FIX Brickwork Support Systems - Design Principles

The brackets are available in three load categories. 3.5 KN, 7.0 KN and 10.5 KN. Projection sizes are available between 130 and 350 mm.

Anchoring positioning is calculated from the lower edge of the brickwork wall to be intercepted at x installation height. All brackets are adjustable in the vertical axis through the set screw from + / - 30 mms.

Fixing system design is formulated according to the utilisation rate, wall distance and the height of the facade.

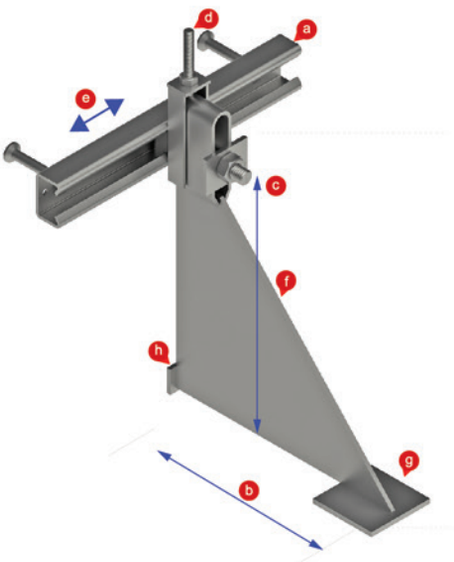
The required connection types on to the walls are as follows.

Load category 3.5 KN: Anchor channel 38/17 or Expansion bolt M12 *

7.0 KN: Anchor channel 49/30 or Expansion bolt M12 *

10.5 KN: Anchor channel 54/33 or Expansion bolt M16 *

* The fastenings has to be calculated in each individual case



a. Brackets are fixed with T bolts on to anchor channels

b: Projection size (K) Distance between wall and centre of brick

c: Installation height (x) - Distance between the bolt centre and bearing level of the bracket

d: Vertical adjustment is made with the set screw

e: Lateral adjustment is made in case installation is made with anchor channels

f: Vertical plate - bracket body

g: Support plate - Bricks are layed on this plate

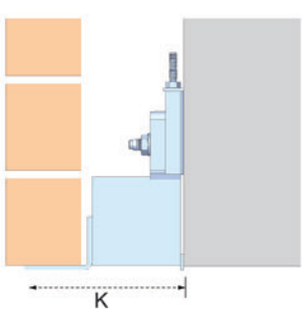
h: Pressure plate - this plate distributes the force to prevent concrete wall from breaking

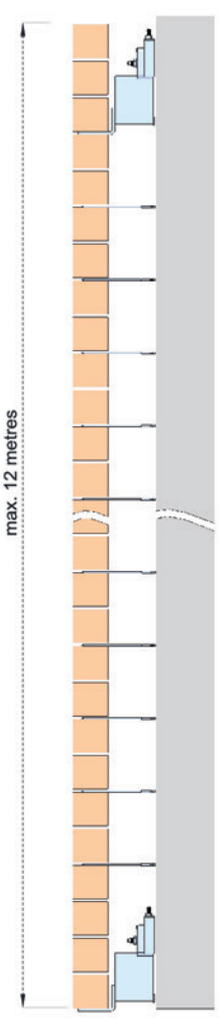
Load Categories: There are three load categories and anchors are structurally designed to take the mentioned loads.

	Load Category	
	Allowable Load	Design Resistance
	3.5 kN	4.7 kN
	7.0 kN	9.5 kN
	10.5 kN	14.2 kN

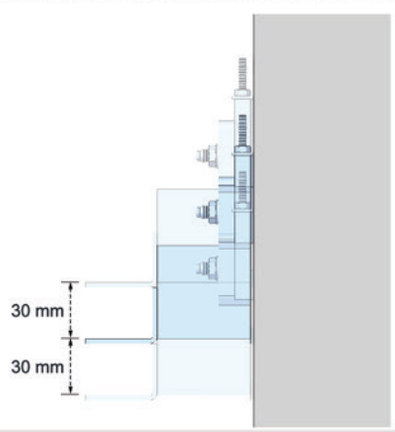
Facade Height: Brickwork support brackets can take a maximum height of 12 metres depending on the thicknesses of the bricks. Generally brackets are fixed at floor levels to support the brickwork wall and restraining is done using restraint ties.

