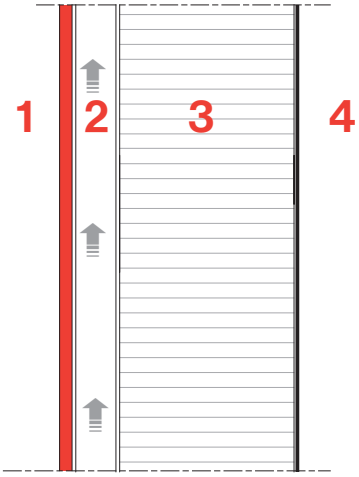
Swisspearl® LARGO panels

DIM Design + Installation Manual

Frontpage project
USA Mission College Center for Math and Science, Los Angeles
ARCH Quatro Design Group, Los Angeles
PHOTOS Lawrence Anderson, Los Angeles

Rain screen cladding



Panel, technical data

1 Cladding panels
Shield off the weather. The cladding panels are crucial for the appearance of the building.
The panels are attached to vertical supports by rivets, screws or concealed fastening system.

2 Vertical panel supports I Air cavity
Made out of metal profiles or timber battens.

3 Exterior thermal insulation
Material, thickness and attachment to be determined by architect; including vapor/moisture barriers as required.

4 Exterior wall

Advantages

- Almost no maintenance
- Maximum thermal insulation effect, without thermal bridges, keeping the building structure at a constant temperature
- Humidity / condensation is eliminated
- Considerable energy savings for HVAC
- No cracks, sealant, paint problems

Rear ventilated façade / Rain screen cladding Installed onto exterior thermal insulation

The design principle involves the deflection (screening) of the rain water. As the panel joints are not sealed, minimal amounts of water can gain access into the air cavity behind the panel. The cavity is naturally ventilated by vent gaps at bottom and top, so that any moisture will evaporate naturally by thermal action.
Cladding systems that are sealed on the exterior do not allow any moisture to evaporate; thus leaks will lead to problems like mold, fungi, etc. on systems without rear ventilation.

Panel

Thickness	Net panel sizes	
LARGO		
8, 12 mm	2500x1220 mm	3040x1220 mm
5/16”, 15/32”	98-7/16” x 4’	10’ x 4’

Some few products are available 920 mm instead of 1220 mm 3’ instead of 4’
Please refer to list of product availability

LINEARIS		
8 mm	1500x147 mm	1500x300 mm
8 mm	2500x147 mm	2500x300 mm

Panels are delivered without drill holes

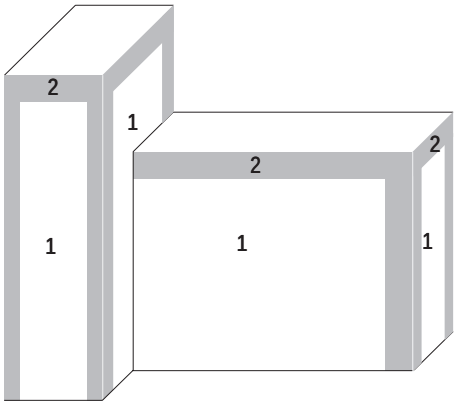
SANDBLASTED		
8 mm	2400x1100 mm	2900x1100 mm

Technical data

Density		
	> 1.75 g/cm³	
Weight of 8 mm panel		
	ca. 15 kg/m² (3 lbs / sqft)	
Modulus of elasticity		
	ca. 15’000 MPa	
Modulus of rupture		
	crosswise	> 24 MPa
	lengthwise	> 18 MPa
	length- /crosswise average	> 22 MPa
Design resistance for bending		
	ca. 8.5 MPa	safety factor 2.5
Thermal expansion coefficient		
	0.01 mm/m/°K	
Thermal range		
	- 40°C to + 80°C	
Fire performance (according to EN 13501-1)		
	A2-s1, d0	

General information

1
Normal area
2
Fringe area



Wind load zones

As per scheme there are two wind load zones: The fringe zones generally are subject to increased negative wind load (suction) due to turbulence at the edges of the building.
The applicable wind load values must be determined in the cladding specification.

www

Further information is available at www.swisspearl.com

Validity of DIM

At the time of the installation the DIM (Design and Installation Manual) at www.swisspearl.com is valid.
All previous and out dated versions are to be disregarded.

Façade engineering

Quantity and spacing of fastening points as set out in this DIM correspond to (international) European codes.
The licensed engineer / contractor is to ensure that the fastener spacing is in compliance with local standards and regulations.
Licensed engineer / contractor shall assume overall responsibility for the façade engineering, including:

- Choice of material and type of sub-framing
- Determine sizes of all structural members to sub-frame
- Determine all fastening details to sub frame and panels

Sub framing / panel supports

The panels are to be attached to vertical metal profiles or timber battens. Engineer/architect/contractor to choose appropriate system in accordance with local building standards, availability, costs, etc.

Sub frame - general remarks

For aluminum sub-frames, the material expansion and retraction due to temperature change must be duly allowed for by providing round / elongated fastening holes. Free gaps at support breaks, which must coincide with the horizontal panel joints. Building tolerances are to be taken up by shimming under the supports, shims between panel/support are not allowed. Allowable deflection ratio for panel 1/300 between panel supports.

Rivets for attaching panels

Use aluminum rivets for aluminum sub frame. Use stainless steel rivets for steel sub frame. Maritime or other aggressive conditions call for the stainless steel rivets. Those may be used on steel or anodized aluminum sub frame.

Maritime environment

Maritime conditions generally are within a distance of 5 km (3 miles) in the main wind direction blowing from the sea. Material specification for sub frame, fasteners and accessories to cater for maritime conditions; according to local standards / good practice.

Tropical / hot climate

In zones with high temperatures / UV radiation the lightening up procedure of finishes is generally intense. Therefore it is indicated to only choose panel finishes in the lighter color shades. Furthermore HR and F-coatings provide increased color stability values and are thus appropriate.

Product warranty

10 year warranty for the functional quality of panels and accessories, provided that the installation is in full compliance with this DIM.

F-coating for façade

For inclined cladding, panels with F-coating cater for increased exposure to weathering.
F-coating is opaque and matched to standard finishes, and has higher UV resistance.

R-coating for roof

Roofing panels must have minimum fall of 6° (10.5%).
R-coating is opaque and matched to standard finishes, and has higher UV resistance.
R-coated panels in the color ranges Amber and Onyx are supplied with standard grey panel core.

HR-coating

This product allows the removal of graffiti using acetone. HR coating provides an increased resistance against scratching and UV.

REFLEX product range

This finish bears a slightly iridescent surface coating.
REFLEX panels are directional. Depending on the color the directionality is more or less noticeable.
REFLEX panels bear arrows on the back side to indicate the direction in which they have to be installed.
All arrows up (portrait)
All arrows left (landscape)

Design and installation

Terminology
DIM = Design and Installation Manual
EPDM = Ethylene propylene diene monomer (rubber).

External wall design
Architect / consultant / contractor are to assume responsibility for the correct design/execution of the external wall and its cladding - including thermal insulation, water, vapor, wind barriers, etc.

Interior applications
Large size panels are suitable for interior applications for walls and ceilings, but with the following exclusions:
- Areas where frequent cleaning has to occur such as in toilets, etc.
- Not suitable for flooring, fireplace surrounding, kitchen top, window sills

Useable panel sizes (net sizes)
On the production line the panels are first punched to size. Punched panel edges are not fit for use and must be trimmed off. The trimming is done at the factory at the same time as the panel cutting to size is made.
Gross panel sizes (untrimmed rough edges) are for panels going to fabrication.
Net panel sizes with squared and cut edges are for panels going to installation on site.

Cutting panels - optimizing yield
Based upon list of panels an optimizer computer program is run in order to minimize cut off waste. The program defines the quantity and size of full panels required and counts the length of cutting and drill holes needed for the job.

Project specific ordering
Subtle visual differences may occur between production batches. Therefore orders should be placed separately for each building or elevation.

Metric system
Generally dimensions and figures are indicated in metric. Some figures are indicated in Imperial values.
Orders are confirmed and processed in metric sizes only.

Prefabrication
Exterior wall elements can be assembled and clad by specialists at the workshop to a high accuracy.
The use of unitized elements save time on site and allow thus to shorten construction schedules.

Ventilation cavity
Building tolerances must be allowed for. The cavity may not be reduced by horizontal profiles or any stray objects such as loose wind proofing layers, etc.

Cladding height	min. cavity
< 6 m	20 mm
6 - 15 m	25 mm
15 - 25 m	30 mm
25 - 50 m	40 mm
50 - 75 m	50 mm
75 - 100 m	75 mm
> 100 m	100 mm

Ventilation gap
Width of the gaps must be at least half of the cavity thickness. Reductions, e. g. by insect screens, must be compensated.

Panel joint
To be min. 6 mm wide. Typical joint width is 8 mm (panel scraps can be used as spacers).The wider any joint, the less noticeable are inaccuracies in the installation.

Horizontal joint closure
l-flashing / joint flashing are to be used for installations on timber battens, in order to reduce the presence of moisture in the cavity. For metal sub frames they are not compulsory, due to the higher moisture resistance of metal.
Joint closures are not recommended in tropical / hot climate so that additional venting can take place through open horizontal panel joints.

