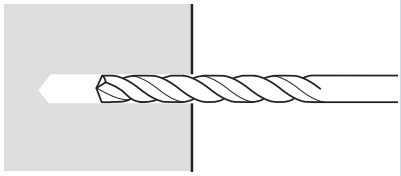
ESI+ & EVL+

STYRENE FREE INJECTION MORTAR

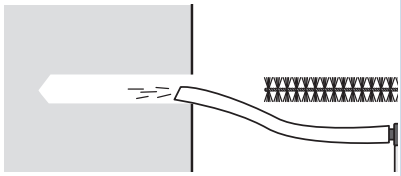
ESI+ and EVL+ for fixing of threaded rods and sleeves in solid brick, hollow brick, aerated concrete and Leca®, Lightweight Aggregate Concrete (LAC) and Solid Sand-Lime Brick/Block

Installation:

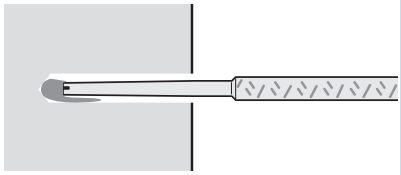
Solid Brick, Aerated Concrete, Lightweight Aggregate Concrete (LAC) and Solid Sand-Lime Brick/Block.



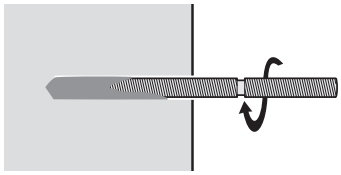
1 Drill a hole in correct diameter and depth



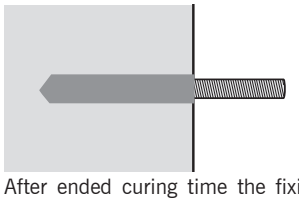
2 Clean the drilled hole thoroughly



3 Insert the mixer into the drilled hole, and while the mixer is slowly retracted inject the correct volume of styrene free injection mortar

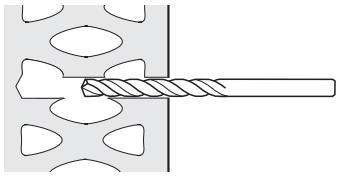


4 Insert the threaded rod or socket in a slowly rotationg motion. For optimal filling of the hole excess mortar should flow out.
Observe temperature dependent curing time

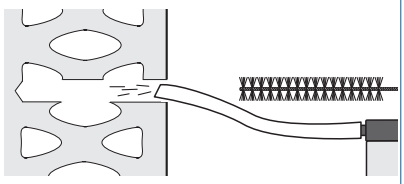


5 After ended curing time the fixing can be loaded and the installation is finished - see curing time table on next page

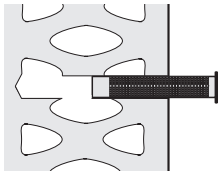
Hollow brick



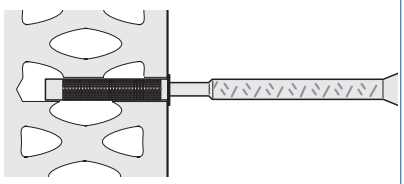
1 Drill a hole in correct diameter and depth



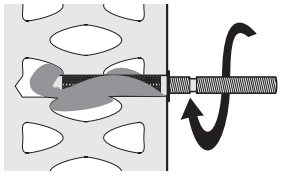
2 Clean the drilled hole thoroughly



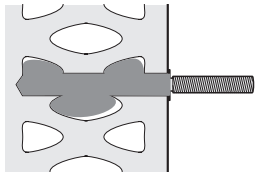
3 Insert sleeve flush with wall



4 Inject mortar from bottom of drilled hole - fill the sleeve completely

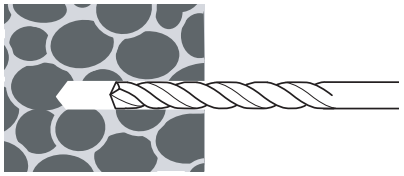


5 Insert the threaded rod or socket in a slowly rotationg motion. For optimal filling of the hole excess mortar should flow out

