REPORT
issued by an Accredited Testing Laboratory

Contact person
Bertil Jonsson
Sustainable Built Environment
+46 10 516 51 60
bertil.jonsson@sp.se

Date 2015-06-23 Reference F516398Brev2

SWEDAC ACKREDITERING 1002 ISO/IEC 17025

Determination of thermal transmittance

(4 appendices)

This revision of the report is in response to a change of address. The original report is F516398B dated 2005-09-28.

Work requested

The client supplied drawings of profile section of panels from Ryterna for calculation of its U-value. Appendix 4 shows the design of the profile sections.

Calculation

Calculation of the U-values of the sections was performed using the FRAME 5.1 program. Values of the thermal conductivity are shown in appendix 1. The thermal conductivity value of PUR has been assigned on basis of measurements shown in appendix 2.

The air temperature and surface resistance have been taken as $\vartheta_i = +20$ °C and $R_{si} = 0.13$ m²K/W (0.20 m²K/W for inward corners) on the inside and $\vartheta_e = 0$ °C and $R_{se} = 0.04$ m²K/W on the outside.

Calculation results

The U-value of a door (U_{door}) is calculated according to

$$U_{door} = \left[A^P \cdot U^P_{1-DIM} + A^W \cdot U^W_{1-DIM} + \left(\sum(\psi \cdot L)\right)\right] / A_{door}$$

where U^P_{1-DIM}, U^W_{1-DIM} = thermal transmittance for the one-dimensional heat flow through the panel and the window, W/(m²K)

ψ = linear thermal transmittance for edge sections, perimeter of pass door and window. Additional heat flow compared to the one-dimensional heat-flow through panel and window due to combined thermal effects of panel(s), thermal bridging at the edge and wall position.

L = length, m

A^P, A^W, A_i^{door} = area of the panels, windows and door (wall opening)

Calculations with a door with width (W) = 3.05 m and height (H) 2.55 m;

Model	**U_{door}, W/(m²K)**
TLB 30 Ribbed	1.8
TLB 30 with cassette	1.9
TLB 40 Ribbed	1.6
TLB 40 with cassette	1.6

The calculations are shown in greater detail in appendix 3.

SP Technical Research Institute of Sweden
Sustainable Built Environment

Performed by

Bertil Jonsson

Appendix 1

Material data

Material	Thermal conductivity, W/(m·K)
Aluminium	160
Steel	48
PUR	0.024 (TLB 40)
PUR	0.025 (TLB 30)
PVC	0.17
Glass	1.0
EPDM	0.25
Cavity (air)*	Calculated according to SS-EN ISO 10077-2
Cavity (window)	Calculated according to EN 673

* Non rectangular air cavities are transformed into equivalent rectangular air cavities in accordance with SS-EN ISO 10077-2 and the thermal conductivity is then calculated for this equivalent air cavity.

Appendix 2

Determination of thermal conductivity according to EN 12667

Product

Sample from door leaf

The samples, which consisted of about 35 urethane foam sandwiched between sheets of steel, were cut out from door panels immediately before determination of the thermal conductivity.

Manufacturer

Ryterna

Test preparation

Before determination of thermal conductivity the surface sheets were removed and the surface were made even.

Test data

Apparatus: Heat-flow meter apparatus HFM2000 single specimen symmetrical configuration with double heat-flow meters (400 x 400 mm). Last calibration 2005-09-14 with reference specimen IRMM 440 F66d $\lambda = 0.0304$ W/(m·K)

Heat-flow: vertical, downwards

Mean temperature: 10±0.3 °C

Ambient temperature: 10 °C

Test date

2005-09-26—27

Remarks

No thickness or volume changes were observed during the tests

Measurement uncertainty

The uncertainty of the measured thermal conductivity is estimated to ±2 %.

The measured results only refer to the tested specimen.

Test results

Model	TLB 40	TLB 30
Material	PUR	PUR
Density of the specimen, kg/m³	50.2	49.9
Thickness of the specimen, mm	26.3	20.8
Mass change during test, kg/kg	0.002	0.002
Temperature difference across the sample, °C	18.2	17.8
Density of the heat-flow, W/m²	16.0	20.3
Thermal conductivity, W/(m·K)	0.0230	0.0237

Appendix 3

Calculated results – Ryterna TLB 40 Ribbed, TLB 40 with cassette (Residential), TLB 40 Ribbed, TLP 40 with Cassette (Industrial)

Area (WxH) wall opening 3.0 m x 2.54 m

Number of panels 5

Panel (d=40 mm) U^{P}_{1-DIM} = 0.56 W/(m²·K) Ribbed

U^{P}_{1-DIM} = 0.57 W/(m²·K) Cassette*

* Insulation thickness has been reduced by 0.7 mm

No.	Part of the door	Length L, m	ψ-value, W/(m·K)
1	Top section	3.0	0.44
2	Bottom section	3.0	0.45
3	Side section	5.1	0.36
4	Joint between panels	12.0	0.28