Horizontal joint flashing
Aluminum, 0.5 mm thick, powder coated black, this piece makes both panels be exactly flush and makes the joint almost water tight. It is easy to cut and cost effective. Joint spacers cannot be used for the panel installation.

l-flashing
Stainless steel, 0.5 mm thick, available black, in panel colors and blank. This is the first generation joint closure. Joint spacers can be used and the l-flashing can be slid in after panel installation, whereas the bottom row of panel fasteners has to be left off in attendance.

Open panel joints
If joints are left open to the weather – cavity thickness to be min. 40 mm. Substrate to be UV resistant and colored dark as it will be visible through the open joints.

Perforated closures
The ventilation gap at the bottom of the cavity is to be closed off by a perforated screen, to prevent any intrusion by rodents. Otherwise the use of perforated screens is not compulsory. The use of aluminum mesh is also possible (thin material, easy to install, high air flow ratio).

Suspended ceilings, soffits

For the installation of panels to suspended ceilings and soffits the same installation details apply as for cladding panels to walls, except fastener distances are max. 500 mm in both directions.

Bending panels

Panels can be bent on building site, whereas the panel shape / size and the fastener distances are determining factors.
Minimal bending radii are as follows:

- min. r = 16 m panel bent lengthwise (landscape)
- min. r = 20 m panel bent crosswise (portrait)

Drawings to be submitted

- Elevations showing panel dimensions, fasteners, fixed points, distances to panel edges, etc.
- Details to bottom and top of cladding, window details, building corners, etc.
- Sub framing schematic drawings showing lengths / breaks of verticals, fixed / slipping attachment points for aluminum profiles.

Building expansion joint

Structural expansion joints must be applied to sub frame and cladding as provided to the building structure.

Material compatibility

Aluminum material is not compatible with cement and must be protected against dust from drilling panels, etc.

Deflection joint at floor slab

The anticipated deflection as determined by Engineering needs to be considered in the panel joints.

Shrinkage

The panel material will undergo a slight shrinkage over the first few years. Panels should not be butted tightly, thus allowing the panel joints to become unnoticeably wider over the years.

Installing contractor

Claddings are to be installed by trained contractor.

Impregnation sealer

On the production line after trimming/ cutting the panel edges are sealed, i.e. the panels leave the factory sealed on all 6 faces. If panels are cut on site, each cut has to be LUKO sealed by hand applicator. Fastener holes do not need to be sealed.

Elastic sealants

Generally to keep the cladding maintenance free the use of sealants should be avoided. Where the use of sealant is unavoidable – polyurethane, acrylic or hybrid polymer products would be best suitable.

Penetrations through cladding

Where water pipes or other installations lead through the panel; leave 6 mm (¼") of free space all around between panel and installation - so as not to constraint the panel movement.

Signage, light fittings, etc.

Provide structural attachment points behind the panel as required. Leave generally 6 mm (¼") free gap between panel edge and installation - so as not to constraint the panel movement.
Light weight letters may be glued onto panel surface, do not span any letters between panels.

Thermal insulation

The insulation layers must be stable and well attached so as not to obstruct the ventilation in the cavity.

Energy saving in warm climate

The panel provides shading effect to the cavity and thus a temperature drop of more than 10°C.
Warm air rises in the cavity by thermal action and exits on top. Cooler air enters at the bottom.
Due to this natural evacuation of heat there is a 10 - 20% saving for cooling energy.

Energy saving in cold climate

The panel acts as wind shield eliminating thus the chilling effect.
This results in some energy saving on heating energy.

Window surroundings

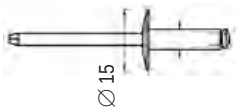
It is good practice to finish the cladding around windows etc. against a frame in metal. This provides a neat finish that is cost effective.
Window sills should be sufficiently solid so that a person can stand on it (for maintenance, etc.).

Adhesive attachment method

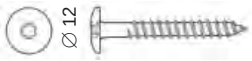
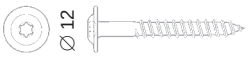
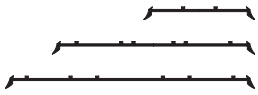
Suitable for interior applications, and up to 3 floors for exterior. Support profiles in metal, distances between supports as per rivet attachment. Use double sided VHB tape for immediate bonding and glue as a backup after it has cured.
Instructions for use by adhesive manufacturer to be followed. Panel manufacturer does not provide any warranty for the panel attachment.
For adhesive attachment order special wax free panel rear side (so called ARSB).

System components and accessories

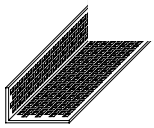
Metal sub frame

		Grip range
 Al rivet, mandrel in steel 1.4541 (321), body AlMg³, head blank or in standard colors	4,0 × 18-15 mm 4,0 × 24-15 mm 4,0 × 30-15 mm	8 - 13 mm 13 - 18 mm 18 - 23 mm
SS rivet, mandrel + body in steel A4 (316), head blank or in standard colors	4,0 × 18-15 mm 4,0 × 23-15 mm	9 - 14 mm 14 - 19 mm
 Fixed point sleeve, aluminum Fixed point sleeve, steel A4 (316)	∅ 9.4/4.1 × 6 mm ∅ 9.4/4.1 × 6 mm	
 Bore concenter gauge	∅ 4.1 mm/drill bit ∅ 4.1 mm/drill bit	type A for aluminum type S for steel

Timber battens

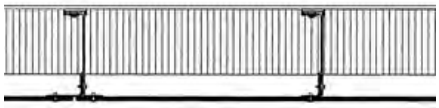
 Screw, head 12 mm, T20, steel 1.4567 (304), blank or in colors	4.8 × 30 mm 4.8 × 38 mm (standard) 4.8 × 44 mm 4.8 × 60 mm
 Screw, head 12 mm, T20, maritime grade steel 1.4578 (316), blank or in colors	on request
 Depth stop with T20 bit, 50 mm long Suitable to any screw driver	
 EPDM strip, black for intermediate battens for panel joints for corners, windows	 W = 60 mm W = 100 mm W = 120 mm W = 150 mm

Accessories for metal and timber sub frame

 Perforated angle, aluminum, mill finish or standard colors 2500 mm long, 0.7 mm thick	50 × 30 mm 70 × 30 mm 100 × 40 mm
 Horizontal joint flashing with bent rib, aluminum, powder coated black	40 × 7 × 0.5 mm Length 2500, 3040 mm
 Horizontal l-flashing, steel 1.4301 (304), available blank, standard colors	35 × 5 × 0.5 mm Length 2500, 3040 mm
 LUKO hand applicator for sealing cut panel edges consisting of reservoir, replaceable sponge, cap	1 fill (125 ml) treats approx. 150 m of 8 mm panel edge

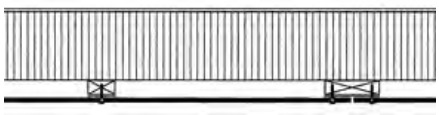
Exterior wall / sub frame types

Proprietary systems



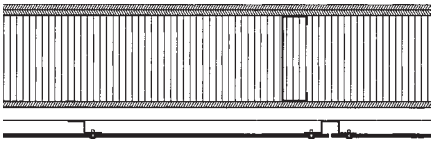
Vertical angles and T-profiles made out of extruded aluminum, attached to brackets. Adjustable in / out; fixed and slipping point brackets to allow for thermal movement.

Timber battens



Vertical timber battens, covered for moisture protection by EPDM bands. The battens are attached to horizontal timber battens or to metal angles or by double threaded spacer screws.

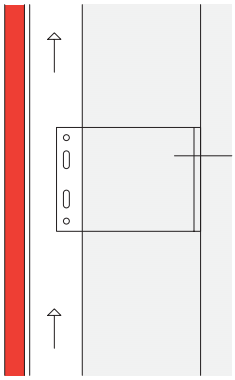
Metal stud wall



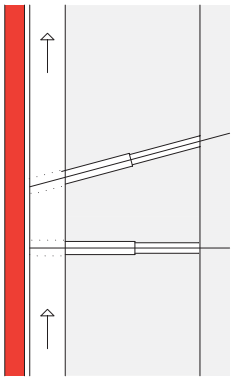
Self made sub frame made out of hat and Z-profiles

If the exterior wall is structural (load bearing) and made out of concrete, brick-work, concrete blocks, etc. the sub frame / brackets can be attached anywhere onto the wall, wherever required by the panel layout.

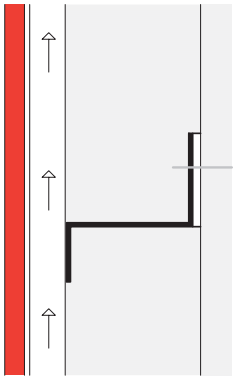
A horizontal structural member, attached to the wall studs, will allow the verticals to be attached wherever required by the panel layout.



