



**FORMICA COMPACT LAMINATE FOR EXTERIOR APPLICATIONS
TECHNICAL GUIDELINES FOR FAÇADE SYSTEMS**

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1.-Product Description.

Formica Compact Laminate is a High Pressure Laminate (HPL) panel made of kraft paper impregnated with stable thermal resins, (Phenolic and Melamine) and compressed under high pressure (10 Mpa = 100 Kg/cm²) at high temperature (150 ° C), resulting in a product that is a stable, flat, impermeable, compact laminate of unequaled strength.

This Formica HPL Laminate is manufactured with an acrylic surface layer containing additives that protect it from the effects of ultraviolet light. The resulting laminate is fully compliant with European Standard EN 438 – 6, and as a result of its characteristics it is ideal for use as a lightweight ventilated wall-covering panel on exterior façades.

Formica Compact Laminate EDF for exteriors is classified according to Standard EN 438 6 as EDF quality (severe conditions): high pressure decorative laminates. Part 6. Classification and specification for EDF grade exterior compact laminates.

2.- Lightweight Ventilated Façades.

Lightweight ventilated façades made with Formica EDF Laminates basically consist of the following parts:

- Compact Formica Panel.
- Air space.
- Thermal insulation.
- Metallic substructure that transmits the load of the panels to the bearing wall.
- Angle brackets.

Figure 1.- Basic diagram of a lightweight ventilated façade.-

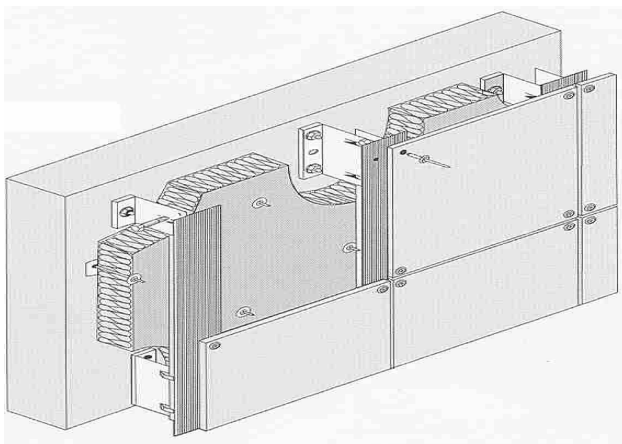
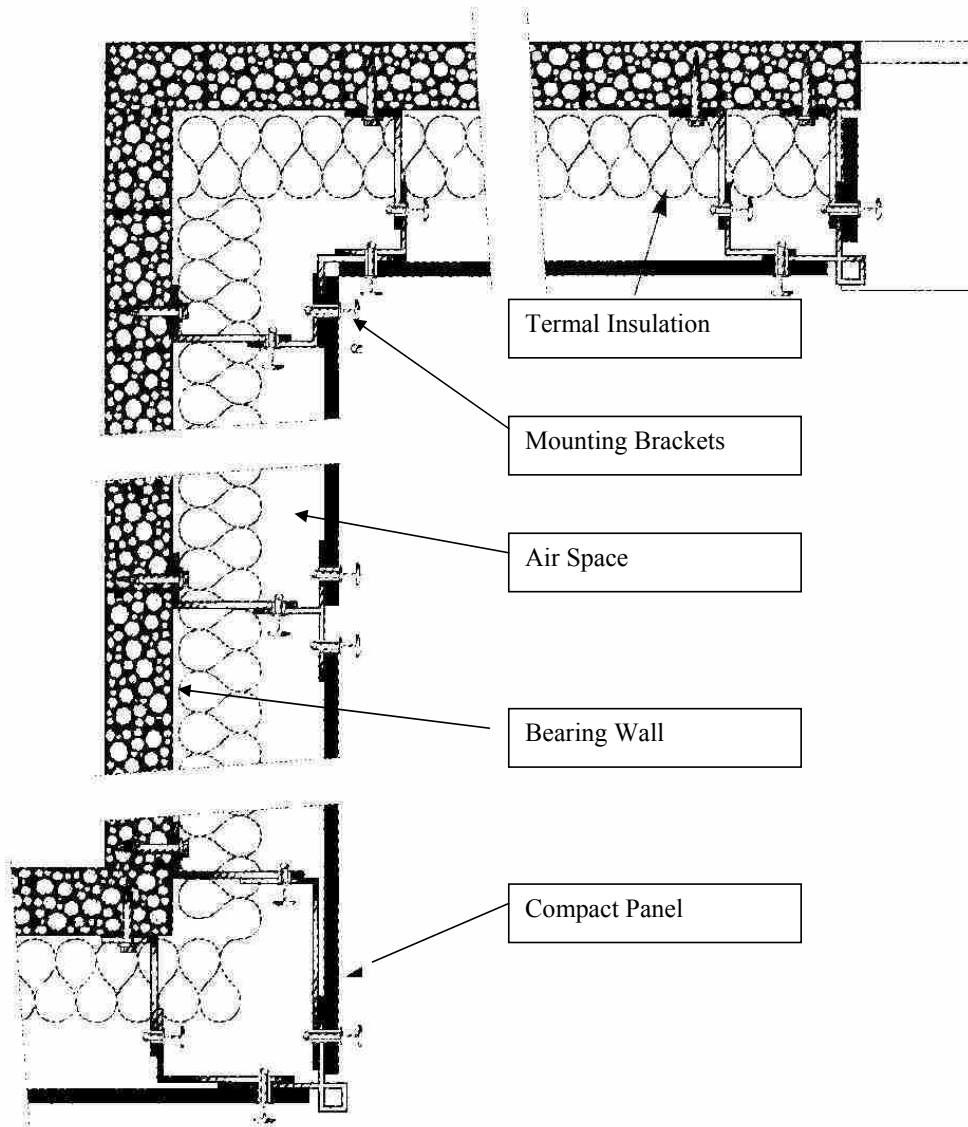


Figure 2 Plan view



The lightweight ventilated façade system has the following advantages:

- A wide range of different decorative designs.
- Best fit based on sheets of different sizes for optimum efficiency.
- Light weight of both substructure and façade.
- Impervious to ultraviolet light
- Durability. Weather resistant.
- Flat and self-supporting.
- Impact resistant.
- Stable chemical and mechanical properties below 180° C.
- Meets fire-rating guidelines and does not soften or drip.
- Quick and easy installation.
- Easy to clean and maintain.
- No thermal transmission.
- Thermal insulation and ventilation fights heat loss in winter and heat transmission in summer.

Compact Formica EDF panels can be attached to a wood or metal substructure with different fasteners like Studs, Screws, invisible Vetâge fasteners, and Chemical adhesives.

3.- Ventilated Façade Components.

- 3.1.- Formica Compact Exterior EDF Panels.
- 3.2.- Substructure.
- 3.3.- Panel to substructure fasteners.

3.1.- Formica Compact Exterior EDF Panels.

The panels are made from EDS type sheets of Formica Compact Exterior Laminates, Compact Exterior Laminates for severe conditions, Fireproof class.

Formica Compact Exterior EDF Laminates are manufactured in the following sizes:

- 2500 x 1220 mm
- 3050 x 1320 mm
- 3660 x 1610 mm

This allows the panels to be custom fitted to the closest and most economic dimensions of the façade or balcony.

- The nominal thicknesses are 6, 8 and 10 mm.

3.2.- Substructure

- U, L and T-section aluminum and galvanized steel hangers.
- Angle brackets.
- Wood strip hangers.

3.3.- Fastening the Panels to the Substructure

- Screws or rivets.
- Invisible Vetâge system.
- Chemical adhesive.

4- Fastening Systems.

4.1. Anchoring the Substructure to the Bearing Structure

- Anchoring the brackets to concrete.
- Anchoring the brackets to hollow materials (brick and cement block).