Projection Size: There are different projection sizes (K) that the brackets can accommodate. The standard projections are between 130 mm and 350 mm.

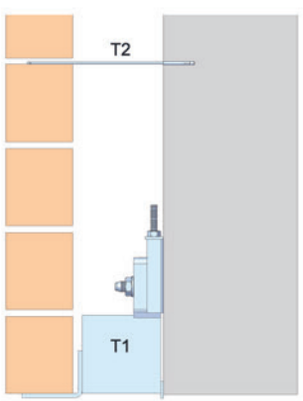




Vertical Adjustability: Adjustability in the vertical axis is made by swirling the set screw on top of the bracket. A total of 60 mm adjustability is possible.



Load Bearing & Restraining: Support of the brickwork walls is made with load bearing brackets (T1). Resraining of the wall is made with restraint ties (T2)



FIX Brickwork Support Systems - Design Principles

Load Calculation Principles

When determining the applied loads on the brickwork support brackets, the following principles needs to be considered. The applied loads should be lower than the allowable loads.

Applied loads (F) ≤ Allowable loads (all. F)

When using the Eurocode standard the conversion from global safety factors to partial safety factors should be adopted. The acting loads should be factored by 1.4 to determine the Design loads.

Design Effect Load (F_{Ed}) ≤ Design Resistance (F_{Rd})

The brickwork support anchors are available in the following load categories:

Allowable load:	Design resistance load:
3.5 kN	4.7 kN
7.0 kN	9.5 kN
10.5 kN	14.2 kN

Dead Load Calculation:

Dead Load (F_V) is important to in order to choose the bracket with adequate load bearing capacity. Dead Load should be determined using the following formula: ds is density which is considered to be 18 kN / m³ for bricks.

F_V = H * cs * bt * γ

(Loading height) * (Bolt spacing) * (Brick thickness) * (density)

$F_{Ed} = F_V * 1.35$

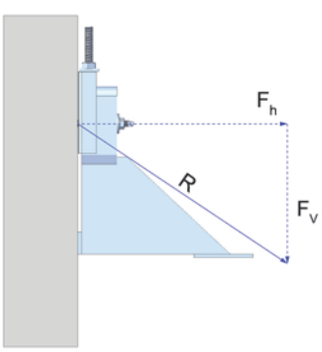
Resultant Load Calculation:

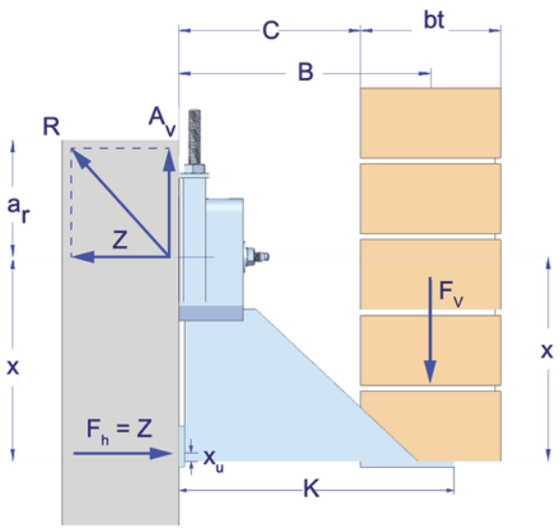
B = C + (d/3) + 15 mm

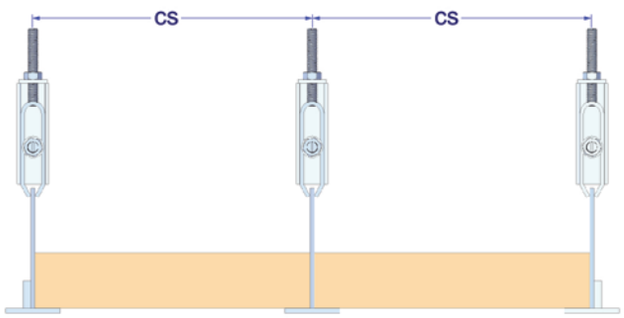
M = Fv x B

Z = M / (x - x_u - 30 mm)

