

Systems for facing masonry

Technical information



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Our synergy concept for easy construction



Three brands, one point of contact.

PohlCon combines the product portfolios and expertise of long-established companies PUK, JORDAHL and H-BAU Technik. As a customer, you benefit from the convenience of having a central point of contact, which will help you to plan, build and fit out your building.

The phrase "That's not possible" is simply not part of our vocabulary. We have a can-do attitude and we will always find a way. However large or unusual your construction project, we can provide exactly the right parts for your needs. Our made-to-measure products are perfectly tailored to your requirements.

When it comes to construction, we lighten the load.

As a central point of contact for the different trades and construction phases, we are here to find the right solution for you; we work with you from the beginning to plan this solution and provide ongoing support when it comes to actually using it.

Combined product portfolio – extensive expertise – over 200 years' combined experience in the construction industry.



PUK

High-quality cable management and underfloor systems that are used in demanding construction projects around the world. At the same time, we support our customers in protecting wireless charging technology.



JORDAHL

Leading solutions for connecting concrete, steel and heavy loads. The portfolio includes products for façade fastening and reinforcement, connection, assembly and fastening technology.

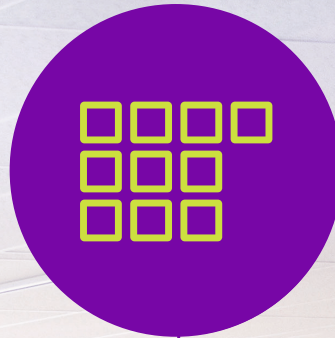


H-BAU

Clever solutions in the fields of sealing, thermal insulation, formwork, sound insulation, reinforcement and connections. With our product brand, we also develop reliable accessories for concrete and precast construction.

10 Product categories

Find the right product faster



7 Applications

Take a holistic approach to solutions



Bespoke solutions

Overcome exceptional challenges and bring unique construction projects to life



Digital solutions: Software and BIM data

Enjoy tailored support for your planning process



Full service, from planning through to use

Benefit from ongoing direct support, from the planning phase all the way through to use

JORDAHL: Partner for stability and safety.



JORDAHL enriches the PohlCon portfolio with leading solutions for connecting concrete, steel, heavy loads and much more. JORDAHL products for fastening, reinforcement, connection and assembly technology as well as facade fastening are used in demanding construction projects worldwide.

Since its foundation in 1907, the company has been one of the pioneers in the field of fastening and reinforcement technology. Owned by the Pohl family of shareholders since 1977, JORDAHL has stood for more than 100 years for more quality and the highest safety standards, comprehensive selection and experience. Proprietary developments such as the anchor channel have become milestones in construction technology and have changed architecture worldwide.



More quality, more experience, more choices:

With around 18,000 products, JORDAHL offers leading solutions for the stability and safety of building projects.



The patented anchor channel was invented by Anders Jordahl and introduced to the market in 1913.

JORDAHL® JVAeco+ brickwork support brackets



Whether for new buildings or renovations: Energy-efficient construction is a major challenge of our time. At the same time, façade design also needs to satisfy high aesthetic standards. JORDAHL® JVAeco+ brickwork support brackets meet all the necessary requirements – particularly where energy certification of the building envelope is necessary. In combination with the JORDAHL® JTM thermal collar, they significantly reduce the thermal bridge correction. For you as a building physicist, energy planner or architect, the JVAeco+ brickwork support brackets currently offer the best thermal properties available.



St. Marien church in Schillig: The curved shapes of the building posed a particular challenge, which was taken into account by the JORDAHL experts when planning the brackets.



Benefits

- Outstanding thermal properties
- Takes into account thermal bridges in the detailed procedure for the energetic assessment according to the Building Energy Act (GEG)
- Avoids the high blanket thermal bridge correction of $\Delta U_{WB} = 0.10 \text{ W}/(\text{m}^2\text{K})$
- For creative façade design, even for tall buildings
- Easy compensation for tolerances thanks to height-adjustable bracket head or slanted slit plate
- Cost-effective mounting on JORDAHL® anchor channels set in concrete
- Free design software available (see p. 61)

Properties

- National technical approval no. Z-21.8-1868
- Permanently corrosion-resistant
- CE mark
- Type approval TP-12-0009
- Environmental Product Declaration (EPD)

New load levels

New and additional load levels have been introduced in response to the continual development of JVAeco+ brickwork support brackets. With the higher load levels of **28%**, the number of brackets can be reduced, thereby also resulting in a reduction of the heat loss due to transmission through the façade. In order to be able to offer the best possible service for an economical and energy-efficient façade solution, we are expanding our range to now include a total of 5 load levels with a new max. load level of 13.5 kN and a cantilever length of up to 390 mm.

- **4.5 kN** new
- **7.0 kN**
- **9.0 kN** new
- **10.5 kN**
- **13.5 kN** new

EPD - Product certification for sustainable construction

An environmental product declaration (EPD) in accordance with ISO 14025 and DIN EN 15804 provides the information basis for the life cycle assessment and is the compilation of all environmentally relevant properties of a product. The product-related life cycle assessment thus considers the entire life cycle of a product, and due to the “polluter pays” principle applied, emissions along the entire value chain are included in the assessment. An EPD therefore provides credible, comparable, transparent and verifiable information! As the **first manufacturer** with an environmental product declaration for brickwork support brackets, we provide building owners, architects, project planners and investors with the option of certifying a sustainability project according to DGNB, LEED or BREEAM. As a member of the Building Material Scout platform and with the products we have listed on it, your next building project can easily be made a reality in line with ecological and economical goals.

Optimised building physics

In order to increase the energy efficiency of JORDAHL® systems for facing masonry, we have developed and introduced a new type of bracket, the JORDAHL® JVAeco+ brickwork support bracket. With their innovative design features, the **JVAeco+** brickwork support brackets reduce energy losses:

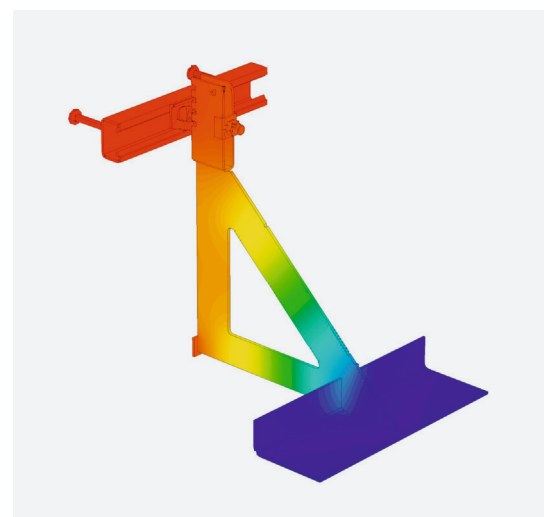
- Use of high-strength Lean Duplex stainless steel, which allows for the minimisation of cross-sections, particularly of the web plate
- Laser-cut recess in the web plate which reduces the amount of thermally conductive material.
- Together with the JORDAHL® JTM thermal collar, heat loss is also effectively reduced in the air layer of rear-ventilated façades
- For the calculation of the thermal transmittance coefficient U_c of the surface disturbed, point-specific thermal transmittance coefficients χ according to the approval are available



JORDAHL products approved and tested by DIBt



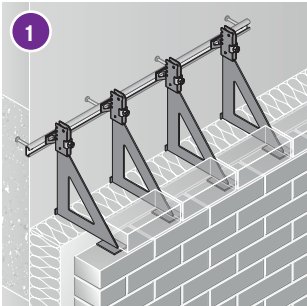
EPD for JORDAHL® JVAeco+ brickwork support brackets



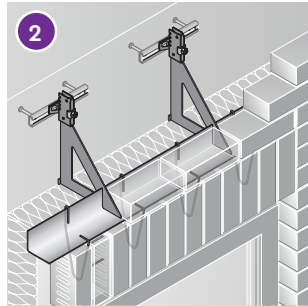
Temperature gradient of JORDAHL® JVAeco+ P brickwork support bracket

Application examples

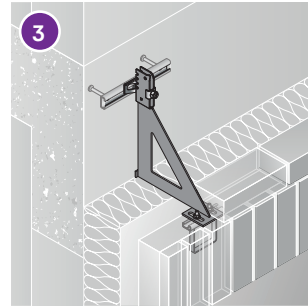




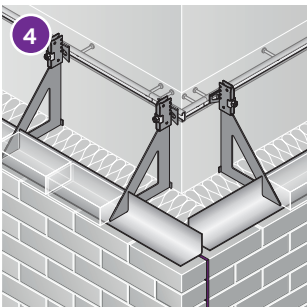
1
Plain wall area:
 JVAeco+ N/NA brickwork
 support brackets (see p. 12-13)
 & JVAeco+ P/PAR (see p. 16)



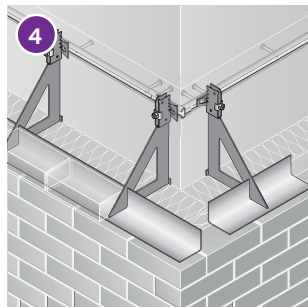
2
Openings:
 JVAeco+ F/FAR brickwork
 support bracket (see p. 18-19)



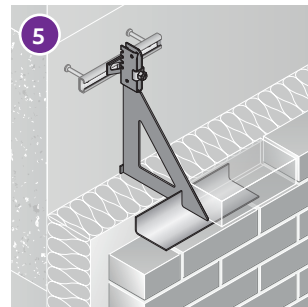
3
Openings with precast lintels:
 JVAeco+ NFT/NAFT brickwork
 support bracket (see p. 24)



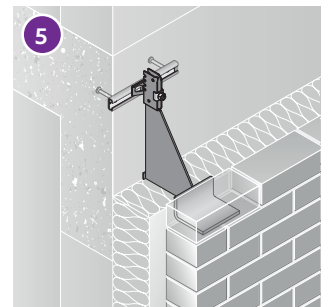
4
**Outer corner with expansion
 joint:** JVAeco+ F brickwork
 support bracket (see p. 18)



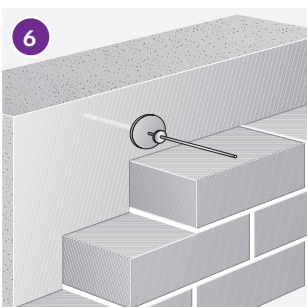
4
**Outer corner without
 expansion joint:**
 JVAeco+ F brickwork support
 bracket (see p. 18)



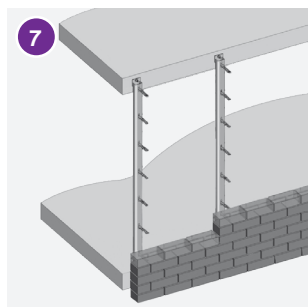
5
Expansion joint and edge area:
 JVAeco+ P/PAR brickwork
 support bracket (see p. 16)



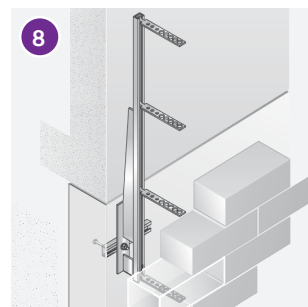
5
**Expansion joint and edge
 area:** JVAeco+ E/EA brickwork
 support bracket (see p. 17)



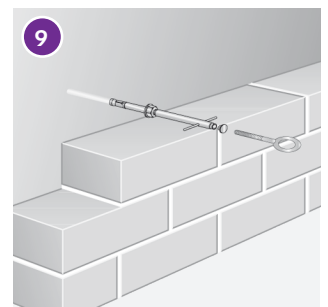
6
**Securing the facing masonry
 against buckling:** JLA cavity
 wall anchor (see p. 34-35)



7
**Securing the horizontal
 position:** JWP windpost (see p.
 37) and JMA brick tie anchor
 (see p. 38)



8
Bracing for parapets:
 JAV parapet brick anchors
 (see p. 36) and JMA brick tie
 anchor (see p. 38)



9
Securing scaffolds:
 JGA+ scaffold anchor
 (see p. 40-41)

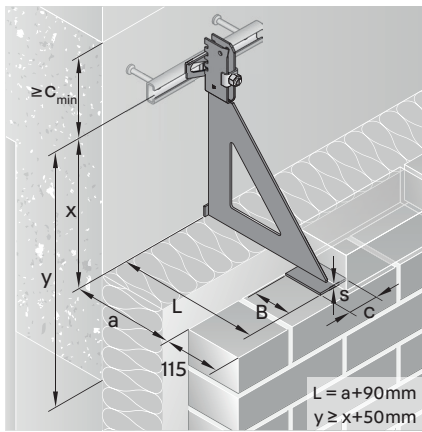
JORDAHL® brickwork support brackets

JVAeco+ N/NA/NU brickwork support bracket

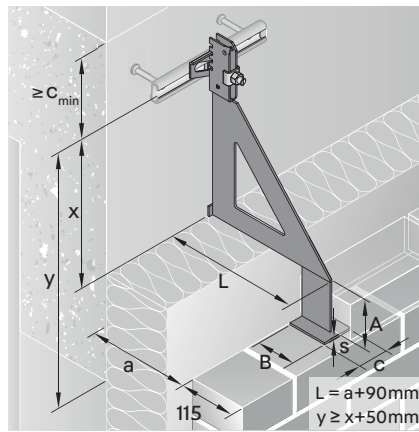
Design variants

The JORDAHL® JVAeco+ N/NA/NU brickwork support brackets support continuous wall surfaces:

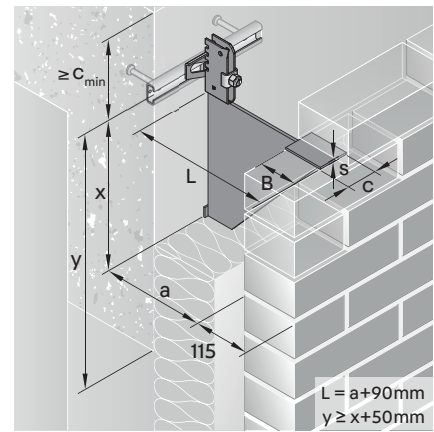
- Design variant N for bracket support at the same height (bracing plane equal to lower edge of web plate)
- Design variant NA with lowered bracket support (bracing plane equal to lower edge of web plate minus offset dimension A)
- Design variant NU with raised bracket support



JVAeco+ N single bracket



JVAeco+ NA single bracket with lowered bracket support



JVAeco+ NU single bracket with raised bracket support

Installation dimension x in mm for JVAeco+N/NA/NU single bracket²⁾

Load levels with rated resistance values

Shell spacing ¹⁾ a in mm	Cantilever length L in mm	4.5 kN	7.0 kN	9.0 kN	10.5 kN	13.5 kN
		F _{Rd} =6.08 kN	F _{Rd} =9.45 kN	F _{Rd} =12.15 kN	F _{Rd} =14.18 kN	F _{Rd} =18.23 kN
50-100	140-190	150	200	200	250	250
110-120	200-210	150	200	225	250	275
130-140	220-230	175	250	250	300	300
150-160	240-250	175	250	275	300	325
170-180	260-270	175	250	300	300	350
190-200	280-290	200	300	325	350	375
210-220	300-310	200	300	375	350	425
230-240	320-330	200	300	400	350	450
250-260	340-350	250	375	425	400	475
270-280	360-370	250	375	450	400	500
290-300	380-390	250	375	475	425	525
Support plate c x B x s in mm		60 x 80 x 3	60 x 80 x 4	60 x 80 x 4	70 x 85 x 5	70 x 85 x 5

¹⁾ Tolerances of ±10 mm can be compensated for

²⁾ JVAeco+ NU without recess

Wall heights

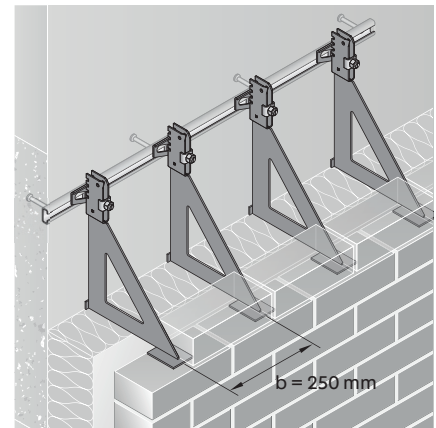
The theoretically permissible height of the wall results from the calculation approaches listed at the bottom of the page and the requirements of DIN EN 1996-2 (see p. 47). In the normal case ($\rho = 1800 \text{ kg/m}^3$, $t = 115 \text{ mm}$), the load on the brackets can be obtained from the following table based on the wall height.

Installation distances

The vertical web plate of the brickwork support bracket can engage in the butt joints between the facing bricks. The minimum spacing for the brackets is 250 mm (corresponds to the length of a normal brick) or, if a JORDAHL® JW angled bracket is used as an intermediate bracket, a multiple of this.

Load levels in kN for JORDAHL® brickwork support brackets JVAeco+ N/NA/NU in the normal case¹⁾

Wall height H in m	Rated force ²⁾ F _{Ed} in kN	Rated resistance F _{Rd} in kN	Required load level of bracket in kN
1	0.7	6.08	4.5
2	1.4	6.08	4.5
3	2.2	6.08	4.5
4	2.8	6.08	4.5
5	3.5	6.08	4.5
6	4.2	6.08	4.5
7	4.9	6.08	4.5
8	5.5	6.08	4.5
9	6.3	9.45	7.0
10	7.0	9.45	7.0
11	7.7	9.45	7.0
12	8.4	9.45	7.0



JVAeco+ N as a single bracket in plain wall areas

¹⁾ Bracket spacing $b = 250 \text{ mm}$

²⁾ Valid for facing masonry with gross density $\rho = 1800 \text{ kg/m}^3$; thickness $t = 115 \text{ mm}$

Accessories

Brick-on-edge courses ($t = 115 \text{ mm}$) are installed using the JORDAHL® JRH 0 suspension loop (see p. 21).



Example order for JVAeco+ NA brickwork support bracket

Type	Cantilever length	Variant	Load level	Offset
JVAeco+	290	- NA	/ 4.5	A = 100

The maximum wall height H_{max} in m can be calculated as a function of the bracket spacing b for the normal case as follows:

$$H_{\text{max}} = \frac{F_{\text{Rd}}}{b \times t \times \rho \times 0,01 \text{ kN / kg} \times \gamma_{\text{G}}}$$

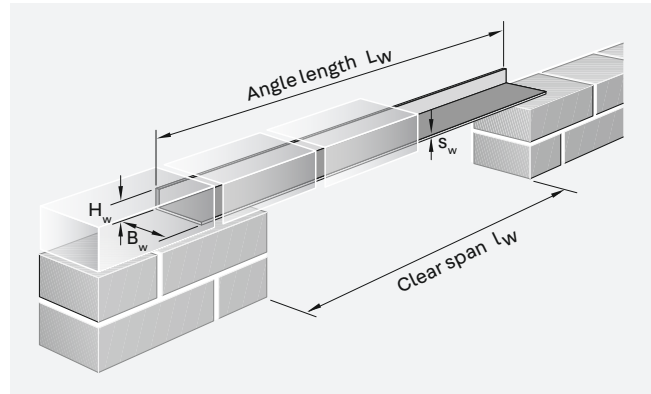
$$H_{\text{max}} = \frac{F_{\text{Rd}}}{b \times 2,8}$$

Where $\rho = 1800 \text{ kg/m}^3$
 $t = 0.115 \text{ m}$
 $\gamma_{\text{G}} = 1.35$ (partial safety factor)
 $b =$ influence width in m

JW angled bracket

Use as bracing above openings

JORDAHL® JW angled brackets can be used individually as bracing above openings by placing them on the lateral masonry. For information on the design software for wall supports, see p. 61. For the normal case (facing masonry $\rho = 1800 \text{ kg/m}^3$ and $t = 0.115 \text{ m}$), the selection of the required angled bracket cross-section based on the clear width l_w from the opening can be made using the following table.



JW angled bracket as bracing above openings

Angled bracket cross-section ^{2,3)} $H_w \times B_w \times s_w$ in mm of the JORDAHL® JW angled bracket as bracing above openings in the normal case¹⁾

	Clear width l_w of opening in mm						
	510	760	1010	1260	1510	1760	2010
	Corresponding length of angled bracket L_w in mm						
	700	950	1200	1450	1700	1950	2200
Wall height H in m							
≤ 0.50	L 25 x 90 x 2	L 30 x 90 x 3	L 40 x 90 x 3	L 45 x 90 x 3	L 60 x 90 x 3	L 60 x 90 x 4	L 70 x 90 x 4
≤ 0.75	L 25 x 90 x 2	L 30 x 90 x 3	L 45 x 90 x 3	L 50 x 90 x 3	L 60 x 90 x 3	L 70 x 90 x 4	L 80 x 90 x 4
≤ 1.00	L 25 x 90 x 2	L 35 x 90 x 3	L 45 x 90 x 3	L 60 x 90 x 3	L 60 x 90 x 4	L 70 x 90 x 4	L 80 x 90 x 4
≤ 1.25	L 25 x 90 x 2	L 30 x 90 x 3	L 50 x 90 x 3	L 60 x 90 x 3	L 70 x 90 x 4	L 80 x 90 x 4	L 90 x 90 x 5
≤ 1.50	L 25 x 90 x 2	L 30 x 90 x 3	L 50 x 90 x 3	L 70 x 90 x 3	L 80 x 90 x 4	L 80 x 90 x 5	L 90 x 90 x 5
≤ 1.75	L 25 x 90 x 2	L 30 x 90 x 3	L 50 x 90 x 3	L 60 x 90 x 3	L 80 x 90 x 4	L 80 x 90 x 5	L 90 x 90 x 6
≤ 2.00	L 25 x 90 x 2	L 30 x 90 x 3	L 50 x 90 x 3	L 60 x 90 x 3	L 70 x 90 x 4	L 90 x 90 x 5	L 90 x 90 x 6
≤ 2.25	L 25 x 90 x 2	L 30 x 90 x 3	L 50 x 90 x 3	L 60 x 90 x 3	L 70 x 90 x 4	L 80 x 90 x 4	L 90 x 90 x 8
> 2.25	L 25 x 90 x 2	L 30 x 90 x 3	L 50 x 90 x 3	L 60 x 90 x 3	L 70 x 90 x 4	L 80 x 90 x 4	L 90 x 90 x 5
Min. wall height H for applicability of the vault effect in m	0.71	0.94	1.17	1.4	1.63	1.85	2.08

Design with vault support effect; verify thrust forces from the vault (p. 59)

Design without vault support effect

¹⁾ Valid for facing masonry with gross density $\rho = 1800 \text{ kg/m}^3$, thickness $t = 115 \text{ mm}$

²⁾ In the case of bracing for more than two storeys, the cross-sectional value B_w is to be increased to 100 mm

³⁾ Max. deflection $l_y/300$ and assumed modulus of elasticity = 200000 N/mm^2

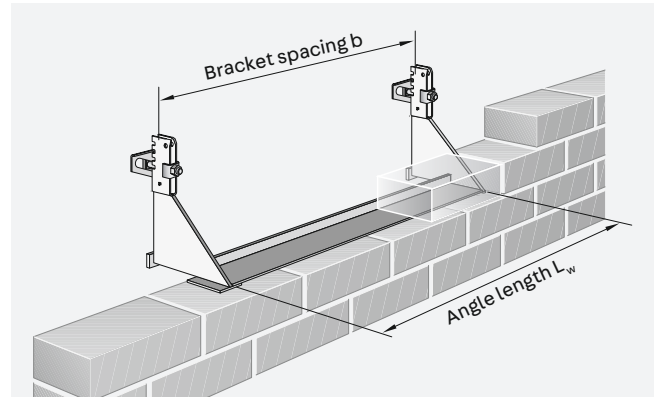


Example order for JW angled bracket

Type	Angled bracket	Length
JW	L 50 x 90 x 3	1200

Use as intermediate angled bracket

JORDAHL® JW angled brackets can be used as intermediate brackets for JORDAHL® JVAeco+ N brickwork support brackets or for JORDAHL® JMK+ N grout-in brackets. For this purpose, they are placed loosely on the support plate of the brickwork support bracket. For information on the design software for wall supports, see p. 61. For the normal case (facing masonry $\rho = 1800 \text{ kg/m}^3$ and $t = 0.115 \text{ m}$), the selection of the required angled bracket cross-section depending on the distance b between the brickwork support brackets can be performed using the following table.