4.2.- Fastening Parts of the Substructure Together

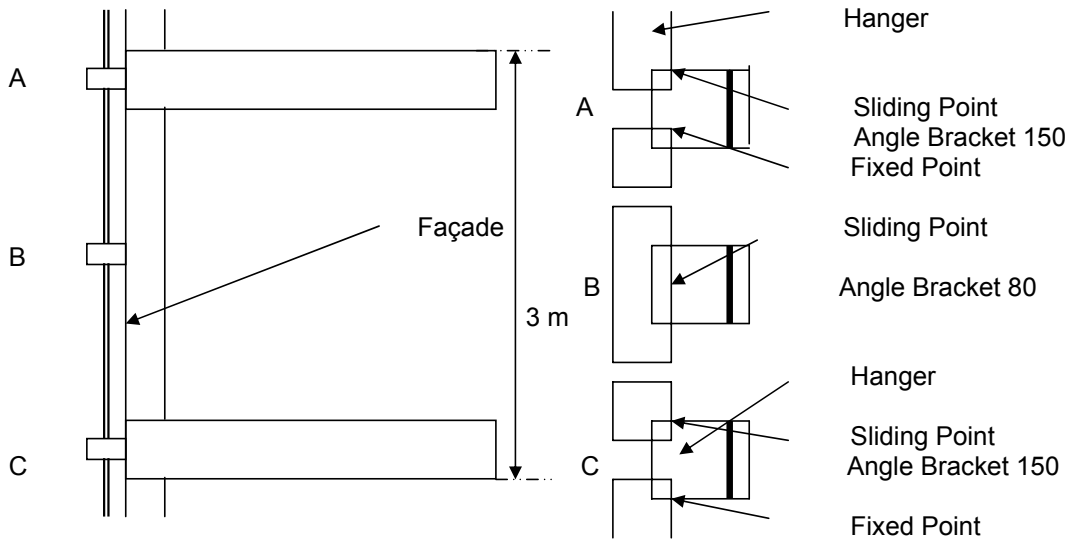
- Attaching the hangers.

4.3.- Attaching Formica EDF to the Substructure:

The system for fastening the panels to the façade of the building consists of the following parts:

- Blind rivets, aluminum with a 4.8 mm diameter, 16 to 22 mm long mandrel and a 16 mm diameter head, the head can be lacquered to match the panel.
- Aluminum hangers 2 mm thick, AW 6060 or AW 6063 alloy. The hangers are placed in a vertical position on the wall, using the L-section (50/42) to hold the center of the panel and the T section (110/52) for attaching the vertical edge.
- Angled wall brackets of 3 mm thick aluminum, AW 6060 or AW 6063 alloy. The hangers are attached at the joint and the façade, normally two per level. Each of the hangers, supplied in 6-meter lengths, is cut to the height of the level, using the LR 150 bracket as the fixed point on the joint, and the LR 80 as a sliding point attached to the façade at approx. half the height of the level. An LR 150 bracket that acts as a sliding point on the next joint is used for the end section and as a fixed point for the hanger that begins at that joint. The brackets are of different lengths, allowing adjustment of the hanger distance <> bearing wall.

Fig. 3: Diagram for attaching brackets to the wall.



A screw can be used to attach the hanger to the bracket (see appendix), placing it in the round hole of the bracket (fixed point) and in the slot at the sliding point. In addition, when attaching a fixed point the screw is tightened as much as possible, and in the case of a sliding joint, the screw should be loosened by approximately $\frac{1}{4}$ turn to allow the hanger to move in relation to the bracket.

See Figure 10.1

The system is finished with:

- Perforations: to avoid thermal bridges between the substructure and the bearing wall.
- Stainless steel washers to avoid the effects of galvanic action between steel and aluminum. Thermal insulation attached to the bearing wall, and its anchors.

5.-Definition of the Panel System

The panels are attached to the metal substructure leaving an 8 mm wide space on all sides.

The effect of the relative humidity (to a great extent) and the temperature (to a lesser extent) affect the dimensional stability of the panels to the maximum limits described in the Technical Information. Following the guidelines of this document will minimize these effects, and there will be no influence on the stability and esthetic appearance of the system.

Although the ventilating function of the façade system minimizes the effects of water entering through the joints, thermal insulation with a water resistant surface film can be used as an added measure of security, which will prevent the thermal insulation from absorbing water and diminishing its performance.

The panels that will be attached to the substructure with rivets or screws should be drilled with holes that are a specific distance between centers. These holes should be made in such way that they have one fixed point and the rest as sliding points.

6.- Calculations For the System Elements.

Loads to be considered

The factors to consider in making calculations for the system are:

- Weight of the panels themselves
- Wind factor

If the calculations for the system are correctly made and executed, there will be no need to take into account variations of temperature and relative humidity.

6.1.- Panel Weight Considerations

The weight of the panels themselves must be considered, calculating by:

The surface mass of the Exterior Compact, after factoring in the maximum amount allowed for water absorption (2%) is:

Table 1

Thickness mm	Weight Kg / m ²
6	8.6
8	11.4
10	14.3

Water is also absorbed through the pop rivets, usually in such small amounts that there is no effect on the dimensional calculations.

6.2.- Wind considerations

Wind loads are transmitted from the panels to the substructure, and from there to the bearing wall.

The effects of the wind are determined according to standard NBE-AE/88 based on the height of the building, its geometric form, and its geographic location, correctly adjusted using the coefficients mentioned in the standard MV-103-72.

The admissible loads (Newtons) for the rivets depend on the location of the rivet according to the following table:

Table 2 : Maximum loads for rivets

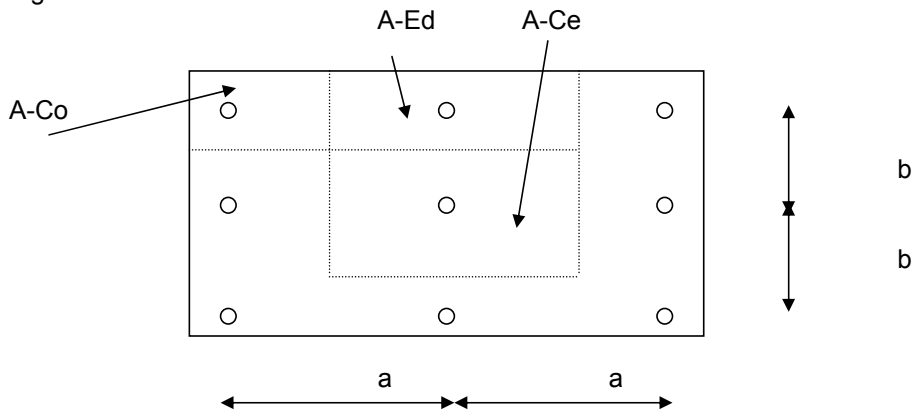
Table 2

THICKNESS mm	DISTANCE mm	POSITION OF FASTENER (Newtons)		
		CENTER	EDGE	CORNER
6	400	410	280	185
	600	380	220	130
8	400	580	420	240
	600	580	400	220
	700	580	380	210
10	400	580	580	380
	600	580	580	360
	700	580	550	330

This includes a safety coefficient of 3 for attachment with rivets.

The part of the panel whose wind depression is supported by each rivet can be seen as follows:

Figure 4



Corner rivet area: A - Corner = $0.50 \times a \times 0.50 \times c$
 Edge rivet area: A - Edge = $1.25 \times a \times 0.50 \times c$
 Center rivet area: A - Center = $1.25 \times a \times 1.25 \times c$

The calculation of the distance between panel fasteners is treated as if it were a continuous beam or beam supported at two points, using the following formula:

$$f = K \frac{P \times L^4}{E \times I}$$

- f = Distance in mm
- K= 0.0130 Two horizontal supports
- K= 0.0054 Three horizontal supports
- P : wind pressure
- L : length between supports
- E : Elasticity of the compact panel (See appendix 1)
- I = Moment of inertia of the panel = $e^3 / 12$

measuring the distance between supports for a maximum arrow of 1/100 of the distance between supports.

The following tables are to be used as an aid for designing the maximum admissible values for wind depression based on the chosen configuration:

Admissible units of resistance under normal winds in Newtons according to the distance between the fasteners

Table 3: Maximum considerations for wind shear in Newtons for a 600 mm distance between fasteners

Table 3

Placement of fasteners	Panel thickness	Distance between the fasteners (mm) at the height of the V profiles (Newtons)					
		200	300	400	500	600	700
V x H							
2 x 2	6 mm	750	750	750	750	----	----
	8 mm	1780	1780	1780	1780	1370	1310
	10 mm	>3000					
3 x 2 n x 2	6 mm	750	750	750	750	----	----
	8 mm	1780	1780	1780	1780	1780	1260
	10 mm	>3000					
2 x 3 2 x n	6 mm	1600	1330	1030	840	710	----
	8 mm	>3000	>3000	2550	2070	1370	860
	10 mm						
3 x 3 n x n	6 mm	1600	1210	910	730	640	----
	8 mm	2670	1780	1340	1070	890	760
	10 mm						

N>3; V : Number of vertical fasteners on the wood strip hanger
H : Number of horizontal fasteners

Table 4: Maximum considerations for wind shear in Newtons for a 400 mm distance Between fasteners

Tabla 4

Placement of fasteners	Panel thickness	Distance between the fasteners (mm) at the height of the V profiles (Newtons)					
		200	300	400	500	600	700
V x H							
2 x 2	6 mm	2910	2910	1950	1000	900	----
	8 mm	>3000	>3000	>3000	2360	1370	860
	10 mm						
3 x 2 n x 2	6 mm	2910	2910	2330	1580	1100	----
	8 mm	>3000	>3000	>3000	>3000	2710	1890
	10 mm						
2 x 3 2 x n	6 mm	>3000	2880	1950	1000		----
	8 mm	>3000	>3000	>3000	2360	1370	860
	10 mm						

3 x 3 n xn	6 mm	2910	2000	1530	1140	880	----
	8 mm	>3000	2500	1910	1540	1290	1140
	10 mm						

Note :

N>3; V : Number of vertical fasteners on the wood strip hanger

H : Number of horizontal fasteners

Once the system is laid out based on the distance between supports for maximum distance "f", it usually does not reach the resistance to flexing published in the Technical Report.

