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TECHNICAL REPORT

Technical report related to assessment of aluminium substructure - BSP System, designed to mount ventilated sidings, in light of requirements of § 225 of the Regulation of the Minister of Infrastructure

02772.4/16/Z00NZP

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TECHNICAL REPORT

Technical report related to assessment of aluminium substructure - BSP System, designed to mount ventilated sidings, in light of requirements of § 225 of the Regulation of the Minister of Infrastructure

Number of the service: 02772.4/16/Z00NZP

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1. The scope of the report

In accordance with § 216 of the Regulation of the Minister of Infrastructure [3.1], requirements in relation to mounting of elements of siding described in § 225 of the Regulation of the Minister of Infrastructure [3.1], in event of fire, for buildings characterized by fire resistance class B, must be met for the minimum of 60 minutes and in case of buildings characterized by fire resistance class C and D, the requirements must be met for the minimum of 30 minutes.

The subject of the report is technical assessment related to the evaluation of aluminium substructure - BSP System designed to mount ventilated sidings, in light of requirements § 225 of the Regulation of the Minister of Infrastructure [3.1].

2. Formal grounds

1. Commission of the BSP Bracket System Polska Sp. z o.o. company
2. Agreement no. 02772/16/Z00NZZP.

3. Merits

1. Regulation of the Minister of Infrastructure from 12 April 2002 on the technical conditions that should be met by buildings and their location (Journal of Laws No. 75, item 690), as amended.
2. ITB Technical Approval AT-15-9325/2014 *Kit of products used to construct aluminium substructure - BSP System designed to mount ventilated sidings.*
3. Test of external wall in relation to fall-off of the siding elements in event of fire, conducted in ITB Fire Testing Laboratory in Pionki on 14/06/2017 according to the internal procedure.
4. Technical documentation delivered by the Employer.

4. Technical description

Types of aluminium constructions and brackets being the subjects of analysis were presented in Figure 3 and 4, and the fitting method of the mounting construction was presented in Figure 1. The selection of appropriate solution of aluminium substructure - BSP System and the mounting bracket depends on the results of static calculations, whereas the carrying capacity and method for mounting of the chosen solution has to be in accordance with conditions presented in the current Technical Approval AT-15-9325/2014 [3.2].

Types of analysed solutions of bracket - BSP System have following designations (Fig. 1):

- KW1 (standard system)
- K1 (floor to floor system),
- KN1 (system produced from stainless steel),
- KW PAS (passive system).

Mounting brackets for aluminium substructures are located in a thermal insulation produced from mineral wool with thickness of at least 150 mm and density higher than 48 kg/m³. Maximal width of the empty space between the layer of mineral wool and sidings is equal to 42 mm. Mineral wool is mounted with usage of plastic or steel pegs intended for fitting the mineral wool, minimum 5 items per 1 m² of wool. Mounting construction is constituted by a masonry wall, concrete wall or reinforced concrete wall with a minimal thickness adjusted to the type of an anchor (in accordance with the guidelines related to minimum depth of the mounting and method of fitting in accordance with the Approval [3.2]), however, with thickness not lower than 120 mm and density not lower than 550 kg/m³. In the points 4.1÷4.5 we have described the type of mountings which were tested [3.3].

1. The mounting of fibre-cement panels - adhesive system

Sidings made of fibre-cement panels, and are sized 500 x 1500 x 8 mm (A1 panels according to Fig. 2 and 4) and 500 x 1000 x 8 mm (A2 panels according to Fig. 2 and 4) were mounted to the surface with usage of KW1 and KW PAS system brackets, aluminium framing and primer / adhesive kits (primer, adhesive and double sided tapes) - in accordance with the guidelines of the producer of primer / adhesive kit. The adhesive was applied in an amount in accordance with the guidelines of the producer. A1 and A2 Panels (first on the left as shown in Fig. 2) were located outside the face of window opening, whereas A1 and A2 panel (second on the left as shown in Fig. 2) were located over the face of window opening. A2 panel located over the face of window opening was additionally mounted with usage of two undercut anchors.