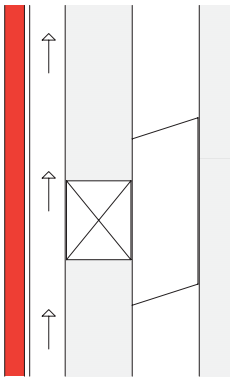
Aluminum bracket (fixed/slipping)
Aluminum verticals adjustable in/out



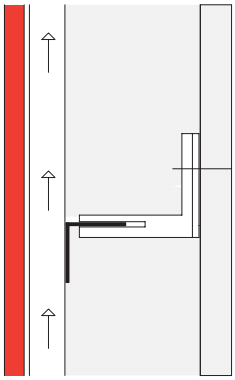
Double threaded spacer screws for timber battens, adjustable in/out



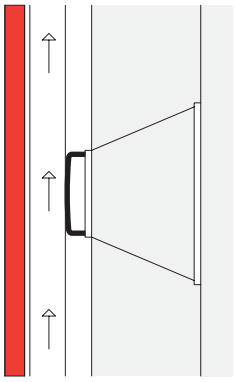
Verticals in metall or timber attached to horizontal Z



Timber sub frame made of horizontal and vertical layer

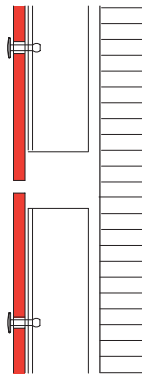


Verticals in metall or timber to horizontal angle adjustable in/out

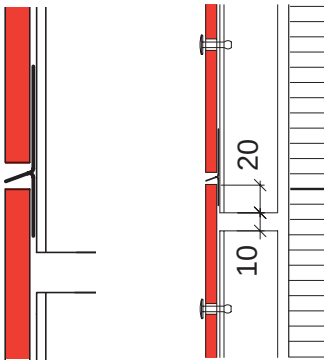


Verticals in metal, attached to horizontals on brackets

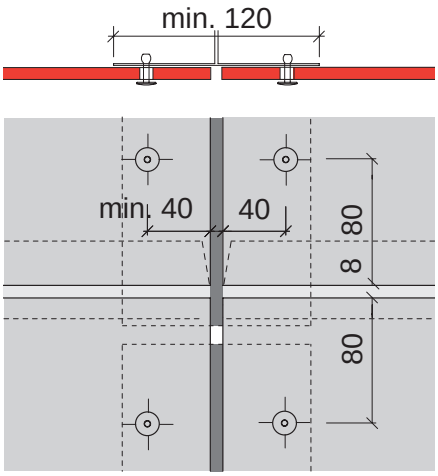
Metal sub frame



Breaks of verticals to coincide with horizontal panel joints



Flashing is clamped (not fastened)



Min. distances to panel edges 40 / 80 mm

Max. distance 100 mm

Sub-frame engineering
Engineer / contractor is responsible for the design and installation of all sub frame parts including all pertaining fasteners.

Vertical panel support profiles
Aluminum profiles should come in lengths of approx. 3 m (10’). They are to be attached to brackets at 1.0 to 1.5 m ctrs.
Each vertical to have 1 fixed and the rest slipping point brackets. For verticals spanning between floor slabs use rectangular tubes attached firmly on op and slipping at the bottom (or vice versa). Steel profiles should not be longer than 6 m (20’). It is good practice to attach all steel supports firmly to the building.

Sub frame profile gauges
Aluminum panel supports to be min. 2 mm thick for minimal stiffness and pull out value.
Steel panel supports to be min. gauge 18 (1.27 mm / 0.05”) to obtain nominal pull out value.
Refer to rivet data sheets regarding technical values for various gauges.

Black panel joints
Panel joints read as shadow lines. It is recommended to blacken the metal where visible, with paint or PVC paint tape.

Horizontal joint closures
These are optional to close off the cavity aesthetically / physically.

Rivets
Stainless steel or aluminum.
Standard type 18 mm, longer rivets for lapped cladding panels.

Rivet installation
Use rivet gun GESIPA ACCUBIRD or similar. Do not use pneumatic equipment.

Rivet removal
Use concenter bore gauge with drill bit type S to drill out head.

Fixed / slipping points
Each panel must be fastened by 2 fixed fastening points in the panel center, installed first.
All the others are slipping points.

One plane
Panel support profiles to be adjusted and shimmed to be all in one plane.

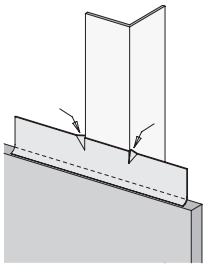
Concenter bore gauge
Use concenter bore gauge to drill holes into sub-frame profiles. Use drill bit type A for aluminum, and type S for steel profiles.

Panel joints
To be min. 6 mm wide. Typical joint width is 8 mm (panel scraps can be used as spacers).
The wider any joint, the less noticeable are inaccuracies in the installation.

Additional material layer
Where parts are added between panel and support profile (flashing, perforated angle) it is imperative to use sheeting of thin gauge and fasteners that do not add material thickness (i.e. countersunk fasteners).

Panel attached restraint free
To ensure the restraint free attachment of the panels it is imperative to use the concenter gauge to drill the holes for the rivets into the sub-frame.

➔ **Interruptions (breaks) of vertical panel supports must coincide with horizontal panel joints.**
The breaks may not be located mid panel.



Lateral dislocation of the flashing to be prevented by cutting and bending back at both sides of one vertical.

Metal sub frame - 8 mm façade panels - rivet distances

Characteristic value of wind suction (according to European standards)		Design value of wind suction (with a safety coefficient of 1.5)		Spacing d (maximal distance between rivets)			
				Vertical panel (portrait)		Horizontal panel (landscape)	
				horizontally	vertically	horizontally	vertically
kN/m²	psf	kN/m²	psf	mm	mm	mm	mm
- 0.60	- 12.53	- 0.9	- 18.8	570	725	725	530
- 0.80	- 16.70	- 1.2	- 25.0	570	725	725	530
- 0.87	- 18.17	- 1.3	- 27.2	570	710	725	530
- 0.93	- 19.42	- 1.4	- 29.2	570	670	710	530
- 1.00	- 20.86	- 1.5	- 31.3	570	635	675	530
- 1.07	- 22.35	- 1.6	- 33.4	570	600	640	530
- 1.13	- 23.60	- 1.7	- 35.5	570	565	610	530
- 1.20	- 25.06	- 1.8	- 37.6	570	535	580	530
- 1.27	- 26.52	- 1.9	- 39.7	570	505	550	530
- 1.33	- 27.77	- 2.0	- 41.8	570	480	520	530
- 1.67	- 34.88	- 2.5	- 52.2	570	385	420	530
- 2.00	- 41.77	- 3.0	- 62.7	380	495	350	530
- 2.33	- 48.66	- 3.5	- 73.1	380	430	465	350
- 2.67	- 55.76	- 4.0	- 83.5	380	375	410	350
- 3.00	- 62.66	- 4.5	- 94.0	380	335	365	350
- 3.33	- 69.55	- 5.0	- 104.4	380	300	325	350

Above table is a guide line for 2 or more fasteners in vertical and horizontal direction. The spacings have been calculated considering a safety factor of 1.5.

The spacings originate from 1220x3040 mm full size panels with equal distances between rivets.
Data may be interpolated.

Engineering responsibility

The spacings in above table are provided as indication. For the actual cladding design a locally licensed engineer shall assume responsibility for calculation and verification.

Panel data

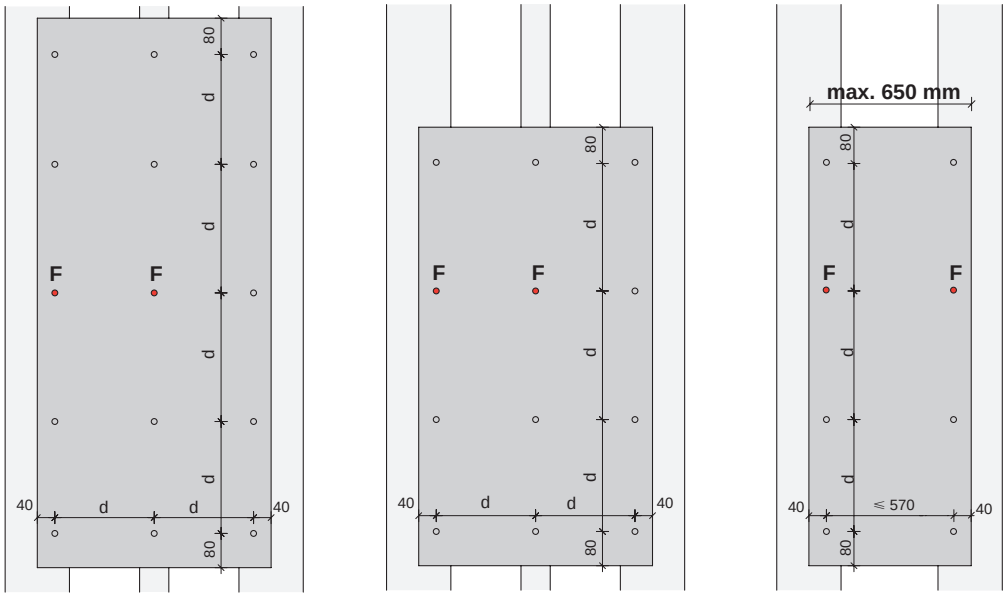
- Modulus of elasticity MOE ca. 15'000 MPA
- Modulus of rupture (characteristic) MOR (average) > 22 MPa
- Design value bending resistance 8.5 MPa (2.5 safety factor)
- Density > 1.75 g/cm³

