

GERMAN INSTITUTE FOR STRUCTURAL ENGINEERING

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Ref.: I 23-1.21.4-53/05

Notification of the extension of the period of validity of the General Building Approval dated 25. July 2002

Approvalnumber: Z-21.4-1690

Client: Deutsche Kahneisen Gesellschaft mbH
Nobelstr. 51/55
12057 Berlin

Subject of the Approval: JORDAHL® anchor-channels type JXA-W 29/20 and JXA-W 38/23

Applicable until: 30. November 2010

This notification extended the period of validity of the General Building Approval No. Z-21.4-1690 dated 26. July 2002. This notification comprises one page. It is valid only in connection with the above mentioned General Building Approval and has to be applied together with this Approval.

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GERMAN INSTITUTE FOR STRUCTURAL ENGINEERING

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General Building Approval

Approval number: Z-21.4-1690

Client: Deutsche Kahneisen Gesellschaft mbH
Nobelstrasse 51/55
12057 Berlin

Subject of the Approval: Jordahl anchor rails type JXA-W 29/20
and JXA-W 38/23

Applicable until: 30 November 2005

The subject of the Approval mentioned above is hereby granted General Building Approval.*

This General Building Approval comprises ten pages and twelve annexes.

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- This general building approval replaces the general building approval no. Z-21.4-1690 dated 27 November 2000.
 - The subject was approved for the first time on 27 November 2000 in terms of a general building approval.

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I. GENERAL PROVISIONS

- 1 The General Building Approval demonstrates the ability to use and apply the subject of the Approval in the sense of the German regional building regulations.
- 2 The General Building Approval does not replace the approvals, agreements and certificates prescribed by law for the implementation of building projects.
- 3 The General Building Approval is granted regardless of the rights of third parties, in particular private protective rights.
- 4 Parties manufacturing and marketing the subject of the Approval must, irrespective of further-reaching regulations in the "Special Provisions", make copies of the General Building Approval available to those using or applying the subject of the Approval and point out that the General Building Approval must be present at the point of use. If required, copies of the General Building Approval must be made available to the authorities involved.
- 5 The General Building Approval may be copied only in full. Any publication of an extract requires the agreement of the German Institute for Structural Engineering. Texts and drawings in advertisements must not contradict the General Building Approval. Translations of the General Building Approval must contain the note "Translation of the German original version not checked by the German Institute for Structural Engineering".
- 6 The General Building Approval is granted until revoked. The provisions of the General Building Approval can subsequently be supplemented and changed, in particular when new technical findings require this.

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II. SPECIAL PROVISIONS

1. Subject of the Approval and area of application

1.1 Subject of the Approval

The Jordahl anchor rail type JXA (type W 29/20 and type W 38/23) comprises a C-shaped rail with tothing and with at least two anchors welded onto the back of the profile or steel round anchors pressed on, made of steel in the rolled blank or hot-dip galvanized form, and made of stainless steel.

Hammer-shaped or hooked head-shaped bolts are inserted into the rail, to which any desired constructional parts can be fixed.

The anchor rail is concreted in flush with the surface.

The anchor rail is illustrated in the installed state in Annex 1.

1.2 Area of application

The anchor rail may be used for anchoring means under predominantly steady loading in reinforced or non-reinforced standard concrete and under a predominantly unsteady central tensile load up to 2×10^6 load cycles in reinforced standard concrete of strength class of at least B15 to DIN 1045:1988-07 "Concrete and reinforced concrete, dimensioning and execution"; it may also be used in concrete of strength class of at least C12/15 to DIN EN 206-1:2001-07 "Concrete; Part 1: Definition, properties, production and conformity" in conjunction with DIN 1045-2:2001-07 "Load-bearing structures of concrete, reinforced concrete and prestressed concrete, Part 2: Concrete - Definition, properties, production and conformity". In the event of requirements on the fire resistance of the concrete components in which the anchor rails are anchored, the restrictions according to Section 3.2.7 must be noted. In the event of fire stress, the anchor rail may be loaded only at right angles to the rail longitudinal axis.

In the case of anchoring in the tension zone of the concrete produced by load stresses or if the minimum spacings of the anchor rails are used, the local transverse tensile stresses occurring as a result of the springing action must be absorbed by additional reinforcement, if constructive measures or other beneficial influences (e.g. transverse pressure) do not prevent the concrete splitting.

The corrosion prevention measures of the anchor rails (rail, anchor, bolt, nut and washer) must be complied with, depending on the area of application and the environmental conditions according to Annex 5.

A galvanized anchor rail (rail and anchor) may be connected to reinforcement only when the temperature of the contact points between the reinforcement and the galvanized steel parts does not exceed 40°C.

In the case of prestressed concrete components, the spacing of a galvanized anchor rail (rail and anchor) from the enveloping tubes of the stressing element or the stressing wire with immediate composite action must be at least 2 cm.

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2 Provisions for the structural product

2.1 Properties and composition

The constructional parts of the anchor rails (rail, anchor, bolt, nut and washer) must correspond to the drawings and specifications in the Annexes.

The material characteristics, dimensions and tolerances of the anchor rails and bolts not specified in this General Building Approval must correspond with the specifications deposited at the German Institute for Structural Engineering, at the certification office and at the third-party monitoring office.

For the rails, the material and the material properties must be documented by means of a works test certificate 2.3 according to DIN EN 10 204:1995-08.

For the anchors, the material and material properties must be documented by a works certificate 2.2 according to DIN EN 10 204.

For the bolts, the dimensions and material properties must be documented at least by a works test certificate 2.3 according to DIN EN 10 204, unless the bolts are identified with strength class and manufacturer's symbol according to DIN EN ISO 898-1:1999-11.

The hexagon nuts with dimensions according to DIN EN ISO 4032:2001-03 must correspond to the strength class 5 or 8 according to DIN EN 20898-2:1994-02 or A4-50 or A4-70 according to DIN EN ISO 3506-02. For the hexagon nuts according to DIN EN ISO 4032 (previously: DIN EN 24032:1992-02), a certificate of conformity (ÜZ) corresponding to construction rules list A, Part 1, index number 4.8.11 or 4.8.9 is required.

The washer with dimensions according to DIN 125-1:1990-03 must correspond at least to the material No 1.0037 (St 37-2) according to DIN EN 10025:1994-03.

For the washer according to DIN 125, a manufacturer's certificate of conformity (ÜH) corresponding to construction rules list A, Part 1, index number 4.8.43 is required.

For the anchor rail (rail, anchor, bolt) made of stainless steel, in addition the provisions of the General Building Approval Z-30.3-6 "Components and connecting elements of stainless steels" must be complied with. In accordance with this Approval, the stainless steel raw material must be supplied by the manufacturer with a certificate of conformity (ÜZ) and an acceptance test certificate 3.1.B to DIN EN 10 204:1995-08 to demonstrate conformance.

2.2 Manufacture and identification

2.2.1 Manufacture (connection between rail and anchor)

The production of the connections (welding on, pressing) between anchor and rail is to be performed in the factory.

For welding on the weld-on anchors, the inert gas welding process MAG/MAGM (process 135 according to DIN EN ISO 4063:2000-04) is to be used. The welds are to be formed in accordance with Annex 2.

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With regard to the requirements on the welding operation, DIN V 18 800-7:2000-10 "Steel structures, designs and manufacturer qualification" and the "Manufacturing guideline for steel construction", issue dated March 1996, Communications of the German Institute for Structural Engineering, special issue number 11/1, apply.

The round anchors are plugged through a hole prefabricated in the rear of the rail and pressed at the factory.

2.2.2 Marking

Each delivery note of the anchor rails and bolts must be marked by the manufacturer with the compliance symbol (Ü symbol) in accordance with the compliance symbol regulations of the German regions. In addition, the works code, the approval number and the complete description of the anchor rails and bolts must be specified on the delivery note.

The marking may be carried out only if the preconditions according to Section 2.3, Verification of compliance, have been satisfied.

The anchor rail is described in terms of the rounded profile external dimensions of the rail (width/height in mm), e.g. profile JXA-W 38/23.

The bolts are designated in accordance with the bolt type (toothed bolt types JXD or JXH, hammerhead bolt types JD, JUD, JH or JUH) and the thread size and assigned to the profile dimensions.

Each anchor rail must be marked in accordance with Annex 5.

