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Spett.le
LOGLI MASSIMO S.P.A.
VIA CHEMNITZ 49/51
59100 PRATO (PO) - ITA

Test report N. 2021/0792 issued in Milan 07/04/2021

Client: LOGLI MASSIMO S.P.A.- PRATO (PO) – ITALIA

Specimen entry: see referenced test reports

TEST REPORT

Test of railing system for glass balustrade

In the following pages are reported:

- References to data from original test certificates;
- Data evaluation according to British Standard 6180:2011

The results are related only to the tested specimens.

The test report consists of 17 pages.

Test certificates referenced within these pages are considered inherent part of this report.

The test report can be only completely reproduced in full and shall be subjected to stamp duty for use according to Italian law D.P.R. 642/72.

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1. INTRODUCTION

Tests were commissioned by the client, Logli Massimo SpA, to evaluate the performance of several balustrade assemblies using different “DEFENDER” railing systems, in combination with laminated glass panels. The testing procedure included a continuous measurement of horizontal displacement on the handrail (upper edge of the glass panel) as a function of a horizontally imposed increasing linear load according to the test set-up described in the Italian Standard UNI 11678:2017.

Results within these certificates are hereby examined in accordance to BS 6180:2011 *Barriers in and about Buildings – Code of Practice* to allow these balustrade systems to be classified for use in accordance with the Code of Practice included within said Standard. Detailed results for each and every configuration evaluated are described in detail in the following test certificates issued by our laboratory:

- Test certificate N.2019/0876 issued May the 8th 2019
- Test certificate N.2019/0877 issued May the 8th 2019
- Test certificate N.2019/2981 issued December the 2nd 2019
- Test certificate N.2019/2982 issued December the 2nd 2019
- Test certificate N.2020/0635 issued March the 16th 2020
- Test certificate N.2020/0637 issued March the 16th 2020
- Test certificate N.2020/0638 issued March the 16th 2020
- Test certificate N.2020/0639 issued March the 16th 2020
- Test certificate N.2020/0640 issued March the 16th 2020
- Test certificate N.2020/2369 issued November the 19th 2020
- Test certificate N.2020/2370 issued November the 19th 2020
- Test certificate N.2020/2371 issued October the 27th 2020
- Test certificate N.2020/2372 issued November the 19th 2020
- Test certificate N.2020/2373 issued November the 19th 2020
- Test certificate N.2020/2374 issued October the 14th 2020
- Test certificate N.2020/2375 issued November the 19th 2020
- Test certificate N.2020/2376 issued November the 19th 2020
- Test certificate N.2020/2377 issued November the 19th 2020
- Test certificate N.2020/2378 issued November the 19th 2020
- Test certificate N.2020/2380 issued October the 14th 2020
- Test certificate N.2020/2381 issued October the 19th 2020
- Test certificate N.2021/0987 issued April the 6th 2021

This evaluation report summarizes without interpretation relevant test results obtained within the aforementioned individual test certificates. Results given in this evaluation report only apply to the samples that have been tested.

2. TEST SAMPLE

The tested assemblies include an aluminum rail with a U-shaped part, which is anchored to a load-bearing structure and is used to secure laminated glass (LG) panels, by means of plastic clamps. The described assemblies are intended to be used as balustrades. Table 1 contains an overview of the different systems evaluated within this report, depending on the mount type and the thickness of the LG panels installed. Balustrades were tested installed on C20/25 concrete elements, casted according to TR048 – EOTA -2016.

For additional details about the test samples identification, refer to the individual certificates listed in §1 and cross-referenced in Table 4.

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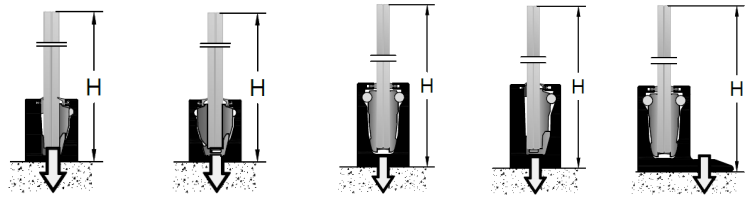
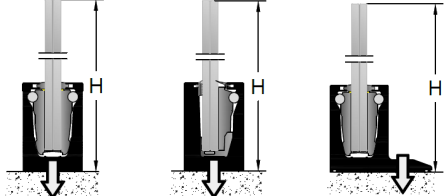
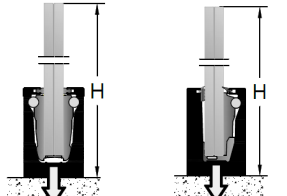
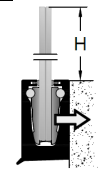
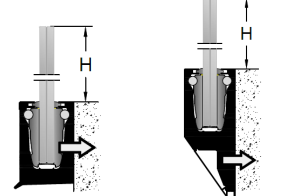
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Table 1 - list of systems per mount type and glass panel thickness

Mount type	glass thickness	Schemes and references of systems within this report
top mount	6+6	 DF66PICO
	8+8	 DF88PICO DF88XP DF88LM DF88MS DF88DK
	10+10	 DF1010LM DF1010MS DF1010DK
	12+12	 DF1212LM DF1212MS
lateral mount	8+8	 DF88FR
	10+10	 DF1010FR DF1010SP

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2.1 Railing systems

All railing systems tested use AW 6063 T6 aluminum profiles, extruded according to EN 573 and EN 755-2. These profiles are predrilled depending on the mount type with equally spaced holes for top mount or lateral mount installations.

The systems use plastic clamps (polyoxymethylene), provided with wedges (anodized aluminium or polyphthalamide) which are allowed to move via a stainless steel M6 screw. Such clamps are used to secure the LG panels within the U shaped parts of the aluminum profiles. Nowhere within the system the glass is put in contact with metal parts. Additional clip-on aluminum profiles are used to provide external cover to clamping mechanism, once the LG panel is secured in place. Sealing gaskets (thermoplastic elastomers) are used at the interface between the aluminum extruded parts and the glass surface at the exit of the system.

Details of all parts comprising each DEFENDER system reference within this evaluation report are given in the figures referenced within the following Table 2. For additional details, refer to the individual certificates listed in §1 cross-referenced in Table 4.