Design values
Resistance of aluminum and steel rivets 4.0×18-15 mm

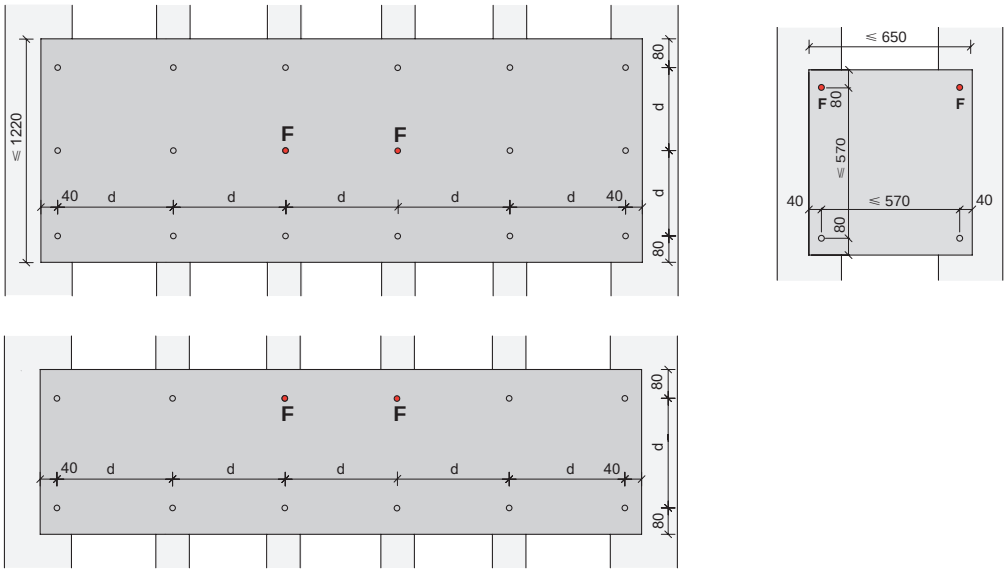
Position	Distance between fasteners (spacing)		
	720 mm	**600 mm**	400 mm
Middle	774 N	**821 N**	864 N
Edge	399 N	**481 N**	575 N
Corner	254 N	**311 N**	414 N

The data was evaluated according to ETAG 034 using 8 mm panel, and includes a safety factor of 2.5. Diameter of panel hole must be 9.5 mm, and rivet head must be 15 mm.
Min. thickness for steel profiles to be 1.27 mm, and 2 mm for aluminum.
Edge distances 40 mm horizontally, 80 mm vertically.
The data may be interpolated.

Metal sub frame



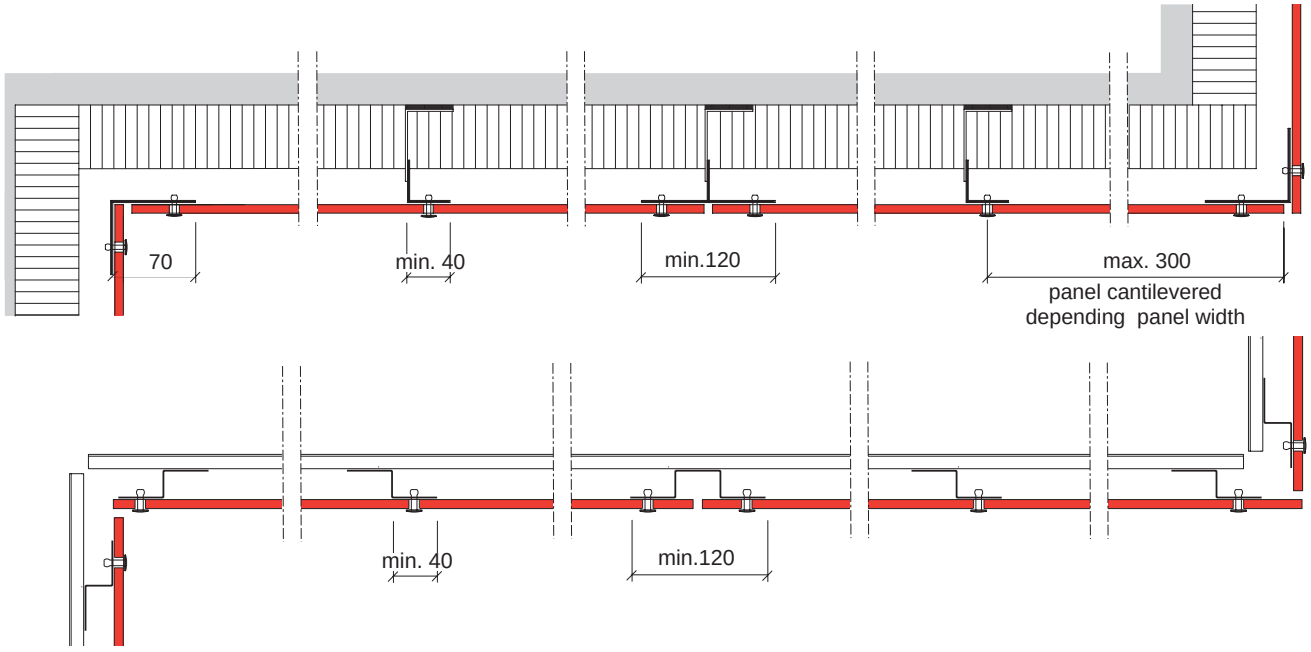
← Single span panel
(no intermediate support)
If more than 5 single span panels are adjoining each other - the chain of fixed points must be interrupted by a different configuration of the fixed points.
Consult with technical advisor.

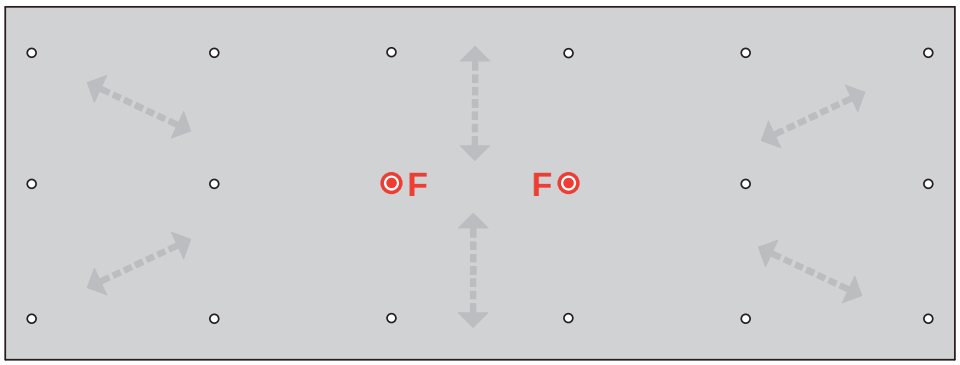


→ Position of fixed points
Fixed points to be located as close to the panel center as possible

→ Hat channels
Since hat channels (both legs attached) are very rigid, the fixed points must be on adjacent 2 verticals.

"d" = max. distance between fasteners (see table)





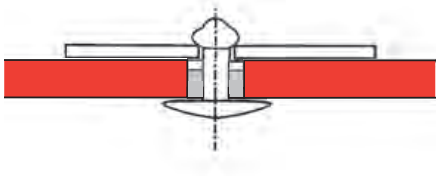
2 fixed points per panel

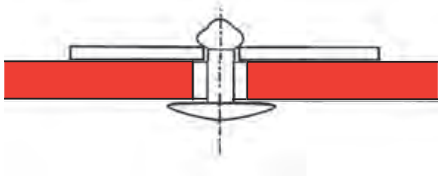
➔ **Panel hole diametre**
All holes to panels for both fixed and slipping points to be of
∅ **9.5 mm**

Drill holes to sub frame
∅ **4.1 mm**

Fixed point

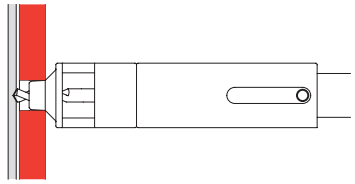
Slipping point

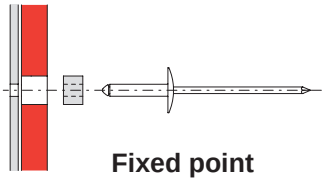




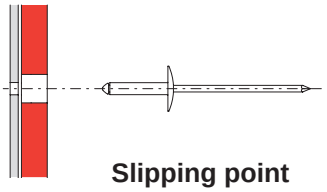
Rivet and fixed point sleeve

Rivet to slipping point



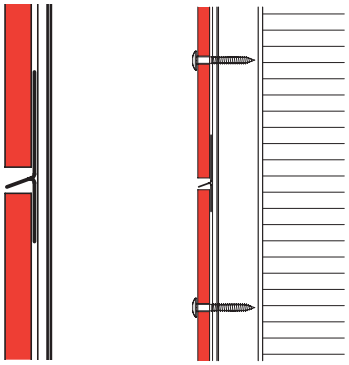


Fixed point

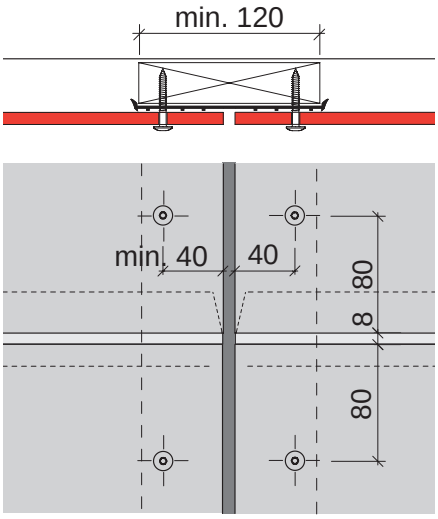


Slipping point

Timber battens



Joint flashing



Min. distances to panel edges 40 / 80 mm

Max. distance 100 mm

➔ **Panel hole diametre ∅ 5.5 mm**

Sub-frame engineering
Engineer / contractor are responsible for the design and installation of all sub framing parts including all pertaining fasteners.

Timber battens
Straight grown pine, dry (max. 16% moisture content).