The values expressed in tables 2 and 3 should be considered as rough guidelines, it is the responsibility of the contractor to do the calculations for the system

The transmission of force from the panel to the bearing wall takes place through the substructure and its anchors, and should be calculated according to the manufacturer's instructions.

7.- Installing the System.

7.1.-General recommendations

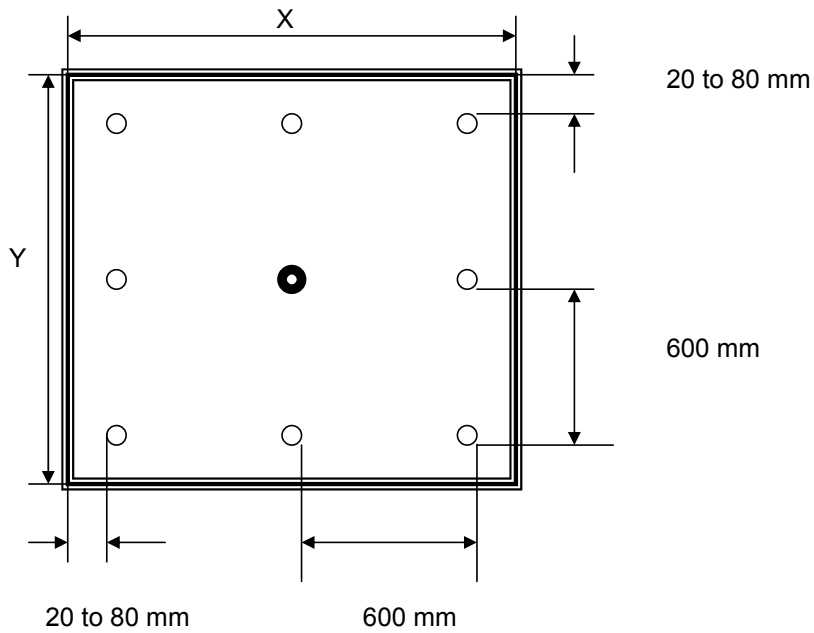
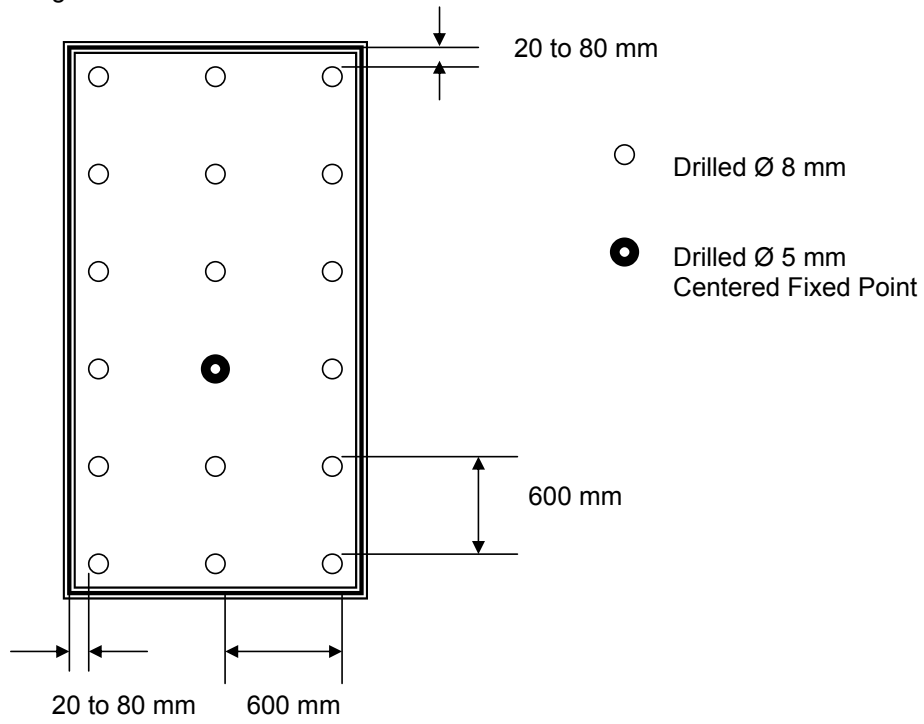
- The system should be installed by qualified and experienced personnel, using the proper tools and auxiliary equipment (scaffolding).
- The substructure must be perfectly leveled and flat, this is particularly important when using 6 mm thick wall-covering panels.
- The manufacturer's recommendations must be carefully followed when joining together the pieces of the aluminum substructure to allow for their differential expansion due to thermal conditions.
- Because of the stresses on the panels due to changes in the relative humidity of the surrounding air, whenever possible avoid mounting the panels in extreme conditions (cold and dry, or hot and humid weather). In addition, the panels should be allowed to adjust to the climate where they will be used.

7.2.-Placement of the fasteners in the compact panels

The following recommendations must be kept in mind so the system will function correctly, and the stresses of thermal and hygrometric expansion will not affect its parts.

- The panels should have a more or less central fixed point as seen in the following Figure 5

Figure 5



- At this point the hole in the panel for the rivet will have a 5 mm diameter hole. In all the rest (sliding points) the drilled diameter in the panel will be 10 mm, making sure that this hole and that of the hanger behind it are concentric, if possible using drill bits of two diameters and drilling the panel and the hanger at the same time.
- The rivets in the sliding points should be placed with the head as represented in figure 2.3, so that there is a distance of 0.3 mm between the rivet head and the panel that allows the panel to move freely in response to changes in weather conditions.
- The horizontal and vertical joints between the panels should be 8 mm wide, preferably leaving them open.
- The holes for the rivets should be drilled at a distance from the edge that is between 20 mm and 10 times the thickness of the panel.
- The space between the panel and the thermal insulation must have a minimum width of 20 mm so the system will function as a ventilated façade, and the upper and lower ventilation screens must have a minimum opening of 5 mm. The insulation should be properly attached so it will not interrupt the flow of ventilating air.
- The rivets that must be used are illustrated in figure 10.3, and the mandrel length must be equal to the thickness of the panel plus 10 mm.

Comentario [WLZ1]: No figure 2.3 in document.

7.3.-Construction details

The dimensions of the anchors attaching the brackets to the bearing wall must follow the manufacturer's specifications.

To keep rodents from entering the air space, any openings in the system larger than 10 mm should be covered with an anti-rodent screen that does not interrupt the flow of air.

7.4.- Insulation

- The insulation must be well secured so it will not interrupt the flow of ventilating air.
- The recommended distance between wood hangers is a maximum 600 mm.
- It is recommended that the distances between the bearing wall and the Formica EDF panel adhere to the following table to allow space for ventilation.

Table 5

Distance from the panel to the bearing wall mm	Bracket length mm	Distance between elements	
		Minimum mm	Maximum mm

62/92	60	68	98
82/112	80	88	118
102/132	100	108	138
122/152	120	128	158
142/172	140	148	178
162/192	160	168	198

Note: The values expressed should be used as a general guideline. It is the responsibility of the contractor to make the calculations for the system.

8.- Working with the Formica Compact Panel.

8.1.- Cutting.