Table 2 - “DEFENDER” aluminum railing systems details

DEFENDER system reference	height of the aluminum system [mm]	width of the aluminum system [mm]	pre-drilled holes spacing [mm]	depth of the glass within the system [mm]	Ref.
DF66PICO	75	62	12.5	60	Figure 5
DF88PICO	75	62	12.5	60	Figure 6
DF88XP	75	62	12.5	60	Figure 7
DF88LM	120	72	20	95	Figure 8
DF88MS	120	72	20	95	Figure 9
DF88DK	120	132	20	95	Figure 10
DF88FR	120	74	20	95	Figure 11
DF1010LM	120	80	20	95	Figure 12
DF1010MS	120	80	20	95	Figure 13
DF1010DK	120	140	20	95	Figure 14
DF1010FR	110	82	20	95	Figure 15
DF1010SP	110	82	20	95	Figure 16
DF1212LM	120	80	20	95	Figure 17
DF1212MS	120	80	20	95	Figure 18

2.2 Anchors

Anchors were selected according to the profile for installation on concrete structure. The following have been used throughout different tests: HECO Multi-monti-plus (ETA-15/0784), FISCHER FBS under (ETA-11/0095) or SPIT GUARDIA (ETA- 07/0047).

The reference of the anchor type used for each individual assembly, refer to the individual certificates listed in §1 and cross-referenced in Table 4.

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2.3 Glass panels

LG panels were assembled using different types of glass plies, depending on thermal treatment used before lamination: EN 572 for annealed float glass, EN 1863 for heat-strengthened plies, EN 12150 for thermally tempered plies.

LG plies were then assembled during lamination using different interlayers for different assemblies. Interlayers used were: standard PVB, EVA Daylight, Saflex®DG41, SentryGlas® (Table 3).

Table 3 - Laminated Glass compositions reference

Laminated glass composition reference	Glass panes thickness [mm]	Glass panes type	Interlayer	Interlayer thickness [mm]
66.2 H PVB	6+6	tempered + heat strengthened*	PVB	0.76
66.4 T EVA	6+6	tempered	EVA Daylight	1.52
88.2 H PVB	8+8	tempered + heat strengthened*	PVB	0.76
88.4 T SG	8+8	tempered	SentryGlas®	1.52
1010.2 F PVB	10+10	annealed	PVB	0.76
1010.2 H PVB	10+10	tempered + heat strengthened*	PVB	0.76
1010.4 T EVA	10+10	tempered	EVA Daylight	1.52
1010.2 T SG	10+10	tempered	SentryGlas®	0.89
1212.2 A DG41	12+12	annealed	Saflex®DG41	0.76
1212.2 A PVB	12+12	annealed	PVB	0.76
1212.4 T SG	12+12	tempered	SentryGlas®	1.52

* this composition was tested with the tempered glass pane facing the inner part of the barrier

For all additional details the origin and properties of every glass panel, refer to the individual certificates listed in §1 cross-referenced in Table 4.

3. INSTALLATION OF THE SPECIMEN

Specimens were installed according to instructions and under the supervision of personnel from the company Logli Massimo. The following procedure was used:

1. Checking of the correct position of the concrete block with a level,
2. marking of the holes to be drilled on the concrete block using the pre-drilled aluminum profile as template,
3. drilling of the slab at an embedment depth according to the anchors of choice for each individual assembly.
4. cleaning of the dust within drilled holes,
5. installation of the main aluminum profile using the appropriate anchors (cf. §2.2),
6. tightening of the anchors to a maximum torque as recommended per supplier instructions,
7. assembly and positioning of the plastic clamps with spacing detailed in Table 4,
8. inserting the LG panel in the system,
9. inserting of interface rollers and tightening of the clamps,

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10. inserting of the gaskets in the clip-on profiles and sealing of the system.

For additional details on the installation of different assemblies, refer to the individual certificates listed in §1 cross-referenced in Table 4.

4. SETUP AND METODOLOGY

Static tests were performed within a broader campaign, which also included dynamic tests according to relevant national standards. Dynamic tests are not taken into account within this evaluation report, as these results have no impact concerning the classification within the Code of Practice in accordance to BS 6180:2011 Standard.

Static test were performed to simulate a distributed line load acting from inside to outside by means of four pneumatic jacks, attached to the strong floor. These pneumatic jacks can apply a uniform and controlled load via four ties attached to the upper edge of the balustrade, fixed with regular spacing according to the width of each specimen, to simulate the load from inside to outside. Sketches and examples of the setup for top mount and lateral mount system testing are shown in the following Figure 1 to Figure 4.

