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Calculation of thermal transmittance according to EN12428:2013

(3 appendices)

Work requested

The linear thermal transmittance Ψ for top, bottom and side section of a door with panel and thermal transmittance for the complete door were calculated. Heat losses are calculated based on the drawings and material data supplied by the client.

Test object

Client:	BİLKA otomatik kapi sistemleri - ISODOOR
Product name:	Garage Door, ISO 220
Type of door:	Overhead, sectional door
Daylight size:	Width 2500 mm, Height 2250 mm
Type of panels:	PUR with steel cover

Calculation and test methods

Calculations were performed according to EN 12428:2013. The THERM 6.3 software was applied when calculating linear heat losses. Values of the thermal conductivity and applied boundary conditions are shown in appendix 1. The calculations are shown with more details in appendix 2.

Results

The thermal transmittance of door with size 3000mm * 2250mm was calculated to

U_D = 1.6 W/(m²K)

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Appendices

1 Material data and boundary conditions
2 Calculation of thermal transmittance
3 Drawings

Appendix 1

Material	Thermal conductivity, W/(m·K)	Source
Steel	50	1
Polyurethane	0.023	2
Aluminium	160	1
EPDM	0.25	1

Cavity (air) is calculated according to SS-EN ISO 10077-2:2012 , single equivalent thermal conductivity method.

For aluminium surfaces that faces the interior of the aluminium profiles is the emissivity 0.3 (-). For other surfaces is the emissivity 0.9 (-) according to SS-EN ISO 10077-2:2012.

1= EN10456:2007
2= According to report 9P02246-1A including increment for ageing

The air temperature and surface resistance have been taken as ϑ_i = +20 °C on the inside and ϑ_e = 0 °C on the outside
R_{se} = 0.04 m²K/W
Rsi = 0.13 m²K/W (0.20 m²K/W for inward corners)

Appendix 2

Calculation of thermal transmittance

Formulation

$$U_D = \left[A^p \cdot U^p_{1-DIM} + A^g \cdot U^g_{1-DIM} + \sum(\psi_i \cdot L_i)\right] / A_{door} + \Delta U_D$$

where

U^p_{1-DIM}, U^g_{1-DIM} = thermal transmittance for the one-dimensional heat flow through the panel and glazing, W/(m²K)

A^p and A^g = area of the insulated panel and glazing

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

L_i = length, m

The total additional thermal transmittance of all point thermal bridges (ΔU_D) is less than 0.01 W/(m^{2}K).

Panel design

4 panels , door size 2500 * 2250

40.0mm panel: 0.5 steel – 39.0 polyurethane – 0.5 steel

$U^p_{1-DIM} = 0.54$ W/(m²·K)

Test results

Section	Length, m	Ψ-value , W/(mK)	Area , m²	U-value, W/(m²K)
Side	4.5	0.40	-	-
Top	2.5	0.58	-	-
Bottom	2.5	0.49	-	-
Between panels	7.5	0.27	-	-
Panels	-	-	5.62	0.54
Point thermal bridges (ΔU_D)	-	-	-	<0.01
Door	-	-	2.5 * 2.25	1.60