The bolts must be marked and stamped in accordance with Annexes 3 and 4

2.3 Verification of compliance

2.3.1 General

The confirmation of the compliance of the anchor rails and bolts with the provisions of this General Building Approval must be carried out for each factory with a certificate of compliance on the basis of in-house production control and regular third-party monitoring, including initial testing of the anchor rails and bolts in accordance with the following provisions.

In order to grant the certificate of compliance and the third-party monitoring, including the product tests to be carried out in the process, the manufacturer of the anchor rails and bolts has to involve a certification authority recognized for this purpose and also a monitoring authority recognized for this purpose.

The German Institute for Structural Engineering must be provided by the certification authority with a copy of the certificate of compliance granted by them, for information.

The German Institute for Structural Engineering must additionally be provided with a copy of the initial testing report, for information.

2.3.2 In-house production control

In each factory, in-house production control must be set up and carried out. In-house production control is understood to mean the continuous monitoring of the production to be performed by the manufacturer, with which it is

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ensured that the structural products produced by it correspond with the provisions of this General Building Approval.

The in-house production control should include at least the measures listed below.

Description and checking of the raw material and the constituent parts:

- For the constructional parts of the anchor rail (rail, anchor, bolt, nut and washer), the verification of compliance required in accordance with Section 2.1 and test certificates must be checked for completeness and correctness.
- The dimensions and material properties of the bolts must be checked continuously by the factory in accordance with DIN ISO 8992 and DIN EN ISO 898-1:1999-11 and DIN EN ISO 3506-1.
- Determination of the functional dimensions (thickness, width, height and opening) of the rails and anchors and comparison with the values specified in the Annexes.

Verifications and tests which must be carried out on the finished structural part, at least on three product samples per 2000 running metres of anchor rails or per 10 000 short pieces or once per production week in each case:

- In the mass production of the anchor rails with the round anchor type R1 or R3, after setting up or changing over, the tests must be performed immediately on at least three samples. If the prescribed dimensions and loads at fracture are complied with, the testing can be reduced to one sample per 2000 running metres or per 10 000 short pieces.
- Checking of the weld thicknesses, weld lengths, anchor widths and anchor axial spacings and comparison with the values specified in the Annexes.
- Checking of the bolt seating in the rail and of the assembly carried out properly.
- Determination of the load at fracture of the anchors in the central tension test and the load at fracture in the rail longitudinal direction (F_x) on rail sections with anchors, if appropriate following galvanizing. Here, the loads at fracture must not fall below the following values:

| Profile | Load at fracture [kN] |
|-------------|-----------------------|
| JXA-W 29/20 | 20 |
| JXA-W 38/23 | 30 |

- The determination of the layer thickness of the corrosion protection is to be carried out in accordance with or following the model of DIN EN ISO 4042:1999-10 with a layer thickness measuring instrument. In the case of bought-in parts (third-party galvanizing), the testing must be carried out even when there is a certificate from the supply company relating to tests.

The results of the in-house production control must be recorded and evaluated. The recordings must contain at least the following information:

- Designation of the structural product or of the raw material and the constituent parts
- Type of inspection or testing
- Date of manufacture and testing of the structural product or the raw material or the constituent parts

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- Result of the inspection and tests and, if relevant, comparison with the requirements
- Signature of the person responsible for the in-house production control.

The records must be kept for at least five years and presented to the monitoring authority involved in the third-party monitoring. They must be presented to the German Institute for Structural Engineering and the responsible highest building inspection authorities on demand.

In the event of an inadequate testing result, the requisite measures for rectifying the deficiency must be taken by the manufacturer without delay. Structural products which do not meet the requirements must be handled in such a way that confusion with compliant parts is ruled out. After the deficiency has been rectified - to the extent technically possible and required in order to verify the elimination of the deficiency - the existing testing must be repeated without delay.

2.3.3 Third-party monitoring

In each factory, the in-house production control must be checked regularly, but at least twice per year, by a third-party monitoring authority.

Within the context of the third-party monitoring, initial testing of the anchor rails and bolts must be carried out, and samples must also be taken for random sample tests. Sampling and testing is in each case the responsibility of the recognized monitoring authority.

The third-party monitoring must be carried out on at least three examples in each case for each size manufactured, as follows:

- Determination of all the dimensions of the rails, anchors, bolts and welds and comparison with the values specified in the Annexes.
- Determination of the load at fracture of the anchors in the central tension test and the load at fracture in the rail longitudinal direction (F_x) on rail sections with anchors, if appropriate following galvanizing. In the process, the loads at fracture must not fall below the following values:

| Profile | Load at fracture [kN] |
|-------------|-----------------------|
| JXA-W 29/20 | 20 |
| JXA-W 38/23 | 30 |

- Determination of the layer thickness of the corrosion protection in accordance with or following the model of DIN EN ISO 4042 with a layer thickness measuring instrument.

The results of the certification and third-party monitoring must be kept for at least five years. They must be presented by the certification authority or the monitoring authority to the German Institute for Structural Engineering and the responsible highest building inspection authorities on demand.

3 Provisions for design and dimensioning

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3.1 Design

3.1.1 General

The anchoring must be planned by engineers. Taking account of the loads to be anchored, checkable calculations and design drawings must be prepared.

The design drawings must contain precise specifications relating to position, size and length of the anchor rails and the bolt type and the size of the associated bolts.

3.1.2 Corrosion prevention

The areas of application of the construction parts (rail, anchor, bolt, nut and washer) are specified in Annex 5, Table 7 as a function of the corrosion prevention measure.

The anchor rail profile W38/23 with welded-on anchors, in which the rail, bolt, nut and washer consist of stainless steel and the anchor of plain rolled steel (line 4 Table 7, Annex 5), may also be used for constructions in corrosion resistance class III in accordance with the General Building Approval "Components and connecting elements of stainless steels" Z-30.3-6; that is to say they may be used in wet rooms and in the open air, also in an industrial atmosphere and close to the sea (but not in the range of influence of seawater), as long as further corrosion loadings do not occur. With regard to the corrosion prevention of the welded-on anchors, the cement covering "c" according to Annex 5 may be used as a basis.

The anchor rail in which all the constructional parts (rail, anchor, bolt, nut and washer) consist of stainless steel (line 4 Table 7, Annex 5) may also be used for constructions in corrosion resistance class III in accordance with the General Building Approval "Components and connecting elements of stainless steels" Z-30.3-6; that is to say they may be used in wet rooms and in the open air, also in an industrial atmosphere and close to the sea (but not in the range of influence of seawater), as long as further corrosion loadings do not occur.

3.2 Dimensioning

3.2.1 General

The anchoring must be dimensioned by engineers. The verification of the immediate local introduction of force into the concrete is adduced.

If the anchor rail is dimensioned in accordance with DIN 1045-1:2001-07 "Load-bearing structures of concrete, reinforced concrete and prestressed concrete, Part 1: Dimensioning and design", the stress dimensional value is to be set as follows:

$$F_{Rd} = \text{perm. } F \times 1.4$$

The passing on of the loads to be anchored in the component must be verified.

The weakening of the concrete cross section by the installation of anchor rails must be taken into account in the static verification, if appropriate.

Flexural stressing may remain unconsidered only if all the following conditions are met:

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- the component to be connected consists of metal and is braced against the rail without any interlayer and
- the hole diameter in the component to be connected does not exceed the values according to Tables 4 and 6, of Annexes 3 and 4.

Additional stresses which arise in the anchor rail, in the component to be connected or in the component in which the anchor rail is anchored as a result of a shape change being prevented (e.g. when the temperature changes) must be taken into account.

The permissible loading directions (stress regions) for the anchor rails are presented in Annex 7 as a function of the bolt type. If the hammerhead bolt (types JD, JUD, JH and JUH) is used, the anchor rail must be stressed only at right angles to the rail longitudinal axis (transverse tension and central tension). If the toothed bolt (types JXD and JXH) is used, the anchor rail may be stressed in all directions (longitudinal tension, transverse tension and central tension).

In the event of simultaneous stressing in a number of directions, the resultant load must not exceed the permissible load according to Table 11 Annex 8.

If smaller bolts are used, the permissible load on the bolts (Annex 3 and 4) must not be exceeded.

The action of the individual load or the pair of loads can take place at any arbitrary point on the anchor rails. The axial and end spacings of the load action points (bolts) are specified in Annex 7 and 8. The axis of the bolt must be at least 25 mm away from the end of the rail.