2. Mountings of composite panels located over the face of the window opening - attachment mounting system

Sidings made of composite panels sized 500 x 1500 x 4 mm (panel B1 as shown in Fig. 2 and 4) and 500 x 1500 x 4 mm (panel B2 as shown in Fig. 2 and 4) were mounted above the face of the window opening using KW1 and KN1 system brackets and BSP KWRY attachment mounting system.

3. Mounting of the panels made of sintered quartz located above the face of the window - adhesive based system

Sidings made of sintered quartz, sized 500 x 1100 x 3 mm (C1 panel according to the Fig. 2 and 4) and 500 x 1000 x 3 mm (C2 panel in accordance with Fig. 2 and 4) were mounted over the face of the window with usage of KW1 and KW PAS system brackets, aluminium frame and primer / adhesive kit (primer, adhesive and double-sided tapes) - in accordance with the guidelines of the producer of the primer / adhesive kit. The adhesive was applied in accordance with the guidelines of the producer. C2 panel was additionally mounted with usage of two rivets.

4. HPL panels mounting - adhesive system

Sidings made of HPL panels, sized 500 x 1100 x 8 mm (D1 panels according to Fig. 2 and 4) and 500 x 1000 x 8 mm (D2 panels according to Fig. 2 and 4) were mounted to the surface with usage of KW PAS, K1 and KW 1 system brackets, aluminium frame and primer / adhesive kits (primer, adhesive and double sided tapes) - in accordance with the guidelines of the producer of primer / adhesive kit. The adhesive was applied in accordance with the producer's guidelines. D1 and D2 panels (first from the right side according to the Fig. 2) were located outside the face of the window opening, whereas D1 and D2 panels (second from the right side according to the Fig. 2) were located above of the window opening. D2 panel located above the face of the window was additionally mounted with usage of two undercut anchors.

5. Mounting of ceramic panels located outside the face of the window - attachment mounting system

Sidings made of ceramic panels, sized 500 x 400 x 26 (E1 panels according to the Fig. 2 and 4) were mounted outside the face of the window with usage of KW1 system brackets and KWR2 profiles with attachment clips for ceramic panels.

5. Description of the test carried out

On 14/06/2017 in the Fire Testing Laboratory of the Building Research Institute in Pionki, we conducted tests in scope of fall-off of elements of siding in event of fire [3.3], Fig. 5-9. Configuration of sample element is shown in Fig. 2 and 3, the list of used materials is shown in Fig. 4, and their mounting method in the Fig. 1.

The panels mounted in accordance with p. 4.1, located outside the area of heating - outside the face of the window opening and located in the area of heating - directly above of the window opening, did not fall off and did not crack.

The bottom panel mounted in accordance with p. 4.2 (B2 panel) located in the area of intensive heating - directly over the window opening cracked and was falling off in pieces of weight up to 5.0 kg. During the test, aluminium substructure (frame) was gradually burning out and falling off. After full 60 minutes of the test we observed a destruction of aluminium substructure (frame) up to the maximum height of about 700 mm (Fig. 9), while brackets located in the thermal insulation layer remained practically intact.

The bottom panel mounted in accordance with p. 4.3 (C2 panel) located in the area of intensive heating - directly over the window opening, was cracking and falling off in pieces of weight up to 5.0 kg. During the test the aluminium substructure (frame) was gradually burning out and falling off. After full 60 minutes we observed a destruction of aluminium substructure (frame) up to the maximum height equal to about 700 mm (Fig. 9), while brackets located in the layer of thermal insulation remained practically intact.

The panels mounted in accordance with p. 4.4, located outside the area of heating - outside the face of the window opening and located in the area of heating - directly above of the window opening, did not fall off and did not crack.

Panels mounted in accordance with p. 4.5, located outside the heating area - outside the face of the window opening, did not fall off or crack.

