Deutsches Institut für Bautechnik

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Approval body for construction products and types of construction

Bautechnisches Prüfamt

An institution established by the Federal and Laender Governments

Designated according to Article 29 of Regulation (EU) No 305/2011 and member of EOTA (European Organisation for Technical Assessment)

European Technical Assessment

ETA-17/0300 of 19 February 2018

English translation prepared by DIBt - Original version in German language

General Part

Technical Assessment Body issuing the European Technical Assessment:	Deutsches Institut für Bautechnik
Trade name of the construction product	JORDAHL Anchor channel JTA W40/22+ and W50/30+
Product family to which the construction product belongs	Anchor channels
Manufacturer	JORDAHL GmbH Nobelstraße 51 12057 Berlin DEUTSCHLAND
Manufacturing plant	
This European Technical Assessment contains	25 pages including 3 annexes which form an integral part of this assessment
This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of	EAD 330008-02-0601

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Specific Part

1 Technical description of the product

The JORDAHL Anchor Channel JTA W40/22+ and W50/30+ is a system consisting of C-shaped channel profile of carbon steel or stainless steel and at least two metal anchors non-detachably fixed to the channel back and channel bolts.

The anchor channel is embedded surface-flush in the concrete. JORDAHL channel bolts with appropriate hexagon nuts and washers are fixed to the channel.

The product description is given in Annex A.

2 Specification of the intended use in accordance with the applicable European Assessment Document

The performances given in Section 3 are only valid if the anchor channel is used in compliance with the specifications and conditions given in Annex B.

The verifications and assessment methods on which this European Technical Assessment is based lead to the assumption of a working life of the anchor channel of at least 50 years. The indications given on the working life cannot be interpreted as a guarantee given by the producer, but are to be regarded only as a means for choosing the right products in relation to the expected economically reasonable working life of the works.

3 Performance of the product and references to the methods used for its assessment

3.1 Mechanical resistance and stability (BWR 1)

Essential characteristic	Performance
Characteristic resistances under static and quasi-static loads and displacements	See Annex C1 to C8
Characteristic resistances under fatigue cyclic loads	See Annex C10 to C12

3.2 Safety in case of fire (BWR 2)

Essential characteristic	Performance
Reaction to fire	Class A1
Resistance to fire	See Annex C9

4 Assessment and verification of constancy of performance (AVCP) system applied, with reference to its legal base

In accordance with EAD No. 330008-02-0601, the applicable European legal act is: [2000/273/EC].

The system to be applied is: 1

5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with Deutsches Institut für Bautechnik.

Issued in Berlin on 19 February 2017 by Deutsches Institut für Bautechnik

BD Dipl.-Ing. Andreas Kummerow
Head of Department

beglaubigt:
Müller

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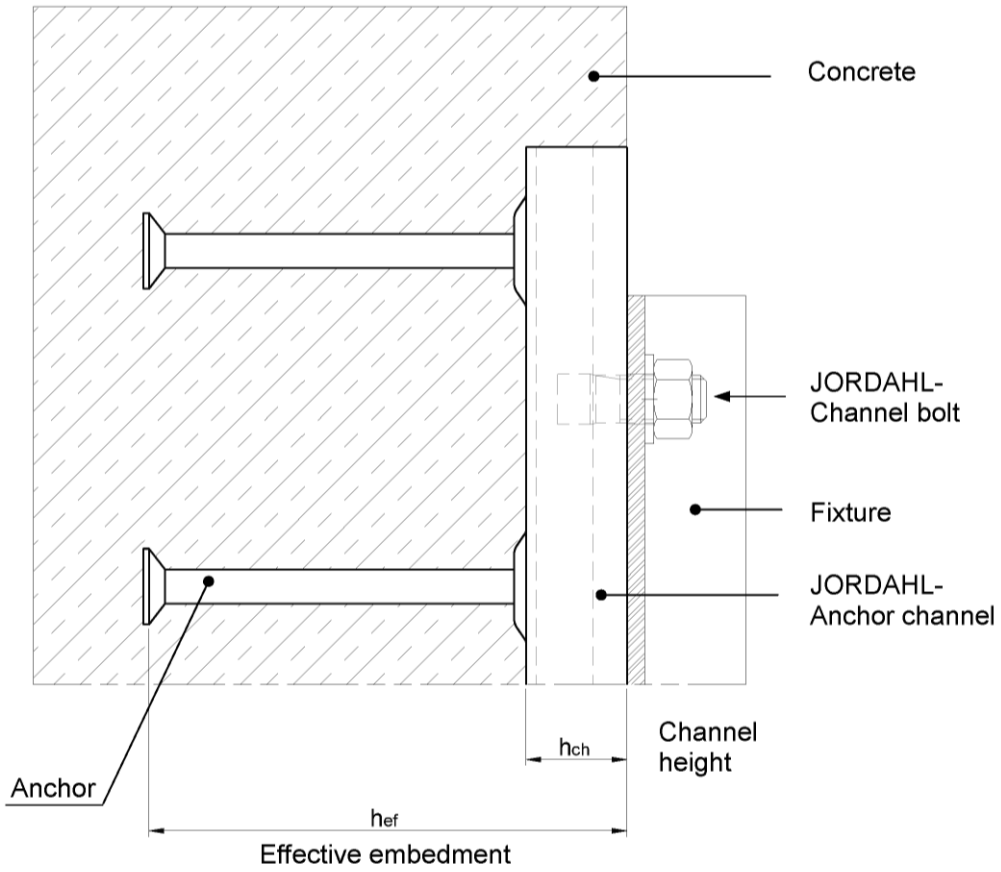

