

HAZ METAL FIXING SYSTEMS

Your Fixing Systems Specialist



Anchor Bolts
Technical Product Catalogue
HAZ-AB-EN/04.15





White Square Office Centre, Moscow



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Company Profile

Introduction

Haz Metal A.S. is located in Iskenderun, in the southern part of Turkey, covering an area of 17.000 M .

The company provides services in the design and production of stainless steel fixing systems for facade claddings, channel systems, brick support systems and a variety of products used in construction.

The company mission statement is to assist and advise its clients in choosing the most suitable fixing systems for their requirements and to provide them with quality production and supply in accordance with customer requirements.

The innovative design and production techniques offer practical and economic solutions to solve every possible problem within the scope of fixing applications in construction.

As a supplier of fixing systems to major projects around the world, Haz Metal has proven its quality and reliability to its clients. The company enjoys serving the sector and works hard to constantly improve and develop its services.

HAZ Metal is a ISO 9001:2008 certified company and has adopted the total quality management systems in its day to day operations. Products are being tested in its own in house laboratory.

With this set up quality assurance is guaranteed for the products supplied to the construction industry.

Expansion bolt production

Haz Metal has been producing expansion bolts since 1993. Since then there has been advances in the production methods and engineering know how of anchor bolts.

Throughout the years the production methods has been developed, improving quality and output. Haz Metal today implements modern technology in the production of expansion bolts.

The factory is equipped with a Hydromat-automatic head transfer machine, cold forging machines, threading machines, lathe turning machines, automatic part former machine and clips presses.

There is also an in house electro galvanizing pool where the 5-12 microns thick zinc coating on mild steel is made. Hot dip galvanizing is made in qualified outside sources.

The presence of a work shop with the capability of preparing and maintaining the required moulding and tooling, provides flexible production.

The production is strictly controlled with periodic testing of both raw materials and finished products in order to sustain the performance of Haz products and to fulfil the safety requirements for use in the construction industry.

Company Profile

Production Capacity

Haz Metal production unit for expansion bolts is equipped with machinery to produce more than 100 tons of bolts per month. The production of all items are produced in the company.

Both turning and cold forging methods are used in production. Aside from the production of standard items, the production of special items are also made to suit special application requirements.

Quality Standards

Maintaining high level of quality is the most essential task of the company. Haz Metal implements DIN, BS and ASTM standards in the production of expansion bolts. Production is strictly controlled within the tolerances of these standards.

All products are produced by its personnel, applying the latest production methods with modern machinery.

The quality control team, under the supervision of a mechanical engineer, is selected from long serving and experienced foremen.

Production is checked during each production step and are compared with detailed manufacturing drawings and specifications.

The company is strictly bound to the concept of ISO 9001:2000 and "Total Quality Management".

The application of this management system is maintained and is a part of day to day operations.

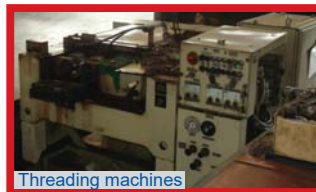
Technical Know-How

Haz Metal's technical staff, with more than 10 years experience, has an outstanding technical knowledge in the field of stainless steel production.

The maintenance of the machines and the preparation of moulds for production are made in the companies work shop.

This enables flexible and economic production that increases quality of service with competitive costs.

Haz Metal Expansion Bolts Production

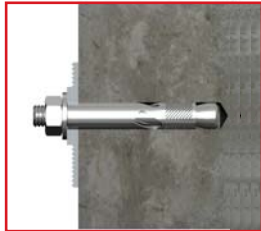


Introduction

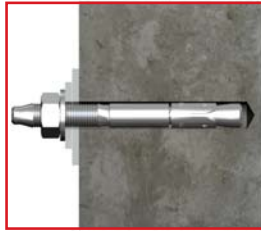
Anchor Bolts

There are many types of expansion bolts available for use to fix anchors on to different types of walls. Expansion bolts are all tested to meet the pull out force and shear force performance criteria.

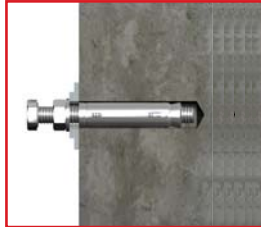
HB01
Sleeve Bolt



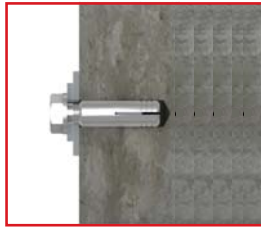
HB03
Through Bolt



HB05
Shell Bolt



HB06
Drop in Bolt



HB07
Chemical Anchor Bolt



HB09
Haz Super



HB01 Sleeve Bolt

The HB01 Sleeve bolt is used for all types of fixings attached on to concrete walls or filled block work walls. The bolts are hammered into the drilled holes and the anchors are fixed by torquing the nut on the bolt. Good anchorage is achieved through the expansion of the sleeve through out the drilled hole.

HB03 Through Bolt

The HB03 Through bolt is used for all types of fixings attached to concrete walls with a minimum C20/25 quality. The bolts are hammered into the drilled hole and fixing is done by torquing the nut. Final torque is achieved fast because the ring on the bolts is optimized to expand quickly. Safe fixture is made by the ring gripping firmly in the drilled hole.

HB05 Shell Bolt

The HB05 shell bolt is used for fixings made on to concrete walls or filled and reinforced masonry walls. The shell is hammered into the concrete first until fully inserted. The torque is achieved using the hex bolt. As the torquing is made the shell is expanded firmly gripping the area around the drilled hole.

HB06 Drop in Bolt

The HB06 drop in bolt is used for fixing pipes, false ceilings etc. on to concrete walls. This bolt is installed in two stages. First the shell is hammered into the drilled hole with a hand tool, then the fixing is made with a hex bolt. Shells expands in the concrete hole as the pin opens the shell after setting process which firmly grips the area around the drill hole. Fixture is made by a hex bolt in to the shell which is anchored into the substrate.

HB07 Chemical Bolt

The HB07 chemical bolt is used for fixing steel construction elements on to hollow block work and hollow masonry walls as well as concrete walls. Chemical capsules or epoxy acrylate tubes is inserted or injected in to the drilled holes and the bolts are set in to the holes. Anchors are fastened after the adhesive has cured.

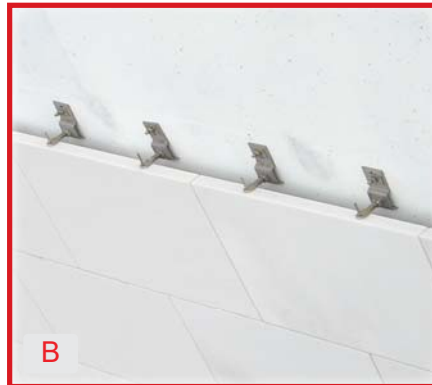
HB09 Haz Super

The HB09 HAZ Super bolt is used for fixing anchors onto the rear side of stone slabs. The bolts are hammered in to the drilled hole gently and then torquing is done expanding the serrated washers inside the hole. The serrated washers create a firm grip in side the drilled hole. This system is an economic and easy to use method which does not require the use of special drilling tools and expensive work stations.

Anchor Bolts - Introduction



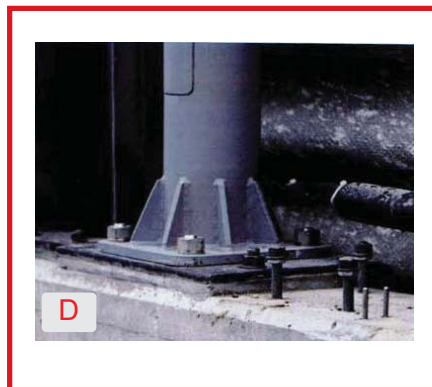
A



B



C



D



E

Expansion bolts are used through out construction for many connections made on to load bearing structures.

