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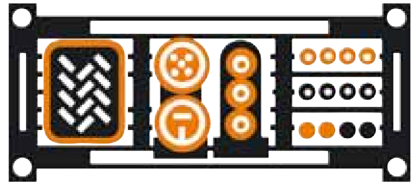

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igus®.de
plastics for longer life®

Chainflex® Special Cables for Energy Chains®

8.2006

Subject to technical alterations! MAT0070582.2 Stand 08/2006

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Chainflex® Cables ... igus® ... 8.06 ...

Definition of the icons used in the catalogue

Control Cables

Bus-/Data Cables

Servo Cables

Motor Cables

Technical Information

Strain Relief Devices

Page side margin

The pictograms arranged on the side in the chapter show where you are at the moment. The arrows point toward the various Chainflex® cables and additional chapters.

Approvals:

VERBAND DEUTSCHER ELEKTROTECHNIKER

UNDERWRITERS LABORATORIES INC.

UNDERWRITERS LABORATORIES INC.

CANADIAN STANDARDS ASSOCIATION

COMMISSION ÉLECTROTECHNIQUE INTERNATIONALE

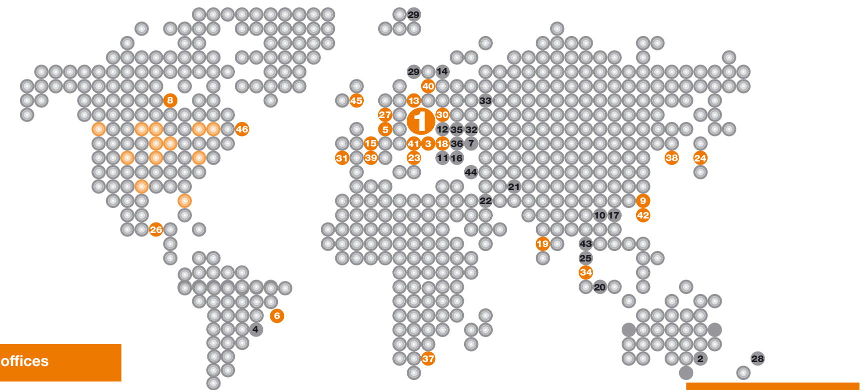
CUSTOMER EQUITY

DEZENTRALE UND STANDARDISIERTE INSTALLATIONSTECHNIK

Economy Line	Energy Chain® cable for light and medium stressing capacity, preferred for unsupported applications.
High Class Line	Energy Chain® cable for high stressing capacity, for unsupported and gliding applications up to 100 m distance of travel.
Premium Line	Energy Chain® cable for maximum stressing capacity, for unsupported and gliding applications exceeding 100 m distance of travel.

User information

Since our products are constantly being developed further in the interest of our customers, we reserve the right to make technical alterations at any time. With the issue of this catalog, all previous publications lose their validity. Subject to printing errors. The terms "igus", "ReadyChain", "Chainflex", "E-Chain Systems", "Energy Chain", "Energy Chain Systems", "E-Ketten", "E-KettenSysteme", "Flizz", "plastics for longer life", "iglidur", "DryLin" and "Polysorb" are legally protected trademarks in the Federal Republic of Germany and in case also in foreign countries.



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Stand: 24.07.2006 – EK+GL

Definition of the icons used in the catalogue

[°C] Temperature range moved

[°C] Temperature range fixed

[V] v max. unsupported/gliding

[a] a max.

UV-resistant

Nominal voltage

Testing voltage

Oil

Flame-retardant

Silicon-free

Halogen-free

Lead free

Conductor

Fibre Cables

Core insulation

Core identification

Core stranding

Inner sheath

Intermediate sheath

Element shield

Element jacket

Overall shield

Outer jacket

Outer jacket

VDE

UL

UL/CSA

CSA

CEI

CE

DESINA

Chainflex® types

	Chainflex® cable	Jacket	Shield	Bending radius, moved [factor x d]	Temperature, moved from/to [°C]	Bending radius, fixed [factor x d]	Temperature, fixed from/to [°C]	Price index
Control cables								
	CF130.UL	PVC		7,5-10	-5/ +70	5	-20/ +70	◐○○
	CF140.UL	PVC	✔	7,5-15	-5/ +70	7,5	-20/ +70	◐○○
	CF5	PVC		6,8-7,5	-5/ +70	4	-20/ +70	●○○
	CF6	PVC	✔	6,8-7,5	-5/ +70	4	-20/ +70	●○○
	CF170.D	PUR		7,5-10	-35/ +80	5	-40/ +80	◐○○
	CF180	PUR	✔	7,5-15	-35/ +80	5	-40/ +80	◐○○
	CF7	PUR		6,8-7,5	-20/ +80	4	-40/ +80	●◐○
	CF7.D	PUR		6,8-7,5	-20/ +80	4	-40/ +80	●◐○
	CF8	PUR	✔	6,8-7,5	-20/ +80	4	-40/ +80	●◐○
	CF2	PUR	✔	5	-20/ +80	4	-40/ +80	●●○
	CF9	TPE		5	-35/ +100	3	-40/ +100	●●◐
	CF10	TPE	✔	5	-35/ +100	3	-40/ +100	●●◐
	CF98	TPE		4	-35/ +90	3	-40/ +90	●●◐
	CF99	TPE	✔	4	-35/ +90	3	-40/ +90	●●◐

These values are based on concrete applications or tests. These values do not represent the limit of what is technically feasible.

Table of contents according to part number ► Page 282

Chainflex® types

Approvals and standards	Flame-retardant	Oil-resistant	Halogen-free	Torsion resistant	V max. unsupported [m/s]	V max. gliding [m/s]	a max. [m/s²]	Number of conductors	Cross section Ø [mm²]	Page
										36
	✔			✔	3	2	20	2 - 25	0,25 - 6,0	38
	✔				3	2	20	3 - 36	0,25 - 2,5	42
	✔	✔		✔	10	5	80	2 - 42	0,25 - 6,0	46
	✔	✔			10	5	80	3 - 25	0,25 - 2,5	50
		✔	✔	✔	3	2	20	3 - 30	0,5 - 10,0	54
		✔	✔		3	2	20	3 - 25	0,75 - 2,5	56
	✔	✔		✔	10	5	80	3 - 36	0,25 - 2,5	58
	✔	✔		✔	10	5	80	3 - 25	0,75 - 1,5	60
	✔	✔			10	5	80	3 - 24	0,5 - 2,5	62
	✔	✔			10	5	80	3 - 48	0,14 - 1,5	64
		✔	✔	✔	10	6	100	2 - 36	0,25 - 35,0	68
		✔	✔		10	6	100	2 - 25	0,14 - 4,0	72
		✔	✔	✔	10	6	100	2 - 7	0,14 - 0,34	76
		✔	✔		10	6	100	2 - 7	0,14 - 0,34	78

Chainflex® types mentioned in the catalogue as “resistant to bio oil“ have been tested by DEA according to VMDA 24568 with Plantocut 8 S-MB.

Table of contents according to part number ► Page 282

Control cables

Bus-, Data cables

Servo cables

Power cables

Technical informa-tionen

Strain Relief

UL, CSA, CEI, CE and DESINA

Many Chainflex® cables possess these certificates. **UL material certification** for igumid materials with Energy Chains® and energy tubes. **CE mark** for all Chainflex® cables. Many Chainflex®-cables conform to **DESINA** specifications.