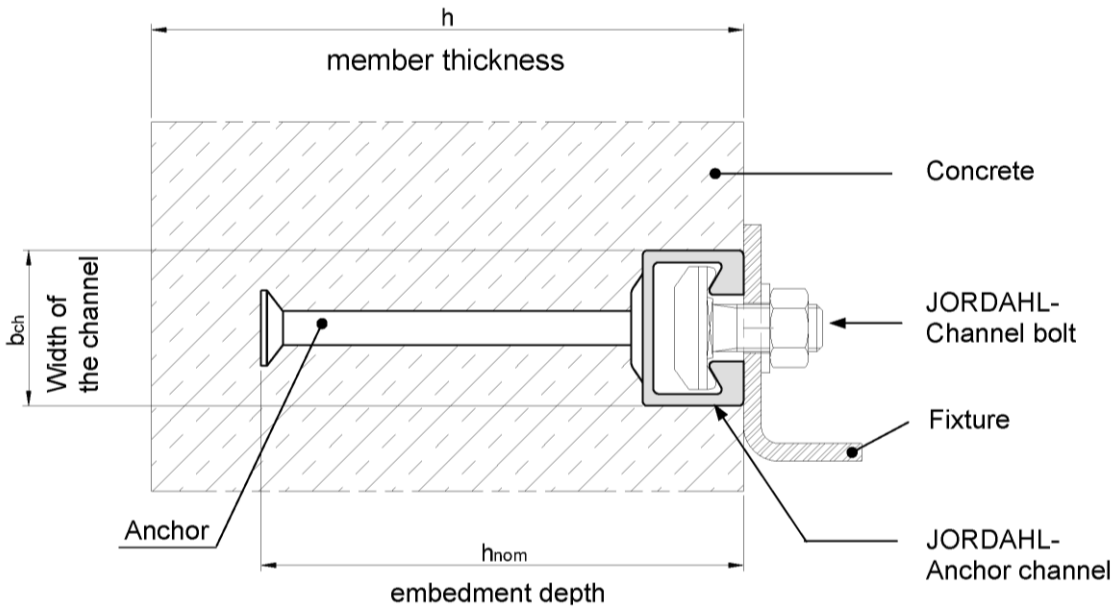

JORDAHL - Anchor Channel JTA W40/22+ and W50/30+

Product description
Installed condition

Annex A1

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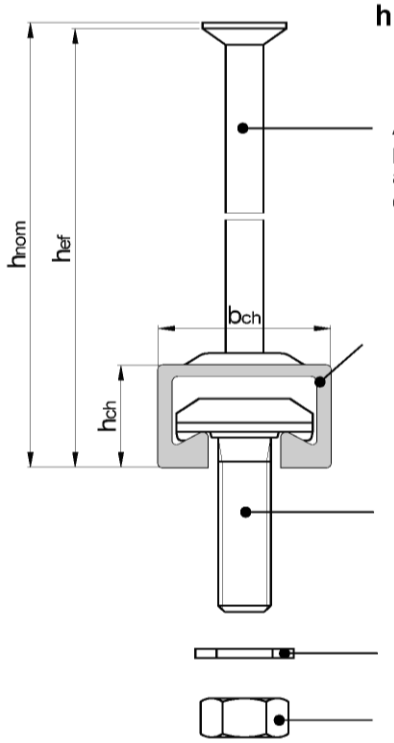
Anchor channel hot rolled profile



Anchor (also possible as weld-on anchor, as I-profile or as round anchor

Channel e.g. JTA-W50/30+

JORDAHL-Channel bolts e.g. JB M16x60

Washer

Hexagon nut

Legend

h_{ch}	Channel height
b_{ch}	Width of the channel
h_{ef}	Effective embedment depth
h_{nom}	Embedment depth

Marking of the JORDAHL - Anchor Channel: e.g. JORDAHL W 50/30+ A4

J or JORDAHL	= Identifying mark of the manufacturer
W	= Manufacturing method
50/30+	= Size
A4	= Material

Close to the anchors a nail hole is positioned

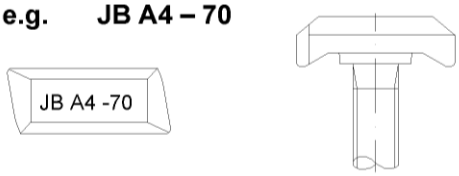
Material channels:

Steel
No marking for 1.0038 / 1.0044

Stainless steel

A2	= 1.4301 / 1.4307 / 1.4567 / 1.4541
A4	= 1.4401 / 1.4404 / 1.4571
L4	= 1.4062 / 1.4162 / 1.4362
F4, FA	= 1.4462
HCR	= 1.4529 / 1.4547

Marking of the JORDAHL – Channel-bolt: e.g. JB A4 – 70



J or JORDAHL	= Identifying mark of the manufacturer
B	= Channel bolt type
A4	= Material
70	= Strength grade

Material bolts:

Steel
No marking

Stainless steel

A2	= 1.4301 / 1.4307 / 1.4567 / 1.4541
A4	= 1.4401 / 1.4404 / 1.4571 / 1.4578
L4	= 1.4362
F4, FA	= 1.4462
HCR	= 1.4529 / 1.4547

Strength grade special bolts:

Steel

4.6, 8.8	Strength grade 4.6, 8.8

Stainless steel

50, 70	Strength grade 50, 70

JORDAHL - Anchor Channel JTA W40/22+ and W50/30+

Product description
Marking and materials

Annex A2

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Table A1: Materials and intended use

1	2	3	4	5	6
Item no.	**Specification**	**Intended use**			
		Dry internal conditions	**Internal conditions with usual humidity**	**Medium corrosion exprosure**	**High corrosion exposure**
		Anchor channels may only be used in structures subject to dry internal conditions (e.g. accommodations, bureaus , schools, hospitals, shops, exceptional internal conditions with usual humidity acc. column 4)	Anchor channels may also be used in structures subject to internal conditions with usual humidity (e.g. kitchen, bath- and laundry in residential buildings, exceptional permanently damp conditions and application under water)	Anchor channels may also be used in structures subject to external atmospheric exposure (including industrial and marine environment) or exposure in permanently damp internal conditions if no particular aggressive conditions (e.g. permanent, alternating immersion in seawater etc. acc. column 6) exist.	Anchor channels may also be used in structures subject to exposure in particular agressive conditions (e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with chemical pollution e.g. in desulphurization plants or road tunnels where deicing materials are used)
		Materials			
1	**Channel profile**	Steel 1.0038; 1.0044 EN 10025:2005 hot-dip galv. ≥ 55µm[4)]	Steel 1.0038; 1.0044 EN 10025:2005 hot-dip galv. ≥ 55µm[4)] Stainless steel 1.4301, 1.4307, 1.4567, 1.4541; EN 10088:2005	Stainless steel 1.4401; 1.4404; 1.4571; 1.4062, 1.4162,1.4362, 1.4462 EN 10088:2005	Stainless steel 1.4529; 1.4547 EN 10088:2005
2	**Anchor**	Steel 1.0038; 1.0214; 1.0401; 1.1132; 1.5525 EN 10263:2001, EN 10269:2013 hot-dip galv. ≥ 55µm[4)]	Steel 1.0038; 1.0214; 1.0401; 1.1132; 1.5525 EN 10263:2001, EN10269:2013 hot-dip galv. ≥ 55µm[4)] Stainless steel 1.4301, 1.4307, 1.4567, 1.4541; EN 10088:2005[6)]	Stainless steel 1.4401; 1.4404; 1.4571; 1.4578; 1.4362; 1.4462 EN 10088:2005 Steel 1.0038[1)]	
3	**Jordahl - Channel bolts with shaft and thread acc. to EN ISO 4018**	Steel, strength grade 4.6/8.8 in dependance on EN ISO 898-1:2013 electroplated ≥ 5µm[2)5)]	Steel, strength grade 4.6/8.8 in dependance on EN ISO 898-1:2013 hot-dip galv. ≥ 50µm[3)5)] Stainless steel, strength grade 50, 70 1.4301, 1.4307, 1.4567, 1.4541 EN ISO 3506-1:2009	Stainless steel strength grade 50, 70 1.4401; 1.4404; 1.4571; 1.4362, 1.4578, 1.4462 EN ISO 3506-1:2009	Stainless steel strength grade 50, 70 1.4529; 1.4547 EN ISO 3506-1:2009
4	**Washer, EN ISO 7089 and EN ISO 7093-1 production class A, 200HV**	Steel EN 10025:2005 electroplated ≥ 5µm[2)]	Steel EN 10025 hot-dip galv. ≥ 50µm[3)] Stainless steel, Steel grade A2, A3 EN ISO 3506-1:2009	Stainless steel Steel grade A4, A5, 1.4462 EN ISO 3506-1:2009	Stainless steel 1.4529; 1.4547 EN ISO 3506-1:2009
5	**Hexagonal nuts EN ISO 4032**	Steel, strength grade 5/8 EN ISO 898-2:2012 electroplated ≥ 5µm[2)]	Steel, strength grade 5/8 EN 898-2:2012 hot-dip galv. ≥ 50µm[3)] Stainless steel, strength grade 70, 80 Steel grade A2, A3 EN ISO 3506-2:2009	Stainless steel strength grade 70, 80 Steel grade A4, A5, 1.4462 EN ISO 3506-2:2009	Stainless steel strength grade 70, 80 1.4529; 1.4547 EN ISO 3506-2:2009