The spacings of the anchor rails (axial, edge and corner spacings) and component dimensions (component width and thickness) must not fall below the minimum according to Annex 6.

3.2.2 Permissible loads

The permissible loads are specified in Table 11, Annex 8 as a function of the rail length, the load spacings and the associated bolts for the concrete strength classes $\geq B25$ and $\geq C20/25$.

In the case of anchoring in concrete in strength class B15 or C12/15, the permissible loads for B25 and C20/25 must be reduced by the factor 0.7.

The permissible loads on the bolts are specified in Annexes 3 and 4.

The smaller value (of the anchor rail or bolt) is critical.

3.2.3 Flexural stressing of the bolts

The permissible bending moments are specified in Annexes 3 and 4. The computational clamping point is the upper edge of the anchor rail.

In the case of bending with an additional central tension or oblique tension, the stresses must be superimposed:

$$F_z \leq \text{perm. } F (1 - M/\text{perm. } M)$$

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- perm. F = permissible central tensile load on the bolt according to Annex 3 or 4
perm. M = permissible bending moment on the bolt according to Annex 3 or 4
 F_z = existing tensile load component \leq permissible load on the anchor rail (Annex 8)
M = existing bending moment.

In the case of façade cladding with variable flexural stresses (e.g. as a result of temperature changes), the alternating stress amplitude $\sigma_A = \pm 50 \text{ N/mm}^2$ about the average σ_M , based on the computational stress cross section of the bolt, must not be exceeded.

3.2.4 Non-predominantly stable central tensile loads in reinforced standard concrete $\geq \text{B15}$ or $\geq \text{C12/15}$

For stress resulting from non-predominantly stable central tensile loads with a load cycle $N \leq 2 \cdot 10^6$, the anchor rails JXA-W 29/20 and JXA-W 38/23 in the design with transversely welded-on I anchors and with round anchors type R1 or R3 may be used. The permissible cycle size with a load cycle of $N = 2 \cdot 10^6$ can be taken from Table 12 of Annex 8. The rails may be anchored only in reinforced standard concrete of at least B15. Only the associated bolts according to Table 12, Annex 8 are permissible.

3.2.5 Special case of narrow reinforced concrete components

An anchor rail arranged in the end of at least 10 cm thick, lightly loaded reinforced concrete components (e.g. façade panels, weakly stressed walls) may be stressed with central tension with the permissible load according to Table 11, Annex 8 if additional reinforcement according to Annex 9 is provided.

3.2.6 Displacement behaviour

Given a loading at the level of the permissible load, displacements of $\leq 0.6 \text{ mm}$ in the direction of the load may be expected:

In the case of transverse loads, the hole play present between bolt and fitted part must be taken into account.

3.2.7 Fire protection

In the event of requirements on the fire resistance of the concrete components, the anchor rails may be stressed under predominantly stable loading only at right angles to the rail axis (central tension, oblique tension and transverse tension) in reinforced and unreinforced standard concrete of strength class of at least B15 or C12/15. The permissible loads for the individual anchor rails are specified as a function of the bolt size for the fire resistance period of 90 minutes (F90) and 60 minutes (F60) in Table 13, Annex 10, and must not be exceeded.

The anchor rails may be used for reinforced concrete floors stressed by fire on one side, reinforced concrete beams stressed by fire on three sides and for reinforced concrete columns stressed by fire on four sides. In the case of reinforced concrete floors stressed by fire on one side, the minimum axial spacing of the tensile reinforcement in the region in the anchor rails according to Table 14, Annex 10 must be maintained. For reinforced concrete beams stressed on three sides and reinforced concrete columns stressed on four sides, the axial spacing "u" required by DIN 4102-4 for the reinforcement must

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be increased by the dimension “ Δu ” specified in Tables 15 and 16 of Annexes 11 and 12.

If the anchor rails are incorporated in concrete components (reinforced concrete floors, beams and columns) in fire resistance class F60 or F90, and if the conditions specified in Annexes 10 to 12 are met, the fire resistance class of the concrete component is maintained.

The assessment of the fire resistance period for the construction to be connected is not the subject of this Approval.

4 Provisions for the implementation

4.1 Installation of the anchor rails

No anchors may be fixed to the anchor rail, nor other changes made.

The installation of the anchor rail is to be performed in accordance with the design drawings produced in accordance with Section 3.1.1.

The anchor rails are to be fixed to the shuttering in such a way that they are not displaced when the reinforcement is laid or during the introduction and compaction of the concrete. They must be protected against the penetration of concrete into the interior of the rails.

4.2 Fixing the connecting construction (bolt mounting)

The required bolt type and size must be taken from the design drawings. In the event of loading in the rail longitudinal direction, only the toothed bolt type JXD and JXH may be used. This bolt is identified at the shank end by two marking slots.

If, as a result of improper concreting or the like, the front edge of the anchor rail is not flush with the surface of the concrete, then this interspace must be lined completely during the mounting of the connecting construction.

The heads of the bolts are inserted into the slot in the rail, following clockwise rotation through 90° must rest completely on both legs of the anchor rail and must be locked by tightening the nut with the torque wrench. The tightening torques specified in Annexes 3 and 4 must be complied with.

Following the mounting, correct seating of the bolt must be checked; the marking slot (marking slots) at the shank end of the bolt must lie transversely with respect to the longitudinal direction of the rail. The axial spacing of the bolts (load spacing) must not fall below the specifications in Annexes 7 and 8.

4.3 Monitoring the implementation

During the installation of the anchor rails and during the mounting of the bolts (fixing of connecting constructions), the contractor entrusted with the anchoring of anchor rails or the construction manager commissioned by him or a specialist representative of the construction manager must be present on the building site. He must ensure the proper implementation of the work.

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In particular, he must monitor the implementation and position of the anchor rails and any possible rear-suspended reinforcement.

The records must be available during the construction period on the building site and must be presented to those entrusted with the supervision on demand. Just like the delivery notes, they must be kept for at least five years by the contractor after the work has been completed.

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Certified

[signature]

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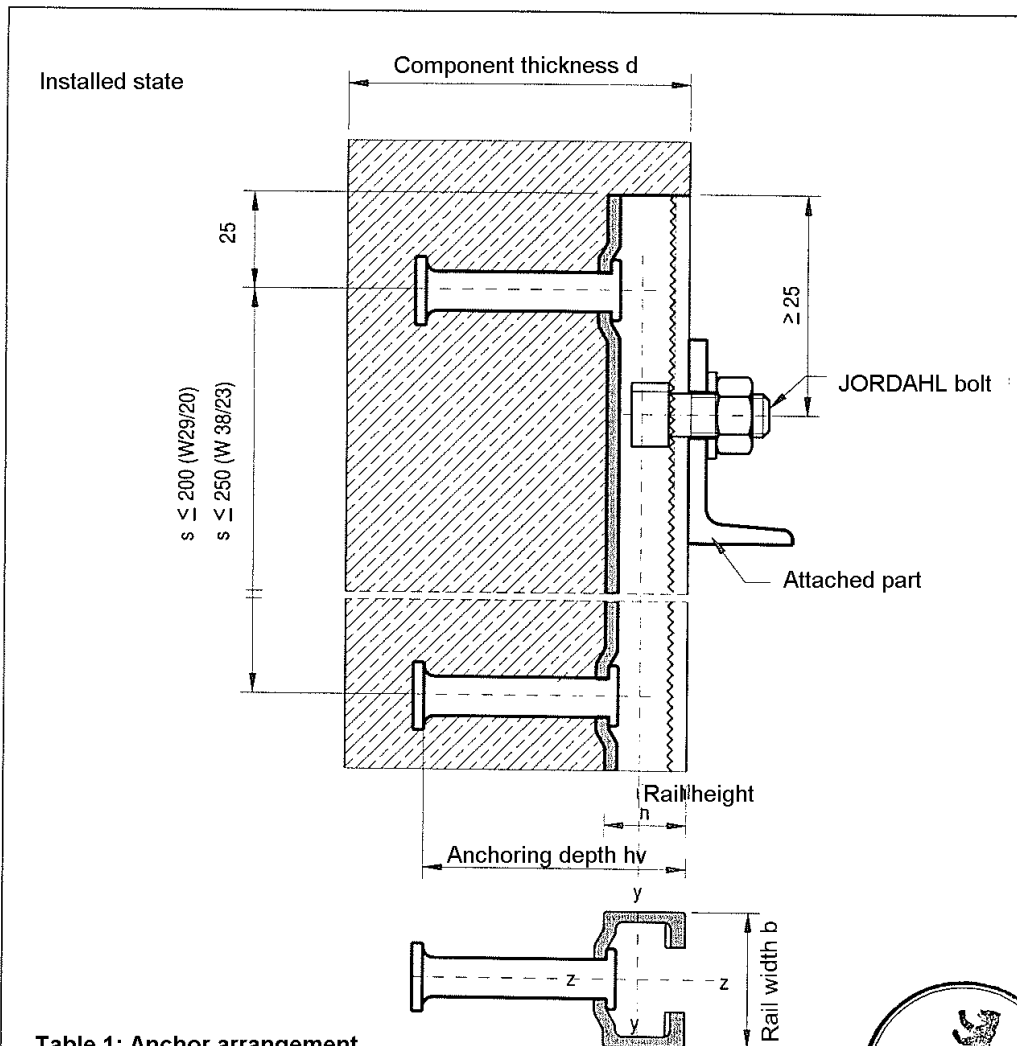


