Sub Channel Systems - Design Principles

Ventilated facades are the most popular type of facade systems. These systems are prefered due to their functinonallty and most of all the because of their desgin possibilities to accomodate various types of claddings to buildings.

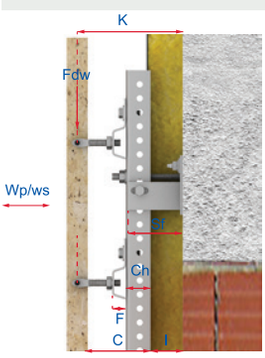
The desing of the fixing systems can be indivdually adopted to the structure and custom design can be made combining various type of components.The sub channels sytems comproising of both boths steel and aluminium components, act as the secondary structure between the wall and the cladding material.

The sub channel systems can be adjusted in three dimensions and are fixed to the main structure free of stress. Uneveness of the main structure and wall projections can be compnesated for perfect horizontal and vertical alingment.

In order to achieve a secure and functional fixing system correct design principles have to be considered.

Required application information for design works

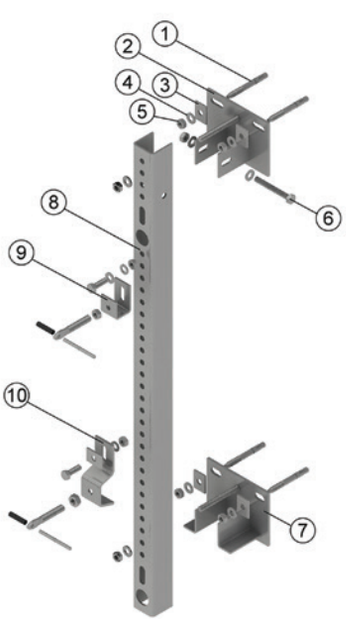
- Stone type and dimensions.
- Cavity structure: projection size and insulation.
- Application type: horizontal or vertical joint installation.
- Joint size.
- Structural wall backing.
- Height of facade.
- Relevant dynamic loads such as wind and seismic loads.
- Design criteria of the project.



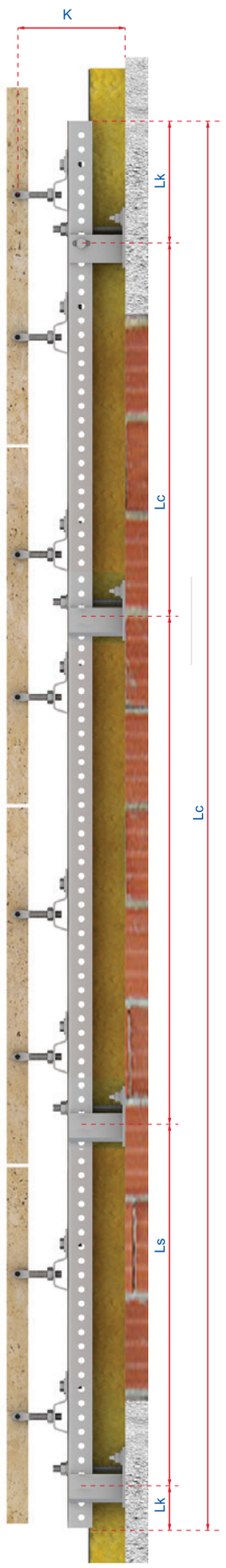
Design parameters

K:	projection size
Fdw:	dead Load
Wp / Ws :	wind pressure / wind suction
C:	wall cavity
I:	insulation thickness
Ch:	channel height
F:	anchor forming size
Sf:	support forming size
Lc:	channel length
Sc:	vertical channel spacing
Lk:	end channel spacing
Ls:	connection spacing

Sub Channel Systems Components

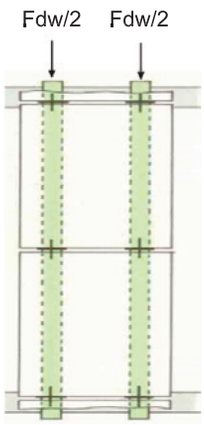


1- Through Bolt
2- Channel Support
3- Plain Washer
4- Washer
5- Nut
6- Bolt Set
7- Channel Restraint
8- Channel
9- Restraint anchor
10-Load bearing anchor

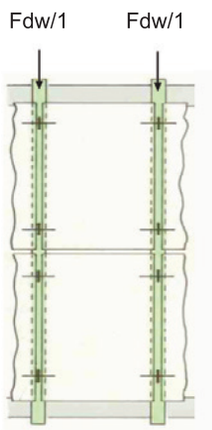


Sub Channel Systems - Design Principles

Installation at horizontal Joints



Installation at vertical Joints



Fixing method & load distribution

• Sub channel systems are fixed to load bearing beams for support.