1) Steel acc. to EN 10025:2005, only for weld-on anchors, with sufficient concrete cover acc. to EN 1992-1-1:2004 + AC:2010
2) Electroplated acc. to EN ISO 4042:1999
3) Hot-dip galvanized acc. to EN ISO 10684:2004 + AC:2009
4) Hot-dip galvanized on the basis of EN ISO 1461:2009, but coating thickness ≥ 55 µm
5) Properties according to EN ISO 898-1:2013 only in threaded part of the channel bolt
6) Stainless steel anchors only in combination with stainless steels profiles

JORDAHL - Anchor Channel JTA W40/22+ and W50/30+

Product description
Materials and intended use

Annex A3

Hot rolled profile

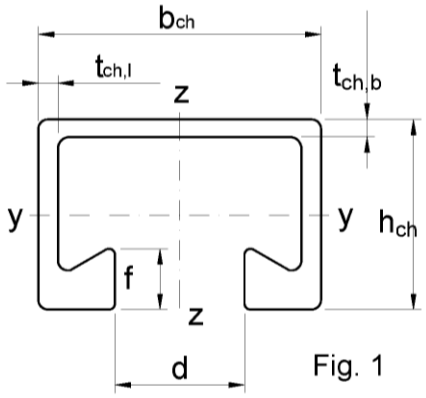
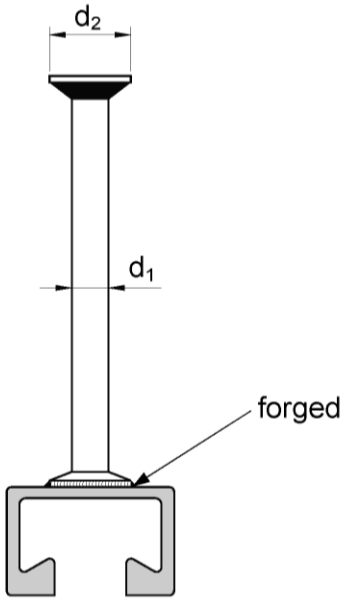
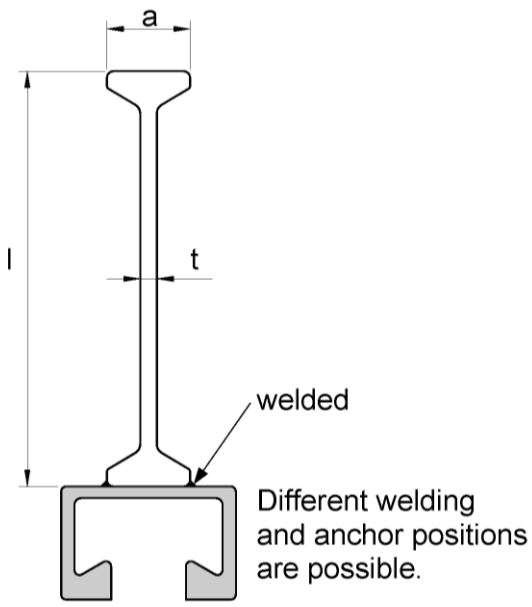


Fig. 1

Table A2: Dimensions of channel profile

Profile	Dimensions						Material	I_y
	b_{ch}	h_{ch}	$t_{ch,b}$	$t_{ch,l}$	d	f		
	[mm]							[mm^4]
W40/22+	39.50	23.00	2.60	2.40	18.00	6.00	steel	20029
W50/30+	49.00	30.00	3.20	2.75	22.50	7.85		52896
W40/22+	39.50	23.00	2.60	2.40	18.00	6.00	stainless steel	20029
W50/30+	49.00	30.00	3.20	2.75	22.50	7.85		52896





Type	Shaft ∅ d_1	Head ∅ d_2	Anchor Channel
	[mm]		
R	10.8	19.0	W40/22+
	10.0	19.5	W50/30+

Table A3: Types of round anchors

Type	Length l	Head width a	Web thickness t	Anchor Channel
	[mm]			
I 128	128	17	6	W40/22+ W50/30+
I 140	140	20	7.1	

Table A4: Types of I-anchors

JORDAHL - Anchor Channel JTA W40/22+ and W50/30+

Product description
Profile dimensions and type of anchors

Annex A4

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Fig. 1

Round anchor

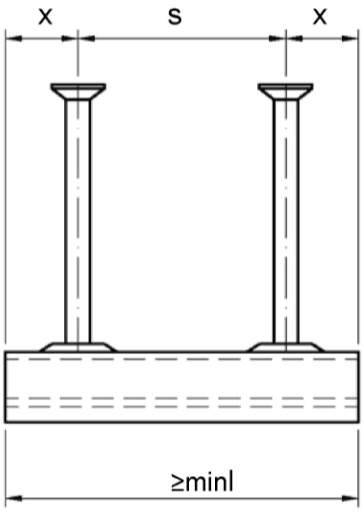

Fig. 2

Welded anchor
(I-anchor)

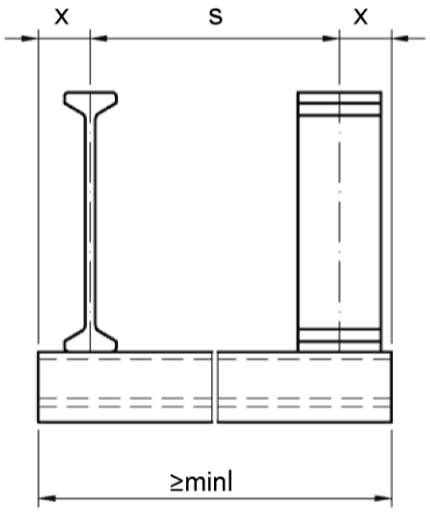

Table A5: Anchor positioning

	Anchor spacing		End spacing x		Min. channel length (min l)	
Anchor channel	s_{min}	s_{max}	**Round anchor** Fig. 1	**Welded anchor** Fig. 2	**Round anchor** Fig. 1	**Welded anchor** Fig. 2
	[mm]		[mm]		[mm]	
W40/22+ W50/30+	50	250	25 [1)]	25	100	

[1)] The end spacing of round anchors for channel lengths ≥ 150mm may be increased from 25 mm to 35 mm