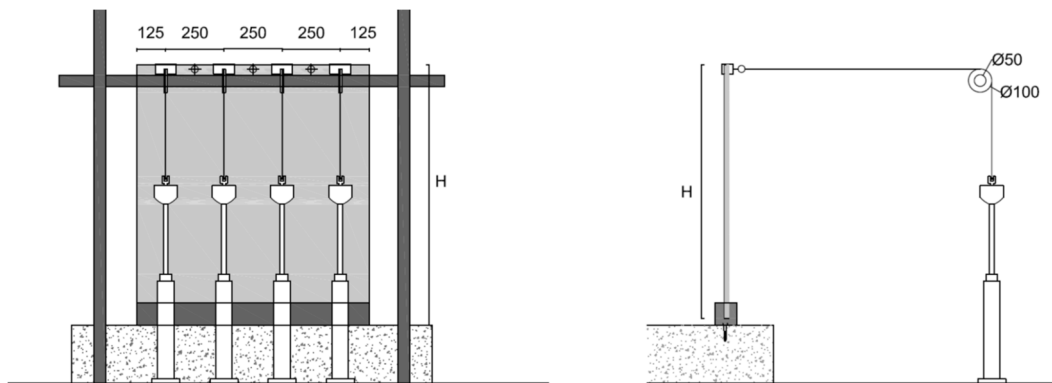


Figure 1 - scheme of the test setup for top mount balustrades

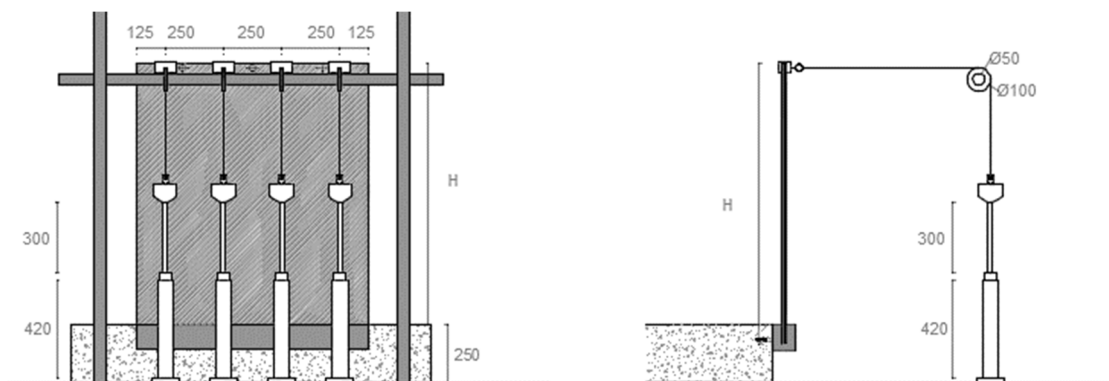


Figure 2 - scheme of the test setup for lateral mount balustrades

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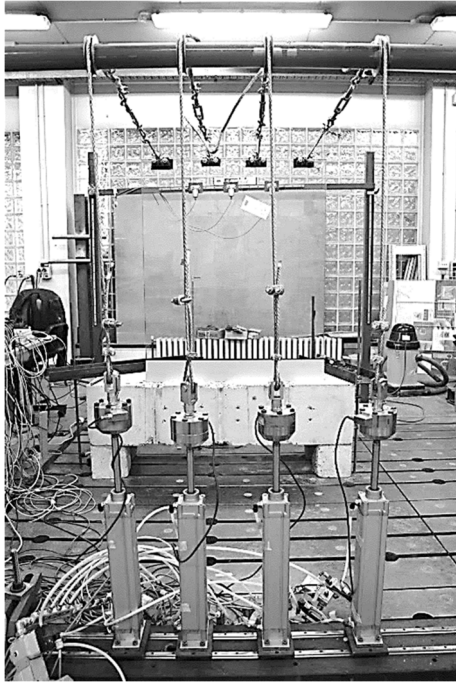


Figure 3 - test setup for top mount balustrades, example from Test certificate 2020/2377

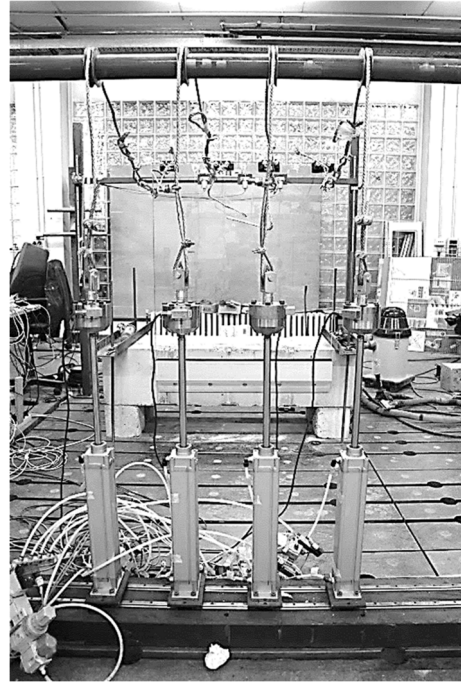


Figure 4 - test setup for lateral mount balustrades, example from Test certificate 2020/2373

4.1 Data acquisition

The applied load of each of the four hydraulic jacks was monitored via load cell (AEP TC4 S.N. 430971 -400896 – 715249 – 440041, class 1).

The load measured by the load cells was acquired by control system PLC Siemens S7 with specific software designed to maintain a uniform load in the four points.

The displacements were measured with three wire transducers WAYCON SX50-750-1R-KA02, placed horizontally at the height of the load application, on the opposite side, at midspan (S.N. 17555215) and at one third the width both on the right (S.N. 17555213) and on the left (S.N. 18561245).

Data from the load cells and from the wire displacement transducers was continuously acquired by Spider 8 HBM data acquisition system with specimen frequency of 2 Hz.

For each and every test, the ambient temperature and the relative humidity were monitored and registered using Extech Instrument RH520 Temperature and Humidity Recorder.

4.2 Testing procedure and data processing

The load was applied in incremental steps, depending on the load class required for relevant standards (both the reference standard and load class are referenced in each certificate listed in §1cross-referenced in Table 4.

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Accordingly, each incremental step includes a quasi-static increasing load distributed linearly on top of the balustrade, a load permanence period at maximum load value and a rapidly decreasing discharge ramp.

Most certificates referenced within this evaluation report include at least one recorded reset of the instruments measurement after a pre-defined incremental step, depending on the load class and the standard (such reset is generally required after a pre-loading phase, as defined by the testing procedures). For the evaluation of the performance of the balustrades within this evaluation report, under the requirements of BS 6180:2011, the reset of the instruments is not accounted for (i.e. when applicable, the residual displacements are always added to the measured displacements of the load ramps following the reset phase).

5. RESULTS

Data from the test certificates listed in §1 cross-referenced in Table 4 was evaluated in accordance with the guidance given in BS 6180 Barriers in and about Buildings – Code of Practice.

The standard states that the maximum allowable deflection for a glass protective barrier panel is 25 mm.

Horizontal uniformly distributed line load measured to reach maximum allowable deflection for the balustrade assemblies tested are given in Table 4.

Table 2 of BS 6180 categorizes parapets, barriers and balustrades for areas of use depending on the loads which have to be applied to produce this maximum allowable deflection. Depending on the type of occupancy for a building, limits for horizontal uniformly distributed line load are 0.22 kN/m, 0.36 kN/m, 0.74 kN/m, 1.50, kN/m and 3.0 kN/m. Such limits are defined in BS 6180 by means of fifteen examples according to various types of occupancies (these are numbered from (i) to (vx), detailing different uses of barriers for domestic and residential activities, offices, areas where people might congregate with or without fixed obstacles, susceptible or not to overcrowding, etc.). Table 5 summarizes the suitability of the tested balustrade systems with regards of horizontal uniformly distributed line loads limits, as these are described in BS 6180:2011.