Chainflex® types

	Chainflex® Cable	Jacket	Shield	Bending radius, moved [factor x d]	Temperature, moved from/to [°C]	Bending radius, fixed [factor x d]	Temperature, fixed from/to [°C]	Price index
Data cables								
	CF240	PVC	✔	10-12	-5/ +70	5	-20/ +70	◐○○
	CF211	PVC	✔	10	-5/ +70	5	-20/ +70	◐○○
	CF11	TPE	✔	10	-35/ +100	5	-40/ +100	●●○
	CF12	TPE	✔	10	-35/ +100	5	-40/ +100	●●◐
Bus cables (with selection chart for Chainflex® bus cables)								
	CFBUS	TPE	✔	10-12,5	-35/ +70	5	-40/ +70	●●○
	CF11.LC	TPE	✔	10	-35/ +70	5	-40/ +70	●●○
	CF11.LC.D	TPE	✔	10	-35/ +70	5	-40/ +70	●●○
	CF14 CAT5	TPE	✔	12,5	-35/ +70	7,5	-40/ +70	●●○
Measuring system cables								
	CF211	PVC	✔	10	-5/ +70	5	-20/ +70	◐○○
	CF111.D	TPE	✔	12	-35/ +100	6	-40/ +100	◐○○
	CF11.D	TPE	✔	10	-35/ +100	5	-40/ +100	●●○
Fibre optic cable (FOC)								
	CFLG	PVC		10	-5/ +70	5	-15/ +70	●●○
	CFLG.2HG.MF	PUR		12,5	-20/ +60	7,5	-25/ +60	●●○
	CFLK	PUR		12,5	-20/ +70	7,5	-25/ +70	●◐○
	CFLG. G.T	TPE		15	-20/ +60	8,5	-25/ +60	●●○
Koax cables								
	CF Koax 1	TPE		10	-35/ +100	7,5	-40/ +100	●●○

These values are based on concrete applications or tests. These values do not represent the limit of what is technically feasible.
Chainflex® types mentioned in the catalogue as “resistant to bio oil“ have been tested by DEA according to VMDA 24568 with Plantocut 8 S-MB.

Table of contents according to part number ► Page 282

Chainflex® types

Approvals and standards	Flame-retardant	Oil-resistant	Halogen-free	Torsion resistant	V max. unsupported [m/s]	V max. gliding [m/s]	a max. [m/s²]	Number of conductors	Cross section Ø [mm²]	Page
										80
	✔	✔			3	2	20	3 - 24	0,14 - 0,34	82
	✔	✔			5	3	50	2 - 28	0,25 - 0,5	84
		✔	✔		10	6	100	4 - 36	0,14 - 2,5	86
		✔	✔		10	6	100	6 - 28	0,25 - 1,0	88
										90
	✔	✔			10	6	100	2 - 10	0,14 - 1,0	92
		✔	✔		10	6	100	2 - 4	0,5	96
		✔	✔		10	6	100	2 - 6	0,25 - 1,5	98
		✔	✔		10	6	100	4 - 10	0,25	100
	✔	✔			5	3	50	6 - 16	0,14 -1,0	102
	✔	✔			2		30	12 - 16	0,14 - 0,5	106
		✔	✔		10	6	100	6 - 17	0,14 - 1,0	110
	✔	✔			10	5	20	4	200/230 µm	114
		✔	✔		10	6	20	2	50 + 62,5/125 µm	116
	✔	✔			10	5	20	1	980/1000 µm	118
		✔	v		10	6	20	6 - 12	50 + 62,5/125 µm	120
		✔	✔		10	5	100	1 - 5		122

Control cables

Bus-, Data cables

Servo cables

Power cables

Technical informa-tionen

Strain Relief

UL, CSA, CEI, CE and DESINA

Many Chainflex® cables possess these certificates. **UL material certification** for igumid materials with Energy Chains® and energy tubes. **CE mark** for all Chainflex® cables. Many Chainflex®-cables conform to **DESINA** specifications.

Chainflex® types

	Chainflex® Cable	Jacket	Shield	Bending radius, moved [factor x d]	Temperature, moved from/to [°C]	Bending radius, fixed [factor x d]	Temperature, fixed from/to [°C]	Price index
Servo cables								
	CF21.UL	PVC	✔	7,5	-5/ +70	4	-20/ +70	●○○
	CF260	PUR	✔	10	-20/ +80	5	-40/ +80	●○○
	CF27.D	PUR	✔	7,5	-20/ +80	4	-40/ +70	●◐○
Power cables								
	CF30	PVC		7,5	-5/ +70	4	-20/ +70	●○○
	CF31	PVC	✔	7,5	-5/ +70	4	-20/ +70	●○○
	CF34	TPE		7,5	-35/ +90	4	-40/ +90	●●◐
	CF35	TPE	✔	7,5	-35/ +90	4	-40/ +90	●●◐
	CF300.UL	TPE		7,5	-35/ +90	4	-40/ +90	●●○
	CFPE	TPE		7,5	-35/ +90	4	-40/ +90	●●○
	CF310.UL	TPE	✔	7,5	-35/ +90	4	-40/ +90	●●○
	CF.BRAID	TPE	✔	7,5	-35/ +70	4	-40/ +70	●●○
	CFCRANE	iguprene	✔	10	-20/ +80	7,5	-30/ +80	●●●
Pneumatic hose								
	CF.Air	PU		10	-25/ +80	5	-40/ +85	●○○

These values are based on concrete applications or tests. These values do not represent the limit of what is technically feasible.

Table of contents according to part number ► Page 282

Chainflex® types

Approvals and standards	Flame-retardant	Oil-resistant	Halogen-free	Torsion resistant	V max. unsupported [m/s]	V max. gliding [m/s]	a max. [m/s²]	Number of conductors	Cross section Ø [mm²]	Page
										124
	✔	✔			10	5	80	6 - 8	0,75 - 35 / Pairs 0,34 - 1,5	126
		✔	✔		10		50	4 - 6	1,5 - 16 / Pairs 0,5 - 1,0	130
	✔	✔	✔		10	5	80	4 - 8	0,75 - 50 / Pairs 0,5 - 1,5	132
										136
	✔	✔		✔	10	5	80	4 - 5	1,5 - 50	138
	✔	✔			10	5	80	4 - 5	1,5 - 70	140
	✔	✔		✔	10	6	80	3 - 5	1,5 - 50	142
	✔	✔			10	6	80	4	1,5 - 25	144
		✔	✔		10	6	100	1	6 - 185	146
	✔	✔			10	6	100	1	4 - 25	148
	✔	✔			10	6	100	1	4 - 185	150
	✔	✔			10	6	80	4 - 8	2,5	152
	✔	✔			10	6	50	1	25 - 95	154
		✔			10	5	50			156

Chainflex® types mentioned in the catalogue as “resistant to bio oil“ have been tested by DEA according to VMDA 24568 with Plantocut 8 S-MB.

Table of contents according to part number ► Page 282

Control cables

Bus-, Data cables

Servo cables

Power cables

Technical informa-tionen

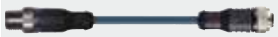
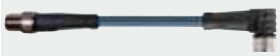
Strain Relief

UL, CSA, CEI, CE and DESINA

Many Chainflex® cables possess these certificates. **UL material certification** for igumid materials with Energy Chains® and energy tubes. **CE mark** for all Chainflex® cables. Many Chainflex®-cables conform to **DESINA** specifications.