JORDAHL - Anchor Channel JTA W40/22+ and W50/30+

Product description
Anchor positioning and channel length

Annex A5

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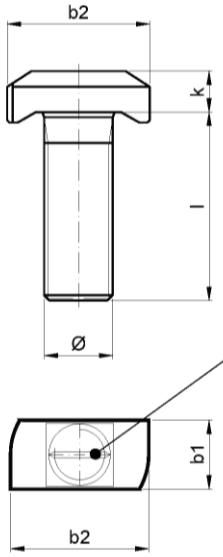
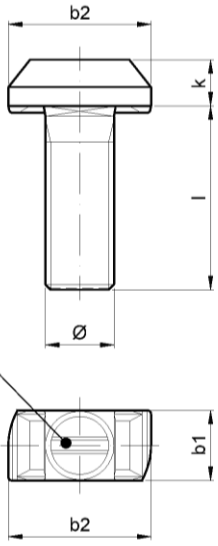
Hook-head JORDAHL - Channel bolt
Fig. 1



Double-Notch-Toothed-Channel bolt
Fig. 2



Notch for
Marking the position

Marking of the JORDAHL - Channel bolt head acc. to Annex A2

Table A6: Dimensions of the JORDAHL - Channel bolts

Anchor channel	Fig.	Channel bolt type	Channel bolts dimensions				Length l
			b_1	b_2	k	Ø	
			[mm]				[mm]
W40/22+	1	JC	14.0	32.0	8.0	10	20-150
					8.0	12	20-250
			17.0	32.0	8.0	16	30-300
	2	JKC	16.8	32.7	8.0	16	40-80
W50/30+	1	JB	17.0	41.5	9.0	10	25-100
					10.0	12	30-300
			17.0	41.5	11.0	16	30-300
			20.5	41.5	12.0	20	30-300
	2	JKB	17.0	41.5	12.0	16	40-80
			20.5	41.5	13.5	20	45-80

Table A7: Strength grade

Channel bolts		Steel [1]		Stainless Steel [1]	
Strength grade		4.6	8.8	50	70
f_{uk}	[N/mm²]	400	800	500	700
f_{yk}		240	640	210	450
Finish		z.p., h.d.g.		—	

[1] Materials according to Annex A3, Table A1

JORDAHL - Anchor Channel JTA W40/22+ and W50/30+

Product description
JORDAHL - Channel bolts, dimensions and strength grade

Annex A6

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Specifications of intended use

Anchor channels and channel bolts subject to:

- Static and quasi-static loads in tension and shear perpendicular to the longitudinal axis of the channel.
- Fatigue cyclic loads.
- Fire exposure for concrete class C20/25 to C50/60.

Base materials:

- Reinforced or unreinforced normal weight concrete according to EN 206-1:2000.
- Strength classes C12/15 to C90/105 according to EN 206-1:2000.
- Cracked or uncracked concrete.

Use conditions (Environmental conditions):

- Structures subject to dry internal conditions (e.g. accommodations, bureaus, schools, hospitals, shops, exceptional internal conditions with usual humidity)
  (anchor channels and channel bolts according to Annex A3, Table A1, column 3 - 6).
- Structures subject to internal conditions with usual humidity (e.g. kitchen, bath, and laundry in residential buildings, exceptional permanent damp conditions and application under water)
  (anchor channels and channel bolts according to Annex A3, Table A1, column 4 - 6)
- Structures subject to external atmospheric exposure (incl. industrial and marine environment) or exposure to permanently damp internal conditions, if no particular aggressive conditions (e.g. permanent, alternating immersion in seawater etc.) exist.
  (anchor channels and channel bolts according to Annex A3, Table A1, column 5 – 6)
- Structures subject to exposure in particular aggressive conditions (e.g. permanent, alternating immersion in seawater or the splash zone of seawater, chloride atmosphere of indoor swimming pools or atmosphere with chemical pollution (e.g. in desulphurization plants or road tunnels where de-icing materials are used))
  (anchor channels and channel bolts according to Annex A3, Table A1, column 6)

Design:

- Anchor channels are designed under the responsibility on an engineer experienced in anchorages and concrete work.
- Verifiable calculation notes and drawings are prepared taking account of the loads to be anchored. The position of the anchor channel and T-bolts are indicated on the design drawings (e.g. position of the anchor channel relative to the reinforcement or to supports).
- For static and quasi-static loading as well as fire exposure the anchor channels are designed in accordance with EOTA TR 047 “Design of Anchor Channels” or FprEN 1992-4:2016
- For fatigue loading the anchor channels are designed in accordance with EOTA TR 050 “Calculation Method for the Performance of Anchor Channels under Fatigue Loading”.
- The characteristic resistances are calculated with the minimum effective embedment depth.

JORDAHL - Anchor Channel JTA W40/22+ and W50/30+	**Annex B1**
Intended use Specifications	

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Installation:

- The installation of anchor channels is carried out by appropriately qualified personnel under the supervision of the person responsible for the technical matters on site.
- Use of the anchor channels only as supplied by the manufacturer – without any manipulations, repositioning or exchanging of channel components.
- Cutting of anchor channels is allowed only if pieces according to Annex A5, Table A5 are generated including end spacing and minimum channel length and only to be used in dry internal conditions. (Annex A3, Table A1, column 3). For anchor channels made of stainless steel there are no restrictions regarding corrosion resistance when using cut channel pieces, if cutting is done professionally and contamination of cutting edges with corroding material is avoided.
- Installation in accordance with the manufacturer`s specifications given in Annexes B6 and B7
- The anchor channels are fixed on the formwork, reinforcement or auxiliary construction such that no movement of the channels will occur during the time of laying the reinforcement and of placing and compacting the concrete.
- The concrete under the head of the anchors is properly compacted. The anchor profiles are protected from penetration of concrete into the internal space of the channel.
- Washer may be chosen according to Annex A3 and provided separately by the user.
- Orientating the channel bolt (groove according to Annex B7) rectangular to the channel axis.
- The required installation torques given in Annex B4 must be applied and must not be exceeded.

JORDAHL - Anchor Channel JTA W40/22+ and W50/30+	**Annex B2**
Intended use Specifications	