Vertical batten sizes
The battens should be thickness gauged and planed down to correct width (to suit EPDM bands).
Battens to vertical panel joints min. 27×120 mm
Intermediate battens min. 27×60 mm

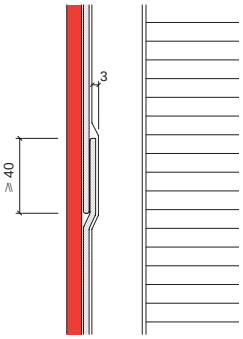
Screws / bit
Stainless steel screw, with powder coated or blank head.
Standard type 4.8×38 mm, head Ø 12 mm, drive T20.
Use T20W bit so as not to damage the paint.

Panel fastening without strain
Use depth stop with correct setting, so that the panel does not dip at the screws.

One plane
All faces of panel support battens to be in the same plane. Battens to be shimmed as required.

Panel joints
Min. joint width = 6 mm.
Typical joint width is 8 mm (panel scraps can be used as spacers).
The wider any joint, the less noticeable are inaccuracies in the installation.

Horizontal panel joints
Use horizontal joint flashings to prevent water from penetrating into ventilation cavity.
Cut flashing 2 mm shorter than panel, so as to avoid the flashing showing in the vertical joints. Where flashings need to be joined together, butt the ends within a vertical profile to have both ends supported.



EPDM strip overlap

EPDM strips
All timber battens must be fully covered by EPDM backing strips stapled to the battens. Stapled at the edges of the bands.
EPDM strips to be in one single piece top to bottom or overlapped as per diagram.

➔ **All screws must be set perpendicularly to the surface of the large size panels, so that the heads rest flat on the panel face.**

Timber battens - 8 mm façade panels – screw distances

Characteristic value of wind suction (according to European standards)		**Design value** of wind suction (with a safety coefficient of 1.5)		**Spacing d (maximal distance between screws)**			
				Vertical panel (portrait)		Horizontal panel (landscape)	
				horizontally	vertically	horizontally	vertically
kN/m²	psf	kN/m²	psf	mm	mm	mm	mm
- 0.60	- 12.53	- 0.9	- 18.8	570	725	725	530
- 0.87	- 18.17	- 1.3	- 27.2	570	725	725	530
- 0.93	- 19.42	- 1.4	- 29.2	570	725	725	530
- 1.00	- 20.86	- 1.5	- 31.3	570	725	725	530
- 1.07	- 22.35	- 1.6	- 33.4	570	705	725	530
- 1.13	- 23.60	- 1.7	- 35.5	570	665	715	530
- 1.20	- 25.06	- 1.8	- 37.6	570	625	680	530
- 1.27	- 26.52	- 1.9	- 39.7	570	595	645	530
- 1.33	- 27.77	- 2.0	- 41.8	570	565	615	530
- 1.67	- 34.88	- 2.5	- 52.2	570	450	485	530
- 2.00	- 41.77	- 3.0	- 62.7	380	565	405	530
- 2.33	- 48.66	- 3.5	- 73.1	380	485	525	350
- 2.67	- 55.76	- 4.0	- 83.5	380	425	460	350
- 3.00	- 62.66	- 4.5	- 94.0	380	380	410	350
- 3.33	- 69.55	- 5.0	- 104.4	380	340	495	260

Above table is a guide line for 2 or more fasteners in vertical and horizontal direction. The spacings have been calculated considering a safety factor of 1.5.

The spacings originate from 1220x3040 mm full size panels with equal distances between screws.
Data may be interpolated.

Engineering responsibility

The spacings in above table are provided as indication. For the actual cladding design a locally licensed engineer shall assume responsibility for calculation and verification.

Panel data

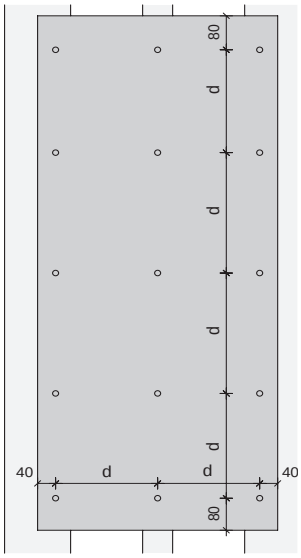
- Modulus of elasticity MOE ca. 15'000 MPA
- Modulus of rupture (characteristic) MOR (average) > 22 MPa
- Design value bending resistance 8.5 MPa (2.5 safety factor)
- Density 1.75 g/cm³

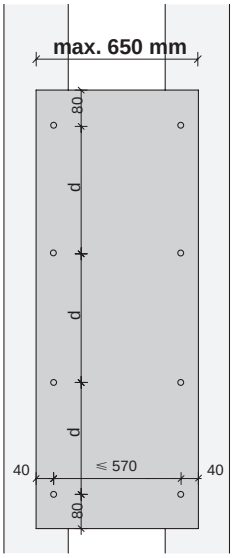
Design values
Resistance of screws 4.8 × 38-12 mm

Position	**Distance between fasteners (spacing)**		
	720 mm	**600 mm**	400 mm
Middle	811 N	**961 N**	977 N
Edge	515 N	**580 N**	665 N
Corner	289 N	**362 N**	445 N

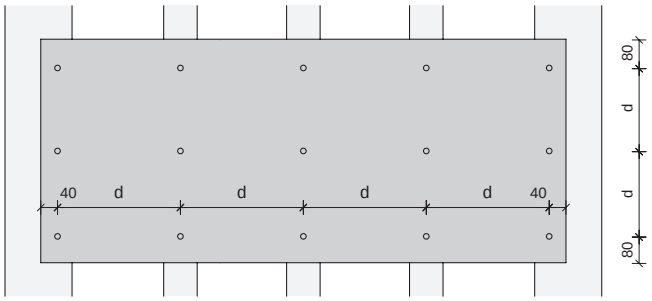
The data was evaluated according to ETAG 034 using 8 mm panel, and includes a safety factor of 2.5. Diameter of panel hole must be 5.5 mm, and screw head must be 12 mm.
Minimum screw engagement in timber to be 27 mm.
Edge distances 40 mm horizontally, 80 mm vertically.
The data may be interpolated.

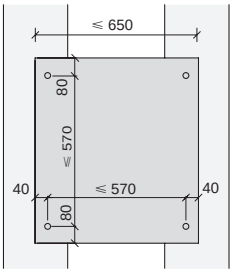
Timber battens

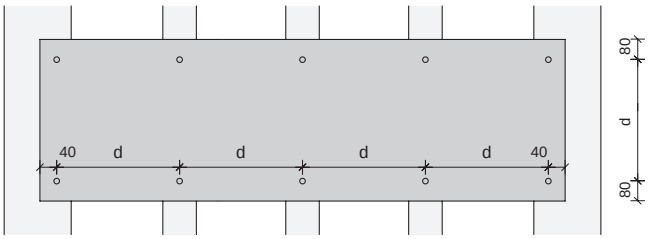




Single span panel
(no intermediate support)

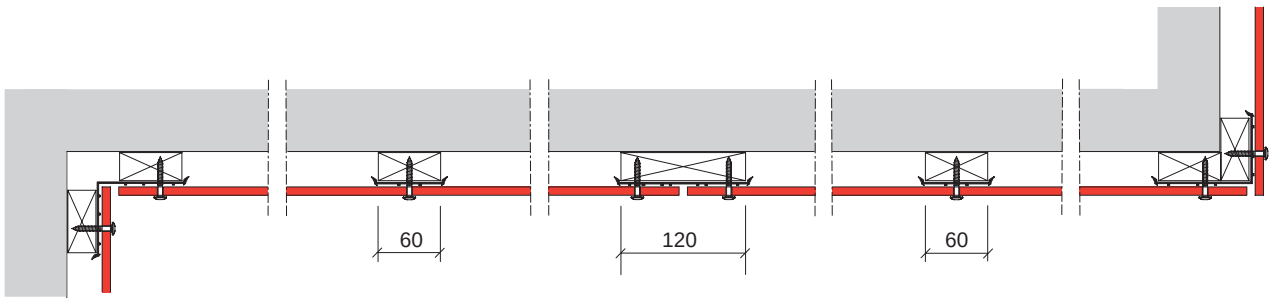






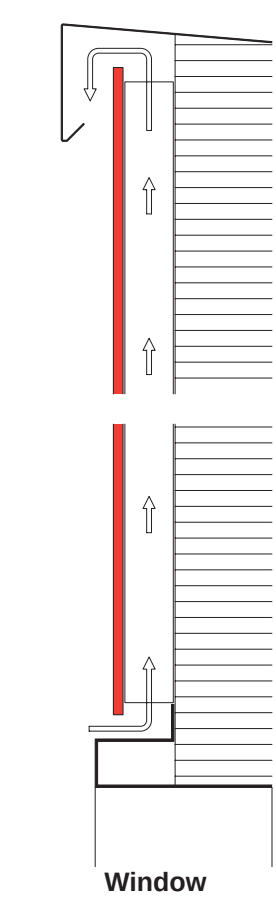
"d" = max. distance between fasteners (see table)

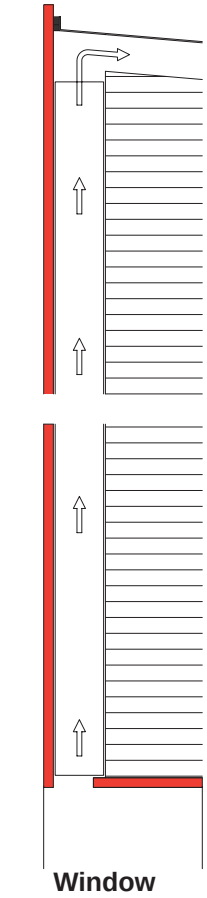
External building corner - battens
The timber battens are to be joined together as per scheme below (same orientation as panels), in order to avoid that the panel fastener falls between the two joined battens.

