fischer Cast-in Channel System

ELITE
FASTENERS LTD
Specialist Distributors to the Construction Industry

fischer

Dear fischer customers and partners:

As a leading supplier of secure and economic construction fixings, the fischer Group of Companies is shaping the future of the fixings industry. We have developed trends, such as advancing digitalisation or Building Information Modelling, into solutions for the buildings of the future. Increasing demands on planning security are changing the requirements placed on fixing technology.

Our innovative Cast-In Channel System provides answers to these new conditions. Our portfolio comprises fischer FES C cold-formed and FES H hot-rolled channels in a hot-dip galvanised variant. We have directly incorporated our Cast-In Channel System into the fischer FIXPERIENCE design software platform to enable simple calculations. Our holistic approach guarantees the highest level of safety and cost efficiency.

Our preinstalled anchor significantly reduces the total operating costs when combined with Building Information Modelling. The fischer Cast-In Channel Systems achieve this thanks to the low follow-on costs with every additional fixing. Its simple installation no longer requires time- and energy-consuming drilling in challenging circumstances such as heavily reinforced concrete. With no drill dust and without requiring heavy machinery, the fischer Cast-In Channel System offers further advantages in terms of health and safety and environmental management – advantages which are noticeable from the very first application.

As the market leader for fixing systems we are shaping the buildings of the future on the construction sites of the present. Discover the advantages of the fischer Cast-In Channel Systems in our catalogue!

Marc-Sven Mengis
Chief Executive Officer

A brand and its promise to perform

„Whoever chooses fischer receives more than a range of safe products. The aim is to always develop the best solutions for our customers across the globe."

Besides the innovative products, this predominantly concerns support that is focused on the customer, and services designed to improve customer benefit.

Continious improvement

With the fischer ProcessSystem (fPS), we ensure that we are adapting and optimising our processes in line with customer requirements in a flexible manner and on a continuous basis. Thus we are glad having been awarded with the 1. place "Excellence in Operations" within the challenging contest "Factory of the Year".

DIE FABRIK DES JAHRES
Global Excellence in Operations
Produktion ATKearney

Award 2016
Exellence in Operations

Always with its finger on the pulse of the times

At fischer, innovation is more than just a sum of the patents. We are open to new things and are prepared for change – always with the aim of offering our customers the greatest possible benefits. Over the years, our own development and production sites have been developing numerous fixing solutions for the most wide-ranging applications.

Be it new production procedures or materials, such as renewable raw materials: We are carrying out the research for your safety and will continue to do so in the future. This gives us such great flexibility that we can even develop tailor-made customer solutions. This power to innovate has seen fischer become market leader in anchor technology and the fixing industry.

Safety that connects – Decisive quality

We don't make any compromises when it comes to the safety of our products. A whole host of our products are distinguished by comprehensive, up-to-date and international approvals. The fischer product range is well-positioned in all sectors of fixing technology – Steel, Nylon and Chemical fixings. In award-winning quality which continues to impress both professional clients and private customers with equal measure.

ICC ES ESR-1990 See ICC-ES Evaluation Report at www.icc-es.org
ETA CE

International approvals
characterise many of our products

We take responsibility

Our active environment management policy means that we are helping to maintain an intact environment for our generation and for those that follow. The environment management policy at the Tumlingen site has been certified in line with DIN EN ISO 14001.

We are a member of the German Sustainable Building Council (DGNB), and our products have been successively certified in line with the guidelines provided by the Institute for Construction and the Environment (IBU). With our greenline products, we have introduced the first fixing assortment in the market, based on over 50% of regrowing raw materials.

Managementsystem ISO 9001:2008 ISO 14001

Institut Bauen und Umwelt e.V.

DGNB
Deutsche Gesellschaft für Nachhaltiges Bauen e.V.
German Sustainable Building Council

BIOBASED 50 - 85 %
DIN Geprüft
8C029

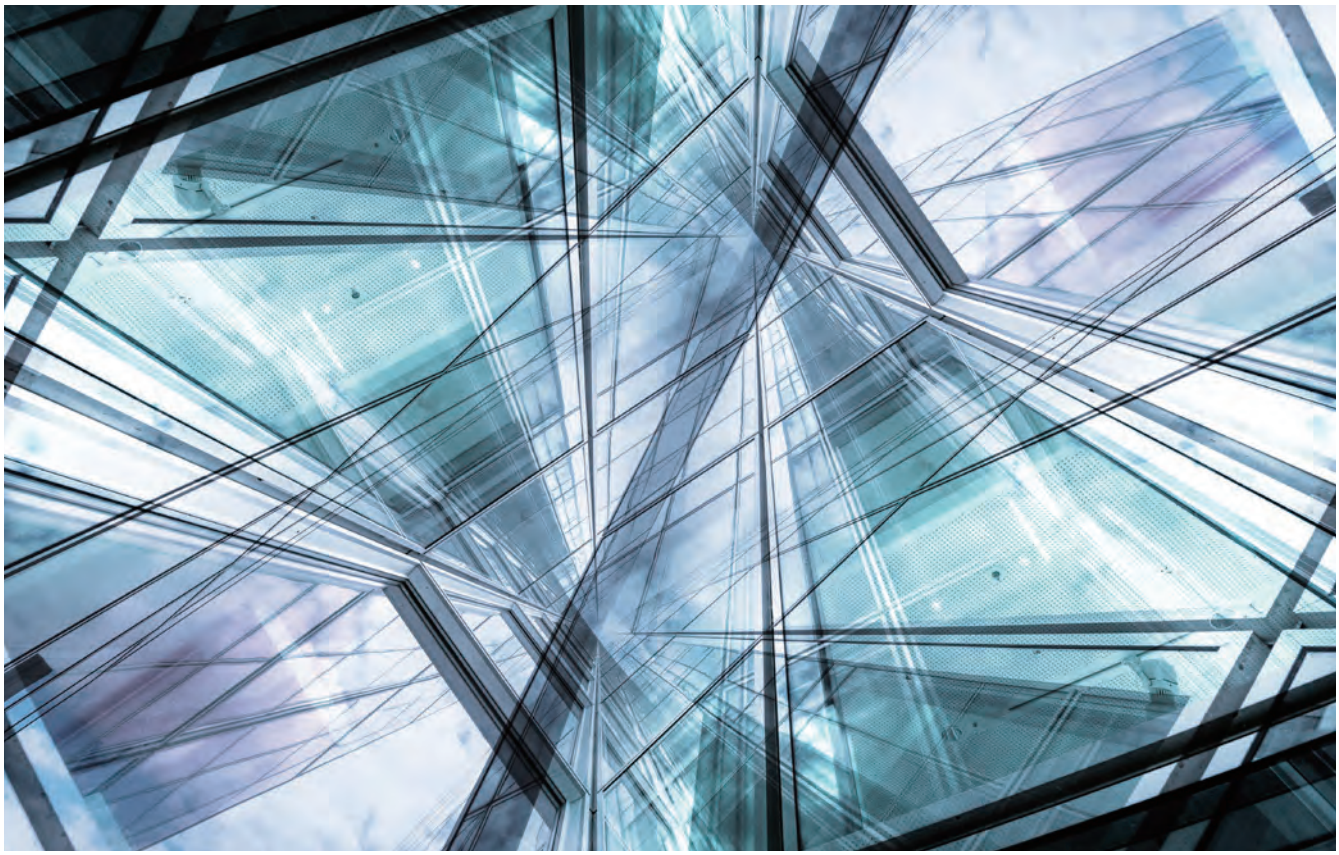
UX GREEN based on over 50 % of regrowing raw materials

Our service to you

We are a reliable partner, one that will stand at your side and address your individual requirements with advice and action:

- Our products range from **chemical systems to steel anchors** through to **plastic anchors.**
- **Competence and innovation** through own research, development and production.
- **Global presence** and active sales service in over 100 countries.
- **Qualified technical consulting** for economical and compliant fastening solutions. Also on-site at the construction site requested.
- **Training sessions,** some with accreditation, at your premises or at the fischer academy.
- **Design and construction software** for demanding applications.

fischer 360°-Service



Content

fischer Cast-in Channel System Introduction

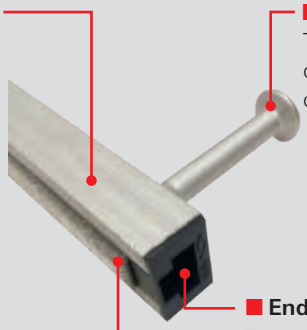
fischer Cast-in Channel System usually refer to cold formed or hot rolled channels with anchors of either I-shaped or round type welded or riveted to the channels. Nail holes in the channel aid the fixing of channel to wooden or other material formwork, inside the channel there are special form of fillers to prevent the ingress of concrete during casting process. After that, the formwork and the fillers can be easily removed, and the specially designed channel bolt are used to connect various attached items.

Advantages of using fischer Cast-in Channel System products:

- Providing adjustability and flexibility
- Easy installation with simple tools to ensure reduced construction time
- Prefabricated products diminish construction effort dramatically
- Time-saving bolted connections rather than time-demanding field welding
- Helping on pre-designing in structures building development
- Suitable for cracked concrete structure
- Applicable for multiple environment due to hot - dip galvanization and other coating options
- Integrated rip-line foam filler protects from concrete intrusion and allows easy and complete foam removal from the channel
- No damage to existing structures

Basic Components of the Cast-in Channel System

C-shaped channel:
To connect the outside structures using channel bolt components to transfer the external load



Anchor:
To be cast deeply into concrete structures and can bear load

End cap:
To prevent the concrete from getting inside through each end of channel and to increase the load capacity of the channel end in concrete structures

Filler and rip line:
To prevent the pouring concrete from getting inside the channel and can be easily removed

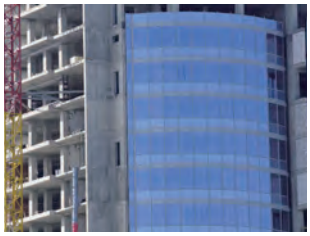
Design Method and Approval

The whole product portfolio is developed strictly following

- EN 1992-4 "Design of concrete structures - Part 4: Design of fastenings for use in concrete"
- EOTA TR047: Technical Report "Design of anchor channels" and combining with fischer renowned expertise in fastening technology

European Technical Assessment ETA-18/0862 of fischer Cast-in Channel System (hot-rolled series)