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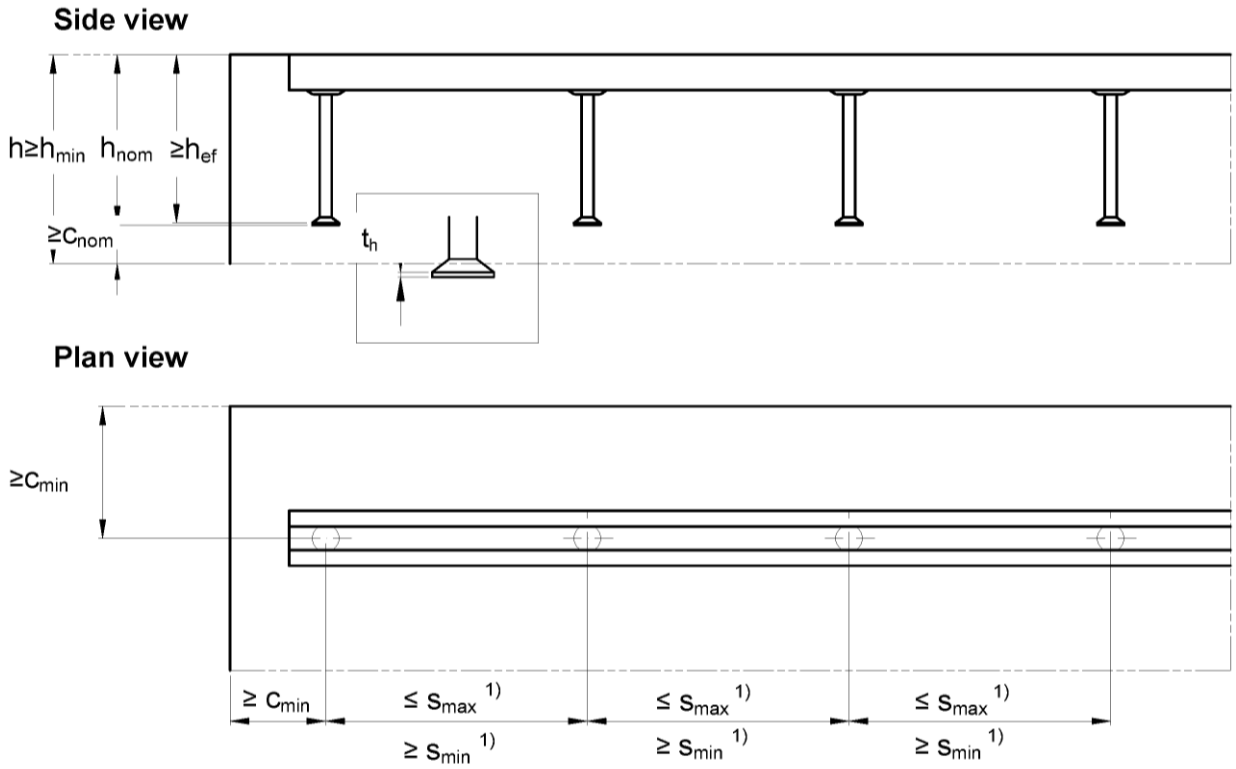

Table B1: Minimum effective embedment depth, edge distance and member thickness for hot rolled profiles

Anchor channel			W40/22+	W50/30+
Min. effective embedment depth	min h_{ef}	[mm]	91	106
Min. edge distance	c_{min}		50	75
Min. member thickness	h_{min}		$h_{ef} + t_h$ [2)] + c_{nom} [3)]	
Min. member thickness with c_{nom} = 10mm	h_{min}		106	123

[1)] s_{min}, s_{max} acc. to Annex A5, Table A5
[2)] t_h = anchor head thickness
[3)] c_{nom} acc. EN 1992-1-1:2004 + AC:2010 and $c_{nom} \geq$ 10mm

JORDAHL - Anchor Channel JTA W40/22+ and W50/30+

Intended use
Installation parameters of anchor channels

Annex B3

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Table B2: Minimum spacing and installation torque of JORDAHL – Channel bolts

Anchor channel	JORDAHL Channel bolt Ø	Min. spacing $s_{min,cbo}$ [4] of the Channel bolt	Installation torque T_{inst} [5]				
			General [2]	Steel-Steel contact [3]			
			Steel 4.6; 8.8 Stainless steel 50; 70 [1]	Steel 4.6 [1]	Stainless Steel 50 [1]	Steel 8.8 [1]	Stainless Steel 70 [1]
	[mm]	[mm]	[Nm]				
W40/22+	10	50	15	15	13	40	30
	12	60	25	25	24	70	50
	16	80	45	65	60	180	130
W50/30+	10	50	15	15	13	40	30
	12	60	25	25	24	70	50
	16	80	60	65	60	180	130
	20	100	75	130	115	360	250

[1] Materials according to Annex A2 and Annex A3, Table A1
[2] Acc. to Annex B5, Fig. 1
[3] Acc. to Annex B5, Fig. 2
[4] See Annex C1, Fig. 1
[5] T_{inst} must not be exceeded

JORDAHL - Anchor Channel JTA W40/22+ and W50/30+

Intended use
Installation parameters of JORDAHL- Channel bolts

Annex B4

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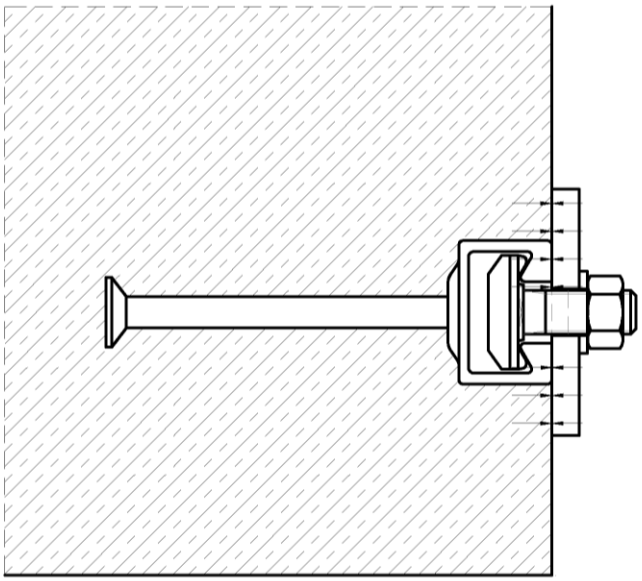

Fig. 1

General:

The fixture is braced to the concrete or to the anchor channel respectively braced to concrete and anchor channel.
The installation torques acc. to Annex B4, Table B2 shall be applied and must not be exceeded.

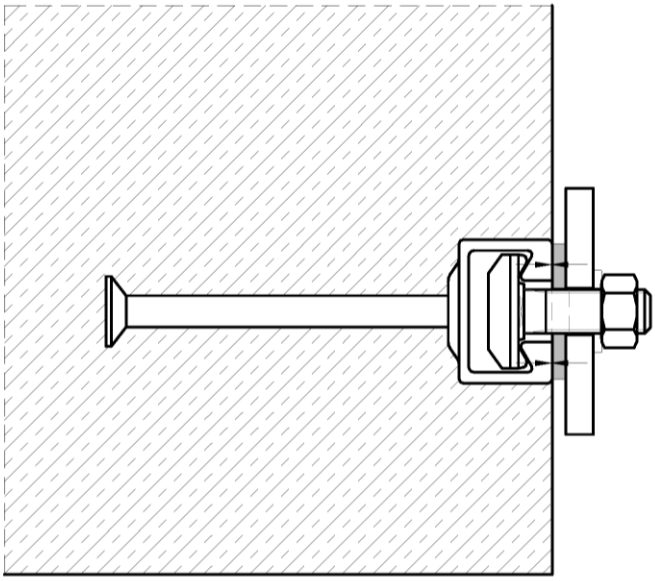

Fig. 2

Steel-steel contact:

The fixture is braced to the anchor channel by suitable washer.
The installation torques acc. to Annex B4, Table B2 shall be applied and must not be exceeded.