Some examples are shown on this page with explanations below:

A: Fixing of anchors on to filled block work walls using HB05 shell bolts.

B: Fixing of natural stone on to concrete walls with HB03 through bolts..

C: Fixing of channels with channel supports and channel restraints on to concrete wall with HB03 through bolts.

D: Fixing of steel post on concrete base floor with HB07 chemical bolts.

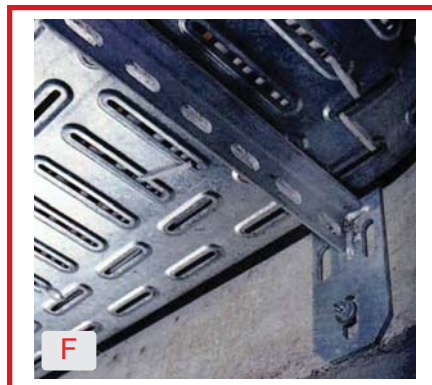
E: Fixing of steel substructure on to concrete floor using HB03 through bolts .

F: Fixing of brackets on to concrete beam using HB01 sleeve bolts.

G: Fixing of shelf racks on to concrete floor using HB03 through bolts.

H: Fixing of pipes on to concrete ceiling with HB06 drop in bolts.

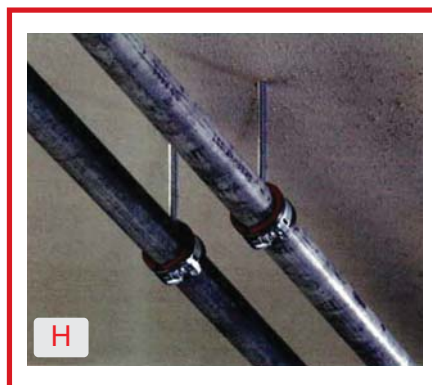
I: Fixing of ladder on to concrete wall HB01 sleeve bolts.



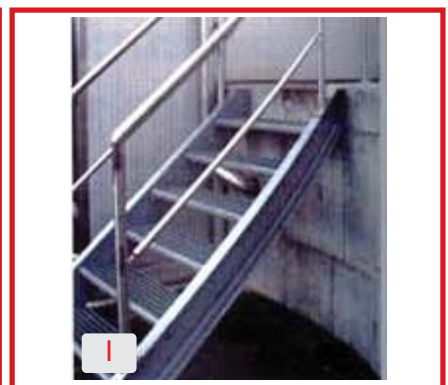
F



G



H



I

Expansion Bolts - Technical Overview

Installation:

To achieve optimum performance values it is essential that all bolts are installed correctly as shown on the installation instructions. Basic points are listed below:

- i) Drill correct diameter hole to the correct depth.
- ii) Clean hole thoroughly.
- iii) Use the correct setting sizes.
- iv) Tighten to the recommended torque using a torque wrench.
- v) Take into consideration the safe edge distances.
- vi) Use adequate washers to establish enough clamping force on the fixture.

Drilling: Drilling must be made using appropriate tools and diamond drills. The drill bits must correspond to the correct size of the required drilling diameter and embedment length of the bolts technical specifications. Drilling must be done correctly and not by wobbling or vibrating as the hole diameter must not be larger than the diameter size of the drill bit.

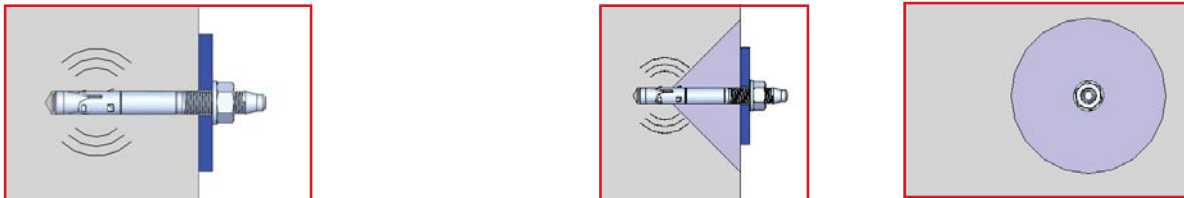
Cleaning of the hole: When holes on the load bearing walls are drilled with diamond drill bits, special care is required to clean the holes thoroughly. The holes must be brushed and blown out to leave the hole free from dust.

Setting the bolt correctly: When installing, the bolt must be set into the hole as depicted on the technical details as this will ensure the optimum performance of the bolt.



Torque sizes:

Torque controlled expansion exerts clamping force to the base material through the fixture. Clamping force is directly proportional to tightening torque. Tightening the bolt enables expansion to surround the hole 360 degrees to provide secure fixing. Tightening in accordance to the recommended torque sizes ensures a clamping force which is greater than the working loads. The tightening must not exceed the torque size as this will over stress the bolt and the base material which may result in bolt failure. Adjustable torque wrenches of the break back type are recommended for setting fixings.

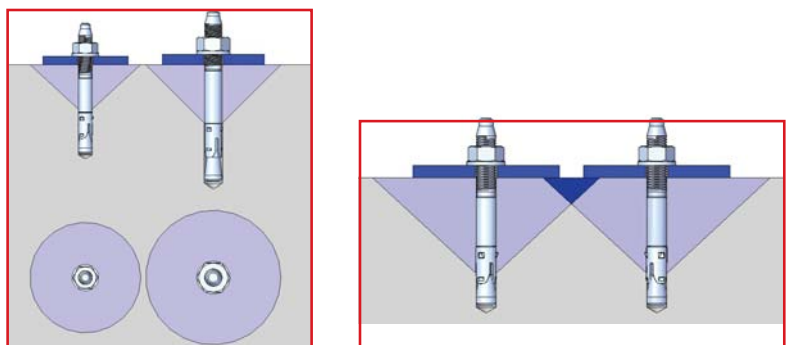


Safe edge and spacing distances:

Torque controlled bolts transmit expansion forces by locally compressing the base material. The forces are exerted at the point of expansion not over the whole length of the fixing. On applying the load to the bolt, additional forces are exerted around the concrete cone. It is this projected area which relates to the performance of the bolt. Thus this area must not be interfered with base material edge or another bolt fixing and its projected area. As the embedment depth increases the larger the cone and the greater the performance of the bolt. There must not be any interference with base material edge or another bolt fixing and its projected area as this will decrease bolt performance and may result in base material failure. Any reduction in the projected area will result in reduced performance and should be avoided if possible. Where unavoidable the appropriate reduction factors shown for reduced spacing or edge distance should be applied to the recommended load resistance indicated for the bolt.

Use of serrated or oversized washers for slotted holes:

When fixing bolts through slotted holes it is important to ensure that there is adequate surface contact between the washer and the fixture to guarantee positive clamping force.



Anchor Bolts - Technical Overview

Base Material (Load bearing wall)

Types of base materials play an essential role when choosing the type of bolt to be used. Distinction is made between concrete, masonry and block work walls.

Concrete walls: Concrete is a base material that contains cement and gravel. The performance of expansion bolts on concrete walls depends on the compressive strength of the concrete. The most common concrete compressive strength is C20/25 which means that there is 25 N / mm² compressive strength on the concrete.

Brick walls: Brick walls are build with individual brick layer on top of each other and bonded together with mortar. Brick walls may be constructed with either hollow or solid bricks. The choice of bolts to be used largely depends on whether the bricks are hollow or solid.

Block work walls: Block work walls are build with individual blocks layer on top of each other and bonded together with mortar. Block work walls may be constructed with either hollow or solid blocks. The choice of bolts to be used largely depends on whether the blocks are hollow or solid.



Load Direction

The direction of loads applied must be taken into consideration when an appropriate bolt is to be selected.

N Pull out loads criterion $N_{ed} \leq N_{rd}$: Pullout loads are applied along the axis of the fixing. Common examples are dead loads applied on ceiling applications or wind loads on bolts used to fix brackets on to vertical surfaces. Pull out resistance is influenced by the anchorage strength of the bolt within the drilled hole.