JW angled bracket as intermediate bracket

Load levels in kN for JORDAHL® brickwork support brackets for the normal case¹⁾ with intermediate angled bracket

Wall height H in m	Spacing b between the brackets in mm		
	500	750	1000
	Corresponding length of angled bracket L_w in mm		
	480	730	980
1	4.5	4.5	4.5
2	4.5	4.5	4.5
3	4.5	7.0	7.0
4	4.5	7.0	9.0
5	7.0	9.0	10.5
6	7.0	10.5	13.5
7	9.0	13.5	Not possible
8	9.0	13.5	Not possible
9	10.5	Not possible	Not possible
10	10.5	Not possible	Not possible
11	13.5	Not possible	Not possible
12	13.5	Not possible	Not possible
Angled bracket cross-section^{2,3)} JORDAHL® JW in mm	L 25 × 90 × 2	L 30 × 90 × 3	L 50 × 90 × 3

¹⁾ Valid for facing masonry with gross density $\rho = 1800 \text{ kg/m}^3$, thickness $t = 115 \text{ mm}$ and with vault effect

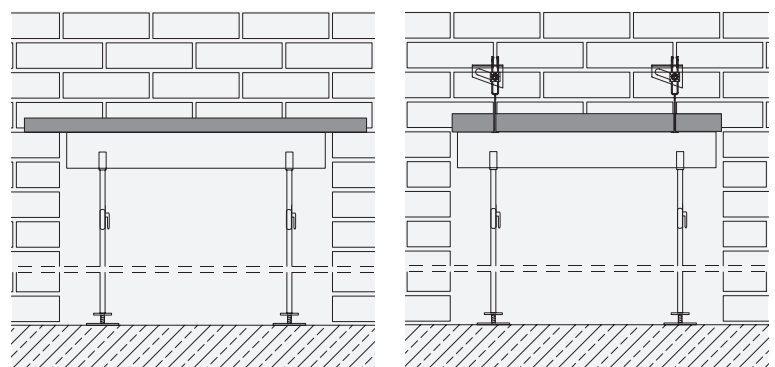
²⁾ In the case of bracing for more than two storeys, the cross-sectional value B_w is to be increased to 100 mm

³⁾ Max. deflection $l_v/300$ and assumed modulus of elasticity = 200000 N/mm²

Installation notes

For all brackets with a welded or loose angle, the angle must be supported until the mortar has hardened.

For use with corner brackets, the angles can be cut to size.



JVAeco+ P/PAR brickwork support bracket

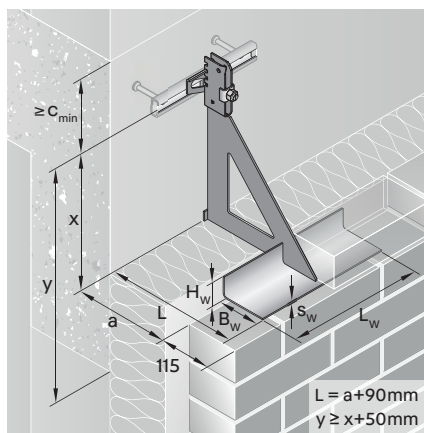
Design variants

JORDAHL® JVAeco+ P/PAR brickwork support brackets are used primarily in plain wall areas or in edge areas, such as interior corners or vertical joints.

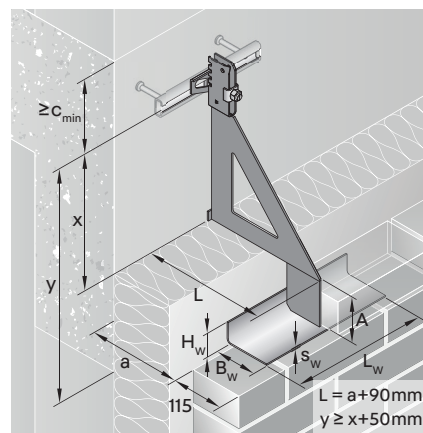
- Design variant P for bracket support at the same height (bracing plane equal to lower edge of web plate)
- Design variant PAR with lowered bracket support (bracing plane equal to lower edge of web plate minus offset dimension A)

Installation distances

The vertical web plate of the bracket engages in the butt joints between the facing bricks. The spacing between the brackets is 500 mm (corresponds to two normal brick lengths).



JVAeco+ P single bracket



JVAeco+ PAR single bracket with lowered bracket support

Installation dimension x in mm for JVAeco+ P/PAR single bracket

Load levels with rated resistance values

Shell spacing ¹⁾ a in mm	Cantilever length L in mm	4.5 kN	7.0 kN	9.0 kN	10.5 kN	13.5 kN
		F _{Rd} =6.08 kN	F _{Rd} =9.45 kN	F _{Rd} =12.15 kN	F _{Rd} =14.18 kN	F _{Rd} =18.23 kN
50-100	140-190	150	200	200	250	250
110-120	200-210	150	200	225	250	275
130-140	220-230	175	250	250	300	300
150-160	240-250	175	250	275	300	325
170-180	260-270	175	250	300	300	350
190-200	280-290	200	300	325	350	375
210-220	300-310	200	300	375	350	425
230-240	320-330	200	300	400	350	450
250-260	340-350	250	375	425	400	475
270-280	360-370	250	375	450	400	500
290-300	380-390	250	375	475	425	525
Angled support bracket²⁾ H _w x B _w x s _w in mm		35 x 100 x 3	45 x 100 x 3	50 x 100 x 3	55 x 100 x 3	60 x 100 x 3

¹⁾ Tolerances of ±10 mm can be compensated for

²⁾ Length of angled bracket L_w = 300mm



Example order for JVAeco+ PAR brickwork support bracket

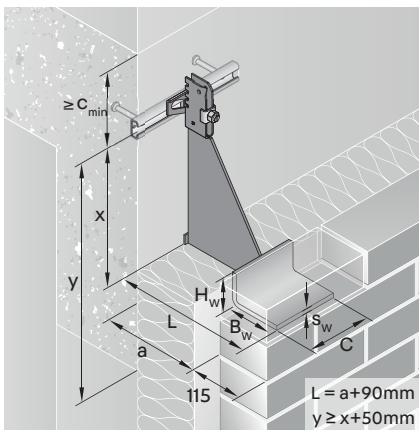
Type	Cantilever length	Variant	Load level	Offset
JVAeco+	290	- PAR	/ 4.5	A = 100

JVAeco+ E/EA brickwork support bracket

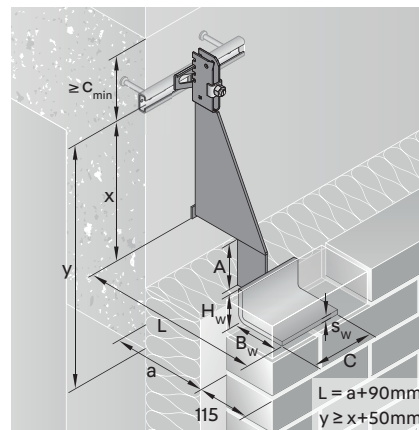
Design variants

JORDAHL® JVAeco+ E/EA brickwork support brackets are used primarily in the end areas of facing masonry slabs, such as internal corners or vertical joints. The bracket is used where it is not possible to engage in the butt joint. It supports individual facing bricks. The load levels of the single brackets differ from those of the other JVAeco+ brickwork support brackets.

- Design variant E for bracket support at the same height (bracing plane equal to lower edge of web plate)
- Design variant EA with lowered bracket support (bracing plane equal to lower edge of web plate minus offset dimension A)



JVAeco+ E single bracket



JVAeco+ EA single bracket with lowered bracket support

Installation dimension x in mm for JVAeco+ E/EA single bracket²⁾

Load levels with rated resistance values

Shell spacing ¹⁾ a in mm	Cantilever length L in mm	2.5 kN $F_{Rd}=3.38$ kN	3.5 kN $F_{Rd}=4.73$ kN	5.0 kN $F_{Rd}=6.75$ kN	7.5 kN $F_{Rd}=10.13$ kN
50-60	140-150	150	150	150	200
70-120	160-210	150	150	150	200
130-180	220-270	175	175	175	250
190-240	280-330	200	200	200	300
250-280	340-370	200	200	225	375
290-300	380-390	200	200	250	375
Angled support bracket $H_w \times B_w \times s_w - C$ in mm		55 x 110 x 6-100	70 x 110 x 8-110	70 x 110 x 8-110	70 x 110 x 10-140

¹⁾ Tolerances of ±10 mm can be compensated for

²⁾ JVAeco+ E/EA without recess



Example order for JVAeco+ EA brickwork support bracket

Type	Cantilever length	Variant	Load level	Offset
JVAeco+	290	- EA	/ 5.0	A = 100

JVAeco+ F/FAR brickwork support bracket

Design variants

JORDAHL® JVAeco+ F/FAR brickwork support brackets are combined bracing brackets with a continuous angled support bracket and two or more bracket anchors. They support visible or invisible building openings or outer corners with or without vertical joints:

- Design variant F for bracket support at the same height (bracing plane equal to lower edge of web plate)
- Design variant FAR with lowered bracket support (bracing plane equal to lower edge of web plate minus offset dimension A)

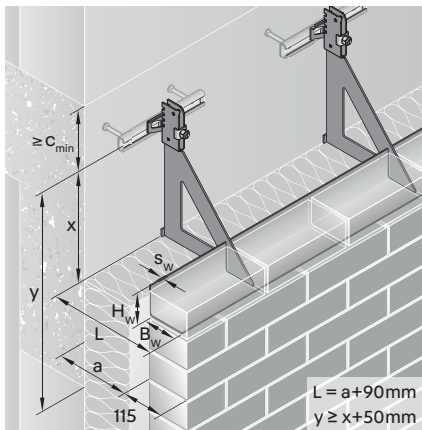
Available lengths

Various system lengths are available in 250 mm increments. Other lengths and increments are available on request.

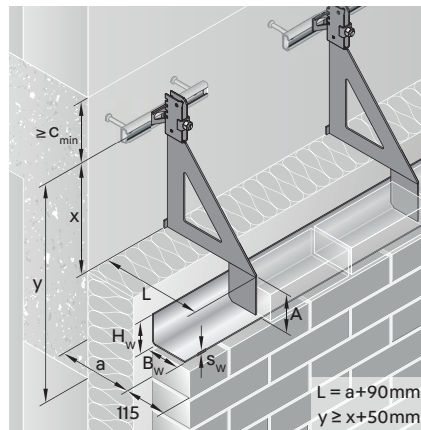


Notes

The angled support brackets must be fully and sufficiently supported until the masonry mortar has hardened in order to avoid undesired deflection!



JVAeco+ F angled bracket



JVAeco+ FAR angled bracket lowered bracket support

Installation dimension x in mm for JVAeco+ F/FAR angled bracket

Load levels with rated resistance values

Shell spacing ¹⁾ a in mm	Cantilever length L in mm	4.5 kN	7.0 kN	9.0 kN	10.5 kN	13.5 kN
		F _{Rd} =6.08 kN	F _{Rd} =9.45 kN	F _{Rd} =12.15 kN	F _{Rd} =14.18 kN	F _{Rd} =18.23 kN
50-100	140-190	150	200	200	250	250
110-120	200-210	150	200	225	250	275
130-140	220-230	175	250	250	300	300
150-160	240-250	175	250	275	300	325
170-180	260-270	175	250	300	300	350
190-200	280-290	200	300	325	350	375
210-220	300-310	200	300	375	350	425
230-240	320-330	200	300	400	350	450
250-260	340-350	250	375	425	400	475
270-280	360-370	250	375	450	400	500
290-300	380-390	250	375	475	425	525

¹⁾ Tolerances of ±10 mm can be compensated for

Use as bracing above openings

Facing masonry above openings can be visibly supported as a stretcher, brick-on-edge, or soldier course with a visible angled support bracket or invisibly with a suspended brick-on-edge or soldier course. With invisible bracing, the suspended facing bricks are secured with suspension loops and stainless steel wire (see p. 21). With both variants, bracing at the same height and with a height offset are possible.

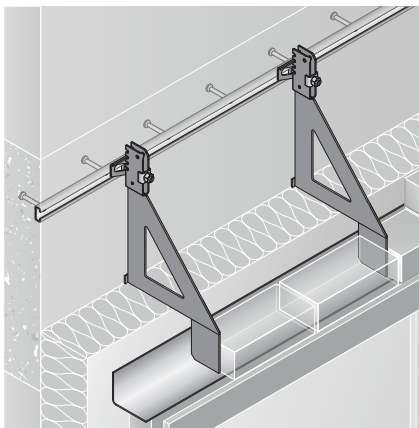
Use at outer corners

For outer corners with a vertical expansion joint, one or two angled brackets with or without a soffit corner are mounted. For outer corners a without vertical expansion joint, two angled brackets with mitre cut are mounted. For outer corners in the non-visible area, angled brackets without mitre cut are used.

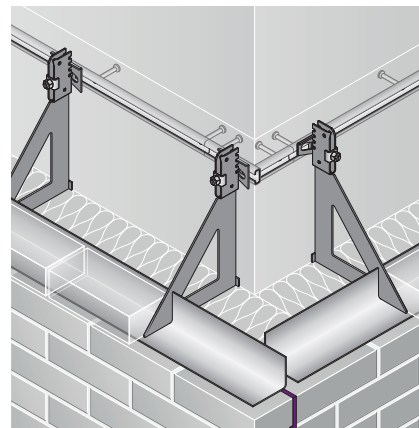


Notes

Ensure that the bracket anchor is far enough away from the building corner so that the required edge distances for fastening to anchor channels or dowels are maintained. If this is not possible, special brackets, e.g. brackets with a fish plate (see p. 27), are available.



Visible bracing above window opening with JVAeco+ FAR



Execution of an outer corner with vertical expansion joint with JORDAHL® JVAeco+ F brickwork support brackets



Example order for JVAeco+ F brickwork support bracket

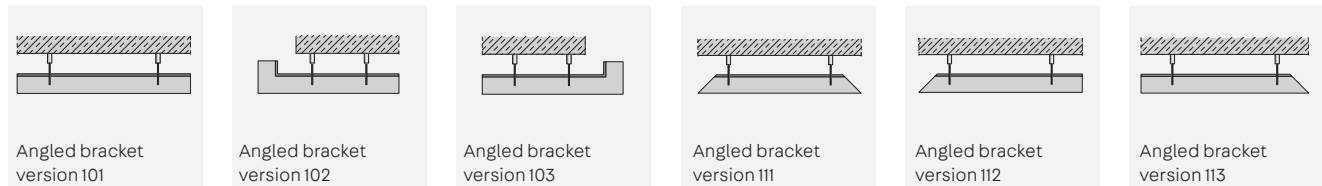
Type	Cantilever length L	Length of angled bracket L _w	Variant	Load level	Angled bracket dimensions
JVAeco+	290	- 1490	- F	/ 7.0	(L70 × 100 × 3)

Angled bracket versions for JVAeco+ F/FAR

Angled bracket versions

JORDAHL® JVAeco+ F/FAR brickwork support brackets feature different angled support brackets depending on the installation situation. The dimensions of the angled support bracket

over openings depends on the clear width of the opening and the existing wall height. At the same time, any soldier or brick-on-edge courses will also need to be considered.

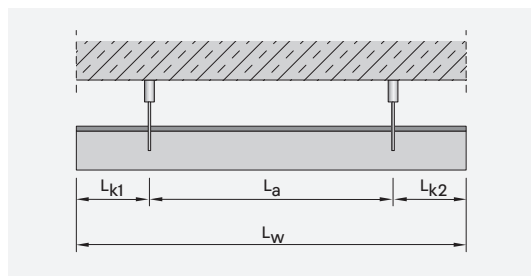


Necessary load levels in kN and angled bracket cross-sections $H_w \times B_w \times s_w$ in mm for JORDAHL® JVAeco+ F/FAR brickwork support brackets in the normal case¹⁾

	Clear width of opening l_w in mm										
	510	760	1010	1260	1510	1760	2010	2260	2510	2760	
	Length of angled bracket L_w in mm; bracket anchor spacing $L_{k1}/L_a/L_{k2}$ in mm										
Wall height H in m	$L_w = 490$ 120/ 250/ 120	$L_w = 740$ 120/ 500/ 120	$L_w = 990$ 245/ 500/ 245	$L_w = 1240$ 245/ 750/ 245	$L_w = 1490$ 245/ 1000/ 245	$L_w = 1740$ 370/ 1000/ 370	$L_w = 1990$ 370/ 1250/ 370	$L_w = 2240$ 495/ 1250/ 495	$L_w = 2490$ 495/ 1500/ 495	$L_w = 2740$ 620/ 1500/ 620	
1	L 30×100×3	L 30×100×3	L 30×100×3	L 30×100×3	L 50×100×3	L 40×100×3	L 60×100×3	L 50×100×3	L 60×100×3	L 60×100×3	
2	L 30×100×3	L 30×100×3	L 30×100×3	L 30×100×3	L 50×100×3	L 50×100×3	L 70×100×3	L 50×100×3	L 80×100×3	L 80×100×3	
3	L 30×100×3	L 30×100×3	L 30×100×3	L 40×100×3	L 60×100×3	L 50×100×3	L 80×100×3	L 60×100×3	L 90×100×3	L 90×100×3	
4	L 30×100×3	L 30×100×3	L 40×100×3	L 40×100×3	L 70×100×3	L 60×100×3	L 80×100×4	L 80×100×3	L 90×100×4	L 100×100×3	
5	L 30×100×3	L 40×100×3	L 40×100×3	L 50×100×3	L 80×100×3	L 60×100×3	L 90×100×4	L 80×100×3	L 100×100×4	Not possible	
6	L 30×100×3	L 40×100×3	L 50×100×3	L 50×100×3	L 80×100×3	L 70×100×3	L 100×100×4	Not possible	Not possible	Not possible	

Load level 4.5
 Load level 7.0
 Load level 9.0
 Load level 10.5
 Load level 13.5

¹⁾ Valid for facing masonry with gross density $\rho = 1800 \text{ kg/m}^3$, thickness $t = 115 \text{ mm}$ and 2 bracket anchors



JVAeco+ F/FAR angled bracket with two bracket anchors, lengths and dimensions



Example order for JVAeco+ F brickwork support bracket

Type	Cantilever length L	Length of angled bracket L_w	Variant	Load level	Angled bracket dimensions
JVAeco+	290	1490	F	7.0	(L70 × 100 × 3)

Furthermore, the bracket anchor spacing values $L_{k1}/L_a/L_{k2}$ are to be specified, e.g.:

L_{k1}	L_a	L_{k2}
245	1000	245



Notes

Custom versions and other angled bracket versions are also available upon request, including for other product variants of the JORDAHL® JVAeco+ brickwork support bracket.

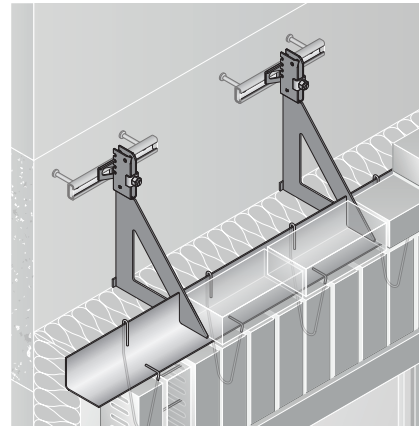
JRH suspension loop

Design variants

JORDAHL® JRH suspension loops can be used as invisible bracing above openings with soldier or brick-on-edge course and with a stretcher course. For this purpose they are mounted to the N/NA/NU single brackets or F/FAR angled brackets:

- Design variants 0 and 20 for brick-on-edge course thickness 115 mm and JVAeco+ N/NA/NU single bracket.
- Design variants 1-7 and 21-27 for brick-on-edge course thickness 115 mm and JVAeco+ F/FAR angled bracket
- Design variants 11-17 for brick-on-edge course thickness 240 mm and JVAeco+ F/FAR angled bracket

The JRH suspension loops with a diameter of 4 mm made of stainless steel of corrosion resistance class III are used with a spacing of ≤ 250 mm.



Invisible bracing above window opening with JVAeco+ F, JRH suspension loops and ESD stainless steel wire

	Suspension loop ¹⁾ JRH	Brick-on-edge course thickness in mm	suitable for angled brackets with		
			H _w in mm	B _w in mm	s _w in mm
	0	115	–	80-100	3-8
	1		30		
	2		35		
	3		40		
	4	115	50	80-100	3-8
	5		55		
	6		60		
	7		65		
			70		
			75		
			80		
			85		
			90		
			95		
	11		30		
			35		
			40		
			45		
			50		
			55		
			60	80-100	3-8
			65		
			70		
			75		
			80		
			85		
			90		
			95		
	12		30		
			35		
			40		
			45		
			50		
			55		
			60	80-100	3-8
			65		
			70		
			75		
			80		
			85		
			90		
			95		

¹⁾Special shapes are available on request

Accessories

ESD stainless steel wire can be supplied in any length up to 3000 mm as reinforcement for soldier or brick-on-edge courses.

Example order for JRH suspension loop with L70 × 100 × 3, thickness of brick-on-edge course 115 mm

Type and version	Brick-on-edge course thickness
JRH 5	11.5

Example order for ESD stainless steel wire

Type	Diameter	Length
ESD	4	3000

JRH suspension loop (for stretcher lintel)

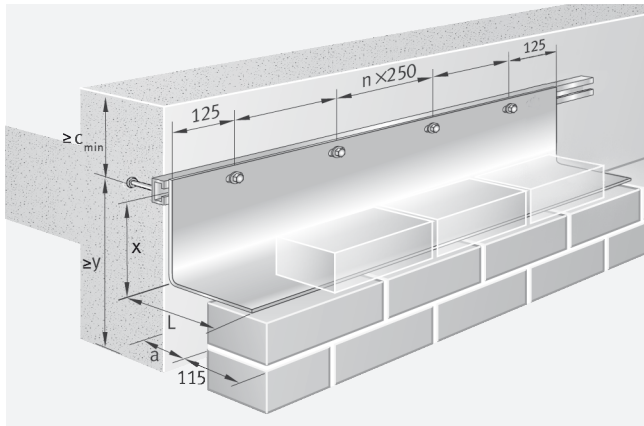
	Suspension loop ¹⁾ JRH	Brick-on-edge course thickness in mm	suitable for angled brackets with		
			H _w in mm	B _w in mm	s _w in mm
	20	115	–	80-100	3-8
	21		30-35		
	22		40-45		
	23		50-55		
	24	115	60-65	80-100	3-8
	25		70-75		
	26		80-85		
	27		90-95		

L-F+/L-DF+/L-DN+ angled brackets

Design variants

The JORDAHL® L-F+, L-DF+ and L-DN+ brickwork support brackets are simple, efficient bracing systems without vertical adjustability. They are used when the bracing is visible and the air layer and insulation are to be completely covered. The angled brackets are fixed to continuous anchor channels or dowels.

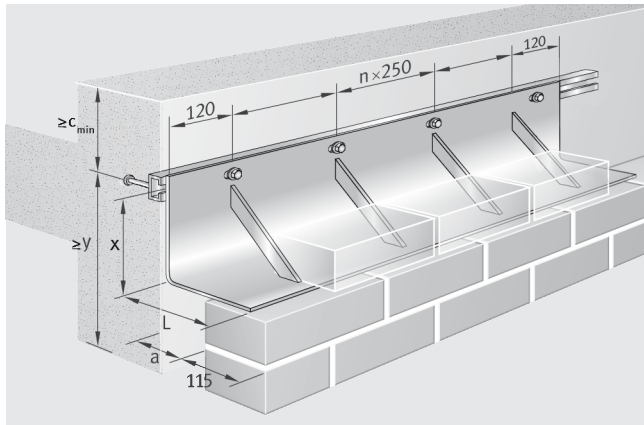
The horizontal alignment of the angled brackets is made possible by the 11 × 30 slotted holes (spacing 250 mm). The L-DF+ and L-F+ angled brackets are available in lengths from 490 mm to 2000 mm. Other lengths available on request. The load levels of the angled and single brackets differ from those of the other brickwork support brackets.