JORDAHL - Anchor Channel JTA W40/22+ and W50/30+	**Annex B5**
Intended use Position of the fixture	

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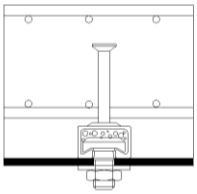
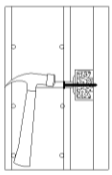
1. Fixing anchor channel

Install the channel surface flush and fix the channel undisplaceable to the formwork or to the reinforcement



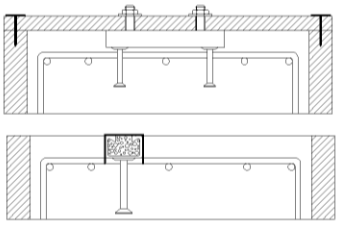
a) Fixing to steel formwork
With JORDAHL- Channel bolts and nuts, with rivets, cramps or with magneting fixings.

or



b) Fixing to timber formwork
With nails through the pre punched holes in the back of the channels and with staples.

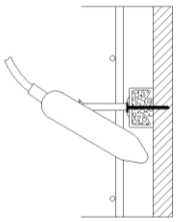
or



c) Fixing to anchor channels at the top
- To timber batten on the side formwork (e.g. with JORDAHL- Channel bolts).
- Fixing from above directly to the reinforcement or to a mounting rebar, attach the channel by wire binding.

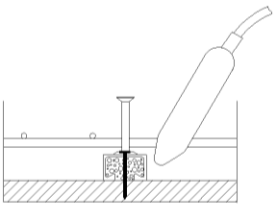
2. Pouring concrete and regular compacting of concrete

Compact the concrete properly around the channel and the anchors.



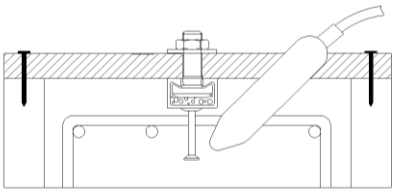
a) sidefaces to the formwork

or



b) in soffits

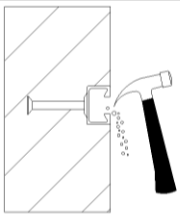
or



c) into top surfaces of concrete up stands

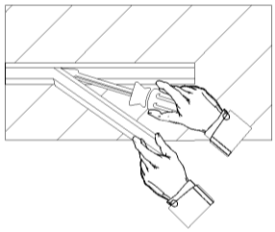
3. Removing of the channel infill

Clean the channel on the outside after removing the formwork



a) Foam infill
With a hammer or a hook.

or



b) PE - foam infill
By hand or with help of a screw driver in one piece.

JORDAHL - Anchor Channel JTA W40/22+ and W50/30+	**Annex B6**
Intended use Installation instruction – JORDAHL-Anchor channel	

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4. Fastening the JORDAHL- Channel bolt to the anchor channel

Fig. 1

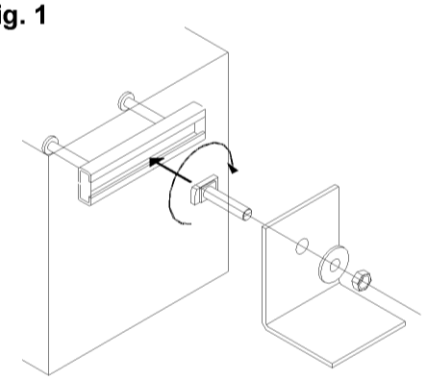
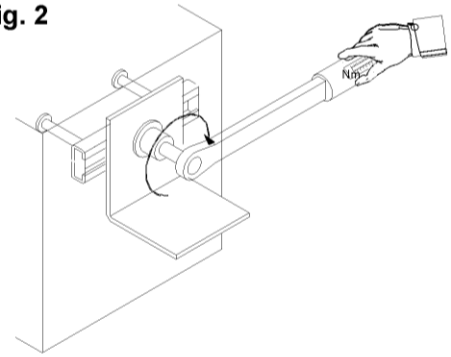


Fig. 2



a) Installation torques (General)

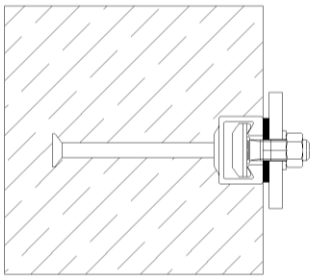
1. Insert the JORDAHL- channel bolt into the channel slot at any point along the channel length (Fig. 1).
2. Turn the channel bolt 90° clockwise and the head of the channel bolt locks into position (Fig. 1).
3. Do not mount the channel bolt at the end of the channel within the end spacing acc. to Annex B3.
4. Use the washer under the nut (Fig. 1).
5. Check the correct fit of the JORDAHL- channel bolt. The groove on the shank end of the channel bolt must be perpendicular to the channel longitudinal axis.
6. Tighten the nuts to the installation torque according to Table 1 (Fig. 2). The installation torque must not be exceeded.

Table 1

Strength grade	Anchor channel	T_{inst} [Nm]			
		M10	M12	M16	M20
4.6, 8.8, Stainless steel 50 / 70	W40/22+	15	25	45	-
	W50/30+	15	25	60	75

or

Fig. 3



b) Installation torques (Steel-to-steel contact)

1. Use washers between the channel and the fixture to create a defined contact.
2. Tighten the nuts to the installation torque according to Table 2. The installation torque must not be exceeded.

Table 2

	Material Strength Grade		Anchor channel	T_{inst} [Nm]			
				M10	M12	M16	M20
Steel-steel-contact	Steel	4.6	W40/22+ W50/30+	15	25	65	130
		8.8		40	70	180	360
	Stainless steel	50		13	24	60	115
		70		30	50	130	250

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Table C1: Characteristic resistances under tension loads – Steel failure channel

Anchor channel			**W40/22+**	**W50/30+**
Steel failure, Anchor				
Characteristic resistance round anchors	$N_{Rk,s,a}$	[kN]	30.0	39.3
Characteristic resistance I anchors	$N_{Rk,s,a}$	[kN]	43.2	54.0
Partial safety factor	γ_{Ms} [1)]		1.8	
Steel failure, Connection channel / anchor				
Characteristic resistance	$N_{Rk,s,c}$	[kN]	30	41
Partial safety factor	$\gamma_{Ms,ca}$ [1)]		1.8	
Steel failure, Local flexure of channel lips for $s_s \geq s_{slb}$				
Spacing of channel bolts for $N_{Rk,s,l}$	$s_{l,N}$	[mm]	79	98
Characteristic resistance	$N^0_{Rk,s,l}$	[kN]	35	41
Partial safety factor	$\gamma_{Ms,l}$ [1)]		1.8	