Chainflex® harnessed

Chainflex® harnessed

	Harnessed according to standard	Cable type	Jacket	Page
Initiators CF9				
	CF.INI	Direct line M12 x 1, straight	TPE	224
	CF.INI	Direct line M12 x 1, angled	TPE	224
	CF.INI	Direct line M12 x 1, straight, LED	TPE	225
	CF.INI	Direct line M12 x 1, angled, LED	TPE	225
	CF.INI	Connection cable M12 x 1, straight	TPE	226
	CF.INI	Connection cable M12 x 1, angled	TPE	226
	CF.INI	Direct line M8 x 1, straight	TPE	227
	CF.INI	Direct line M8 x 1, angled	TPE	227
	CF.INI	Direct line M8 x 1, angled, LED	TPE	228
	CF.INI	Connection cable M8 x 1, straight	TPE	229
	CF.INI	Connection cable M8 x 1, angled, LED	TPE	229
Initiators CF98				
	CF.INI	Direct line M12 x 1, straight	TPE	230
	CF.INI	Direct line M12 x 1, angled	TPE	230
	CF.INI	Connection cable M12 x 1, straight	TPE	231
	CF.INI	Connection cable M12 x 1, angled	TPE	231
	CF.INI	Direct line M8 x 1, straight	TPE	232
	CF.INI	Direct line M8 x 1, angled	TPE	232
	CF.INI	Connection cable M8 x 1, straight	TPE	233
	CF.INI	Connection cable M8 x 1, angled	TPE	233

Chainflex® accessory

Chainflex® accessory

Chainflex® Quick Selection

DESINA-conforming	UL and/or CSA approval	PVC-free and halogen-free	Cutting and Welding Systems	Timber Processing Machines	Low-Temperature Applications	Cranes Harbor Equipment Systems Materials-Handling Technology Outdoor	Cranes Materials-Handling Technology Storage and Retrieval Units for High-Bay Warehouses Indoor	Packaging Handling Automation	Machine Tools/ Processing Machines	Page No.	
										36	CF130.UL
										40	CF140.UL
										44	CF5
										48	CF6
										52	CF170.D
										54	CF180
										56	CF7
										58	CF7.D
										60	CF8
										64	CF2
										66	CF9
										70	CF10
										74	CF98
										76	CF99
										80	CF240
										82	CF211
										84	CF11
										86	CF12
										90	CFBUS
										94	CF11.LC
										96	CF11.LC.D
										98	CF14 CAT5

Control cables

Data

Bus

Chainflex® according to Branches

Measuring System	FOC/Koax	Servo cables	Power cables	Pneu-matics

CF211	CF111.D	CF11.D	CFLG	CFLG.2HG.MF	CFLK	CFLG. G.T	CF Koax 1	CF21.UL	CF260	CF27	CF30	CF31	CF34	CF35	CF300.UL	CFPE	CF310:UL	CF.BRAID	CFCRANE	Pneumatik-schlauch
100	104	108	112	114	116	118	120	124	128	130	136	138	140	142	144	146	148	152	154	156

Chainflex® Quick Selection

Page No.



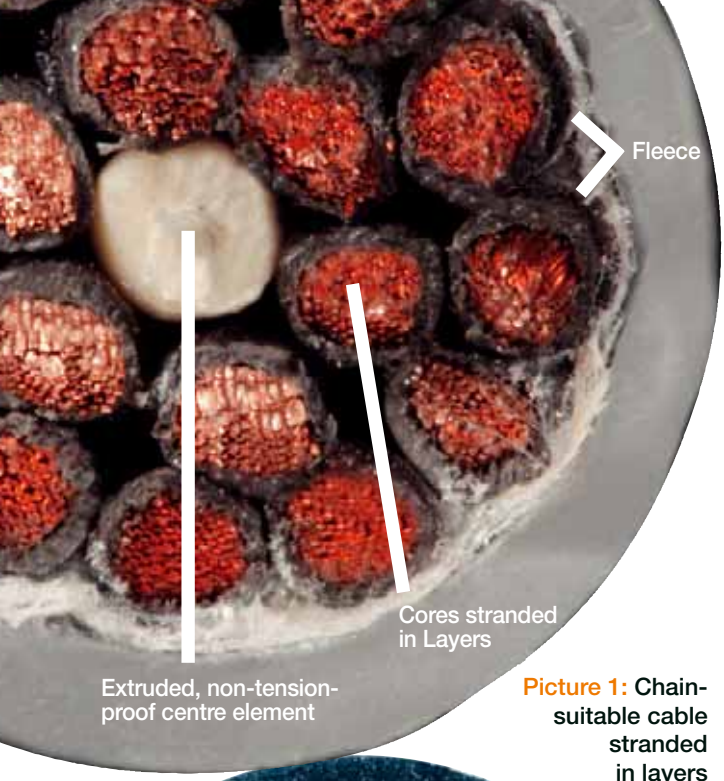




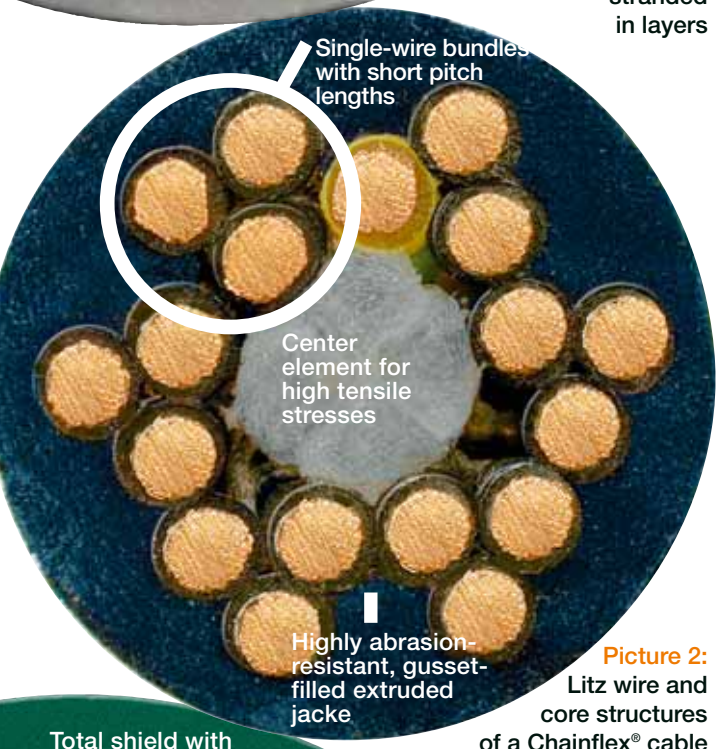



Chainflex®...

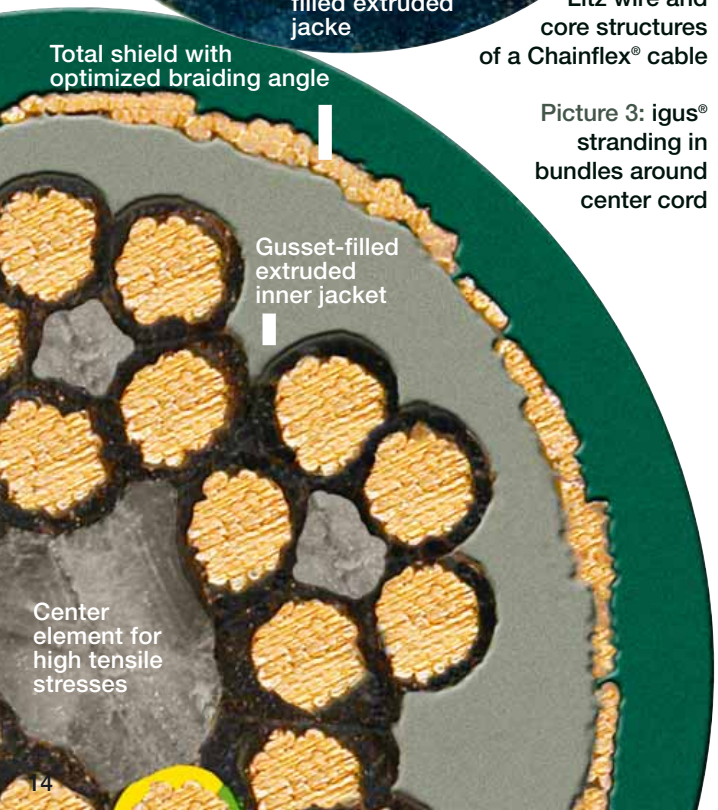
The tricks and ingenious features of...