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Table 4 details of tested assemblies and results obtained according to BS 6180:2011

Assembly reference	Certificate number	DEFENDER railing system					Laminated glass panel	Line load when reaching 25 mm horizontal displacement [kN/m]
		name	mount	protection height H ¹ [cm]	clamps spacing [cm]	anchors spacing (cm)		
01	2020/2371	DF66PICO	top	60	25	25	66.2 H PVB	1.67
02	2020/2370	DF66PICO	top	80	25	25	66.2 T EVA	0.97
03	2019/2981	DF88PICO	top	80	25	12.5	88.2 H PVB	1.22
04	2020/2369	DF88XP	top	80	25	25	88.2 H PVB	1.19
05	2020/2374	DF88LM	top	110	25	40	88.2 H PVB	0.86
06	2019/0877	DF88LM	top	122	25	20	88.4 T SG	0.96
07	2020/2380	DF88MS	top	110	25	40	88.2 H PVB	0.95
08	2019/2982	DF88DK	top	122	25	40	88.2 H PVB	1.03
09	2019/0876	DF88FR	lateral	110	25	20	88.4 T SG	0.80
10	2021/0987	DF1010LM	top	110	25	40	1010.2 F PVB	1.54
11	2020/0636	DF1010LM	top	122	25	40	1010.2 H PVB	1.19
12	2020/0638	DF1010LM	top	122	25	20	1010.2 T SG	2.08
13	2020/2377	DF1010MS	top	122	25	40	1010.4 T EVA	1.36
14	2020/2376	DF1010DK	top	122	25	60	1010.2 H PVB	1.14
15	2020/2375	DF1010DK	top	122	25	60	1010.4 T EVA	1.09
16	2020/0637	DF1010FR	lateral	110	25	40	1010.2 H PVB	1.10
17	2020/0639	DF1010FR	lateral	110	25	20	1010.2 T SG	1.70
18	2020/2372	DF1010SP	lateral	110	25	20	1010.2 H PVB	0.97
19	2020/2373	DF1010SP	lateral	110	25	20	1010.4 T EVA	1.06
20	2020/0640	DF1212LM	top	122	25	40	1212.2 A DG41	2.15
21	2020/2378	DF1212MS	top	122	25	40	1212.2 A PVB	1.25
22	2020/2381	DF1212LM	top	110	12.5	10 ²	1212.4 T SG	4.54

¹ The height of the protection is measured differently for top-mount or lateral mount installations: see Table 1 for reference on the protection height H for all systems.

² extra holes have been drilled for this assembly, to reduce the spacing from standard 200 mm spaced holes to 100 mm spaced holes.

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*Table 5 - Suitability DEFENDER balustrade systems under line load
in accordance with BS 6180:2011 minimum horizontal imposed loads requirements*

Balustrade assembly identification				Suitability per type of occupancy for part of the building				
Reference within this document	DEFENDER system reference	laminated glass reference	protection height H ³ [cm]	(iii)	(i) (iv)	(ii) (v) (viii) (ix)	(vi) (vii) (x) (xiii) (xiv)	(xi)
				0.22 kN/m	0.36 kN/m	0.74 kN/m	1.50 kN/m	3.0 kN/m
01	DF66PICO	66.2 H PVB	60	✓	✓	✓	✓	X
02	DF66PICO	66.2 T EVA	80	✓	✓	✓	X	X
03	DF88PICO	88.2 H PVB	80	✓	✓	✓	X	X
04	DF88XP	88.2 H PVB	80	✓	✓	✓	X	X
05	DF88LM	88.2 H PVB	110	✓	✓	✓	X	X
06	DF88LM	88.4 T SG	122	✓	✓	✓	X	X
07	DF88MS	88.2 H PVB	110	✓	✓	✓	X	X
08	DF88DK	88.2 H PVB	122	✓	✓	✓	X	X
09	DF88FR	88.4 T SG	110	✓	✓	✓	X	X
10	DF1010LM	1010.2 F PVB	110	✓	✓	✓	✓	X
11	DF1010LM	1010.2 H PVB	122	✓	✓	✓	X	X
12	DF1010LM	1010.2 T SG	122	✓	✓	✓	✓	X
13	DF1010MS	1010.4 T EVA	122	✓	✓	✓	X	X
14	DF1010DK	1010.2 H PVB	122	✓	✓	✓	X	X
15	DF1010DK	1010.4 T EVA	122	✓	✓	✓	X	X
16	DF1010FR	1010.2 H PVB	110	✓	✓	✓	X	X
17	DF1010FR	1010.2 T SG	110	✓	✓	✓	✓	X
18	DF1010SP	1010.2 H PVB	110	✓	✓	✓	X	X
19	DF1010SP	1010.4 T EVA	110	✓	✓	✓	X	X
20	DF1212LM	1212.2 A DG41	122	✓	✓	✓	✓	X
21	DF1212MS	1212.2 A PVB	122	✓	✓	✓	X	X
22	DF1212LM ⁴	1212.4 T SG	110	✓	✓	✓	✓	✓

³ The height of the protection is measured differently for top-mount or lateral mount installations: see Table 1 for reference on the protection height H for all systems.

⁴ extra holes have been drilled for this assembly, to reduce the spacing from standard 200 mm spaced holes to 100 mm spaced holes.