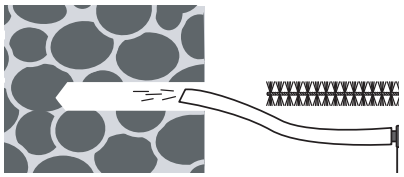


6 After ended curing time the fixing can be loaded and the installation is finished - see curing time table on next page

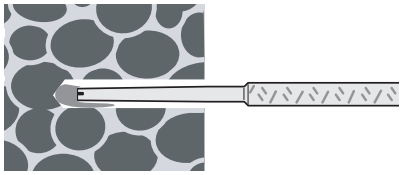
Leca®



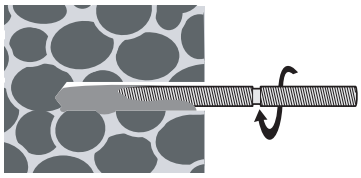
1 Drill a hole in correct diameter and depth



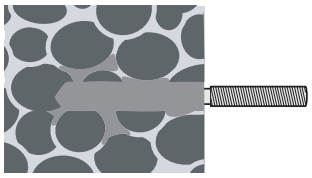
2 Clean the drilled hole thoroughly



3 Insert the mixer into the drilled hole and while the mixer is slowly retracted fill the hole completely with mortar

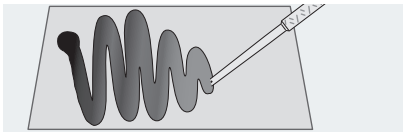


4 Insert anchor rod with a slow clockwise motion. Excess mortar should flow out in order to secure correct installation. In Leca it is very important that enough mortar is used: Anchor rod has to be completely surrounded by mortar in the entire length of the drilled hole. This means that refilling during installation will occur



5 After curing time the fixing can be loaded and the installation is finished - see curing time table on next page

NOTE:



Always use thread rods free of oil and other impurities.
Eject 10-15 cm of Injection Mortar in order to secure correct mix-ratio.
Always respect and comply with temperature dependent curing time.
Anchor rod must not be disturbed or loaded during curing time.

EXPANDET®

ESI+ and EVL+ STYRENE FREE INJECTION MORTAR

Advantages:

Expansion free.
Applicable close to free edge - and with small spacing.
It is not necessary to use the whole cartridge in one operation.

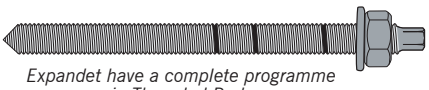
Materials:

ESI+ Expandet Styrene Free Injection Mortar is a two-component hybrid mortar – supplied in 300 and 345 ml cartridges (300 ml. cartridges can be used with normal silicone gun).

EVL+ winter injection mortar, supplied in 300 ml cartriges and can be used in brickwork with a temperarure down to -10°C

Accessories:

Blow Out Bulp.
Brush.
Threaded rods/- bolts.
Sleeve, plastic or metal.
Socket Anchor with internal thread.
Injection gun for 300, 380 and 825 ml.



Expandet have a complete programme in Threaded Rods

ESI+ and EVL+ in Aerated Concrete (PP2)

Type	Dim.	Fixing							Load Capacities	
	d	d_0	h_1	h_{nom}		h_{min}	S_{min}	C_{min}	N_{Rd}	V_{Rd}
Threaded Rods	Threaded Rod diameter mm	Drill hole diameter mm	Depth of drilled hole (Min.) mm	Embedment depth (Min.) mm	Approx. filling quantity per hole ml	Thickness of concrete member, min. mm	Minimum allowable spacing mm	Minimum allowable edge distance mm	**Design resistance** tension kN◆	**Design resistance** shear kN◆
	M 8	10	80	80	3,0	100	80	100	0,78	0,67
	M10	12	90	90	4,4	110	100	100	1,04	0,77
	M12	14	110	110	6,7	130	100	100	1,15	0,89

◆ Design resistance is valid for a single anchor not influenced by edge distance and / or spacing in aerated concrete PP2:
Density 375 kg/m³ with a compressive strength of 2 N/mm².

Partial safety factor for material (γ_m) is included. Partial safety factor for actions (γ_f) must be applied according to national building code.

If no guidance for γ_f exists Expandet recommend a partial safety factor for actions of minimum 1,5. 1 kN ≈ 100 kg.