Table 1: Anchor arrangement

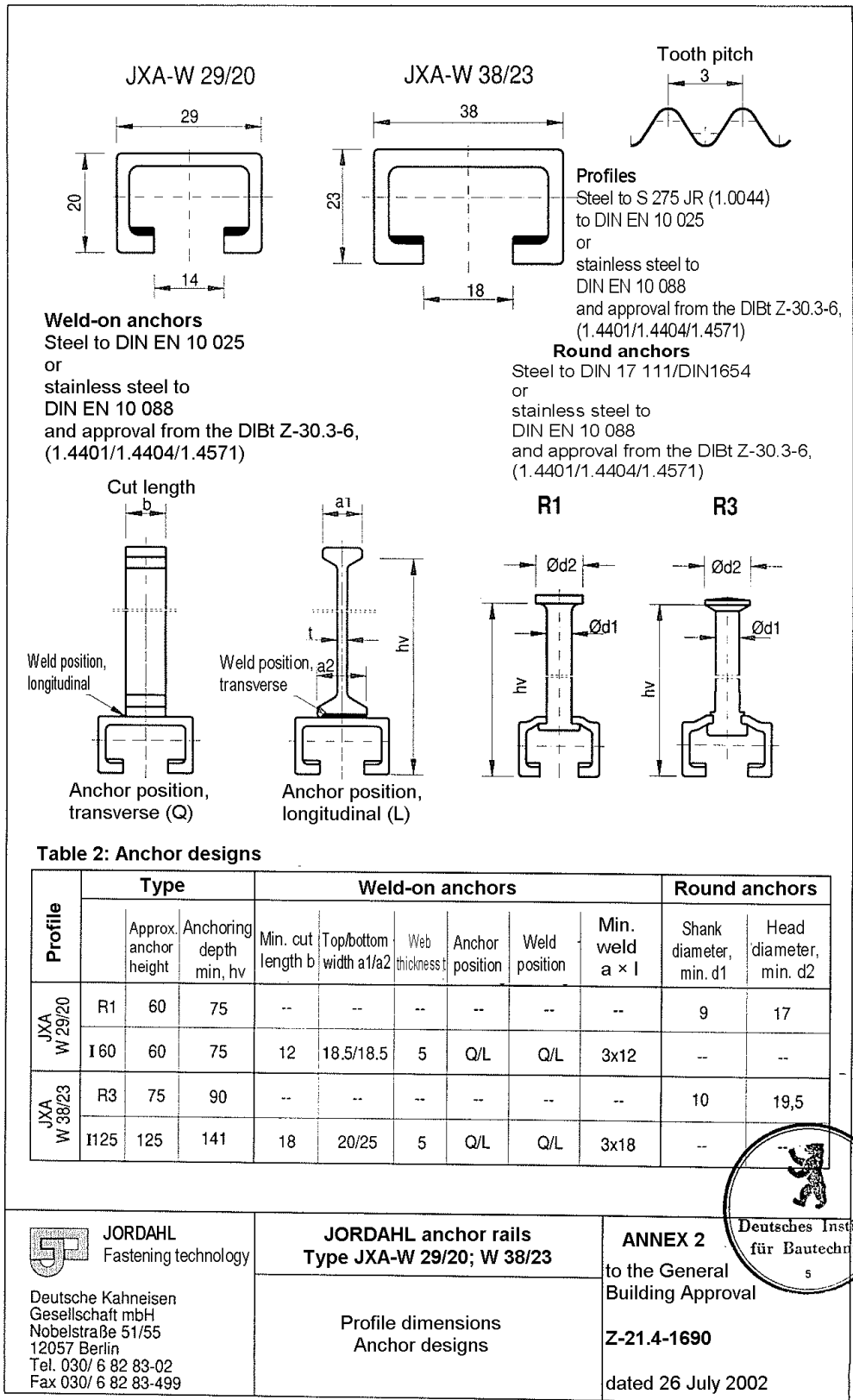
| Rail length [mm] | Axial and end spacing 1 of the anchors [mm] | |
|------------------|---|--|
| 100 | 25 | 50 25 |
| 150 | 25 | 100 25 |
| 200 | 25 | 150 25 |
| 250 | 25 | 200 25 |
| >250 | W 29/20 | 25 ≤200 25 25 ≤200 // ≤200 25 |
| | W 38/23 | 25 ≤250 25 25 ≤250 // ≤250 25 |

Dimensions in [mm]

 5

① The end spacing may be increased from 25 mm to 35 mm in the case of round anchors

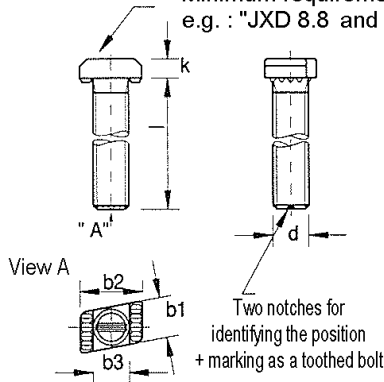
| | | |
|---|---|---|
| JORDAHL Fastening technology Deutsche Kahneisen Gesellschaft mbH Nobelstraße 51/55 12057 Berlin Tel. 030/ 6 82 83-02 Fax 030/ 6 82 83-499 | JORDAHL anchor rails Type JXA-W 29/20; W 38/23 | ANNEX 1 to the General Building Approval Z-21.4-1690 dated 26 July 2002 |
| | Installed state of anchor arrangement | |



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Toothed bolts type JXD and JXH - for loading in all directions

Embossing:
Minimum requirements works symbol "J", material short code
e.g. : "JXD 8.8 and JXD A4-70"



Material:

Bolts:

- Shank and thread design to DIN EN ISO 4018
- Material steel, strength class 8.8 to DIN EN ISO 898-1 or stainless steel (A4: 1.4401/1.4404/1.4571; FA: 1.4462) strength class 70 to DIN EN ISO 3506-1

Hexagon nuts:

- Design to DIN EN ISO 4032
- Strength class 8 to DIN EN 20898-2 or stainless steel, strength class 70 to DIN EN 3506-2

Washers:

- to DIN 125-1, DIN 9021 product class A
- material steel or stainless steel (1.4401/1.4404/1.4571) to DIN EN 10 088 and Z-30.3-6

Corrosion protection:

Bolts, hexagon nuts and washers according to Annex 5.