Tools for cutting hardened steel should be used when working with Formica EDF panels. The following specifications are recommended:

Table 6

CIRCULAR SAW		
Peripheral speed	m/seg	> 60
Diameter	mm	300
Speed	rpm	> 4000
Blade thickness	mm	3.0 – 4.05
Number of teeth	-	> 96
Distance between teeth	mm	13 - 15
Angle	°	oct-15
Tooth profile	-	Straight or 10°
Metal hardness	-	H20

8.2.- Drilling

The following instructions are recommended for drilling

- Use a flat and firm base to avoid cracks at the exit hole
- Use a high-speed bit with a 60 – 80° angle
- The inside edges should be rounded (minimum 8 mm radius) to keep possible micro fractures from traveling.

9.- Guarantees and Certifications.

9.1.- Guarantees.

Formica guarantees that its Formica EDF Compact Panels for Exteriors are manufactured in and distributed from our factories exactly as indicated and prescribed in this document and in their catalogue at the moment of distribution.

9.2.- Color Fastness.

Formica EDF Compact Laminate for Exteriors installed on the same façade or balcony at the same time is guaranteed to show the same color for a period of 10 years.

9.3.- Mechanical Properties and Chemical Resistance.

See Tables numbers 7 – 8 – 9 and 10

9.4.- Certifications.

- Document of Technical Suitability from the Spanish IETcc (pending)
- Avis Technique from the CSTB (France).
- Euroclass Approval class B-S1do
- Meets Fire Class B - s2 requirements, d0 in accordance with the EU Standards
- ISO 9001:2000 Certification

9.5.- Environmental aspects.

- Does not contain Asbestos.
- Does not contain PVCs.
- Does not contain Heavy Metals.
- Can be recycled by incineration.
- Does not generate organic halogens (Dioxins) when incinerated.

10.- Appendix.

10.1.- Technical Information and Color Range

Table 7 Technical Information

FORMICA COMPACT PHENOLIC EXTERIOR PANEL				
Standard Type EN 438 6: EDF Fireproof Harsh Conditions				
TEST	TEST STANDARD	FIELD	UNIT	EN 438 6 EDF
Density	ISO 1183	Mass	g/cm ³	≥ 1.35
Length and width	EN 438 2 - 6	Panel	mm	+ 10 - 0
Edge straightness	EN 438 2 - 7	Panel	mm	≤ 1,5
Squareness	EN 438 2 - 8	Panel	mm/m	≤ 1,5
Thickness	EN 438 2 - 5	5.0 ≤ e < 8.0	mm	tol ± 0.4
		8.0 ≤ e < 12.0		tol ± 0.5
Flatness	EN 438 2 - 9	6.0 ≤ e < 10.0	mm	≤ 5.0
		10.0 ≤ e -		≤ 3.0
Flexibility module	ISO 178	Strength	Mpa	≥ 9000
Resistance to flexing	ISO 178	Strength	Mpa	≥ 80
Tensile strength	EN ISO 527 - 2	Strength	Mpa	≥ 60

Impact resistance (Large diameter ball)	EN 438 2 - 21	Dropped Ball $e \geq 6$ mm	mm	≥ 1800
Performance in fire	EN 13501 - 1	Classification	$e \geq 6$ mm	B - s2, d0
			$e < 6$ mm	C - s2, d0
Resistance to humidity	EN 438 2 - 15	Increment of Mass	mm	≤ 8
		Aspect	Scale (Table II)	≥ 4
Dimensional stability at high temperatures	EN 438 2 - 17	Accumulated Dimensional Change	%	$\leq 0,3$ (L)
				$\leq 0,6$ (T)
Oxygen index	ISO 4589 - 2	Index	%	≤ 45
Resistance to changes in temperature	EN 438 2 - 19	Aspect	Scale (Table II)	≥ 4
		Warp Resistance Index	Ds	≤ 0.95
			Dm	≤ 0.95
Resistance to ultra violet light	EN 438 2 - 28	Contrast	Gray Scale	≥ 3 (1500 hrs. exposure)
		Aspect	Scale (Table II)	≥ 4 (1500 hrs. exposure)
Resistance to artificial aging. (Including light fastness)	EN 438 2 - 29	Contrast	Gray Scale	≥ 3 After radiant exposure at 650 MJ/m ²
		Aspect	Scale (Table II)	≥ 4 After radiant exposure at 650 MJ/m ²

Table 8 Classification by Grade

Grade 2: Marked Change in Brilliance or Color
Grade 3: Moderate Change in Brilliance or Color
Grade 4: Slight Change visible at a certain angle
Grade 5: No visible change

Table 9 Resistance to Chemical Reactions

REACTIVE GROUPS		
Group 1	Group 2	Group 3
Acetone	Coffee (120 gr of coffee / liter)	Caustic Soda at a 25 % solution
Trichloroethylene	Tea (9 gr of Tea / liter)	Peroxide at 30%
Other organic solvents	Milk (all types)	Shoe polish
Toothpaste	Cola drinks	Concentrated vinegar. 30% acetic acid
Hand cream	Wines and Vinegars	Sanitary cleaners
Urine	Alkaline cleaning agents at 10% in water	Mercurochrome
Alcoholic beverages		Whitening agents containing sanitary cleaners
Natural fruit and vegetable juices	Peroxide at 3%	Cleaning agent containing Chlorhydric acid ≤ 3 %
Meats and sauces	Commercial ammonia at 10 %	

Animal and vegetable oils and fats	Nail polish	
Leavening agents dissolved in water	Nail polish remover	Hair dye
Salt. NaCl solution	Lipstick	Acid metal cleaners
Water	Fabric dye	Tincture of iodine
Mustard	Ball point pens	Boric acid
Soap solution bleaches		Lacquers and adhesives (except fast drying ones)
Cleaning solution: 23 % dodecyl benzene sulfonate 10 % alkyl aryl polyglycol ether 67 % water		Amino sulfonic acid < 10 % (de-scaling agents)
Phenol and Chloromene T		
Disinfectants		
Citric acid 10 %		
Organic solvents for paints		
Reagents applied at ambient temperatures over a 16 hour period (except coffee - Tea - milk at 80 ° C)		Reagents applied at ambient temperatures for 10 minutes

Table 10 Fire Safety

FIRE RESISTANCE CLASS	STANDARD	FIELD	VALUE
Compact Panel	EN 13501 - 1	e ≥ 6 mm	B - s2, d0
		e < 6 mm	C - s2, d0
Insulating Material PSE	UNE 23727	-	M - 1
Mineral Wools	UNE 23727	-	M - 0
Combustible Mass	MJ/m2		
6 mm Compact Panel	150 ± 10		
6 mm Compact Panel	200 ± 12		
6 mm Compact Panel	250 ± 14		
PSE Insulation Material	Weight in Kg/m2 x 43		
Mineral Wools	Not applicable		

Table 11 Range of Colors

2005 RANGE			
Code	Name	Code	Name

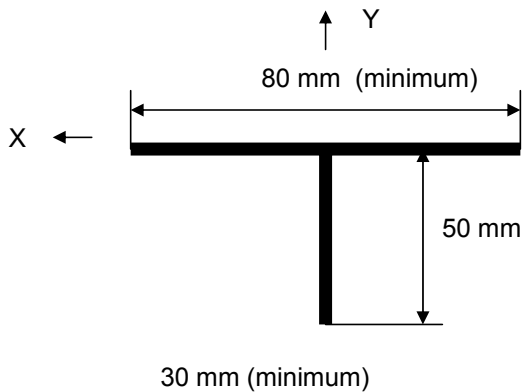
1040	Alpine	3007	Gray Green
1202	Basil	5511	Bosc Pear
1302	Acropolis	5513	Sequoia
1321	Sinai	5530	Savoy Beech
1327	Fiji	5532	Clear Beech
1531	Irish Cream	7851	Spectrum Blue
1532	Eldorado	7858	Silver Gray
1534	Magnolia	7884	China Blue
1535	Tornado	7912	Dark Gray
1614	Punga	7929	Sandstone
1840	Coral	7932	Antique White
1977	Puma	7940	Spectrum Yellow
1998	Oslo	0163	Fantasy Brown
2005	Paprika	0900	Hawaii
2010	Malibu	0901	Gobi
2014	Gauguin	0902	Kashmir
2200	Chocolate Brown	0903	Coffee
2296	Snow White	0904	Acapulco
2833	Sandstone	0905	Mahogany

10.2- Diagrams.- Sections – Assembly – Fasteners.

Figure no. 6 Aluminum sections in the substructure.