Combined resistance shall be verified if both tension and shear actions are applied: $\left(\frac{N_{Sd}}{N_{Rd}}\right)+\left(\frac{V_{Sd}}{V_{Rd}}\right) \le 1,2$

ESI+ and EVL+ in Aerated Concrete (PP4)

Type	Dim.	Fixing							Load Capacities	
	d	d_0	h_1	h_{nom}		h_{min}	S_{min}	C_{min}	N_{Rd}	V_{Rd}
Threaded Rods	Threaded Rod diameter mm	Drill hole diameter mm	Depth of drilled hole (Min.) mm	Embedment depth (Min.) mm	Approx. filling quantity per hole ml	Thickness of concrete member, min. mm	Minimum allowable spacing mm	Minimum allowable edge distance mm	**Design resistance** tension kN◆	**Design resistance** shear kN◆
	M 8	10	80	80	3,0	100	80	100	0,93	1,05
	M10	12	80	80	3,9	100	100	100	1,07	1,08
	M12	14	80	80	4,9	100	100	100	1,09	1,09

◆ Design resistance is valid for a single anchor not influenced by edge distance and / or spacing in aerated concrete PP4:
Density 535 kg/m³ with a compressive strength of 4 N/mm².

Partial safety factor for material (γ_m) is included. Partial safety factor for actions (γ_f) must be applied according to national building code.

If no guidance for γ_f exists Expandet recommend a partial safety factor for actions of minimum 1,5. 1 kN ≈ 100 kg.

Combined resistance shall be verified if both tension and shear actions are applied: $\left(\frac{N_{Sd}}{N_{Rd}}\right)+\left(\frac{V_{Sd}}{V_{Rd}}\right) \le 1,2$

Important: See Expandet's "*Principles for fastening*" for general information on fastening as well as information on limited liability.
(Can be downloaded at www.expandet.com)

CURING TIME ESI+:

Temperature (Celcius) *	Processing time	Load time
+5 to +10°C	10 mins	145 mins
+10 to +15°C	8 mins	85 mins
+15 to +20°C	6 mins	75 mins
+20 to +25°C	5 mins	50 mins
+25 to +30°C	4 mins	40 mins

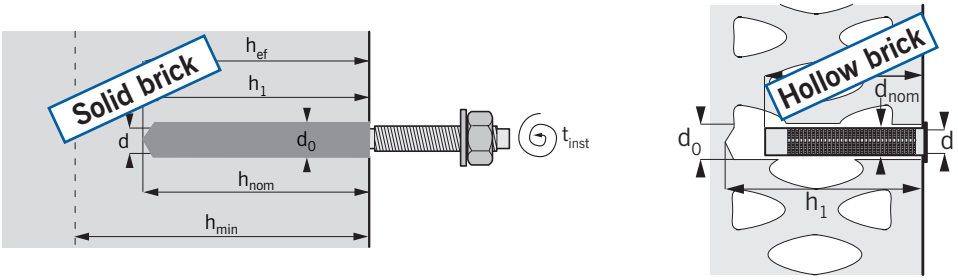
* Concrete temperature
Processing time refers to the highest temperature in the range.
Load time refers to the lowest temperature in the range.
Cartridges temperature (storage and installation): +5°C

CURING TIME EVL+ (WINTER):

Temperature (Celcius) *	Processing time	Load time
-11 to -20°C	50 mins	24 hour
-10 to -5°C	50 mins	12 hour
-5 to 0°C	15 mins	100 mins
0 to +5°C	10 mins	75 mins
+5 to +20°C	5 mins	50 mins
+20°C	100 sec	20 mins

* Concrete temperature
Processing time refers to the highest temperature in the range.
Load time refers to the lowest temperature in the range.
Cartridges temperature (storage and installation): +0°C

ESI+ and EVL+ STYRENE FREE INJECTION MORTAR



ESI+ and EVL+ in Solid Brick (minimum 15 N/mm²)

Type	Dim.	Fixing							Load Capacities	
	d	d_0	h_1	h_{nom}		T_{inst}	S_{min}	C_{min}	N_{Rd}	V_{Rd}
Threaded Rods	Threaded Rod diameter mm	Drill hole diameter mm	Depth of drilled hole (Min.) mm	Embedment depth (Min.) mm	Approx. filling quantity per hole ml	Required setting torque Nm	Minimum spacing mm	Minimum edge distance mm	**Design resistance** tension kN◆	**Design resistance** Shear kN◆
	M 8	10	90	90	3,4	7,5	See fig. 1	See fig. 1	2,6	2,5
	M10	12	90	90	4,4	10,0	See fig. 1	See fig. 1	3,0	3,0
	M12	14	90	90	5,5	12,5	See fig. 1	See fig. 1	3,5	3,5
	M16	18	90	90	7,6	20,0	See fig. 1	See fig. 1	3,5	4,0