Table 3: Bolt dimensions

| Profile | Bolt type | d [mm] | b1 [mm] | b2 [mm] | b3 [mm] | k [mm] | min l [mm] |
|-------------|-----------|--------|---------|---------|---------|--------|------------|
| JXA W 29/20 | JXD | M 10 | 13.4 | 20.9 | 11.8 | 6.5 | ≥ 15 |
| | | M 12 | 13.4 | 20.9 | 11.8 | 6.5 | ≥ 20 |
| JXA W 38/23 | JXH | M 12 | 17.2 | 28.9 | 16.9 | 8 | ≥ 20 |
| | | M 16 | 17.2 | 28.9 | 16.9 | 8 | ≥ 30 |

Table 4: Permissible loads, tightening torques and permissible bending moments of the toothed bolts

| Type | Bolt diameter d [mm] | Clearance hole in component to be attached [mm] | Tightening torque | Permissible bending moments on the bolts [Nm] | | Permissible loads F (tensile and shear) [kN] | |
|------------------------------|----------------------|---|-------------------|---|-----------------------------------|--|-----------------------------------|
| | | | | 8.8 | stainless steel strength class 70 | 8.8 | stainless steel strength class 70 |
| Toothed bolts, type JXD, JXH | M 10 | 12 | 40 | 24.9 | 18.7 | 13.3 | 8.7 |
| | M 12 | 14 | 80 | 43.7 | 32.8 | 19.4 | 12.6 |
| | M 16 | 18 | 120 | 111 | 83.3 | 36.1 | 23.0 |

1) For stress ranges see Annex 7


If there is simultaneous stress in all directions (longitudinal stress x, transverse stress y, central stress z,) the resultant of the permissible loads must not exceed the following, in accordance with the Table:

$$\sqrt{F_x^2 + F_y^2 + F_z^2} \leq \text{perm. } F$$

2) Based on the upper edge of rail or concrete

3) The permissible loads on the anchor rails according to Annex 8 must not be exceeded

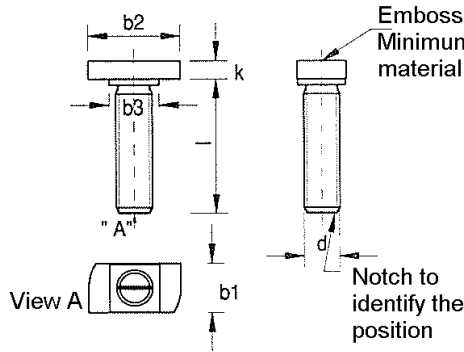


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|  JORDAHL Fastening technology Deutsche Kahneisen Gesellschaft mbH Nobelstraße 51/55 12057 Berlin Tel. 030/ 6 82 83-02 Fax 030/ 6 82 83-499 | JORDAHL anchor rails Type JXA-W 29/20; W 38/23 | ANNEX 3 to the General Building Approval Z-21.4-1690 dated 26 July 2002 |
| | Toothed bolts, JXD, JXH Dimensions, material, permissible loads | |

Note:

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Hammerhead bolts type JD, JUD and JH, JUH for loading under tension, transverse tension, inclined tension



Material:

Bolts:

- Shank and thread design to DIN EN ISO 4018
- Steel, strength class 4.6 to DIN EN ISO 898-1
- stainless steel 1.4401/1.4404/1.4571 strength class A4-50 to DIN EN ISO 3506-1

Hexagon nuts:

- Design to DIN EN ISO 4032 or DIN EN ISO 4034
- Strength class 5 or 8 to DIN EN ISO 20898-2
- stainless steel, strength class A4-50 to DIN EN ISO 3506-2

Washers:

- DIN 125-1, DIN 9021 product class A
- material steel and stainless steel 1.4401/1.4404/1.4571 to DIN EN 10088 and Approval Z-30.3-6

Table 5: Bolt dimensions

| Profile | Bolt type | d [mm] | b1 [mm] | b2 [mm] | b3 [mm] | k [mm] | min l [mm] |
|----------------|-----------|--------|---------|---------|---------|--------|------------|
| JXA W 29/20 | JD | M 6 | 11.2 | 22.4 | 11.0 | 4.5 | ≥ 15 |
| | | M 8 | | | | 4.5 | ≥ 15 |
| | | M 10 | | | | 5 | ≥ 20 |
| | JUD | M 12 | | | | 6.5 | ≥ 20 |
| JXA W 38/23 | JH | M 10 | 16.5 | 30.5 | 17.0 | 6 | ≥ 20 |
| | | M 12 | | | | 7 | ≥ 20 |
| | JUH | M 16 | 8 | ≥ 30 | | | |

Corrosion protection:

Bolts, hexagon nuts and washers according to Annex 5.

Table 6: Permissible loads, tightening torques and permissible bending moments of the hammerhead bolts

| Type | Bolt diameter d [mm] | Clearance hole in component to be attached [mm] | Tightening torque [Nm] | Permissible bending 2) moments on the bolts [Nm] | | Permissible loads F 1) (tensile and shear) [kN] | |
|---|----------------------|---|------------------------|--|-------|---|-------|
| | | | | 4.6 | A4-50 | 4.6 | A4-50 |
| | | | | | | | |
| Hammerhead bolts type JD, JUD and JH, JUH | M 6 | 7 | 3 | 2.0 | 1.8 | 2.2 | |
| | M 8 | 9 | 8 | 5.0 | 4.4 | 4.0 | |
| | M 10 | 12 | 15 | 10.0 | 8.7 | 6.4 | |
| | M 12 | 14 | 25 | 17.5 | 15.3 | 9.3 3) | |
| | M 16 | 18 | 60 | 44.0 | 38.8 | 17.3 3) | |

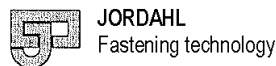
1) For stress ranges see Annex 8

If there is simultaneous stress in the directions (transverse stress y, oblique stress and central stress z,) the resultant of the permissible loads must not exceed the following, in accordance with the Table:

2) Based on the upper edge of rail or concrete

3) The permissible loads on the anchor rails according to Annex 8 must not be exceeded

$$\sqrt{F_z^2 + F_y^2} \leq \text{perm. } F$$



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**JORDAHL anchor rails
Type JXA-W 29/20; W 38/23**

Hammerhead bolts, JD, JUD and JH, JUH
Dimensions, material, permissible loads

ANNEX 4
to the General
Building Approval

Z-21.4-1690

dated 26 July 2002



Note:

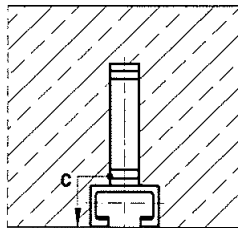
Translation of the German original version not checked by the German Institute for Structural Engineering

Table 7: Areas of use depending on corrosion protection

| | Corrosion protection of the constructional parts | | | Intended use |
|---|--|--|---|---|
| | Rail | Anchor | Bolt, nut, washer | |
| 1 | Plain rolled | Plain rolled | no corrosion protection | Use only possible if all the fixing elements are protected, depending on the ambient conditions, by a minimum concrete covering to DIN 1045:1988-07, Table 10 or DIN 1045-1:2001-07, Table 4 |
| 2 | Hot galvanized (Coating $\geq 50 \mu\text{m}$) | Hot galvanized (Coating $\geq 50 \mu\text{m}$) | Electrogalvanized (Coating $\geq 5 \mu\text{m}$) | Concrete components in closed rooms, e.g. dwellings, offices, schools, hospitals, retail premises, except wet rooms |
| 3 | Hot galvanized (Coating $\geq 50 \mu\text{m}$) | Hot galvanized (Coating $\geq 50 \mu\text{m}$) | Hot galvanized (Coating $\geq 40 \mu\text{m}$) | Concrete components in interior rooms with normal atmospheric humidity (including kitchen, bathroom and washroom in dwellings) to DIN 1045:1988-07, Table 10, line 1 or DIN 1045-1:2001-07, Table 3 |
| 4 | Stainless steel 1.4571 1.4401 1.4404 | Plain rolled weld-on anchor 1) Stainless steel 1.4571/1.4401 1.4404 | Stainless steel, strength class 50 or 70 | Constructions in corrosion resistance class III corresponding to General Building Approval Z-30.3-6, see Section 3.1.2 |

1) Only permissible for Profile 38/23.

With regard to the corrosion protection for the weld-on anchors, the concrete covering c according to Table 8 may be used as a basis.



**Table 8:
Concrete covering of
the weld-on anchors**

| Profile JXA | Existing concrete covering c of the weld-on anchor [mm] |
|-------------|---|
| W 38/23 | 30 |

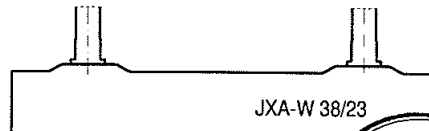
Identification

The identification is to be made permanently on the rear of the rail (inside or outside), on the rail web or on the anchor. It can be made by means of a sticker, imprint, embossing or other suitable measures.