Shear loads criterion $V_{ed} \leq V_{rd}$: Shear loads are applied at right angles to the axis of a fixing and directly against the face of the load bearing structure. Shear performance is influenced by the shear strength of the bolt material and the compressive strength of the load bearing structure.

Combined loads criterion $\frac{N_{ed}}{N_{rd}} + \frac{V_{ed}}{V_{rd}} \leq 1.2$:

Combined loads are the combination of pullout and shear loads. If the angle of combined load is within 10 degrees of pure shear or pull out load, then the safe working load for that direction maybe taken into consideration. Otherwise the applied combination load should be resolved into its pullout and shear load.

Offset loads criterion steel $\frac{M_{ed}}{M_{rd}} + \frac{V_{ed}}{V_{rd}} \leq 1.0$:

Offset loads are applied at right angles on the fixing axis but are offset from the surface. In this situation the deflection of the bolt due to bending needs to be considered as well as the shear capacity of the bolt.

Failure Types

Bolting base failure

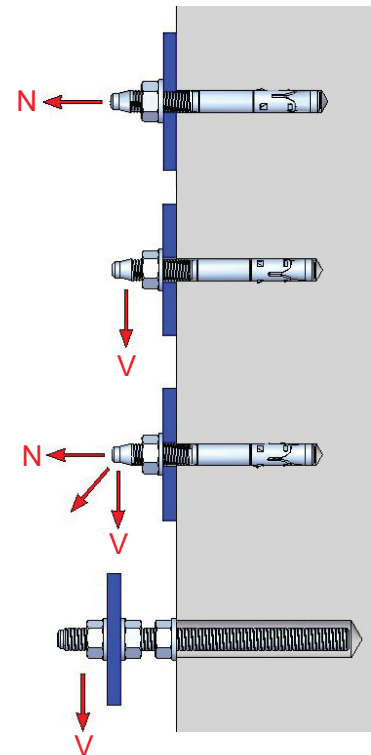
- High pull out and shear load.
- Low compressive base material.
- Low embedment length.

Disruption failure

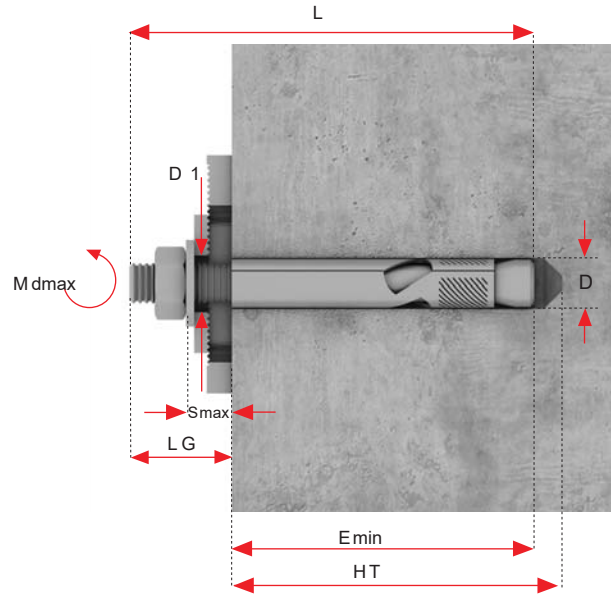
- Incorrect base material dimensioning.
- Insufficient near edge spacing.
- High thermal expansion loads.

Bolt slip failure

- Incorrect installation or heavy load.
- Failure on bolt**
- Insufficient bolt resistance.

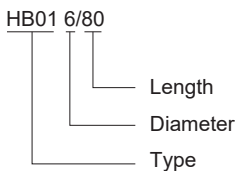


HB01 Sleeve Bolt - Technical Details



Product Code	Technical Details									
	Bolt Size	Sleeve Size	Drill Hole Diameter	Drill Length	Min. Embedment	Max Fixture Thickness	Fixture Hole Diameter	Max. Torque	Bolt Length	Thread Length
	(mm)	(mm)	D (mm)	Ht (mm)	Emin (mm)	Smax (mm)	D1 (mm)	Md max (Nm)	L (mm)	(mm)
HB01-6/80	M6x80	Ø 8x60	8	55	45	10	9	7	80	27
HB01-8/80	M8x80	Ø 10x60	10	55	45	10	11	15	80	27
HB01-10/80	M10x80	Ø 12x60	12	55	45	10	13	30	80	25
HB01-12/100	M12x100	Ø 16x78	16	75	65	10	17	45	100	30

Product Code Explanation:



Filled concrete blockwork base material values

Allowable loads (kN)					
Load direction	a degree	M6	M8	M10	M12
pull out	0	2.50	2.89	3.00	3.20
shear	90	0.84	1.04	1.24	1.40

A safety factor of 3.5 is taken for mean ultimate failure loads.

Application:

- Concrete walls.
- Filled hollow block walls.
- Solid concrete dense block 7N /mm²

Available in:

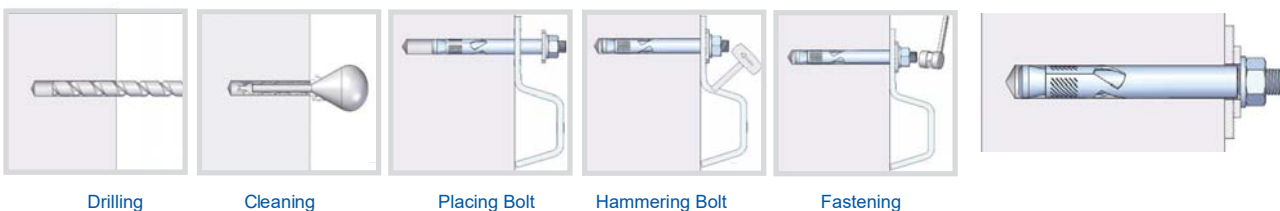
Stainless steel AISI 304 & AISI 316 and E.galvanized Mild Steel

C25/30 strength class concrete base material values (30 N/mm²)

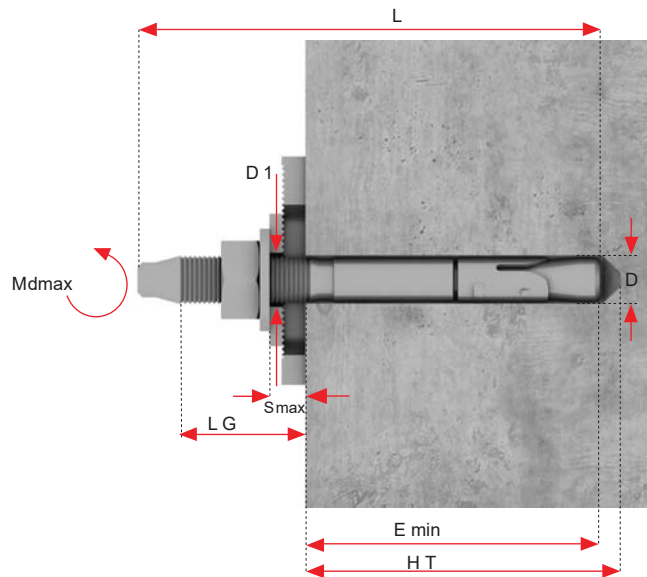
Allowable loads (kN)					
Load direction	a degree	M6	M8	M10	M12
pull out	0	4.29	6.85	7.72	8.00
shear	90	5.43	9.89	15.60	16.10

A safety factor 3.5 was taken for mean ultimate failure loads.