Civil Buildings



- Façade
- Elevators fastening
- MEP applications

Industrial and Power Facilities

- Façade
- Machine and shelf fastening
- MEP applications
- Elevators fastening

Subway and Railway Construction

- MEP applications
- Traffic signs fastening
- Evacuation platform fastening

Road & Bridge Construction

- MEP applications
- Traffic signs fastening
- Security fence fastening
- Noise & Safety barrier fastening

Prefabricated Concrete Structure

- Structures/Blocks connections
- MEP applications
- Facilities fastening

Other Applications

- Stadium construction (seat fastening, fastening of
- Precast elements & supply lines)
- Cable Cars & Airports

1	Changchun Longxiang- business center	Changchun (China)
2	Guiyang Financial Center building	Guiyang (China)
3	Baoding Healthy city	Baoding (China)
4	Hangzhou Xiasha Marriott hotel	Hangzhou (China)
5	Wuxi Hanglung Plaza	Wuxi (China)
6	Dali East sea developing zone Utility tunnel	Dali (China)
7	Chengdu Global Foundrie	Chengdu (China)
8	Shanghai Yoozoo Plaza	Shanghai (China)
9	Zhengzhou Media Group Mansion	Zhengzhou (China)
10	Tianjing Utility Tunnel	Tianjing (China)
11	Zhengzhou Zhengshang International Building	Zhengzhou (China)
12	Chengdu Tianfu Airport City Pipeline Terminal	Chengdu (China)
13	Shenzhen Fuji Land Building 1# Building	Shenzhen (China)
14	Hangzhou Joy City	Hangzhou (China)
15	Guizhou Anshun Urban Construction Building	Guizhou (China)

Baoding Healthy city

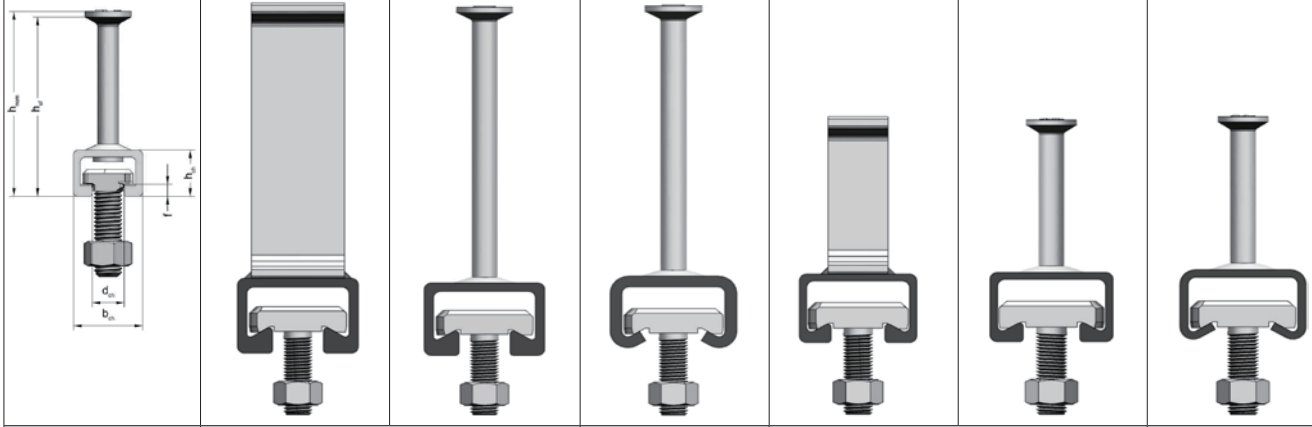
Chengdu Global Foundries

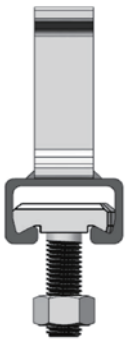
Dali East sea developing zone Utility tunnel

Dali East sea developing zone Utility tunnel

Dali East sea developing zone Utility tunnel

Hangzhou COfCO Joy City

Profile	Non-Serrated Channels					
	FES-H-I-52/34	**FES-H-52/34**	**FES-C-54/33**	**FES-H-I-50/30**	**FES-H-50/30**	**FES-C-49/30**
Type	Hot-rolled	Hot-rolled	Cold-formed	Hot-rolled	Hot-rolled	Cold-formed
Geometry						
Channel Bolts	**FBC-50/30 FBC-N-50/30**		**FBC-50/30**	**FBC-50/30 FBC-N-50/30**		**FBC-50/30**
Thread	M10 - M20		M10 - M20	M10 - M20		M10 - M20
Design resistance for connection between anchor and channel						
$N_{Rd,s,c}$ [kN]	39.1	30.6	30.6	22.2	17.2	17.2
$V_{Rd,s,c,y}$ [kN]	55.6	55.6	30.6	33.3	33.3	17.2
$V_{Rd,s,c,x}$ [kN]	23.4	18.3	-	13.3	10.3	-
Design resistance for lip failure of channel						
$N_{Rd,s,l}$ [kN]	40.0	40.0	30.6	23.9	23.9	17.2
$V_{Rd,s,l,y}$ [kN]	55.6	55.6	30.6	33.3	33.3	17.2
$V_{Rd,s,l,x}$ [kN] (yinst included)	7.4	7.4	-	7.4	7.4	-
Dimension of anchor channel						
b_{ch} [mm]	52.5	52.5	53.5	50	50	50
h_{ch} [mm]	34	34	33	30	30	30
d_{ch} [mm]	22.5	22.5	21.5	22.5	22.5	22
f [mm]	11.5	11.5	7.5	8.1	8.1	7
$h_{nom,min}$ [mm]	160	157.5	157.5	99	96.2	96.2
$h_{ef,min}$ [mm]	155	155	155	94	94	94

Non-Serrated Channels					Serrated Channel	
FES-H-I-40/22	**FES-H-40/22**	**FES-C-40/25**	**FES-C-38/17**	**FES-C-28/15**	**FES-H-S-38/23**	**FES-H-S-29/20**
Hot-rolled	Hot-rolled	Cold-formed	Cold-formed	Cold-formed	Hot-rolled	Hot-rolled
						
FBC-40/22			**FBC-38/17**	**FBC-28/15**	**FBC-S-38/23**	**FBC-S-29/20**
M10 - M16			M10- M16	M8 - M12	M12 - M16	M12
Design resistance for connection between anchor and channel						
19.4	11.1	11.1	10.0	5.0	16.8	11.2
22.2	22.2	11.1	10.0	5.0	16.8	11.2
-	-	-	-	-	10.1	6.7
Design resistance for lip failure of channel						
21.1	21.1	11.1	10.0	5.0	16.8	11.2
22.2	22.2	11.1	10.0	5.0	16.8	11.2
-	-	-	-	-	12.9	10.4
Dimension of anchor channel						
40	40	40	38	28	38	30
23.5	23.5	25	17.3	15.5	23	20
18	18	18	18	12	18	14
6.2	6.2	6	3	2.3	6	5.2
84	92	81	78	46.5	99.2	79.2
79	90	79	76	45	97	77

Cast-in Channel System

Cold formed
Cast-in Channel System

Application

- Suitable for all types of buildings or structures
- Curtain Walls
- Prefabricated buildings

Advantages

- One time cold forming
- Excellent anti-corrosion performance
- Easy adjustment
- Economical solution

Non-Serrated hot rolled
Cast-in Channel System

Application

- Suitable for all types of buildings or structures
- Curtain Walls
- Prefabricated buildings
- Industrial Use/Railway

Advantages

- One time hot-rolled forming
- Excellent anti-corrosion performance
- Easy adjustment
- Can resist longitudianl shear loads when pairing with suitable notched channel bolt

Serrated hot rolled
Cast-in Channel System

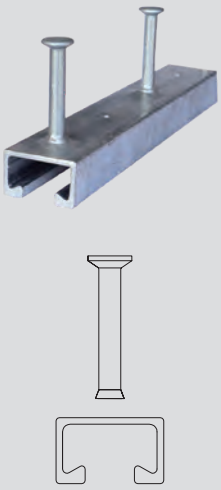
Application

- Suitable for all types of buildings or structure
- Metro/Subway
- Utility Tunnel
- Prefabricated buildings

Advantages

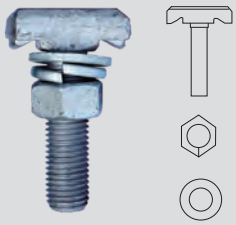
- One time hot rolled forming with serration structure
- Can bear the longitudinal shear load
- Excellent anti-corrosion performance
- Easy adjustment

Material of Cast-in Channel



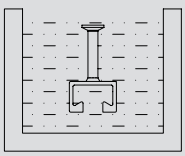
	Components	Mechanical Properties		Coating		Coating Standard
Hot-rolled	Channel	1.0038, 1.0044	EN10025:2004	HDG≥ 50 µm	Zn-Al ≥ 25µm	EN ISO 10684: 2004+AC:2009 10684: 2004+AC:2009
		1.0976, 1.0979	EN10149:2013	HDG≥ 50 µm	Zn-Al ≥ 25µm	
	Anchor	1.0038, 1.0213, 1.0214	EN10025:2004	HDG≥ 50 µm	Zn-Al ≥ 25µm	
		1.5523, 1.5535	EN10263:2017	HDG≥ 50 µm	Zn-Al ≥ 25µm	
Cold-formed	Channel	1.0038, 1.0044	EN10025:2004	HDG≥ 50 µm	Zn-Al ≥ 25µm	EN ISO 10684: 2004+AC:2009
		1.0976, 1.0979	EN10149:2013	HDG≥ 50 µm	Zn-Al ≥ 25µm	
	Anchor	1.0038, 1.0213, 1.0214	EN10025:2004	HDG≥ 50 µm	Zn-Al ≥ 25µm	
		1.5523, 1.5535	EN10263:2017	HDG≥ 50 µm	Zn-Al ≥ 25µm	

Material of Channel Bolt

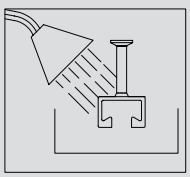


	Components	Material	Standard	Coating	
Channel bolt	Head bolt	Steel grade 8.8	EN ISO898-1:2013	Electroplated acc. To EN ISO 4042:2018	HDG ≥ 50 µm acc. To EN ISO 10684:2004+AC:2009
	Hexagonal Nut acc.to EN ISO 4032:2012	Property class 5 or 8	EN ISO898-2:2012		
	Plain washer acc.	Hardness clasee A≥200 HV	EN ISO 7089:2000 and EN ISO 7093-1:2000		
	Spring washer	Spring Steel	DIN 127		

Cast-in Channel System Anti-Corrosion Protection



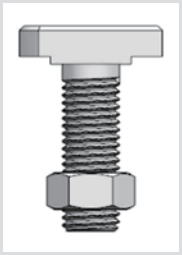
- Hot-dip galvanized zinc coating
- Dipping the product in molten zinc pool to apply a metal zinc coating
- The usual approach of Cast in Channel for corrosion protection

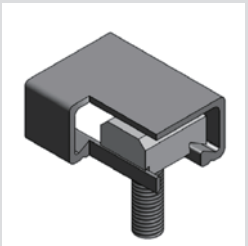


- Zinc-aluminum alloy coating
- Physical painting coating
- Better anticorrosion performance than hot-dip galvanized zinc

Channel Bolt

- There are three types of fischer Channel Bolts defined in product portfolio to match different type of Cast-in Channel and also forming as fastening system to match multiple applications' requirements.