• Channels are fixed on to beams with channel supports.

• Fixing of channels in the middle to the wall with channel restraints are made to reduce deflection.

• When installation is at vertical joints, the sub channel system bears the whole load of the slabs installed.

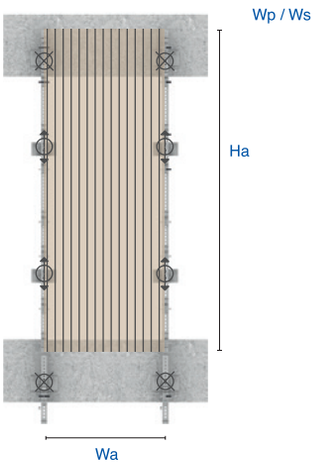
• When installation is at horizontal joints, the sub channel system bears half the load of the slabs installed.

Elevation

W: Stone panel Width
Lc: Channel length
Lf: Floor height

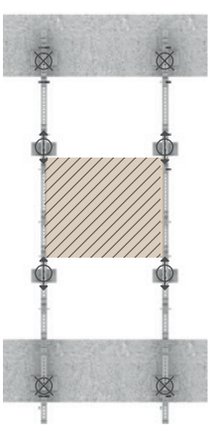
Wa: Cladding Width area
Ha: Claddign Height area
Sc: Channel spacing

Channel support



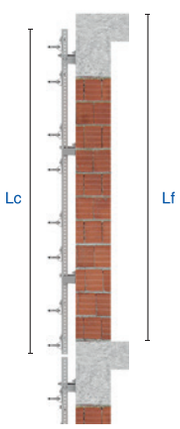
channel support - fixed
channel restraint - flexiable

Channel Restraint



channel support - fixed
channel restraint - flexiable

Section



Load calculation for channel supports

Load bearing:
Subject to weight of cladding area

Fdw = St x Wa x Ha x ds x yf

Fdw:	Dead Load kN
St:	Stone panel thickness
Wa:	Width of area of cladding
Ha:	Height area of cladding
ds:	Volume of claddign material
yf:	Safety factor 1.35

To be verified against resistant loads

Restraint:
subjected to wind pressure & suction load

W = Wn x b x a x yf

a:	distance between brackets
yf:	coefficient of wind load 1,4

Wn = Wm x æ x c

Wn:	normative zone wind load kN/m²
æ:	coefficient of wind load change according to certain height
c:	Aerodynamic coefficients
c:	+0,8 , for wind pressure load
c:	- 0,6 , for wind suction

Wn: 0,43 x 1, 05 x 0,8 = 0,36 kN
W: 0,36 x 1,25 x 1,0 x 1,4 = 0,63 kN
To be verified against resistemt wind pressure load

Wn = 0,43 x 1, 05 x - 0,6 = - 0,27 kN
W =- 0,27 x 1,25 x 1,0 x 1,4 =- 0,47 kN
To be verified against resistent wind suction load

Load calculation for channel restraints

Restraint:
subjected to wind suction load

W = Wn x b x a x yf

a:	distance between brackets
yf:	coefficient of wind load 1,4

Wn = Wm x æ x c

Wn:	normative zone wind load kN/m²
æ:	coefficient of wind load change according to certain height
c:	Aerodynamic coefficients
c:	- 0,6 , for wind suction

Wn = 0,43 x 1, 05 x - 0,6 = - 0,27 kN
W =- 0,27 x 1,25 x 1,0 x 1,4 =- 0,47 kN
To be verified against resistent wind suction load

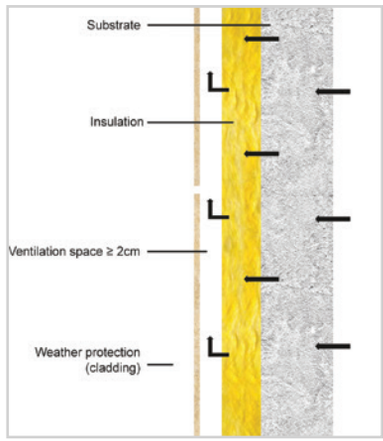
Sub Channel Systems - Design Principles

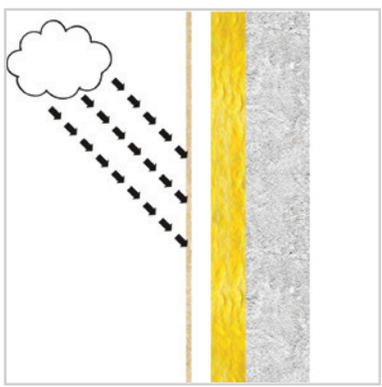
Ventilated Facades

Ventilated facade systems are a construction which offer both aesthetic quality and effective insulation permitting energy savings. It consists of an outer cladding, an air space at least 50 mm, a sub channel sytems made of steel or aluminium components that are anchored to the building and an insulating layer secured to the outer wall of the building.