Fixing Instructions

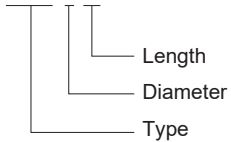


HB03 Through Bolt - Technical Details



Product Code	Technical Details								
	Bolt Size	Drill Hole Diameter	Drill Length	Min. Embedment	Max Fixture Thickness	Fixture Hole Diameter	Max. Torque	Bolt Length	Thread Length
	(mm)	D (mm)	Ht (mm)	E min (mm)	S max (mm)	D1 (mm)	Mdmax (Nm)	(mm)	(mm)
HB03 - 8/80	M8x80	8	65	47	23	9	13	80	30
HB03 - 8/100	M8x100	8	65	47	43	9	13	100	45
HB03 - 8/120	M8x120	8	65	47	63	9	13	120	65
HB03 - 10/90	M10x90	10	70	65	17	11	25	90	35
HB03 - 10/110	M10x110	10	70	65	37	11	25	110	45
HB03 - 10/130	M10x130	10	70	65	57	11	25	130	65
HB03 - 12/110	M12x110	12	95	80	15	13	40	110	35
HB03 - 12/135	M12x135	12	95	80	40	13	40	135	40
HB03 - 12/145	M12x145	12	95	80	50	13	40	145	40
HB03 - 16/125	M16x125	16	115	90	10	17	100	125	45
HB03 - 16/145	M16x145	16	115	90	30	17	100	145	45
HB03 - 16/165	M16x165	16	115	90	50	17	100	165	45

HB03 8/80



C20/25 strength class concrete based material values.

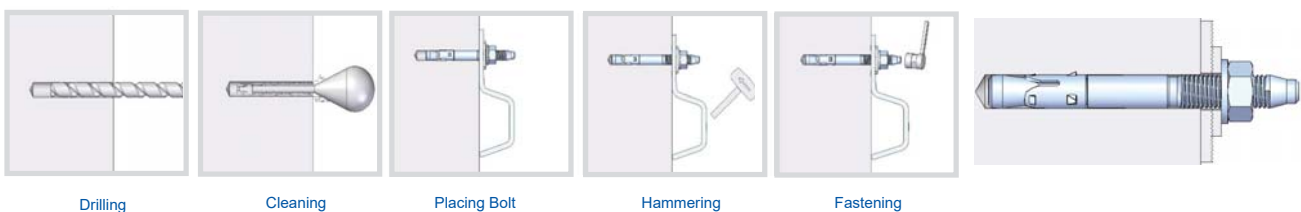
Allowable loads (kN)						
Load direction	a degree	M8	M10	M12	M16	
pull out	0	4.11	6.47	9.64	15.62	
shear	90	6.50	9.70	12.40	18.20	

A safety factor of 3.5 is taken for mean ultimate failure loads.

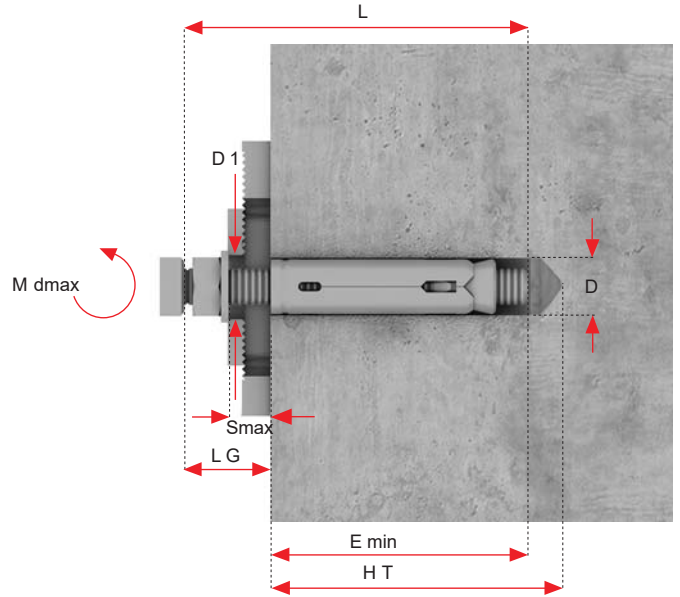
Application: For fastening fixtures to concrete walls strength class C20/25.

Available in: Stainless Steel AISI 304 & AISI 316 and E.galvanized Mild Steel

Fixing Instructions



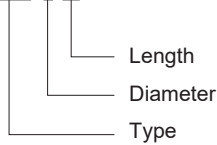
HB05 Shell Bolt - Technical Details



Product Code	Technical Details								
	Bolt Size	Shell Size	Drill Hole Diameter	Drill Length	Min. Embedment	Max. Fixture Thickness	Fixture Hole Diameter	Max. Torque	Bolt Length
	(mm)	(mm)	D (mm)	Ht (mm)	Emin (mm)	Smax (mm)	D1 (mm)	Mdmax (Nm)	(mm)
HB05-6/60	M6x60	Ø 10x39	10	65	40	5	7	10	60
HB05-6/80	M6x80	Ø 10x59	10	65	40	15	7	10	80
HB05-8/80	M8x80	Ø 12x44	12	80	45	20	9	20	80
HB05-8/100	M8x100	Ø 12x44	12	80	45	30	9	20	100
HB05-10/100	M10x100	Ø 15x50	15	90	55	30	11	40	100
HB05-12/120	M12x120	Ø 18x65	18	105	65	30	13	75	120

Product Code

HB05 6/80



Filled concrete blockwork base material values.

Allowable loads (kN)					
Load direction	a degree	M6	M8	M10	M12
pull out	0	3.50	4.10	5.20	6.05
shear	90	3.30	6.70	11.00	12.15

A safety factor of 3.5 is taken for mean failure loads.

Application on:

- Concrete walls.
- Filled hollow block walls.
- Solid concrete dense block 7N /mm

C20/25 strength concrete base material values.

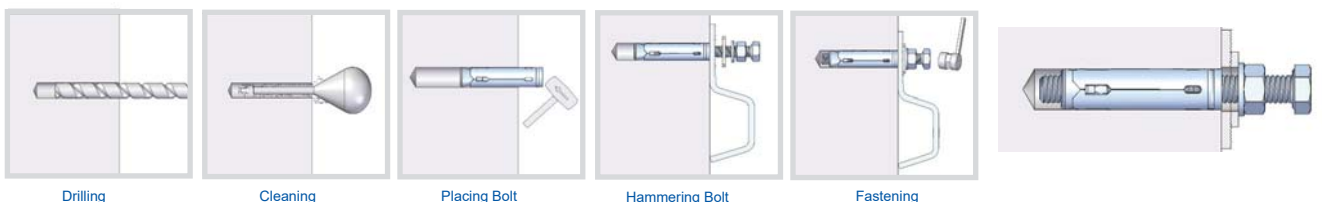
Allowable loads (KN)					
Load direction	a degree	M6	M8	M10	M12
pull out	0	4.20	6.15	9.50	11.95
shear	90	3.30	6.70	11.00	17.50

A safety factor of 3.5 is taken for mean failure loads.

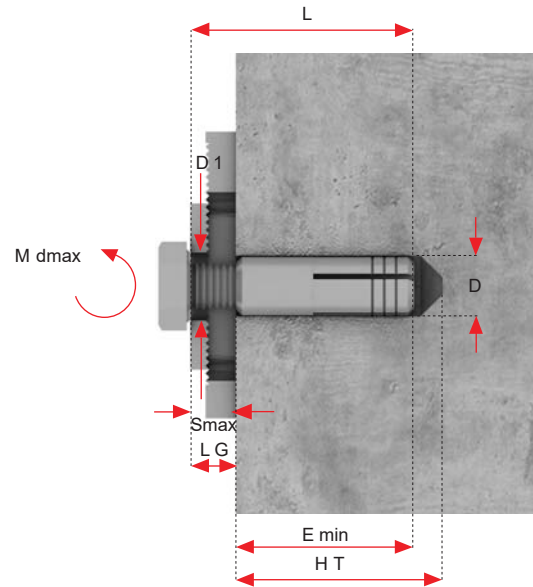
Available in:

Stainless Steel AISI 304 & AISI 316 and E.galvanized Mild Steel

Fixing Instructions

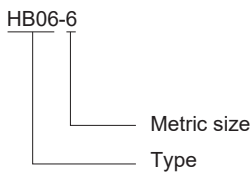


HB06 Drop in Bolt - Technical Details



Product Code	Technical Details								
	Bolt Size	Shell Size	Drill Hole Diameter	Drill Length	Min. Embedment	Max Fixture Thickness	Fixture Hole Diameter	Max. Torque	Screw in Depth Min / Max
	(mm)	(mm)	D (mm)	Ht (mm)	E min (mm)	S max (mm)	D1 (mm)	Mdmax (Nm)	Sd (mm)
HB06-6	M6x20	Ø 8x25	8	28	25	11	7	4	6/10
HB06-8	M8x25	Ø 10x30	10	33	30	13	9	8	11/17
HB06-10	M10x30	Ø 12x40	12	43	40	17	11	15	13/19
HB06-12	M12x35	Ø 14x50	14	53	50	18	13	35	15/21

Product Code



C25/30 strength class concrete base material values.