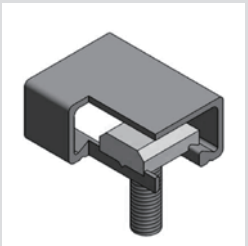




Standard Channel Bolt

Cast-in Channel System with smooth surface of the channel lips in combination with a smooth surface on the underside of the channel bolt head

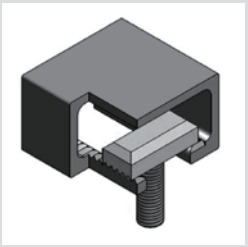
- Two directional load capacity
- Marked on bolt tip with one groove
- Steel grade: 8.8



Notched Channel Bolt

Cast - in Channel with smooth surface of the channel lips in combination with a notching channel bolt

- Only for hot-rolled profiles without teeth
- All directional load capacity
- Fundamental load capacity in channel longitudinal direction provided
- Marked on bolt tip with paralleled two grooves
- Steel grade: 8.8



Serrated Channel Bolt

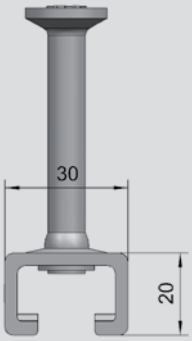
Cast - in Channel with serrated channel lips in combination with locking channel bolts with matching serrations on the channel bolt head

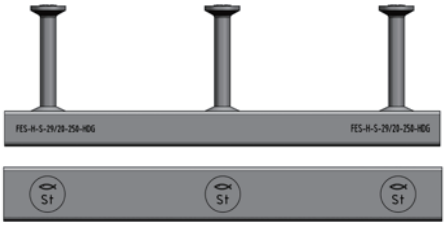
- Only for hot-rolled profiles with teeth
- All directional load capacity
- Qualified load capacity in channel longitudinal direction to prevent bolt slide risks
- Marked on bolt tip with staggered two grooves
- Steel grade: 8.8

Nomenclature for Ordering Channel

FES-H-S-I-52/34-xxxx-HDG(-Rxxxx)

- Fischer Einlege Schiene (fischer Cast-in Channel System)
- C - Cold formed
  H - Hot rolled
- Serrated (if applicable)
- I-anchor (if applicable)
  Note: Round anchors are considered standard and go without special abbreviation in the product naming
- Width: 52mm
- Height: 34mm
- Length [mm]
- Coating HDG: > 50µm
- for curved channels only: R [mm]





Example:
Standard plain channel

FES-H-S-29/20-1050-HDG
for:
Serrated hot rolled channel
Round anchor
Hot dip galvanized

Cold-formed Cast-in Channel

Profile	Article No.	Name	Length (mm)	Anchor [n]	Serrated (Y/N)	Round Anchor/ I Anchor	Coating	Anchor Bolt	
								Bolt Profile	Thread Size
28/15	**552543**	FES-C-28/15-100-HDG	100	2	N	Round Anchor	HDG	FBC-28/15	M6,M8, M10,M12
	552544	FES-C-28/15-150-HDG	150	2	N	Round Anchor	HDG		
	552545	FES-C-28/15-200-HDG	200	2	N	Round Anchor	HDG		
	552546	FES-C-28/15-250-HDG	250	2	N	Round Anchor	HDG		
	552547	FES-C-28/15-300-HDG	300	3	N	Round Anchor	HDG		
	552548	FES-C-28/15-350-HDG	350	3	N	Round Anchor	HDG		
	552549	FES-C-28/15-450-HDG	450	3	N	Round Anchor	HDG		
	552550	FES-C-28/15-500-HDG	500	4	N	Round Anchor	HDG		
	552551	FES-C-28/15-850-HDG	850	5	N	Round Anchor	HDG		
	552552	FES-C-28/15-1050-HDG	1050	6	N	Round Anchor	HDG		
	552553	FES-C-28/15-3050-HDG	3050	16	N	Round Anchor	HDG		
	552554	FES-C-28/15-6070-HDG	6070	31	N	Round Anchor	HDG		
38/17	**552555**	FES-C-38/17-100-HDG	100	2	N	Round Anchor	HDG	FBC-38/17	M8,M10, M12,M16
	552556	FES-C-38/17-150-HDG	150	2	N	Round Anchor	HDG		
	552557	FES-C-38/17-200-HDG	200	2	N	Round Anchor	HDG		
	552558	FES-C-38/17-250-HDG	250	2	N	Round Anchor	HDG		
	552559	FES-C-38/17-300-HDG	300	3	N	Round Anchor	HDG		
	552560	FES-C-38/17-350-HDG	350	3	N	Round Anchor	HDG		
	552561	FES-C-38/17-450-HDG	450	3	N	Round Anchor	HDG		
	552562	FES-C-38/17-500-HDG	500	4	N	Round Anchor	HDG		
	552563	FES-C-38/17-850-HDG	850	5	N	Round Anchor	HDG		
	552564	FES-C-38/17-1050-HDG	1050	6	N	Round Anchor	HDG		
	552565	FES-C-38/17-3050-HDG	3050	16	N	Round Anchor	HDG		
	552566	FES-C-38/17-6070-HDG	6070	31	N	Round Anchor	HDG		

Cold-formed Cast-in Channel

Profile	Article No.	Name	Length (mm)	Anchor [n]	Serrated (Y/N)	Round Anchor/ I Anchor	Coating	Anchor Bolt	
								Bolt Profile	Thread Size
40/25	**552567**	FES-C-40/25-150-HDG	150	2	N	Round Anchor	HDG	FBC-40/22	M10,M12, M16
	552568	FES-C-40/25-200-HDG	200	2	N	Round Anchor	HDG		
	552569	FES-C-40/25-250-HDG	250	2	N	Round Anchor	HDG		
	552570	FES-C-40/25-300-HDG	300	2	N	Round Anchor	HDG		
	552571	FES-C-40/25-350-HDG	350	3	N	Round Anchor	HDG		
	552572	FES-C-40/25-400-HDG	400	3	N	Round Anchor	HDG		
	552573	FES-C-40/25-550-HDG	550	3	N	Round Anchor	HDG		
	552574	FES-C-40/25-800-HDG	800	4	N	Round Anchor	HDG		
	552575	FES-C-40/25-1050-HDG	1050	5	N	Round Anchor	HDG		
	552576	FES-C-40/25-3050-HDG	3050	13	N	Round Anchor	HDG		
	552577	FES-C-40/25-6070-HDG	6070	25	N	Round Anchor	HDG		
49/30	**552578**	FES-C-49/30-150-HDG	150	2	N	Round Anchor	HDG	FBC-50/30	M10,M12, M16,M20
	552579	FES-C-49/30-200-HDG	200	2	N	Round Anchor	HDG		
	552580	FES-C-49/30-250-HDG	250	2	N	Round Anchor	HDG		
	552581	FES-C-49/30-300-HDG	300	2	N	Round Anchor	HDG		
	552582	FES-C-49/30-350-HDG	350	3	N	Round Anchor	HDG		
	552583	FES-C-49/30-400-HDG	400	3	N	Round Anchor	HDG		
	552584	FES-C-49/30-550-HDG	550	3	N	Round Anchor	HDG		
	552585	FES-C-49/30-800-HDG	800	4	N	Round Anchor	HDG		
	552586	FES-C-49/30-1050-HDG	1050	5	N	Round Anchor	HDG		
	552587	FES-C-49/30-3050-HDG	3050	13	N	Round Anchor	HDG		
	552588	FES-C-49/30-6070-HDG	6070	25	N	Round Anchor	HDG		
54/33	**552589**	FES-C-54/33-150-HDG	150	2	N	Round Anchor	HDG	FBC-50/30	M10,M12, M16,M20
	552590	FES-C-54/33-200-HDG	200	2	N	Round Anchor	HDG		
	552591	FES-C-54/33-250-HDG	250	2	N	Round Anchor	HDG		
	552592	FES-C-54/33-300-HDG	300	2	N	Round Anchor	HDG		
	552593	FES-C-54/33-350-HDG	350	3	N	Round Anchor	HDG		
	552594	FES-C-54/33-400-HDG	400	3	N	Round Anchor	HDG		
	552595	FES-C-54/33-550-HDG	550	3	N	Round Anchor	HDG		
	552596	FES-C-54/33-800-HDG	800	4	N	Round Anchor	HDG		
	552597	FES-C-54/33-1050-HDG	1050	5	N	Round Anchor	HDG		
	552598	FES-C-54/33-3050-HDG	3050	13	N	Round Anchor	HDG		
	552599	FES-C-54/33-6070-HDG	6070	25	N	Round Anchor	HDG		