$R = \sqrt{F_V^2 + F_h^2}$

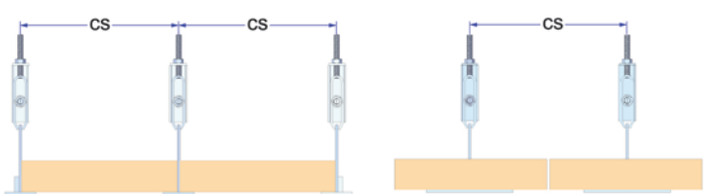


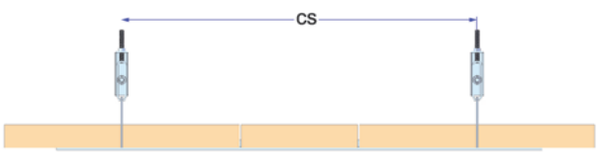




Legend

H:	Loading height	F_V:	Dead load
C:	Wall cavity	F_h:	Horizontal reaction load
K:	Projection	R:	Resultant load
B:	Lever (load distance) (C + (d/3)+15)		
bt:	Brick thickness		
cs:	Bolt spacing		
γ:	Density of bricks		



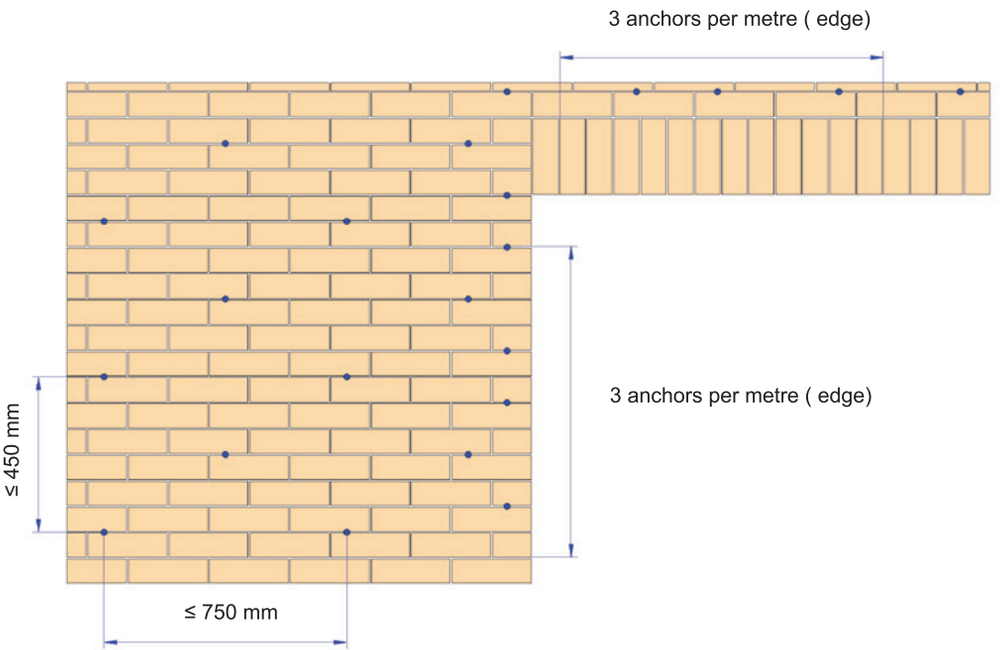


HMS Brickwork Support System - Design Principles

Restraining Of Facing Shell Brickwork Walls

Brick faced brickwork walls form a thin outer layer shell. This wall needs to be strengthened against buckling and must transfer wind loads into the load bearing walls. The brick shells are to be connected using restraining ties that are produced from stainless steel. The positioning of the restraining ties should be made according to the illustration on the right hand side. The vertical distance between the restraining ties should not exceed 500 mm. The horizontal distance between the ties should not exceed 750 mm.