[1)] In absence of order national regulations

Fig. 1

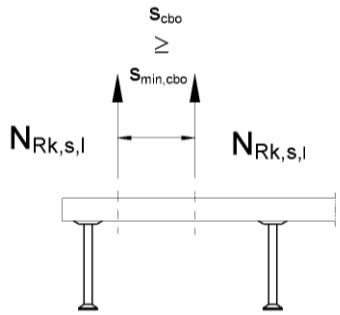

Fig. 2 **Assumption of system**

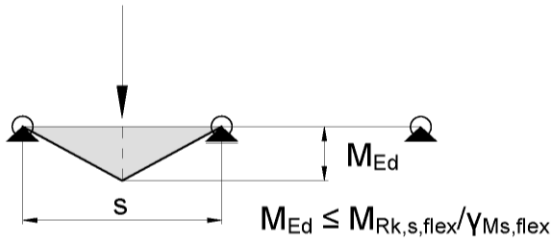

Table C2: Flexure resistance of channel

Anchor channel			**W40/22+**	**W50/30+**
Steel failure, Anchor				
Characteristic flexure resistance of channel	$M_{Rk,s,flex}$ [Nm]	Steel	1406	2830
		Stainless Steel	1580	3184
Partial safety factor	$\gamma_{Ms,flex}$ [1)]		1.15	

[1)] In absence of other national regulations

JORDAHL - Anchor Channel JTA W40/22+ and W50/30+

Performance
Characteristic resistances under tension load – steel failure channel

Annex C1

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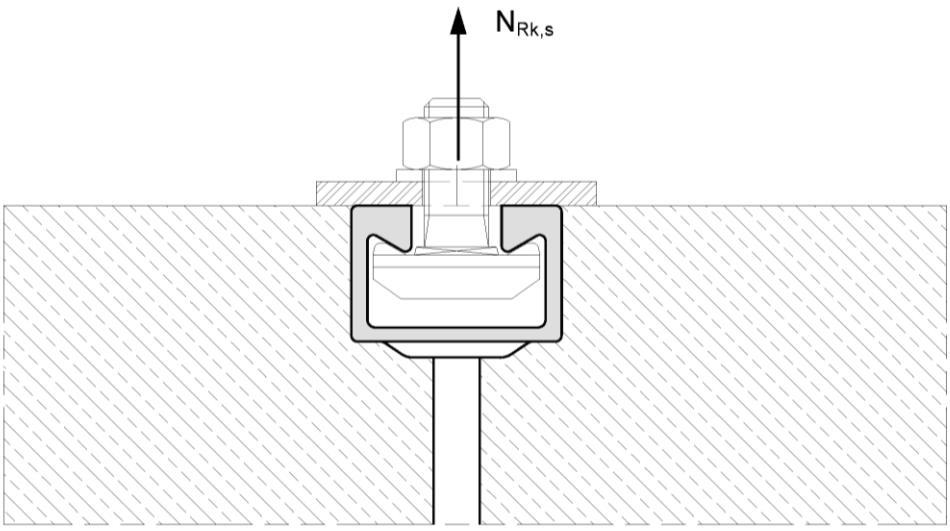
Table C3: Characteristic values for tension loads – Steel failure JORDAHL-Channel bolts

Special channel bolt Ø				M 10	M 12	M 16	M 20
				Steel failure			
Characteristic resistance	$N_{Rk,s}$ [2]	[kN]	4.6	23.2	33.7	62.8	98.0
			8.8	46.4	67.4	125.6	196.0
			50 [1]	29.0	42.2	78.5	122.5
			70 [1]	40.6	59.0	109.9	171.5
Partial safety factor	γ_{Ms} [3]		4.6	2.00			
			8.8	1.50			
			50 [1]	2.86			
			70 [1]	1.87			

[1] Materials according to Annex 2 and Annex 3, Table A1
[2] In conformity to EN ISO 898-1:2013
[3] In absence of other national regulations



JORDAHL - Anchor Channel JTA W40/22+ and W50/30+

Performance
Characteristic values for tension loads-Steel failure JORDAHL-Channel bolts

Annex C2

Table C4: Characteristic resistances under tension loads – Concrete failure

Anchor channel				**W40/22+**	**W50/30+**
Pullout failure					
Characteristic resistance in cracked concrete C12/15	Round anchors	$N_{Rk,p}$	[kN]	17.3	19.8
	Welded anchors			19.8	24.8
Characteristic resistance in uncracked concrete C12/15	Round anchors	$N_{Rk,p}$	[kN]	24.2	27.7
	Welded anchors			27.7	34.7
Increasing factor of $N_{Rk,p}$	C20/25	ψ_c	[–]	1.67	
	C25/30			2.08	
	C30/37			2.50	
	C35/45			2.92	
	C40/50			3.33	
	C45/55			3.75	
	C50/60			4.17	
	C55/67			4.58	
	≥ C60/75			5.00	
Partial safety factor		$\gamma_{Mp} = \gamma_{Mc}$ [1)]		1.5	
Concrete cone failure					
Product faktor k_1		$k_{cr,N}$		8.0	8.2
		$k_{ucr,N}$		11.5	11.7
Characteristic edge distance		$c_{cr,N}$	[mm]	195	216
Characteristic spacing		$s_{cr,N}$		390	432
Partial safety factor		γ_{Mc} [1)]	[–]	1.5	
Splitting					
Characteristic edge distance		$c_{cr,sp}$	[mm]	273	318
Characteristic spacing		$s_{cr,sp}$		546	636
Partial safety factor		γ_{Msp} [1)]	[–]	1.5	

[1)] In absence of other national regulations

Table C5: Displacements under tension loads

Anchor channel			**W40/22+**	**W50/30+**
Tension load	N_{Ek}	[kN]	11.9	15.6
Short time displacement	δ_{N0}	[mm]	0.4	0.5
Long time displacement	$\delta_{N\infty}$	[mm]	0.8	1.0

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Table C6: Characteristic resistances under shear load – steel failure of anchor channel

Anchor channel			**W40/22+**	**W50/30+**
Steel failure, Failure of anchor				
Characteristic resistance round anchors	$V_{Rk,s,a}$	[kN]	30.0	59
Characteristic resistance I anchors	$V_{Rk,s,a}$	[kN]	43.2	59
Partial safety factor	γ_{Ms} [1)]		1.5	
Steel failure, Failure of connection between anchor and channel				
Characteristic resistance	$V_{Rk,s,c}$	[kN]	30	59
Partial safety factor	$\gamma_{Ms,ca}$ [1)]		1.8	
Steel failure, , Local failure by flexure of channel lips				
Characteristic spacing of channel bolts for $V_{Rk,s,l}$	$s_{l,V}$	[mm]	79	98
Characteristic resistance	$V^0_{Rk,s,l}$	[kN]	35	59
Partial safety factor	$\gamma_{Ms,l}$ [1)]		1.8	
Pry out failure				
Product factor		k_8	2.0	
Partial safety factor		γ_{Mc} [1)]	1.5	
Concrete edge failure				
Product factor k_{12}	cracked concrete	$k_{cr,V}$	7.5	
	uncracked concrete	$k_{ucr,V}$	10.5	
Partial safety factor		γ_{Mc} [1)]	1.5	

[1)] In absence of other national regulations

Table C7: Displacements under shear loads

Anchor channel			**W40/22+**	**W50/30+**
Shear load	V_{Ek}	[kN]	11.9	15.6
Short time displacement	δ_{V0}	[mm]	0.6	0.6
Long time displacement	$\delta_{V\infty}$	[mm]	0.9	0.9

Table C8: Characteristic resistances under combined tension and shear load

Anchor channel		**W40/22+**	**W50/30+**
Steel failure: Local failure by flexure of channel lips and failure by flexure of channel			
Product factor	k_{13}	2.0	1.0 [1)]
Steel failure: Failure of anchor and connection between anchor and channel			
Product factor	k_{14}	2.0	1.0 [2)]