(Minimum requirement: profile specification, additionally A4 in the case of a stainless steel design)



Embossing on the anchor



Imprint on the profile web

| | | |
|--|--|--|
|  JORDAHL Fastening technology Deutsche Kahneisen Gesellschaft mbH Nobelstraße 51/55 12057 Berlin Tel. 030/ 6 82 83-02 Fax 030/ 6 82 83-499 | JORDAHL anchor rails Type JXA-W 29/20; W 38/23 | ANNEX 5 to the General Building Approval Z-21.4-1690 dated 26 July 2002 |
| | Corrosion protection Identification | |



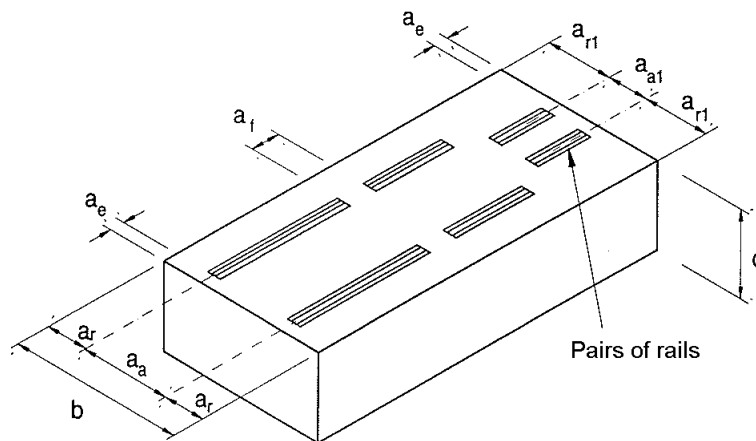
Note:

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Table 9:
Minimum spacings and minimum component dimensions
for all concrete strength classes

| Minimum spacings and component dimensions [mm] 1) | | | | | | | | |
|---|-------|-------|-------|-------|-----|----|-------------------|----------|
| Profile JXA | a_r | a_a | a_e | a_f | 2) | 3) | Pairs of rails 4) | |
| | | | | | b | d | a_{r1} | a_{a1} |
| W 29/20 | 100 | 200 | 80 | 200 | 200 | | 140 | 125 |
| W 38/23 | 150 | 300 | 130 | 250 | 300 | | 225 | 150 |

- 1) The minimum spacings specified in the Table apply to reinforced concrete. If the spacings are increased by 30%, no requirements are placed on the reinforcement.
- 2) Applies when arranging a rail.
- 3) Results from the length of the anchor and the required concrete covering in accordance with DIN 1045:1988-07 or DIN 1045-1:2001-07.
- 4) Only permissible for central tension



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JORDAHL anchor rails
Type JXA-W 29/20; W 38/23

Axial and edge spacings



ANNEX 6
to the General
Building Approval

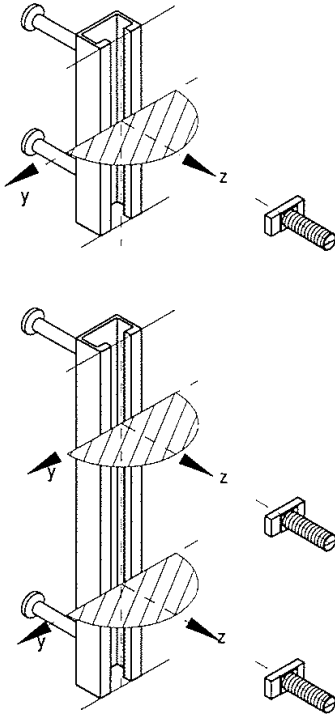
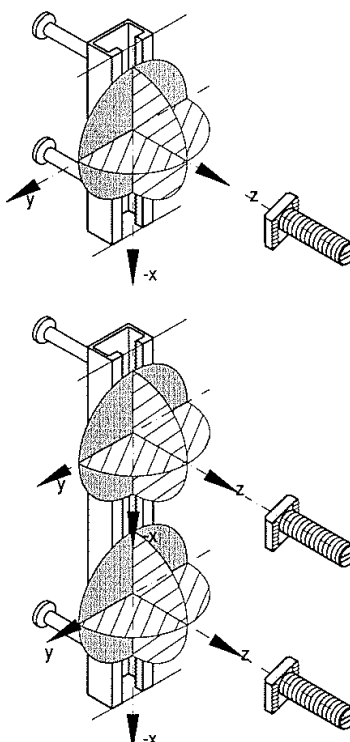
Z-21.4-1690

dated 26 July 2002

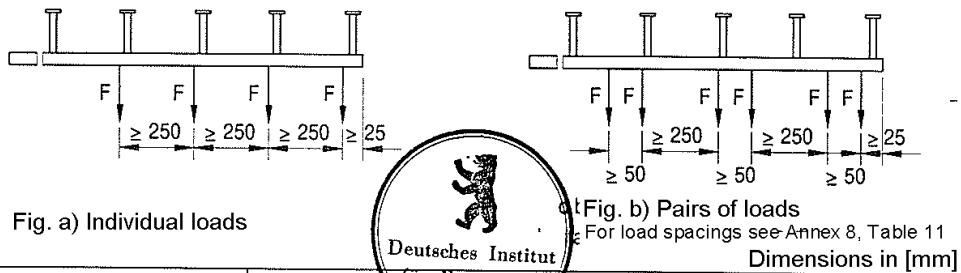
Note:

Translation of the German original version not checked by the German Institute for Structural Engineering

Table 10: Stress ranges
depending on the bolt type

| Hammerhead bolts type JD, JUD and JH, JUH Stress at right angles to the rail longitudinal axis (Transverse tension y, central tension z) | Toothed bolts type JXD and JXH Stress in all directions (Longitudinal tension x, transverse tension y, central tension z) |
|---|---|
|  <p style="text-align: center;">Fire loading according to Annexes 10 to 12 permissible</p> |  |
| $\sqrt{F_z^2 + F_y^2} \leq \text{perm. } F$ <p>In the event of simultaneous stress in all directions, the resultant load must not exceed the permissible loads to Annex 8, Table 11</p> | $\sqrt{F_x^2 + F_z^2 + F_y^2} \leq \text{perm. } F$ <p>In the event of simultaneous stress in all directions, the resultant load must not exceed the permissible loads to Annex 8, Table 11</p> |

Load arrangement for JXA-W 29/20 and JXA-W 38/23



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JORDAHL anchor rails
Type JXA-W 29/20; W 38/23

Stress ranges
Load arrangement

ANNEX 7
to the General
Building Approval

Z-21.4-1690

dated 26 July 2002

Note:

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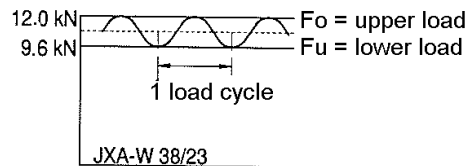
Table 11:
Permissible loads on the anchor rail 1)
for all concrete strength classes \geq C20/25 (B25)

| Profile JXA | Associated bolts | | Permissible loads F [kN] 2) Stress range in all load directions 3) | | |
|----------------|--------------------------|--------------------|---|---------------------|--------|
| | Hammer- head bolts 4) | Toothed bolts | Individual load | Paired loads | |
| | | | | Profile length [mm] | ≥100 |
| | Load spacing [mm] | | ≥250 | ≥50 | ≥150 |
| W 29/20 | JUD M12 | JXD M10 JXD M12 | 8 | 4.5 5) | 6.4 5) |
| W 38/23 | JUH M16 | JXH M12 JXH M16 | 12 | 6.7 5) | 8.6 5) |

- 1) When anchoring in concrete of strength class C 12/15 (B15), the permissible loads for C 20/25 (B25) must be reduced by the factor 0.7.
- 2) In the event of simultaneous stressing in a number of directions (see Annex 7, Table 10), the resultant load must not exceed the permissible loads according to Table 11.
- 3) For stress ranges, see Annex 7, Table 10.
- 4) Hammerhead bolts type JD, JUD and JH, JUH are not permitted for loads in the rail longitudinal direction (x-x). If smaller bolts type JD and JH according to Annex 4 are used, the permissible load on the bolts according to Annex 4, Table 6 must not be exceeded.
- 5) Intermediate values may be interpolated.