Recommended alloy: EN AW 6063 or AW 6060

Minimum thickness: 2.0 mm

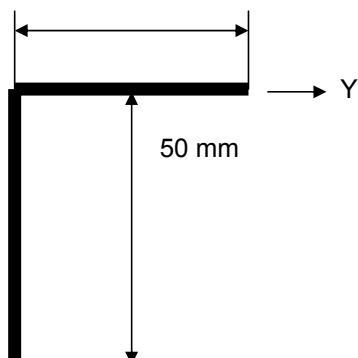


T-section for attaching 2
Compact Panels

$$I_x = 6.3 \text{ cm}^4$$

$$I_y = 8.6 \text{ cm}^4$$

$$S = 2.56 \text{ cm}^2$$



L-section for attaching
center

$$I_x = 1.15 \text{ cm}^4$$

$$I_y = 4.16 \text{ cm}^4$$

$$S = 1.56 \text{ cm}^2$$

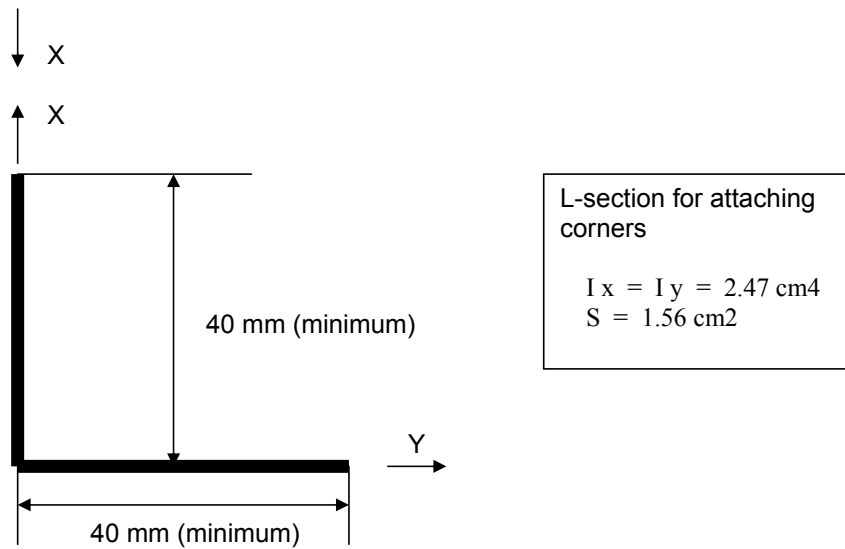
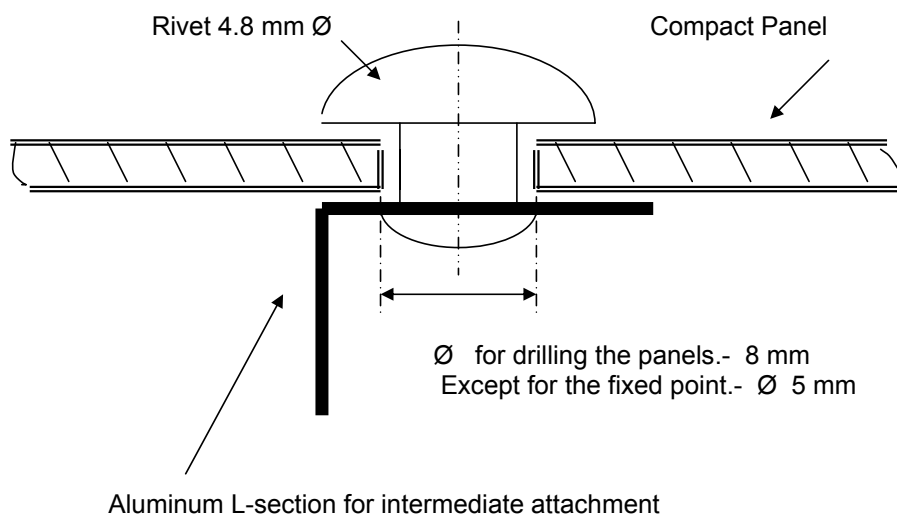


Figure no. 7 Diagrams for attaching the fasteners.

7.1.- Intermediate fasteners.



7.2.- Fastening two panels.

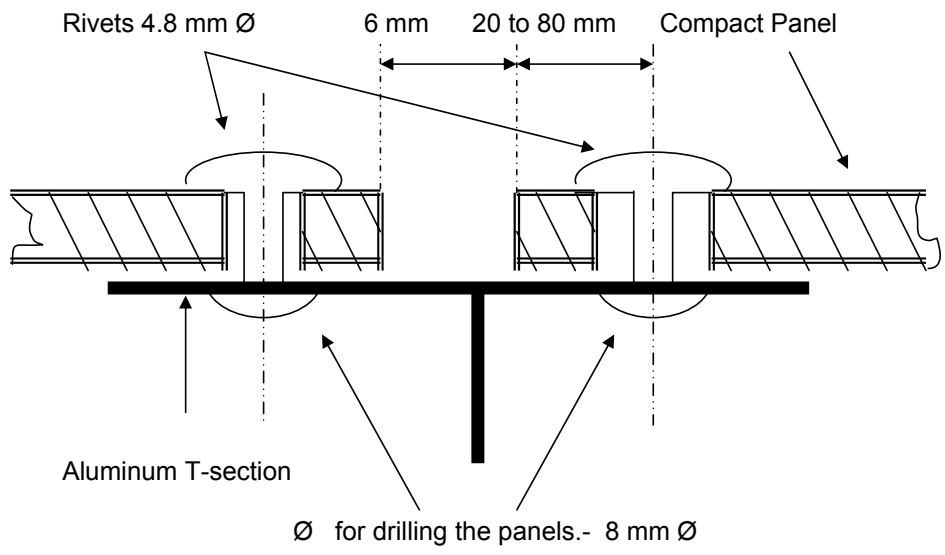
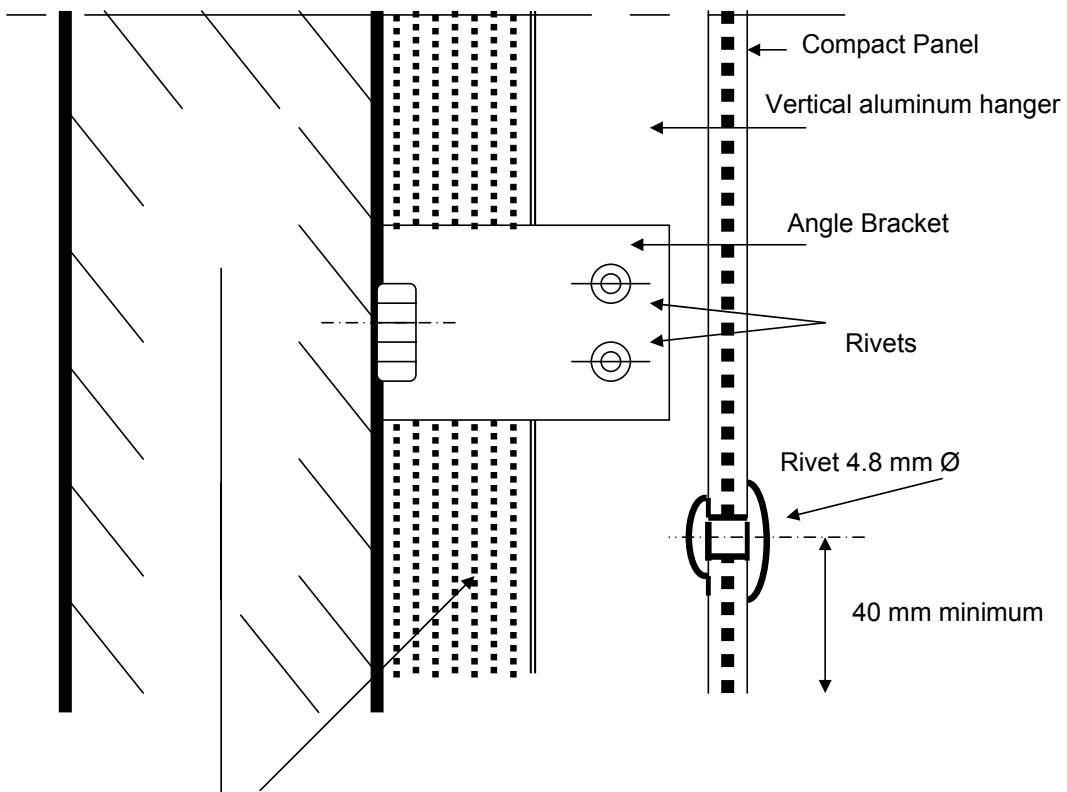


Figure no. 8.- Diagram for Attaching Panels to Metal Brackets.