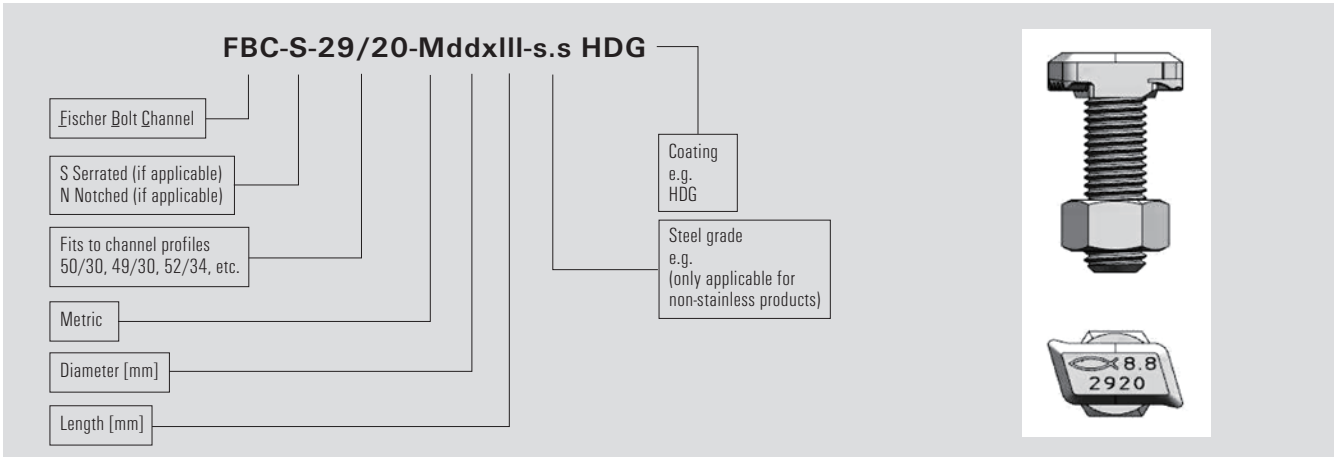
Hot-rolled Cast-in Channel

Profile	Article No.	Name	Length (mm)	Anchor [n]	Serrated (Y/N)	Round Anchor/ I Anchor	Coating	Anchor Bolt	
								Bolt Profile	Thread Size
29/20	552446	FES-H-S-29/20-150-HDG	150	2	Y	Round Anchor	HDG	FBC-S-29/20	M12
	552447	FES-H-S-29/20-200-HDG	200	2	Y	Round Anchor	HDG		
	552448	FES-H-S-29/20-250-HDG	250	2	Y	Round Anchor	HDG		
	552449	FES-H-S-29/20-300-HDG	300	3	Y	Round Anchor	HDG		
	552450	FES-H-S-29/20-350-HDG	350	3	Y	Round Anchor	HDG		
	552451	FES-H-S-29/20-400-HDG	400	3	Y	Round Anchor	HDG		
	552452	FES-H-S-29/20-500-HDG	500	4	Y	Round Anchor	HDG		
	552453	FES-H-S-29/20-850-HDG	850	5	Y	Round Anchor	HDG		
	552454	FES-H-S-29/20-1050-HDG	1050	6	Y	Round Anchor	HDG		
	552455	FES-H-S-29/20-3050-HDG	3050	16	Y	Round Anchor	HDG		
	552456	FES-H-S-29/20-6070-HDG	6070	31	Y	Round Anchor	HDG		
38/23	552457	FES-H-S-38/23-150-HDG	150	2	Y	Round Anchor	HDG	FBC-S-38/23	M12,M16
	552458	FES-H-S-38/23-200-HDG	200	2	Y	Round Anchor	HDG		
	552459	FES-H-S-38/23-250-HDG	250	2	Y	Round Anchor	HDG		
	552460	FES-H-S-38/23-300-HDG	300	2	Y	Round Anchor	HDG		
	552461	FES-H-S-38/23-350-HDG	350	3	Y	Round Anchor	HDG		
	552462	FES-H-S-38/23-400-HDG	400	3	Y	Round Anchor	HDG		
	552463	FES-H-S-38/23-550-HDG	550	3	Y	Round Anchor	HDG		
	552464	FES-H-S-38/23-850-HDG	850	5	Y	Round Anchor	HDG		
	552465	FES-H-S-38/23-1050-HDG	1050	5	Y	Round Anchor	HDG		
	552466	FES-H-S-38/23-3050-HDG	3050	13	Y	Round Anchor	HDG		
	552467	FES-H-S-38/23-6070-HDG	6070	25	Y	Round Anchor	HDG		
40/22	552468	FES-H-40/22-150-HDG	150	2	N	Round Anchor	HDG	FBC-40/22	M10,M12,M16
	552469	FES-H-40/22-200-HDG	200	2	N	Round Anchor	HDG		
	552470	FES-H-40/22-250-HDG	250	2	N	Round Anchor	HDG		
	552471	FES-H-40/22-300-HDG	300	2	N	Round Anchor	HDG		
	552472	FES-H-40/22-350-HDG	350	3	N	Round Anchor	HDG		
	552473	FES-H-40/22-400-HDG	400	3	N	Round Anchor	HDG		
	552474	FES-H-40/22-550-HDG	550	3	N	Round Anchor	HDG		
	552475	FES-H-40/22-800-HDG	800	4	N	Round Anchor	HDG		
	552476	FES-H-40/22-1050-HDG	1050	5	N	Round Anchor	HDG		
	552477	FES-H-40/22-1300-HDG	1300	6	N	Round Anchor	HDG		
	552478	FES-H-40/22-1550-HDG	1550	7	N	Round Anchor	HDG		
	552479	FES-H-40/22-1800-HDG	1800	8	N	Round Anchor	HDG		
	552480	FES-H-40/22-2050-HDG	2050	9	N	Round Anchor	HDG		
	552481	FES-H-40/22-2300-HDG	2300	10	N	Round Anchor	HDG		
	552482	FES-H-40/22-3050-HDG	3050	13	N	Round Anchor	HDG		
	552483	FES-H-40/22-6070-HDG	6070	25	N	Round Anchor	HDG		
	552507	FES-H-I-40/22-150-HDG	150	2	N	I Anchor	HDG		
	552508	FES-H-I-40/22-200-HDG	200	2	N	I Anchor	HDG		
	552509	FES-H-I-40/22-250-HDG	250	2	N	I Anchor	HDG		
	552510	FES-H-I-40/22-300-HDG	300	2	N	I Anchor	HDG		
	552511	FES-H-I-40/22-350-HDG	350	3	N	I Anchor	HDG		
	552512	FES-H-I-40/22-400-HDG	400	3	N	I Anchor	HDG		

Hot-rolled Cast-in Channel

Profile	Article No.	Name	Length (mm)	Anchor [n]	Serrated (Y/N)	Round Anchor/ I Anchor	Coating	Anchor Bolt	
								Bolt Profile	Thread Size
40/22	552513	FES-H-I-40/22-550-HDG	550	3	N	I Anchor	HDG	FBC-40/22	M10,M12,M16
	552514	FES-H-I-40/22-1050-HDG	1050	5	N	I Anchor	HDG		
	552515	FES-H-I-40/22-6070-HDG	6070	25	N	I Anchor	HDG		
50/30	552484	FES-H-50/30-150-HDG	150	2	N	Round Anchor	HDG	FBC-50/30 or FBC-N-50/30	M10,M12, M16, M20 for FBC-50/30 or M20 for FBC-N-50/30
	552485	FES-H-50/30-200-HDG	200	2	N	Round Anchor	HDG		
	552486	FES-H-50/30-250-HDG	250	2	N	Round Anchor	HDG		
	552487	FES-H-50/30-300-HDG	300	2	N	Round Anchor	HDG		
	552488	FES-H-50/30-350-HDG	350	3	N	Round Anchor	HDG		
	552489	FES-H-50/30-400-HDG	400	3	N	Round Anchor	HDG		
	552490	FES-H-50/30-550-HDG	550	3	N	Round Anchor	HDG		
	552492	FES-H-50/30-800-HDG	800	4	N	Round Anchor	HDG		
	552493	FES-H-50/30-1050-HDG	1050	5	N	Round Anchor	HDG		
	552494	FES-H-50/30-3050-HDG	3050	13	N	Round Anchor	HDG		
	552495	FES-H-50/30-6070-HDG	6070	25	N	Round Anchor	HDG		
	552516	FES-H-I-50/30-150-HDG	150	2	N	I Anchor	HDG		
	552517	FES-H-I-50/30-200-HDG	200	2	N	I Anchor	HDG		
	552518	FES-H-I-50/30-250-HDG	250	2	N	I Anchor	HDG		
	552519	FES-H-I-50/30-300-HDG	300	2	N	I Anchor	HDG		
	552520	FES-H-I-50/30-350-HDG	350	3	N	I Anchor	HDG		
	552521	FES-H-I-50/30-400-HDG	400	3	N	I Anchor	HDG		
	552522	FES-H-I-50/30-550-HDG	550	3	N	I Anchor	HDG		
	552523	FES-H-I-50/30-1050-HDG	1050	5	N	I Anchor	HDG		
	552524	FES-H-I-50/30-6070-HDG	6070	25	N	I Anchor	HDG		
52/34	552496	FES-H-52/34-150-HDG	170	2	N	Round Anchor	HDG	FBC-50/30 or FBC-N-50/30	M10,M12, M16,M20 for FBC-50/30 or M20 for FBC-N-50/30
	552497	FES-H-52/34-200-HDG	200	2	N	Round Anchor	HDG		
	552498	FES-H-52/34-250-HDG	250	2	N	Round Anchor	HDG		
	552499	FES-H-52/34-300-HDG	320	2	N	Round Anchor	HDG		
	552500	FES-H-52/34-350-HDG	350	3	N	Round Anchor	HDG		
	552501	FES-H-52/34-400-HDG	400	3	N	Round Anchor	HDG		
	552502	FES-H-52/34-550-HDG	550	3	N	Round Anchor	HDG		
	552503	FES-H-52/34-800-HDG	800	4	N	Round Anchor	HDG		
	552504	FES-H-52/34-1050-HDG	1050	5	N	Round Anchor	HDG		
	552505	FES-H-52/34-3050-HDG	3050	13	N	Round Anchor	HDG		
	552506	FES-H-52/34-6070-HDG	6070	25	N	Round Anchor	HDG		
	552525	FES-H-I-52/34-150-HDG	150	2	N	I Anchor	HDG		
	552526	FES-H-I-52/34-200-HDG	200	2	N	I Anchor	HDG		
	552527	FES-H-I-52/34-250-HDG	250	2	N	I Anchor	HDG		
	552528	FES-H-I-52/34-300-HDG	300	2	N	I Anchor	HDG		
	552529	FES-H-I-52/34-350-HDG	350	3	N	I Anchor	HDG		
	552530	FES-H-I-52/34-400-HDG	400	3	N	I Anchor	HDG		
	552531	FES-H-I-52/34-550-HDG	550	3	N	I Anchor	HDG		
	552532	FES-H-I-52/34-1050-HDG	1050	5	N	I Anchor	HDG		
	552533	FES-H-I-52/34-6070-HDG	6070	25	N	I Anchor	HDG		

Nomenclature for Ordering Channel Bolt Products



Channel Bolt (Standard/Notched/Serrated)