Allowable loads (kN)					
Load direction	a degree	M6	M8	M10	M12
pull out	0	2.00	3.20	4.35	6.00
shear	90	1.78	3.30	3.90	6.80

A safety factor of 3.5 has been used against mean ultimate failure loads.

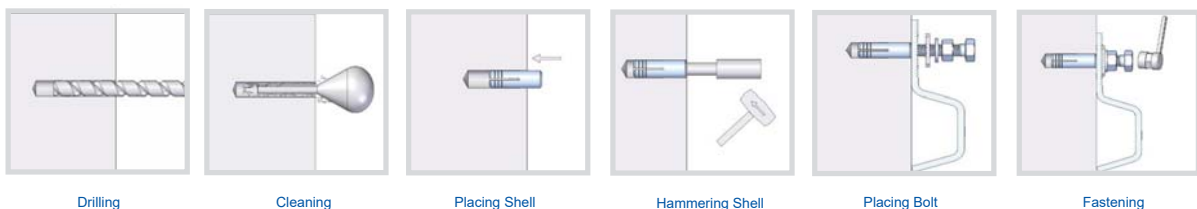
Application:

For fastening fixtures to concrete walls.

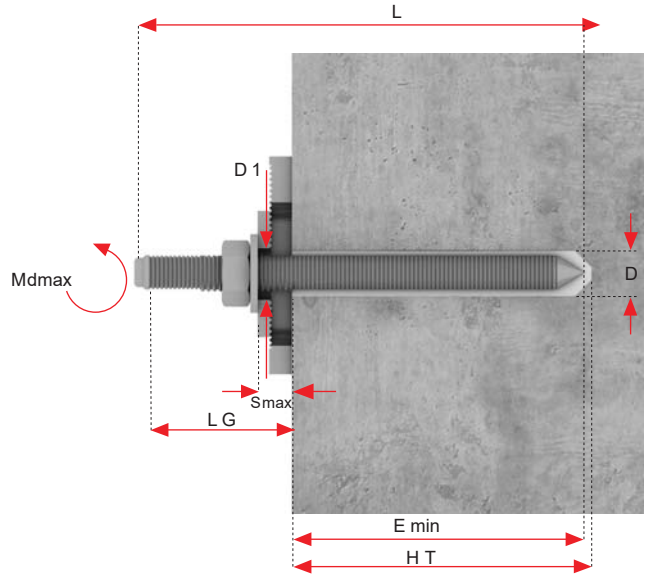
Available in;

Stainless Steel AISI 304 & AISI 316 and E.galvanized Mild Steel

Setting Tool:

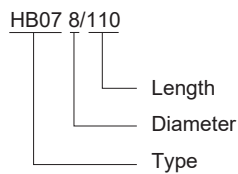


HB07 Chemical Bolt - Technical Details



Product Code	Technical Details								
	Bolt Size	Drill Hole Diameter	Drill Length	Min. Embedment	Max Fixture Thickness	Fixture Hole Diameter	Max. Torque	Bolt Length	Thread length
	(mm)	D (mm)	Ht (mm)	E min (mm)	S max (mm)	D1 (mm)	M dmax (Nm)	(mm)	(mm)
HB07-8/110	M8x110	10	82	80	14	9	7	110	23
HB07-10/130	M10x130	12	92	90	21	11	15	130	30
HB07-10/170	M10x170	12	92	90	59	11	15	170	70
HB07-12/160	M12x160	14	115	110	28	13	25	160	40
HB07-12/190	M12x190	14	115	110	60	13	25	190	70
HB07-16/190	M16x190	18	130	125	38	17	60	190	52,5
HB07-16/260	M16x260	18	130	125	108	17	60	260	135
HB07-20/240	M20x240	25	175	170	48	17	120	240	115
HB07-20/260	M20x260	25	175	170	70	24	120	260	135

Product Code



C20/25 strength class concrete base material values.

Allowable loads (kN)						
Load direction	a degree	M8	M10	M12	M16	M20
pull out	0	8,80	12,30	18,30	20,50	24,60
shear	90	10,20	15,60	22,00	23,58	26,50

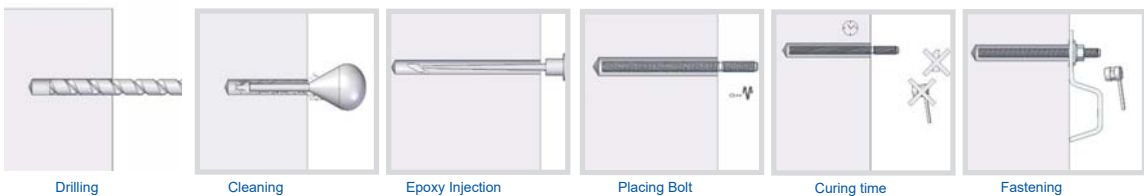
Application;

For fastening fixtures to concrete walls and filled block walls.

Available in;

Stainless Steel AISI 304 & AISI 316 and E.galvanized Mild Steel

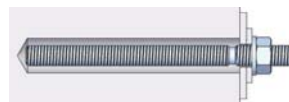
Fixing Instructions



Injection gun



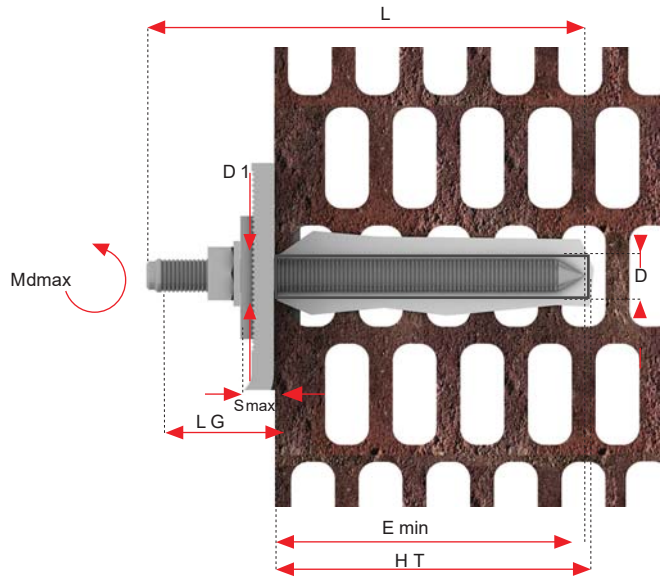
Epoxy acralyt capsule



Curing time & Temperatures

°C	cure
5	25'
10	15'
20	6'
30	4'
35	2'

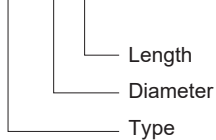
HB07-2 Chemical Bolt - Technical Details



Product Code	Technical Details								
	Bolt Size	Drill Hole Diameter	Drill Length	Min. Embedment	Max Fixture Thickness	Fixture Hole Diameter	Max. Torque	Bolt Length	Thread Length
	(mm)	D (mm)	Ht (mm)	E min (mm)	S max (mm)	D1 (mm)	Mdmax (Nm)	(mm)	(mm)
HB07-2-8/110	M8x110	10	82	80	14	9	7	110	25
HB07-2-10/130	M10x130	12	92	90	21	11	7	130	35
HB07-2-10/170	M10x170	12	92	90	59	11	15	170	75
HB07-2-12/160	M12x160	14	115	110	28	13	15	160	40
HB07-2-12/190	M12x190	14	115	110	60	13	25	190	70

Product Code

HB07-2 8/110



Hollow Masonry wall base material values.