L-F+ angled bracket
without diagonal struts

Example order for L-F+ angled bracket

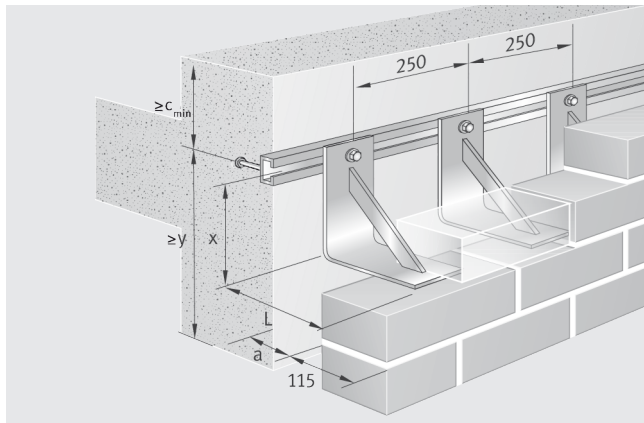
Type	Cantilever length L	Length of angled bracket L _w	Load level
L-F+	110	- 1000	/ 2.1



L-DF+ angled bracket with
diagonal struts

Example order for L-DF+ angled bracket

Type	Cantilever length L	Length of angled bracket L _w	Load level
L-DF+	190	- 990	/ 3.2



L-DN+ single bracket with
diagonal struts

Example order for L-DN+ single bracket

Type	Cantilever length L	Load level
L-DN+	190	/ 3.2

Installation dimensions and load-bearing capacity L-F+

Shell spacing ¹⁾ a in mm	Cantilever length L in mm	Load level in kN	F _{Rd} in kN	Angled bracket dimensions H _W × B _W × s _W in mm	Installation dimension x in mm	Installation dimension y in mm
0-20	110	1.2	1.6	110 × 110 × 4	84	y ≥ x + 25 mm
		2.1	2.8	110 × 110 × 5	83	
		3.2	4.3	110 × 110 × 6	82	
30-40	130	1.2	1.6	130 × 130 × 4	104	
		2.1	2.8	130 × 130 × 5	103	
		3.2	4.3	130 × 130 × 6	102	

¹⁾Tolerances of ±10 mm can be compensated for

Installation dimensions and load-bearing capacity L-DF+ und L-DN+

Shell spacing ¹⁾ a in mm	Cantilever length L in mm	Load level in kN	F _{Rd} in kN	Angled bracket dimensions H _W × B _W × s _W in mm	Installation dimension x in mm	Installation dimension y in mm
30-40	130	1.5	2.0	130 × 130 × 3	105	y ≥ x + 25 mm
		3.2	4.3	130 × 130 × 5	103	
50-60	150	1.5	2.0	150 × 150 × 3	125	
		3.2	4.3	150 × 150 × 5	123	
70-80	170	1.5	2.0	170 × 170 × 3	145	
		3.2	4.3	170 × 170 × 5	143	
90-100	190	1.5	2.0	190 × 190 × 3	165	
		3.2	4.3	190 × 190 × 5	163	
110-120	210	1.5	2.0	210 × 210 × 3	185	
		3.2	4.3	210 × 210 × 5	183	
130-140	230	1.5	2.0	230 × 230 × 3	205	
		3.2	4.3	230 × 230 × 5	203	
150-160	250	1.5	2.0	250 × 250 × 3	225	
		3.2	4.3	250 × 250 × 5	223	
170-180	270	1.5	2.0	270 × 270 × 3	245	
		3.2	4.3	270 × 270 × 5	243	
190-200	290	1.5	2.0	290 × 290 × 3	265	
		3.2	4.3	290 × 290 × 5	263	
210-220	310	1.5	2.0	310 × 310 × 3	285	
		3.2	4.3	310 × 310 × 5	283	
230-240	330	1.5	2.0	330 × 330 × 3	305	
		3.2	4.3	330 × 330 × 5	303	

¹⁾Tolerances of ±10 mm can be compensated for

JVAeco+ NFT/NAFT brickwork support bracket

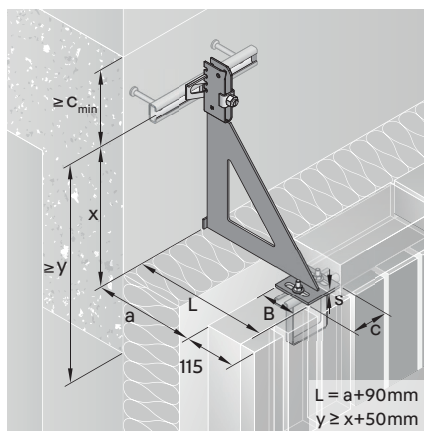
Design variants

The JORDAHL® JVAeco+ NFT/NAFT brickwork support brackets can be used for the area of openings that are supported by precast lintels and do not have a lateral support:

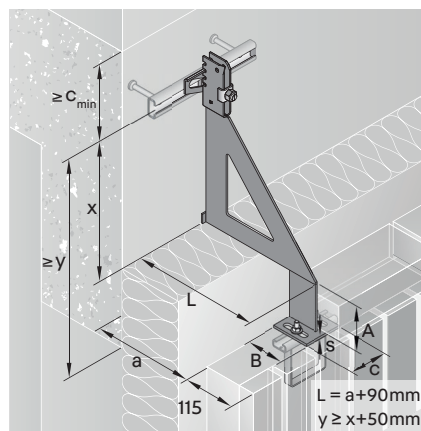
- Design variant NFT for bracket support at the same height (bracing plane equal to lower edge of web plate)
- Design variant NAFT with lowered bracket support (bracing plane equal to lower edge of web plate minus offset dimension A)

Dimensioning

When calculating the existing load, the dead weight of the supported facing masonry, the weight of the suspended precast lintel, DIN EN 1996-2 and the structural circumstances must be taken into account.



JVAeco+ NFT single bracket for the suspension of precast lintels



JVAeco+ NAFT single bracket with lowered bracket support for the suspension of precast lintels

Installation dimension x in mm for JVAeco+ NFT/NAFT single bracket

Load levels with rated resistance values

Shell spacing ¹⁾ a in mm	Cantilever length L in mm	4.5 kN	7.0 kN	9.0 kN	10.5 kN	13.5 kN
		F _{Rd} =6.08 kN	F _{Rd} =9.45 kN	F _{Rd} =12.15 kN	F _{Rd} =14.18 kN	F _{Rd} =18.23 kN
50-100	140-190	150	200	200	250	250
110-120	200-210	150	200	225	250	275
130-140	220-230	175	250	250	300	300
150-160	240-250	175	250	275	300	325
170-180	260-270	175	250	300	300	350
190-200	280-290	200	300	325	350	375
210-220	300-310	200	300	375	350	425
230-240	320-330	200	300	400	350	450
250-260	340-350	250	375	425	400	475
270-280	360-370	250	375	450	400	500
290-300	380-390	250	375	475	425	525
Support plate c x B x s in mm		80 x 80 x 4	80 x 80 x 5	80 x 80 x 5	80 x 85 x 6	80 x 85 x 6

¹⁾ Tolerances of ±10 mm can be compensated for



Example order for JVAeco+ NAFT brickwork support bracket

Type	Cantilever length L	Variant	Load level	Offset
JVAeco+	290	- NAFT	/ 4.5	A = 100

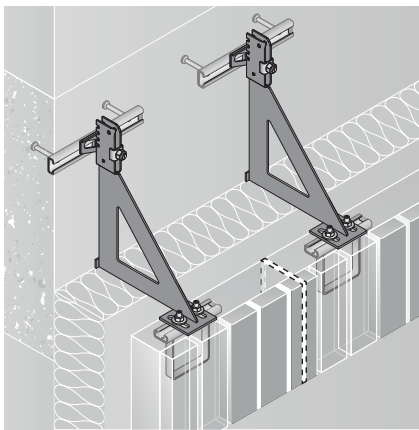
JFT+ suspension system

Design variants

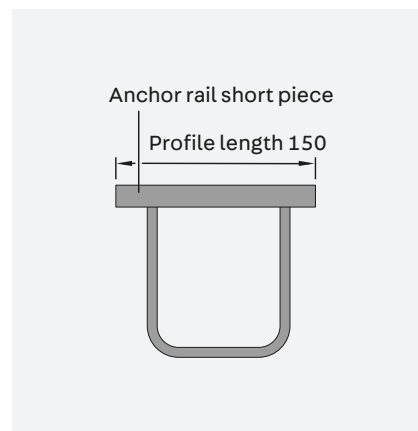
The precast lintels are fitted with JORDAHL® JFT+ prefabricated element holders set in concrete at the factory and these are suspended from the NFT/NAFT single brackets. The adjustment options parallel and perpendicular to the façade allow the lintels to be optimally aligned.

Dimensioning

The structural engineer or the prefabricated element manufacturer must provide proof of load-bearing capacity for the precast lintel.



JFT+ suspension system for suspending precast lintels



JORDAHL® JFT+ prefabricated element holder



Note
 National technical approval:
 Z-21.4-2014

JORDAHL® fastening elements and load level of single bracket for precast lintels

Load level in kN	$F_{Rd}^{2)}$ in kN	JORDAHL® JFT+ prefabricated element holder with necessary fastening elements	Suitable load level of JORDAHL® NFT/NAFT single bracket in kN
4.5	6.08	JFT 1+ (K28/15) 2x JORDAHL® JD screw M10x30 (A4-50) 2x washer 10.5 and 2x nut M10 (A4)	4.5
7.0	9.45	JFT 2+ (K38/17)¹⁾ 2x JORDAHL® JH screw M10x30 (A4-50) 2x washer 10.5 and 2x nut M10 (A4)	7.0 9.0 ³⁾
10.5	14.18	JFT 3+ (K38/17)¹⁾ 2x JORDAHL® JH screw M12x30 (A4-50) 2x washer 13 and 2x nut M12 (A4)	9.0 10.5 13.5 ³⁾

¹⁾ Additional reinforcement necessary according to approval Z-21.4-2014

²⁾ With reinforced normal concrete of strength class C30/37

³⁾ Only possible with increased concrete strength class according to approval



Example order for JFT+ prefabricated element holder

Type	Profile type
JFT 1+	K 28/15

Special shapes are available on request

JFTW precast lintel bracket

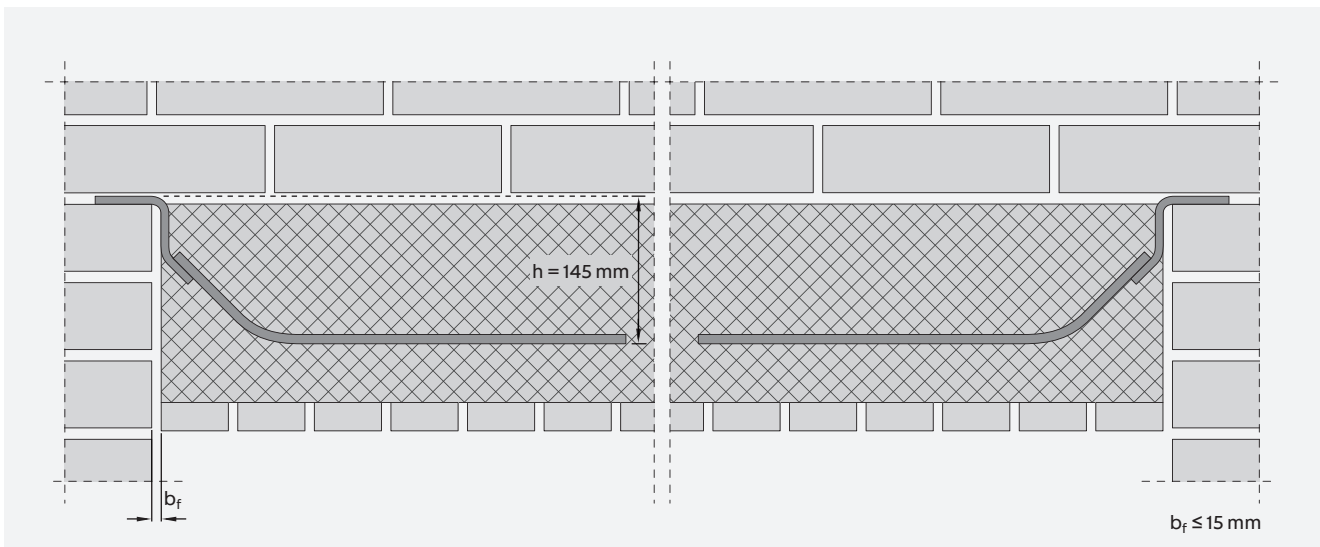
Design variants

The precast lintels are fitted with the JORDAHL® JFTW precast lintel bracket set in concrete at the factory, and placed on the clinker masonry on site.

Dimensioning

The structural engineer or the prefabricated element manufacturer must provide proof of load-bearing capacity for the precast lintel. The verification for the JFTW precast lintel bracket is carried out via a separate structural analysis. The Jordahl experts will be happy to advise you.

Support of precast lintels for normal case¹⁾



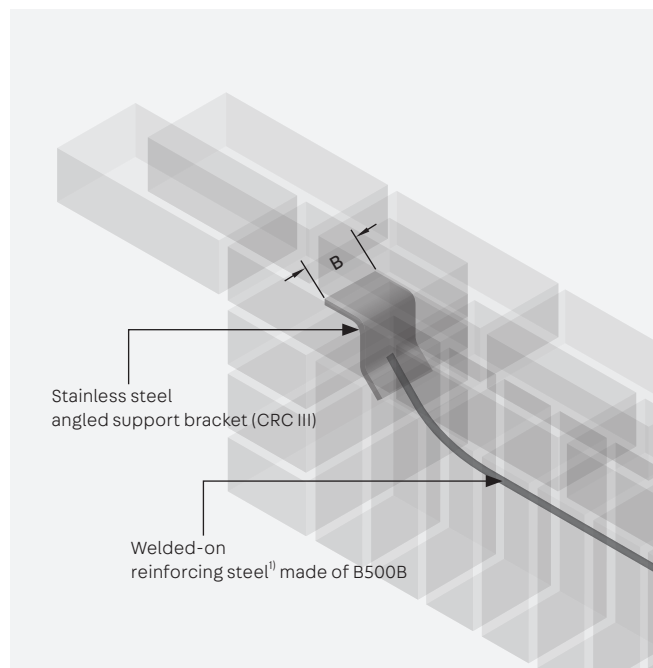
¹⁾ Valid for precast lintels with thickness $t = 115 \text{ mm}$ and concrete cross-section $\geq 80 \text{ mm}$

Installation dimensions and load-bearing capacity JFTW

	Load levels				
	2.6 kN	3.5 kN	4.2 kN	5.5 kN	7.0 kN
F_{Rd} in kN	3.51	4.73	5.67	7.43	9.45
Bracket width B in mm	60	60	60	70	75

Example order for JFTW precast lintel bracket

Type	Load level
JFTW -	5.5



¹⁾ For thinner precast elements with a concrete cross-section $\geq 60 \text{ mm}$, the reinforcing steel selected is to be from B500B NR

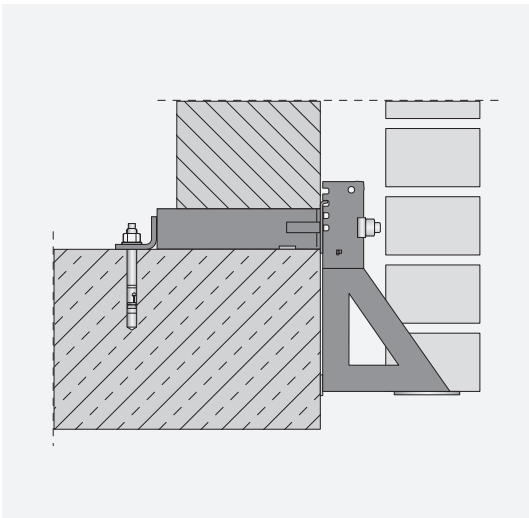
Custom brackets

Unlimited creativity

The special designs illustrated represent only a small selection of the wide range of possibilities and variants for facing brickwork support. We offer you individually adapted brackets for other support situations according to your required installation situation.

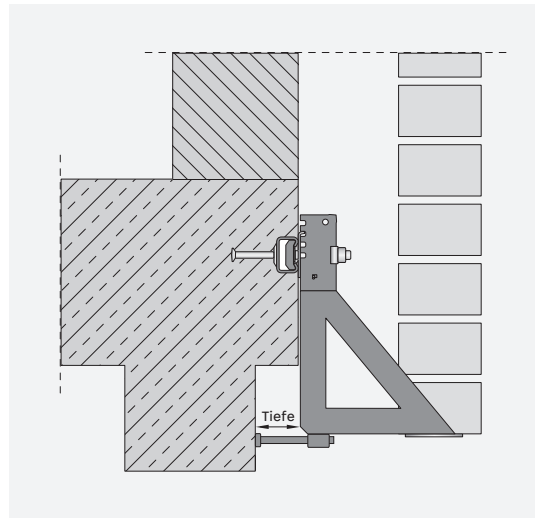
For a special bracket customised for difficult circumstances as well as for the planning of designs adapted to economical and structural requirements, please give us a call or contact us at experten@jordahl.de – we will be happy to advise you.

Mounting on thin ceilings



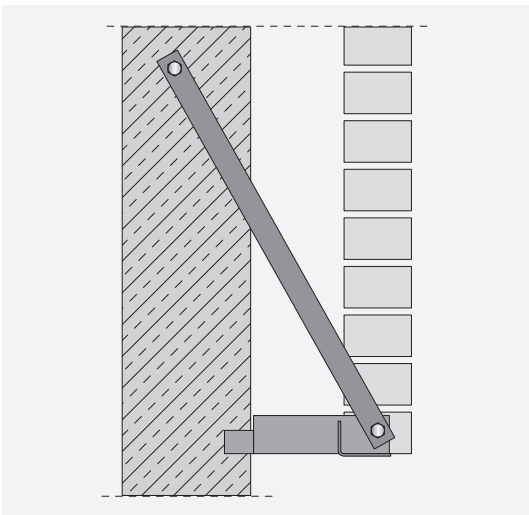
JVAeco+ standard bracket with additional component type JVAeco+ ZB for mounting on thin ceilings

Fastening to different wall thicknesses



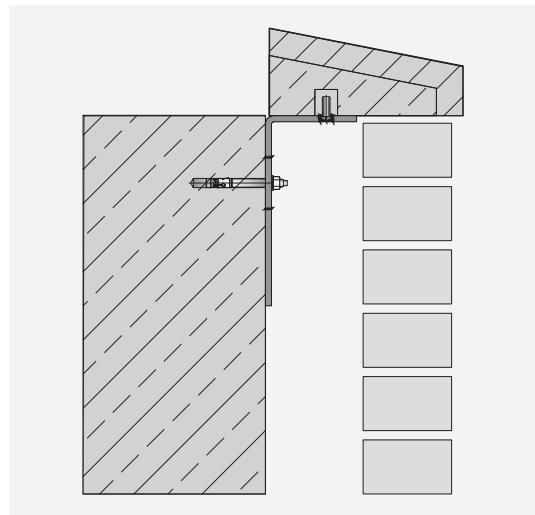
Special bracket with pressure screw for depth adjustment

Mounting close to the edge



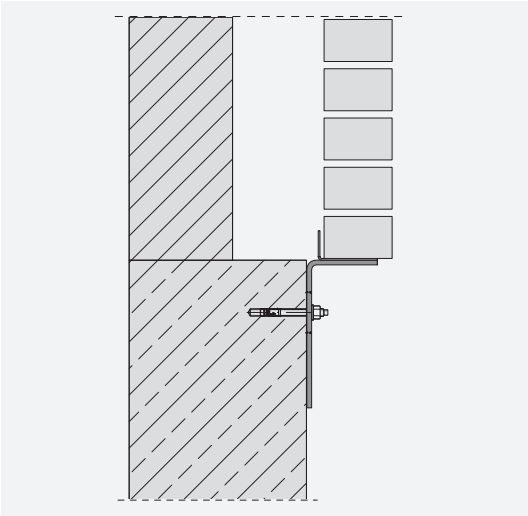
Special bracket with fish plate on outer corner

Mounting of window sills



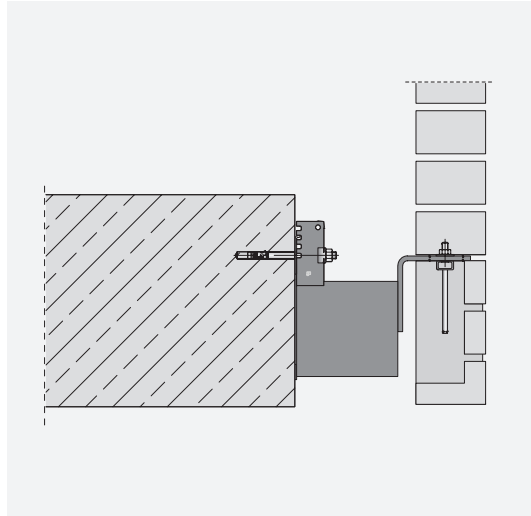
FB-SX special bracket with toothed slotted hole and a horizontal position lock

Mounting with too-small support surfaces



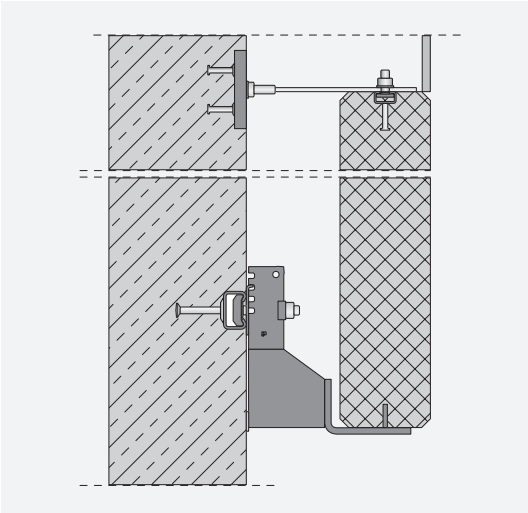
Special bracket for plinth supports as support extension

Mounting of lintels



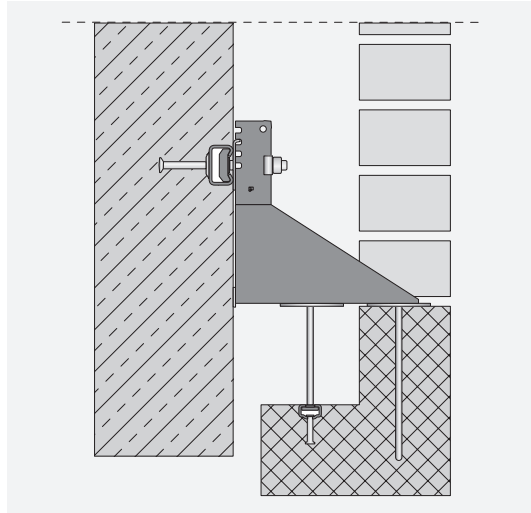
Special bracket with raised bracket support for fastening behind the precast element

Mounting of exposed concrete elements



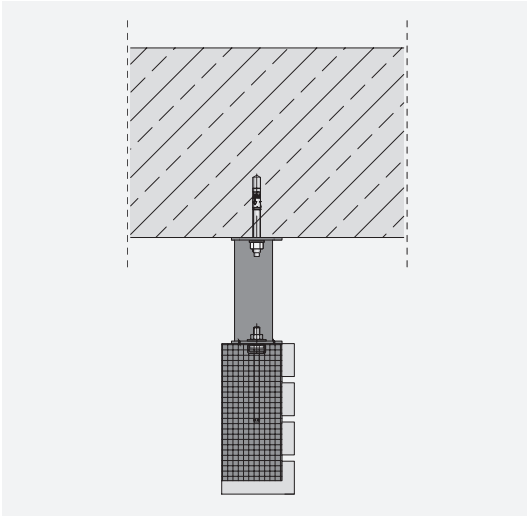
Special bracket for precast elements and tilt support

Mounting of L-lintels



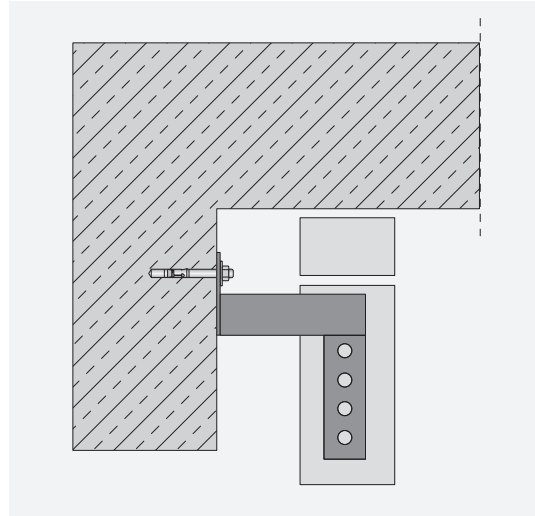
Special bracket with additional support plate for securing position towards the rear

Mounting below the ceiling



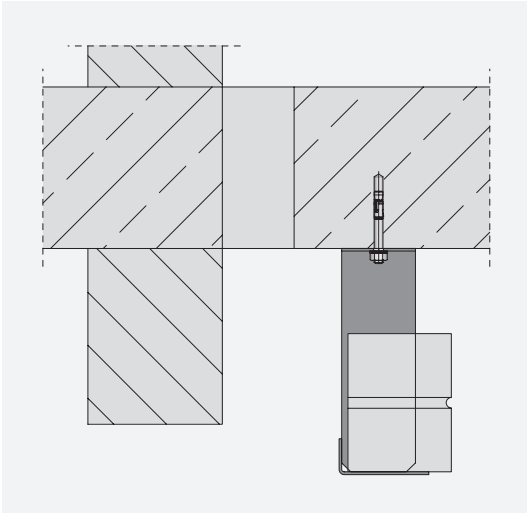
Special bracket for precast elements

Mounting with low wall height



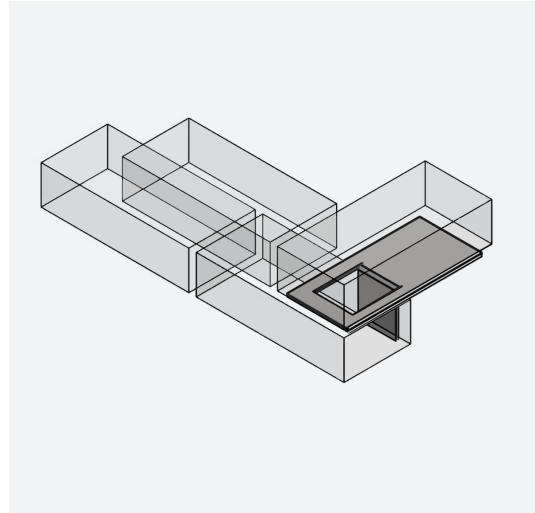
Special bracket JL-UL for brick-on-edge and soldier lintels

Mounting below the ceiling



Special bracket as angled bracket with visible bracing

Mounting of brick soffits



Special bracket JLB for window and door openings

JMK+ grout-in brackets

Design variants

If existing buildings are to be retrofitted with facing masonry, JORDAHL® JMK+ grout-in brackets can be used. For this purpose, sufficiently deep support pockets are drilled into the load-bearing masonry and the brackets are mortared in using Group III cement mortar (expanding concrete). Alternatively, the holes can also be chiselled out.