Profile	Article No.	Name	Thread Size	Length (mm)	Steel Class	Coating	Fitting to Channel Profiles
FBC-28/15	552600	FBC-28/15-M8x40-8.8-HDG	M8	40	8.8	HDG	FES-C-28/15
	552604	FBC-28/15-M10x40-8.8-HDG	M10	40	8.8	HDG	
	552605	FBC-28/15-M12x30-8.8-HDG	M12	30	8.8	HDG	
	552606	FBC-28/15-M12x40-8.8-HDG	M12	40	8.8	HDG	
	552607	FBC-28/15-M12x60-8.8-HDG	M12	60	8.8	HDG	
	552609	FBC-28/15-M12x80-8.8-HDG	M12	80	8.8	HDG	
FBC-38/17	552610	FBC-38/17-M10x30-8.8-HDG	M10	30	8.8	HDG	FES-C-38/17
	552613	FBC-38/17-M10x40-8.8-HDG	M10	40	8.8	HDG	
	552616	FBC-38/17-M10x60-8.8-HDG	M10	60	8.8	HDG	
	552619	FBC-38/17-M10x80-8.8-HDG	M10	80	8.8	HDG	
	552622	FBC-38/17-M12x40-8.8-HDG	M12	40	8.8	HDG	
	552623	FBC-38/17-M12x60-8.8-HDG	M12	60	8.8	HDG	
	552624	FBC-38/17-M12x80-8.8-HDG	M12	80	8.8	HDG	
	552625	FBC-38/17-M16x50-8.8-HDG	M16	50	8.8	HDG	
	552626	FBC-38/17-M16x80-8.8-HDG	M16	80	8.8	HDG	
FBC-40/22	552627	FBC-40/22-M12x40-8.8-HDG	M12	40	8.8	HDG	FES-H-40/22 FES-C-40/25
	552628	FBC-40/22-M12x50-8.8-HDG	M12	50	8.8	HDG	
	552629	FBC-40/22-M12x60-8.8-HDG	M12	60	8.8	HDG	
	552630	FBC-40/22-M12x80-8.8-HDG	M12	80	8.8	HDG	
	552637	FBC-40/22-M12x100-8.8-HDG	M12	100	8.8	HDG	
	552650	FBC-40/22-M16x50-8.8-HDG	M16	50	8.8	HDG	
	552655	FBC-40/22-M16x60-8.8-HDG	M16	60	8.8	HDG	
	552656	FBC-40/22-M16x80-8.8-HDG	M16	80	8.8	HDG	
	552657	FBC-40/22-M16x100-8.8-HDG	M16	100	8.8	HDG	

Channel Bolt (Standard/Notched/Serrated)

Profile	Article No.	Name	Thread Size	Length (mm)	Steel Class	Coating	Fitting to Channel Profiles
FBC-50/30	552658	FBC-50/30-M12x40-8.8-HDG	M12	40	8.8	HDG	FES-C-49/30 FES-H-50/30 FES-H-52/34 FES-C-54/33
	552659	FBC-50/30-M12x50-8.8-HDG	M12	50	8.8	HDG	
	552661	FBC-50/30-M12x60-8.8-HDG	M12	60	8.8	HDG	
	552663	FBC-50/30-M12x80-8.8-HDG	M12	80	8.8	HDG	
	552667	FBC-50/30-M12x100-8.8-HDG	M12	100	8.8	HDG	
	552669	FBC-50/30-M16x50-8.8-HDG	M16	50	8.8	HDG	
	552671	FBC-50/30-M16x60-8.8-HDG	M16	60	8.8	HDG	
	552673	FBC-50/30-M16x80-8.8-HDG	M16	80	8.8	HDG	
	552675	FBC-50/30-M16x100-8.8-HDG	M16	100	8.8	HDG	
	552676	FBC-50/30-M16x125-8.8-HDG	M16	125	8.8	HDG	
	552677	FBC-50/30-M20x60-8.8-HDG	M20	60	8.8	HDG	
	552678	FBC-50/30-M20x80-8.8-HDG	M20	80	8.8	HDG	
	552679	FBC-50/30-M20x100-8.8-HDG	M20	100	8.8	HDG	
	552684	FBC-50/30-M20x125-8.8-HDG	M20	125	8.8	HDG	
	552686	FBC-50/30-M20x200-8.8-HDG	M20	200	8.8	HDG	
FBC-N-50/30	552689	FBC-N-50/30-M20x60-8.8-HDG	M20	60	8.8	HDG	FES-H-50/30 FES-H-52/34
	552690	FBC-N-50/30-M20x80-8.8-HDG	M20	80	8.8	HDG	
	552691	FBC-N-50/30-M20x100-8.8-HDG	M20	100	8.8	HDG	
	552693	FBC-N-50/30-M20x125-8.8-HDG	M20	125	8.8	HDG	
	552699	FBC-N-50/30-M20x200-8.8-HDG	M20	200	8.8	HDG	
FBC-S-29/20	552700	FBC-S-29/20-M12x40-8.8-HDG	M12	40	8.8	HDG	FES-H-S-29/20
	552704	FBC-S-29/20-M12x50-8.8-HDG	M12	50	8.8	HDG	
	552705	FBC-S-29/20-M12x60-8.8-HDG	M12	60	8.8	HDG	
	552711	FBC-S-29/20-M12x80-8.8-HDG	M12	80	8.8	HDG	
FBC-S-38/23	552712	FBC-S-38/23-M12x40-8.8-HDG	M12	40	8.8	HDG	FES-H-S-38/23
	552713	FBC-S-38/23-M12x50-8.8-HDG	M12	50	8.8	HDG	
	552714	FBC-S-38/23-M12x60-8.8-HDG	M12	60	8.8	HDG	
	552718	FBC-S-38/23-M12x80-8.8-HDG	M12	80	8.8	HDG	
	552719	FBC-S-38/23-M16x40-8.8-HDG	M16	40	8.8	HDG	
	552720	FBC-S-38/23-M16x60-8.8-HDG	M16	60	8.8	HDG	
	552721	FBC-S-38/23-M16x100-8.8-HDG	M16	100	8.8	HDG	

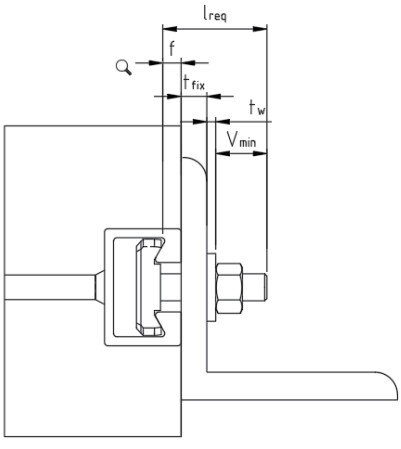
Channel Bolt Design Resistance

Design Resistence						
Product Profile	**Strength Class**	**Load Capacity**	**M10**	**M12**	**M16**	**M20**
FBC-S-29/20	Steel Grade: 8.8	$N_{Rd,s}$ [kN]		32.3		
		$V_{Rd,s}$ [kN]		27.0		
		$MO_{Rd,s}$ [Nm]		83.8		
FBC-S-38/23	Steel Grade: 8.8	$N_{Rd,s}$ [kN]		44.9	47.7	
		$V_{Rd,s}$ [kN]		27.0	50.2	
		$MO_{Rd,s}$ [Nm]		83.8	213.1	
FBC-40/22	Steel Grade: 8.8	$N_{Rd,s}$ [kN]	30.9	36.7	54.8	
		$V_{Rd,s}$ [kN]	18.6	27.0	50.2	
		$MO_{Rd,s}$ [Nm]	47.8	83.8	213.1	
FBC-50/30	Steel Grade: 8.8	$N_{Rd,s}$ [kN]	30.9	44.9	64.3	84.8
		$V_{Rd,s}$ [kN]	18.6	27.0	50.2	78.4
		$MO_{Rd,s}$ [Nm]	47.8	83.8	213.1	415.4
FBC-N-50/30	Steel Grade: 8.8	$N_{Rd,s}$ [kN]				95.0
		$V_{Rd,s}$ [kN]				78.4
		$MO_{Rd,s}$ [Nm]				415.4

The above table shows the design resistance of fischer Channel Bolts with different thread diameters and product profiles

$N_{Rd,s}$ is the resistance against tension loads, $V_{Rd,s}$ is the load capacity in terms of shear loads and $M_{Rd,s}$ is the flexural resistance when subjected to transverse load induced with a cantilever.

Channel Bolt Installation Parameter



V_{min} /Size	
Channel Bolt Thread	V_{min} [mm]
M10	14.5
M12	17.0
M16	20.5
M20	26.0

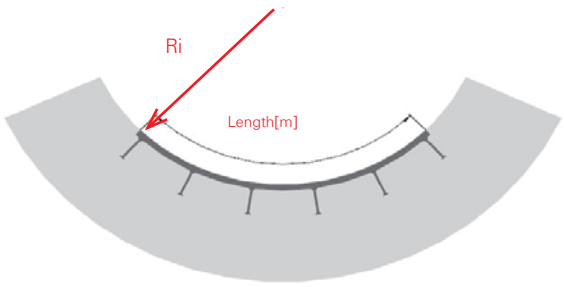
Cast-in Channel System Lip Thickness f	
Profile	Thickness [mm]
29/20	5.2
38/23	6.0
40/22	6.2
50/30	8.1
52/34	11.5

- l_{req} = required bolt length
- t_{fix} = thickness of clamped component
- f = profile lip thinkness
- t_w = washer thickness
- v_{min} = nut height EN ISO 4032 + overhang approximately 5 mm (for M20: 7 mm)

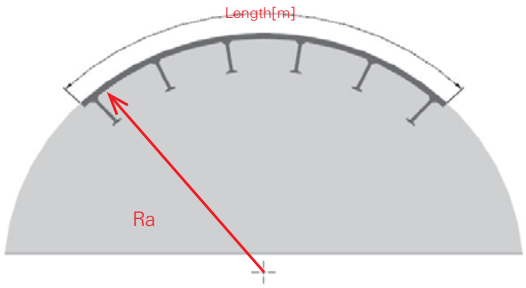
Curved Cast-in Channel System

- For those high-demanding applications like tunnel construction, reinforced concrete utility tunnels, curved walls or sewage plants, fischer also provides curved Cast-in Channel System products as customized solution to meet your specific requirements. fischer also provides customized solution to meet you tailored needs in specific applications. These type of special products include curved channel, channel with rebar and etc.