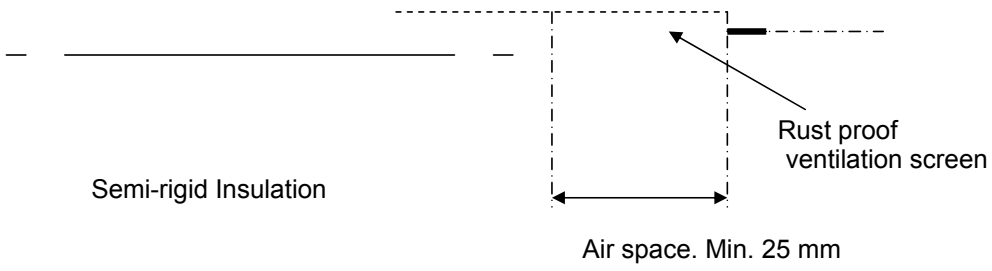
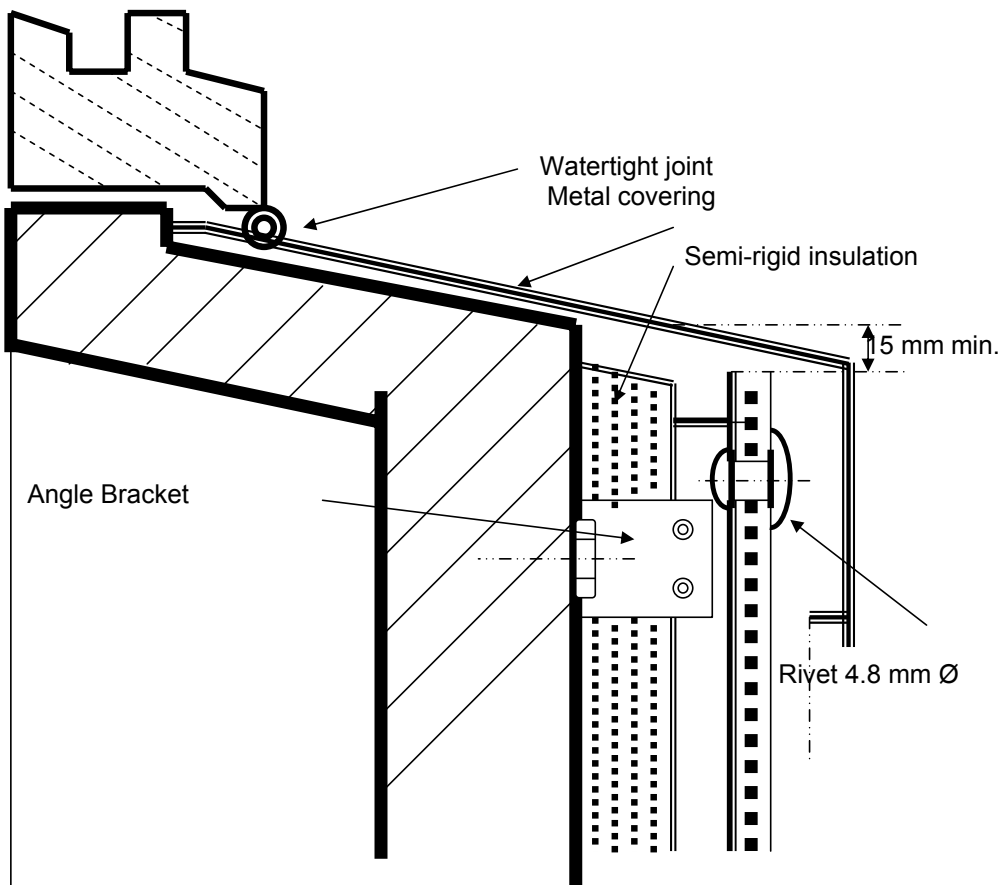


Figure no. 9 Diagram for covering windowsills.



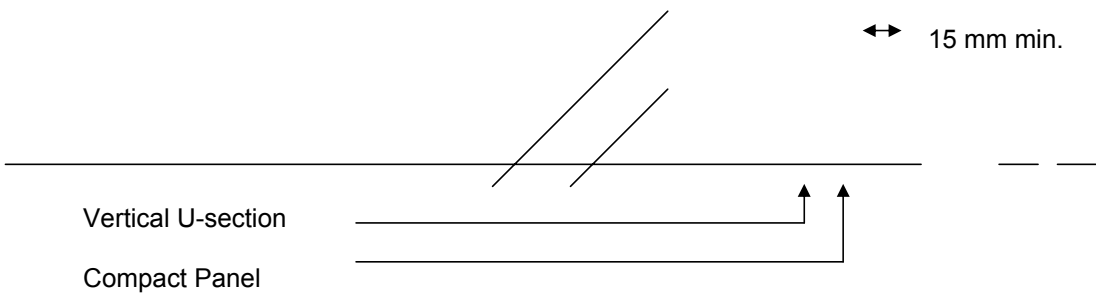
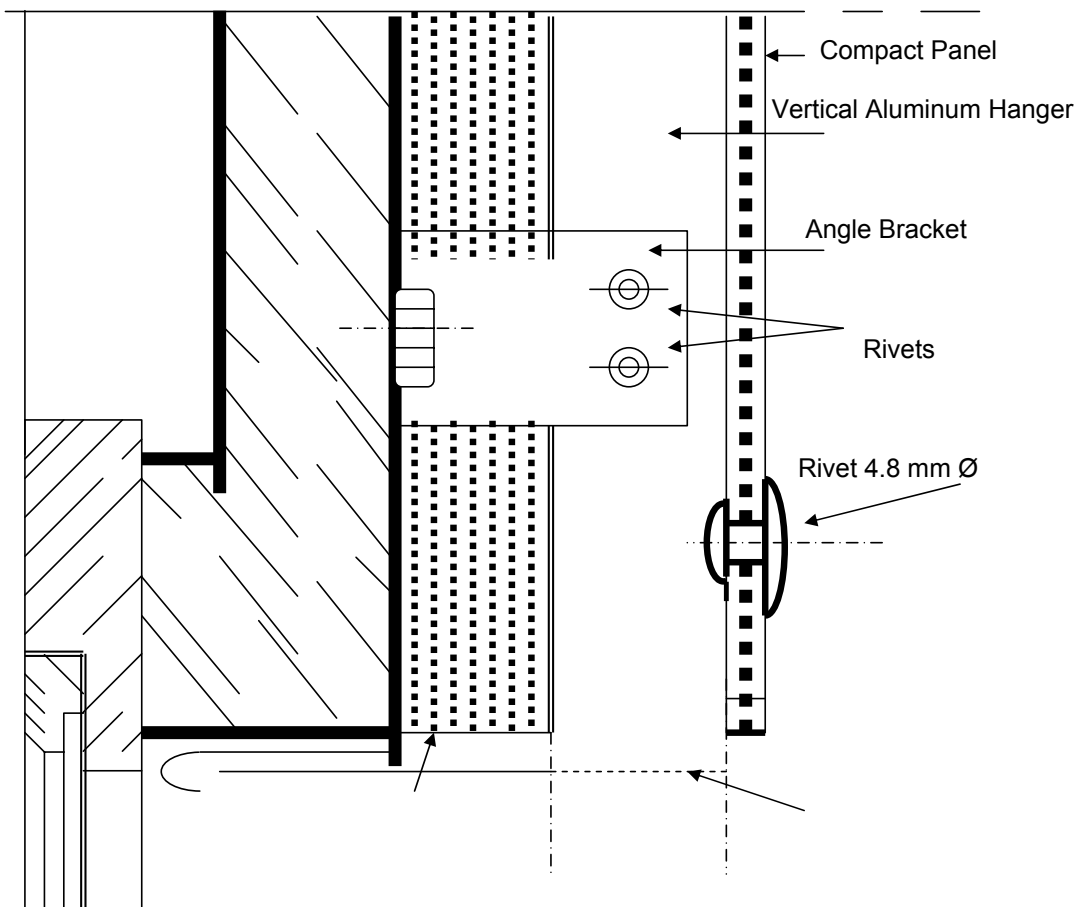