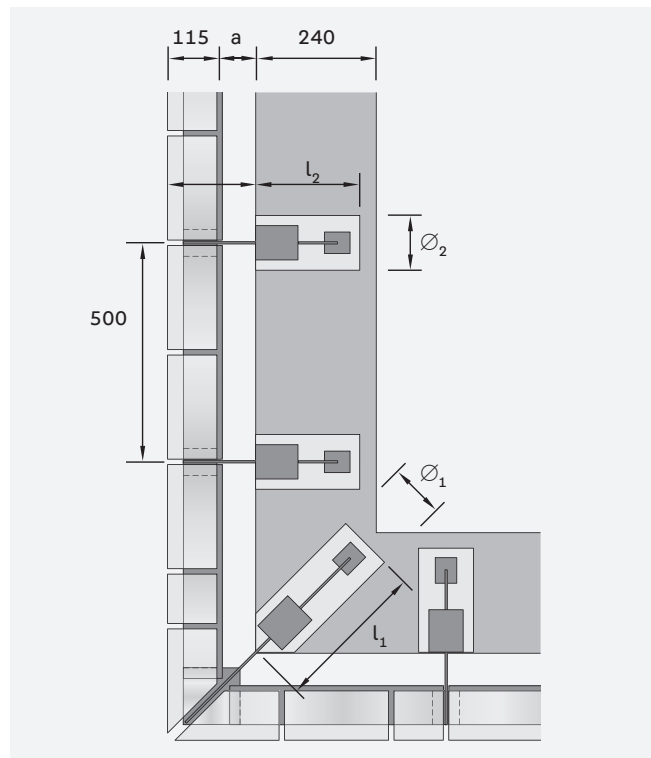
JORDAHL® JMK+ grout-in brackets are available in the same design variants as the JORDAHL® JVAeco+ brickwork support brackets:

- Design variants N/NA/NU
- Design variants P/PAR
- Design variants F/FAR
- Design variants NFT/NAFT



Top image: JMK+ P bracket being installed

Bottom image: JMK+ P bracket, installed



Arrangement of JMK+ N and JMK+ E grout-in brackets in top view

Dimensioning

The condition and load-bearing capacity of the substrate must be checked in advance: The compressive strength of the existing masonry must be at least $f_d = 2.1 \text{ N/mm}^2$ and the wall thickness at least 240 mm. In case of a lower compressive strength or thinner walls, a special solution must be worked out. The load transmitted into the masonry must be taken into account by the structural engineer. External walls or foundations must be able to safely bear the additional loads.

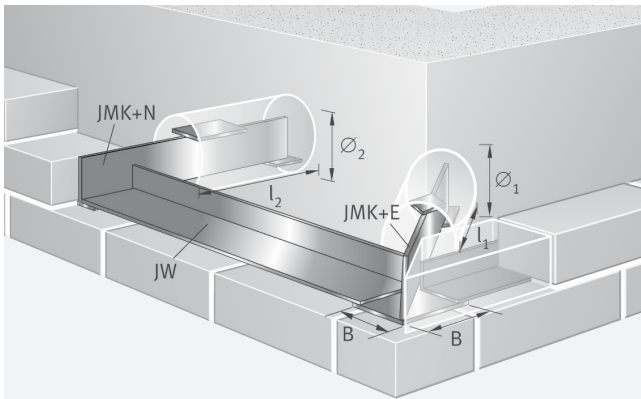
Accessories

Naturally, for the design variants N/NA/NU, the JORDAHL® JW angled bracket can be used (see p.s 14-15), for the design variants F/FAR the JORDAHL® JRH suspension loop (see p. 21), and for the design variants NFT/NAFT the JORDAHL® JFT+ prefabricated element holder (see p. 25) for the grout-in brackets as well.

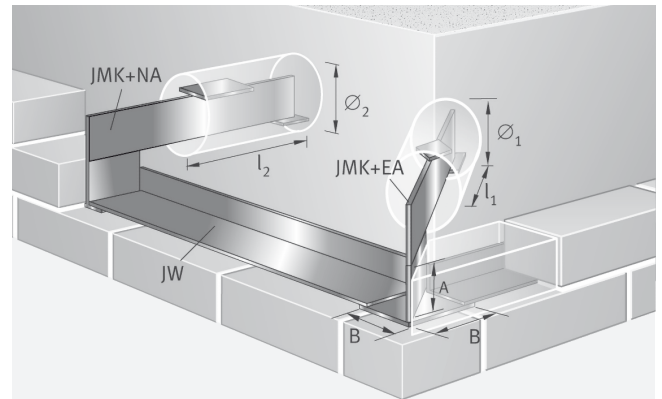


Notes

The grout-in brackets are available in the load levels 3.5 and 7.0; the rated resistances are therefore $F_{Rd} = 4.7 \text{ kN}$ or $F_{Rd} = 9.5 \text{ kN}$. The maximum wall height per bracing plane for a grout-in bracket spacing of 500 mm in the normal case ($\rho = 1800 \text{ kg/m}^3$, $t = 115 \text{ mm}$) is max. 6.75 m.



JMK+ N grout-in bracket and JMK+ E grout-in bracket for ends

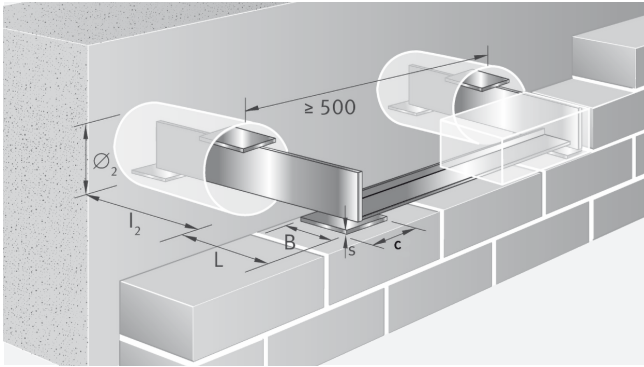


JMK+ NA grout-in bracket and JMK+ EA grout-in bracket for ends

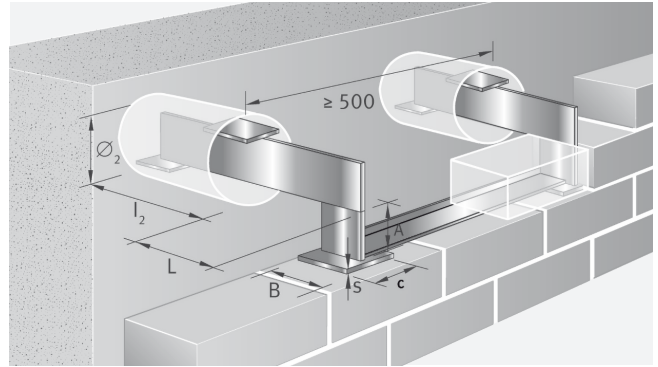
Installation dimensions and load-bearing capacity for JORDAHL® JMK+ E/EA grout-in brackets for ends

Shell spacing ¹⁾ a in mm	Cantilever length L in mm	Load level in kN	F _{Rd} in kN	Core hole Dia. ₁ in mm	Length of core hole l ₁ in mm
20	110	3.5	4.7	140	250
↓	↓				
70	160	3.5	4.7	150	250
80	170				
↓	↓				
120	210	3.5	4.7	160	250
130	220				
140	230	3.5	4.7	170	250
↓	↓				
200	290				
210	300	3.5	4.7	180	250
↓	↓				
220	310	3.5	4.7	190	250
230	320				
↓	↓				
240	330	7.0	9.5	170	280
↓	↓				
80	170	7.0	9.5	180	280
90	180				
↓	↓				
120	210	7.0	9.5	190	280
130	220				
140	230	7.0	9.5	200	280
↓	↓				
190	280				
200	290	7.0	9.5	210	280
↓	↓				
230	320	7.0	9.5	220	280
240	330				

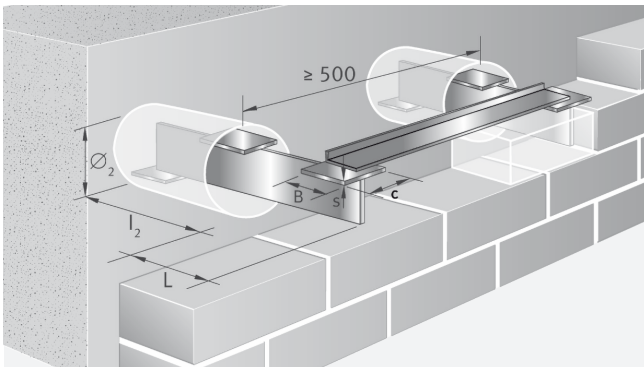
¹⁾ Tolerances of ±10 mm can be compensated for



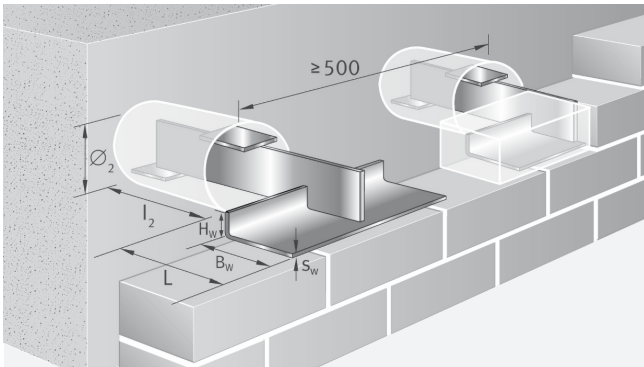
JMK+ N grout-in brackets



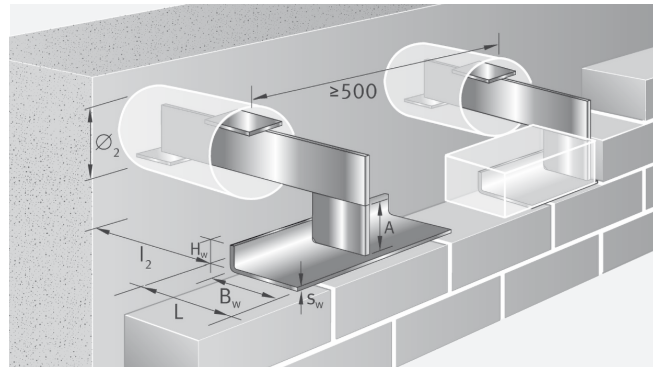
JMK+ NA grout-in brackets



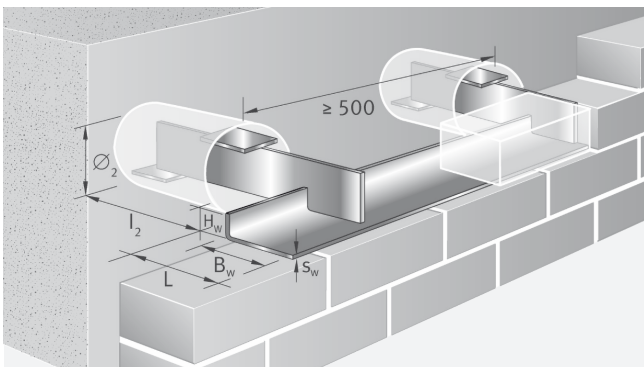
JMK+ NU grout-in brackets



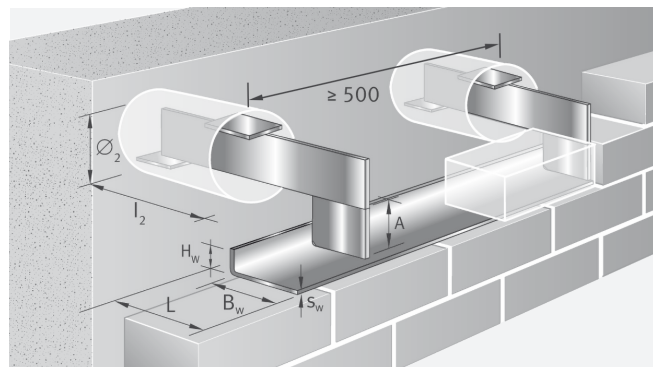
JMK+ P grout-in brackets



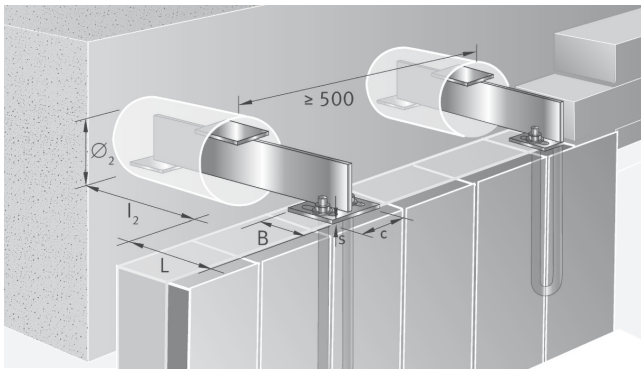
JMK+ PAR grout-in brackets



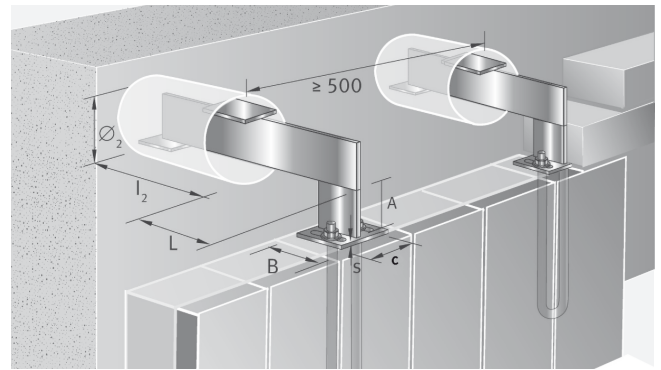
JMK+ F grout-in brackets



JMK+ FAR grout-in brackets



JMK+ NFT grout-in brackets



JMK+ NAFTA grout-in brackets

Installation dimensions and load-bearing capacity for JORDAHL® JMK+ N/NA/NU/NFT/NAFT/P/PAR/F/FAR grout-in brackets

Shell spacing ¹⁾ a in mm	Cantilever length L in mm	Load level in kN	F _{Rd} in kN	Core hole Dia. ₂ in mm	Length of core hole l ₂ in mm
20	110	3.5	4.7	90	205
↓	↓				
70	160	3.5	4.7	100	205
90	170				
↓	↓				
100	190	3.5	4.7	110	205
110	200				
↓	↓				
200	290				
210	300	3.5	4.7	120	205
↓	↓				
240	330				
20	110	7.0	9.5	130	205
↓	↓				
50	140	7.0	9.5	140	205
60	150				
↓	↓				
90	180	7.0	9.5	150	205
100	190				
↓	↓				
150	240				
160	250	7.0	9.5	160	205
↓	↓				
240	330				

¹⁾ Tolerances of ±10 mm can be compensated for



Example order for JMK+ grout-in bracket

Type	Cantilever length L	Variant	Load level
JMK+	190	- N	/ 3.5

Accessories

JLA cavity wall anchor

The facing masonry forms a thin shell. It must be secured against buckling and also be able to dissipate high wind forces into the load-bearing component. Depending on the material of the load-bearing interior wall, these tasks are performed by cavity wall anchors or brick tie anchors made of flat steel.

Minimum number n_{\min} of wire anchors according to Table NA-18 DIN EN 1996-1/NA per m^2 wall area (wind zones according to DIN EN 1991-1-4/NA)

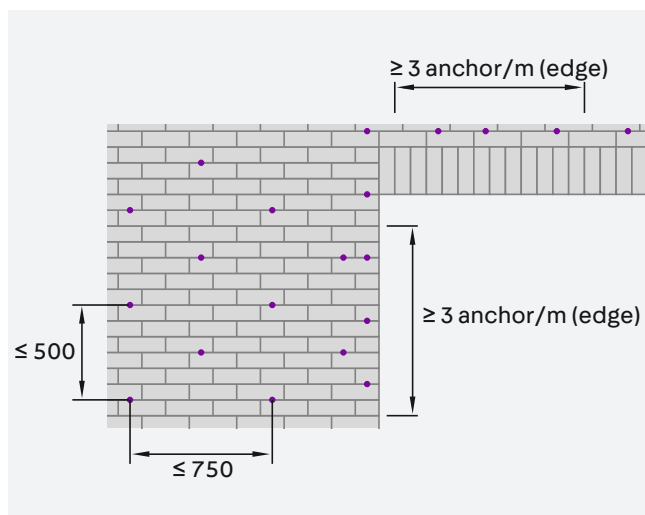
Building height	Wind zones 1 to 3, wind zone 4 inland	Wind zone 4 coast of the North Sea and Baltic Sea and islands of the Baltic Sea	Wind zone 4 islands of the North Sea
$h \leq 10 \text{ m}$	7 ¹⁾	7	8
$10 \text{ m} < h \leq 18 \text{ m}$	7 ²⁾	8	9
$18 \text{ m} < h \leq 25 \text{ m}$	7	8 ³⁾	–

Validity of table for shell spacing $a \leq 150 \text{ mm}$

¹⁾ In wind zone 1 and wind zone 2 inland: 5 anchors/ m^2

²⁾ In wind zone 1: 5 anchors/ m^2

³⁾ If a building floor plan length is smaller than $h/4$: 9 anchors/ m^2



Arrangement of cavity wall anchors in the wall area, at joints and edges according to DIN EN 1996-1

DIN EN 1996-1-1/NA:2012-05 (Eurocode 6, excerpt)

NDP for 8.5.2.2 (2) "Double-skin walls with air layer and double-skin walls with facing layer".

The masonry shells are to be connected by means of anchors in accordance with the relevant national technical approval made of stainless steel, or by means of anchors in accordance with DIN EN 845-1 made of stainless steel, the use of which is regulated in a national technical approval. For wire anchors corresponding in shape and dimensions to Figure NA.9 the following applies:

- Vertical spacing not exceeding 500 mm
- Horizontal spacing not exceeding 750 mm
- Clear spacing of the masonry shells not exceeding 150 mm
- Diameter: 4 mm
- Normal masonry mortar, at least group IIa
- Minimum number: see Table NA.18

unless otherwise specified in the approval for the wire anchors.

At all free edges (of openings, at building corners, along expansion joints and at the upper ends of outer shells), three wire anchors per metre of edge length are to be installed in addition to Table NA.18.

Particular attention is to be paid to the execution requirements specified in DIN EN 1996-2:2010-12, 3.5.1.

The wire anchors are to be designed – taking into account their structural effectiveness – in such a manner that they cannot conduct moisture from the outer to the inner shell (e.g. by sliding on a plastic washer, see Figure NA.9).

If the outer shell is not anchored via a surface, e.g. in linear form or only at the level of the ceilings, its stability must be verified separately.

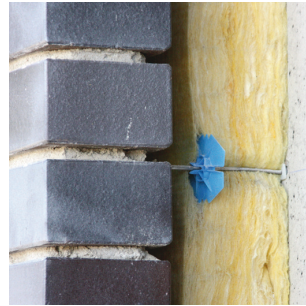
In the case of curved masonry shells, the type, arrangement and number of anchors shall be determined taking into account the deformation.

NDP for 8.5.2.3 (2) "Double-skin walls without an air layer"

Double-skin walls made of masonry without an air layer are to be anchored in the same way as double-skin walls with an air layer. All other application conditions and instructions apply as for double-skin walls with air layer according to 8.5.2.2 (2).

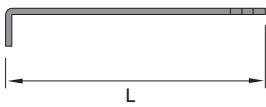

Cavity wall anchors anchor the facing shell to walls and secure the facing masonry against horizontal forces.

- Cavity wall anchor type JLA W-L: for double-skin masonry with and without thermal insulation. Due to its corrugated shape, there is no need to bend it into the facing shell.
- Cavity wall anchor type JLA D-ZV: pre-assembled cavity wall anchor for subsequent facing of masonry walls made of solid brick or concrete walls. Due to its corrugated shape, there is no need to bend it into the facing shell.



Cavity wall anchor with ISO clip

Selecting a JLA cavity wall anchor

JLA cavity wall anchors stainless steel version	Designation	Shell spacing ¹⁾ a in mm	Area of application ²⁾	
			Load-bearing inner shell ³⁾	Non-load-bearing outer shell
JLA W-L cavity wall anchor 	W-L-4/225	≤ 100	Masonry in acc. w/ DIN EN 1996-1	Masonry in acc. w/ DIN EN 1996-2
	W-L-4/250	≤ 125		
	W-L-4/275	≤ 150		
	W-L-4/300	≤ 175		
	W-L-4/340	≤ 215		
JLA D-ZV dowel anchor  Incl. pre-mounted dowel and driving tool	D-ZV-4/180	≤ 45	Normal concrete ≥ C12/15	Brick in acc. w/ DIN EN 771-1
	D-ZV-4/210	≤ 75		
	D-ZV-4/250	≤ 115		
	D-ZV-4/275	≤ 140		
	D-ZV-4/300	≤ 165		
	D-ZV-4/320	≤ 185	Solid brick ≥ Mz 12 in acc. w/ DIN EN 771-1	Sand-lime bricks in acc. w/ DIN EN 771-2
	D-ZV-4/350	≤ 215		
	D-ZV-4/375	≤ 240	Solid sandstone ≥ KS 12 in acc. w/ DIN EN 771-2	Concrete facing bricks in acc. w/ DIN EN 771-3
	D-ZV-4/400	≤ 265 ⁴⁾		
	D-ZV-5/350	≤ 215		
	D-ZV-5/375	≤ 240		
	D-ZV-5/400	≤ 265		
	D-ZV-5/425	≤ 290		
	D-ZV-5/450	≤ 315		
	D-ZV-5/475	≤ 340		
D-ZV-5/500	≤ 360			
D-ZV-5/525	≤ 390			
D-ZV-5/550	≤ 415 ⁴⁾			

¹⁾ Up to 150 mm shell spacing in acc. w/ DIN EN 1996-2 and exceeding 150 mm to 400 mm shell spacing according to manufacturer's approval

²⁾ The specifications are to be checked against the current standard/approval.

³⁾ Cavity wall anchors for other inner shell materials upon request

⁴⁾ National technical approval up to 250 mm shell spacing for dia. 4 and up to 400 mm for dia. 5

Material

The JLA cavity wall anchors are made of stainless steel of corrosion resistance class (CRC) III as standard. For applications in CRC IV, the cavity wall anchors are also available with approval upon request.