6. Assessment of the mounting of sidings

After analysis of acquired test results and also basing on presented technical documentation we determine that:

- **adhesive-base mounting system of sidings** together with BSP system brackets of type KW1, K1, KN1 and KW PAS, prepared and mounted to the surface of building construction in zone without windows (not exposed for direct influence of fire), in accordance with the technical description identified in point 4.1 and 4.4, will remain durable in conditions of fire for duration not shorter than 60 minutes.
- **adhesive-based system of mounting for sidings with at least two mechanical mounting points**, together with BSP System brackets of KW1, K1, KN1 and KW PAS type, mounted to surface of the building construction in the window zone (exposed to the direct influence of fire), in accordance with the technical description identified in points 4.1, 4.3 and 4.4, will remain durable in conditions of fire for a duration not shorter than 60 minutes, despite the partial melting of the aluminium frame and adhesive-based system. The sidings may gradually fall off in pieces, which should not pose a threat in event of evacuation of people and operations of rescue teams.
- **attachment mounting system for sidings** together with BSP system brackets of KW1 and KW PAS type, prepared and mounted to the construction of the building **in the zone without windows** (not exposed to a direct influence of fire), in accordance with the technical description presented in point 4.5, will remain durable in the conditions of fire for a period not shorter than 60 minutes.
- **attachment mounting system for sidings** together with BSP system brackets of KW1, KN1 and KW PAS type, mounted to the construction of the building **in window zone** (exposed to a direct influence of fire), in accordance with the technical description presented in point 4.2, will remain durable in the conditions of fire in duration not shorter than 60 minutes, despite the partial melting of aluminium frame. Sidings may gradually fall off in pieces, which should not pose a threat in event of evacuation of people and operations of rescue teams.

In order to consider the solution, with usage of aluminium frame in accordance with the technical description presented in point 4, as safe in the light of the § 225 of the Regulation of the Minister of Infrastructure, the possibility of burning out the fragment of frame on height up to 700 mm above the window opening / glazing without fire grade, in event of fire lasting for 60 minutes should be taken into account by the Designer.

Interchangeably for adhesive-based system - siding panels may be mounted mechanically - with usage of façade rivets with aluminium heads, minimum 4 rivets for each panel.

7. Final remarks

Technical assessment remains valid for an unlimited period of time, provided that the technical solutions for BSP Systems substructure and KW1, K1, KN1 and KW PAS brackets used to mount sidings, will not be modified in terms of used material and construction.

Attachments: Figures 1 ÷ 9.

Assessment author:
MSc Eng. Krzysztof Lenarcik

[stamp and illegible signature: *Head of the Fire Testing Department PhD, Eng. Paweł Sulik*]

Passive system BSP passive bracket type KW PAS/170 Self-drilling screw 4.8x19 A2 Aluminium profile BSP KWR1	
BSP KWR Y hanging brackets system BSP KW1/140 Aluminium bracket Self-drilling screw 4.8x19 A2 BSP KWR Y Aluminium profile BSP KWZ Aluminium attachment clip	
Floor to Floor system BSP K1/120 aluminium bracket M10x80 A2 Mounting screw BSP KWR6 Aluminium profile	
BSP hanging brackets system for ceramic panels BSP KW1/140 Aluminium bracket Self-drilling screw 4.8x19 A2 BSP KWR2 Aluminium profile with an attachment clip for ceramic panels	
Standard system BSP KW1/170 Aluminium bracket Self-drilling screw 4.8x19 A2 Aluminium profile BSP KWR1	