Along the edges where there are free openings such as corners of buildings, expansion joints, window and door openings, and upper ends of external walls; three restraining ties should be used per metre of edge length in addition to the specifications provided. Restraint ties must absorb a tensile force of 1 kN with a slip of maximum 1 millimetre per tie.



Minimum Quantity And Diameter Of Wire Anchors Per Square Meter

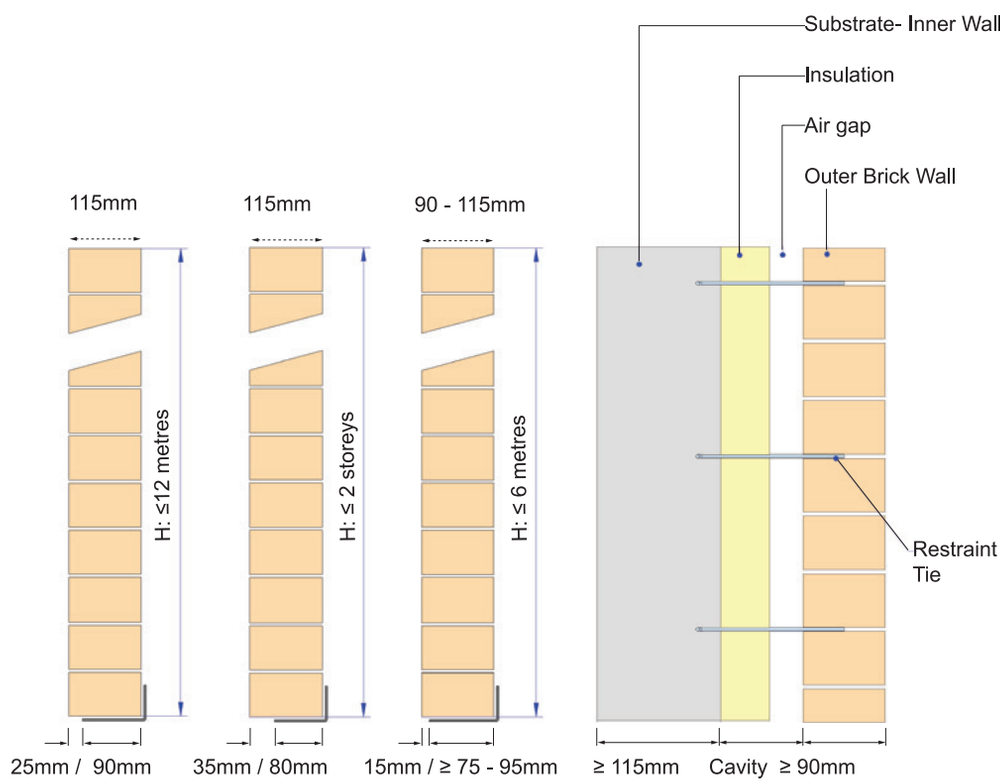
	Minimum quantity	Diameter
1. Wall area higher than 12 m above ground or cavity size from 70 to 120 mm	5	4
2. Cavity from 120 to 150 mm	7	4
3. Cavity from 120 to 150 mm	5	5
4. Cavity from 150 to 170 mm	8	5
5. Cavity from 170 to 200 mm	9	5

Bearing On The Support Brackets

When designing a non load bearing outer shell brickwork wall in front of a load bearing inner shell, the minimum thickness of the outer shell must be 90 mm. Thinner outer shell walls are classified as cladding and these claddings must be installed so that they are supported individually.