Table 12:
Predominantly unsteady central tensile loads
permissible cycle sizes for a load cycle number $N = 2 \times 10^6$


| Profile JXA | Permissible cycle size ΔF under tensile stress $\Delta F = F_o - F_u$ [kN] | | Permissible bolts |
|----------------|--|------------|--------------------|
| | Design | Steel, fv | |
| W 29/20 | 2.0 | 1.8 | JXD M12 JUD M12 |
| W 38/23 | 3.0 | 2.4 | JXH M16 JUD M16 |



Example: JXA W 38/23 (A4)
 perm. F (perm. static load) = 12.0 kN
 perm. ΔF (threshold stress) = -2.4 kN
 remaining tensile stress = 9.6 kN

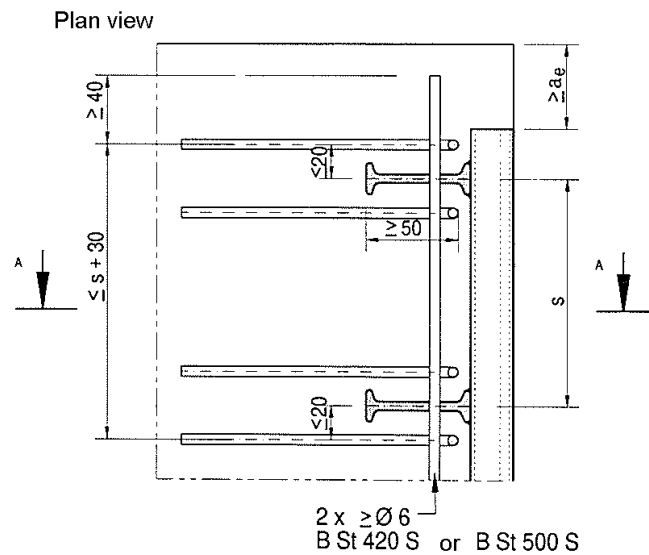
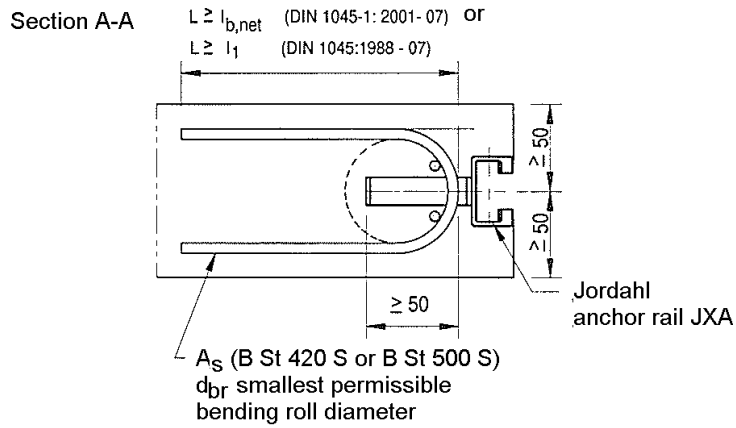
- The cycle sizes specified apply to the profiles JXA W 29/20 and JXA W 38/23 with round anchors or with T-anchors welded on transversely.

- Use is permitted only in reinforced components. In the event of installation in the tensile zone of reinforced concrete components produced by the load stress, it is necessary to verify that the forces are passed on.

| | | |
|--|---|---|
|  JORDAHL Fastening technology Deutsche Kahneisen Gesellschaft mbH Nobelstraße 51/55 12057 Berlin Tel. 030/ 6 82 83-02 Fax 030/ 6 82 83-499 | JORDAHL anchor rails Type JXA-W 29/20; W 38/23 | ANNEX 8 to the General Building Approval Z-21.4-1690 dated 26 July 2002 |
| | Permissible loads Permissible cycle sizes | |



Reduced edge spacing under tensile stress and arrangement of additional reinforcements to Section 3.2.5 for profiles 29/20 and 38/23



$$\text{found } A_s = \frac{\text{perm. } F}{4 * \sigma_s}$$

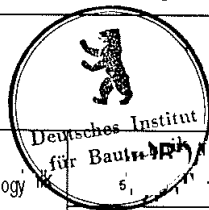
Applicable steel stress $\sigma_s = 8 \text{ kN/cm}^2$

A_s [cm²] = reinforcement cross section of one leg of a loop

perm. F [kN] = max. load according to Annex 8, Table 11

For designations, see Annexes 1 and 6

Dimensions in [mm]



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JORDAHL anchor rails
 Type JXA-W 29/20; W 38/23

Rear-suspended reinforcement
 with reduced edge spacing

ANNEX 9
 to the General
 Building Approval

Z-21.4-1690

dated 26 July 2002

Note:

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Table 13:
Permissible loads [kN]

at right angles to the rail longitudinal axis, under central tension and transverse tension and under fire loading according to fire resistance class F 90 and F 60 (bracketed values) for JORDAHL anchor rails, taking into account the associated hammerhead bolts.

| Profile ²⁾ JXA | Permissible load [kN] ¹⁾ Jordahl hammerhead bolts Strength class 4.6 or A4-50 | | | |
|------------------------------|--|------|------|------|
| | M 8 | M 10 | M 12 | M 16 |
| W 29/20 | 0.5 (0.7) | 1.3 | 1.8 | - |
| W 38/23 | - | 1.3 | 1.8 | 4.0 |

1) Only for a load direction at right angles to the rail longitudinal axis for central tension and transverse tension according to Annex 7.

2) Profiles of plain rolled or galvanized steel and of stainless steel

**Reinforced concrete ceilings of normal concrete with
JORDAHL anchor rails concreted in, with fire loading on one side.**

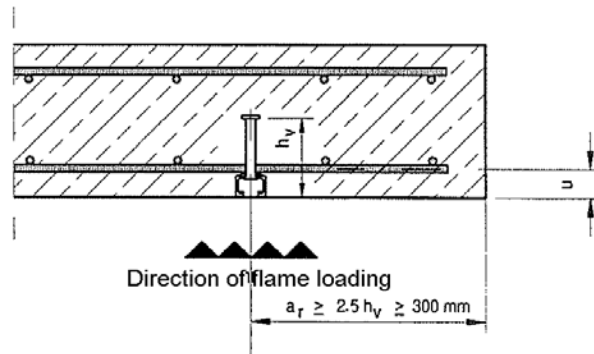


Table 14:
**Required axial spacing u [mm] with a fire resistance period F 60 and F 90
in the area of the JORDAHL anchor rails**

| Profile JXA | Required axial spacing u [mm] for fire resistance period | |
|-------------|---|------------|
| | 60 minutes | 90 minutes |
| W 29/20 | 35 | 45 |
| W 38/23 | | |



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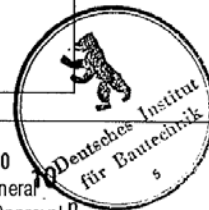
JORDAHL anchor rails
Type JXA-W 29/20; W 38/23

Fire loading:
- Permissible loads on the bolts
- Anchor rails in reinforced concrete ceilings

ANNEX 10
to the General
Building Approval ¹⁾

Z-21.4-1690

dated 26 July 2002



Note:

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Reinforced standard concrete beams stressed by fire on three sides

Loading of the anchor rail permissible only at right angles to the rail longitudinal axis for central tension and transverse tension according to Annex 7.

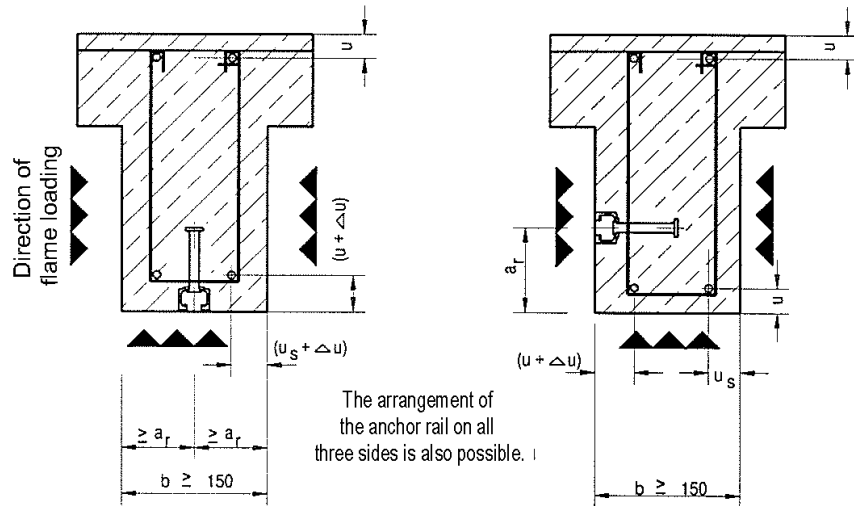



Table 15:
Increasing the axial spacing u [mm] of the tensile reinforcement

The axial spacings u and u_s required in accordance with DIN 4102-4:1994-03 must be increased by the amount Δu when anchor rails are installed.

| Profile JXA | Δu [mm] ¹⁾ for F 90 based on beam width | | | |
|--------------------|--|----------------|----------------|-------------------|
| | $b = 150$ [mm] | $b = 250$ [mm] | $b = 300$ [mm] | $b \geq 400$ [mm] |
| W 29/20 W 38/23 | 15 | 10 | 10 | 10 |

¹⁾ Intermediate values may be interpolated linearly.