Σ (ψL) = 7.8

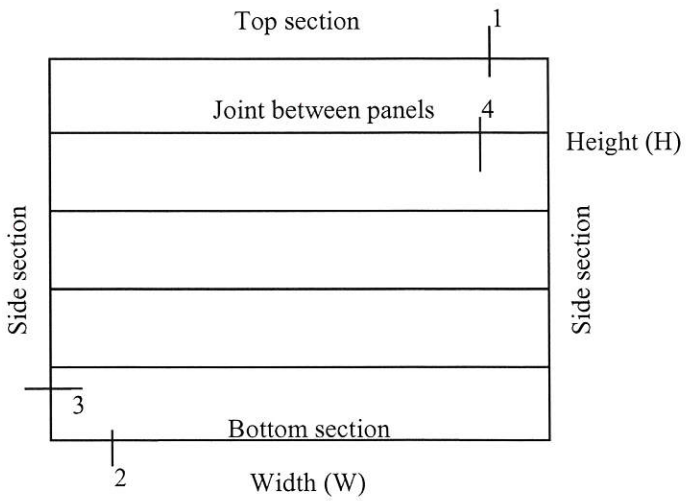


Figure 1. Location of the calculated sections

Appendix 3

Calculated results – Ryterna TLB 30 Ribbed, TLB 30 with cassette

Area (WxH) wall opening 3.0 m x 2.54 m

Number of panels 5

Panel (d=30 mm) U^{P}_{1-DIM} = 0.76 W/(m²·K) Ribbed

U^{P}_{1-DIM} = 0.77 W/(m²·K) Cassette*

* Insulation thickness has been reduced by 0.7 mm

No.	Part of the door	Length L, m	ψ-value, W/(m·K)
1	Top section	3.0	0.45
2	Bottom section	3.0	0.53
3	Side section	5.1	0.35
4	Joint between panels	12.0	0.29

Σ (ψL) = 8.3

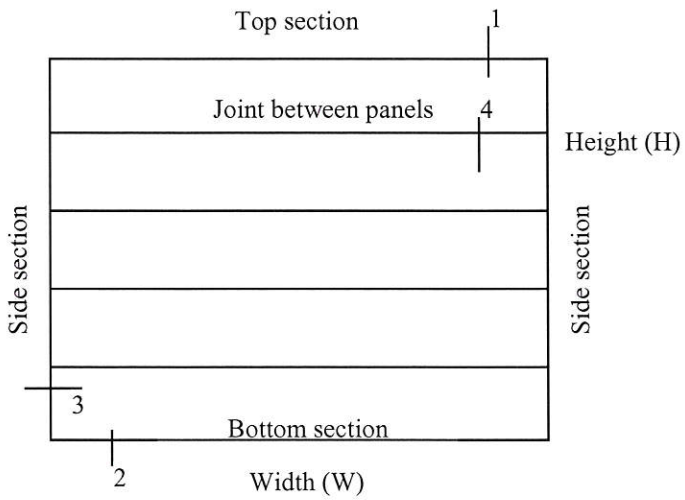
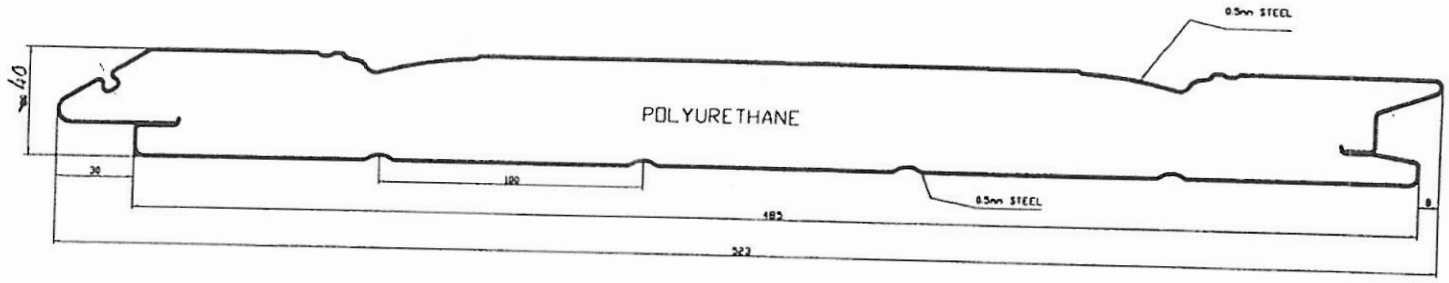
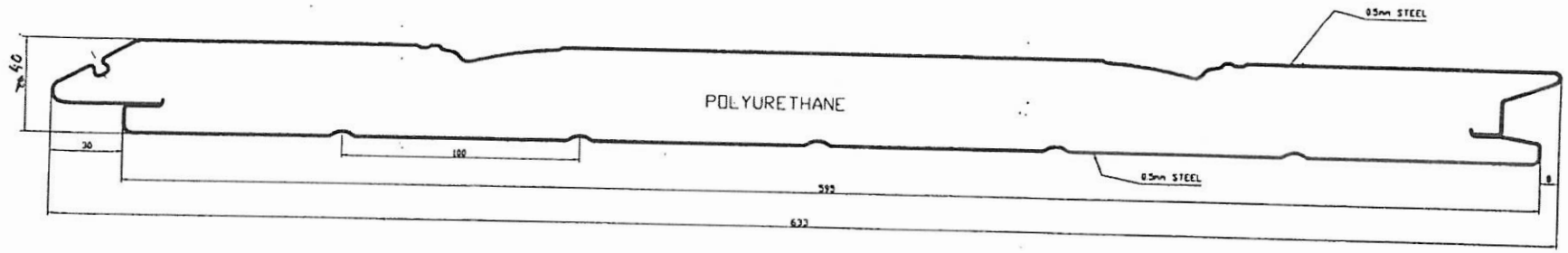