Accessories

As an accessory, you can order the ISO clips, a practical combination of a drip disc and clamping claw plate.



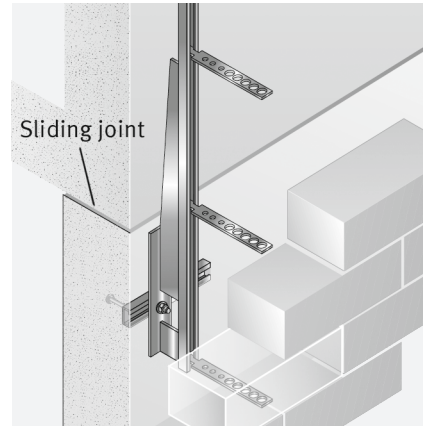
Example order for JLA cavity wall anchor

Type	Diameter	Length L
JLA D-ZV	- 4	/ 350

JAV parapet brick anchors

Application

Reinforced concrete flat roofs deform due to stress from temperature and loads. Flat roofs made of reinforced concrete are therefore partially supported on the lower walls in a sliding manner. The facing masonry is not able to absorb the deformations of the parapet without damage. Facing masonry that leads up to the upper roof edge should therefore not be anchored in the area of the parapet. JORDAHL® JAV parapet brick anchors secure the facing masonry freely up to the upper edge of the parapet by anchoring it in the ring beam of the lower wall.



JAV parapet brick anchor and JMA brick tie anchor

Choosing a JORDAHL® JAV parapet brick anchor for the normal case ¹⁾

Parapet brick anchor type	Length L in mm	Useful height H in mm	Required number of brick tie anchors	Wall spacing ²⁾ a in mm	Brick tie anchor type
JAV/75/600	600	400-550	3	80-110	JMA 85/12
				90-145	JMA 120/12
				145-200	JMA 180/12
JAV/75/850	850	650-800	4	80-110	JMA 85/12
				90-145	JMA 120/12
				145-200	JMA 180/12
JAV/75/1100	1100	900-1000	5	80-110	JMA 85/12
				90-145	JMA 120/12
				145-200	JMA 180/12

¹⁾ Valid for facing masonry thickness $t = 115$ mm

²⁾ Larger wall spacing values upon request

Installation distances

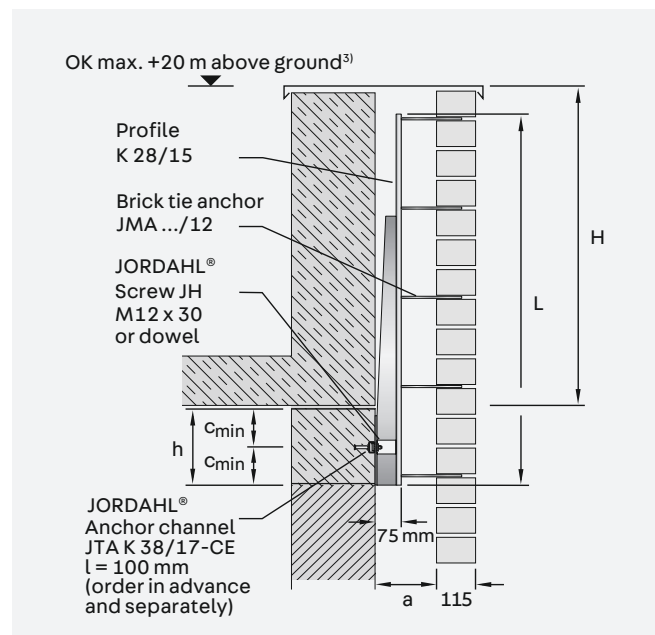
Parapet brick anchors are installed with a spacing of no more than 750 mm from each other and no more than 375 mm from the edge or corner. This ensures the absorption of loads from wind suction and wind pressure.

Accessories

The connection between the facing masonry and the parapet brick anchor is made using JORDAHL® JMA brick tie anchors (see p. 38).

Example order for JAV parapet brick anchor

Type	Construction depth	Length
JAV	75	/ 600

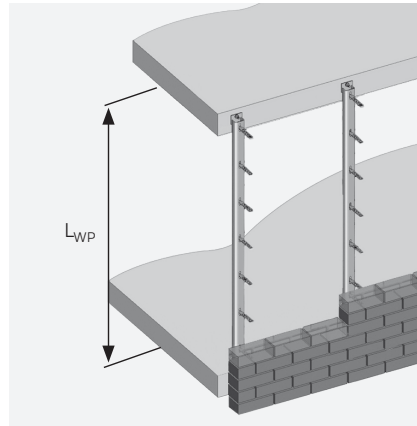


³⁾ Greater heights must be verified on a per-project basis.

JWP windposts

Application

JORDAHL® JWP windposts and the corresponding JORDAHL® JMA brick tie anchors are used to brace facing masonry and to bear loads from wind suction and wind pressure in reinforced concrete framing. They are affixed to the transoms or slab ends made of reinforced concrete and thus bridge the area of the thermal insulation or lightweight walls. We can take your special requirements in terms of dimensions, forces, and fastening methods into account. The design load $q_{R,d}$ is 0.75 kN/m. The spacing of the JORDAHL® windposts e in m is therefore calculated as the quotient of $q_{R,d}$ in kN/m and the existing wind load $w_{E,d}$ in kN/m² in accordance with DIN EN 1991-1-4NA.



JWP windpost and JMA brick tie anchor

Choosing a JORDAHL® JWP windpost for the normal case¹⁾

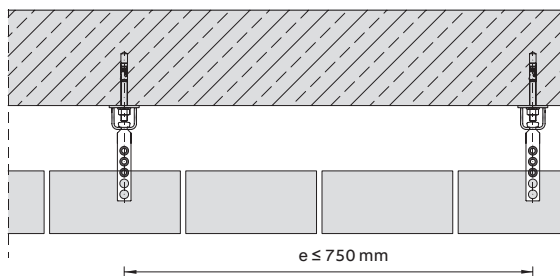
	Effective load height L in m	Profile dimensions b × h × s in mm	Wall spacing ²⁾ a in mm	Brick tie anchor JMA
	2.50	70 × 60 × 3	70-95	85/12
	2.75	75 × 65 × 3	95-130	120/12
	3.00	75 × 65 × 4	135-190	180/12
	3.25	80 × 70 × 4		
	3.50	85 × 75 × 4	85-110	85/12
	3.75	90 × 80 × 4	115-145	120/12
	4.00	95 × 85 × 4	150-205	180/12

¹⁾ Valid for facing masonry thickness $t = 115$ mm

²⁾ Larger wall spacing values upon request

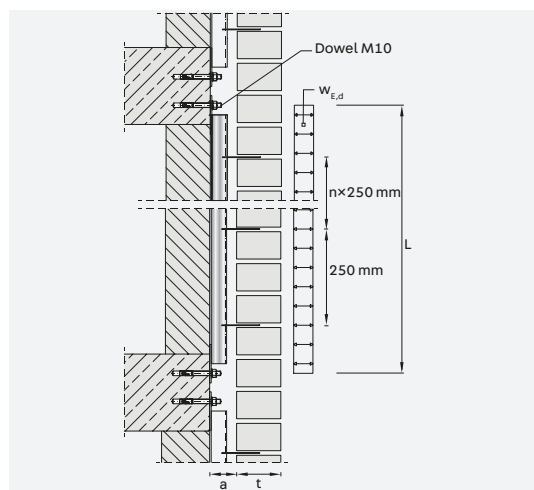
Installation distances

Windposts are installed with a spacing of no more than 750 mm from each other and no more than 375 mm from the edge or corner.



Example calculation for determining the installation distance e for a building in WLZ 3 (inland):

$$e = (0.75 \text{ kN/m}) / (0.80 \text{ kN/m}^2 \times 1.5) = 0.625 \text{ m}$$



Accessories

The connection between the facing masonry and the windposts is made using JORDAHL® JMA brick tie anchors (see p. 38). The required number of brick tie anchors is given by the quotient of L in m and 0.25 m (max. JMA spacing).



Example order for JWP windpost

Type	Dimensions	Length
JWP	75 × 65 × 4	- 3000

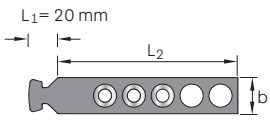
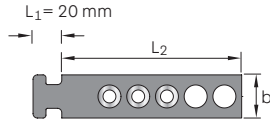
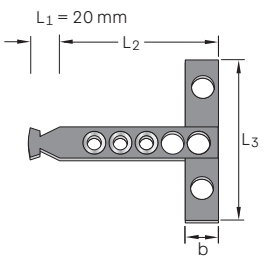
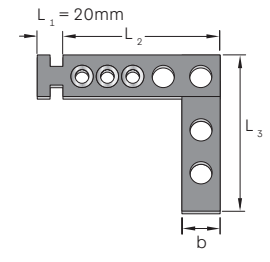
JMA brick tie anchor

Design variants

The brick tie anchors are inserted into the brick tie channels and pressed into the horizontal joint mortar of the masonry at the recommended intervals:

- Design variant JMA-L₂ in straight shape
- Design variant JMA-L₂ × L₃-Q in T-shape
- Design variant JMA-L₂ × L₃-QE in L-shape
- Design variant JMA-D in extra-flat shape for connecting large-format masonry

Selecting a JORDAHL® JMA brick tie anchor for thick-bed mortar


Brick tie anchor, fv or A4 version	Length and series ²⁾	Shell spacing			Dimensions		
		a in mm	b in mm	t in mm	L ₂ ¹⁾ in mm	L ₃ in mm	
	JMA-L ₂ /12	20-40	25	2	85	-	
		40-80			120		
		85-140			180		
		140-160			300		
	JMA-L ₂ /18	20-40	25	3	85	-	
		40-80			120		
		85-140			180		
		140-160			300		
	JMA-L ₂ × L ₃ -Q / 12	20-40	25	2	85	120	
		40-80			120		
		85-140			180		
	JMA-L ₂ × L ₃ -Q / 18	140-160	25	3	300	120	
		20-40			85		120
		40-80			120		180
	JMA-L ₂ × L ₃ -QE / 12	20-40	25	2	85	120	
		40-80			120		
		85-140			180		
	JMA-L ₂ × L ₃ -QE / 18	140-160	25	3	300	120	
		20-40			85		120
		40-80			120		180
		85-140	180	300	180		
		140-160	300	300			

¹⁾The required length L₂ must be determined taking into account the thickness t of the facing brickwork (embedding depth ≥ 50 mm).

²⁾Series 12 for profile 25/15, 28/15 and series 18 for profile 38/17

Selecting a JORDAHL® JMA brick tie anchor for thin-bed mortar

Brick tie anchor, version A2

	Dimensions		Length
	b in mm	s in mm	L in mm
	25	1	125
	25	1	185
	25	1	245

Example order for JMA-QE brick tie anchor

Type	Length L ₂ × L ₃	Series	Version
JMA	- 85 × 120	- QE/12	- A4

Example order for JMA brick tie anchor

Type	Length	Series	Version
JMA	- 120	/ 12	- A4

Brick tie channels

Connection

There are several connection options for the JORDAHL® JMA brick tie anchor to ensure the permanent and secure connection of masonry to adjacent building components.

- JORDAHL® JTA anchor channels
- JORDAHL® JM mounting channel, which can also be mounted on wood and steel components

Material

The brick tie channels and anchors are manufactured in stainless steel 1.4571 or 1.4401 (A4) for use in façade areas. Hot-dip galvanised products can be used for interior applications.

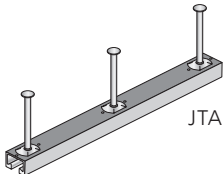
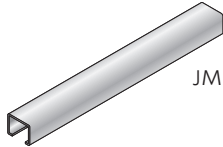
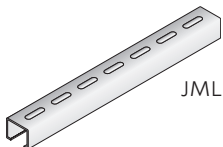
Dimensioning

All channels are available in various cross-sections matched to the loads. The loads that can be borne by the channels set in concrete (quality \geq C20/25) can be taken from the following table.



Connection of facing masonry to reinforced concrete components

Selecting JORDAHL® brick tie channels

Brick tie channels	Version	Channel load capacity F_{Rd} in kN with a spacing of 250 mm	Corresponding brick tie anchor
 <p>JTA</p>	fv A2 A4	4.2	JMA-L ₂ /12 JMA-L ₂ × L ₃ -Q/12 JMA-L ₂ × L ₃ -QE/12 JMA-L-D/12
 <p>JM</p>			
 <p>JML</p>	fv A2 A4	6.3	JMA-L ₂ /18 JMA-L ₂ × L ₃ -Q/18 JMA-L ₂ × L ₃ -QE/18

JGA+ scaffold anchor

Applications

JORDAHL® JGA+ scaffold anchors secure scaffolding on the finished structure without damaging the facing shell. They are attached to the load-bearing structure with dowels and guided through the facing shell in the T-joint.

- Fastening of scaffolds that are not stable when free-standing
- Fastening of outdoor advertising

Design variants

The JORDAHL® JGA+ scaffold anchor is available in two design variants:

- Design variant JGA+ Z for transferring forces acting vertically on the outer wall
- Design variant JGA+ Q for transferring forces acting vertically on and parallel to the outer wall

Accessories

For fastening, we supply dowels suitable for proven non-cracked or cracked concrete (quality \geq C20/25). A plastic cap in grey is supplied to conceal the scaffold anchor in the facing masonry.

For connection to the scaffold anchor, we supply scaffolding eyelets M12 (eye diameter 23 mm; effective length 40 mm), galvanised, on request.

Dimensioning

In Germany, the anchoring of scaffolds is regulated in two DIN standards. DIN 4420-3 regulates the anchoring of tube coupling scaffolds and DIN 4426 the anchoring of system scaffolds.

The load-bearing capacity of the JORDAHL® scaffold anchors was dimensioned according to the specifications of DIN 4426. This standard does not specify a specific grid, but the maximum vertical spacing of the anchorage points must not exceed 4 m. No distinction is made between clad and unclad scaffolding in DIN 4426. $F_{\perp} = 2.25 \text{ kN/m}$ and $F_{\parallel} = 0.75 \text{ kN/m}$ façade length are assumed as loads. This results in the following forces, taking into account the partial safety factor:

$$F_{Ed, \perp} = F_{\perp} \times \gamma_Q = 2.25 \text{ kN/m} \times 1.5 = 3.38 \text{ kN/m}$$

$$F_{Ed, \parallel} = F_{\parallel} \times \gamma_Q = 0.75 \text{ kN/m} \times 1.5 = 1.13 \text{ kN/m}$$

With a usual post spacing of 2.5 m, this results in the following forces for the scaffold anchors:



Attachment of the scaffolding to the scaffold anchor by means of a scaffolding eyelet.

$$F_{Ed, \perp} = 3.38 \text{ kN/m} \times 2.5 \text{ m} = 8.45 \text{ kN}$$

$$F_{Ed, \parallel} = 1.13 \text{ kN/m} \times 2.5 \text{ m} = 2.83 \text{ kN}$$

In the case of deviating anchorage distances, the forces on the scaffold anchors must be verified in accordance with the relevant DIN. Scaffolds designed according to DIN 4420-3 can also be anchored with JORDAHL® scaffold anchors, as the loads to be anchored are lower (see DIN 4420-3, Table 3).

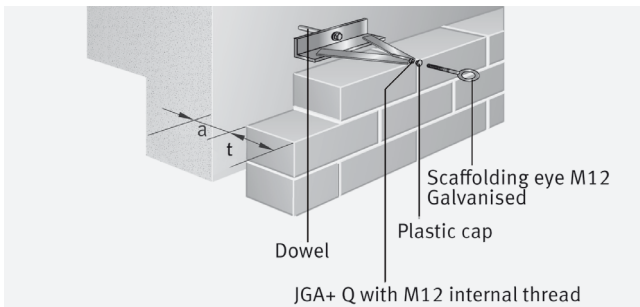
Material

JORDAHL® scaffold anchors incl. dowels are made of stainless steel of corrosion resistance class III.

JGA+ Q scaffold anchor

With absorption of horizontal forces

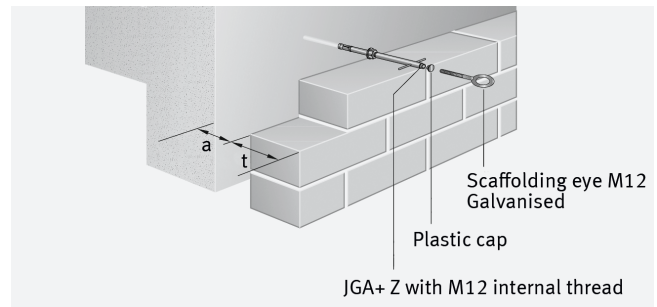
JORDAHL® JGA+ Q scaffold anchors transfer tensile and compressive forces perpendicular to the façade and horizontal forces parallel to the façade which act on the structure. Anchoring is carried out with the specified dowels in cracked or non-cracked concrete (quality \geq C20/25). The load-bearing capacity of the dowels must always be verified according to the conditions of use.



JGA+ Z scaffold anchor

Without absorption of horizontal forces

JORDAHL® JGA+ Z scaffold anchors transmit tensile and compressive forces acting on the structure perpendicular to the façade. Anchoring is carried out with the specified dowels in cracked or non-cracked concrete (quality \geq C20/25). If a shear check is carried out in the masonry on site, loads parallel to the façade can also be absorbed when using JGA+ Z scaffold anchors.



Example order for JGA+ Q scaffold anchor

Type	Total projection
JGA+ Q -	210



Example order for JGA+ Z scaffold anchor

Type	Total projection
JGA+ Z -	210

Selecting a JORDAHL® JGA+ Q scaffold anchor

Designation	Shell spacing a in mm	Clinker thickness d in mm	Total projection a + t in mm	Matching dowel ²⁾
JGA+Q-150	40-55	115	150	M12
JGA+Q-170	60-75	115	170	M12
JGA+Q-190	80-95	115	190	M12
JGA+Q-210	100-115	115	210	M12
JGA+Q-230	120-135	115	230	M12
JGA+Q-250	140-155	115	250	M12
JGA+Q-270	160-175	115	270	M12
JGA+Q-290	180-195	115	290	M12
JGA+Q-310	200-215	115	310	M12
JGA+Q-330	220-235	115	330	M12
JGA+Q-350	240-255	115	350	M12
JGA+Q-370	260-275	115	370	M12
JGA+Q-390	280-295	115	390	M12
JGA+Q-410	300-315	115	410	M12

Other shell spacing values, load levels and anchoring reasons upon request.

¹⁾ Dowels must always be verified on the basis of the respective installation situation and the existing forces.

Rated resistance: $F_{Rd,\perp} = \pm 8.6$ kN $F_{Rd,\parallel} = \pm 2.9$ kN



Example order for dowels

Type	Thread	Clamp thickness	Version
AB	M12	/ 10	A4

Selecting a JORDAHL® JGA+ Z scaffold anchor

Designation	Shell spacing a in mm	Clinker thickness d in mm	Total projection a + t in mm	Matching dowel ²⁾
JGA+Z-110	0-15	115	110	M12/10
JGA+Z-130	20-35	115	130	M12/30
JGA+Z-150	40-55	115	150	M12/10
JGA+Z-170	60-75	115	170	M12/30
JGA+Z-190	80-95	115	190	M12/10
JGA+Z-210	100-115	115	210	M12/30
JGA+Z-230	120-135	115	230	M12/10
JGA+Z-250	140-155	115	250	M12/30
JGA+Z-270	160-175	115	270	M12/10
JGA+Z-290	180-195	115	290	M12/30
JGA+Z-310	200-215	115	310	M12/10
JGA+Z-330	220-235	115	330	M12/30
JGA+Z-350	240-255	115	350	M12/10

Other shell spacing values, load levels and anchoring reasons upon request.

²⁾ Dowels included in scope of delivery

Rated resistance: $F_{Rd,\perp} = \pm 8.6$ kN

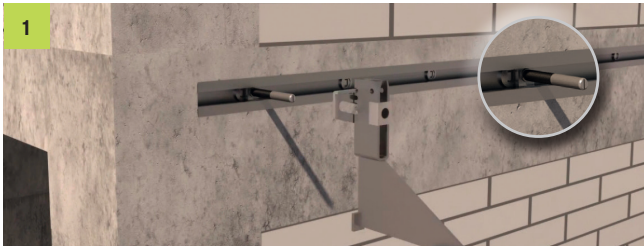


Example order for scaffolding eyelets

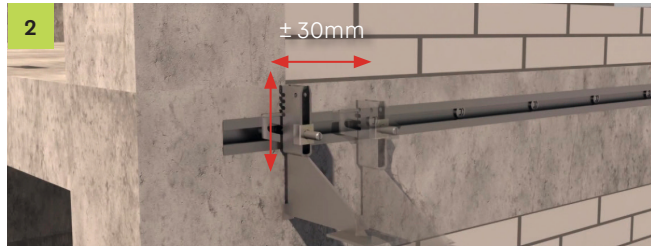
Type	Thread	Version
FIG	M12	Galvanised (gv)

Installation notes

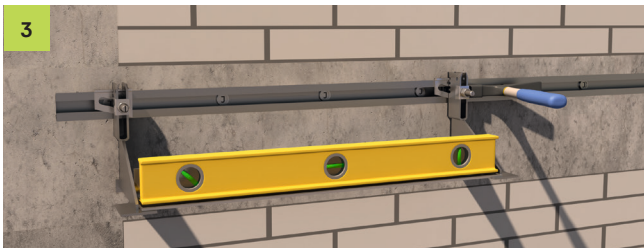
Mounting of JORDAHL® brickwork support brackets



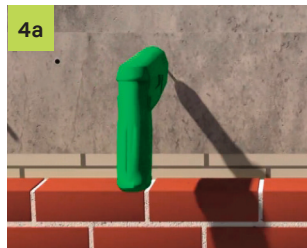
1 Set JORDAHL® anchor channel properly in concrete and remove foam filling. Insert the JORDAHL® screw horizontally into the anchor channel slot and turn by 90°. The marking slot at the end of the shaft must be perpendicular to the longitudinal axis of the channel.



2 Adjust the brickwork support bracket vertically using the teeth in the bracket head and the slanted slit plate. Adjust horizontally by means of the JORDAHL® anchor channel. Screw on nut and tighten with torque spanner.

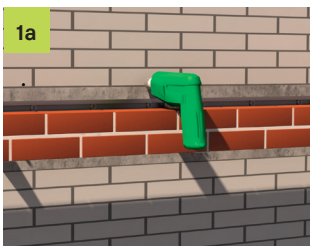


3 Fine adjustment by moving the JORDAHL® slanted slit plate sideways.

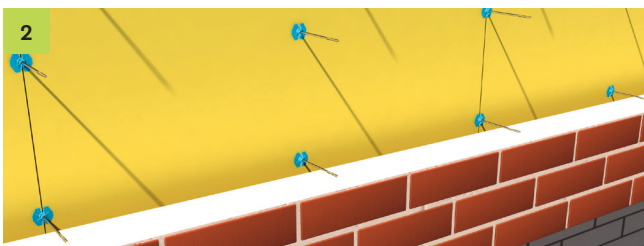


4a For attachment to dowels, install dowels as specified in the approval. Place bracket and slanted slit plate on the dowel, adjust, place nut and tighten.

Mounting of JORDAHL® cavity wall anchors



1a The mounting of JORDAHL® cavity wall anchors is carried out in accordance with the installation instructions supplied.



2 During installation, the structurally specified number of cavity wall anchors per m² must be observed.

Mounting of JORDAHL® windposts



1 The JORDAHL® windposts are fastened in the reinforced concrete ceiling by means of a structurally verified anchor bolt or anchor channel.