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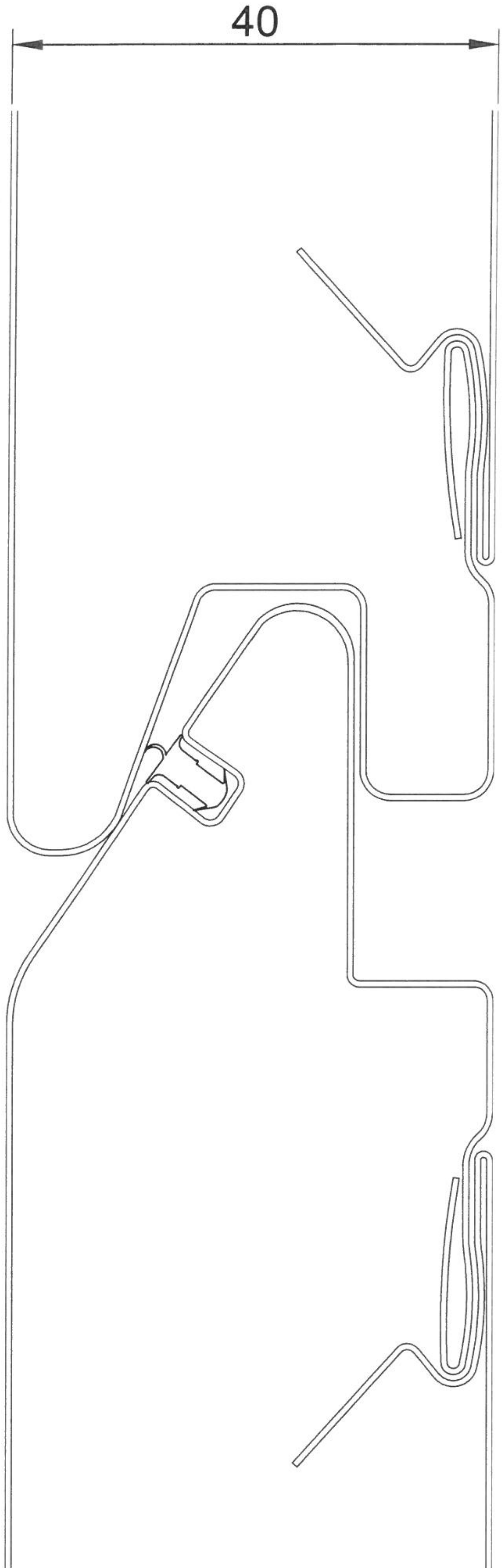
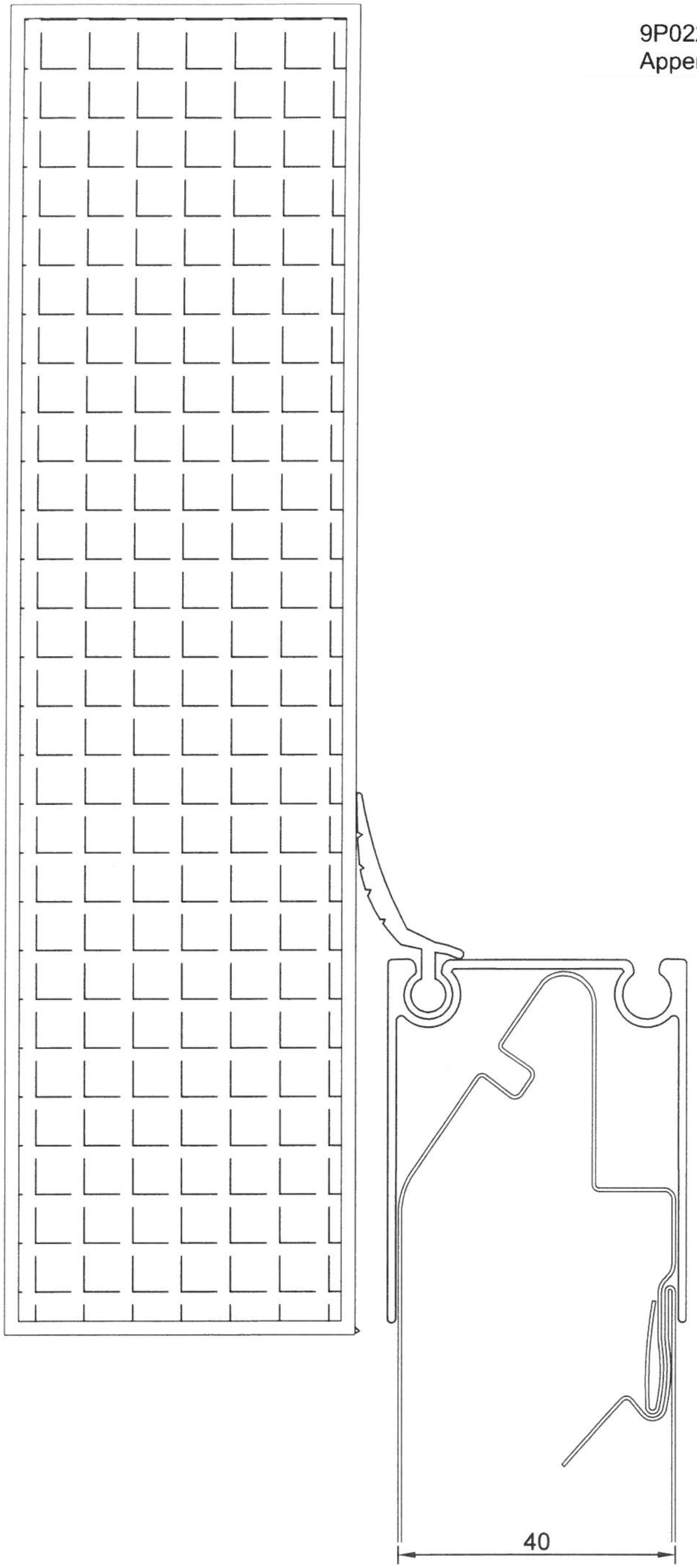