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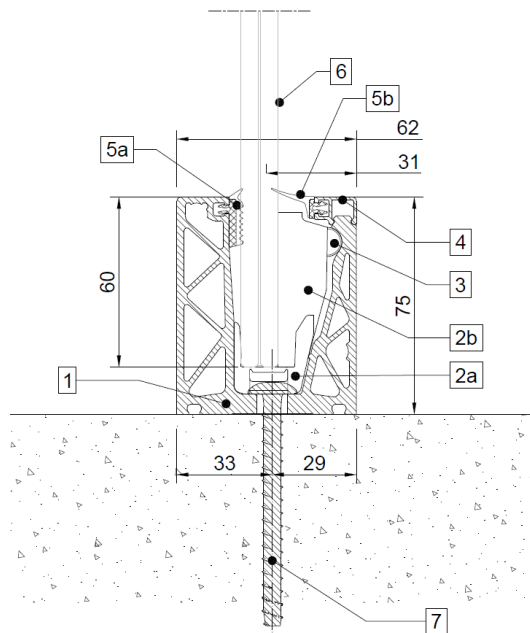
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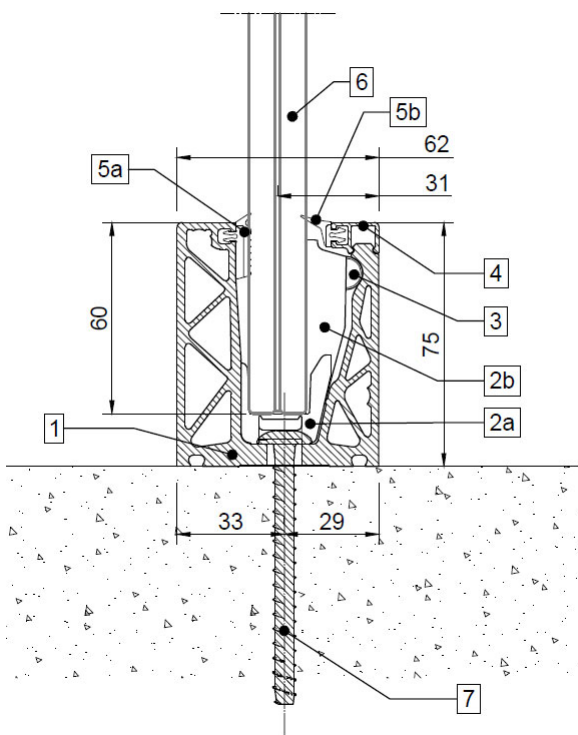
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- 1 base profile [ref. DF88PICO.60]
- 2a clamps base element with option for LED strip (not shown) [part of ref. DFP135]
- 2b clamps with tightening screw [ref. DFP135]
- 3 contact rollers between the clamps and the base profile [part of ref. DFP135]
- 4 clip-on profile with rail for gasket installation [ref. DFP100]
- 5a external gasket [ref. DFPG03]
- 5b internal gasket [ref. DFP15G01]
- 6 Laminated glass 6.6/x
- 7 installation on main structure (example on concrete)

Figure 5 – Scheme of the DEFENDER system DF66PICO



- 1 base profile [ref. DF88PICO.60]
- 2a clamps base element with option for LED strip (not shown) [part of ref. DFP175]
- 2b clamps with tightening screw [ref. DFP175]
- 3 contact rollers between the clamps and the base profile [part of ref. DFP175]
- 4 clip-on profile with rail for gasket installation [ref. DFP100]
- 5a external gasket [ref. DFPG03]
- 5b internal gasket [ref. DFP88G01]
- 6 Laminated glass 8.8/x
- 7 installation on main structure (example on concrete)

Figure 6 – Scheme of the DEFENDER system DF88PICO

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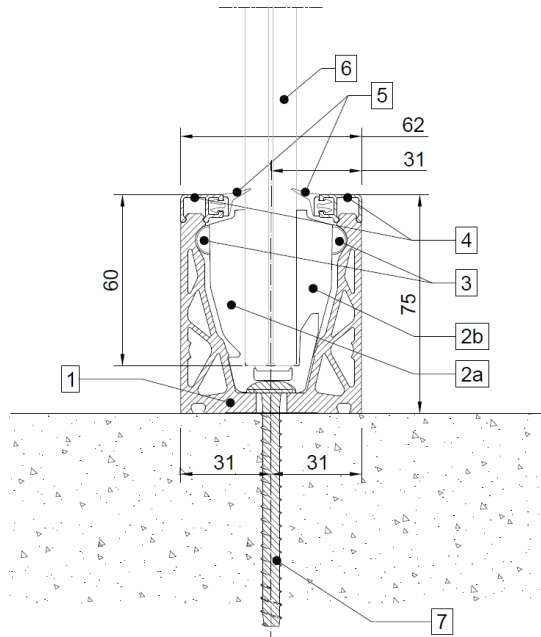
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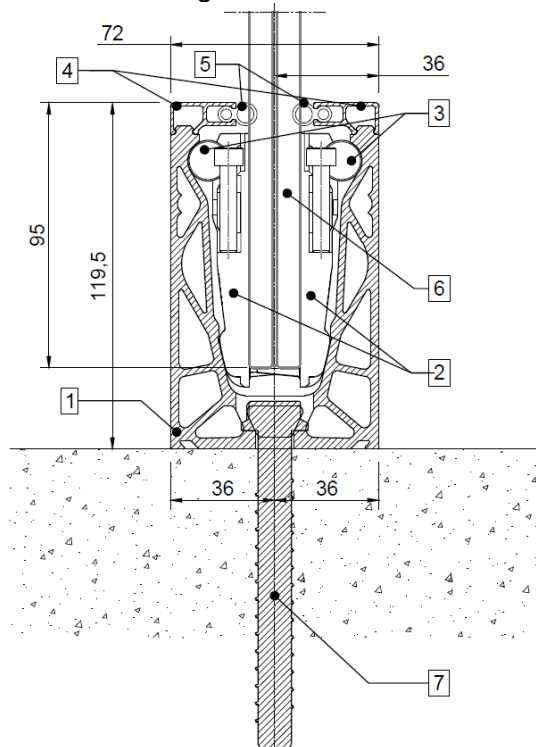
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- 1 base profile [ref. DFXP88.60]
- 2a part of the clamps including tightening screw and a base element with option for LED strip (not shown) [part of ref. DFXP175]
- 2b clamps with tightening screw [ref. DFXP175]
- 3 contact rollers between the clamps and the base profile [part of ref. DFXP175]
- 4 clip-on profile with rail for gasket installation [ref. DFP100]
- 5 gaskets [ref. DFP88G01]
- 6 Laminated glass 8.8/x
- 7 installation on main structure (example on concrete)

Figure 7 – Scheme of the DEFENDER system DF88XP



- 1 base profile [ref. DF88LM.60]
- 2 clamps made with two identical L shaped elements assembled to form a U shaped clamp [ref. DF88175]
- 3 contact rollers between the clamps and the base profile [part of ref. DF88175]
- 4 clip-on profiles with rail for gasket installation [ref. DF105]
- 5 gaskets [ref. DF1010]
- 6 laminated glass 8.8/x
- 7 installation on main structure (example on concrete)