Picture 1: Chain-suitable cable stranded in layers



Picture 2: Litz wire and core structures of a Chainflex® cable



Picture 3: igus® stranding in bundles around center cord

From the customer's point of view, a flexible energy supply system only needs to function properly. However, this demand presupposes the perfect operation of all components, including the cables being used in this system. And this is exactly where problems came up in the early 1980s. Due to constantly – and frequently even tremendously – increasing loads resulting form the application of automation technology, guided cables often failed although the energy supply system itself was functioning perfectly. In extreme cases, failures caused by "corkscrews" and core ruptures brought the entire production process to a standstill and resulted in high costs.

In order to find a solution to this unsatisfactory situation for its customers, igus® decided to take the initiative. As the first company worldwide, igus® began to develop complete Energy Chain Systems®. Chainflex® cables and Energy Chains® are now being offered as a delivery from a single source and with a system guarantee depending on the application in each case. Based on the increasing know-how gained since 1989 and on the very sophisticated series of tests that have been conducted since then, design principles were and are still being created that help prevent machine downtimes in factories throughout the world today.

How can "corkscrews" be prevented?

Here, the term "corkscrew" does not refer to a useful instrument for wine connoisseurs. Instead, it refers to the permanent deformation of guided, moved cables caused by excessive stressing – which, in most cases, results in core rupture almost immediately afterwards. How does this happen? How can "corkscrews" be prevented? An important factor here – in addition to a sensible design of the total Energy Chain System® – is the construction of the guided cables. Basically speaking, a clear distinction can be made between cables stranded in bundles and cables stranded in layers **(see picture 4).**

Properties of stranding in layers

Stranding in layers is significantly easier to produce and is therefore offered on the market in so-called "chain-suitable" cables at low cost. But what appears to be tempting at first glance can quickly turn into an expensive mistake when a "corkscrew" immobilizes the system being operated with these cables. How do these problems arise? A look at the cable structure can be quite helpful **(see picture 1).**

In the case of stranding in layers, the cable cores are mostly stranded more or less firmly and relatively long in several layers around a center and are then provided with a jacket extruded to the form of a tube. In the case of shielded cables, the cores are wrapped up with fleece or foils. But what, for example, happens to a similarly structured 12-core cable during normal operation?

The bending process compresses, in the movement of the core, the inner radius of the cable and stretches the core in the outer radius. Initially, this works quite well because the elasticity of the material is still sufficient. But very soon, material fatigue causes permanent deformations, and then, due to excursion from the specified paths, the cores make their "own compressing and stretching zones": The corkscrew is created, then followed rather quickly by core ruptures most of the time.

lasts or your money back!

...the Chainflex® design and why we feel so confident about this design

Stranding in bundles tried and tested expensively and efficiently millions of times since 1989

Stranding in bundles eliminates these problems by means of its very sophisticated, multiply stranded internal structure. Here, the litz wires are stranded with a special pitch length first and then the resulting cores are stranded into single core bundles. For large cross sections, this is done around a strain relief element. The next step is the renewed stranding of this core bundle around a tension-proof center – a genuine center cord. (see picture 2)

Due to this multiple stranding of the cores, all cores change the inner radius and the outer radius of the bent cable several times at identical spacing distances. Pulling and compressing forces balance one another around the high-tensile center cord that gives the stranded structure its necessary inner stability. Accordingly, the stranding remains stable even under maximum bending stress (see picture 3).

Picture 4: **Shielded "chain-suitable" control cable after only 400,000 to-and-fro cycles with a bending factor of 10 x d**

What are EMC problems and shield wire breakage?

In principle, cable shields must fulfil two tasks:

- Protecting the cables from external interferences
- Shielding any interferences before transmitting them to the outside

Both tasks are equally important because faulty signals can cause considerable consequential damage in the system itself as well as in any external systems. Furthermore, this is an especially problematic point due to the fact that incorrect shielding usually cannot be detected from outside, and this is something that makes the trouble-shooting procedure extremely difficult. How can these kinds of problems arise in the first place?
Once again, the answer is to be found in the internal structure of the cable itself: Is the shielding designed for the movements of the cable? Although it may be very easy to shield a fixed cable, it is much more difficult to guarantee the permanent shielding of a moving cable.

In the case of so-called "chain-suitable" cables, for example, the stranding bond of an intermediate layer is wrapped up with foils or fleeces. This stranding bond is supposed to guarantee the separation between the cores and the shield braid. But something that functions quite well for the fixed installation of cables is often quite insufficient in the case of moving cables. This has to do with the fact that the foils and fleeces do not create a bond between the stranding, shield and jacket and may fall

Dictionary of defects

Core rupture

Failure of electric conductivity due to broken copper wires as a result of subjecting the individual cores to mechanical overload/ tensile load under constant bending stress. In most cases, the causes are incorrect litz wires and/or incorrect stranding pitch directions and lengths.

Insulation damage

Short circuits due to damage to the insulation above the conductor. The cause can be material fatigue under constant bending stress or material abrasion within the stranded structure. Single-wire breakage of the conductor or the shield braid result in perforation of the insulation.

Corkscrew

An externally detectable screw-like deformation of the entire cable due to broken copper wires as the result of subjecting the individual cores to mechanical overload/ tensile load during the bending process. In most cases, the causes are unfavorable superstructure properties (stranding in layers, missing center, loose jackets extruded to the form of a "tube") and subjecting the cables to high bending stress.

Jacket abrasion

The jacket is rubbed off down to the stranding or down to the total shield. In most cases, the causes are incorrect selection of materials and/or unfavorable extrusion processes resulting in detrimental surface properties so that abrasion is an unavoidable effect.

Jacket swelling/ jacket breakage

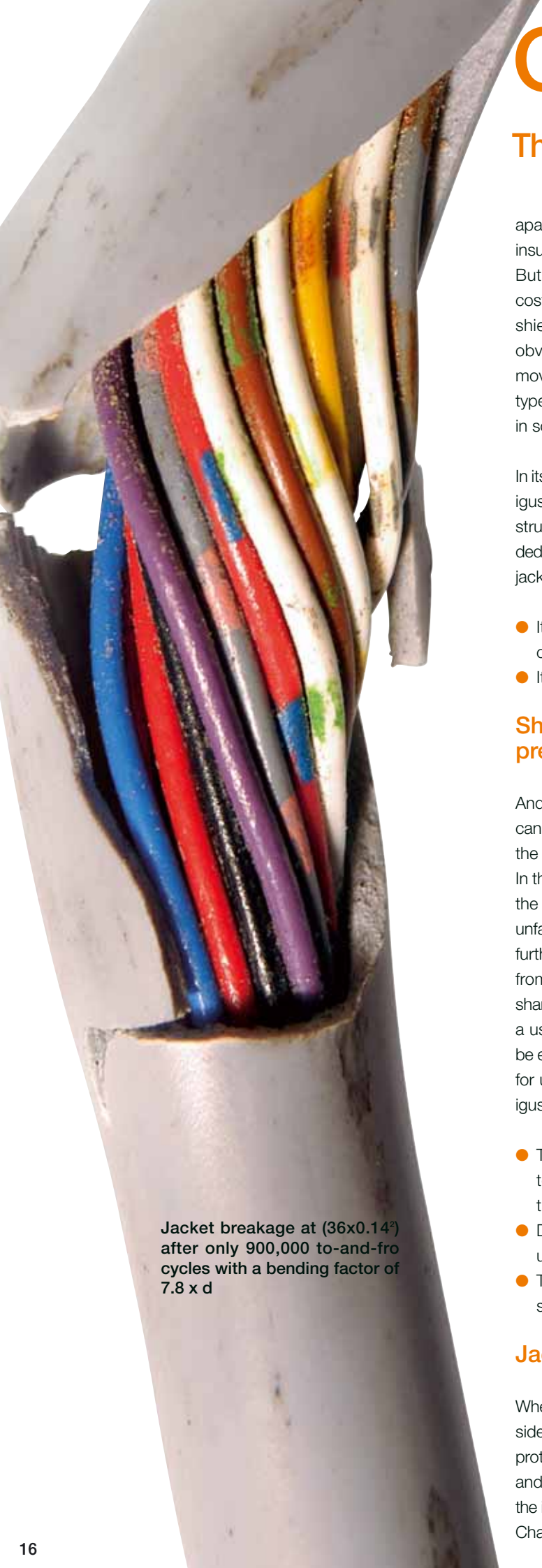
Jacket becomes soft and deformed or breaks until the stranding/shield can be seen. The cause can be the incorrect selection of materials with respect to the oils or other chemical substances being used.