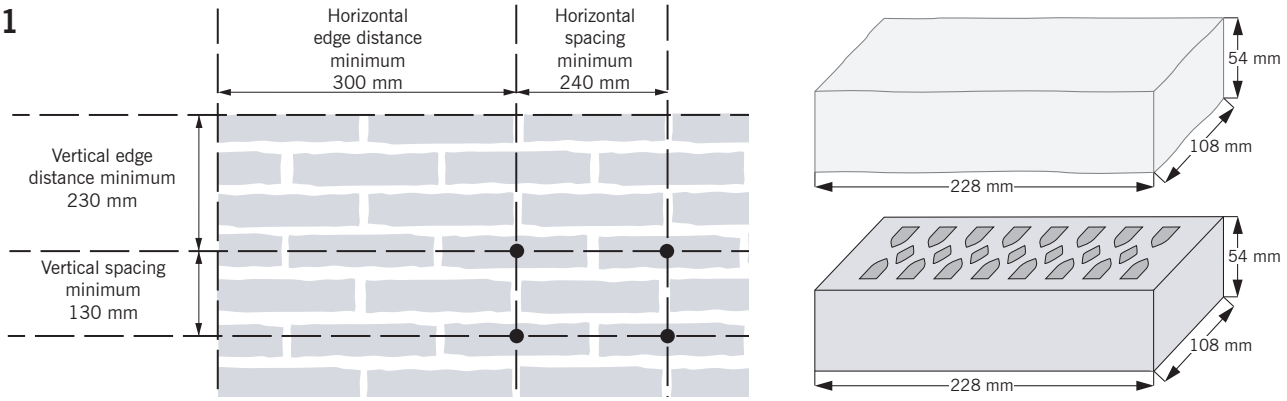
◆ Design resistance is valid for a single anchor not influenced by edge distance and / or spacing in solid brick with a minimum compressive strength of 15 N/mm². Only actual tests can define load capacity for a specific brick. Thus above load capacities are only for guidance. Further it is important to ensure that the brick wall can absorb the loads applied.

Combined resistance shall be verified if both tension and shear actions are applied: $\left(\frac{N_{Sd}}{N_{Rd}}\right)+\left(\frac{V_{Sd}}{V_{Rd}}\right) \le 1{,}2$

Partial safety factor for material (γ_m) is included. Partial safety factor for actions (γ_f) must be applied according to national building code.

If no guidance for γ_f exists Expandet recommend a partial safety factor for actions of minimum 1,5. 1 kN ≈ 100 kg.

Fig. 1



In solid and hollow brickwork it is the quality (primarily the compressive strength of brick and the quality of the mortar) of the brickwork that determins the load capacity. The load capacities stated in 326 are valid for bricks with the minimum dimensions 228 x 108 x 54 mm together with good quality mortar (class M2,5) where both horizontal and vertical joints are completely filled.

ESI+ and EVL+ in Hollow Brick (minimum 22 N/mm²)

Type	Dim.	Fixing								Load Capacities	
	d		d_0	h_1	h_{nom}	T_{inst}	S_{min}	C_{min}		N_{Rd}	V_{Rd}
Threaded Rods	Threaded Rod diameter mm	Sleeve dimension mm	Drill hole diameter mm	Depth of drilled hole (Min.) mm	Embedment depth (Min.) mm	Required setting torque Nm	Minimum spacing mm	Minimum edge distance mm		**Design resistance** tension kN◆	**Design resistance** Shear kN◆
	M 8	12 x 50	12	55	50	5,0	See fig. 1	See fig. 1		1,6	1,8
	M10	16 x 85	16	90	85	8,0	See fig. 1	See fig. 1		2,0	2,5
	M12	16 x 85	16	140	85	10,0	See fig. 1	See fig. 1		2,3	3,0
	M16	20 x 85	20	90	85	12,0	See fig. 1	See fig. 1		3,2	3,8

◆ Design resistance is valid for a single anchor not influenced by edge distance and / or spacing in hollow brick with a minimum compressive strength of 22 N/mm². Only actual tests can define load capacity for a specific brick. Thus above load capacities are only for guidance. Further it is important to ensured that the brick wall can absorb the loads applied.