Figure 8 – Scheme of the DEFENDER system DF88LM

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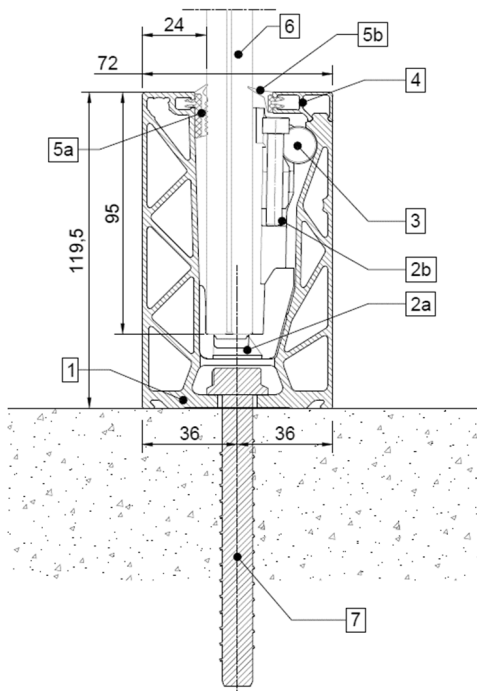
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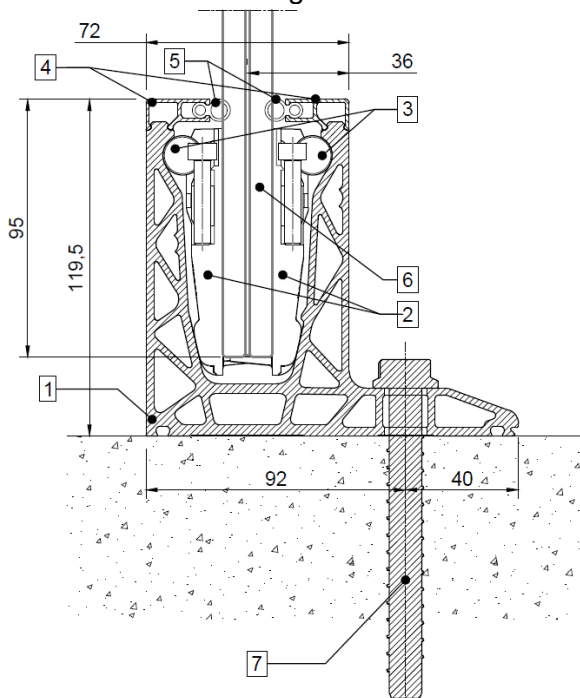
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- 1 base profile [ref. DF88MS.60]
- 2a clamps base element with option for LED strip (not shown) [part of ref. DFMS175]
- 2b clamps with tightening screw [ref. DFMS175]
- 3 contact rollers between the clamps and the base profile [part of ref. DFMS175]
- 4 clip-on profile with rail for gasket installation [ref. DF105]
- 5a external gasket [ref. DFIG03]
- 5b internal gasket [ref. DFP88G01]
- 6 Laminated glass 8.8/x
- 7 installation on main structure (example on concrete)

Figure 9 – Scheme of the DEFENDER system DF88MS



- 1 base profile [ref. DF88DK.60]
- 2 clamps made with two identical L shaped elements assembled to form a U shaped clamp [ref. DF88175]
- 3 contact rollers between the clamps and the base profile [part of ref. DF88175]
- 4 clip-on profiles with rail for gasket installation [ref. DF105]
- 5 gaskets [ref. DF1010]
- 6 laminated glass 8.8/x
- 7 installation on main structure (example on concrete)

Figure 10 – Scheme of the DEFENDER system DF88DK

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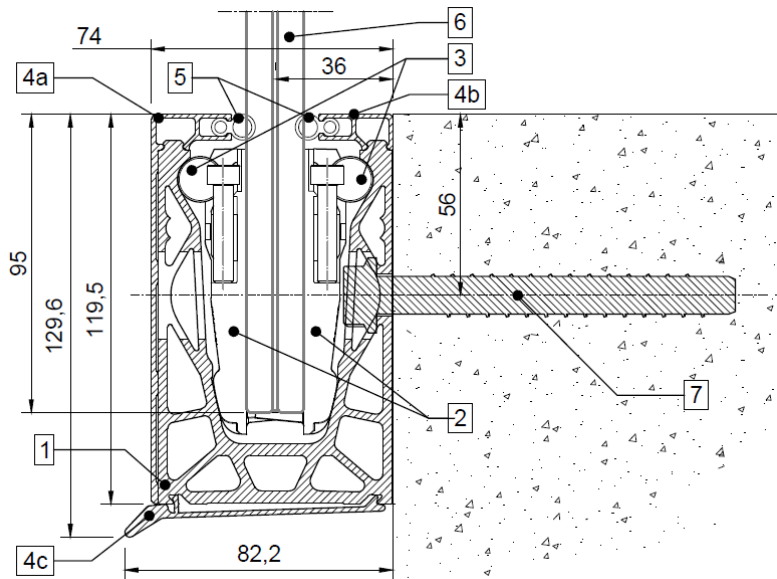
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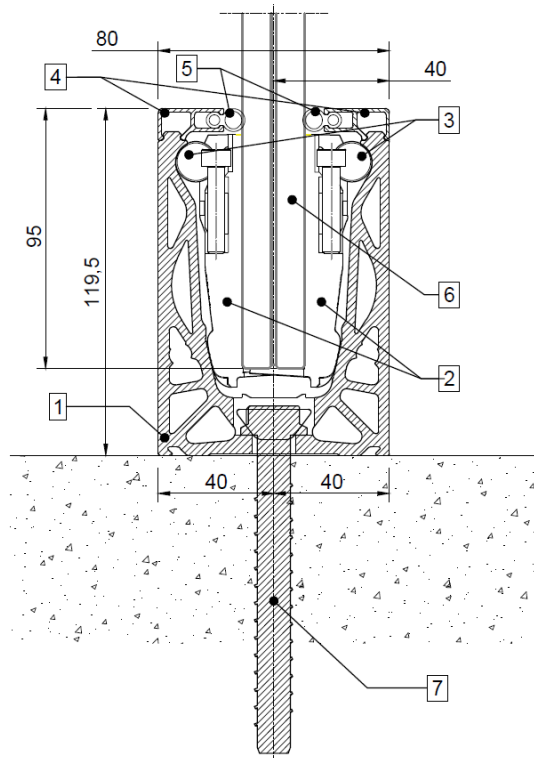
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- 1 base profile [ref. DF88FR.60]
- 2 clamps made with two identical L shaped elements assembled to form a U shaped clamp [ref. DF88175]
- 3 contact rollers between the clamps and the base profile [part of ref. DF88175]
- 4a lateral clip-on profile with rail for gasket installation [ref. DF8803]
- 4b clip-on profile with rail for gasket installation [ref. DF105]
- 4c clip-on profile with dripper [ref. DFS07]
- 5 gaskets [ref. DF1010]
- 6 laminated glass 8.8/x
- 7 installation on main structure (example on concrete)