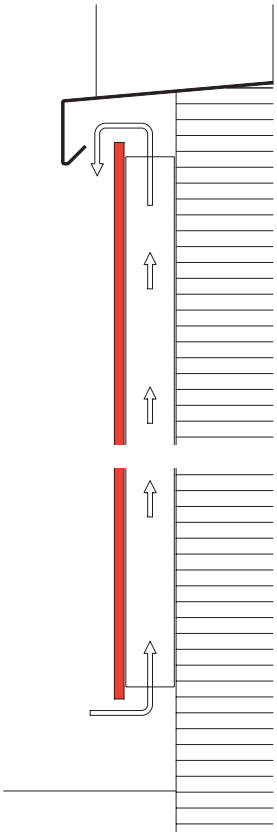


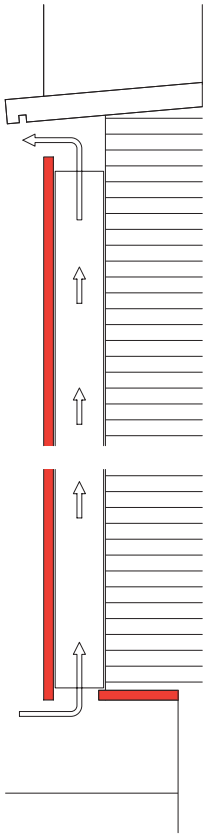
Standard coping

Top detail without coping - vented back
[only for metal sub frame]





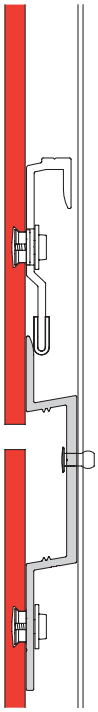




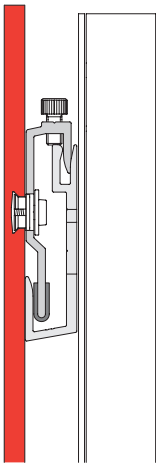
Window surroundings
It is good practice to finish the cladding around windows etc. against a frame in metal. This provides a neat finish that is cost effective.
Window sills should be sufficiently solid so that a person can stand on it (for maintenance, etc.).

Where windows are recessed far back the use of 8 mm panel can be considered.

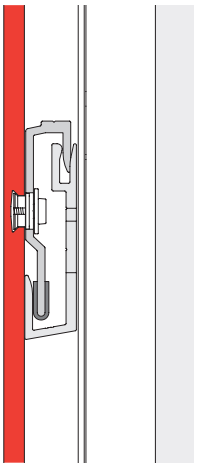
Concealed panel fastening SIGMA 8



Omega cleat S8



Panel clip S8 with level screw



Panel clip S8

SIGMA 8 with individual attachment parts

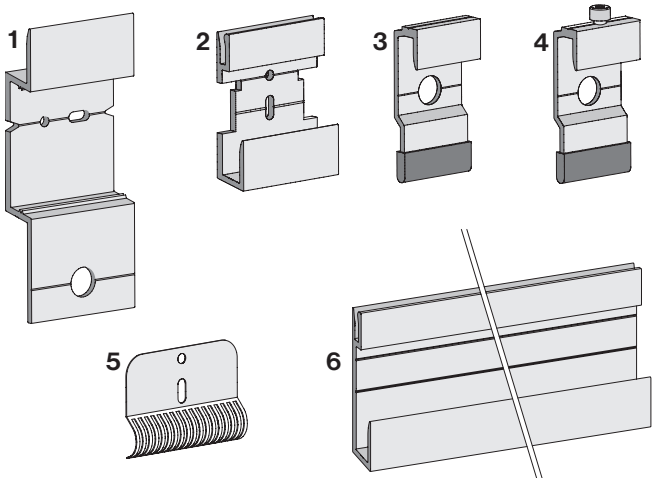
The undercut anchor holes are drilled, and anchor and inner thread sleeve fitted at the factory.
The panels are shipped with polystyrene layers between their back faces, since the anchors are protruding slightly.

On site, the vertical supports either in timber or metal are installed, attached thereto the U-cleats and the Omega cleats which are firmly attached to the panels on top. Thus the panels are hung at the top; whereas all the other attachments only take wind load and not any dead load.

For planning and installation details refer to separate SIGMA 8 DIM.

Anchor position	Distance between anchors 720 mm	**600 mm**	400 mm
Middle	569 N	**653 N**	691 N
Edge	351 N	**413 N**	551 N
Corner	332 N	**373 N**	522 N
Omega (top)	262 N	262 N	262 N

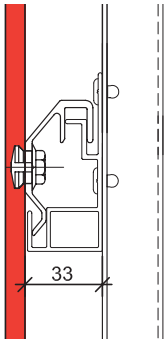
The data was evaluated according to ETAG 034 using 8 mm panel, and includes a safety factor of 2.5.
The spacings in above table are p rovided as indication. For the actual cladding design a locally licensed engineer shall assume responsibility for calculation and verification.



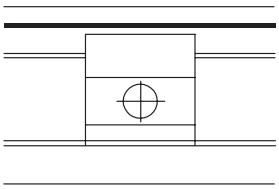
SIGMA 8 parts

1 Omega cleat S8 black anodized
2 U-cleat S8 black anodized
3 Panel clip S8
4 Panel clip S8 with level screw
5 Panel fixing comb S8
6 U-profile S8 3000 mm black anodized

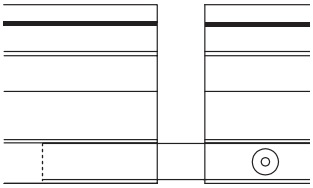
Concealed panel fastening on horizontal rails



8 mm panel



Panel clip
∅ 14.3 mm hole

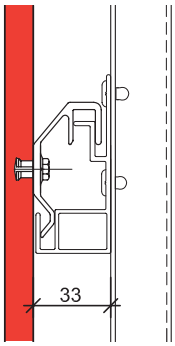


Rail connector

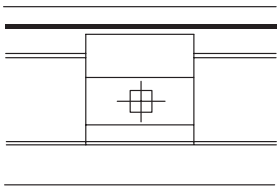
SIGMA 8/12 on horizontal rails; all single anchors

8 mm panel
The undercut anchor holes are drilled, and anchor and inner thread sleeve fitted at the factory.
The panels are shipped with polystyrene layers between their back faces, since the anchors are protruding slightly.

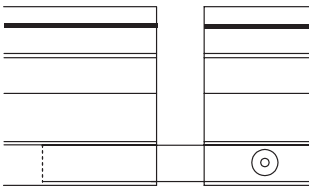
The clips are attached to the panels, which are hung into horizontal rails. The horizontal rails are to be attached to vertical metal supports by others. Engineering verification to be provided by the supplier of the clips and rails.



12 mm panel



Panel clip
10.2×10.2 mm hole

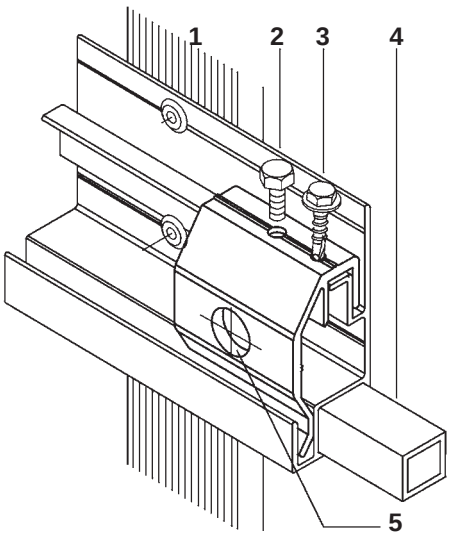


Rail connector

12 mm panel
The undercut anchor holes are drilled at the factory or locally.
The panels are stacked into pallets (standard).

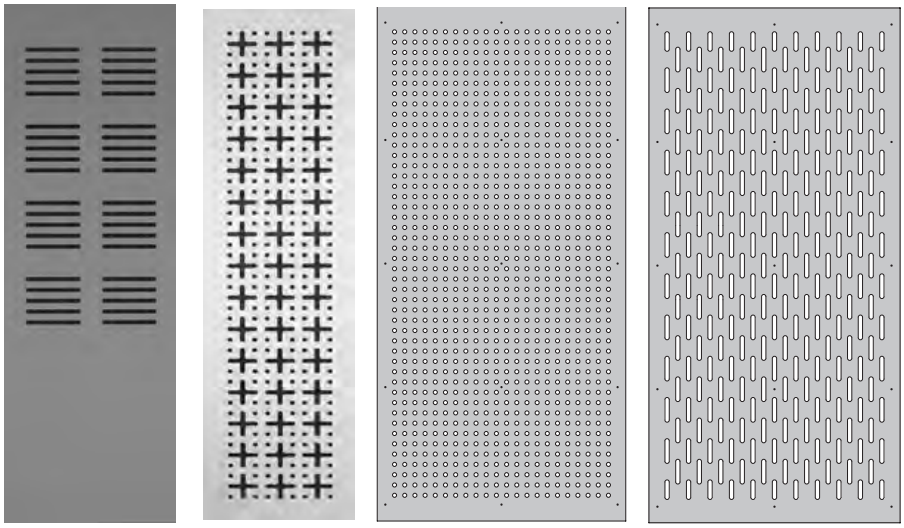
The clips are attached to the panels, which are hung into horizontal rails. The horizontal rails are to be attached to vertical metal supports by others. Engineering verification to be provided by the supplier of the clips and rails.