Allowable Loads (kN)				
Load direction	a degree	M8	M10	M12
pull out	0	0.4	0.4	0.4
shear	90	1.1	1.1	1.1

A safety factor of 3.5 is taken for mean ultimate failure loads.

Application;

For fastening fixtures to hollow block and masonry walls.

Available in;

Stainless Steel AIS 304 & AISI 316 and E.galvanized Mild Steel

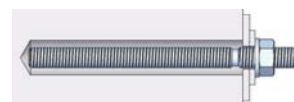
Injection gun



Epoxy acralyt capsule



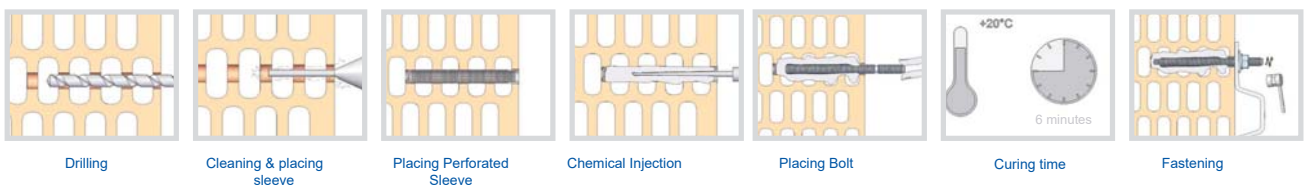
Perforated sleeve



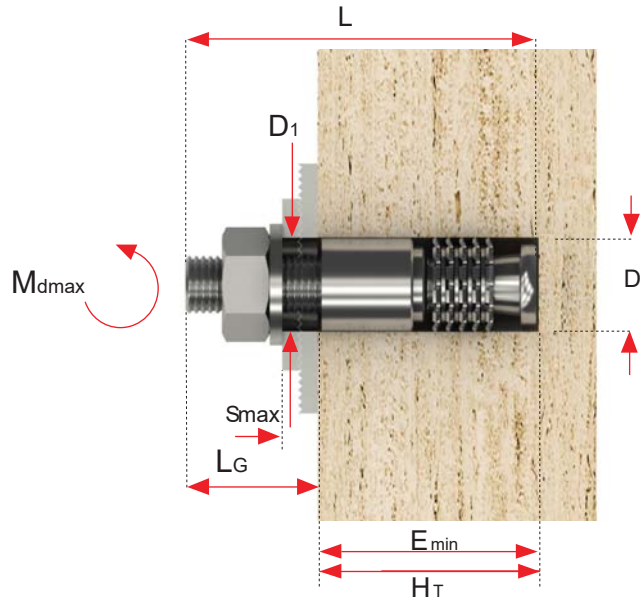
°C	cure
5°	25'
10°	15'
20°	6'
30°	4'
35°	2'

Curing Time & Temperatures

Fixing Instructions

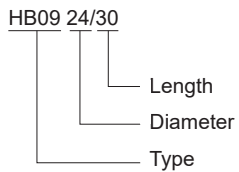


HB09 HAZ Super - Technical Details



Product Code	Technical Details									
	Bolt Size	Stone Thickness	Drill Hole Diameter	Drill Length	Min. Embedment	Max Fixture Thickness	Fixture Hole Diameter	Max. Torque	Bolt Length	Thread Length
	(mm)	St (mm)	D (mm)	Ht (mm)	E_min (mm)	S_max (mm)	D1 (mm)	M_dmax (Nm)	(mm)	(mm)
HB09-24/30	M8x30	20	12	12	12	5	9	13	30	18
HB09-48/45	M8x45	30	12	22	22	5	9	13	45	23
HB09-72/60	M8x60	40	12	32	32	5	9	13	60	28

Product Code



Application:

For fastening fixtures to natural stone

Available in:

Stainless Steel AISI 304 & AISI 316

Advantages of HB09 Haz Super Bolt

- No use of special and expensive drilling tools.
- No need of expensive drill bits.
- No stone breakage during fixation of bolt

Hard Granite based values

Mean Ultimate (KN)		
Load direction	a degree	M8
pull out	0	1,40
shear	90	3,00

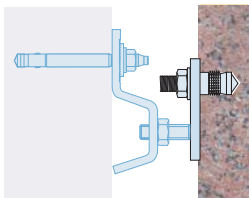
Marble based values

Working Load Resistance (KN)		
Load direction	a degree	M8
pull out	0	1,00
shear	90	2,10

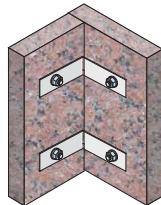
A safety factor of 2.5 is taken for mean ultimate failure loads.

Application examples:

Facade cladding



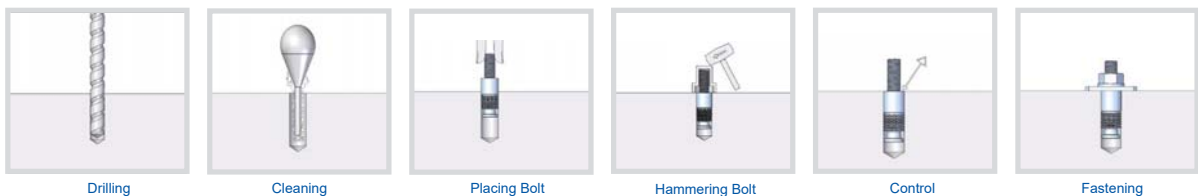
Corner Stone Fixing



Vanity Top Fixing



Fixing Instructions



Anchor Bolts Edge Reduction Factors - Standard Embedment

Edge Reduction Factors (Tension) Nrd

Bolt Size	Edge Distance (C1)								
	20	30	40	50	60	80	100	120	135
M6	0.27	0.48	0.56	0.78	1.00				
M8	0.35	0.48	0.60	0.79	0.98	1.00			
M10			0.39	0.55	0.70	0.83	1.00		
M12				0.48	0.59	0.80	0.98	1.00	
M16						0.60	0.80	0.90	1.00

Edge Reduction Factors (Shear) Vrd

Bolt Size	Edge Distance (C2)								
	20	30	40	50	60	80	100	120	135
M6	0.18	0.23	0.27	0.64	1.00				
M8	0.12	0.21	0.30	0.37	0.44	1.00			
M10			0.21	0.29	0.37	0.52	1.00		
M12					0.22	0.44	0.66	1.00	
M16						0.45	0.60	0.70	1.00

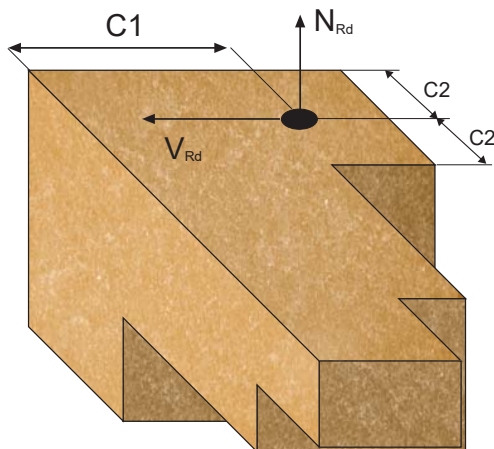
Spacing Reduction Factors (Tension) Nrd

Bolt Size	Spacing (S)								
	40	50	60	80	100	120	140	160	180
M6	0.61	0.72	0.82	1.00					
M8		0.65	0.70	0.75	1.00				
M10			0.65	0.77	0.88	0.91	1.00		
M12				0.65	0.75	0.82	0.88	1.00	
M16						0.70	0.80	0.85	1.00

Single anchor case

$$N_{rd,red} = C1 * N_{rd}$$

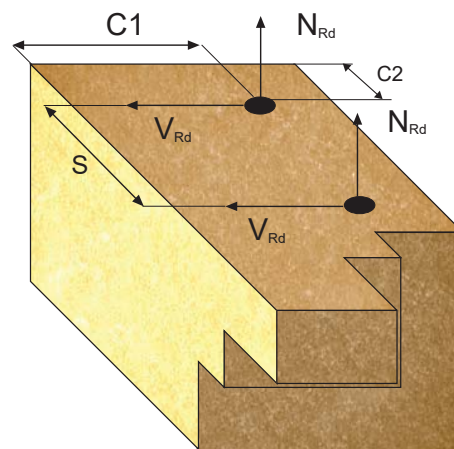
$$V_{rd,red} = C2 * V_{rd}$$



Double anchor case

$$N_{rd,red} = C1 * S * N_{rd}$$

$$V_{rd,red} = C2 * S * V_{rd}$$



Nrd: Axial design resistance.