Fig. 1 BSP system solutions

Dimensions in mm

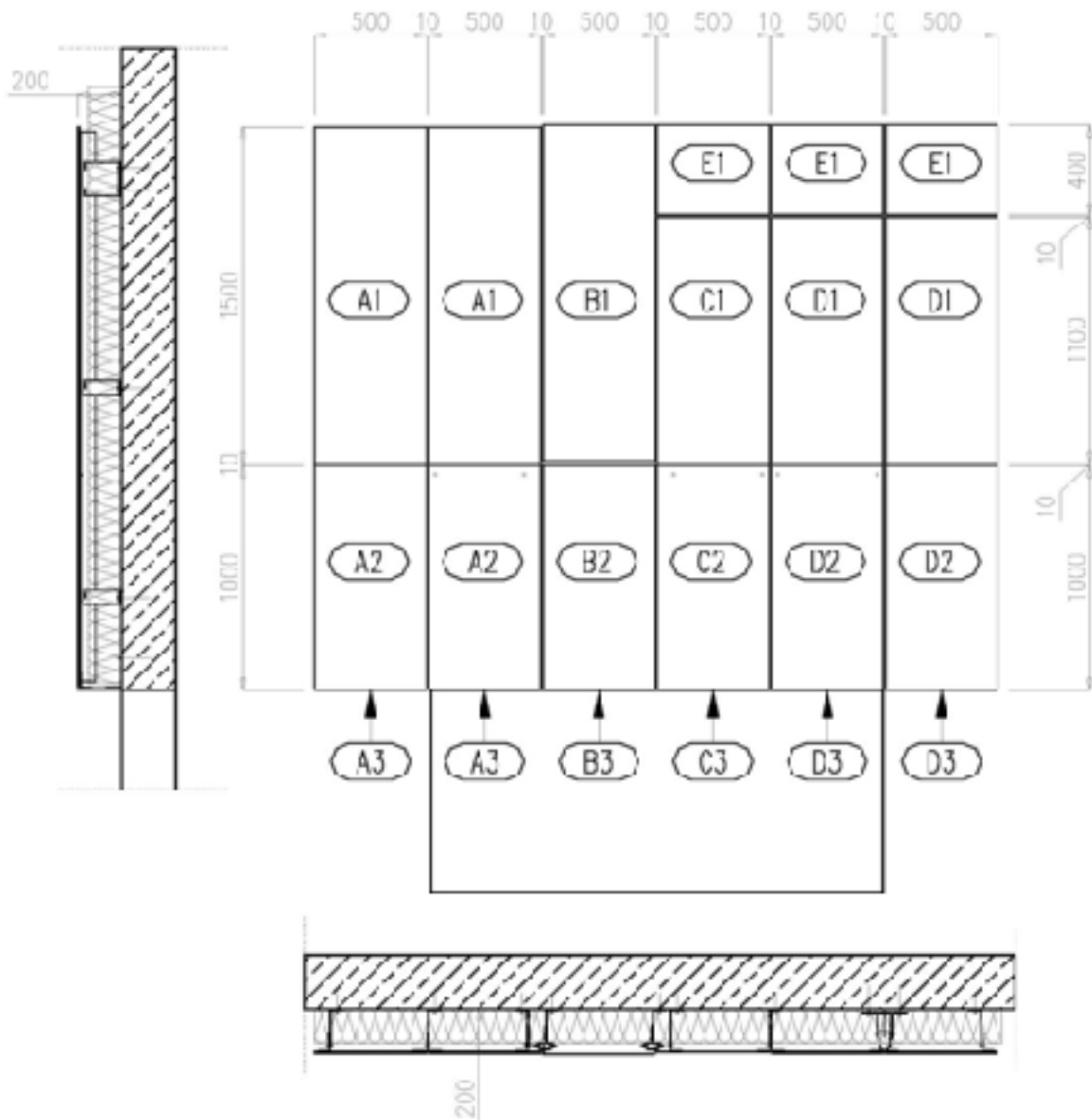


Fig. 2. View and cross-section of the sample element

Dimensions in mm

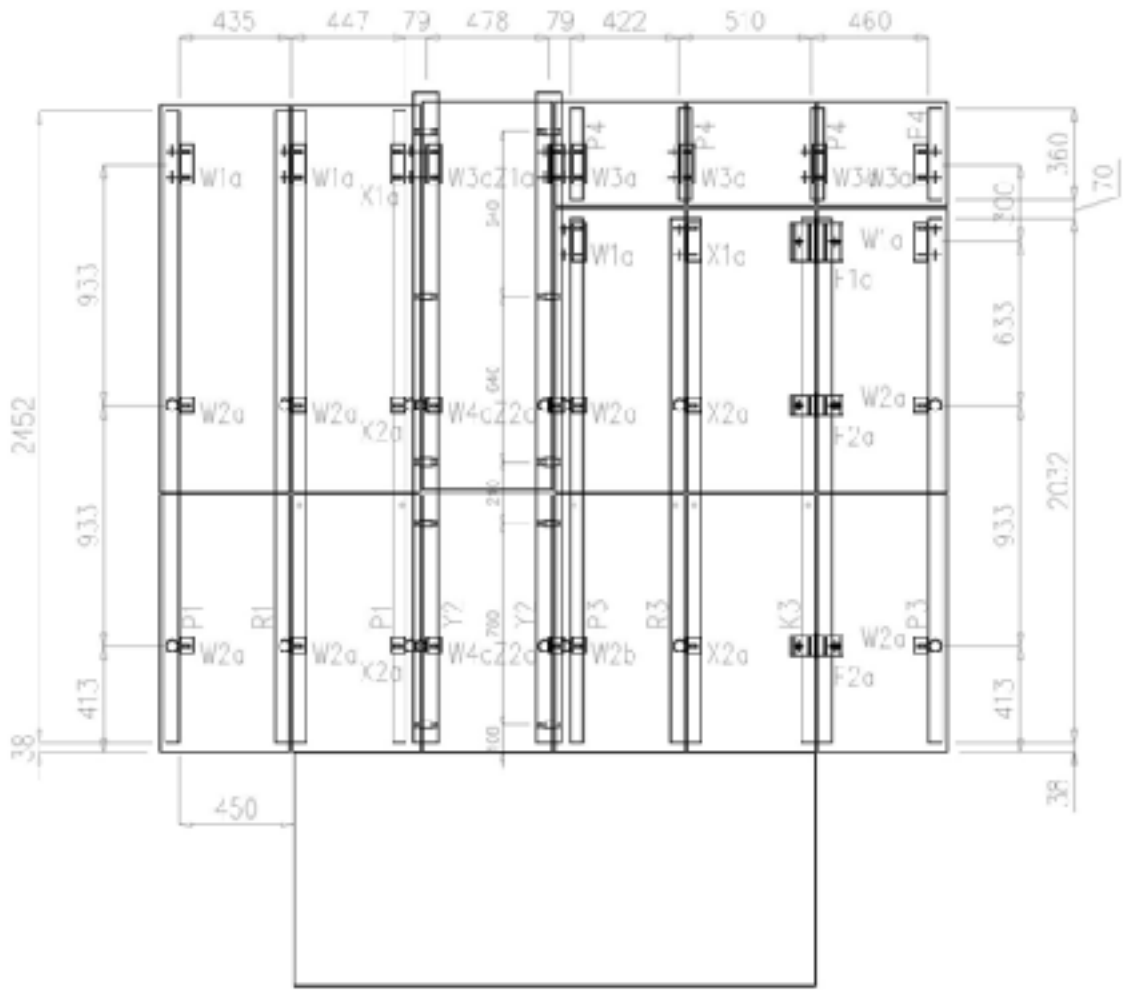


Fig. 3. Arrangement of mountings in sample element

LIST OF ALUMINIUM BRACKETS				
catalogue data		amount [items]	REMARKS	
Node type	bracket type			
W1a	KW1/170-150	4	Standard system, EPDM pad	
W2a	KW1/170-60	7	Standard system, EPDM pad	
W2b	KW1/170-60	1	Standard system, PCV pads	
W3a	KW1/140-150	5	Standard system, EPDM pad	
W4a	KW1/140-60	1	Standard system, EPDM pad	
W4c	KW1/140-60	1	Standard system, BSP HDPE	
X1a	KW PAS/170-150	2	Passive system, EPDM pads	
X2a	KW PAS/170-60	4	Passive system, EPDM pads	
Z1a	KN1/140-150	1	Stainless system, EPDM pads	
Z2a	KN1/140-60	2	Stainless system, EPDM pads	
F1a	KI /120-150	1	Floor to floor system, EPDM pads	
F2a	K1/120-80	2	Floor to floor system, EPDM pads	

LIST OF ALUMINIUM FRAME PROFILES						
profile number	Panel dimensions [mm]			amount [items]	REMARKS	
	length	type	size			
P1	2454	KWR2	50x70	2		
P3	2032	KWR2	50x70	2		
P4	360	KWR2	50x70	4		
R1	2454	KWR1	120x70	1		
R3	2032	KWR1	120x70	1		
K3	2032	KWR6	120x70	1		
Y2	2522	KWRY	99x80	2		