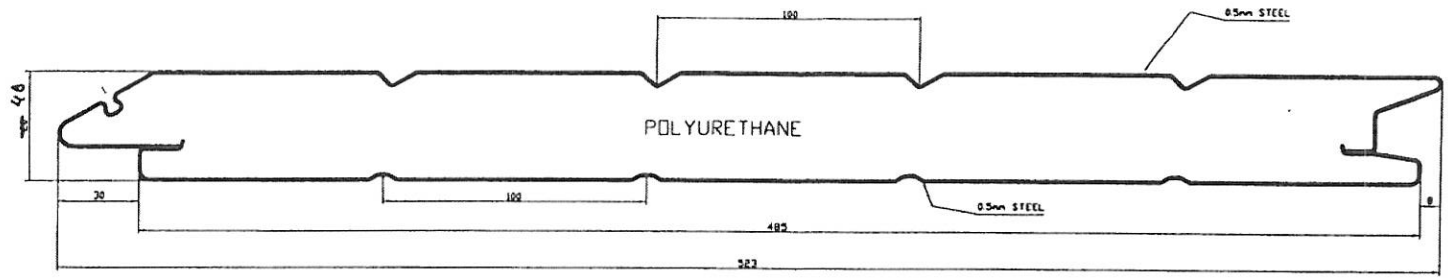
Figure 1. Location of the calculated sections

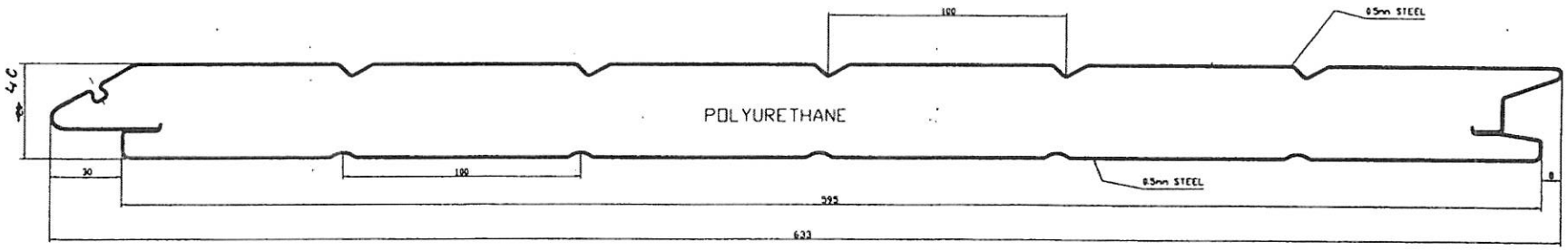




Braize A.PANAVAS	Tikrino _	Patvirtinta 2003.08.27	Byla PANELE	Data 2003.08.27
RYTERNA		PANELS_WITH_C/		
		2003082714		L(1

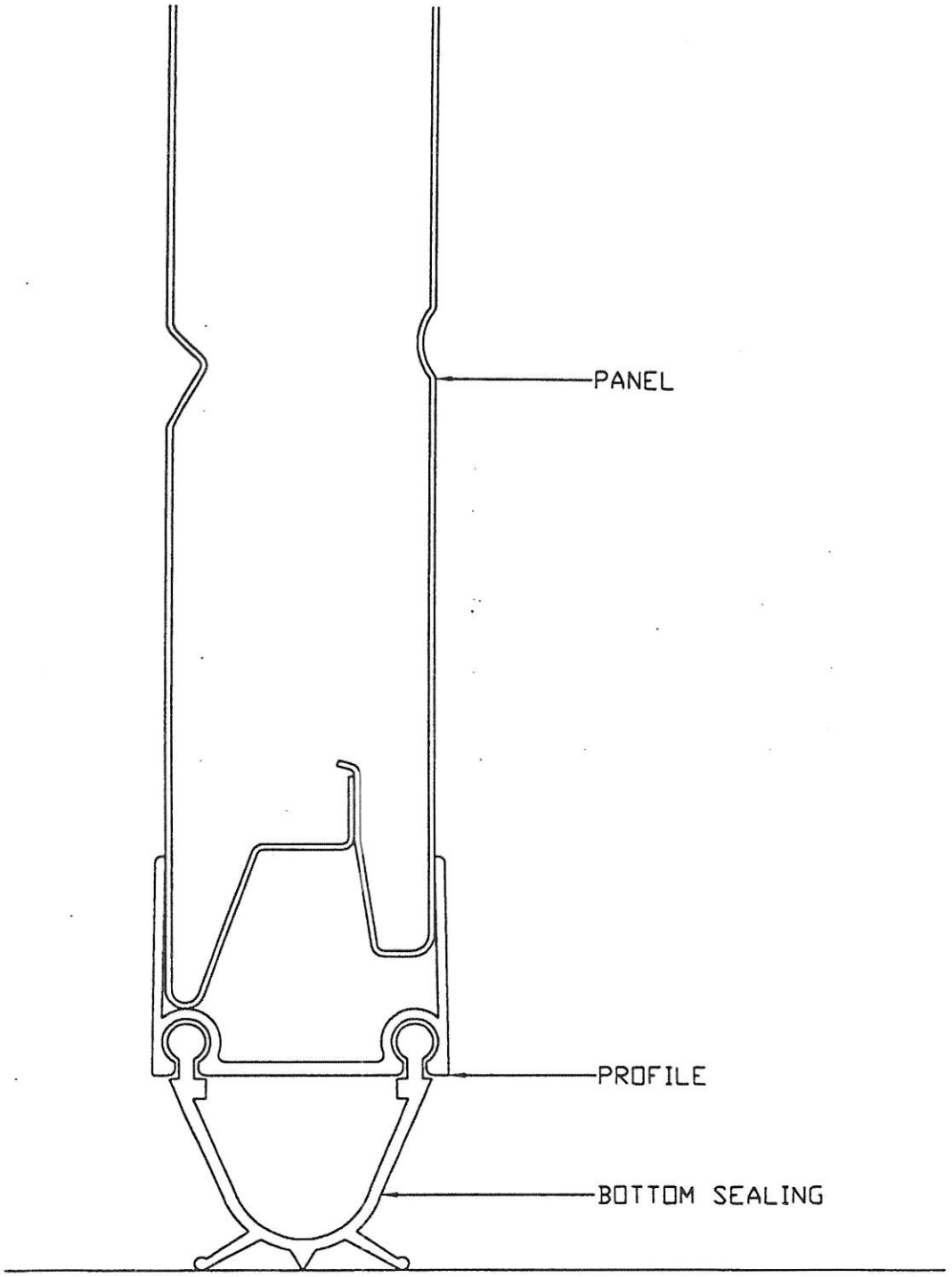
F516398 B
Appendix 4
1(12)