Combined resistance shall be verified if both tension and shear actions are applied: $\left(\frac{N_{Sd}}{N_{Rd}}\right)+\left(\frac{V_{Sd}}{V_{Rd}}\right) \le 1{,}2$

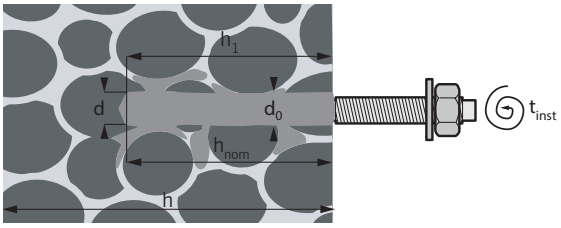
Partial safety factor for material (γ_m) is included. Partial safety factor for actions (γ_f) must be applied according to national building code.

If no guidance for γ_f exists Expandet recommend a partial safety factor for actions of minimum 1,5. 1 kN ≈ 100 kg.

Important: See Expandet's "*Principles for fastening*" for general information on fastening as well as information on limited liability.

EXPANDET®

ESI+ and EVL+ STYRENE FREE INJECTION MORTAR



ESI+ and EVL+ in Leca® (3 N/mm²)									
Type	**Dim.**	**Fixing**				**Load Capacities**			
	d	**d_0**	**h_1**	**h_{nom}**	**h_{min}**	**S_{min}**	**C_{min}**	**N_{Rd}**	**V_{Rd}**
Threaded Rods	Threaded Rod diameter mm	Drill hole diameter mm	Depth of drilled hole (Min.) mm	Embedment depth (Min.) mm	Thickness of member minimum mm	Minimum spacing mm	Minimum edge distance mm	**Design resistance** tension kN◆	**Design resistance** Shear kN◆
	M10	12	80	80	110	100	100	2,10	1,00
	M12	14	90	90	130	150	100	2,60	1,20
	M16	18	110	110	150	150	100	3,50	2,20

◆ Design resistance is valid for a single anchor not influenced by edge distance and / or spacing in Leca with a compressive strength of 3 N/mm² and a density of 600 kg/m3

Combined resistance shall be verified if both tension and shear actions are applied: $\left(\frac{N_{Sd}}{N_{Rd}}\right)+\left(\frac{V_{Sd}}{V_{Rd}}\right) \leq 1{,}2$

Partial safety factor for material (γ_m) is included. Partial safety factor for actions (γ_f) must be applied according to national building code.

If no guidance for γ_f exists Expandet recommend a partial safety factor for actions of minimum 1,5.

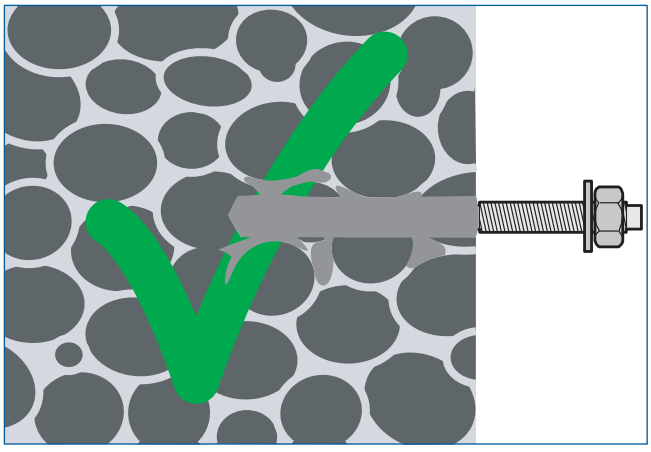
1 kN ≈ 100 kg.

Important: See Expandet's "*Principles for fastening*" for general information on fastening as well as information on limited liability.

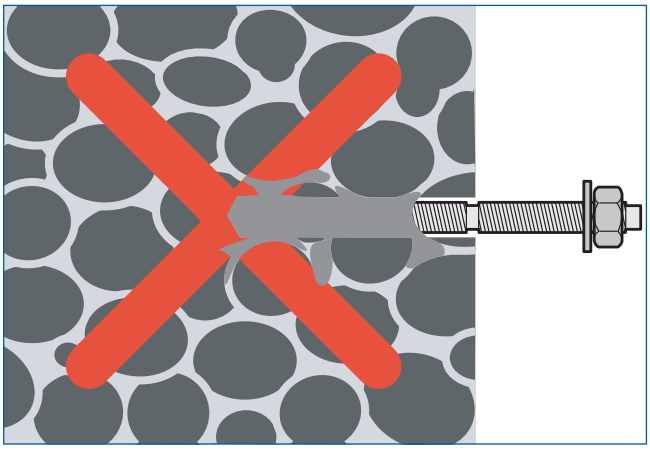
Installation:

Installation of anchor rods in Leca must be carried out so that the mortar completely encircles the anchor rod. Due to the structure of Leca this means that refilling of the holes will occur during installation.