Vrd: Shear design resistance.

Expansion Bolts Reduction Factors - Reduced Embedment

Edge Reduction Factors (Tension) N_{rd}

Bolt Size	Edge Distance (C1)							
	20	30	40	50	60	80	100	110
M6	0.58	0.75	0.88	1.00				
M8	0.42	0.66	0.89	0.95	1.00			
M10		0.53	0.59	0.65	0.77	1.00		
M12		0.38	0.46	0.53	0.62	0.81	1.00	
M16					0.45	0.60	0.80	1.00

Edge Reduction Factors (Shear) V_{rd}

Bolt Size	Edge Distance (C2)							
	20	30	40	50	60	80	100	110
M6	0.16	0.32	0.66	1.00				
M8	0.13	0.26	0.38	0.69	1.00			
M10		0.16	0.29	0.41	0.61	1.00		
M12			0.13	0.24	0.35	0.68	1.00	
M16					0.30	0.55	0.70	1.00

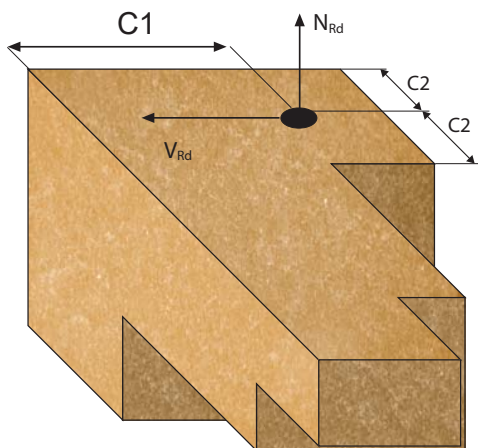
Spacing Reduction Factors (Tension) N_{rd}

Bolt Size	Spacing (S)								
	20	30	40	50	60	80	100	120	140
M6	0.56	0.58	0.60	0.80	1.00				
M8			0.65	0.71	0.77	1.00			
M10					0.65	0.77	1.00		
M12						0.65	0.67	1.00	
M16						0.50	0.80	0.70	1.00

Single anchor case

$$N_{rd.red} = C1 * N_{rd}$$

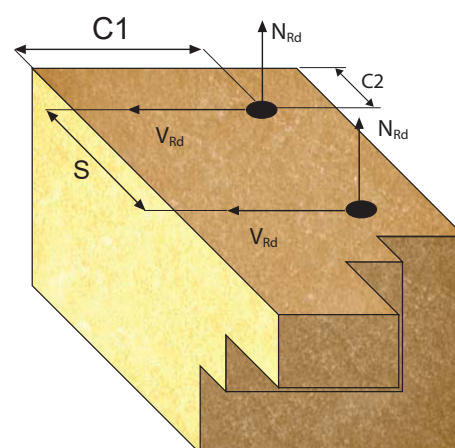
$$V_{rd.red} = C2 * V_{rd}$$



Double anchor case

$$N_{rd.red} = C1 * S * N_{rd}$$

$$V_{rd.red} = C2 * S * V_{rd}$$



N_{rd} : Axial design resistance.
 V_{rd} : Shear design resistance.

Chemical Bolt Reduction Factors

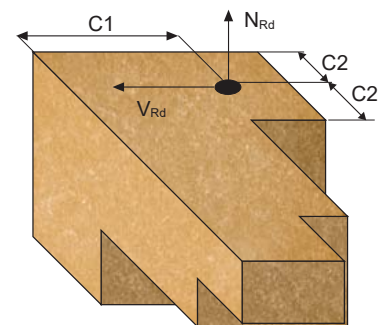
Edge Reduction Factors - (Tension) N_{Rd}

Edge Distance C (mm)	Bolt Size				
	M8	M10	M12	M16	M20
40	0.70				
50	0.74	0.72			
60	0.78	0.75	0.71		
70	0.81	0.78	0.74	0.72	
80	0.85	0.82	0.77	0.74	
90	0.89	0.85	0.80	0.77	0.71
100	0.93	0.88	0.82	0.79	0.73
120	1.00	0.95	0.88	0.84	0.76
140		1.00	0.93	0.89	0.80
170			1.00	0.96	0.85
190				1.00	0.89
220					0.94
260					1.00

Single anchor case

$$N_{rd.red} = C1 * N_{Rd}$$

$$V_{rd.red} = C2 * V_{Rd}$$



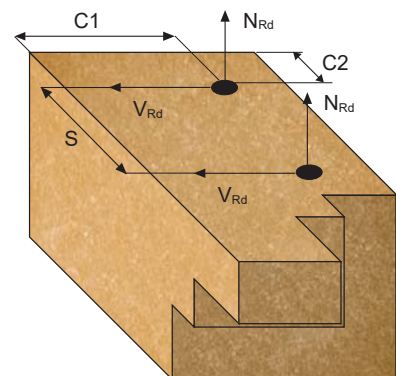
Edge Reduction Factors - (Shear) V_{Rd}

Edge Distance C (mm)	Bolt Size				
	M8	M10	M12	M16	M20
40	0.40				
50	0.50	0.44			
60	0.60	0.53	0.44		
70	0.70	0.62	0.51	0.45	
80	0.80	0.71	0.58	0.51	
90	0.90	0.80	0.65	0.58	0.42
100	1.00	0.89	0.73	0.64	0.47
120		1.00	0.87	0.77	0.56
140			1.00	0.90	0.66
170				1.00	0.80
190					0.89
220					1.00

Double anchor case

$$N_{rd.red} = C1 * S * N_{Rd}$$

$$V_{rd.red} = C2 * S * V_{Rd}$$



Spacing Reduction Factors - (Tension & Shear) N_{Rd} & V_{Rd}

Distance Between Anchors S (mm)	Bolt Size				
	M8	M10	M12	M16	M20
40	0.78				
50	0.83	0.80			
60	0.89	0.85	0.80		
70	0.94	0.90	0.84	0.80	
80	1.00	0.95	0.88	0.84	
90		1.00	0.92	0.87	
100			0.95	0.91	0.80
110			1.00	0.95	0.84
130				1.00	0.89
150					0.95
170					1.00