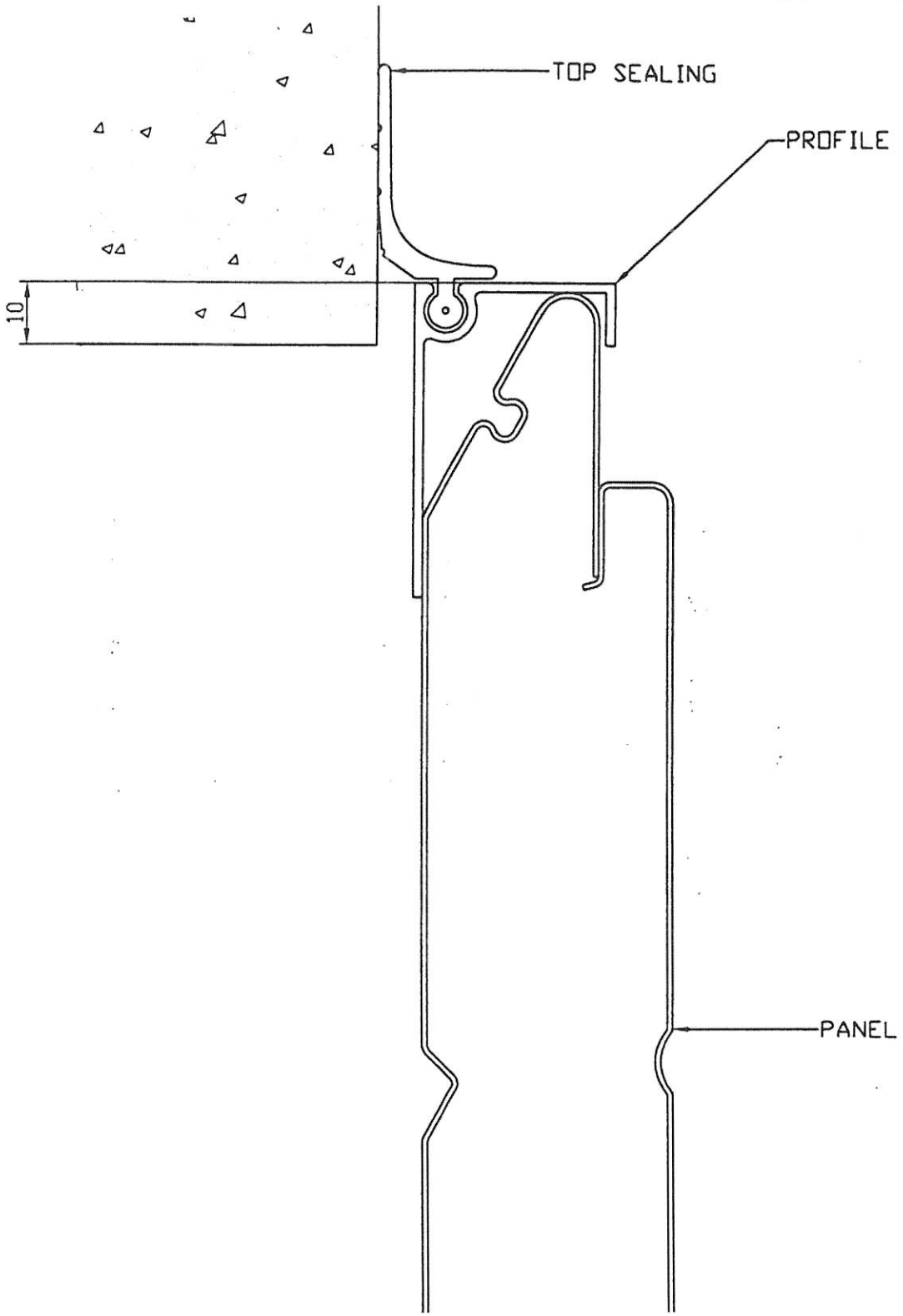


Braize A.PANAVAS	Tikrino _	Patvirtinta 2003.08.27	Byla PANELE	Data 2003.08.27
RYTERNA			RIBBED_PANEL	
			2003082713	Laida 1 / Lapas 1