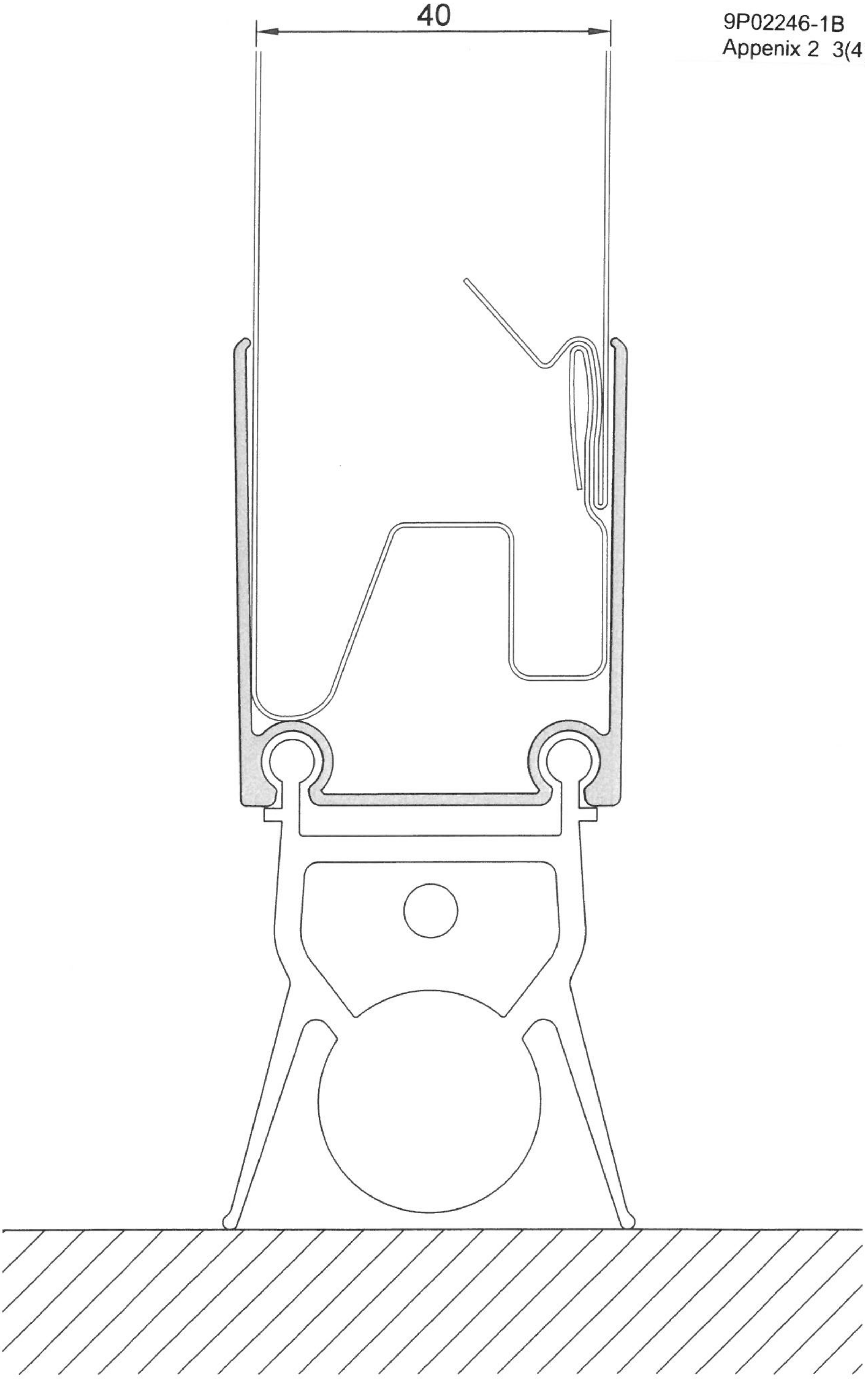


Panel Joint



Top Section



Bottom Section

Side Section