2 For more information on JORDAHL® windposts, see p. 37.

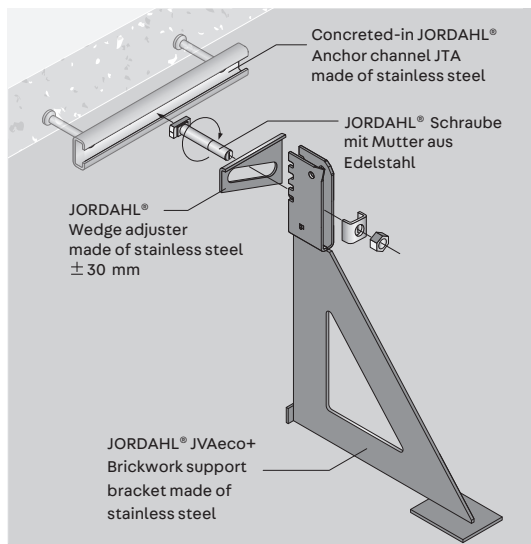
Fastening elements

Fastening elements for JORDAHL® JVAeco+ brickwork support bracket, JAV parapet brick anchor and L+ angled bracket

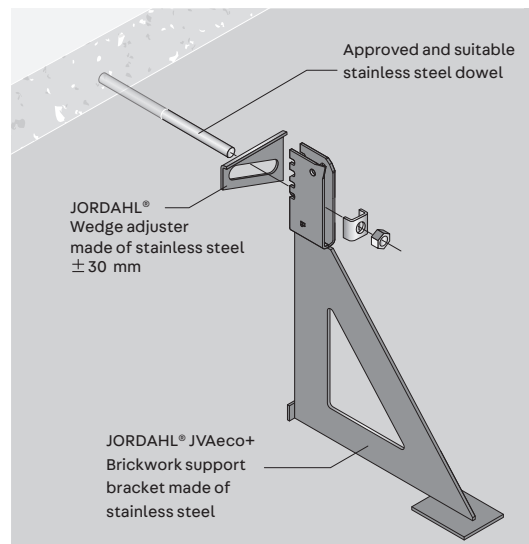
JORDAHL® Product	Load level in kN	F _{Rd} in kN	Type	JORDAHL® anchor channel ¹⁾	Approved and suitable dowel ¹⁾			
				JORDAHL® Accessories	Dia. dowel	Clamp thickness in mm	JORDAHL® Accessories	
Brickwork support brackets	2.5	3.38	K 38/17-CE	JH screw M12 x 70 T (A4-50) Nut M12 DIN EN 24032 Slanted slit plate Clamping washer KS 13	M12	50	Slanted slit plate Clamping washer KS 13	
	3.5	4.73						
JVAeco+ N/NA/NU NFT/NAFT P/PAR F/FAR E/EA	4.5	6.08	K 50/30-CE	JB screw M12 x 80 T (A4-70) Nut M12 DIN EN 24032 Slanted slit plate Clamping washer KS 13	M12	60 ²⁾	Slanted slit plate Clamping washer KS 13	
	5.0	6.75						
	7.0	9.45						
	7.5	10.13						
JAV parapet brick anchors	10.5	14.18	K53/34-CE W50+CE	JB screw M16 x 85 T (A4-50) Nut M16 DIN EN 24032 Slanted slit plate Clamping washer KS 17	M16	60	Slanted slit plate Clamping washer KS 17	
	13.5	18.23						
Angled brackets L-F+, L-DF+, L-DN+	–	–	K 38/17-CE	JH screw M12 x 30 (A4-50) Nut M12 DIN EN 24032 Washer 13 EN ISO 7089	M12	10	–	
	1.2	1.6	K 28/15-CE	JD screw M10 x 30 (A4-50) Nut M10 DIN EN 24032 Washer 10.5 EN ISO 7089	M10	10	–	
	1.5	2.0						
2.1	2.8	3.2	4.3	K 38/17-CE	JH screw M10 x 30 (A4-50) Nut M10 DIN EN 24032 Washer 10.5 EN ISO 7089	M10	10	–

¹⁾ Anchor channels and dowels must always be verified on the basis of the existing component geometry, the position of the fastening element and the existing forces.

²⁾ At load level 4.5 kN the clamping thickness is 50 mm



Mounting on anchor channels



Mounting on dowels

JTA-CE anchor channels

Product information

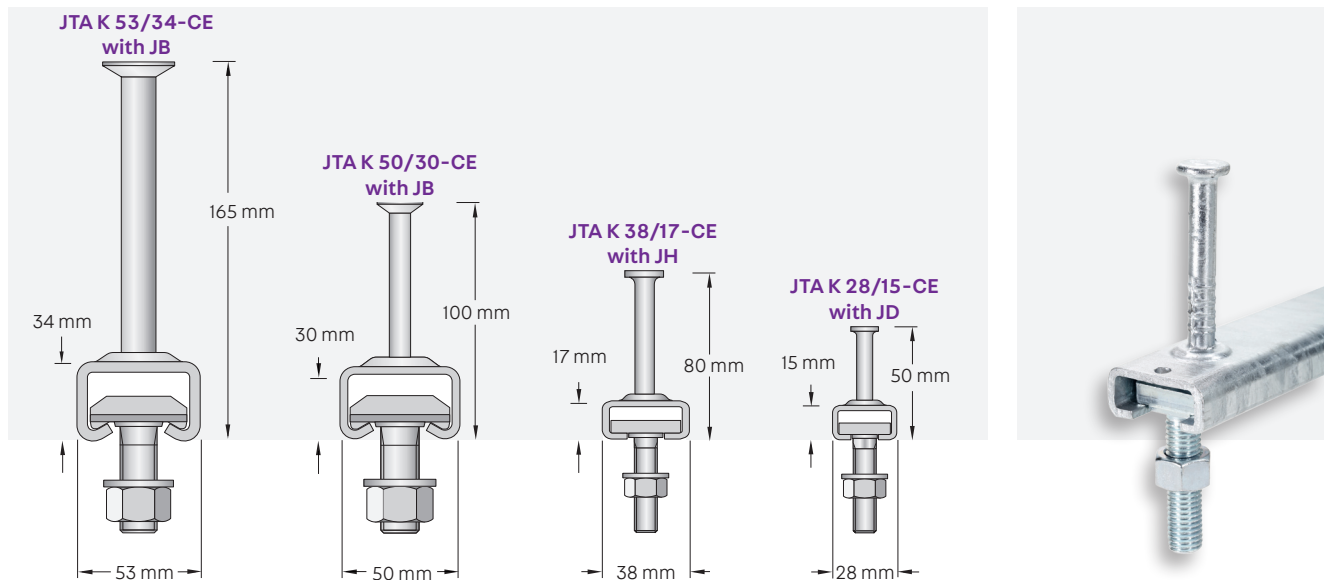
JORDAHL® JTA-CE anchor channels are characterised by their high flexibility and quality. They have European Technical Approval (ETA-09/0338). In general, anchor channels in various sizes and designs are available in our product range. Only the anchor channels that are used for the installation of brickwork support brackets, angled brackets and parapet facing are listed here. The anchor channels and the associated fastening

elements are made of high-quality stainless steel for use in façade applications.

Technical values

Before installing the brickwork support brackets, check that the required edge distances of the anchor channels are observed.

Recommended JORDAHL® JTA-CE anchor channels with JORDAHL® JB/JH/JD screws



Delivery units

JORDAHL® JTA anchor channels are supplied by the metre (stock length 6 m), as short channel pieces and as corner pieces. To prevent the ingress of fresh concrete, all anchor channels are provided with a filling. The anchor spacing is 200–300 mm depending on the rail channel.

Anchor channel corner pieces (without approval)

JTA profile	Leg lengths in mm
K 38/17	125 × 250
	250 × 250
K 50/30	150 × 250
	250 × 250
K 53/34	250 × 250



JORDAHL® anchor channel



JORDAHL® anchor channel corner piece



Example order for anchor channel

Type	Profile	Length	Version
JTA-CE	K 50/30	6000	A4



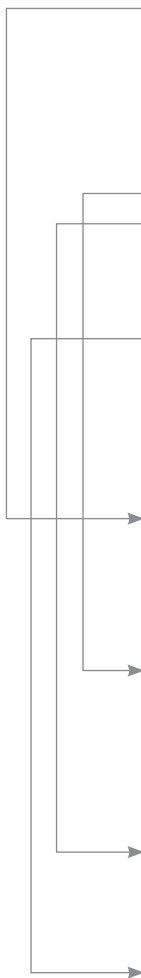
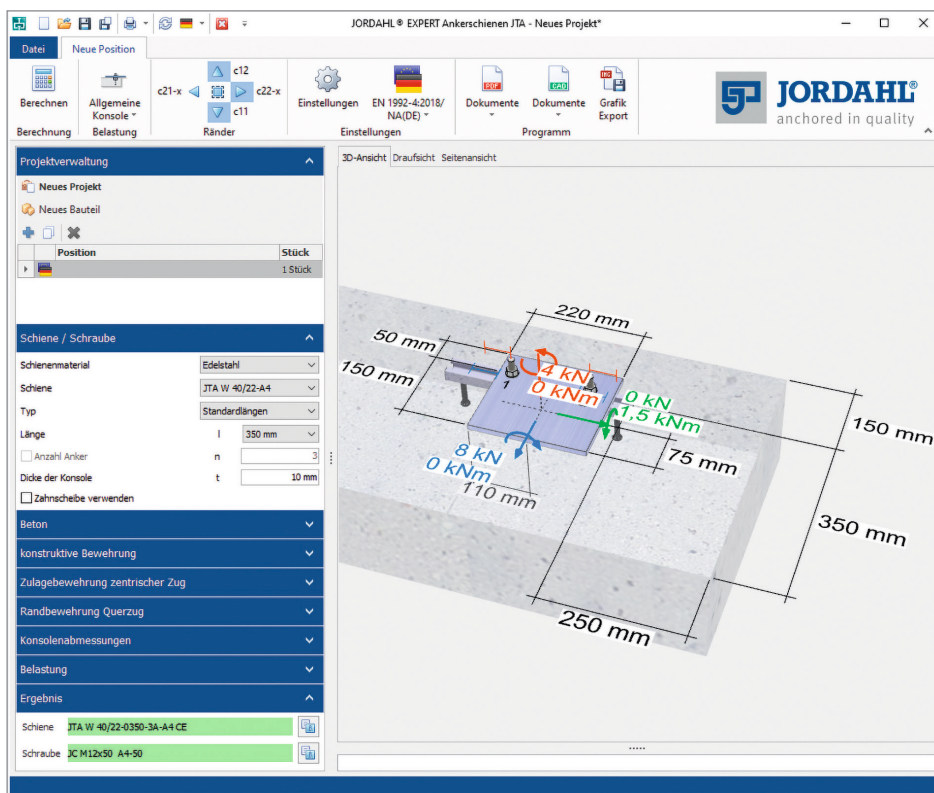
Example order for anchor channel corner piece

Type	Profile	Leg lengths	Version
JTA	K 38/17	125 × 250	A4

JORDAHL® EXPERT software

Our JORDAHL® EXPERT software makes it a breeze to perform verification calculations for anchoring in concrete using JTA-CE anchor channels. The design is always tailored to the individual anchoring situation, enabling you to optimise the anchoring in terms of technical and economic aspects. Once the input and calculation have been completed, the results of the multiple design are displayed for all available

channel sizes. The design results are output both on the screen and in the form of a verifiable printout. The program is based on European Technical Approval ETA-09/0338. The design software for JORDAHL® anchor channels is adapted to the current EN 1992-4:2018 and other international design methods. Download for free at www.jordahl.de.



Channel/Screw

- Channel length
- Material; galvanised or stainless steel
- Spaced mounting

Concrete

- Concrete quality
- Slab thickness
- Edge clearances
- Concrete cover

Structural reinforcement

- Normal or unreinforced concrete
- Density of reinforcement

Load

- Input of single and paired loads in individually defined load positions



Printout of results

Easy-to-understand and transparent design printout containing all test-relevant data

Introduction to cavity walls (double-skin walls)

Cavity walls combine the current requirements in terms of ecology, economy and aesthetics. Its design provides optimal protection against wind, snow, rain or heat as well as against noise and dirt. It also offers creative design options. Whether bricks, sand-lime bricks, concrete bricks or facing bricks, cavity walls are now available in various materials and looks, in almost every style and to suit every taste. However, the choice of the right bracing system is also fundamental for energy-efficient construction with facing masonry.

With JORDAHL® systems for facing masonry, façades can be fixed in place permanently, economically and safely. Brickwork support brackets bear the loads of the facing masonry and transfer them to the load-bearing wall via professionally installed anchor channels or dowels. Together with the insulation and air layer, this creates an exterior cavity wall.



Benefits

- Flexible and durable
- Creative façade design, even for tall buildings
- No algae formation, no condensation problems
- Flame retardant
- Sustainable and recyclable
- Good indoor climate
- Protection against noise, dirt and weather
- Economical solution for a wide variety of bracing situations
- Competent advice and comprehensive service from JORDAHL experts



- 1 JORDAHL® brickwork support bracket JVAeco+
- 2 JORDAHL® cavity wall anchor JLA with ISO clip
- 3 Reinforced concrete
- 4 Mineral wool insulation
- 5 Facing masonry

DIN EN 1996-2/NA:2012-01 (Eurocode 6, excerpt)
Cavity walls (double-skin walls)

NA.D.1 General provisions for execution

1. The space between the two masonry walls – usually the load-bearing inner wall (inner shell) and the non-load-bearing outer wall (outer shell) – is referred to as the shell gap. This cavity can be constructed without, completely or partially with a thermal insulation layer. The thermal insulation layer may consist of one or more layers of insulation material.
2. If no thermal insulation layer is placed in the cavity, this configuration (or wall structure) is referred to as a double-skin wall with an air layer. The thickness of the cavity is thus equal to the thickness of the air layer.
3. If the cavity between the shells is completely or partially filled with a thermal insulation layer, this configuration is referred to as a double-skin wall with thermal insulation.
4. When placing a non-load-bearing outer shell (facing shell or rendered facing shell) in front of a load-bearing inner shell (rear wall shell), the following must be observed:
 - a) For the design, only the thickness of the load-bearing inner shell is to be assumed as the wall thickness.
 - b) The **thickness of the outer shell** is to be at least **90 mm** (see Fig. 1). Thinner outer shells are claddings, the design of which is regulated in DIN 18515. The minimum length of masonry piers in the outer shell, which only have to bear loads from the outer shell, is 240 mm. As a rule, the outer shell must be supported over its entire length and over its entire surface. In the case of interrupted support (e.g. on brackets), all bricks must be supported on both sides in the bracing plane.

- c) The outer shell must be made of frost-resistant masonry blocks or of non-frost-resistant masonry blocks with an outer render that meets the requirements of DIN EN 998-1 in conjunction with DIN V 18550.
- d) **Outer shells with a thickness of 115 mm** should be supported at **height intervals of approximately 12 m** (see Fig. 2). They may protrude up to 25 mm above their support. If the 115 mm thick outer shell is **not higher than two storeys** or is supported every two storeys, it may project up to 38 mm above its support. These projections must be taken into account when verifying the bracing pressure. In the case of subsequent jointing, the joints of the visible surfaces must be scraped out flank clean to a depth of at least 15 mm and then grouted in a manner appropriate to the trade.
- e) **Outer shells with thicknesses of $t \geq 105$ mm and $t < 115$ mm** must not be built higher than 25 m above ground and must be supported at **height intervals of approx. 6 m** (see Fig. 2). For buildings with up to two full storeys, a gable triangle up to 4 m high may be installed without additional bracing. These outer shells may protrude no more than 15 mm above their support. As a rule, the joints are to be executed with a smooth joint coat. In the case of subsequent jointing, the joints of the visible surfaces must be scraped out flank clean to a depth of at least 15 mm and then grouted in a manner appropriate to the trade.
- f) **Outer shells with thicknesses of $t \geq 90$ mm and $t < 105$ mm** must not be built higher than 20 m above ground and must be supported at height intervals of approx. 6 m. For buildings with up to two full storeys, a gable triangle up to 4 m high may be installed without additional bracing. The joints of the visible surfaces of these facing shells must be executed with a smooth joint coat. These outer shells may protrude no more than 15 mm above their support. Tested according to DIN EN 61537, including electrical conductivity.

Figure 1

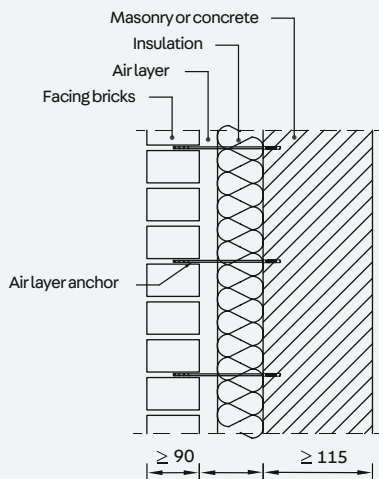
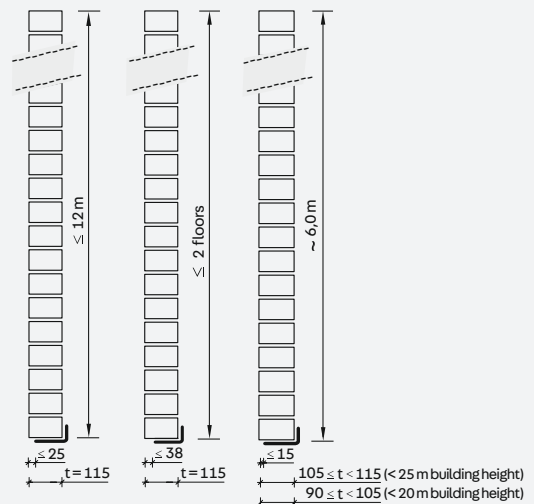


Figure 2



Façade design and joint configuration

Façades with facing masonry offer the planner many design options, as the choices with regard to structure, material and joint arrangement of the facing masonry are manifold. These factors determine the character of a building – but they also influence each other and affect the construction of the load-bearing components. The façade should therefore be carefully planned at an early stage so that the results can be incorporated into the structural design.

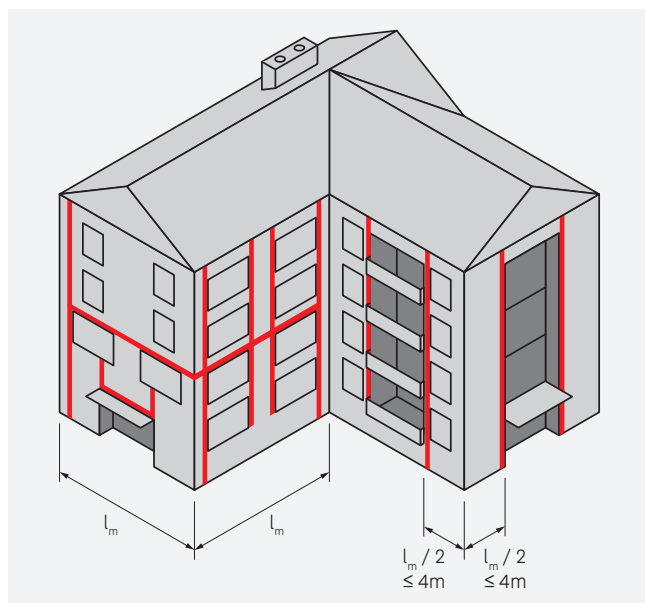
Joint configuration

Horizontal and vertical expansion joints compensate for changes in length and volume and prevent cracking. In addition, the joints relieve stress peaks at the top corners of openings.

Horizontal expansion joints are located in the bracing planes of facing masonry. The spacing of the bracing planes depends on the permissible height of the brickwork and the specifications of DIN EN 1996 (Eurocode 6) (see p. 47).

The spacing of the vertical expansion joints depends on the compass direction, the climatic stress, the type of building materials and the colour of the facing masonry (see info on right).

Depending on the compass direction, continuous wall slabs must not be wider than 6–12 m. The wall slabs can be interrupted by a vertical joint in corner areas, or led around the corner. Expansion joints of the load-bearing structure must be continued in the facing shell. Two examples are shown in the following illustrations.



Structure

Each façade is primarily structured based on:

- Storey height,
- Position, number and shape of the openings, as well as
- Projections or recesses

When choosing facing masonry, further accents can be achieved with the laying of brick-on-edge or soldier courses and the targeted arrangement of expansion joints.

DIN EN 1996-2:2012-01 (Eurocode 6, excerpt)

2.3.4.1 General

1. To take account of the effects of thermal and moisture expansion, creep and deflection and the possible effects of internal stresses caused by vertical or lateral forces, vertical and horizontal expansion joints should be provided to prevent damage to the masonry.
2. The location of expansion joints should take into account the need to maintain the load-bearing capacity and stability of the wall.

2.3.4.2 Spacing between expansion joints

1. Horizontal spacing between vertical expansion joints in masonry should take into account the type of masonry, masonry stones and mortar, as well as specific construction details.
2. The horizontal spacing between vertical expansion joints in non-load-bearing exterior walls should not exceed l_m .

The supporting structure

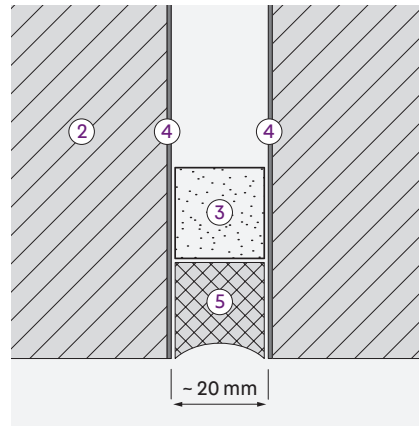
The design of the façade has a direct impact on the construction of the supporting structure. The positioning of a horizontal expansion joint or a bracing plane in the facing masonry requires that a load-bearing component be placed behind it so that the forces from the façade bracing can be safely transferred into the supporting structure.

Possible arrangement of vertical and horizontal expansion joints

Vertical expansion joints



Continuous vertical expansion joints next to openings (horizontal expansion joints not shown)

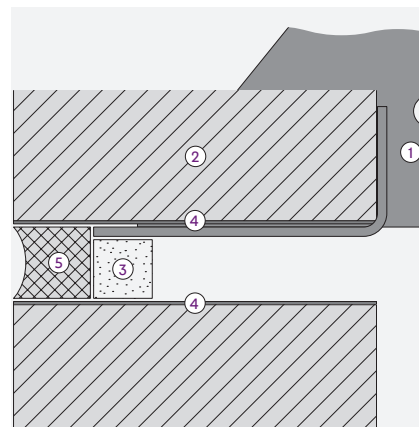


Proposal for the arrangement of vertical expansion joints in facing shells

Horizontal expansion joints



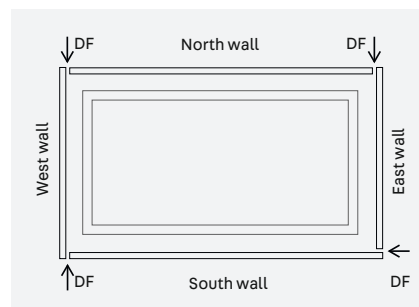
Continuous horizontal expansion joints on the same plane as the bracing, flush with the upper edge of the opening (vertical expansion joints not shown)



Suggested arrangement of horizontal expansion joints in facing shells

Structural design of expansion joints

1. JORDAHL® brickwork support bracket
2. Facing masonry
3. Closed-cell foam (backer rod)
4. Adhesive primer
5. Elastoplastic sealant (joint sealant)



Suggested position of vertical expansion joints for building corners in facing shells

Maximum vertical expansion joint spacing l_m for different types of brickwork

Brick masonry	12m
Sand-lime brickwork	8m
Concrete masonry (with aggregates) and concrete blocks	6m
Aerated concrete masonry	6m
Natural stone masonry	12m

Recommended vertical expansion joint spacing according to compass direction for brick and natural stone masonry based on empirical values

Compass direction	Max. expansion joint spacing l_g
North side	12m
West side	7-8m
South side	8-9m
East side	10-12m

Introduction to JORDAHL® brickwork support brackets

Creative design combined with sustainability: The JORDAHL® JVAeco+ brickwork support bracket is the tool of choice and offers advantages in every respect.

Benefits

- New load levels with increased load capacities (the highest type-tested design resistances on the German market) for a more economical façade solution
- Environmental Product Declaration (EPD) for a better life cycle assessment of your building project
- Vertically adjustable for easy compensation of building tolerances
- Permanently corrosion-resistant stainless steel

CE mark

The JORDAHL® JVAeco+ brickwork support bracket bears a CE mark because its conformity with DIN EN 845-1 has been examined and confirmed by a recognised body.

High-quality stainless steel

All components of JORDAHL® systems for facing masonry are made entirely of selected stainless steels according to DIN EN 10880. These fulfil the high requirements of national technical approval Z-30.3-6 and are classified under corrosion resistance class (CRC) III or higher according to DIN EN 1993-1-4. This ensures maintenance-free use of the JORDAHL® brickwork support brackets.

Above all, the use of Lean Duplex stainless steel offers many design, static and economic advantages, as it makes additional corrosion protection measures superfluous and allows for single-material, recyclable construction. This is environmentally conscious and sustainable. It also has more than twice the basic strength of the material grades 1.4404 and 1.4571, a higher modulus of elasticity and significantly lower amounts of nickel and molybdenum in the alloy.