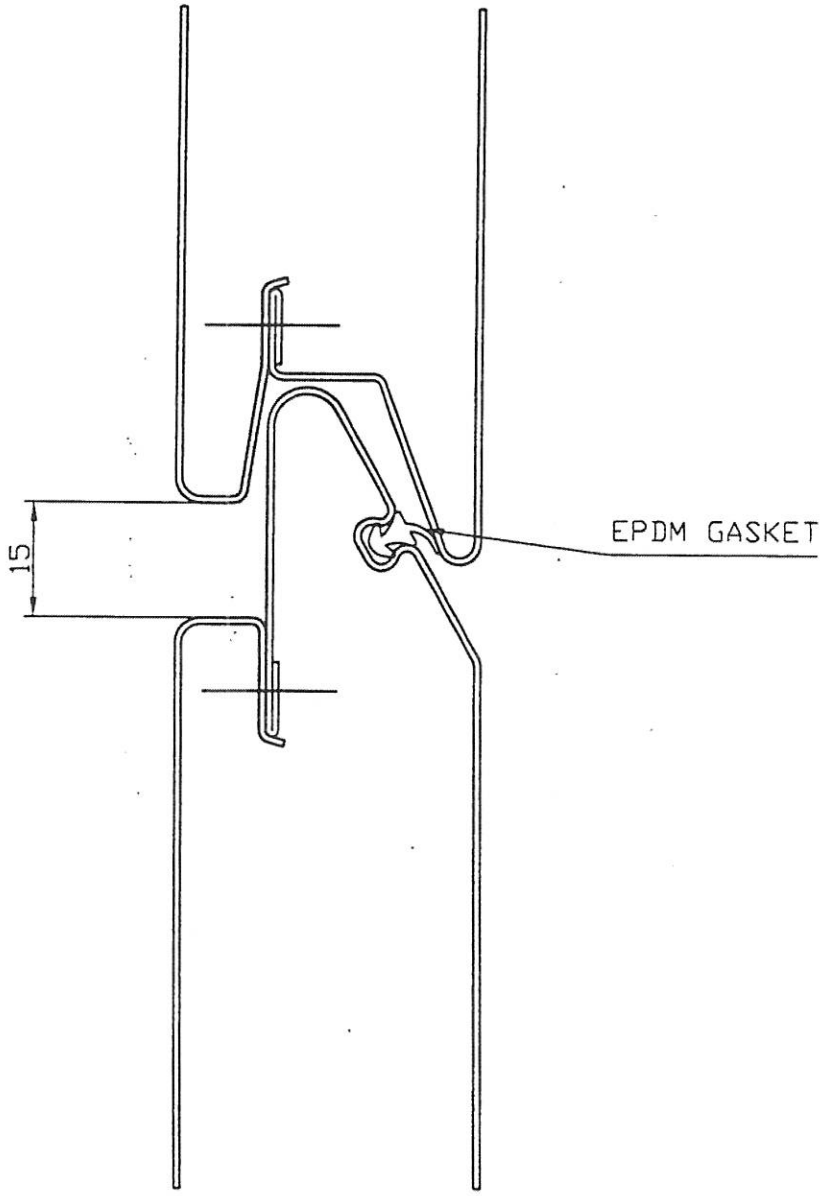
F516398 B
Appendix 4
2(12)



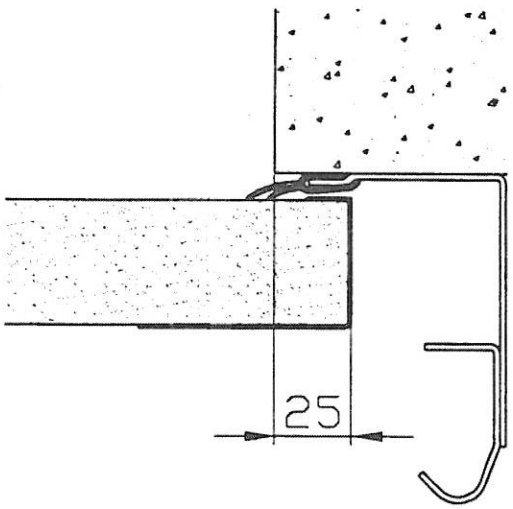
Braize A.PANAVAS	Tikrino _	Tvirtino _	Byla	Data 2005.05.12	Scale
UAB_RYTERNA	BOTTOM_OF_THE_DOOR				
	20050512011		Laida 1	Lapas	



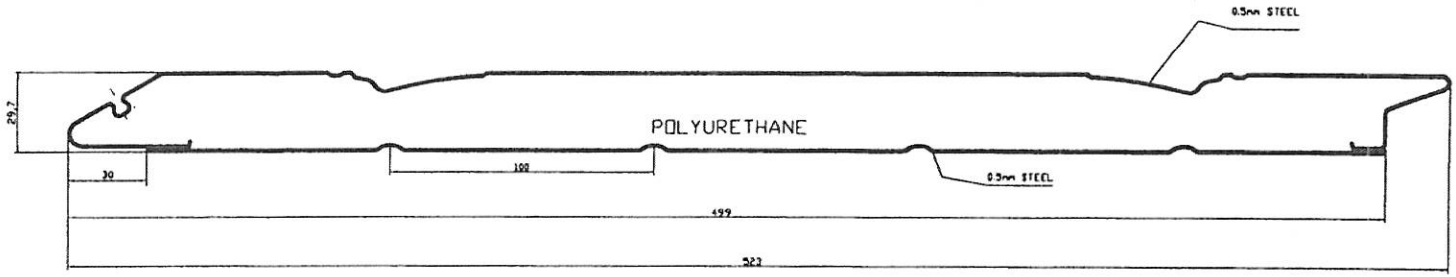
Braize A.PANAVAS	Tikrino	Tvirtino	Byla	Data 2005.05.12	Scale
UAB_RYTERNA	TOP_OF_THE_DOOR				
	20050512012		Laida 1	Lapas	