Channel Inward Installation

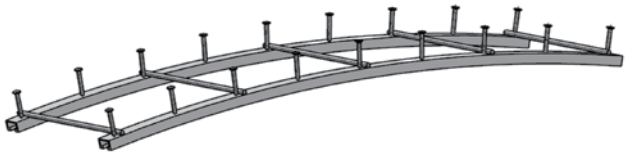


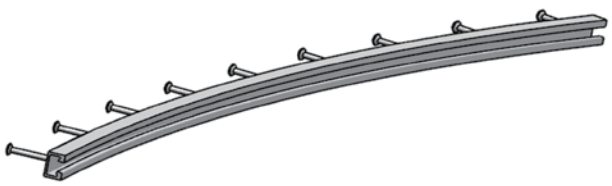
Channel Outward Installation



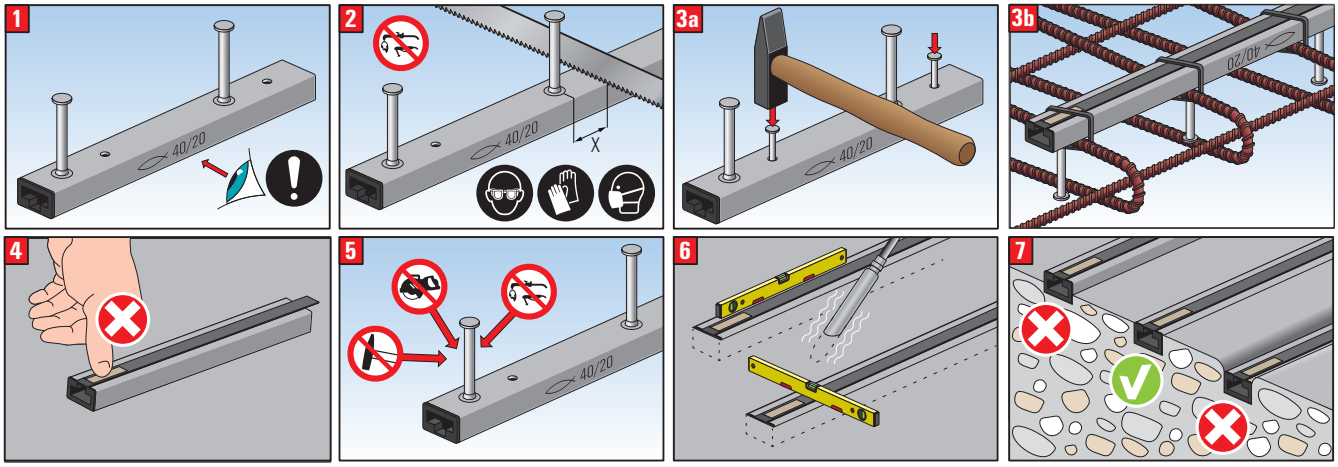
Minimum recommended bending radius for all materials

Profile	Non-serrated hot-rolled			Serrated hot-rolled	
	40/22	50/30	52/34	29/20	38/23
Ri min [m]	0.80	0.80	0.80	0.55	0.70
Ra min [m]	2.10	2.10	3.60	1.80	2.10
Length min [m]	1.50	1.50	1.50	0.50	0.50
Length max [m]	5.80	5.80	5.80	5.80	5.80



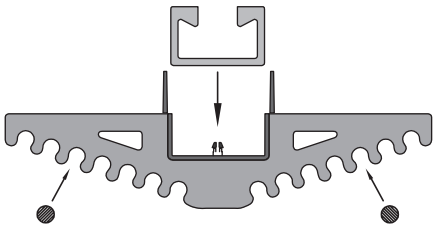


Installation of Channel

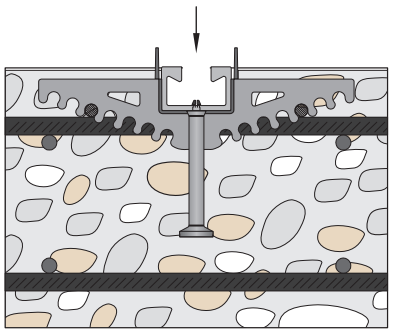


X	
25 - 35 mm	S - 29/20 S -38/23 40/22 50/30 I - 50/30 I - 52/34
35 mm	52/34

Top Application Installation

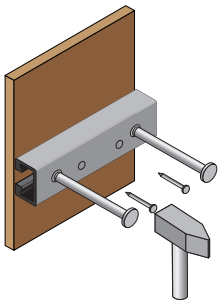


Attach the Cast-in Channel
to the plastic clip

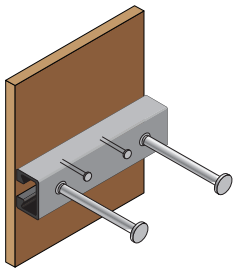


Attach the clip to the rebar

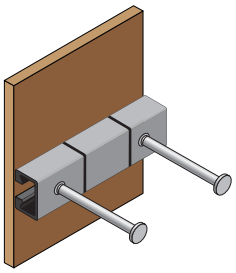
Side And Bottom Application Installation



A. Nails Fixing

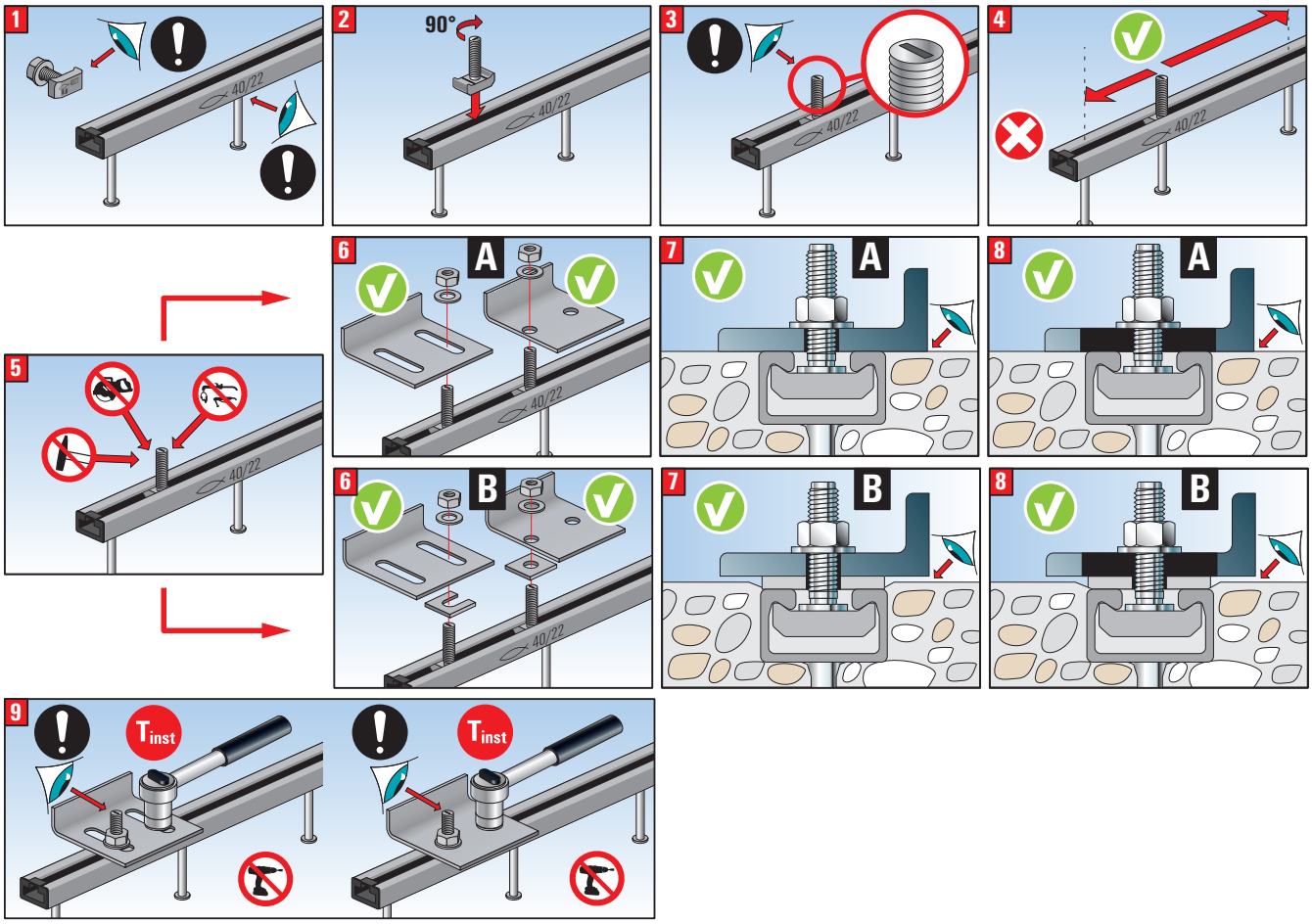


B. Self drilling screws Fixing



C. Clamps Fixing

Installation of Channel Bolt



Required installation torque T_{inst}			
fischer Channel Bolt FBC		T_{inst} [Nm]	
Channel Bolt Profile	Thread Size	Gerneral (A) $T_{inst,g}$	Steel - steel contact (B) $T_{inst,s}$
S-29/20	M12	80	80
S-38/23	M12	80	80
	M16	100	100
40/22	M10	15	30
	M12	25	45
	M16	50	100
50/30	M10	15	30
	M12	25	45
	M16	60	100
	M20	75	230
N-50/30	M20	-	400

Minimum Edge Distances And Minimum Bolt Spacing

- The installation of the Cast-in Channel System and the Channel bolt must fit the requirements for the edge spacing, because of danger of concrete splitting due to installation
- The value of edge spacing is related to channel profile and the spacing of Channel bolt is related to bolt sizes
- According to EOTA standards, the spacing between Channel bolt must fit the requirement that it is five times of the bolt' s diameter, otherwise there will be loss in force value