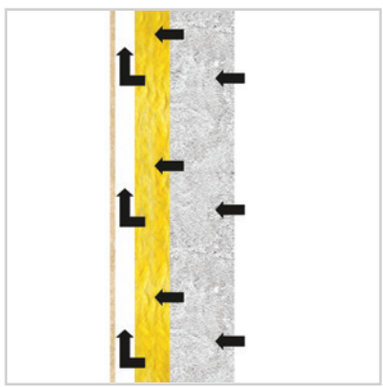
The main functions of the outer cladding are aesthetic and protective. The air gap is essential for activating the natural ventilation that is necessary for the system to function as a whole. The sub channel system ensures stability of the cladding system, while the insulating layer, usually consisting of self-supporting water-repellent glass wool panels, takes care of adequate thermal stability.

Ventilated facades aid natural ventilation, reduce drastically damp on walls and therefore the problem of condensation. The building breathes really better. Ventilated facades also guarantee protection against acid rain and smog absorption.

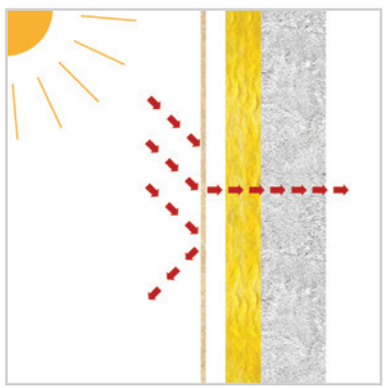




The entire construction is weather proof and non ageing. Wall cladding enhances the safety and longevity of a building. Consistent separation between outer cladding and insulation and structural framework protects the building from weathering effects.

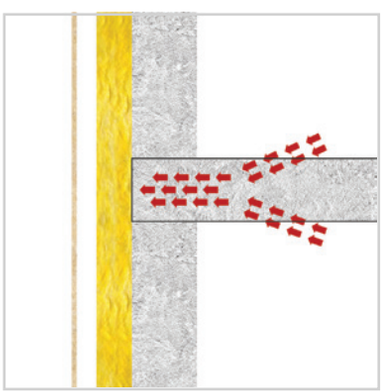


The air gap prevents heat accumulation and damage due to moisture. Load-bearing outside walls and the insulation in particular remain dry and in proper function. The overall construction continues to allow diffusion of moisture.



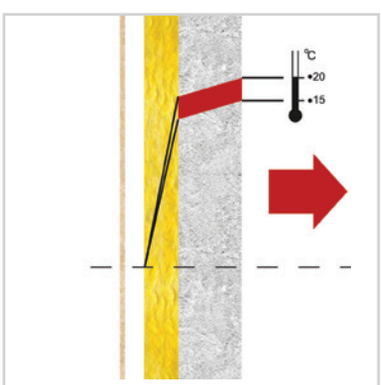
Cooling and heat losses in winter as well as heating up in summer will be prevented.

Adequate cavity space between the classing and the insulation acts as a natural insulator with the stack effect.



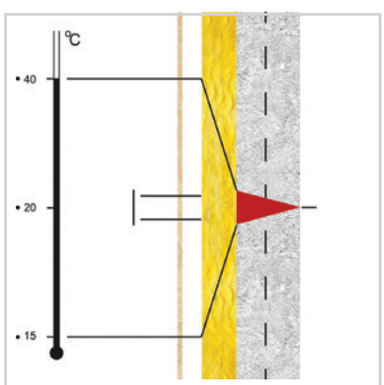
Formation of thermal bridges will be minimised.

Low anchoring points on the wall and the use thermal breaks increase the protection against themal bridges.



The insulation ensures maximum heat storage in the inside of the building.

Comfortable room climate is achieved.