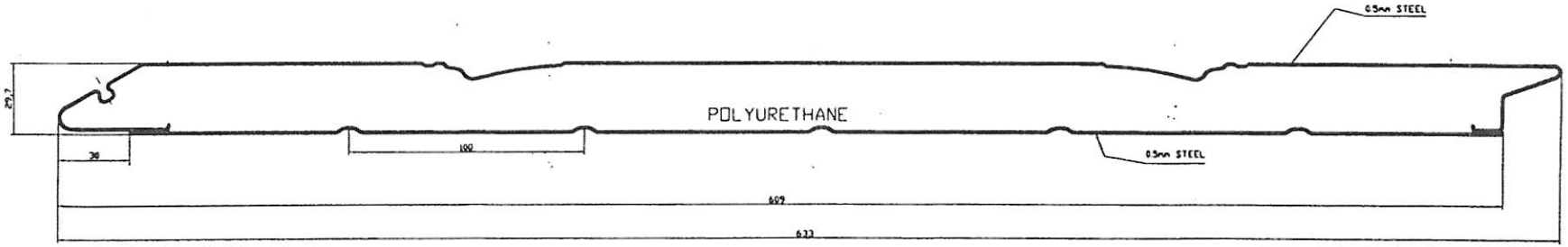


Braize A.PANAVAS	Tikrino	Tvirtino	Byla	Data 2005.05.12	Scale
UAB RYTERNA	JOINT BETWEEN PANELS				
	2005051201		Laida 1	Lapas	



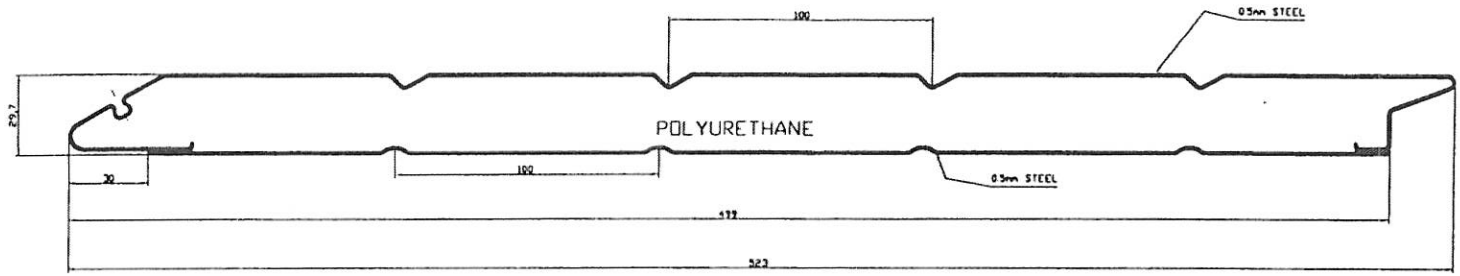
Braize A.PANAVAS	Tikrino _	Tvirtino _	Byla	Data 2005.05.12	Scale
UAB_RYTERNA	SIDE_OF_THE_DOOR				
	20050512022		Laida 1	Lapas	

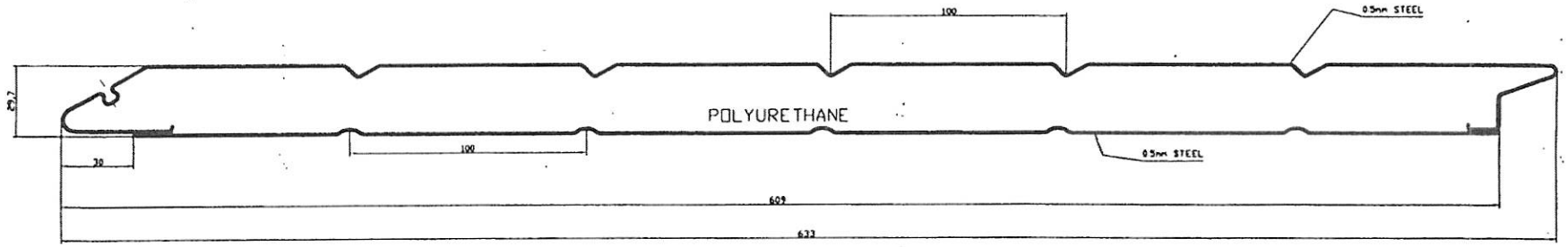




Braize A.PANAVAS	Tikrino _	Patvirtinta 2003.08.27	Byla PANELE	Data 2003.08.27
RYTERNA			PANELS_WITH_CA	
			2003082714	Lai 1

F516398 B
Appendix 4
7(12)





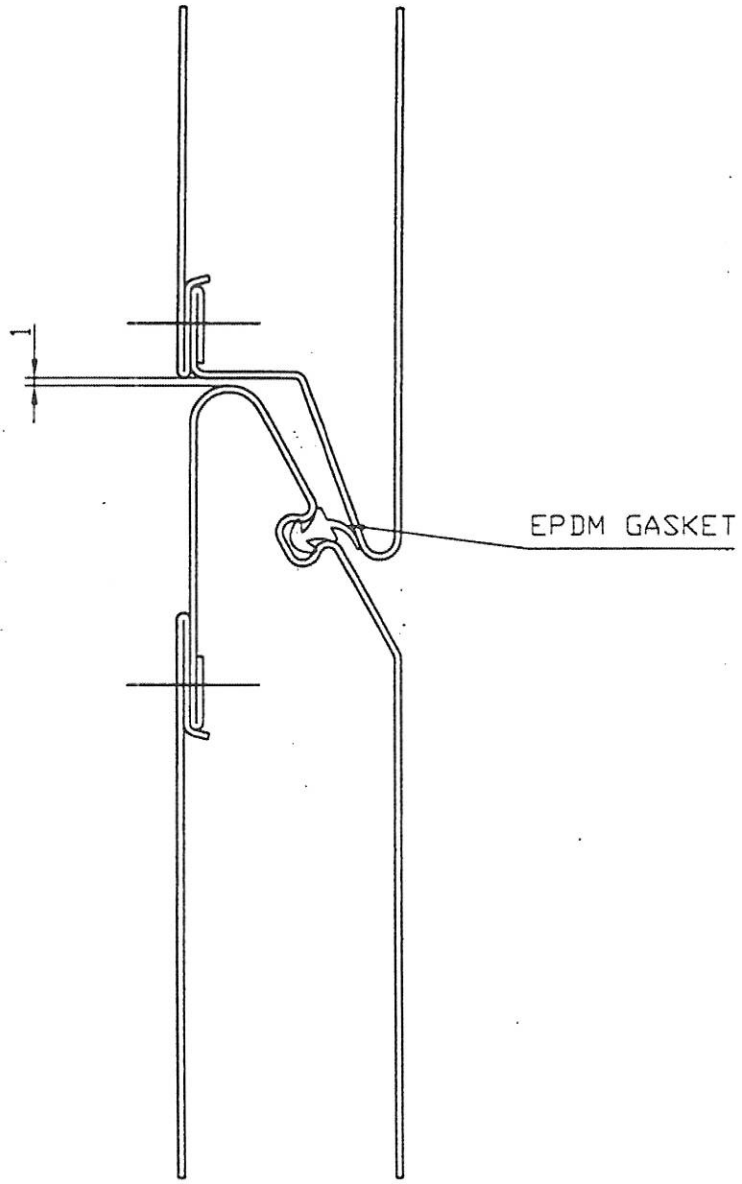
F516398 B
Appendix 4
8(12)