Shielding losses/ EMC problems

Electromagnetic interferences inside or outside an electric cable. In most cases, the cause is shield wire breakage due to mechanical overload with incorrect shield braid angles. Other causes include loose braids over foils without supporting effects or very open coverings.

Chainflex®...

The tricks and ingenious features of...



Jacket breakage at (36x0.14²) after only 900,000 to-and-fro cycles with a bending factor of 7.8 x d

apart under stress. Consequently, the metallic shield then rubs on the insulation of the cores – short circuits are then to be expected.
But the production of the shield itself is very time-consuming and cost-intensive and may have been the reason for the use of open braid shields or even simple wire wrappings. The disadvantages are quite obvious: Open shields only possess a limited shielding effect in their moved state – motion and expansion reduce this effect even further. The type of shield is therefore an important point that is not even mentioned in some catalogues.

In its up to approx. 70% linearly and approx. 90% optically covered cables, igus® eliminates these weak points by means of an optimized internal structure. In virtually all shielded Chainflex® cables, a gusset-filled extruded inner jacket over the stranded structure is therefore used. This "second jacket" fulfils two tasks:

- It holds the stranded structure together and guides the individual cores as in a channel.
- It serves as a firm, round base for a very tight-fitting shield.

Shield wire breakage – and how this can be prevented

And even during the production of the shield, there are many things that can be done correctly – or incorrectly. Here, an important parameter is the braiding angle.
In the case of "chain-suitable" cables, a tensile load of the shield wires in the outer radius of the cable must usually be taken into account. If an unfavorable braiding angle is to be added, the tensile load increases even further and shield wire breakage is the result. The consequences range from reduced shielding effects right up to short circuits whenever the sharp wire ends penetrate through the fleeces or foils into the cores. Here, a useful tip: If, after the insulation has been stripped off, the shield can be easily pushed back over the jacket, the shield is then usually unsuitable for use in moved flexible energy supply systems! This is a problem that igus® has now solved with its direct approach:

- The shield braiding angle determined in long-term tests efficiently neutralizes the tensile forces and is therefore highly suitable for Energy Chains®.
- Due to the stable inner jacket, the shield cannot wander uncontrolled.
- The shield itself has a torsion protection effect on the stranded structure.

Jacket abrasion/ jacket breakage

Whereas defects in the internal structure are hardly detectable on the outside, jacket problems strike the eye immediately. The jacket is the first protection for the complicated internal structure. This is why broken, worn and swollen jackets are a serious quality defect. To prevent this problem, the igus® customer can select among 7 acket materials to adapt his Energy Chain® cables to suit the conditions of the respective environment.

lasts or your money back!

...the Chainflex® design and why we feel so confident about this design

Gusset-filled extruded jacket

Here, not only the material is an important factor but also the production process. In the case of the so-called "chain-suitable" cables, the jackets are usually produced extruded to the form of a tube and therefore do not provide the stranded structure with the necessary support for constant bending processes. The stranded structure can fall apart.

Therefore, igus® is the first manufacturer of Energy Chain Systems® to offer the so-called the "gusset-filled extruded" jacket.

Here, the jacket material is injected between the core stranding powdered with talc and ensures that the stranded structure does not open up and also makes sure that the cores are guided as in a channel. The special characteristic of this type of production is that the intermediate spaces, which are created between the cores during the stranding process, are completely filled with jacket material by the high extrusion pressure. As a result, the jacket material creates a channel-like guide which allows the cores to carry out a defined longitudinal movement. The jacket also provides a supporting function for the stranding.

The quality bundles of igus® Chainflex® cables

- Strain-relieving center
- Stranding in bundles
- Gusset-filled extruded inner jacket in shielded cables
- Enclosed shield braid
- Optimized shield braiding angle
- Gusset-filled extruded jacket

7 basic rules for a good cable

1. Strain-relieving center

Clear space is created in the center of a cable according to the number of cores and the cross section of each cable. This center should be filled, as far as possible, with a genuine center cord (and not, as frequently the case, with fillers or dummy cores consisting of waste materials). These measures will then efficiently protect the stranded structure situated above and prevent the stranding from wandering into the middle of the cable.

2. Litz wire structure

With respect to the selection of litz wires, the maximum flexibility has proved to be the best solution. Although very flexible conductors can be made using very thin individual wires, these conductors tend toward extreme formation of kinks. Long-term series of tests provided the result of a shielded combination of single-wire diameter, pitch length and pitch direction as the best bending-resistant solution.

3. Core insulation

The insulation materials must be made so that they do not stick to one another within the cable. Furthermore, the insulation is also required to support the stranded individual wires of the conductor. Accordingly, only the highest-quality, high-pressure-extruded PVC or TPE materials that have proved their tested reliability in millions of core kilometers are then used in Energy Chain® applications.

4. Stranding

The stranded structure must be stranded around a stable, tension-proof center with an optimized short pitch length. However, due to the insulating materials being used, this stranded structure should still be defined in mobile form within the stranding. Starting from a quantity of 12 cores, however, the method of stranding in bundles should be applied.

5. Inner jacket

A gusset-filled extruded inner jacket must be used instead of inexpensive fleeces, fillers or accessory fillers. This measure ensures that the stranded structure is efficiently guided in longitudinal direction. Moreover, the stranded structure cannot fall apart or wander off.

6. Shielding

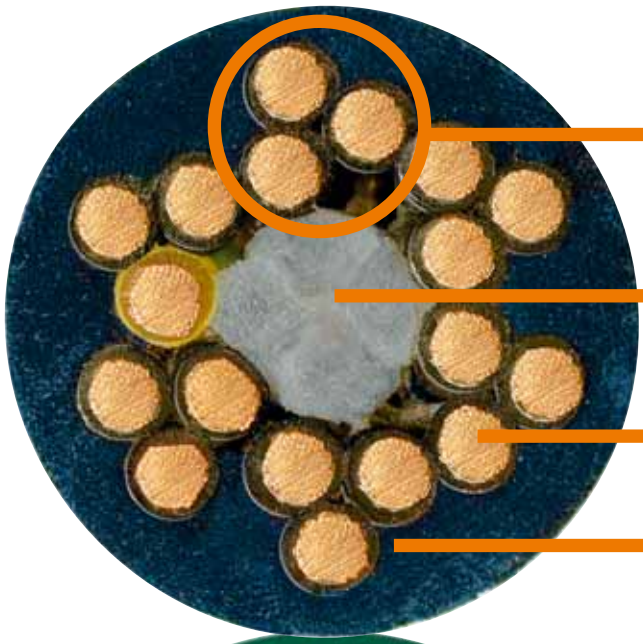
The total shield should be made tight using an optimized shield braiding angle over an extruded inner jacket. Loose open braids or wrapped stranding reduce the EMC protection considerably and can fail very quickly due to shield wire breakage. A tight total braid shield also has a torsion protection effect on the stranded structure.