Outer brickwork shells can be supported with a maximum height of 12 metres. They may project up to 25 mm beyond their bearing structure. If the 115 mm thick outer shell is not higher than 2 floors then it may project up to one third of its width from its bearing.

Outer shells with thicknesses less than 115 mm must not be built to a height of more than 20 metres above ground and have to be supported in vertical intervals of about 6 metres.



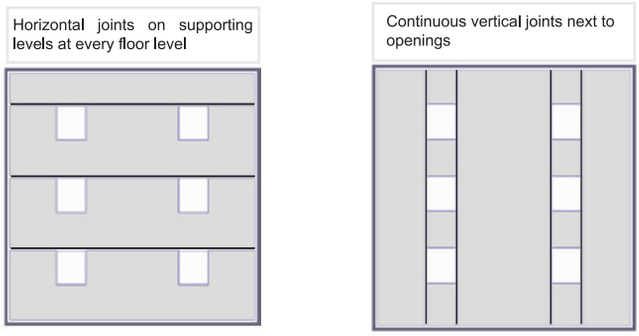
HMS Brickwork Support Systems - Design Principles

Layout And Design Of Expansion Joints

Fluctuations in temperature result in changes of lengths and volume of materials. There will also be movements on the building through the deflection of beams and columns. Expansion joints are incorporated on the facade in order to compensate for these movements to avoid any cracking of the brickwork facade.

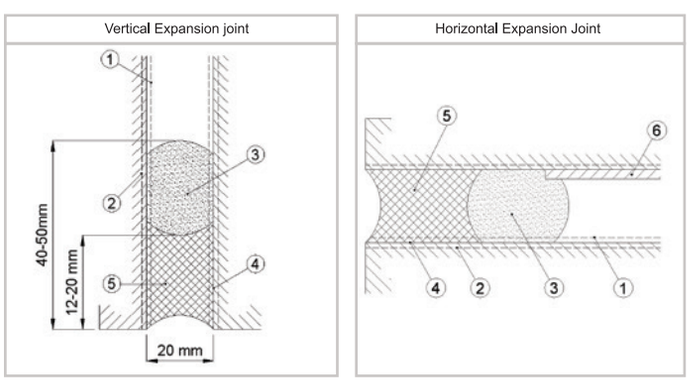
Positioning Of Expansion Joints:

Horizontal joints are positioned at each supporting level. The distance between the support level thus the expansion joints are determined according to the maximum permissible height on to which the brickwork wall can be built. The distances between vertical expansion joints depend on climatic loads and the type of materials. The expansion joints in the brick facing shell must continue along the facing load bearing structure. The appearance choice of the expansion joints also is a factor that needs to be taken into consideration. Some examples of the expansion joint positioning are shown in the figures on the right.



Vertical And Horizontal Joint Details:

Expansion joints should be placed in the outer shell of the brick wall. The distances of the expansion joints depend on various factors such as temperature, humidity, the type of materials used, height of the building, type of the load bearing walls etc. The expansion joints should take the movements of the building structure as well as the thermal expansion of the cladding material. Free mobility of the outer shell must be enabled in order to avoid cracking of the brick work. The expansion joints should be filled with suitable material and must be tightly sealed. The structure of the expansion joints should be as shown below:



Details:
1. Compressed joint. 2. Elongated joint. 3. Joint gasket.
4. Keyed surface. 5. Joint sealant. 6. Bracket.

Expansion Joint Arrangement:

The distance between the vertical expansion joints depends on the climate conditions of the geographical area in which the construction will be made. In general, the connected brickwork walls should not be built wider than 7-14 metres in the corner areas. The wall slabs can be interrupted with a vertical joint or continue around the corner as shown in the diagram on the right.

Thermal expansion coefficient	
Clay bricks	0.006 mm / m K
Calcium silicate blocks	0.008 mm / m K
Gas concrete	0.008 mm / m K
Concrete	0.012 mm / m K
Steel	0.012 mm / m K