Figure no. 10.- Diagram for covering a window frame



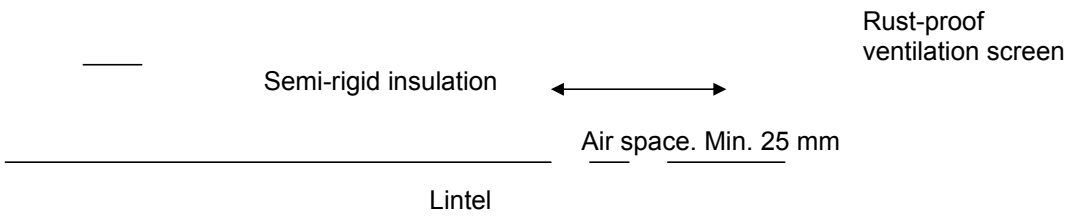
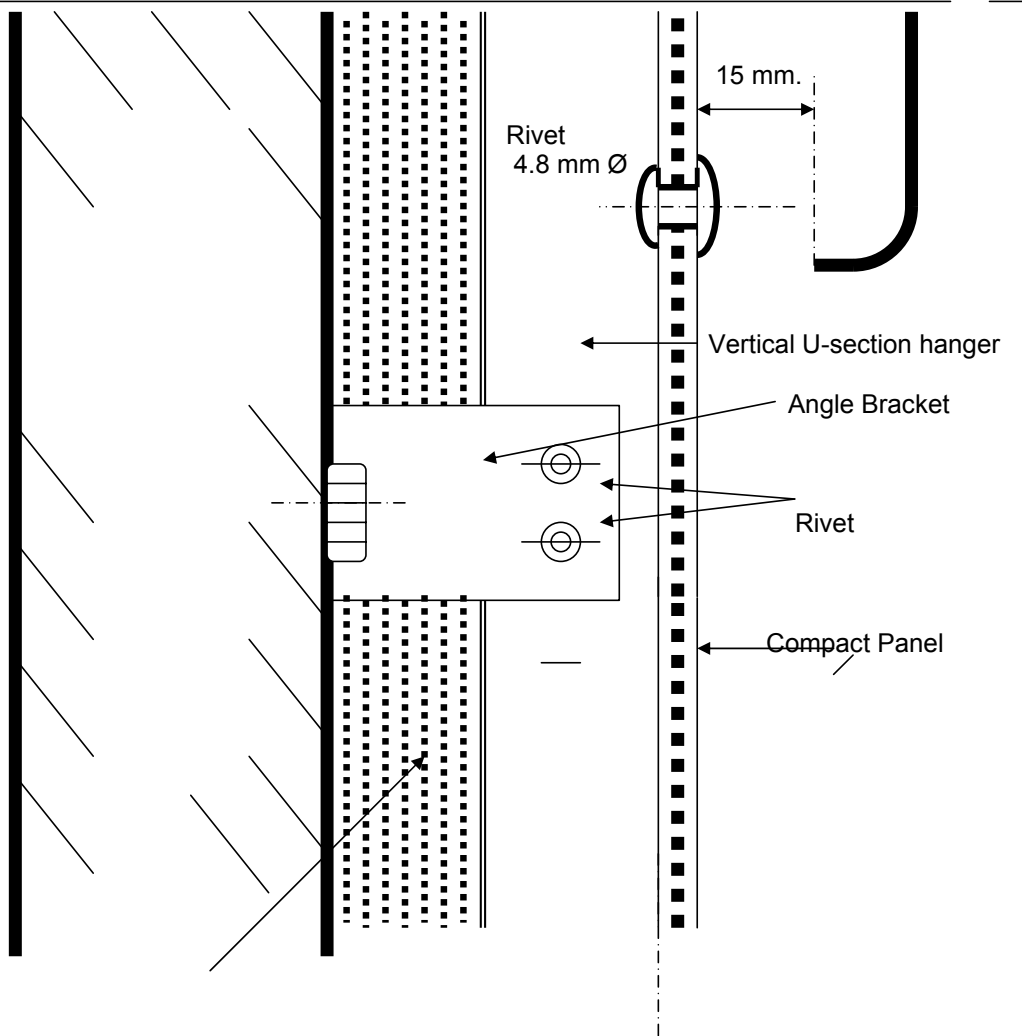


Figure no. 11.- Diagram for fastening base.