Embedment Reduction Factor = Actual Embedment Depth / Minimum Embedment

Eurocode Concept

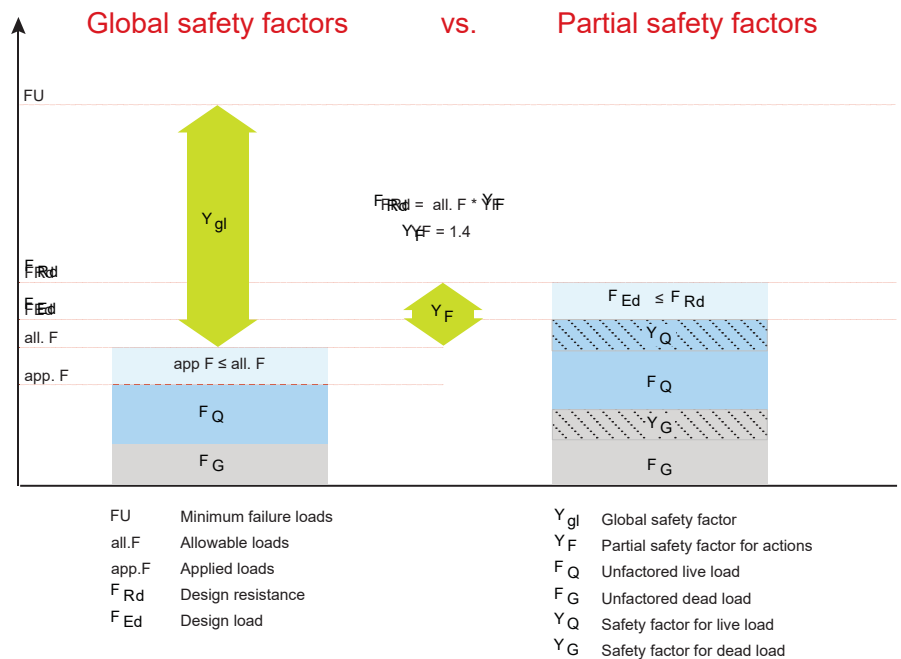
Partial vs Global Safety Factors

The new DIN 1045-1:2001-07 standard has created the bases of abandoning the Global Safety factors and is leading towards a common standard design concept in Europe.

The change from allowable loads to design resistance loads may cause confusion when selecting fixings.

When mistakes are made the choice of fixings are either 40 % over design making it uneconomical because the fixings selected are too big; or 40 % under design making it on safe because the loads applied are 40 % higher then assumed.

In order to prevent mistakes the applied loads and the resistance of fixings must be correctly determined and compared.



Global Safety Factors

With the current Global safety factor concept, the allowable loads (all. F) are determined for fixings. Applied characteristic force loads (app. F) are compared with the allowable loads. Allowable loads represent the nominal load capacity and is derived from test results which are then divided by global safety factor (Ygl). The chosen fixing is considered safe with the following condition:

$$\text{Applied loads (app. F)} \leq \text{Allowable loads (all. F)}$$

Partial Safety Factors

The design verification according to Euro code 2 for concrete and Euro code 3 for steel is taken into consideration during the design level. The applied loads (app. F) are factored with partial factors: for static loads 1.35 and for dynamic loads 1.5. The applied design forces (FEd) are compared with the Design resistance loads (FRd). The design resistance is determined by dividing the characteristic resistance of the fixings with the partial material safety factors subsequently for concrete and steel. The chosen fixing is considered safe with the following condition:

$$\text{Design Load (FEd)} \leq \text{Design Resistance (FRd)}$$

The new Euro code concept leads to achieving a more constant and reliable safety level by taking into account different influences of load and materials.

Allowable loads vs Design Resistance Loads

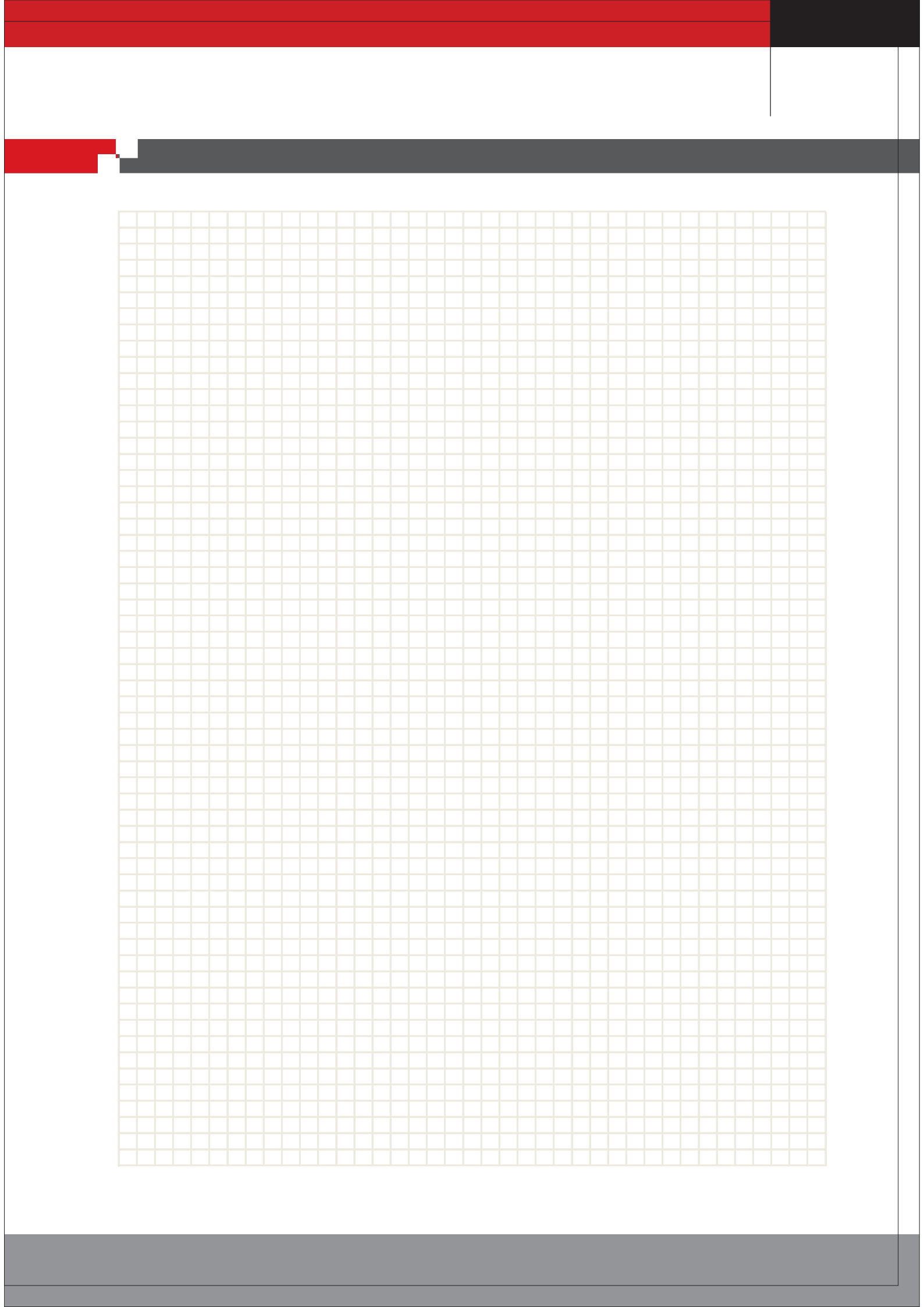
In order to design fixings according to the new Euro concept the, applied loads must be factored using partial safety factors to determined the design loads (FEd). The design loads must be compared with the design resistance (FRd) values of the products to be chosen. If the design resistance values are not available and only allowable loads are available, the new design resistance values must be calculated. The partial factor for actions here 1.4 is weighted average of partial load safety factors 1.35 for permanent loads and 1.5 for variable loads. The global safety factor remains safe with this equation.

$$\text{Design Resistance (FRd)} = \text{allowable loads (all. F)} * 1.4$$

Loads indicated on this catalogue

The loads on this catalogue are the allowable loads already factored from the characteristics loads. The allowable loads are labelled as all. F.

$$\text{Allowable loads (all. F)}$$





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Always at the forefront of fixing technology, HAZ METAL has earned a reputation as the leaders in fixing systems innovation and is regarded as the one to follow. HAZ METAL fixing systems of today become the standard of tomorrow.

HAZ METAL combines the very latest international technology with its own research and development team to establish a technical excellence within the industry. HAZ METAL readily embraces the responsibility of a major producer and shares its expertise with problem solving solutions.