Braize A.PANAVAS	Tikrino _	Patvirtinta 2003.08.27	Byla PANELE	Data 2003.08.27

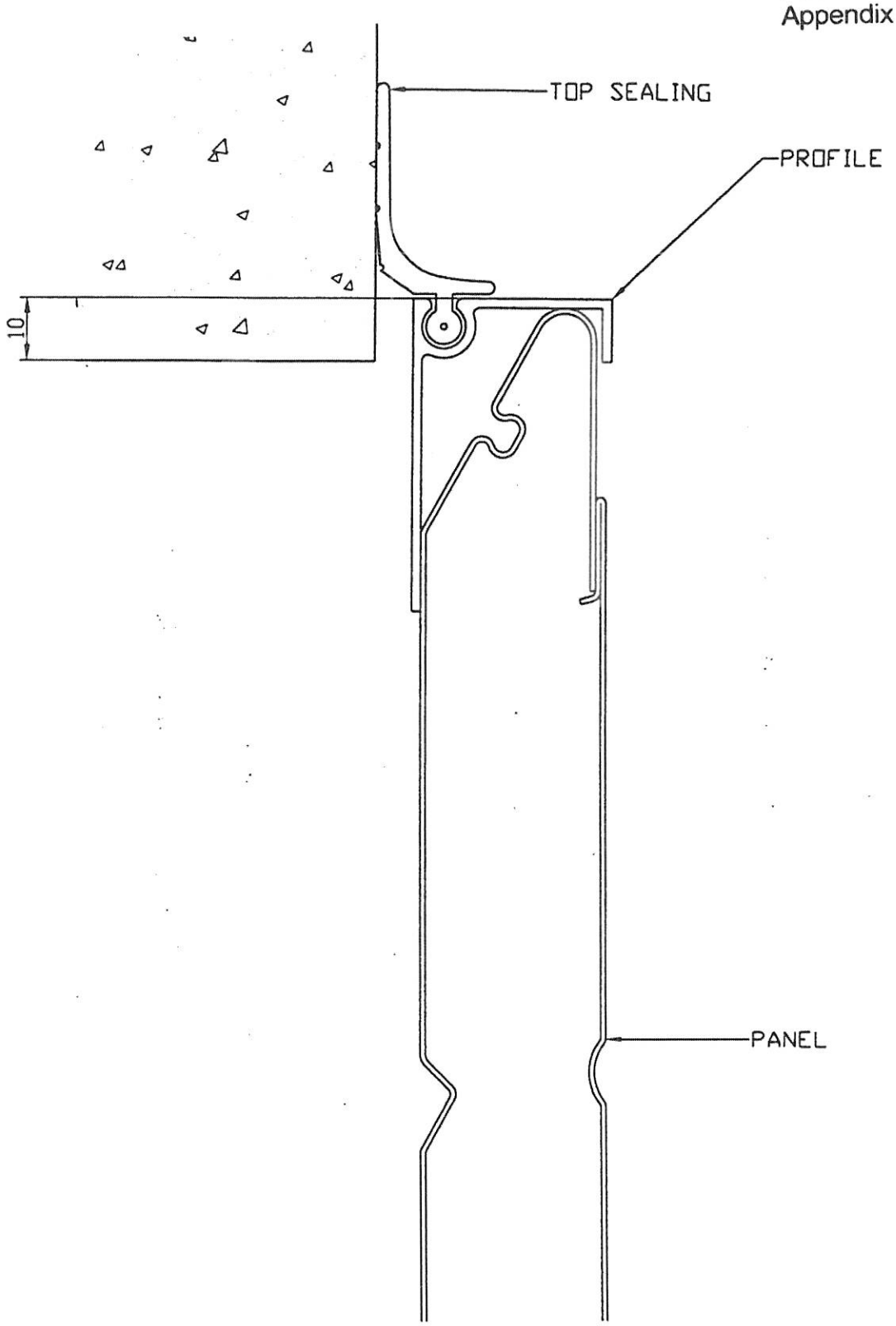
RYTERNA

RIBBED_PANEL

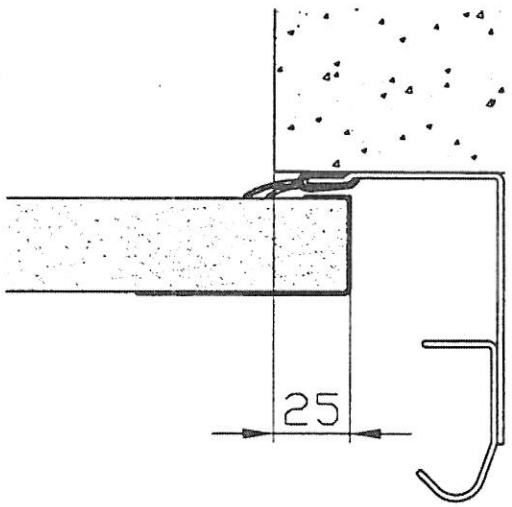
2003082713	Laida 1	Lapas 1



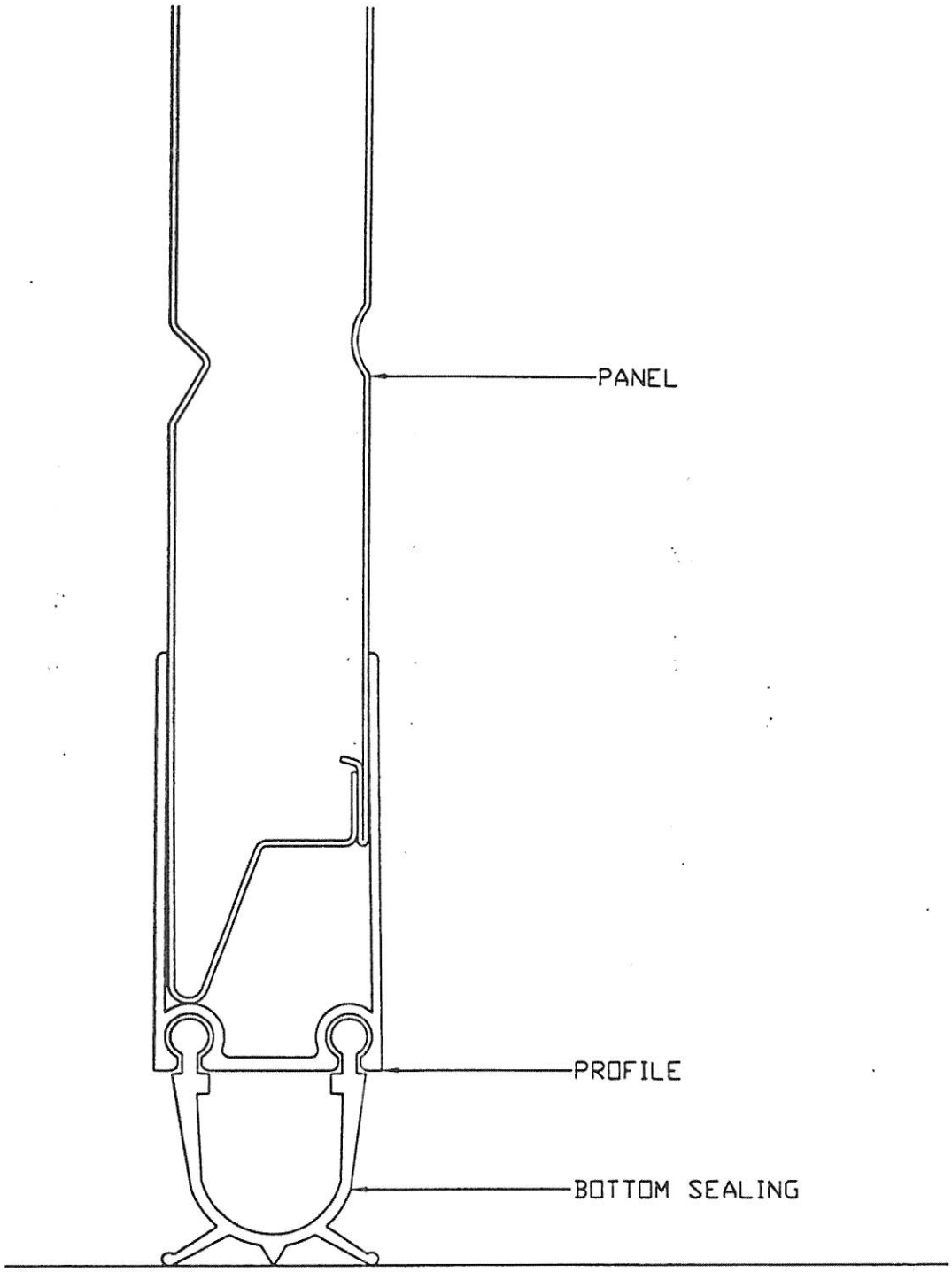
Braize A.PANAVAS	Tikrino _	Tvirtino _	Byla	Data 2005.05.12	Scale
UAB_RYTERNA	JOINT_BETWEEN_PANELS				
	2005051201		Laida 1	Lapas	



Braize A.PANAVAS	Tikrino	Tvirtino	Byla	Data 2005.05.12	Scale
UAB RYTERNA	TOP OF THE DOOR				
	20050512012		Laida 1	Lapas	



Braize A.PANAVAS	Tikrino _	Tvirtino _	Byla	Data 2005.05.12	Scale
UAB_RYTERNA	SIDE_OF_THE_DOOR				
	20050512022		Laida 1	Lapas	



Braize A.PANAVAS	Tikrino —	Tvirtino —	Byla	Data 2005.05.12	Scale
UAB RYTERNA	BOTTOM OF THE DOOR				
	20050512011		Laida 1	Lapas	