7. Outer jacket

The material-optimized outer jacket can fulfil many different requirements: From UV-resistant to low-temperature-flexible, and from oil-resistant to cost-optimized. But these outer jackets must have one thing in common: A jacket material must be highly abrasion-resistant but not be allowed to stick to anything. It must be flexible but also provide a supporting function. In any case, the jacket should also be extruded under pressure (gusset-filled).

Sectional views through

Detailed structure of igus® control, data, servo and motor



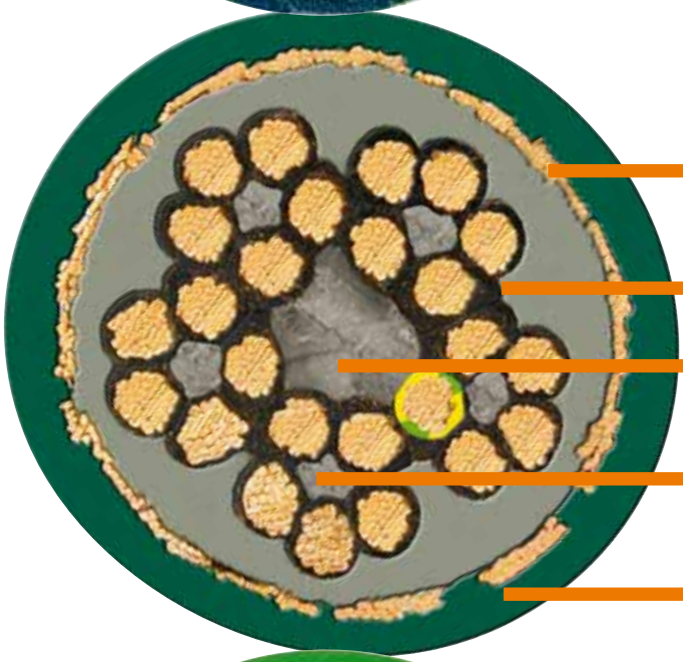
Chainflex® control cable, unshielded

Individual bundles with optimized pitch length and pitch direction

Single-wire diameter optimized for Energy Chains®

Center element for high tensile stresses

Highly abrasion-resistant, gusset-filled extruded jacket



Chainflex® control cable, shielded

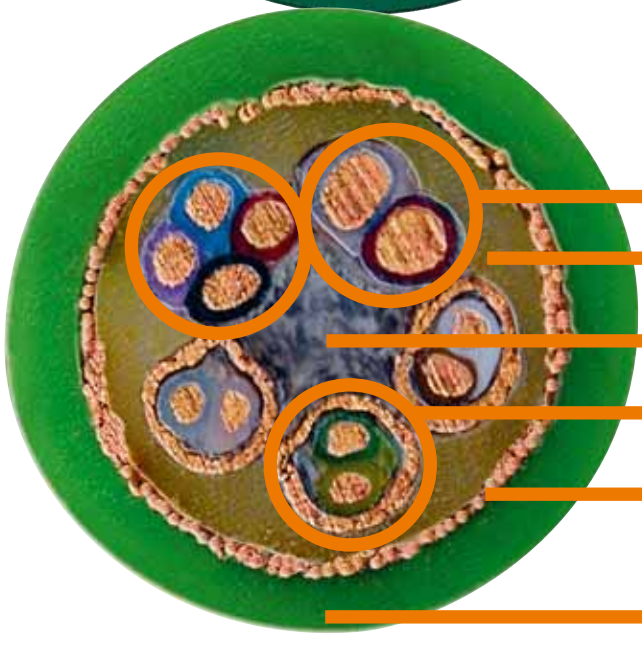
Total shield with optimized braiding angle (covering approx. 70% linear, approx. 90% optical)

Gusset-filled extruded inner jacket supports stranding

Center element for high tensile stresses

Tension-proof center element in individual bundles

Pressure extruded jacket



Chainflex® data/ sensor cable, shielded

Stranded elements with optimized pitch length and pitch direction

Gusset-filled extruded inner jacket supports stranding

Center element for high tensile stresses

Pair braid shield

Total shield with optimized braiding angle (covering approx. 70% linear, approx. 90% optical)

Pressure extruded jacket

the igus® cable types

cables starting from the high-class category

Chainflex® FOC gradient fiber cable

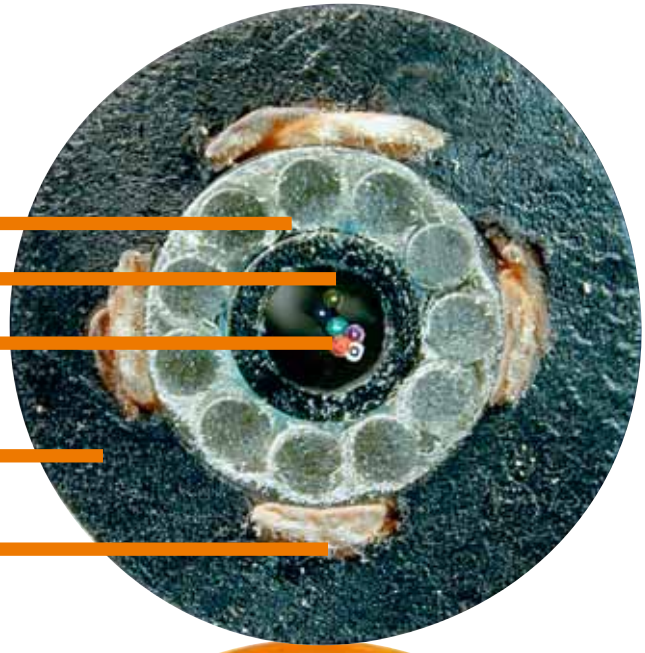
Supporting braid made of glass-yarn-stranded FRP rods

Gel-filled fiber sheath

FOC fibers

Highly abrasion-resistant TPE jacket

Integrated torsion protection



Chainflex® servo cable, shielded

Total shield with optimized braiding angle (covering approx. 70% linear, approx. 90% optical)

Optimized single-wire diameter

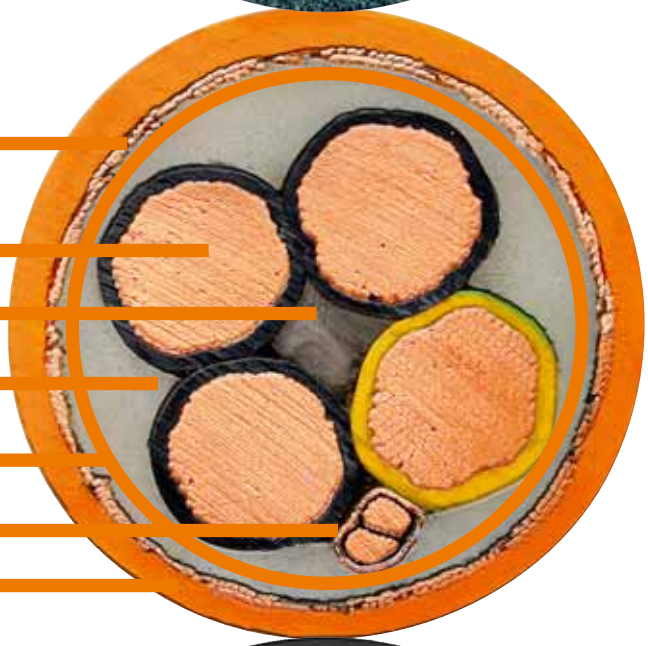
Center element for high tensile stresses