[1)] k_{13} can be taken as 2,0 if $V_{Rd,s,l}$ is limited to $N_{Rd,s,l}$
[2)] k_{14} can be taken as 2,0 if $V_{Rd,s,c,}$ is limited to $N_{Rd,s,c,}$

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Table C9: Characteristic values for shear loads – Steel failure JORDAHL-Channel Bolts

JORDAHL-Channel Bolts Ø				M 10	M 12	M 16	M 20
				Steel failure			
Characteristic resistance	$V_{Rk,s}$ [2]	[kN]	4.6	13.9	20.2	37.7	58.8
			8.8	23.2	33.7	62.8	98.0
			50 [1]	17.4	25.3	47.1	73.5
			70 [1]	24.4	35.4	65.9	102.9
Characteristic flexure resistance	$M^{\circ}_{Rk,s}$	[Nm]	4.6	29.9	52.4	133.2	259.6
			8.8	59.8	104.8	266.4	519.3
			50 [1]	37.4	65.5	166.5	324.5
			70 [1]	52.3	91.7	233.1	454.4
Partial safety factor	γ_{Ms} [3]		4.6	1.67			
			8.8	1.25			
			50 [1]	2.38			
			70 [1]	1.56			

[1] Materials according to Annex A2 and A3, Table A1
[2] In conformity to EN ISO 898-1:2013
[3] In absence of other national regulations

JORDAHL - Anchor Channel JTA W40/22+ and W50/30+

Characteristic values for shear loads – steel failure JORDAHL Channel bolts

Annex C5

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Table C10: Characteristic values for tension load and shear load under fire exposure

Anchor channels				**W40/22+**	**W50/30+**
Special bolt ≥			[mm]	M16	M16
Steel failure: Anchor, Connection channel/anchor, Local flexure of channel lip					
Char. Resistance	R90	$N_{Rk,s,fi} = V_{Rk,s,fi}$	[kN]	2.0	2.5
	R120			1.2	2.1
Partial safety factor [3]		$\gamma_{Ms,fi}$		1.0	
Concrete cone failure					
Edge distance		$c_{cr,N,fi}$	[mm]	$2\ h_{ef}$ [1] $\geq c_{cr,N}$	
		$c_{min,fi}$		2 hef [1], max (2 hef, 300 mm) [2]	
Spacing		$s_{cr,N,fi}$	[mm]	$4\ h_{ef} \geq s_{cr,N}$	
		$s_{min,fi}$		acc. to Annex A5, Table A5	

[1] Fire exposure from one side only
[2] Fire exposure from more than one side
[3] In absence of other national regulations

Fig. 1

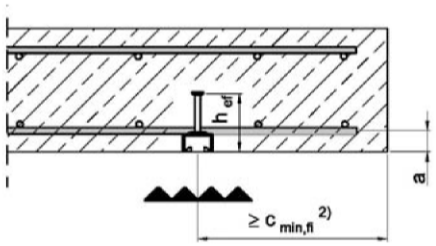

Fig. 2

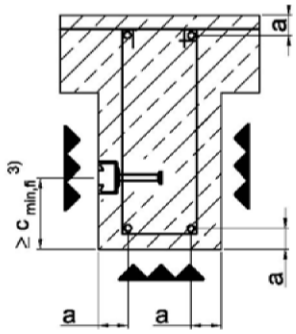

Table C11: Concrete cover [4]

Anchor channels				**W40/22+**	**W50/30+**
Concrete cover	R90	a	[mm]	45	45
(axis distance)	R120			60	60

[4] The reinforced concrete has to be build acc. to EN 1992. The fire resistance class of the reinforced concrete is not part of this ETA.

JORDAHL - Anchor Channel JTA W40/22+ and W50/30+

Annex C6

Performance
Characteristic values for tension and shear load under fire exposure, Concrete cover

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Table C12: Combinations for anchor channels and special bolts for fatigue tension load

Anchor channel	Anchor		Channel bolts			
	Type	d_1 [mm]	Type	d	Strength	Finish
W40/22+	R	10.8	JC	M12	8.8	z.p. h.d.g.
				M16	4.6 8.8	
W50/30+		10.0	JB	M16 M20	4.6 8.8	

Table C13: Characteristic resistances under fatigue tension load after n load cycles without static preload (N_{Ed} = 0) -Steel failure for design method I

Anchor channel	Load cycles n	W40/22+	W50/30+
		$\Delta N_{Rk,s;0,n}$ [kN]	
Characteristic resistances under fatigue tension load without static preload	$\le 10^4$	12.8	16.5
	$\le 10^5$	7.7	9.8
	$\le 10^6$	4.7	5.8
	$\le 2 \cdot 10^6$	4.0	4.9
	$\le 5 \cdot 10^6$	3.3	4.0
	$\le 10^8$		

Table C14: Reduction factor for concrete cone and pullout failure without static preload (N_{Ed} = 0) for design method I

	Load cycles n	$\eta_{c,fat} = \eta_{p,fat}$ [-]
Reduction factor for $\Delta N_{Rk,c,0,n} = \eta_{c,fat} \cdot \Delta N_{Rk,c}$ [1)] $\Delta N_{Rk,p,0,n} = \eta_{p,fat} \cdot \Delta N_{Rk,p}$ [1)]	$\le 10^4$	0.736
	$\le 10^5$	0.665
	$\le 10^6$	0.600
	$\le 2 \cdot 10^6$	0.582
	$\le 5 \cdot 10^6$	0.559
	$\le 10^8$	0.500

1) $N_{Rk,c}$ static resistance according Annex C3 and EOTA TR 047 or FprEN 1992-4:2016

JORDAHL - Anchor Channel JTA W40/22+ and W50/30+

Performance
Characteristic resistances under fatigue tension load – Design method I

Annex C7

Table C15: Characteristic limit resistances under fatigue tension load – Steel failure for design method II

Anchor channel		**W40/22+**	**W50/30+**
Characteristic resistances under fatigue tension load	$\Delta N_{Rk,s,0,\infty}$ [kN]	3.3	4.0

Table C16: Characteristic limit resistances under fatigue tension load – Concrete cone and pullout failure for design method II

Characteristic resistances under fatigue tension load	$\eta_{c,fat}$ [-]
$\Delta N_{Rk,c,0,n} = \eta_{k,c,fat} \cdot N_{Rk,c}$ [1)] $\Delta N_{Rk,p,0,n} = \eta_{k,p,fat} \cdot N_{Rk,p}$ [2)]	0.5

[1)] $N_{Rk,c}$ static resistances acc. Annex C3 and EOTA TR 047 or FprEN 1992-4:2016
[2)] $N_{Rk,p}$ static resistances acc. Annex C3

In absence of other national regulations the following safety factors $\gamma_{M,fat}$ are recommended for design method I and II (Table C13 to C16) acc. to EOTA TR 050:
$\gamma_{M,fat}$ = 1.35 (Steel)
$\gamma_{M,fat}$ = 1.5 (concrete)