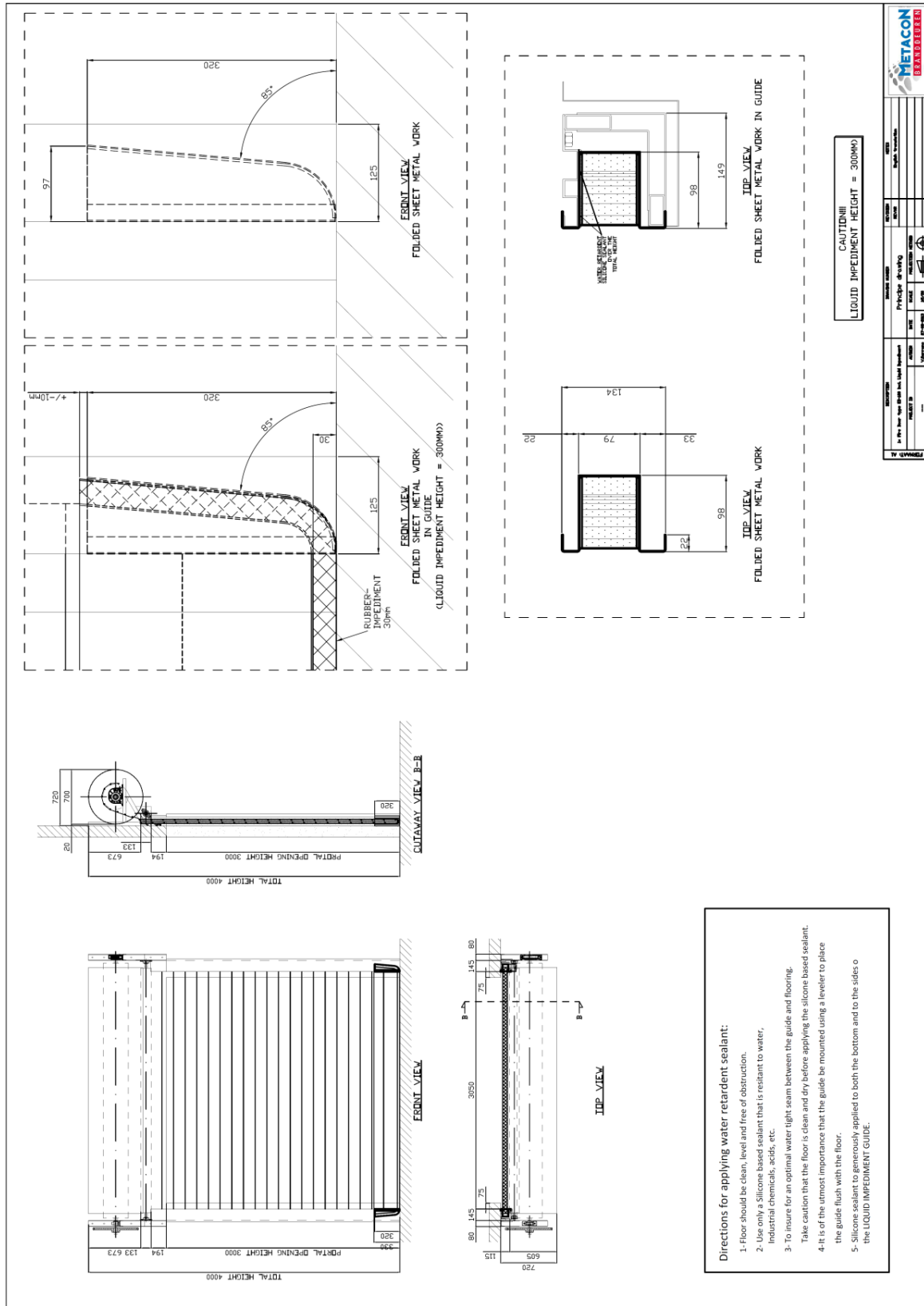


Figure B.2 Principle drawing EI-120





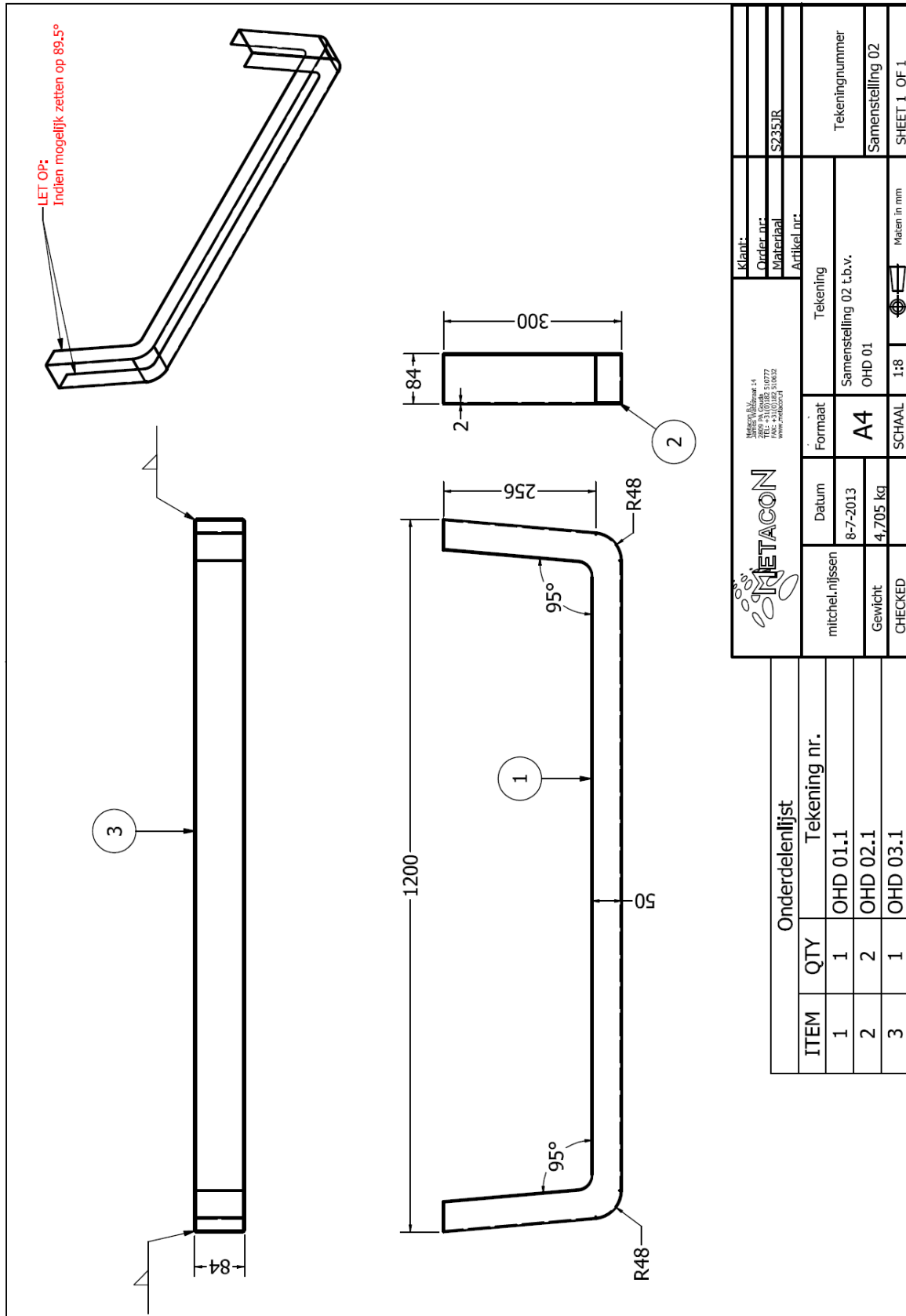


Figure B.4 Profile OHD

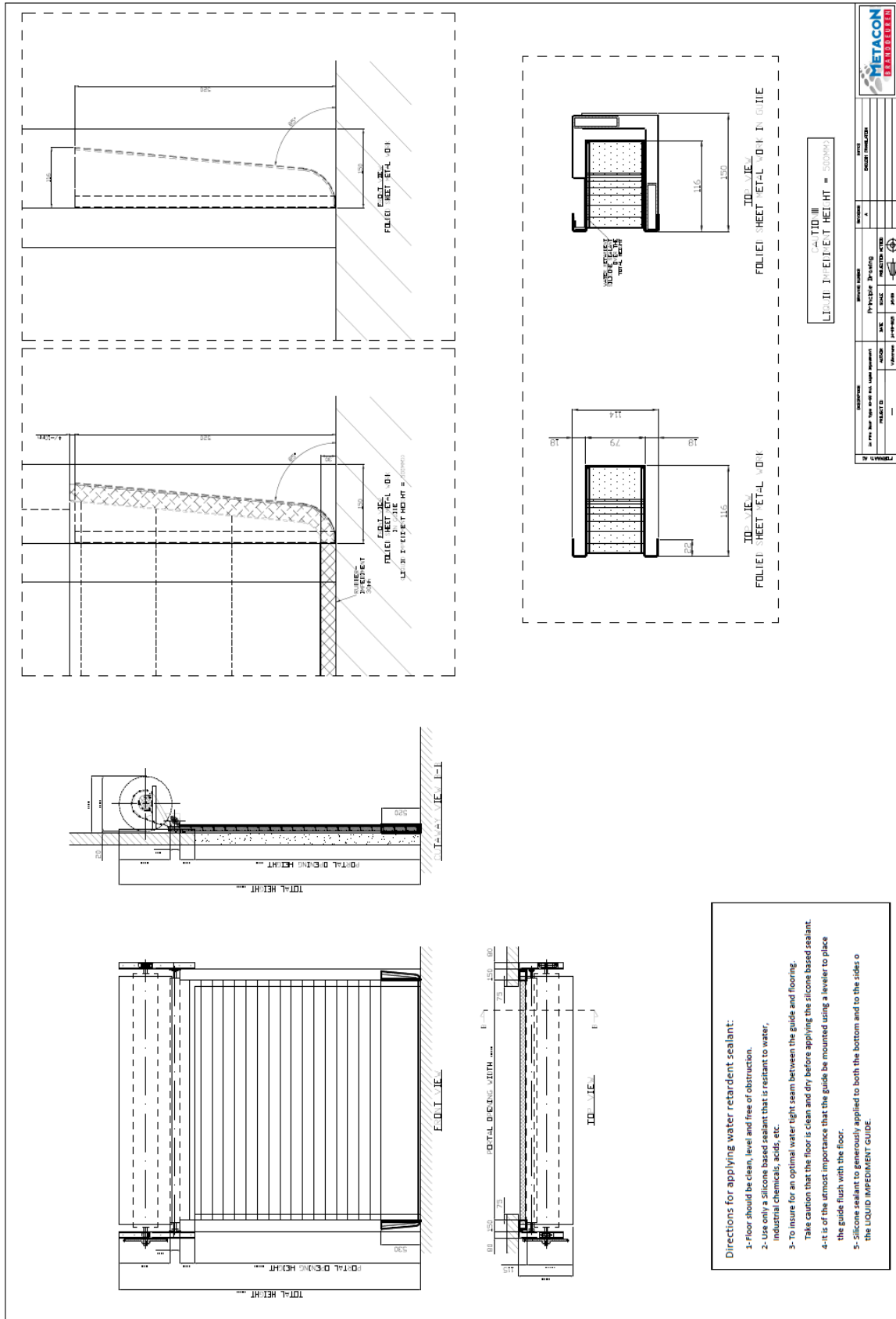


Figure B.5 Profile EI60 530H