Characteristic pull out value for SIGMA 12 anchor is ca. 1.2 kN. With a safety factor of 2.0 there is an admissible load of ca. 600 N per anchor.
To be verified by local engineering.



1 Vertical support in metal
2 Level adjustement screw
3 Fixing screw
4 Rail connecto
5 ∅ 14,3 mm

Perforated panels



Panel stability
The greater the perforated area, the lesser the panel stability.
Generally the perforated area should not exceed 15 – 18 % of the panel size. Decisive factors are in particular the panel size and the perforation pattern.
As a thumb rule the solid part between perforations should be at least of the same dimension as the perforation itself.
Large panels should have a non-perforated frame to accommodate the panel fasteners. Each perforation project to be submitted in order to check technical feasibility.

Wind load, mechanical impact
Since perforated panels are more fragile, quantity of support profiles and fasteners to be increased as required.
Do not use perforated panels in areas exposed to mechanical impact.

Exterior application
Min. size perforation:
Holes Ø 20 mm. slots min. 20 mm wide.
Edge of perforation must be chamfered, so that coating will be continuous between panel face and perforations. The coating will be applied after routing the perforations.

Interior application
For interior application the perforations can be carried out on finished panels, because chamfering and coating after fabrication is not necessary.
However, chamfered perforations provide a higher finishing quality and a washable panel surface.
Smaller holes (non-chamfered) to be of Ø 5.5, 6, 8, 9.5 mm on a 16 / 32 / 48 mm grid.

No bending perforated panels!
Perforated panels may not be bent at all.

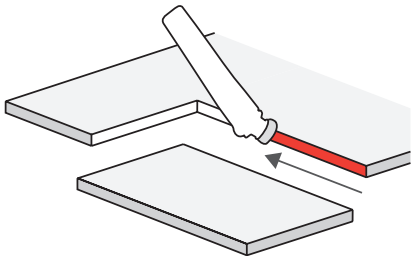
Ventilation void
Ventilated cavities to perforated panels to be same as for standard application.

Exhaust air
Where perforated panels are used in connection with air extraction, condensation may occur on the panel and the formation of ice or dirt. Detail with care to avoid such occurrence.

Designing panel
When establishing the design of a perforated panel, the panel support profiles and panel fastener holes must be considered right at the start.
Most panels will have an intermediate vertical support in the center, so for instance with an even quantity of larger holes the support in the middle will not be visible.

CAD drawing
For quotes and for manufacturing of perforated panels one dwg for each panel to be provided as follows
- in metric
- rounded curved lines (not segmented)
- in layers for panel, fastener holes, dimensions
- no text within the panel

LUKO sealer



LUKO impregnation liquid in hand applicators
For panel edge treatment after cutting on site

- Panel edge must be slightly broken, clean and dry
- Position hand applicator – tank upwards
- Apply sponge at right angle to panel edge and run with moderate pressure along edge (forth and back)
- Caution – do not allow LUKO to get onto panel face, as it cannot be removed after drying
- Check that LUKO has been applied over entire panel length
- Put on the cap when interrupting the job
- Replace sponge when worn
- Store + use this product at min. - 8°C (18°F)

LUKO liquid has a shelf life of 12 months.

LUKO impregnation liquid in 1 liter bottles
For indoor fabrication panel edge treatment

- Store and use this product at minimum + 5°C (41°F)

Check existence of LUKO application
Simply check with water, if it gets absorbed – edge has not been properly treated with LUKO.

125 ml

Masking tape

Masking tape
For the use of masking tape on panels it should be noted that most common masking tapes are not resistant to UV rays.
Such tapes leave behind residues, that cannot be removed without causing damage to panel surface.
However the use of the following masking tapes is recommended

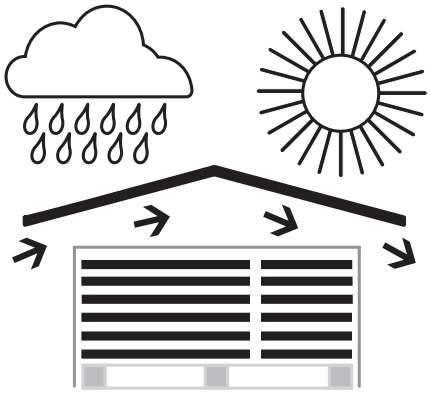
- Masking tape 3M Blue 2090 for temporary application (1 - 2 weeks).
- Masking tape 3M Gold 244 for longer term application.

Saw blade

Saw blade to cut panels
It is up to the contractor to choose the saw blade type to obtain a high quality smooth cut.
Suitable blades are toothless diamond coated or carbide metal toothed blades.

Swisspearl® saw blade
Ø 160 mm / 20 / 4.4 mm thick, 24 double teeth
Cutting performance ca. 500 m, sharpenable 4 - 5 times.
Sharpening details are engraved on blade.

Handling on site



On site storage

Pallets must be stored under cover, i. e. out of rainfall and direct sunlight. Where this is not possible, store under tarpaulin.
Ingress of water into stacked panels will cause permanent staining to panel surface.
Excess heat to stacked panels can cause damage to panel surface.
Overseas pallets can be stacked several above another.

Re stacking panels on site

- Always stack the panels horizontally on pallet base.
- Each stack should not be more than 500 mm high (1' 8").
- Use foam protection layer between the panels (as supplied by factory)

Fabricating panels at local fabricators or on site

- Always work out of the weather.
- Cutting panels to size:
  - Use industrial vertical panel saw for large quantities.
  - For small quantities use circular hand saw with straight edge and dust extraction.
- Panel cut outs, etc. use jig saw
- Cutting blade supplied by factory or procured locally; considering cutting quality, performance, costs
- Dust from fabricating on site must be removed immediately.
- Avoid tools which produce fine dust.

Cleaning procedures

Remove dust immediately after fabricating panels.

- Dry dust
  To be removed with a vacuum cleaner, or with a clean, dry and soft cloth or brush.
- Wet dust
  Results in staining the panel surface. It must be removed immediately, using plenty of water and a sponge or soft brush.

Cleaning of completed claddings

- Non calcium based stains
  Use high pressure cold water at max. 80 bars (minimum distance from panel 25 cm/10"). Use flat fan spray nozzle, dirt blasters are not allowed. Prior do test on inconspicuous part of cladding.
- If required use mild soap or dishwashing liquid. Do not use abrasive or solvent containing cleaning agents.
- Do not use glass cleaning detergents !
- Never wash claddings in direct sun light with alkaline or acid cleaners, as the detergent may cause irreversible stains.
- Calcium based stains
  1. Apply a mist spray of a solution of 10% acetic acid in water
  2. Allow to react a few minutes but do not let dry out
  3. Use high pressure cold water to rinse cladding

Repeat steps 1 to 3 on obstinate stains

- For rust and other metal stains use hydrochloric acid (5%) or similar detergent.

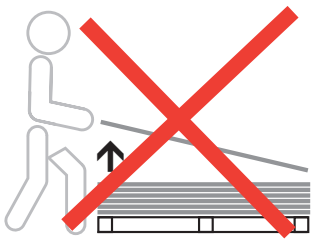
Cleaning during service life

Normally no cleaning will be needed since the rain will periodically wash away dust, environmental dirt, etc. However, if particular environmental conditions lead to a dirty surface, wash with garden hose or high pressure cold water.

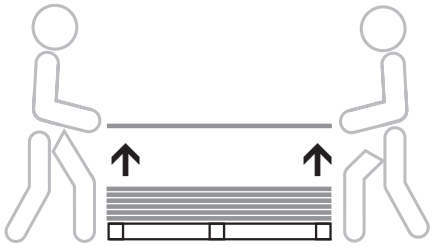
Organic growth

Remove algae / fungii with a 5% solution of hydrogen peroxide (H_2O_2) to eliminate all spores.