Gusset-filled extruded inner jacket

Stranding with optimized pitch length and pitch direction

Pair braid shield over optimized stranded core pair

Highly abrasion-resistant pressure extruded jacket



Chainflex® motor cable, shielded

Total shield with optimized braiding angle (covering approx. 70% linear, approx. 90% optical)

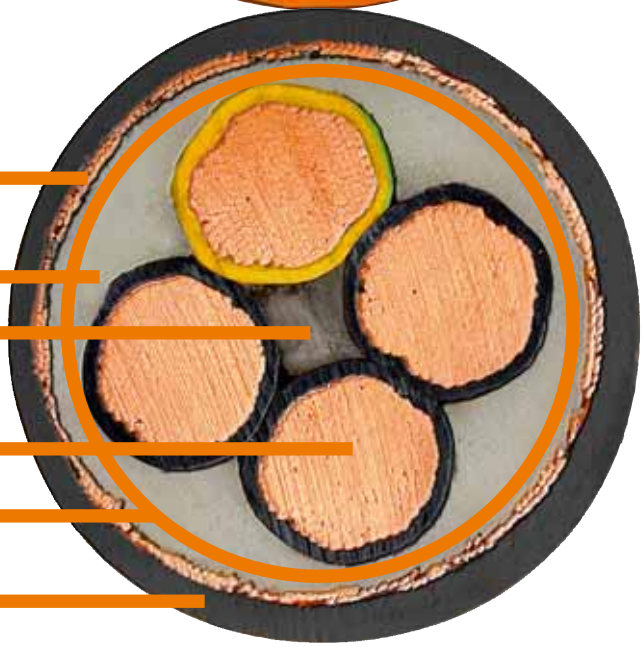
Gusset-filled extruded inner jacket

Center element for high tensile stresses

Optimized single-wire diameter

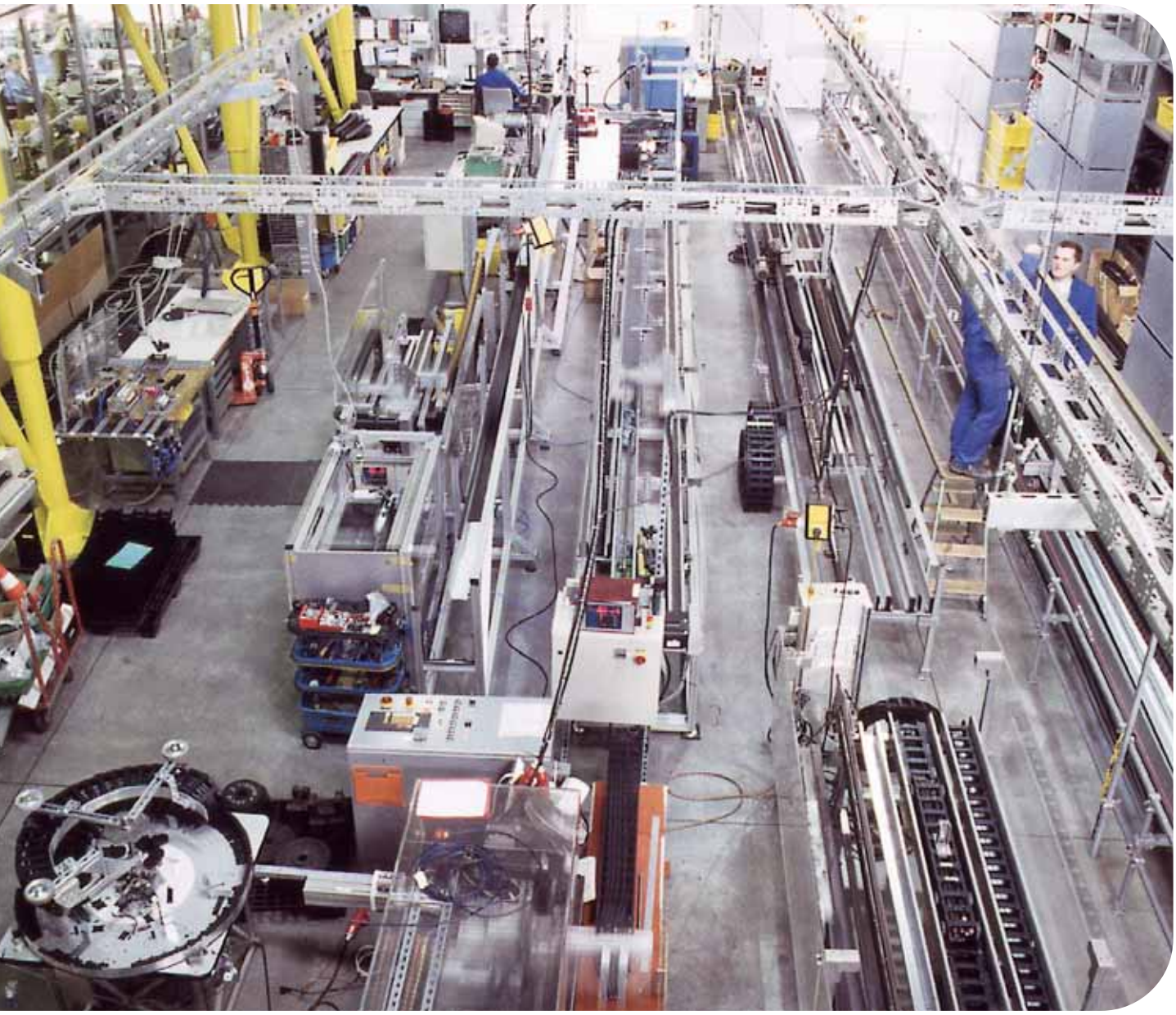
Stranding with optimized pitch length and pitch direction

Highly abrasion-resistant pressure extruded jacket

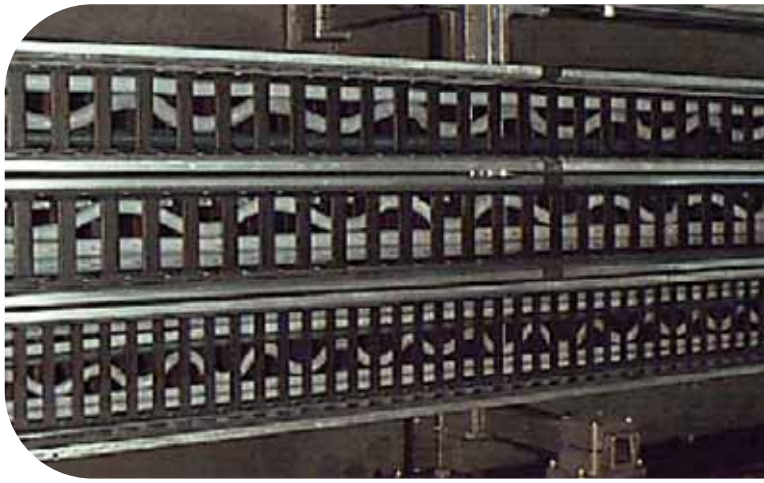


Chainflex® are the special cables for Energy Chain Systems® – tested, tested, tested and tested.