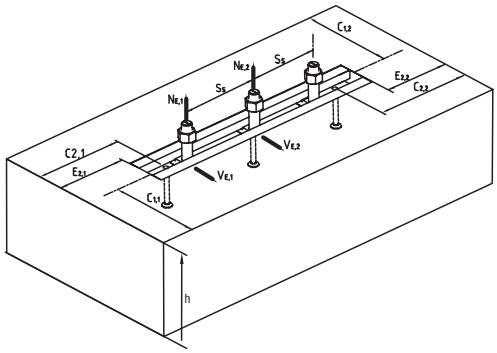
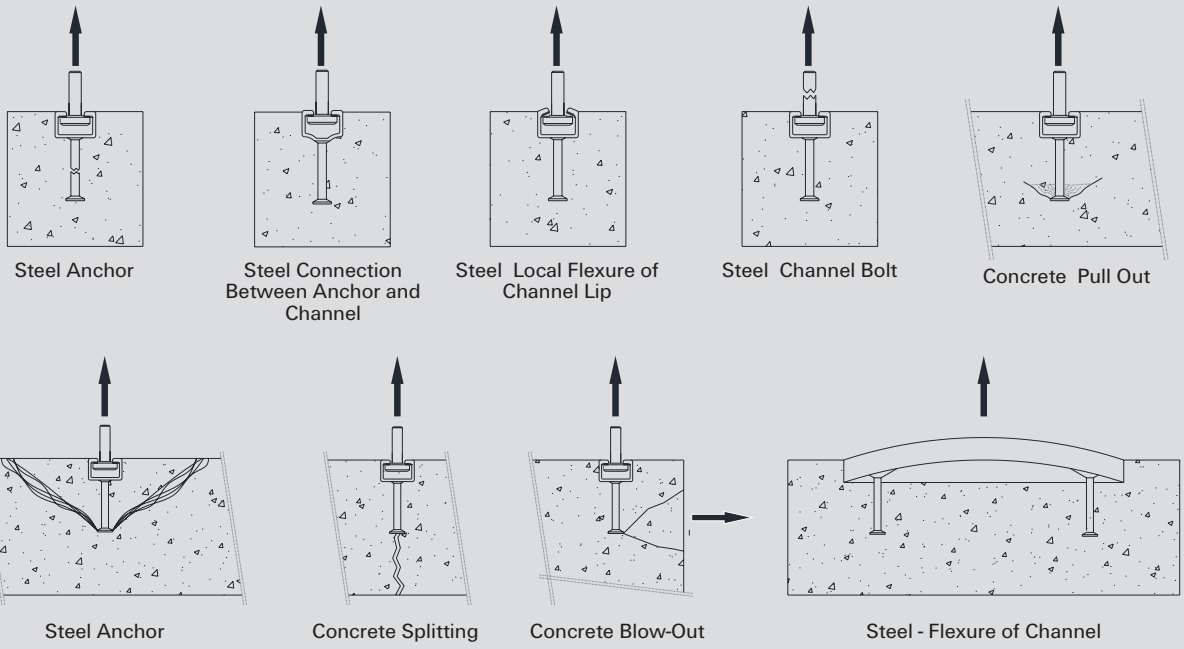


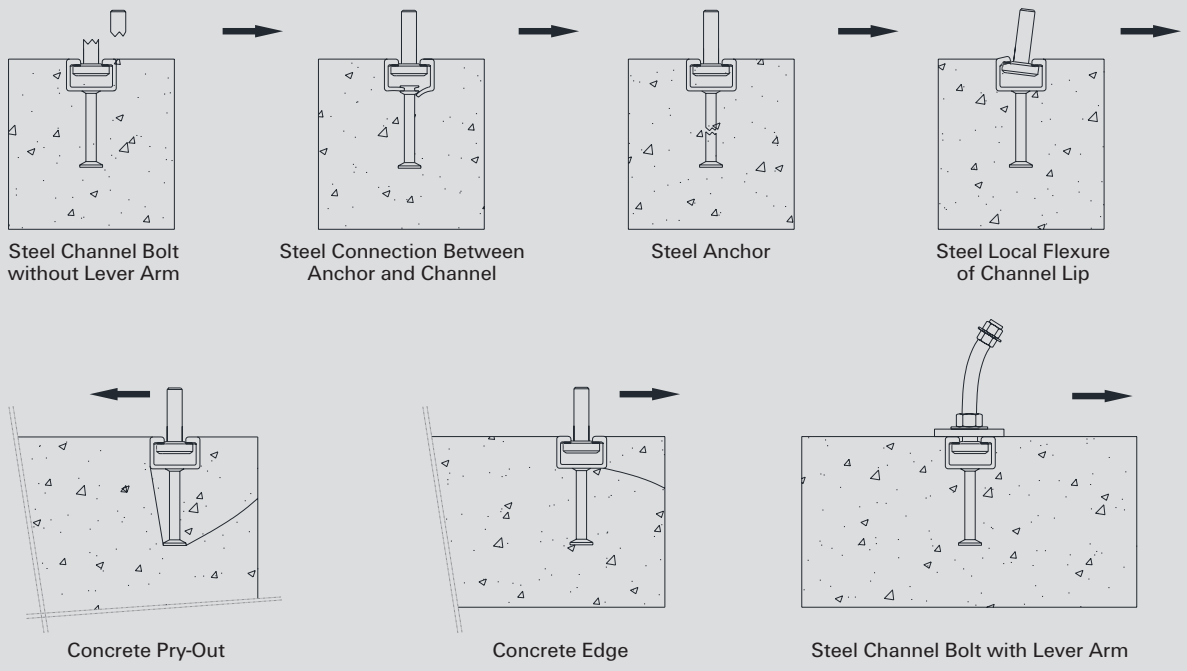
Figure: Minimal edge and Bolt spacings

Edge and Bolt Spacing							
Profile			Thread [M]	Min spacing Ss,min [mm]	Min.edge sapcing C1,min [mm]	Min.edge spacing C2,min [mm]	Min.end spacing e,min [mm]
Cold-formed		28/15	8	40	40	40	15
			10	50	40	40	15
			12	60	40	40	15
		38/17	10	50	50	50	25
			12	60	50	50	25
			16	80	50	50	25
		40/25	12	60	50	50	25
			16	80	50	50	25
		49/30	12	60	75	75	50
			16	80	75	75	50
			20	100	75	75	50
		54/33	12	60	100	100	75
			16	80	100	100	75
			20	100	100	100	75
Hot-rolled	Non-serrated round anchor	40/22	12	60	50	50	25
			16	80	50	50	25
		50/30	12	60	75	75	50
			16	80	75	75	50
			20	100	75	75	50
		52/34	12	60	100	100	65
			16	80	100	100	65
			20	100	100	100	65
	Non-serrated I anchor	40/22	12	60	50	50	25
			16	80	50	50	25
		50/30	12	60	75	75	50
			16	80	75	75	50
			20	100	75	75	50
		52/34	12	60	100	100	75
			16	80	100	100	75
			20	100	100	100	75
	Serrated round anchor	29/20	12	60	75	75	50
		38/23	12	60	100	100	75
			16	80	100	100	75

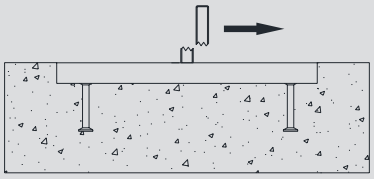
Under Tension Load



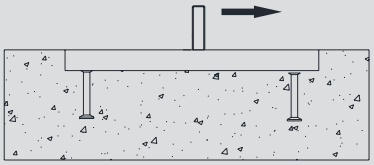
Under Shear Load Acting Transverse to the Longitudinal Channel Axis



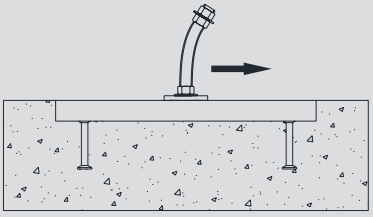
Under Shear Load Acting Parallel to the Longitudinal Channel Axis



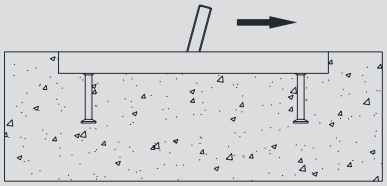
Steel Channel Bolt without Lever Arm



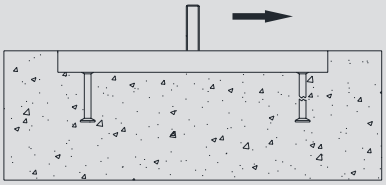
Steel Connection Between Anchor and Channel



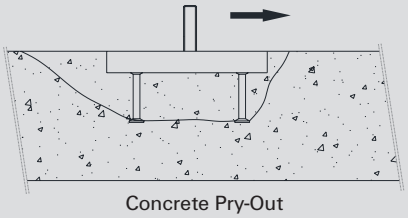
Steel Channel Bolt with Lever Arm



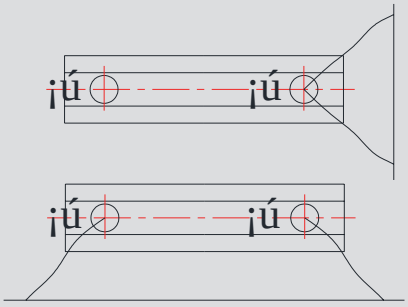
Steel Connection Between Channel and Channel Bolt