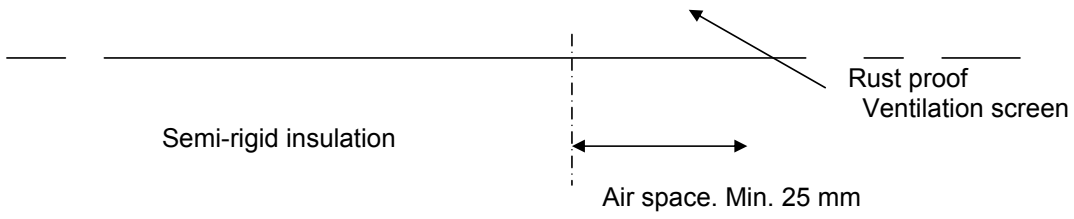


Figure no. 12.- Diagram for installing an inside corner

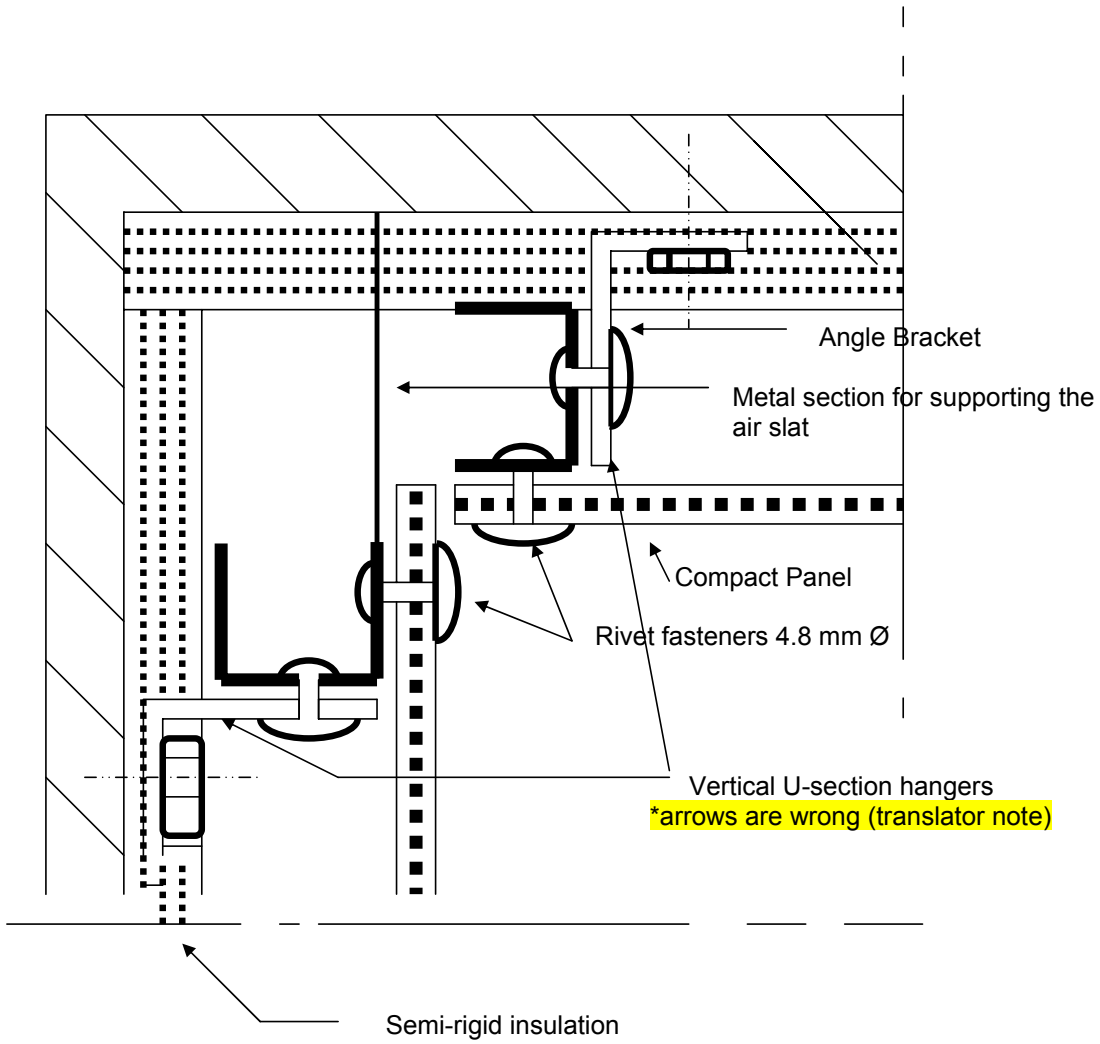


Figure no. 13 Diagram for installing an outside angle

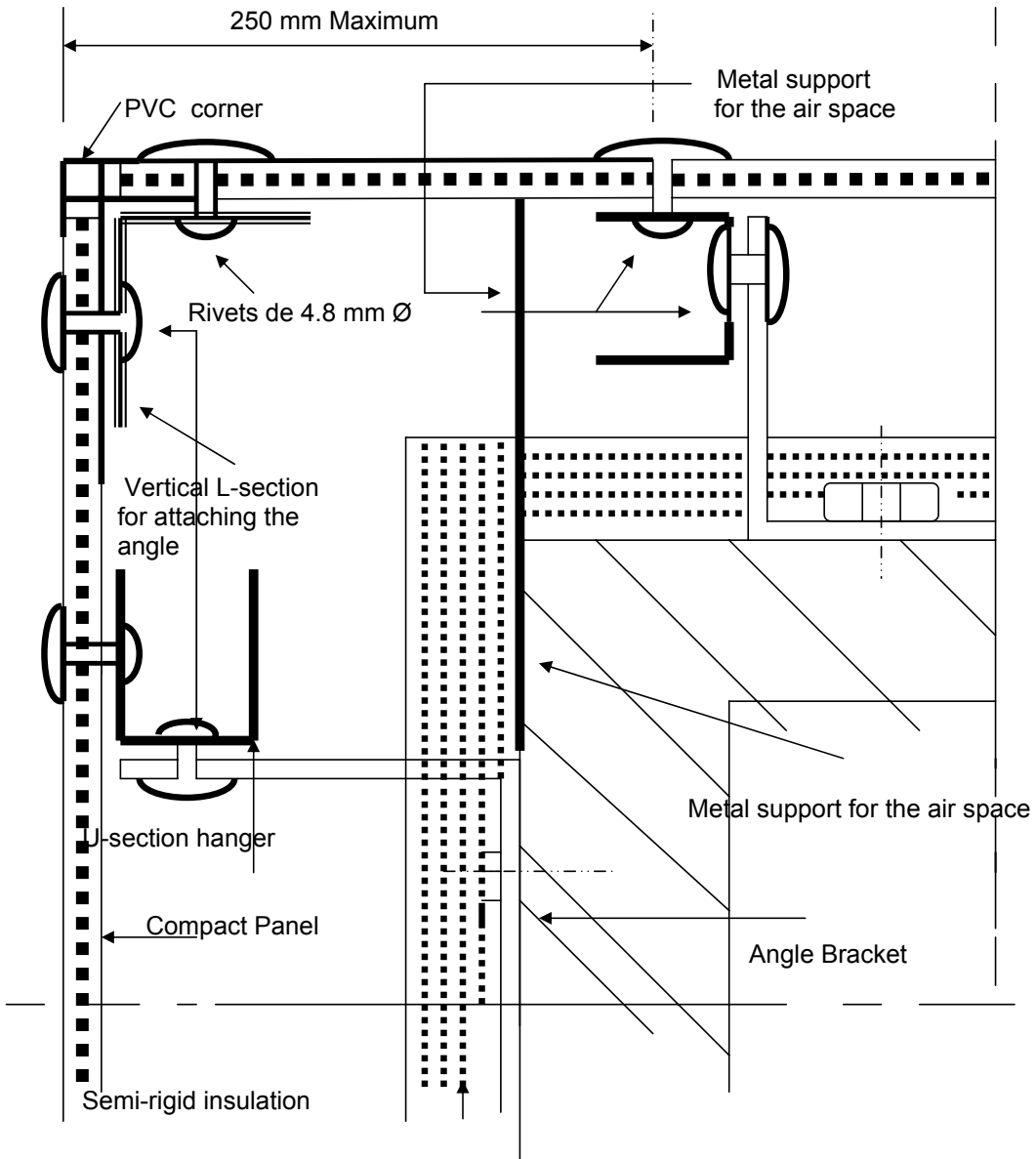
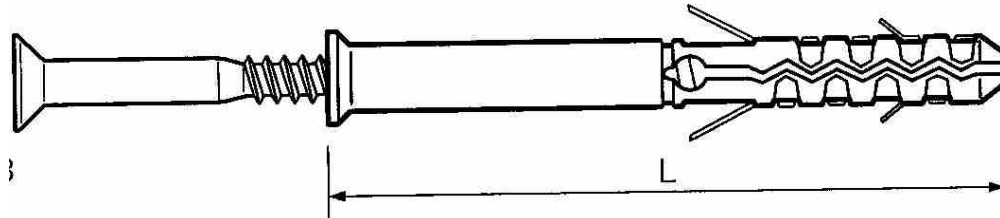
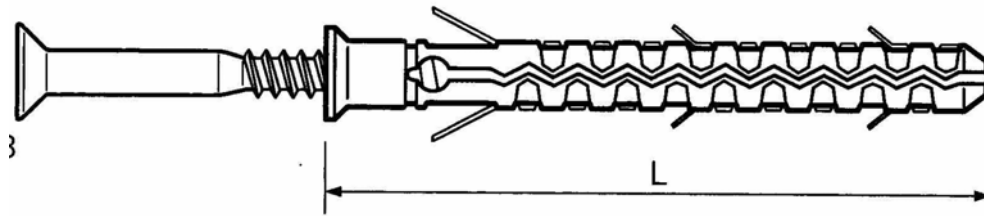


Figure no. 14 Screws and rivets

14.1.- Screw for anchoring the substructure to the bearing structure .-

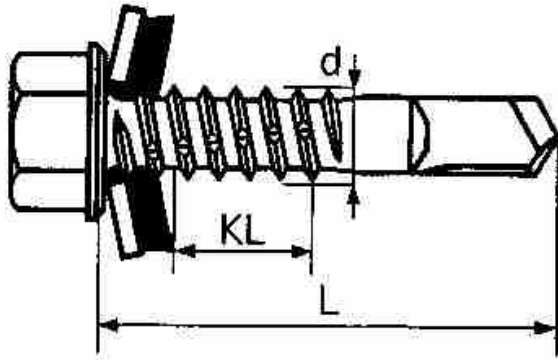


Depth of Structure (mm)	Material	Diameter (mm)	Length L (mm)	Anchor Depth (mm)	Maximum Depth of structure	Material
10 - 30	Stainless steel	10	60 - 80	50	10 - 30	Concrete Hollow Brick Concrete Block Hollow concrete Block

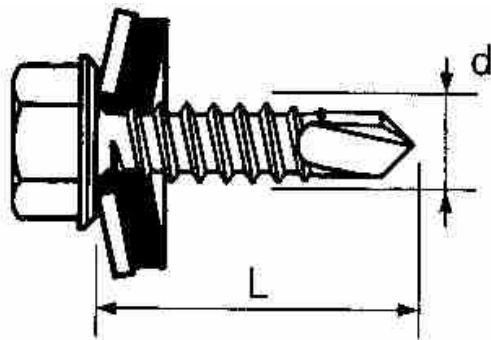


Depth of Structure (mm)	Material	Diameter (mm)	Length L (mm)	Depth of Anchor (mm)	Maximum Depth of Structure	Material
10 - 50	Stainless steel.	10	80 - 120	90	10 - 50	Concrete Hollow brick Concrete block Hollow concrete block

14.2- .- Austenitic stainless steel self-tapping screw for aluminum substructures.-

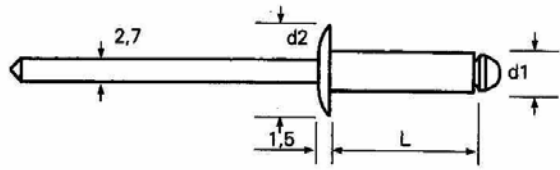


Maximum capacity of drill VD (mm)	Depth of assembly	Locking washer Ø mm	Diameter d (mm)	Length L (mm)	Depth of assembly KL (mm)	Depth of the 2 Sections
6 - 12	6 - 12	16	5.5	26 - 32	6 - 12	VD Max: 6.0 mm t min. 2.0 mm



Maximum capacity of the drill VD (mm)	Assembly Depth	Locking Washer Ø mm	Diameter d (mm)	Length L (mm)	Assembly depth KL (mm)	Depth of two 2 sections
6 - 12	4 - 10	16	5.5	22 - 28	6 - 12	VD Max: 3.0 mm t min. 2.0 mm

14.3.- Rivet for fastening panels to hangers



Type	d2 Ø of the rivet head	d1 Ø of the rivet mandrel	Length L of the head of the rivet
Stainless steel	16 - 22	5	18