Tested and approved by the building authority

All JORDAHL® systems for facing masonry are approved by the German Institute for Building Technology (DIBt) (Z-21.8-1868) and type-tested (TP 12/009), so that you can always rely on the stated values of our products, such as the load-bearing capacity or the thermal transmittance coefficient.

Mounting

Our brickwork support brackets are fixed to JORDAHL® stainless steel anchor channels which are embedded in concrete components (quality \geq C20/25). Alternatively, the brickwork support brackets can be mounted in the concrete using approved stainless steel dowels.

Adjustability

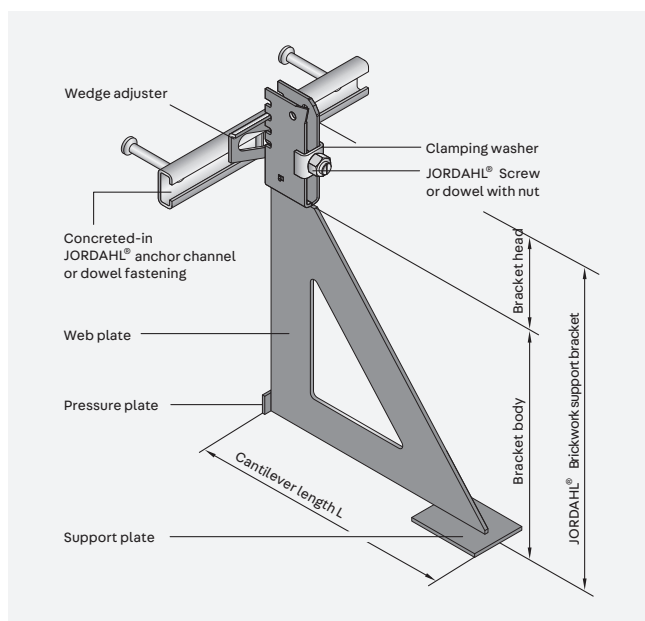
The brickwork support brackets can be adjusted vertically by ± 30 mm and perfectly aligned by means of the teeth provided in the bracket head and a slanted slit plate. The anchor channel enables horizontal adjustability. In this way, construction tolerances can be optimally compensated for.

Extensive product range

JORDAHL® brickwork support brackets are available in different versions (e.g. for plain wall, corner, pier or lintel areas) and dimensions. Standard cantilever lengths of 140–390 mm are available, calculations for other cantilever lengths are provided upon request. Numerous accessories complete the product range.

Service

Our JORDAHL® experts offer you comprehensive services focusing on our systems for facing masonry. Competent, fast and friendly, we assist you with dimensioning, structural calculations, economic and cost-conscious planning, as well as in the selection of suitable brickwork support brackets and anchor channels. Naturally, we also develop individualised custom solutions for you. In addition, we provide you with powerful and intuitive software for designing your application scenarios free of charge. The earlier we are involved in the planning, the more economical the bracing.



Like all JORDAHL® systems for facing masonry, the JORDAHL® JVAeco+ brickwork support bracket is made entirely of stainless steel.

Energy-efficient construction with facing masonry

Thermal insulation requirements have been defined by the Building Energy Act (GEG) since 01/11/2020. The GEG brings together the Energy Conservation Act (EnEG), the Energy Conservation Ordinance (EnEV) and the Renewable Energies Heat Act (EEWärmeG) and applies to buildings that are heated or cooled. Since the majority of the energy used for heating is lost in the form of transmission heat losses via the external surfaces, building insulation is of outstanding importance. Thermal insulation needs to be increasingly effective in order to reduce the annual energy demand. Despite this, creative design freedom should be preserved. Double-skin exterior walls for new buildings easily meet the current requirements of the GEG and passive houses.



New building project

In refurbishment projects, the main focus is on preserving value and aesthetics, as well as energy efficiency. The refurbishment of double-skin facing masonry is particularly useful when, for example, the maintenance costs of flats are to be kept low in the long term. This is the case with rented flats, for example.



Refurbishment project

Thermal bridges are localised areas in the heat-transferring envelope of a building and are also known as disturbed areas. In terms of thermal insulation, they are a weak point in the construction, as increased heat loss from transmission occurs in these areas. Bracing for facing masonry, for example, constitute such a structural thermal bridge. We meet the increasing requirements for building insulation and the special significance of thermal bridges with the JORDAHL® JVAeco+ brickwork support bracket. With a recess in the web plate and combined with the JORDAHL® JTM thermal collar, it minimises the heat flow, thereby significantly reducing energy loss.



Visualisation of thermal bridges by means of thermography

Knowledge of building physics helps save energy!

Basic principles

Background information

Suspension systems for facing masonry – like any other penetration of thermal insulation – constitute a structural thermal bridge. A thermal bridge basically translates to heat loss, and thus energy loss. Therefore, they should be thermally optimised to minimise losses. Because the efficacy of thermal insulation for surfaces is increasing, thermal bridges have a growing influence on energy loss in buildings.

The web plate of the JORDAHL® JVAeco+ brickwork support bracket is designed with a recess which, together with the JORDAHL® JTM thermal collar, minimises energy losses via the brickwork support bracket.

Thermal resistance R_{tot} in $\text{m}^2 \text{K}/\text{W}$

The thermal resistance (R-value) is the sum of the internal and external heat transfer resistance and the heat conductivity resistances of the individual homogeneous material layers according to their insulating properties, defined as the quotient of layer thickness d and thermal conductivity λ :

$$R_{\text{tot}} = R_{\text{si}} + \sum (d_i/\lambda_i) + R_{\text{se}}$$



JORDAHL® JVAeco+ brickwork support bracket with JORDAHL® JTM thermal collar

Thermal transmittance coefficient U in $\text{W}/(\text{m}^2\text{K})$

The thermal transmittance coefficient (also called U-value) for the undisturbed surface is the reciprocal of the thermal resistance R_{tot} . It is the measure of the heat loss of a flat component at a temperature difference of one Kelvin:

$$U = 1/R_{\text{tot}}$$

Corrected thermal transmittance coefficient U_c in $\text{W}/(\text{m}^2\text{K})$

The corrected thermal transmittance coefficient is calculated from the thermal transmittance coefficient U , taking into account corrections for air gaps in building components ΔU_g , mechanical fastening elements ΔU_f , which penetrate building component layers, (e.g. brickwork support brackets and cavity wall anchors) and inverted roofs ΔU_i , according to DIN EN ISO 6946:

$$U_c = U + \Delta U_g + \Delta U_f + \Delta U_i$$

Transmission heat loss H_T in W/K

The energy lost via the external surface of a building is called transmission heat loss. It is calculated from the product of the thermal transmittance coefficients U and the external surface area A as well as a correction to take into account the transmission heat loss via thermal bridges H_{WB} in W/K :

$$H_T = \sum (U \times A + H_{\text{WB}})$$

Thermal bridge correction

Thermal bridges are areas where the otherwise uniform thermal resistance of a building component is altered significantly. Thermal bridges exhibit an increased heat flow and a lower surface temperature on the room side.

Building Energy Act (GEG)

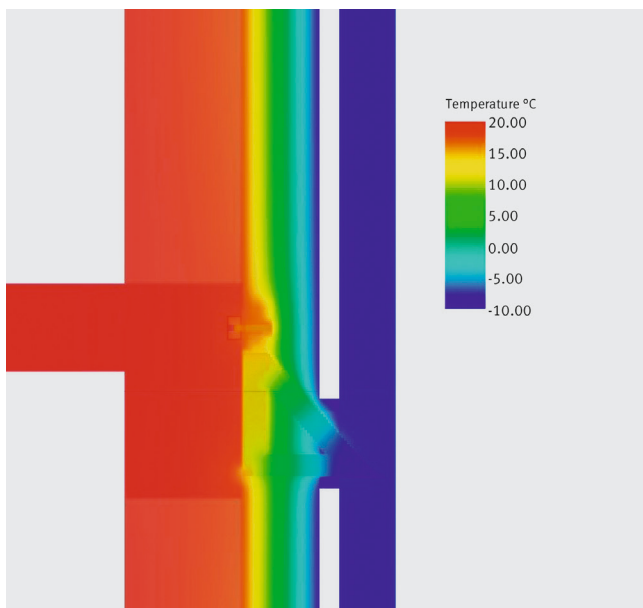
The thermal insulation requirements for residential and non-residential buildings are defined by the Building Energy Act (GEG). The GEG standardises German energy conservation law and implements the European requirements for the energy performance of buildings. It brings together the Energy Conservation Act (EnEG), the Energy Conservation Ordinance (EnEV) and the Renewable Energies Heat Act (EEWärmeG) and applies to buildings that are heated or cooled, including the necessary systems and equipment such as heating, cooling, indoor air and lighting technology and the hot water supply.

Requirements are defined by a permissible annual primary energy demand. The annual primary energy demand is calculated for both residential and non-residential buildings according to DIN V 18599. Until the end of 2023, the combination of standards DIN V 4108-6 and DIN V 4701-10 may continue to be used for non-cooled residential buildings. Since the majority of the energy used for heating is lost in the form of transmission heat losses H_T via the external surfaces, the thermal insulation of buildings is of particular importance. Therefore the GEG limits the transmission heat losses in buildings.

In addition to the sum of heat losses from the external surfaces, the transmission heat loss is significantly influenced by the heat losses via the thermal bridges. These are taken into account by means of a thermal bridge correction ΔU_{WB} , which is determined either as a blanket quantity or in detail.

Calculation and correction of the U-value

The calculation of thermal transmittance coefficients is described in DIN EN ISO 6946 (Building components and building elements - Thermal resistance and thermal transmittance - Calculation methods) and requires a correction of the U-value when connecting elements such as brickwork support brackets are used if their influence is greater than 3% compared to the undisturbed thermal transmittance.



Temperature gradient with JORDAHL® JVAeco+ brickwork support bracket and JORDAHL® JTM thermal collar

Determination of the thermal bridge correction H_{WB} in W/K

When determining transmission heat losses via thermal bridges, the total heat-transferring external surface A of the building is multiplied by a total correction value ΔU_{WB} :

$$H_{WB} = \Delta U_{WB} \times A$$

Without individual verification of the thermal bridges, $\Delta U_{WB} = 0.10 \text{ W}/(\text{m}^2\text{K})$ is to be assumed, and for external building components with an internal insulation layer and an integrated solid ceiling, $\Delta U_{WB} = 0.15 \text{ W}/(\text{m}^2\text{K})$. If the connection details are carried out in accordance with DIN 4108 Supplement 2, reduced correction values can be used.

With verification and compliance with the equivalence of the connection details shown in Supplement 2, a thermal bridge correction of $\Delta U_{WB} = 0.03 \text{ W}/(\text{m}^2\text{K})$ can be used if the criteria according to Category B are met for all connections. In all other cases, a thermal bridge correction of $\Delta U_{WB} = 0.05 \text{ W}/(\text{m}^2\text{K})$ shall apply, which corresponds to equivalence to Category A. This means that connections can either be clearly correlated to the basic design principle (visual proof of equivalence) or have a lower or the same length-related thermal transmittance coefficient Ψ (mathematical proof of equivalence).

In the case of visual proof of equivalence, the connections must have the described component dimensions and building material properties or, in the case of deviating thermal conductivities, at least the identical heat transmittance resistance of the respective layer.

The mathematical equivalence must be verified using the boundary conditions specified in Supplement 2. Likewise, values for the length-related thermal transmittance coefficient Ψ can be taken from publications, thermal bridge catalogues or manufacturers' certificates based on the described boundary conditions.

Detailed determination of the thermal bridge corrections

H_{WB} in W/K and ΔU_{WB} in W/(m²K)

For the detailed determination of transmission heat losses via thermal bridges, the linear thermal bridges are calculated individually as the product of their length l_i and the length-related thermal transmittance coefficients Ψ_i :

$$H_{WB} = \sum (\Psi_i \times l_i)$$

If the line-specific thermal transmittance coefficients Ψ_i are related to the external surface A , a detailed project-specific thermal bridge correction ΔU_{WB} is obtained:

$$\Delta U_{WB} = \sum (\Psi_i \times l_i) / A$$

Blanket total correction values

DIN 18599-2 specifies the thermal bridge corrections ΔU_{WB} listed in the following table, which depend on the design type in the planning.

Design type in planning	ΔU_{WB} in W/(m ² K)
Execution of connections according to DIN 4108 Supplement 2, Category B	0.03
Execution of connections according to DIN 4108 Supplement 2, Category A	0.05
Connections without further verification	0.10
More than 50% of the external wall is out-fitted with an internal insulation layer and an integrated solid ceiling	0.15

If equivalence cannot be established to one or more of the construction principles presented in the supplement or with one or more of the construction principles of category A or B, the blanket thermal bridge correction ΔU_{WB} in W/(m²K) can be corrected as follows via the difference from the respective Ψ -reference value of category A and B indicated in the supplement:

$$\Delta U_{WB} = \sum ((\Delta\Psi_i \times l_i) / A) + 0.03$$

or

$$\Delta U_{WB} = \sum ((\Delta\Psi_i \times l_i) / A) + 0.05$$

However, the correction described above may only be used if the project-specific Ψ -value is greater than the reference value of the corresponding connection detail. If thermal bridges are taken into account that are not included in Supplement 2, the correction is made using the Ψ -value of the relevant connection situation with its respective length:

$$\Delta U_{WB} = \sum ((\Psi_i \times l_i) / A) + 0.03$$

or

$$\Delta U_{WB} = \sum ((\Psi_i \times l_i) / A) + 0.05$$

Detailed total correction values

In order to avoid compensation with high thermal bridge correction values via the building envelope, it is a good idea to perform a detailed thermal bridge verification. In this way, a lower total correction value can be obtained to account for the thermal bridges. Depending on the building type, ΔU_{WB} values of up to 0.01 W/(m²K) are possible.

Determination of χ -values

The determination of χ -values cannot be carried out with reasonable effort; numerical simulations are necessary. In this case, the wall structure is recreated together with the thermal bridges in models and the heat flow is simulated. By summarising the heat flow distributed over the surface, the χ -values can be determined with the help of the U-values. Here, the Ψ -values serve as an equivalent for linear thermal bridges and χ -values as an equivalent for single-point thermal bridges.

χ -values for JORDAHL products

In order to enable the detailed energetic consideration of the JORDAHL® system for facing masonry, the χ -values were determined. For this purpose, different insulation qualities were examined and the shell distances a were varied from 140 mm to 300 mm so that usual insulation layer thicknesses are taken into account.

The simulations showed that the insulation quality only has a significant influence on the χ -values in core-insulated designs. This can be disregarded for rear-ventilated constructions. While for core-insulated designs only a "finger gap" of up to 20 mm is permissible, for rear-ventilated designs the thickness of the air layer may be up to 60 mm.

We recommend 40 mm as the maximum thickness of the air layer, as the energy loss is low despite rear ventilation. The χ -values are clearly shown in table form in the national technical approval Z-21.8-1868 for the JORDAHL® JVAeco+ brickwork support bracket. In our design software, these exact values are used to achieve an optimum result. The heat flow was also simulated and χ -values determined for the JORDAHL® JGA+ permanent scaffold anchor and JORDAHL® JLA cavity wall anchor.

Core-insulated and rear-ventilated

With core-insulated facing façades, the air layer between the insulation and the facing masonry is only a finger wide, up to a maximum of 20 mm. This merely facilitates bricklaying.

We speak of rear-ventilated facing façades when the gap is between 20 mm and 60 mm and is used for dehumidification.

Installation for ceilings and lintels

Facing masonry brackets are attached to the reinforced concrete supporting structure of the building. The attachment points can be located near integrated ceilings or lintels.

χ_{\max} -values for JORDAHL products

The following table provides χ_{\max} -values which summarise the exact χ -values of the approval Z-21.8-1868 for the JORDAHL® JVAeco+ brickwork support bracket. For this purpose, only cantilever lengths that are not smaller than 250 mm were taken into account due to the thickness of the insulation material commonly used today. The table also provides the χ_{\max} -values for JORDAHL® JGA+ permanent scaffold anchors.

The table makes it clear that the χ_{\max} -value of JORDAHL® JVAeco+ brickwork support brackets is at most 0.033 W/K, regardless of the installation situation and cantilever length, design type and design variant. The value applies to both core-insulated and rear-ventilated constructions if the JORDAHL® JTM thermal collar is used. For the JORDAHL® JGA+ permanent scaffold anchor, the χ_{\max} -value is 0.025 W/K, and JORDAHL® JLA cavity wall anchors can be assumed to have a χ -value of 0.001 W/K.

Thermal collars

In order to reduce heat emissions in the area of the rear ventilation, the brickwork support bracket must be separately sheathed with insulation in this area using the JORDAHL® JTM thermal collar.

Permanent scaffold anchors

In order to be able to scaffold the façade in accordance with regulations even after completion of the building, permanent scaffold anchors are required. JORDAHL® JGA+ permanent scaffold anchors enable horizontal forces to be transferred safely into the supporting structure located behind the facing masonry.

Cavity wall anchors

JORDAHL® JLA cavity wall anchors are installed to transfer wind pressure and wind suction forces acting on the facing masonry.



JORDAHL® JGA+ permanent scaffold anchor



JORDAHL® JLA cavity wall anchor

χ_{\max} -values of the JORDAHL® JVAeco+ brickwork support bracket with JTM thermal collar and JORDAHL® JGA+ permanent scaffold anchor

Installation area	Core-insulated				Rear-ventilated	
	0 mm < h _{LS} ≤ 20 mm		20 mm < h _{LS} ≤ 40 mm		40 mm < h _{LS} ≤ 60 mm	
	JVAeco+	JGA+	JVAeco+ with JTM ¹⁾	JGA+	JVAeco+ with JTM ¹⁾	JGA+
Ceiling	0.025 W/K	0.020 W/K	0.027 W/K	0.023 W/K	0.028 W/K	0.025 W/K
Lintel	0.031 W/K		0.031 W/K		0.033 W/K	

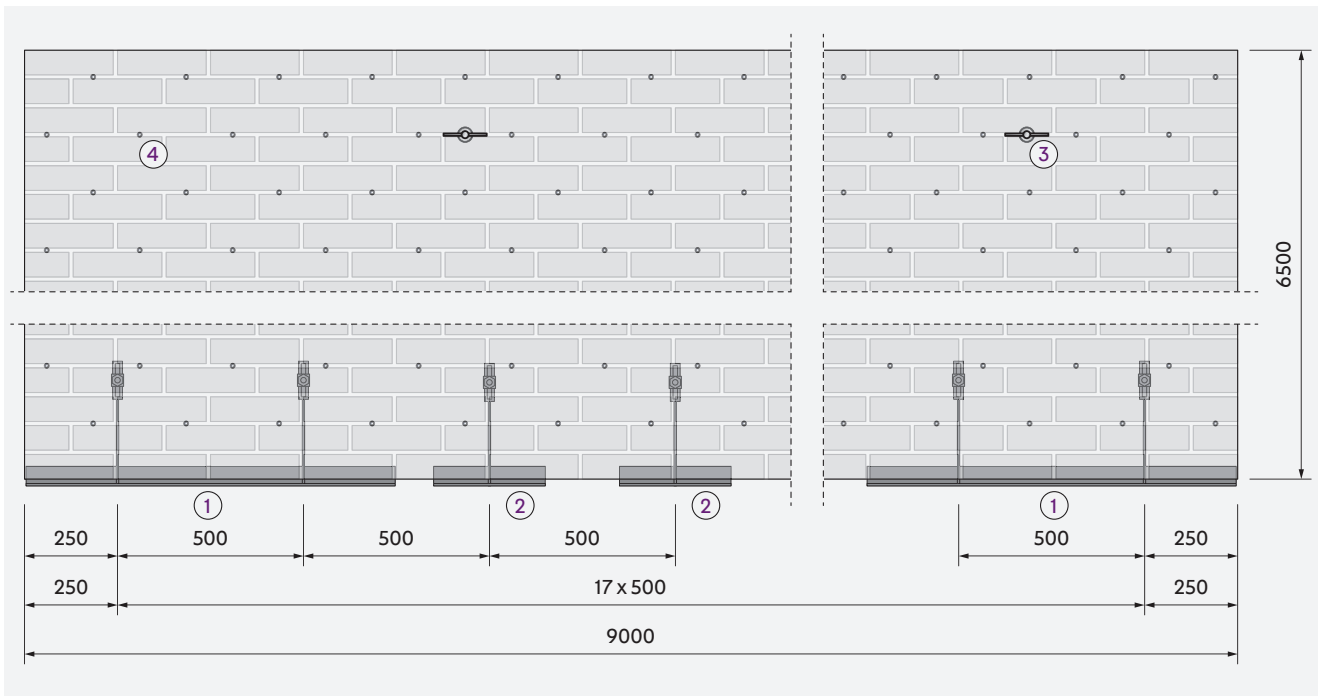
¹⁾ If the JORDAHL® JTM thermal collar is not used, the values are poorer by approx. 10%

Sample assessment

Exterior wall

The following example explains the design steps for the structural planning of an exterior wall. Thermal insulation aspects are also taken into account. The wall view with the

brickwork support brackets, permanent scaffold anchors and cavity wall anchors is shown in the following drawing.



Installation parts (single-point thermal bridges)

1	JORDAHL® JVAeco+ 250 - F/7.0 brickwork support bracket and JORDAHL® JTM 40 thermal collar
2	JORDAHL® JVAeco+ 250 - P/7.0 brickwork support bracket and JORDAHL® JTM 40 thermal collar
3	JORDAHL® JGA+ 270 permanent scaffold anchor, 1 ea./10 m ²
4	JORDAHL® JLA cavity wall anchor, 8 ea./m ²

Dimensioning of brackets

Each brickwork support bracket bears the weight of a wall strip of width B and height H, resulting in the following design load:

$$t = 0.115 \text{ m} \quad b = 0.50 \text{ m} \quad H = 3.25 \text{ m}$$

$$\gamma_G = 1.35 \quad \rho = 1800 \text{ kg/m}^3$$

The rated resistance of the selected JVAeco+ 250 - F and JVAeco+ 250 - P (load level 7.0) brickwork support bracket is therefore:

$$F_{Rd} = 9.45 \text{ kN}$$

Verification:

$$F_{Ed} = \rho \times 0.01 \text{ kN/kg} \times t \times b \times H \times \gamma_G$$

$$F_{Ed}/F_{Rd} = 9.08 \text{ kN}/9.45 \text{ kN} = 0.96 \leq 1$$

$$F_{Ed} = 1800 \text{ kg/m}^3 \times 0.01 \text{ kN/kg} \times 0.115 \text{ m} \times 0.5 \text{ m} \times 6.5 \text{ m} \times 1.35$$

$$= 9.08 \text{ kN}$$

In the following, the required number of other built-in parts is determined.

Determining the required number of brackets

Since all brackets are planned with a standard spacing of 0.5 m, the required number of brackets is calculated as follows:

$$n = 9 \text{ m} \times 1 \text{ bracket} / 0.5 \text{ m} = \mathbf{18 \text{ brackets}}$$

Determining the required number of permanent scaffold anchors

Usually, one permanent scaffold anchor is installed per 10 m² of wall area:

$$n = (6.5 \text{ m} \times 9 \text{ m}) \times 1 \text{ anchor} / 10 \text{ m}^2 = \mathbf{6 \text{ anchors}}$$

Determining the required number of cavity wall anchors

Assuming that the building is located in wind zone 4, at least 8 cavity wall anchors are required per m²:

$$n = (6.5 \text{ m} \times 9 \text{ m}) \times 8 \text{ anchors} / \text{m}^2 = \mathbf{468 \text{ anchors}}$$

Calculation of the thermal transmittance coefficient U of the undisturbed area

In the following table, the thermal resistance R_{tot} and the thermal transmittance coefficient U are calculated for the wall design shown below based on the values for density ρ and thermal conductivities λ specified in DIN V 4108-4 and DIN EN 12524.