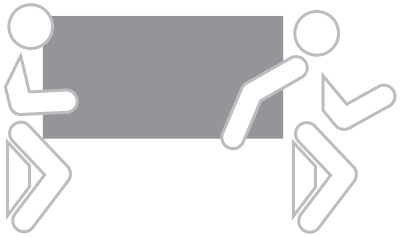
Handling on site



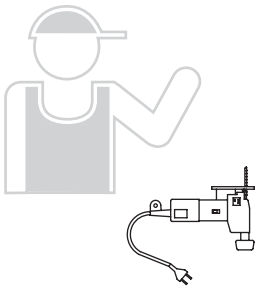
Wrong
Do not pull panel from the stack



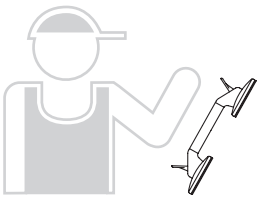
Correct
Always lift panels off the stack



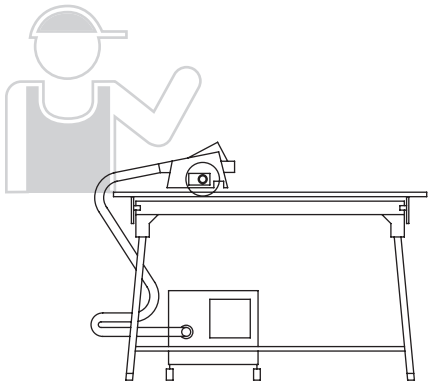
Correct
Carry panels upright



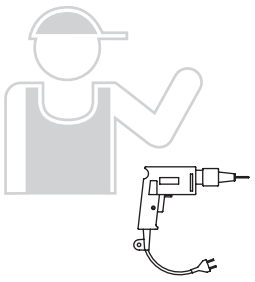
Jig saw



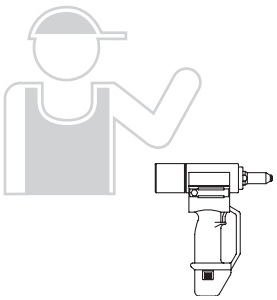
Vacuum handle



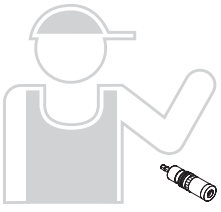
FESTO, HILTI, etc. circular saw
with straight edge and dust extractor



Power drill



Riveting gun GESIPA
ACCUBIRD



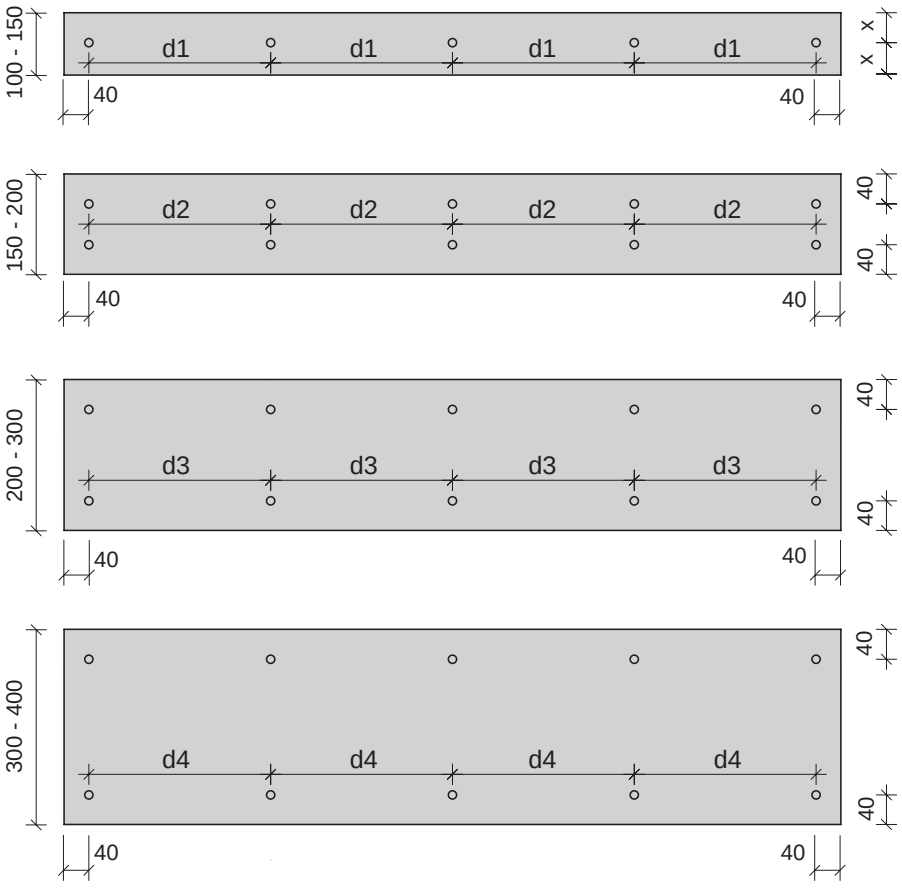
Depth stop

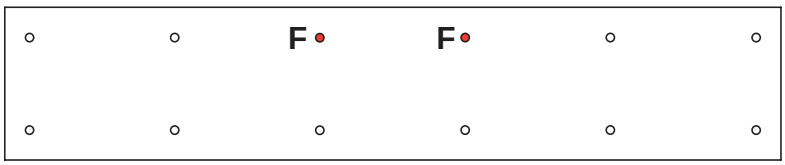
Depth stop
A single setting of the depth stop ensures that all screws are tightened to exactly the desired depth, regardless of the timber hardness (knots). Thus all screws will be tightened adequately and panel will not dip at the screws.

Height of strip		Max. distance between fasteners [mm]
100 - 150 mm	**d** 1	400
150 - 200 mm	**d** 2	450
200 - 300 mm	**d** 3	500
300 - 400 mm	**d** 4	550

Table of max. spacing distance "d" between fasteners

Panel strips
The narrower the strip, the closer the distance between fasteners should be, to ensure that the panel strip stays perfectly flat.
Panel strips should be generally min. 100 mm; narrower strips require utmost care for handling and installation.





LINEARIS
8 mm 1500x147 mm 1500x300 mm
8 mm 2500x147 mm 2500x300 mm

LINEARIS panel strips are delivered without drill holes.
Installation details as per this DIM are applicable.

Metal sub frame
Typical positions of fixed points

Conversion

US standard gauges for sheet and plate iron & steel

Gauge	Metric	
0	7.9375	mm
1	7.1374	mm
2	6.731	mm
3	6.35	mm
4	5.9436	mm
5	5.55498	mm
6	5.1562	mm
7	4.7625	mm
8	4.3688	mm
9	3.9624	mm
10	3.556	mm
11	3.175	mm
12	2.7686	mm
13	2.37998	mm
14	1.9812	mm
15	1.778	mm
16	1.5875	mm
17	1.4224	mm
18	1.27	mm
19	1.10998	mm
20	0.9525	mm
21	0.87122	mm
22	0.79248	mm
23	0.7112	mm
24	0.635	mm
25	0.55372	mm
26	0.47498	mm
27	0.4318	mm
28	0.39624	mm
29	0.3556	mm
30	0.3175	mm
31	0.27686	mm
32	0.254	mm
33	0.23622	mm
34	0.2159	mm
35	0.19812	mm
36	0.1778	mm

Fractions of an inch	
1/32	0.8 mm
1/16	1.6 mm
3/32	2.4 mm
1/8	3.2 mm
5/32	4.0 mm
3/16	4.8 mm
7/32	5.6 mm
1/4	6.4 mm
9/32	7.1 mm
5/16	7.9 mm
11/32	8.7 mm
3/8	9.5 mm
13/32	10.3 mm
7/16	11.1 mm
15/32	11.9 mm
1/2	12.7 mm
17/32	13.5 mm
9/16	14.3 mm
19/32	15.1 mm
5/8	15.9 mm
21/32	16.7 mm
11/16	17.5 mm
23/32	18.3 mm
3/4	19.1 mm
25/32	19.8 mm
13/16	20.6 mm
27/32	21.4 mm
7/8	22.2 mm
29/32	23.0 mm
15/16	23.8 mm
31/32	24.6 mm
1 inch	25.4 mm

Inches	
1”	25.4 mm
2”	50.8 mm
3”	76.2 mm
4”	101.6 mm
5”	127.0 mm
6”	152.4 mm
7”	177.8 mm
8”	203.2 mm
9”	228.6 mm
10”	254.0 mm
11”	279.4 mm
12”	304.8 mm

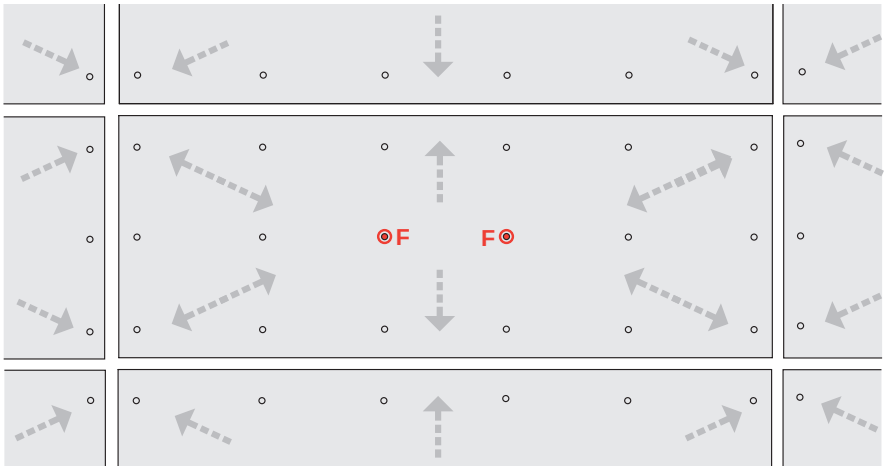
Feet	
1’	304.8 mm
2’	609.6 mm
3’	914.4 mm
4’	1’219.2 mm
5’	1’524.0 mm
6’	1’828.8 mm
7’	2’133.6 mm
8’	2’438.4 mm
9’	2’743.2 mm
10’	3’048.0 mm

Distance	
1 mile	1’609.3 m
1 km	0.621 mile

Temperatures	
212°F	100°C
100°F	37.78°C
32°F	0°C
0°F	-17.78°C
- 40°F	- 40°C

Weight	
1 lb.	453.6 g
1 oz	28.35 g

www.worldwidemetric.com



each panel to **expand & contract**
when **warming & cooling** daily
from the **center & back**

Authorized Distributor

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PRINTED IN GERMANY_042016ENG