PANEL LIST						
panel number	Panel dimensions [mm]			amount [items]	REMARKS	
	height	width	thickness			
A1	1500	500	8	2	Fibre-cement panel	
A2	1000	500	8	2	Fibre-cement panel	

A3	200	500	8	2	Fibre-cement panel
B1	1500	500	4	1	Composite panel
B2	1000	500	4	1	Composite panel
B3	200	500	4	1	Composite panel
C1	1100	500	3	1	Sintered quartz panel
C2	1000	500	3	1	Sintered quartz panel
C3	200	500	3	1	Sintered quartz panel
D1	1100	500	8	2	HPL panel
D2	1000	500	8	2	HPL panel
D3	200	500	8	2	HPL panel
E1	400	500	26	3	Ceramic panel

Fig. 4. List of the elements used in the test

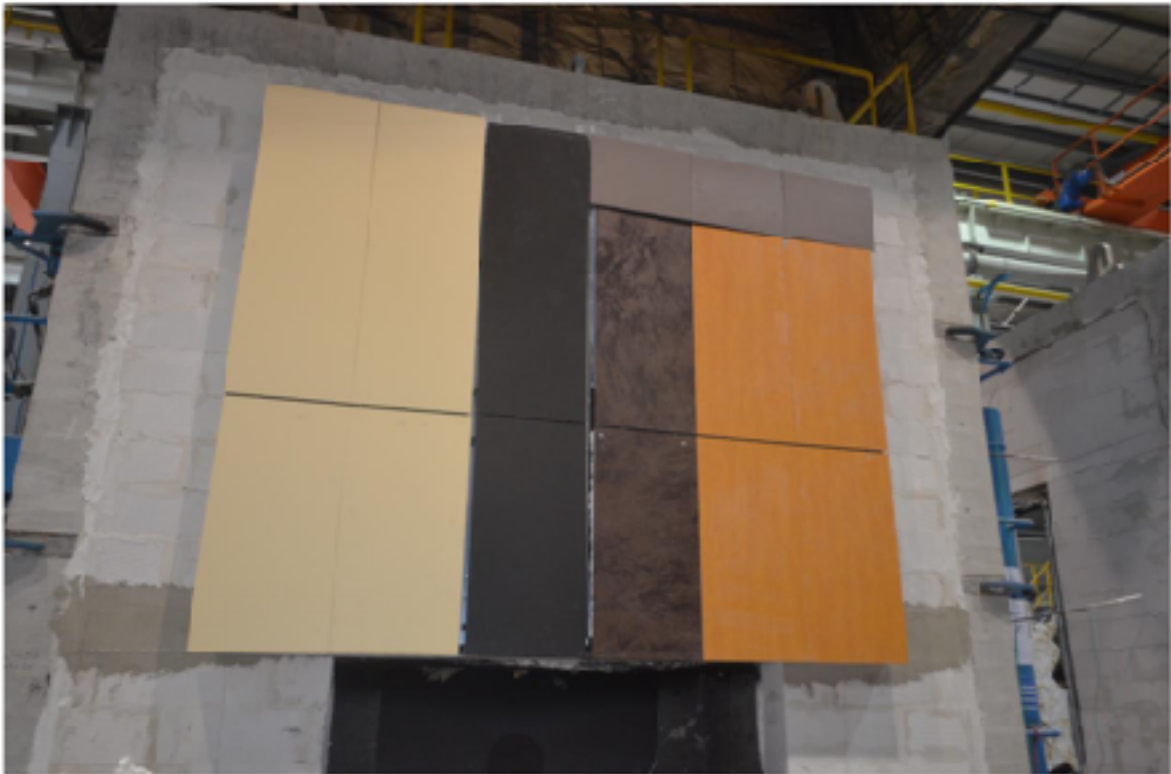


Fig. 5 Picture of the sample element before the test



Fig. 6. Picture of the sample element in 7th minute of the test (workpiece)



Fig. 7. Picture of the sample element in 15th minute of the test



Fig. 8. Picture of the sample element in 24th minute of the test (workpiece)



Fig. 9. Picture of the sample element after the test