Layers

i	Material
1	Gypsum plaster
2	Concrete ($\rho_{1\%rebar} = 2300 \text{ kg/m}^3$)
3	WLG 035 thermal insulation
4	Air layer (at rest)
5	Facing masonry ($\rho = 1800 \text{ kg/m}^3$)

Calculation of U-value

Wall structure layer i	Thick-ness d in m	Thermal conductivity λ in W/(mK)	Heat transfer and heat transmittance resistance in m ² K/W	
R_{si}			Heat transfer resistance, internal	0.13
1	0.01	0.7	0.014	$R_i = h_i / \lambda_i$
2	0.24	2.3	0.104	
3	0.12	0.035	3.43	
4	–	–	0.16	
5	0.115	0.81	0.142	
R_{se}			Heat transfer resistance, external	0.04
R_{tot}			Sum of heat transfer and heat transmittance resistances	4.02
U			Thermal transmittance coefficient ($1/R_{tot}$) in W/(m ² K)	0.25

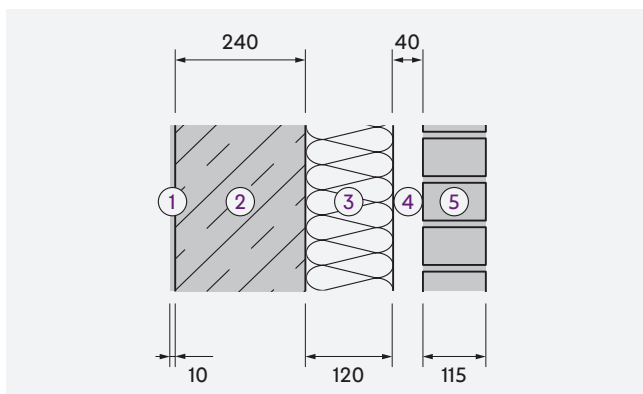
Calculation of the thermal transmittance coefficient U_c of the disturbed area

The consideration of additional heat losses via fastening elements in the determination of the U-value is carried out according to DIN EN ISO 6946 via a correction for mechanical fastening elements ΔU_f .

In the calculation for the corrected thermal transmittance coefficient for the facing façade, it is assumed that there are no corrections for air gaps and inverted roofs. However, if they are present, ΔU_g and ΔU_r must also be taken into account!

The correction is taken into account in the calculation of the thermal transmittance coefficient U_c by adding it to the thermal transmittance coefficient U. If the resulting correction is less than 3% of the thermal transmittance coefficient U, it does not have to be taken into account.

The χ -values for the brickwork support brackets are included in the approval Z-21.8-1868. The χ -values for scaffold anchors and cavity wall anchors were confirmed by an expert opinion.



Calculation of ΔU_f -value

	Mechanical fastening elements	Point-sp. therm. trans. coeff. χ in W/K	Number n Ea.	Component area A in m ²	Correction values $\chi \times n/A$ in W/(m ² K)
1	JVAeco+ + 250-... and JTM 40	0.026 according to approval	18	58.5	0.008
3	JGA+ 270	0.023	6	58.5	0.002
4	JLA 250	0.001	468	58.5	0.008
Correction value ΔU_f					0.018

The following checks whether the correction must be taken into account:

$$\Delta U_f / U = 0.018 / 0.25 = 7.2\% > 3\%$$

The correction must be taken into account!

The thermal transmittance coefficient U_c is therefore calculated as follows:

$$U_c = U + \Delta U_f = 0.25 + 0.018 = \mathbf{0.268 \text{ W/(m}^2\text{K)}}$$

Reduction in energy loss with JORDAHL® JVAeco+ brickwork support bracket

On average, each bracket supports 3 m² of facing masonry, even if the actual load-bearing capacity is higher (e.g. JVAeco+ 13.5 kN supports 6.5 m² of facing masonry). With the simplified χ_{\max} -values for the JORDAHL® JVAeco+ brickwork support bracket and the JORDAHL® JGA+ permanent scaffold anchor as well as the same realistic assumptions for the number of permanent scaffold and cavity wall anchors as before, we obtain the following for the corrected U-value:

JVAeco+ brickwork support bracket:
 1 bracket / 3 m², $\chi = 0.033 \text{ W/K}$

JGA+ permanent scaffold anchor:
 1 anchor / 10 m², $\chi = 0.025 \text{ W/K}$

JLA cavity wall anchor:
 8 anchors / m², $\chi = 0.001 \text{ W/K}$

$$\rightarrow 1/3 \times 0.033 + 1/10 \times 0.025 + 8 \times 0.001 = \Delta U_f = \mathbf{0.02 \text{ W/(m}^2\text{K)}}$$

Do brickwork support brackets, permanent scaffold and cavity wall anchors have to be taken into account?

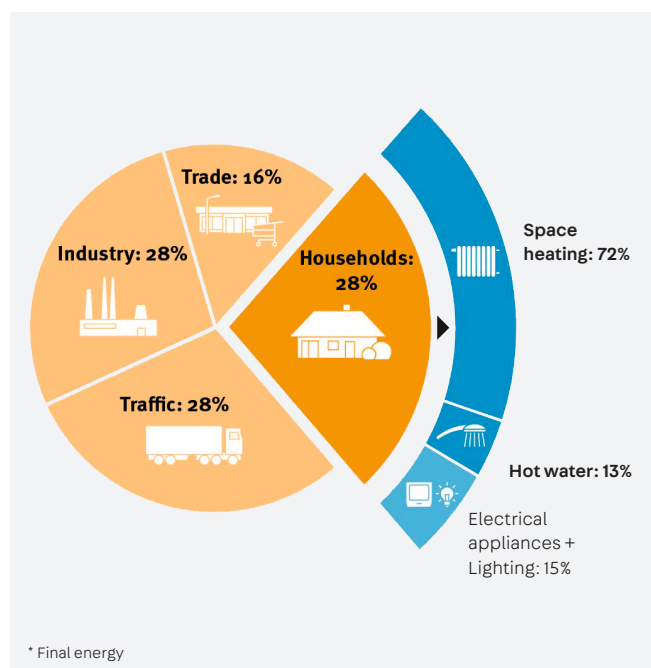
Disregarding these mechanical fastening elements is only possible if the resulting correction for the thermal transmittance coefficient ΔU_f is less than 3% of the thermal transmittance coefficient U !

The correction is then made exclusively for the thermal transmittance coefficient. All other thermal bridges remain unaffected and are covered by the blanket thermal bridge correction ΔU_{WB} .

Energy efficiency

In recent years, the increase in energy consumption has grown exponentially to the world's population. Although this problem is mainly taking place outside the leading industrial nations, it is precisely the technologically advanced and developed countries that must set a good example and use their know-how to improve energy efficiency.

Around a quarter of the energy* consumed in Germany is used by private households. More than two thirds of this energy consumption is used for heating purposes.



Breakdown of energy consumption in Germany
 (dena /energy data from BMWi for reference year 2010, as of 12/2011)

Introduction to app. principles

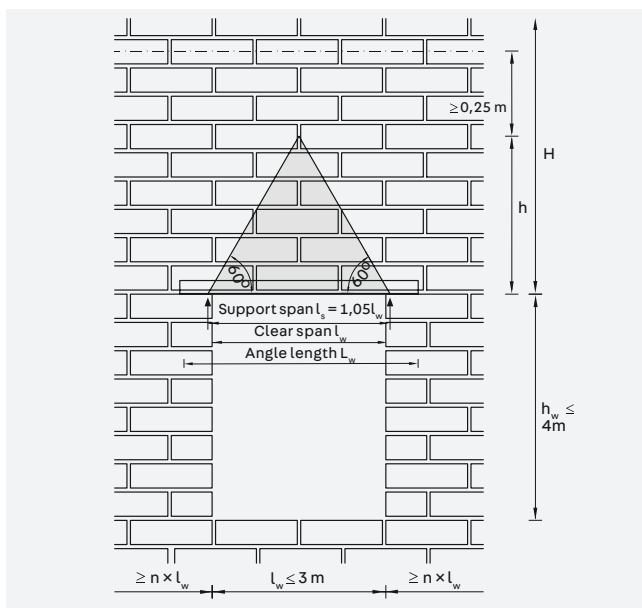
Assessment of openings

Design of bracing above wall openings with vault effect

Angled brackets used for support above wall openings can be designed with reduced wall loads, since a vault effect is experienced above the bracing plane. In this case, the vault can be simplified as an equilateral triangle above the beam. The prerequisite for this is that the thrust forces from the vault can be supported. Therefore, the height of the wall H must be free of openings and sufficiently large ($H \geq h + 0.25$ m). In addition, sufficient distance must be maintained from neighbouring openings, which can be checked with the following table.

Prerequisite for the applicability of the vault effect

h_w/l_w	0.85	1.2	1.6	2.0	2.5	3.0	3.6
n	0.4	0.5	0.6	0.7	0.8	0.9	1.0



Design with vault effect

Wall height H in m: $H \geq h + 0.25$ m

Load height h in m: $h = \sin 60^\circ \times l_s = 0.866 \text{ m} \times l_s$

Load q_{Ed} in kN/m

$$q_{Ed} = \rho \times 0.01 \text{ kN/kg} \times H \times t \times \gamma_G$$

Maximum moment M_{Ed} in kNm:

$$M_{Ed} = q_{Ed} \times l_s^2 / 12$$

Maximum shear force at support V_{Ed} in kN:

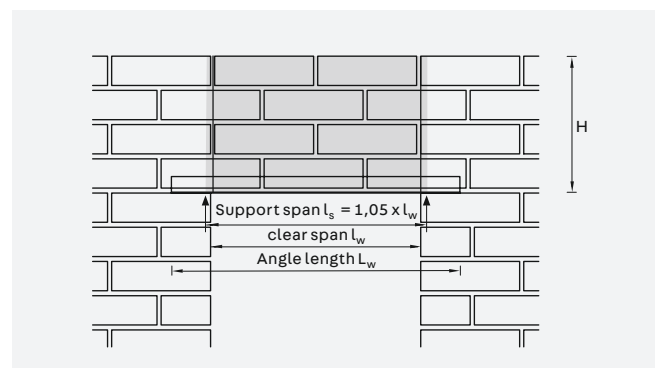
$$V_{Ed} = q_{Ed} \times l_s / 4$$

Length of angled bracket L_w in m:

$$L_w = l_w + 2 \times 0.095 \text{ m}$$

Design of bracing above wall openings without vault effect

If the height of the wall is too small or if neighbouring openings are too close, the vault effect is not taken into account and the load is calculated as a uniformly distributed linear load over the beam.



Design without vault effect

Load height = wall height H in m

Load q_{Ed} in kN/m

$$q_{Ed} = \rho \times 0.01 \text{ kN/kg} \times H \times t \times \gamma_G$$

Maximum moment M_{Ed} in kNm:

$$M_{Ed} = q_{Ed} \times l_s^2 / 8$$

Maximum shear force at support V_{Ed} in kN:

$$V_{Ed} = q_{Ed} \times l_s / 2$$

Length of angled bracket L_w in m:

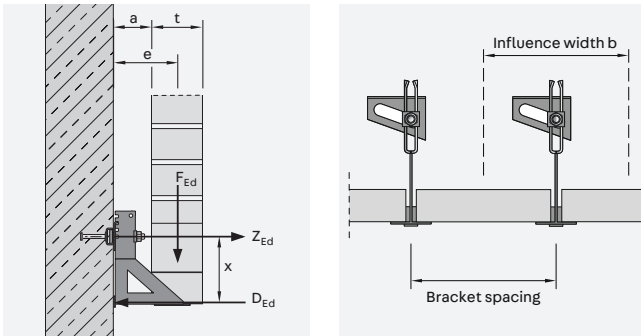
$$L_w = l_w + 2 \times 0.095 \text{ m}$$

Design of angled support brackets

The angled support bracket is chosen according to tables or according to a structural calculation. The bending moment M_{Ed} and adherence to the permissible deflection of, for example, $l_s / 300$ are decisive for the angled support bracket. The support force V_{Ed} is decisive for the dimensioning of the support points, i.e. brickwork support brackets. A selection of suitable angled brackets can be found on pages 14-15.

Mounting of brickwork support brackets

Brickwork support brackets are used to safely transfer the vertical load of the facing masonry to the supporting structure made of reinforced concrete behind it. The determination of the vertical load F_{Ed} based on the influence width b , which corresponds to the bracket spacing, is explained on page 56.



The load F_{Ed} in kN acting with the eccentricity e in mm generates a moment M_{Ed} in kNm, which is transferred to the supporting structure via a tension-compression force pair $Z_{Ed} = D_{Ed}$ in kN:

$$Z_{Ed} = D_{Ed} = \frac{M_{Ed}}{x_{min}} = \frac{F_{Ed} \times e}{x_{min}}$$

The eccentricity e in mm results from the shell distance a in mm, half the thickness of the facing masonry t in mm and a tolerance of 10 mm:

$$e = a + \frac{t}{2} + 10$$

The lever arm x_{min} in mm of the tension-compression force pair is calculated from the installation dimension x in mm of the brickwork support bracket, for which the height adjustability of 30 mm must be taken into account:

$$x_{min} = x - 30$$

JORDAHL® brickwork support brackets are dimensioned in such a way that the surface pressure generated by the compressive force D_{Ed} can be borne by the concrete component (quality $\geq C20/25$). A reinforcement close to the surface is to be positioned behind the pressure point. The tensile force Z_{Ed} must be borne by an approved dowel or an anchor channel with a special screw. We recommend consulting JORDAHL® experts when dimensioning the fastening.

Anchor channels with special screws

The fastening of brackets to JORDAHL® anchor channels with special screws offers many advantages:

- Screws can be slid horizontally
- Small edge clearances
- Easy installation without prior knowledge, thereby ensuring correct execution of the fastening
- No issues with drilling into rebar
- No time-consuming search for suitable dowels
- No noise and respiratory pollution (dust, reaction gases) for installers and the environment
- No additional tools (air compressor, hammer drill)
- No consumables (drill bits, brushes)



Mounting of a JORDAHL® JVAeco+ facing masonry bracket with a JORDAHL® JTA anchor channel and a special screw

Dowels

When installing JORDAHL® brickwork support brackets, dowels can be used:

- Dimensioning required for each installation situation
- Only dowels made of stainless steel with national technical approval may be used
- Drilling of hole and cleaning according to approval



Mounting of a JORDAHL® JVAeco+ brickwork support bracket with a dowel

JORDAHL® software for brickwork support brackets

Software

To determine the optimum products for individual installation situations, we provide you with convenient design software: JORDAHL® software for JVAeco+ brickwork support brackets and JORDAHL® software for JMK+ brickwork support brackets for choosing the right brackets in accordance with national technical approval Z-21.8-1868 and type approval TP 12/009. The programs enable the printout of verifiable calculations

with drawings. Naturally, the printout also includes the point-specific thermal transmittance coefficients χ , which are required for the energetic building assessment according to the Building Energy Act (GEG) and for the preparation of the tender. Download for free at www.jordahl.de.

The screenshot displays the JORDAHL software interface. At the top, there is a technical drawing of a brickwork support bracket with various dimensions labeled (e.g., h_{Br}, h_{Is}, a, b, x, e, d, h_{Lu}). Below the drawing, the software shows input data fields for facing masonry and insulation, brickwork support bracket and mounting, and output data. The output data section includes verification results for load-bearing capacity and thermal transmittance coefficient.

Statischer Nachweis für Ausführungsvarianten N, NA, NU, E, EA, NFT und NAFT

Bauvorhaben und Pos.-Nr.:
 Bauvorhaben: Osterl Pos.-Nr.: 1

Eingabedaten:

Rohdichte: ρ [kg/m ³]	2200	Belastungshöhe: H [m]	3	JVA - Konsoltyp:	N
Steindicke: d [cm]	11,5	Lasteinflusbreite: b [m]	0,5	Laststufe:	7,0
Schalensabstand: a [cm]	25	X-Maß Konsole: x [cm]	30,0	Befestigungsmittel:	Ankerschraube
Versatzmaß: A [mm]	0	Steinüberstand: e [mm]	25	Talicherheitsbeiwert: γ_r	1,35
Dicke Dämmung: h _{Is} [cm]	22	Qualität Dämmung: WLG	> 030	Einbaubereich:	Decke

Ausgabedaten:

Hebelarm: e [cm]	32,75	max. Belastung: F _{Ed} [kN]	5,12
D _{Ed} = Z _{Ed} : [kN]	6,21	Schrägzugkraft: R _{Ed} [kN]	8,05
Dicke Luft: h _{Lu} [cm]	4	hinterlüftet, JORDAHL® Thermomanschette JTM erforderlich	

Nachweise:

- Nachweis im Grenzzustand der Tragfähigkeit der Konsole** ($F_{Ed} < F_{Rd}$) Laststufe: 7,0 kN
 F_{Rd} [kN]: 9,45 F_{Ed} / F_{Rd} : 0,54 < 1 **Nachweis erbracht**
- Nachweis des zugelassenen Befestigungsmittels**
 siehe separaten Nachweis

Konsolbezeichnung:

Pos.-Nr.: 1
 gewählte JORDAHL® Verbinderkonsole: JVAeco+ 350 - N / 7,0
 Ein losser Winkel zwischen den Konsolen ist erforderlich. (Querschnitte siehe Berechnungsmodul -Winkel-).
 Punktbbezogener Wärmedurchgangskoeffizient: χ [W/K] 0,021

2 drawing modes:

- Cross section
- Elevation view

Input data for facing masonry and insulation

- Load height H
- Load influence width b
- Shell spacing a
- Offset A
- Brick projection o
- Insulation thickness h_{DS}
- Insulation quality WLG

Input data for brickwork support bracket and mounting

- Design variant
- Load level
- Installation area
- Anchor channels with special screws or dowels

Output data

- Lever arm e
- Forces D_{Ed}, Z_{Ed}, F_{Ed}
- Air gap h_{LS}

Results

- Verification of load-bearing capacity
- Exact designation/name
- Point-specific thermal transmittance coefficient χ

Stainless steel

Permanently corrosion resistant rather than just anti-corrosion treatment

Corrosion

Corrosion is the chemical reaction of a material with its environment, which causes a measurable change in the material and can result in an impairment of the function of a component or system. Moisture (e.g. due to condensation) is a necessary prerequisite for corrosion to occur. The best-known type of corrosion is probably rust, i.e. the oxidation of metals.

Corrosion protection

Corrosion protection refers to all measures that contribute to preventing the damage or loss of a component by protecting the materials from destruction by chemical and/or physical agents.

Anti-corrosion treatment

Generally, components are protected against corrosion by means of powder coatings or zinc coatings in order to meet the minimum corrosion protection requirements for the material itself.

Corrosion resistance

The corrosion resistance of stainless steel depends on the alloy composition, the surface and the structural condition of the steel used. The corrosion resistance thus indicates that a material in a given corrosion system can withstand the corrosion loads for the respective structure or component caused by the environmental conditions without experiencing any adverse effects.

General information

Stainless steel has established itself in the construction industry in particular due to its corrosion resistance, very good mechanical properties and other advantages such as durability and longevity. This makes it possible to create slender yet highly load-bearing, but also hygienic and recyclable components and bracing structures.

Stainless steels get this high level of corrosion protection from their external passive layer. This extremely thin and impermeable layer can even re-passivate when defects occur, provided certain conditions of use are met.

A corrosion system describes the interaction between multiple components and influencing factors which serve to prevent corrosion.

Material selection from the point of view of corrosion resistance

Corrosion resistance is the main reason for using stainless steel in construction. Therefore, in order to determine a suitable steel grade, the exposure of the components to certain environmental influences will need to be determined. Previously, this was done in tabular form via Z-30.3-6, but now a points system is used for this, which came into effect with

the introduction of DIN EN 1993-1-4. This procedure for material selection is carried out in three steps and is only suitable for Europe:

- Determination of the corrosion resistance factor CRF
- Determination of the corrosion resistance class CRC
- Selection of a steel grade according to CRC

However, the following criteria must be met for this procedure:

- The operating conditions should exhibit a neutral pH range (pH value between 4 and 10)
- The components are not directly or partially exposed to a chemical process
- The load-bearing components are not in constant or frequent contact with seawater.

The CRF is calculated as follows and depends on the environment considered for the components:

CRF = F1 + F2 + F3, where

F1 = risk of exposure to chlorides from salt water or de-icing salts

F2 = risk of exposure to sulphur dioxide

F3 = the cleaning requirements or exposure to wash-off from rain

Thus, a steel grade can now be determined from the five corrosion resistance classes CRC I-V depending on the corrosion resistance factor CRF. The method applies to structures with a load-bearing function and requires compliance with the requirements of EN 1090-2 with regard to welding procedures, the post-treatment of weld seams and the prevention and elimination of impurities on the surfaces. For determination of the CRF, the CRC as well as the steel grade, the tables A.1-A.3 Annex A according to DIN EN 1993-1-4 apply.

Stainless steel and galvanised steel

Bracing systems for facing masonry must be made of permanently corrosion-resistant material according to DIN EN 1996-2/NA. Therefore, stainless steel must always be used for supporting structures if it is not possible for the structure to subsequently be inspected. A combination of galvanised components and stainless steel should always be avoided. If it is nevertheless necessary for this design, suitable protective measures must be taken against bimetallic corrosion. More information at: www.edelstahl-rostfrei.de.



Notes

For facing masonry bracing, this means that stainless steel grades of CRC III or higher are to be used. The use of stainless steels with a lower CRC or even galvanised material is therefore not permitted for exterior use! JORDAHL® brickwork support brackets as well as all accessories such as screws, dowels, anchor channels, scaffold anchors, cavity wall anchors etc. are made of stainless steel of the corresponding corrosion resistance class.

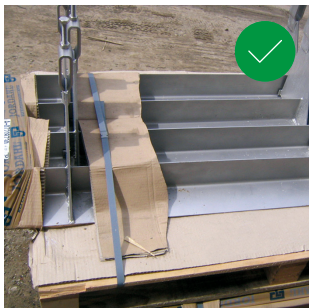
Working with stainless steel

Basic principles

In order to maintain the surface quality and thus the corrosion protection of stainless steel, contamination through contact with normal steel must be avoided in all phases of production, transport, storage and installation. Contact with chemicals such as acids and acidic solutions, greases and oils must also be avoided.

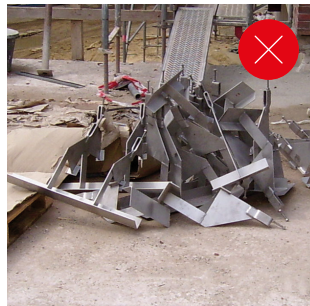
If the surface of a stainless steel component has been damaged, the passive layer of the stainless steel will restore itself in the short term. It is advisable to contact us.

Important notes



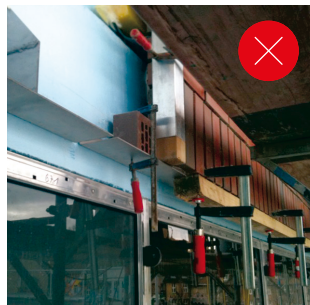
Transportation

When transporting stainless steel components, use straps and belts that do not damage the surface, e.g. made of plastic. Lifting devices must be cleaned thoroughly before use. A suitable intermediate layer must be placed between stainless steel components and the wooden pallet (provided on the production side). Stainless steel components and components made of normal steel must be transported and stored in such a way that they have no direct or indirect contact with each other.



Storage

Stainless steel components must be stored in a dry and, if possible, covered place, especially if the components are packed in cardboard boxes. Contact between components made of stainless steel and normal steel must be avoided. Stainless steel must also be protected from flash rust and drill dust by appropriate measures, such as covering it with a tarpaulin.



Installation

Stainless steel components must be installed using separate tool sets. If subsequent machining (cutting, grinding, etc.) is required on site, only tools suitable for stainless steel and not previously used for machining normal steel may be used. Angled brackets may only be supported by wooden beams that have not yet been in contact with mild steel. If profiles made of normal steel are used for support, a suitable intermediate layer must be installed.



Notes

For further information on working with stainless steel, please refer to Information Sheet 969 which provides general information on the fabrication and erection of stainless steel structures, issued by the Stainless Steel Information Centre (www.edelstahl-rostfrei.de).

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With us, you benefit from the collective experience of three established manufacturers, who combine products and expertise in a comprehensive range. That is the PohlCon synergy concept.



Full-service consulting

Our extensive network of consultants is available to answer all your questions about our products on site. From planning to use, you can enjoy personal support from our qualified employees.



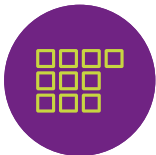
Digital solutions

Our digital solutions provide targeted support in planning with our products. From tender texts to CAD details and BIM data, right through to modern software solutions, we offer customized support for your planning process.



7 fields of application

We think in terms of holistic solutions. This is why we have combined our products into seven fields of application, where you can benefit from their synergy and the overall PohlCon product range.



10 product categories

In order to find the right product in our extensive range even faster, we have divided our products into ten product categories. This way you can navigate clearly and precisely between our products.



Individual solutions

Is there no series product on the market that is suitable for your project? We realize unique construction projects and deal with exceptional challenges using the many years of expertise of the three manufacturing brands.

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