Figure 11 – Scheme of the DEFENDER system DF88FR



- 1 base profile [ref. DF1012LM.60]
- 2 clamps made with two identical L shaped elements assembled to form a U shaped clamp [ref. DF1010215]
- 3 contact rollers between the clamps and the base profile [part of ref. DF1010215]
- 4 clip-on profile with rail for gasket installation [ref. DF105]
- 5 Gaskets [ref. DF88]
- 6 Laminated glass 10.10/x
- 7 installation on main structure (example on concrete)

Figure 12 – Scheme of the DEFENDER system DF1010LM

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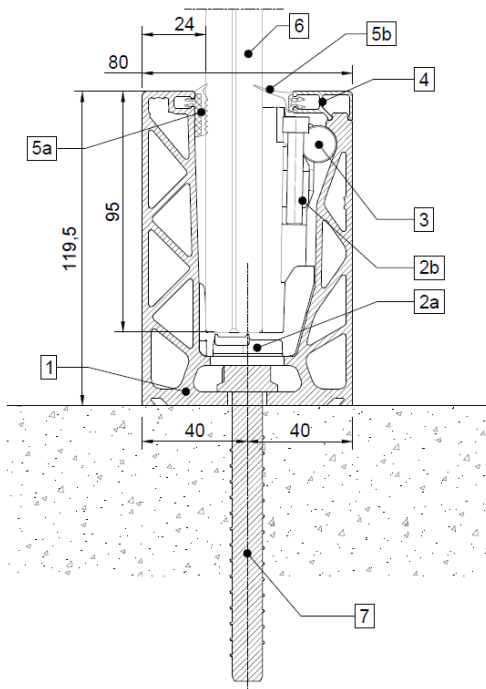
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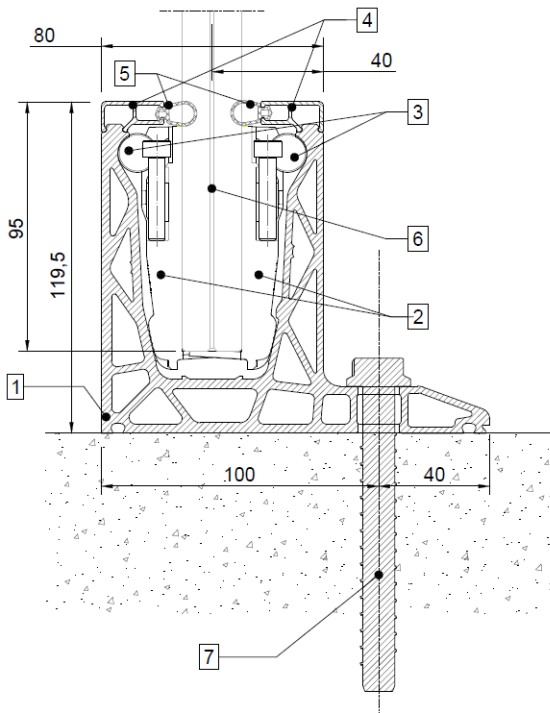
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- 1 base profile [ref. DF1012MS.60]
- 2a clamps base element with option for LED strip (not shown) [part of ref. DFMS215]
- 2b clamps with tightening screw [ref. DFMS215]
- 3 contact rollers between the clamps and the base profile [part of ref. DFMS215]
- 4 clip-on profile with rail for gasket installation [ref. DFP100]
- 5a external gasket [ref. DFPG03]
- 5b internal gasket [ref. DFP15G01]
- 6 Laminated glass 10.10/x
- 7 installation on main structure (example on concrete)

Figure 13 – Scheme of the DEFENDER system DF1010MS



- 1 base profile [ref. DF1012DK.60]
- 2 clamps made with two identical L shaped elements assembled to form a U shaped clamp [ref. DF1010215]
- 3 contact rollers between the clamps and the base profile [part of ref. DF1010215]
- 4 clip-on profiles with rail for gasket installation [ref. DF105]
- 5 gaskets [ref. DF88]
- 6 laminated glass 10.10/x
- 7 installation on main structure (example on concrete)