Installation is only correct when excess mortar comes out of the hole in the entire circumference of the anchor rod.

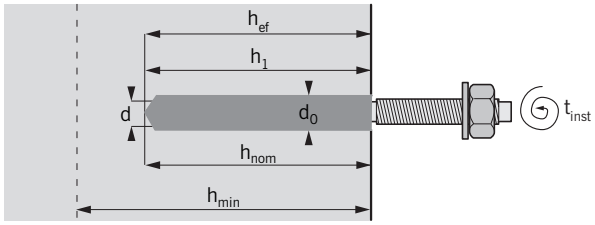


Correct installation



Incorrect installation

ESI+ and EVL+ STYRENE FREE INJECTION MORTAR



Lightweight Aggregate Concrete (LAC) 10/1550

Type	Dim.	Fixing						Load Capacities	
	d	d_0	h_1	h_{nom}	h_{min}	S_{min}	C_{min}	LAC 10/1550	
Threaded Rods	Threaded Rod diameter mm	Drill hole diameter mm	Depth of drilled hole (Min.) mm	Embedment depth (Min.) mm	Thickness of concrete member mm	Minimun allowable spacing mm	Minimum allowable edge distance mm	**Desing resistance** tension kN ($N_{Rd,d}$)[1]	**Design resistance** Shear kN ($V_{Rd,d}$)[2]
M8	8	10	70	70	100	210[3]	50	3,1	3,0
M10	10	12	70	70	100	210[3]	50	4,8	3,0
M12	12	14	70	70	100	210[3]	50	5,6	3,0

1) Design resistance is valid for a single anchor with 50 mm edge distance and is based on test performed with 100mm LAC elements.
The tests are performed in the side og the elements with 50 mm edge distance to both sides.
Load capacities are not valid for fixing where the third (corner) edge distande is < 150 mm
2) Design resistance for share is valid for a single anchor with 210 mm spacing distance.
Load capacities are valid in both directions, against and along the edge.
3) If the anchor is influenced by tension load only, the spacing distance can be reduced to 150 mmm.

Combined resistance shall be verified if both tension and shear actions are applied: $\left(\frac{N_{Sd}}{N_{Rd}}\right)+\left(\frac{V_{Sd}}{V_{Rd}}\right) \leq 1{,}2$

Lightweight Aggregate Concrete (LAC) 15/1850

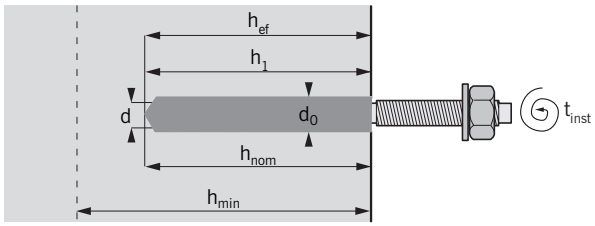
Type	Dim.	Fixing						Load Capacities	
	d	d_0	h_1	h_{nom}	h_{min}	S_{min}	C_{min}	LAC 15/1850	
Threaded Rods	Threaded Rod diameter mm	Drill hole diameter mm	Depth of drilled hole (Min.) mm	Embedment depth (Min.) mm	Thickness of concrete member mm	Minimun allowable spacing mm	Minimum allowable edge dis-tancemm	**Desing resistance** tension kN ($N_{Rd,d}$)[1]	**Design resistance** Shear kN ($V_{Rd,d}$)[2]
M8	8	10	70	70	100	210[3]	50	3,6	3,2
M10	10	12	70	70	100	210[3]	50	5,2	3,2
M12	12	14	70	70	100	210[3]	50	5,8	3,2

1) Design resistance is valid for a single anchor with 50 mm edge distance and is based on test performed with 100mm LAC elements.
The tests are performed in the side og the elements with 50 mm edge distance to both sides.
Load capacities are not valid for fixing where the third (corner) edge distande is < 150 mm
2) Design resistance for share is valid for a single anchor with 210 mm spacing distance.
Load capacities are valid in both directions, against and along the edge.
3) If the anchor is influenced by tension load only, the spacing distance can be reduced to 150 mmm.