Steel Anchor

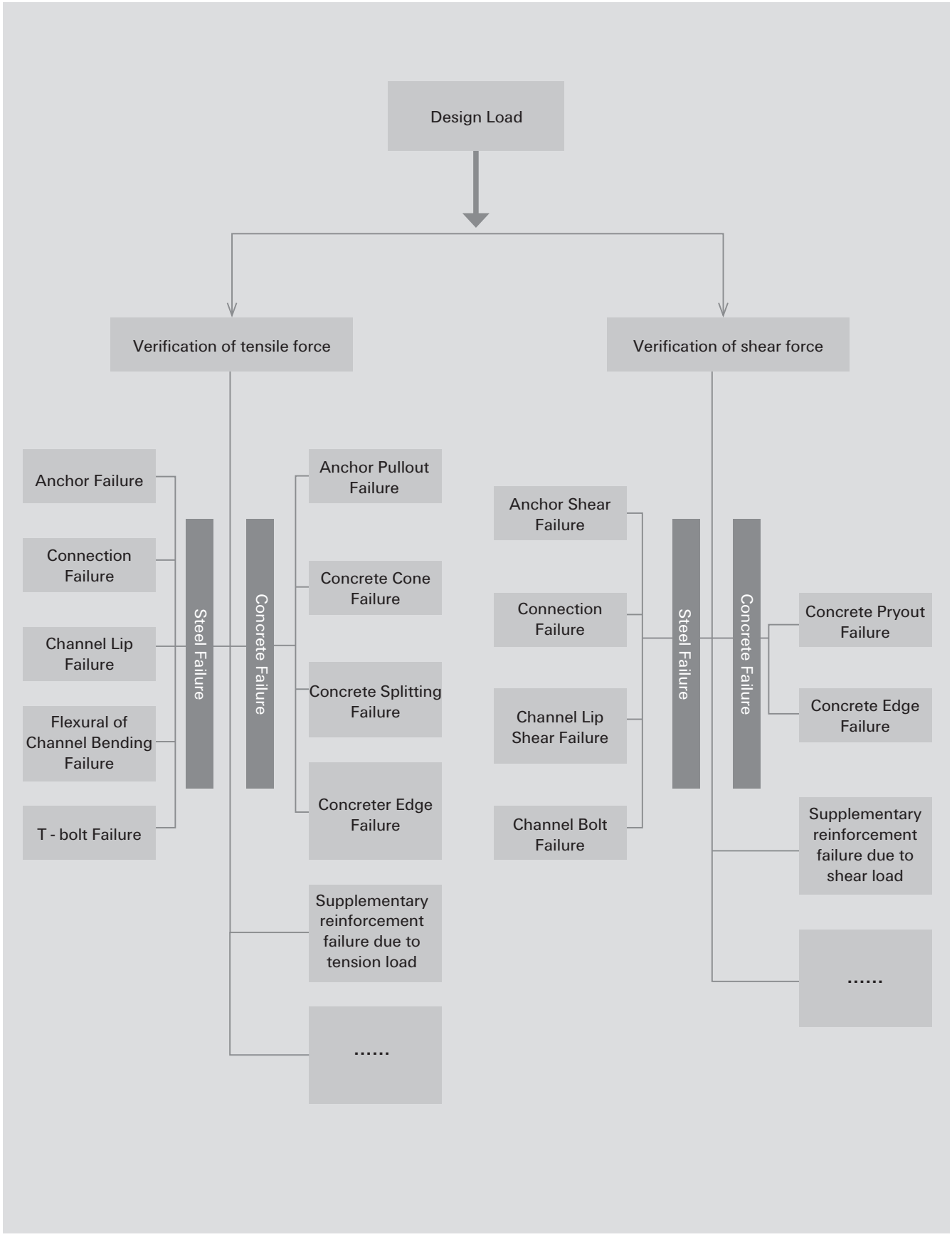


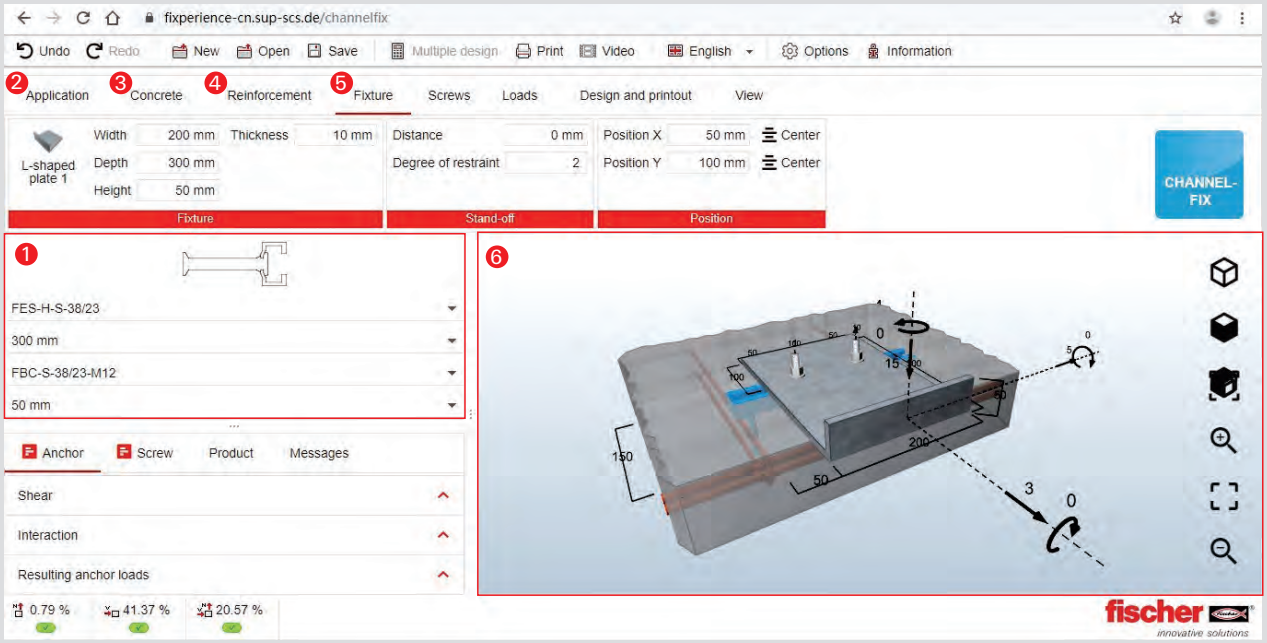
Concrete Pry-Out



Concrete Edge

Software Calculation Methodology/Process





1 **Channel system selection**

2 **Application**

- Top of slab
- Front of slab

3 **Concrete**

- Concrete grade
- Concrete condition
- Concrete thickness
- Concrete cover
- Concrete chamfer

4 **Reinforcement**

- Area reinforcement
- Tensile reinforcement
- Shear reinforcement
- Reinforcement to control splitting

5 **Fixture**

- Simple fixture
- Rectangular plate
- Round plate
- L-shared plates
- PI - shaped plate

6 **Graphics**

- The 3D graphical interactive interface helps to simulate according to the parameter inputs. The display function supports rotation, zoom-in/out and other dynamic operation

- The fischer Cast-in Channel System software embedded with multiple application expertise fea tures friendly and reliable execution of verification for anchor channel cast in concrete structure, allowing you to model accurately and optimize about your specific fastening scenario.
- A variety of base materials, supplementary reinforcement, and loads can be applied. Ad ditionally, different types of base plates and pre-defined brackets can be modeled. Results can be easily optimizedand
- PDF reports can be generated in detailed or brief form for easy to follow verification including design formulas.

Calculation Examples for Cast-in Channel System in Curtain Walls

CHANNEL-FIX Online
Database version
X.XX.X.X
Date
XX.XX.XXXX

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New Project

Design specifications

Anchor channel system

Anchor channel: FES-H-I-50/30-300-HDG
Channel bolt: FBC-50/30-

Input data

Design method: EN 1992-4
Application: Front of Sla
Concrete: C25/30 Crac
Concrete thi
Concrete co

Area reinforcement: None
Tensile reinforcement: None
Shear reinforcement: None
Reinforcement to control splitting: Yes

Fixture: PI-Shaped F
Width = 200
Depth = 200
Top protrusi

Channel bolt distance from left of bracket edge: Channel bolt 1, 2

Sliding Area: Full sliding a

Stand-off installation: distance = 0

Load Position: Distance fro
Distance fro
Distance fro

Load #	Loading type	Load type
1	Static or quasi-static	Design load

Overall Utilisation:

All Proofs are Okay.

The input values and the
Please respect

userId

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Database version
X.XX.X.X
Date
XX.XX.XXXX

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Steel failure channel bolt tension

$N_{Ed}^{cb} \le N_{Rd,s} = N_{Rk,s}/\gamma_{Ms}$

$N_{Rk,s}$	γ_{Ms}	$N_{Rd,s}$	N^{ch}_{Ed}	$\beta_{N,s}$
142.5 kN	1.50	95 kN	13.88kN	14.59 %

Concrete failure pull-out tension

$N_{Ed}^{a} \le N_{Rd,p} = N_{Rk,p}/\gamma_{Mp}$

$N_{Rk,p} = N^{0}_{Rk,p} \cdot \psi_c = 33.8\text{kN} \cdot 2.08 = 7$

$N_{Rk,p}$	γ_{Mp}
70.3 kN	1.50

Concrete failure breakout tension

$N_{Ed}^{a} \le N_{Rd,c} = N_{Rk,c}/\gamma_{Mc}$

$N_{Rk,c} = N^{a}_{Rk,c} \cdot \psi_{ch,s,N} \cdot \psi_{ch,e,N} \cdot \psi_{ch,s,N}$

$N^{a}_{Rk,c} = k_1 \cdot \sqrt{f_{ck}} \cdot h_{ef}^{1.5} = 8.1 \cdot \sqrt{25}M$

$N_{Rk,c}$	γ_{Mc}
32.48 kN	1.50

Resistance to shear loads

Proof
Steel failure anchor X shear
Steel failure anchor Y shear
Steel failure anchor Y shear
Steel failure connection between anchor and chan
Steel failure connection between anchor and chan
Steel failure connection between anchor and chan
Steel failure channel lip X shear
Steel failure local flexure channel lip Y shear
Steel failure local flexure channel lip Y shear
Steel failure channel bolt shear
Concrete failure pry out X shear
Concrete failure pry out Y shear
Concrete failure edge c... X shear

(1) for actual $V_{Rd,y} > N_{Rd}$
(2) take $V_{Rd,y} = N_{Rd}$

The input values and the
Please respect

userId

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Database version
X.XX.X.X
Date
XX.XX.XXXX

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New Project

Resistance to combined tensile and shear loads

Interaction anchor and connection between anchor and channel steel [2]

$\beta_N = 74.74\%$
$\beta_{Vx} = 18.75\%$
$\beta_{Vy} = 16.74\%$

$(\beta_N)^{2.00} + (\beta_{Vy})^{2.00} \le (1-\beta_{Vx})^{1.00} ; (0.75)^{2.00} + (0.17)^{2.00} \le (1-0.19)^{2.00}$

(2) take VRd,y =NRd

Interaction Channel lip[2]

$\beta_N = 58.03\%$
$\beta_{Vy} = 33.69\%$
$\beta_{Vx} = 12.56\%$

$(\beta_N)^{2.00} + (\beta_{Vy})^{2.00} \le (1-\beta_{Vx})^{1.00} ; (0.58)^{2.00} + (0.13)^{2.00} \le (1-0.34)^{2.00}$

(2) take VRd,y =NRd

Interaction concrete

$\beta_N = 76.71\%$
$\beta_{Vx} = 14.13\%$
$\beta_{Vy} = 8.59\%$

$(\beta_N)^{1.50} + (\beta_{Vx})^{1.50} + (\beta_{Vy})^{1.50} = (0.77)^{1.50} + (0.14)^{1.50} + (0.09)^{1.50} \le 1$

Interaction Channel bolt

$\beta_N = 14.59\%$
$\beta_V = 4.98\%$

$(\beta_N)^{2.00} + (\beta_V)^{2.00} = (0.15)^{2.00} + (0.05)^{2.00} \le 1$

Proof successful

The input values and the design results should be checked against local valid standards and approvals.
Please respect the disclaimer of warranty in the license agreement of the Software.

userId

Page 6

Conclusion: the verification passed, the chosen product fits the application requirements

Notes

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