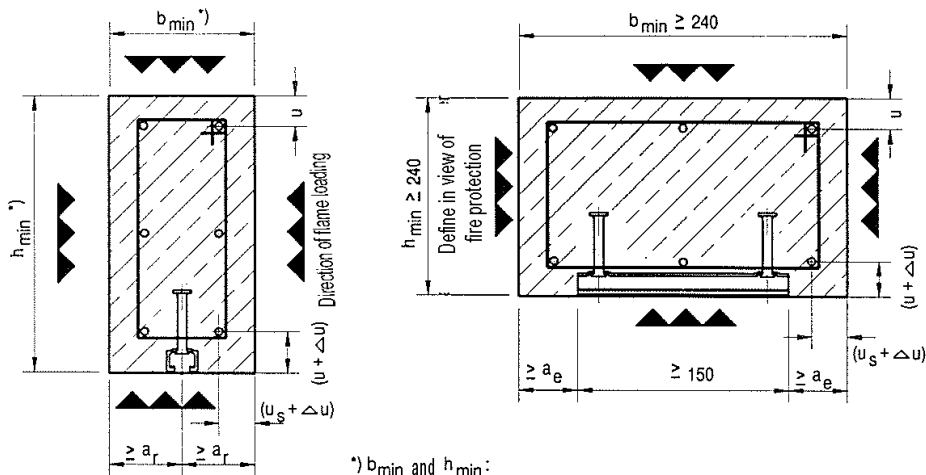
| | | |
|---|--|--|
|  JORDAHL Fastening technology Deutsche Kahneisen Gesellschaft mbH Nobelstraße 51/55 12057 Berlin Tel. 030/ 6 82 83-02 Fax 030/ 6 82 83-499 | JORDAHL anchor rails Type JXA-W 29/20; W 38/23 | ANNEX 11 to the General Building Approval Z-21.4-1690 dated 26 July 2002 |
| | Fire loading: - Anchor rails in reinforced concrete beams | |

Note:

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Reinforced standard concrete beams stressed by fire on four sides

Loading of the anchor rail permissible only at right angles to the rail longitudinal axis for central tension and transverse tension according to Annex 7.



*) b_{min} and h_{min} :
 ≥ 180 mm with $\alpha_1 < 0.3$
 ≥ 210 mm with $\alpha_1 < 0.7$
 ≥ 240 mm with $\alpha_1 < 1.0$
 $\alpha_1 \rightarrow$ DIN 4102-4 Table 31


Table 16:
Increasing the axial spacing u [mm] of the concrete steel reinforcement by Δu

The axial spacings u and u_s required in accordance with DIN 4102-4:1994-03 must be increased by the amount Δu when anchor rails are installed.

| Profile JXA | Δu [mm] ¹⁾ for F 90 based on column cross section of | | | | |
|--------------------|---|------------------------|-------------------|-------------------|----------------------|
| | $b = 180^{2)}$ [mm] | $b = 210^{3)}$ [mm] | $b = 240$ [mm] | $b = 300$ [mm] | $b \geq 400$ [mm] |
| W 29/20 W 38/17 | 15 | 10 | 10 | 10 | 10 |

- 1) Intermediate values may be interpolated linearly.
- 2) Utilization factor α_1 according to Section 3.13.2.2 DIN 4102-4 ≤ 0.3
- 3) Utilization factor α_1 according to Section 3.13.2.2 DIN 4102-4 ≤ 0.73



| | | |
|---|---|--|
|  JORDAHL Fastening technology Deutsche Kahneisen Gesellschaft mbH Nobelstraße 51/55 12057 Berlin Tel. 030/ 6 82 83-02 Fax 030/ 6 82 83-499 | JORDAHL anchor rails Type JXA-W 29/20; W 38/23 | ANNEX 12 to the General Building Approval |
| | Fire loading: - Anchor rails in reinforced concrete columns | Z-21.4-1690 dated 26 July 2002 |

As at: July 2000

Legal basis for the grant of General Building (statutory) Approvals

| | |
|------------------------|--|
| Baden-Württemberg: | §18 and §21 of the Regional Building Order for Baden-Württemberg (LBO) dated 8 August 1995 (Law Gazette GBl. p. 617), changed by the law dated 15 Dec 1997 (GBl. p. 521) |
| Bavaria: | Article 20 and Article 23 of the Bavarian Building Order (BayBO) in the version published on 4 August 1997 (Legal Orders Gazette GVBl. p. 433), last changed by the law dated 24 Jul 1998 (GVBl. p. 439) |
| Berlin: | §19 and §21 of the Building Order for Berlin - BauOBln - in the version dated 3 Sep 1997 (GVBl. p. 421), changed by Article VI of the law dated 25 Jun 1998 (GVBl. p. 177, 210) |
| Brandenburg: | §21 and §24 of the Brandenburg Building Order (BbgO) in the version published on 25 March 1998 (GVBl. I p. 82) |
| Bremen: | §21 and §24 of the Bremen Regional Building Order - BremLBO - dated 27 March 1995 (Brem GBl. p.211) |
| Hamburg: | §20a and §21 of the Hamburg Building Order - HBauO - dated 1 July 1986 (Hamburg Law and Orders Gazette p. 183), changed on 20 July 1994 (Hamburg Law and Orders Gazette p.221), last changed on 25 June 1997 (Hamburg Law and Orders Gazette p.261) in conjunction with Article 4 Item 3 of the Order for cancelling and changing and reissuing Orders in the Building sector dated 29 November 1994 (Hamburg Law and Orders Gazette p. 310) |
| Hessen: | §21 and §24 of the Hessen Building Order - HBO - dated 20 December 1993 (GVBl. I p. 655), last changed by the law dated 17 Dec 1998 (GVBl. I p. 562) |
| Mecklenburg-Vorpommern | §18 and §21 of the Regional Building Order for Mecklenburg-Vorpommern (LBauO M-V) dated 26 April 1994 (GVOBl. M-V p. 518), changed on 27 April 1998 (GVOBl. M-V p. 388) |

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|----------------------|---|
| Niedersachsen: | §25 and §27 of the Niedersachsen Building Order (NBauO) in the version dated 13 July 1995 (Nds.GVBl. p. 199), last changed by the law dated 6 Oct 1997 (Nds.GVBl. p. 422) |
| Nordrhein-Westfalen: | §21 and §24 of the Building Order for the Nordrhein-Westfalen Region - Regional Building Order (BauO NRW) - dated 1 March 2000 (GV. NRW p.256) |
| Rheinland-Pfalz: | §19 and §22 of the Regional Building Order for Rheinland-Pfalz (LBauO) dated 24 November 1998 (GVBl. p.365) |
| Saarland: | §26 and §28 of the Building Order for the Saarland (LBO) dated 27 March 1996 - Law No. 1370 - (Official Gazette p. 477), last changed by the law dated 8 July 1998 (Official Gazette p. 721) in conjunction with §1 Paragraph 2 Number 1 of the Order for transferring authorisations from the highest building inspectorate authorities to the German Institute for Structural Engineering dated 20 June 1996 (Official Gazette p.750) |
| Sachsen: | §21 and §23 of the Saxon Building Order (SächsBO) dated 18 March 1999 (SächsGVBl. p. 85) |
| Sachsen-Anhalt: | §21 and §24 of the law relating to building in the Sachsen-Anhalt Region (BauOLSA) dated 23 June 1994 (GVBl. LSA p.723) |
| Schleswig-Holstein: | §24 and §27 of the Regional Building Order for the Schleswig-Holstein Region in the version published on 10 January 2000 (GVOBl. Schl.-H p. 47) |
| Thüringen: | §21 and §23 of the Thüringen Building Order (ThürBO) dated 3 June 1994 (GVBl. p. 553) |

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