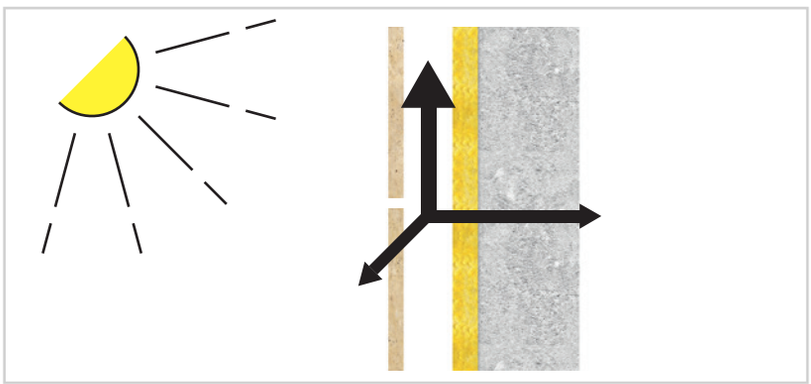


The suspended rear ventilated facade shields the building from strong thermal loading

Sub Channel Systems - Design Principles

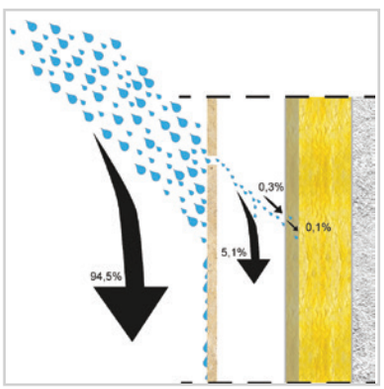
Thermal insulation

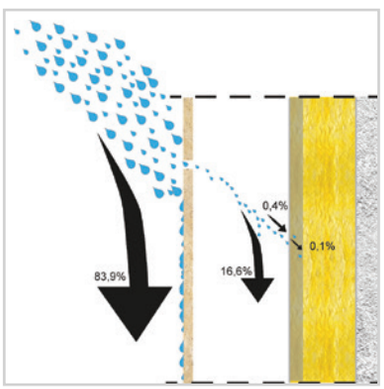
The rear-ventilated facade system can be designed for various energy requirements, with individually measured insulation materials of any desired thickness. This makes the achievement of U-values possible that are usually characteristic of low-energy or passive homes and surpass the thresholds presented in the recent energy savings regulations. In respect to energy requirements, the insulation achieves the highest possible heat retention values for the structure, while it compensates high temperatures in the summer from within.



Rain Protection

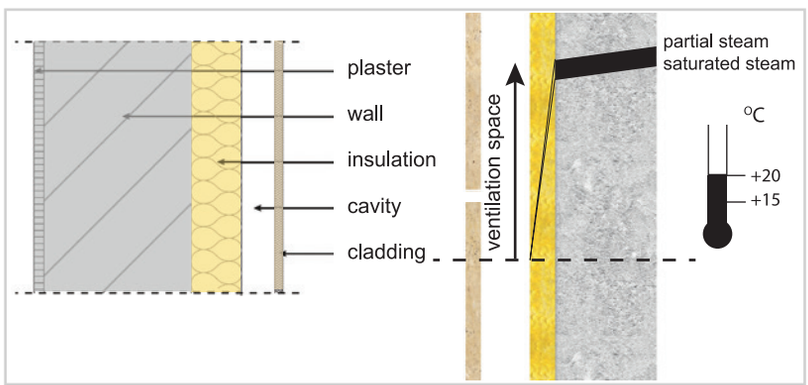
Due to a constant exposure to climate conditions, fissures and moisture damages occur over time. Rear-ventilated facades belong to wear class **III** and are resistant to driving rain. Moisture is quickly removed through the ventilated space between insulating material and cladding (weather protection). The rain protection of the rear-ventilated facade works on two levels: The ventilation gap functions as a pressure compensation room, which ensures that, in a worst-case scenario, driving rain is drained over the back of the cladding, thus protecting the thermal insulation from wetness. Hence, it is possible to construct rear-ventilated facades with open, horizontal seams without decreasing the protection against rain.





Protection against moisture and condensation

Due to the structure of the rear-ventilated facade, the vapour diffusion resistance decreases from the internal to the external walls. Any moisture from condensation, or accumulated during construction, is channeled through the ventilated space and contributes to a healthy and comfortable indoor climate.



Insulation

The insulation components (thermal insulation, damp proofing, sound insulation and fire protection) and the cladding (weather protection) are structurally separate in the ventilated rainscreen system.

Due to the free selection of system components for rear-ventilated facades, the fire protection requirements »non-inflammable« or »hardly inflammable« can be met according to the country-specific building guidelines.

Rear-ventilated facades positively affect the sound insulating properties of the external wall. Depending on the thickness of the insulation, the dimensions of the cladding and the percentage of open joints, the sound reduction index can be increased by up to 14 dB.