Figure 14 – Scheme of the DEFENDER system DF1010DK

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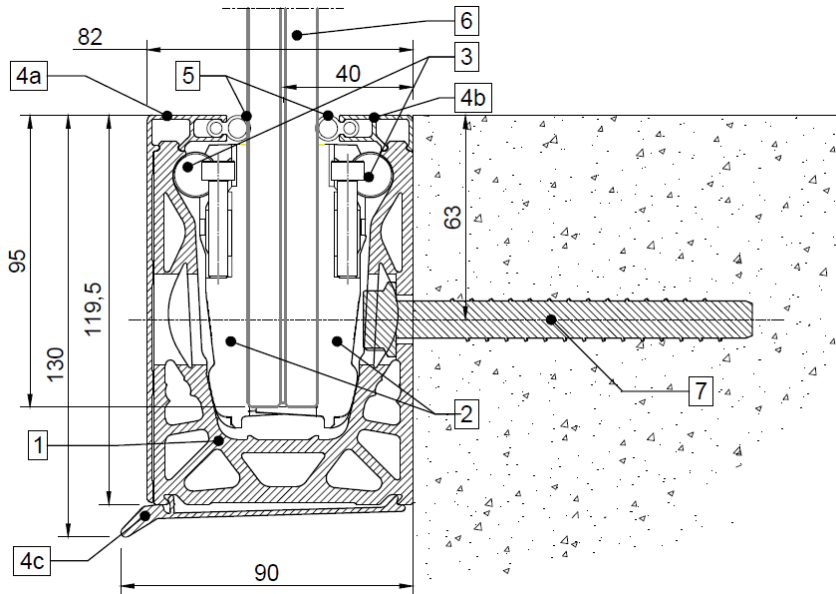
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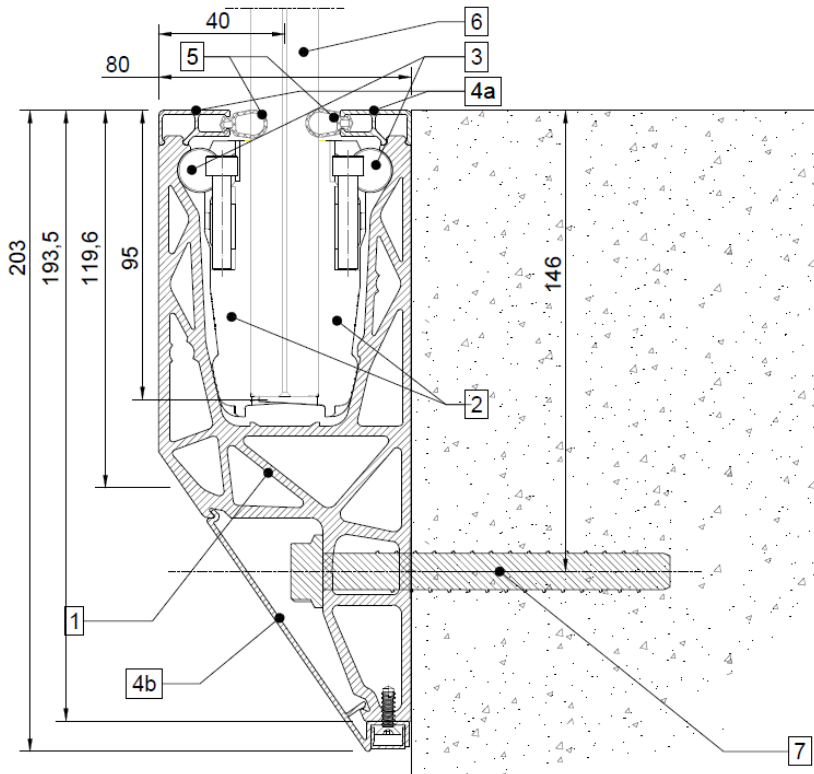
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- 1 base profile [ref. DF1012FR.60]
- 2 clamps made with two identical L shaped elements assembled to form a U shaped clamp [ref. DF1010215]
- 3 contact rollers between the clamps and the base profile [part of ref. DF1010215]
- 4a lateral clip-on profile with rail for gasket installation [ref. DF8803]
- 4b clip-on profile with rail for gasket installation [ref. DF105]
- 4c clip-on profile with dripper [ref. DFS09]
- 5 gaskets [ref. DF88]
- 6 laminated glass 10.10/x
- 7 installation on main structure (example on concrete)

Figure 15 – Scheme of the DEFENDER system DF1010FR



- 1 base profile [ref. DF1012SP.60]
- 2 clamps made with two identical L shaped elements assembled to form a U shaped clamp [ref. DF1010215]
- 3 contact rollers between the clamps and the base profile [part of ref. DF1010215]
- 4a clip-on profile with rail for gasket installation [ref. DF105]
- 4b clip-on profile with dripper [ref. DFS11]
- 5 gaskets [ref. DF88]
- 6 laminated glass 10.10/x
- 7 installation on main structure (example on concrete)

Figure 16 – Scheme of the DEFENDER system DF1010SP

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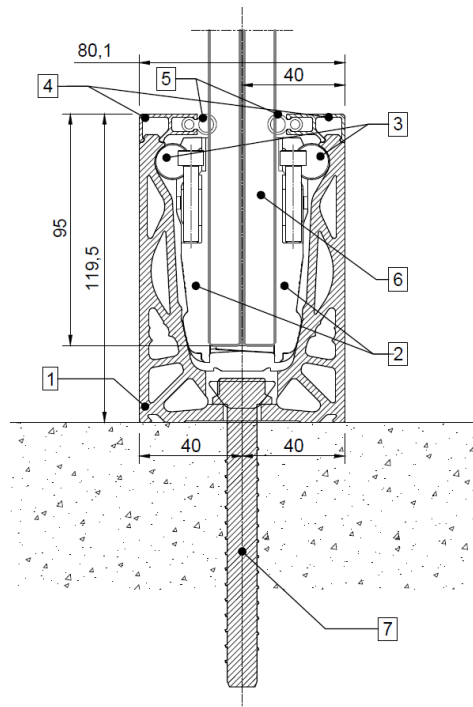
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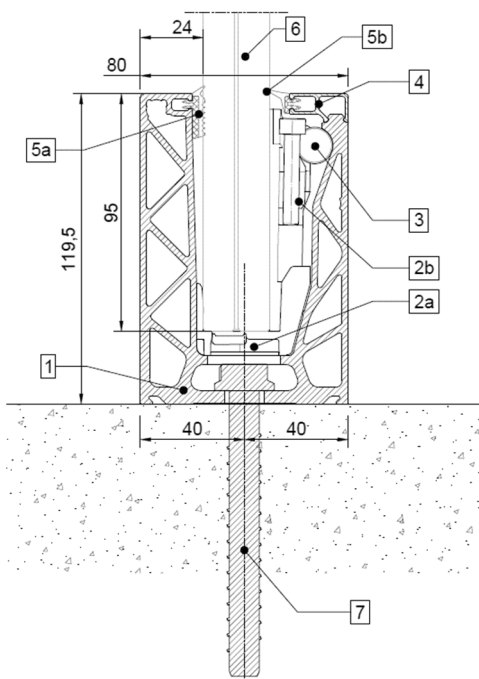
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- 1 base profile [ref. DF1012LM.60]
- 2 clamps made with two identical L shaped elements assembled to form a U shaped clamp [ref. DF1212255]
- 3 contact rollers between the clamps and the base profile [part of ref. DF1212255]
- 4 clip-on profiles with rail for gasket installation [ref. DF105]
- 5 gaskets [ref. DF1010]
- 6 laminated glass 12.12/x
- 7 installation on main structure (example on concrete)

Figure 17 – Scheme of the DEFENDER system DF1212LM



- 1 base profile [ref. DF1012MS.60]
- 2a clamps base element with option for LED strip (not shown) [part of ref. DFMS255]
- 2b clamps with tightening screw [ref. DFMS255]
- 3 contact rollers between the clamps and the base profile [part of ref. DFMS255]
- 4 clip-on profile with rail for gasket installation [ref. DF105]
- 5a external gasket [ref. DFPG03]
- 5b internal gasket [ref. DFP88G01]
- 6 Laminated glass 12.12/x
- 7 installation on main structure (example on concrete)

Figure 18 – Scheme of the DEFENDER system DF1212MS

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