Combined resistance shall be verified if both tension and shear actions are applied: $\left(\frac{N_{Sd}}{N_{Rd}}\right)+\left(\frac{V_{Sd}}{V_{Rd}}\right) \leq 1{,}2$

EXPANDET®

ESI+ and EVL+ STYRENE FREE INJECTION MORTAR

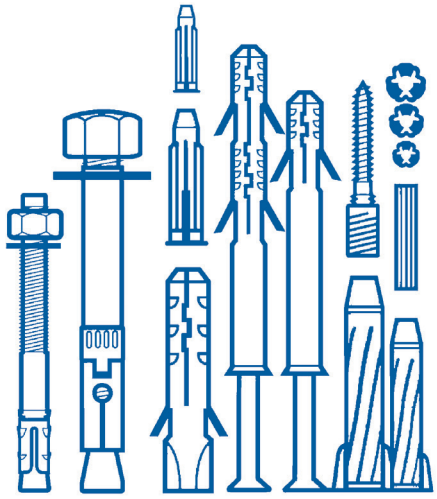


Solid Sand-Lime Brick/Block										
Type	**Dim.**	**Fixing**							**Load Capacities**	
	d	**d_0**	**h_1**	**h_{nom}**	**h_{min}**	**S_{min}**		**C_{min}**	**LAC 10/1550**	
Threaded Rods	Threaded Rod diameter mm	Drill hole diameter mm	Depth of drilled hole (Min.) mm	Embedment depth (Min.) mm	Thickness of concrete member mm	Minimum allowable spacing mm	Minimum spacing to third edge mm	Minimum allowable edge distance mm	**Design resistance** tension kN ($N_{Rd,d}$)[1]	**Design resistance** Shear kN ($V_{Rd,d}$)[2]
M8	8	10	80	80	100	210[3]	320	50	3,1	2,0
M10	10	12	80	80	100	210[3]	320	50	5,3	2,6
M12	12	14	80	80	100	210[3]	320	50	5,3	2,6

1) Design resistance is valid for a single anchor with 50 mm edge distance and is based on test performed with 100mm elements.
The tests are performed in the side og the elements with 50 mm edge distance to both sides.
Load capacities are not valid for fixing where the third (corner) edge distande is < 320 mm
2) Design resistance for shear load is valid for a single anchor with 210 mm spacing distance.
Load capacities are valid in both directions, against and along the edge.
3) If the anchor is influenced by tension load only, the spacing distance can be reduced to 150 mmm

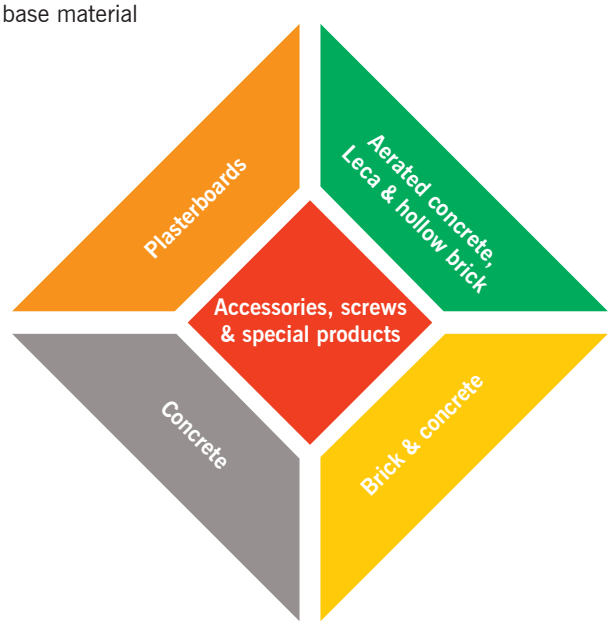
Combined resistance shall be verified if both tension and shear actions are applied: $\left(\frac{N_{Sd}}{N_{Rd}}\right)+\left(\frac{V_{Sd}}{V_{Rd}}\right) \leq 1{,}2$

EXPANDET SCREW ANCHORS A/S



Expandet Screw Anchors A/S was established in 1955 and was pioneers in the field of fastener products for concrete and brickwork - being the first company to patent a fastener made in plastic. We are devoted to a constant development of our product range, which now covers the entire range of anchors and fasteners for both professional and DIY.