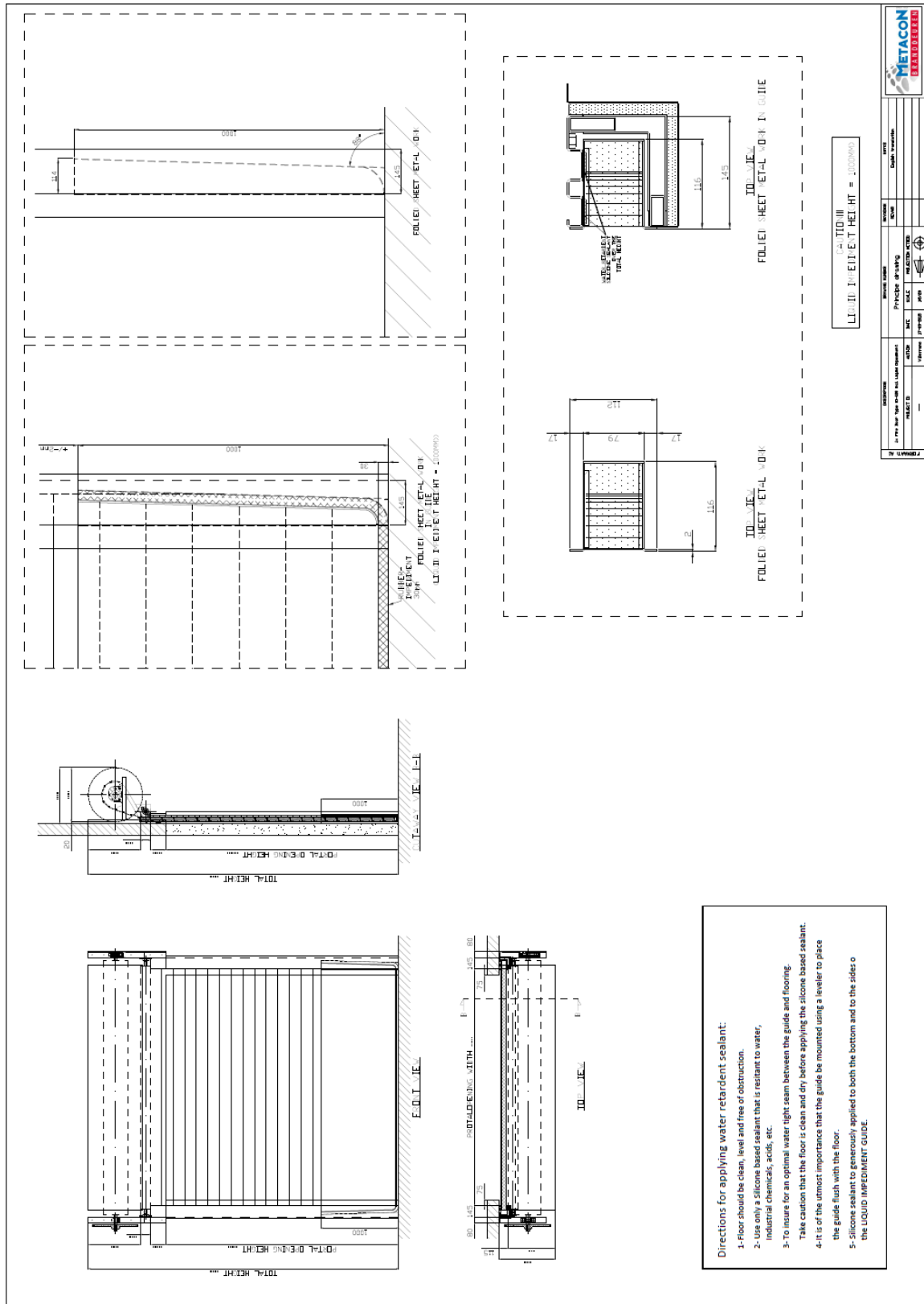


Figure B.8 Profile E120 1000H



**APPENDIX C: PHOTO'S**



Photo C.1 View of inside of test specimen 300 mm, water at the outside



Photo C.2 View of outside of test specimen 300 mm, water the inside



Photo C.3 Leakage under the test specimen 300 mm, water at the outside



Photo C.4 Folded sheet metal in guide 300 mm





Photo C.5 View of the outside of the test specimen 500 mm, water at the outside



Photo C.6 Leakage under the specimen 500 mm, water at outside



Photo C.7 View of the inside of the test specimen 500 mm, water at the inside



Photo C.8 View of the inside of the test specimen 1000 mm, water at inside



Photo C.9 Leakage under the specimen 1000 mm, water at inside