We have - with our base-material orientated colour code system - made it easy to choose the right anchor for the right base material



EXPANDET CALCULATION SOFTWARE

Expandet Calculation Software offers the possibility for design of single anchors and anchors groups in concrete according to ETAG 001, Annex C with our range of products that are defined according to CC Method. This includes our range of anchor systems approved for structural connections with CE-marking.

TERMINOLOGY

Code	Unit	Definition
d	Mx	Bolt diameter
d_{nom}	mm	Outside diameter of anchor
L	mm	Anchor length
L_{bolt}	mm	Bolt / screw length
L_{thread}	mm	Length of metric thread
L_{th}	mm	Available internal thread length
L_{sdmin}	mm	Minimum screw in depth
d_o	mm	Drill hole diameter
h_1	mm	Depth of drilled hole
h_{nom}	mm	Anchor embedment depth
h_{ef}	mm	Effective anchorage depth
h	mm	Thickness of member (concrete, brickwall etc.)
h_{min}	mm	Minimum thickness of member
h_f	mm	Minimum cavity behind wall
t_{fix}	mm	Thickness of fixture
$b_{fix1; 2}$	mm	Witdt of fixture: b_{fix1} (direction 1) & b_{fix2} (direction 2)
T_{inst}	Nm	Required setting touque
S	mm	Spacing between anchors in an anchorgroup
S_1; S_2	mm	Spacing between anchors in an anchorgroup: S_1 (direction 1) & S_2 (direction 2)
$S_{cr, N}$	mm	Characteristic spacing for ensuring the transmission of the characteristic resistance of a single anchor in case of concrete cone failure
$S_{cr, sp}$	mm	Characteristic spacing for ensuring the transmission of the characteristic resistance of a single anchor in case of splitting failure
S_{rec}	mm	Recommended spacing (for full resistance)
S_{min}	mm	Minimum allowable spacing
S_{cr}	mm	Characteristic spacing at a defined edge distance
C	mm	Edge distance
C_1;C_2	mm	Edge distance fra anchor to edge: C_1 (direction 1) & C_2 (direction 2)
$C_{cr, N}$	mm	Characteristic edge distance for ensuring the transmission of the characteristic resistance of a single anchor in case of concrete cone failure
$C_{cr, sp}$	mm	Characteristic edge distance for ensuring the transmission of the characteristic resistance of a single anchor in case of splitting failure
C_{rec}	mm	Recommended edge distance (for full resistance)
C_{min}	mm	Minimum allowable edge distance
C_{cr}	mm	Characteristic edge distance at a difined spacing
N_{Rd}	kN	Design resistance, tension
$N_{Rd, s}$	kN	Design resistance, tension (steel failure)
$N_{Rd, p}$	kN	Design resistance, tension (pull out failure)
$N_{Rd, c}$	kN	Design resistance, tension (concrete cone failure)
$N_{Rd, sp}$	kN	Design resistance, tension (splitting failure)
V_{Rd}	kN	Design resistance, shear
$V_{Rd, s}$	kN	Design resistance, shear (steel failure)
$V_{Rd, c}$	kN	Design resistance, shear (concrete pryout failure, concrete edge failure)
F_{Rd}	kN	Design resistance, independent of load directioin
M_{Rd}	Nm	Design resistance, bending moment
γ_M		Partial safety factor for material
γ_{Ms}		Partial safety factor for material, steel failure
γ_{Mp}		Partial safety factor for material, pull out failure
γ_{Mc}		Partial safety factor for material, concrete cone failure
γ_{Msp}		Partial safety factor for material, splitting failure
N_{Sd}	kN	Design value of tensile actions acting on a single anchor or the fixture of an anchor group
V_{Sd}	kN	Design value of shear actions acting on a single anchor or the fixture of an anchor group
γ_f		Partial safety factor for actions
N_{rec}	kN	Maximum recommended tension load
V_{rec}	kN	Maximum recommended shear load
F_{rec}	kN	Maximum recommended load, independent of load direction
f_{ck}	N/mm²	Characteristic concrete compression strength messured on cylinders
$f_{ck, cube}$	N/mm²	Characteristic concrete compression strength messured on cubes
F_{yk}	N/mm²	Characteristic steel yield strength
F_{uk}	N/mm²	Characteristic steel ultimate tensile strength