Partial view of igus® experimental laboratory – testing, testing, testing of Chainflex® cables



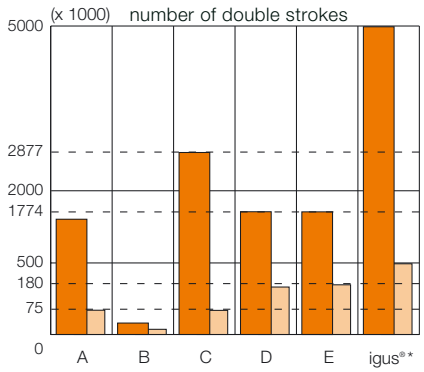
Purpose of every Chainflex® cable



More sensitive applications with high clock cycle numbers, velocities and accelerations as well as sophisticated environmental conditions call for, especially in the field of energy management, tried-and-tested systems that are functionally efficient for a long period of time. EMC safety and the fulfillment of standards and directives such as UL, CSA, VDE, Interbus and Profibus are a necessary requirement today. After all, your automation system is supposed to function correctly non-stop and worldwide even on a low-cost basis. That's the igus® mission.

No contradiction: Good cables cost less.

Quick availability throughout the world is a significant purchase criterion. Advantages of our cables: successful tests, presence in more than 50 countries around the world and deliverability ex warehouse. This saves time, money, storage capacity and applies to each one of our 600 cable types which you can order without any minimum quantity purchases or surcharges. Which further advantages can be included is something that depends on your specific conditions of use.

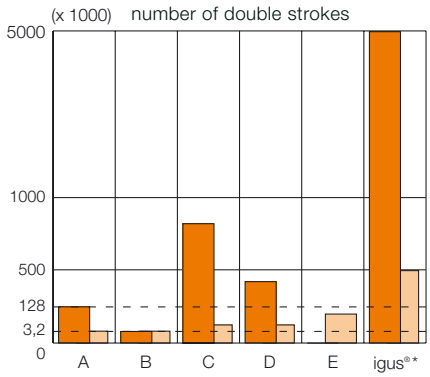


Testing of a Chainflex® CF5: 7 x 1 in "short" and "long" distances of travel compared with other cables. CF5 with 4.3 x d bending radius

"Short Travel"

"Long Travel"

*** Cables OK, test abandoned.**



Testing of a Chainflex® CF5: 25 x 1 in "short" and "long" distances of travel compared with other cables. CF5 with 4.3 x d bending radius

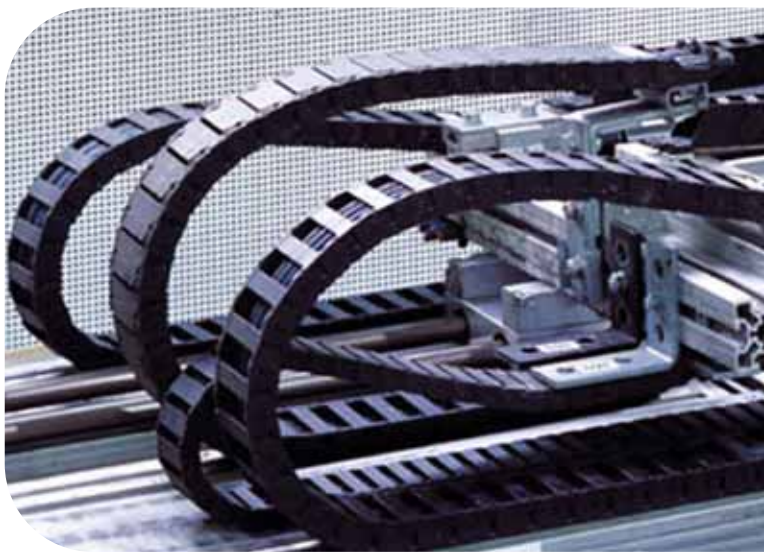
"Short Travel"

"Long Travel"

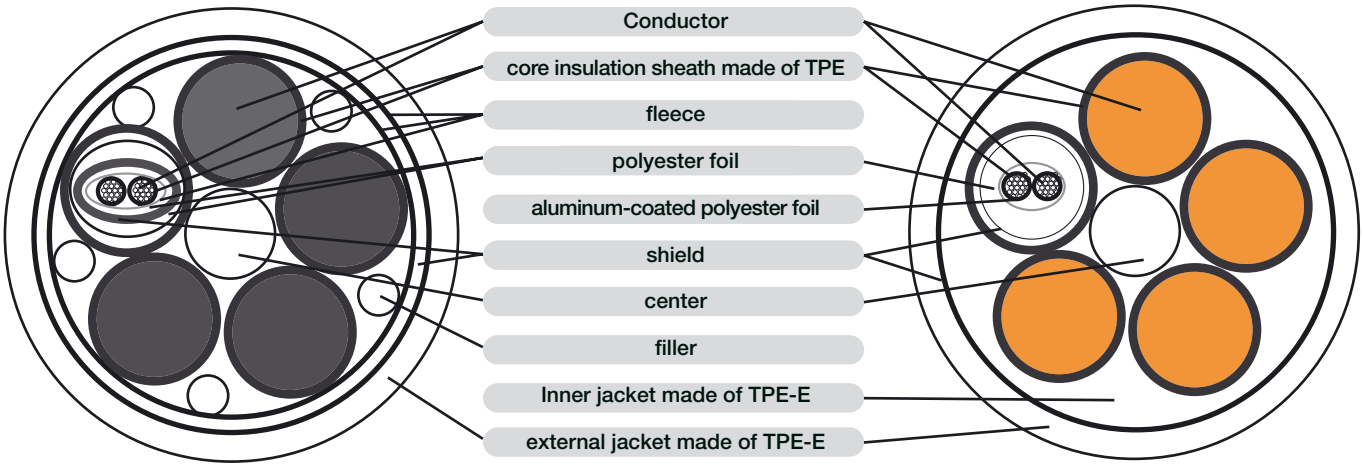
*** Cables OK, test abandoned.**

igus® tested

As a manufacturer of Energy Chains® and special Energy Chain® cables, igus® uses the possibility of testing many different types of chains and cables on a practice-oriented basis. At the company-own technical training center in Cologne, numerous series of tests are carried out on a parallel basis under the most difficult conditions. At the present time, there are more than 35 test setups with their test results being summarized in databases. This extensive, current data pool provides precise, reliable information on the actual service life and is also the basis of new product developments at the company. The test data for Energy Chains® and cables, but also for ready-made systems, are, however, described in such detailed form that igus® confirms a functional guarantee for its Energy Chain Systems®.



Example 1: tested, tested, tested! Servo cable structure



Sample B with fleece and filler experimental production 4x10+(2x1.0) C

The purpose of the test is to determine the advantages of the more expensive internal jacket in shielded servo cables versus the less expensive fleece taping with fillers.

In the case of flexible shielded cables, the shield is usually separated from the composite core structure. On the one hand, this is done in order to achieve a rounder braid form and, on the other hand, the friction of the core insulation sheath against the braided shield structure is prevented due to the separation of the cores and shield. This can be achieved with an internal jacket or a fleece taping which is wrapped around the composite core structure. The internal jacket is more sophisticated and is therefore more expensive to produce. Following the twisting process, the composite core structure must run through the extruder in which the internal jacket is then put on. In contrast to this method, the fleece tape can be put on between the twisting point and the reeling-up device during the twisting process and therefore does not require an own work operation.

Sample A with internal jacket igus® Chainflex® CF27.100.10.02.01.D

Comparison between the igus® solution with the gusset-filled internal jacket and the fleece version with fillers

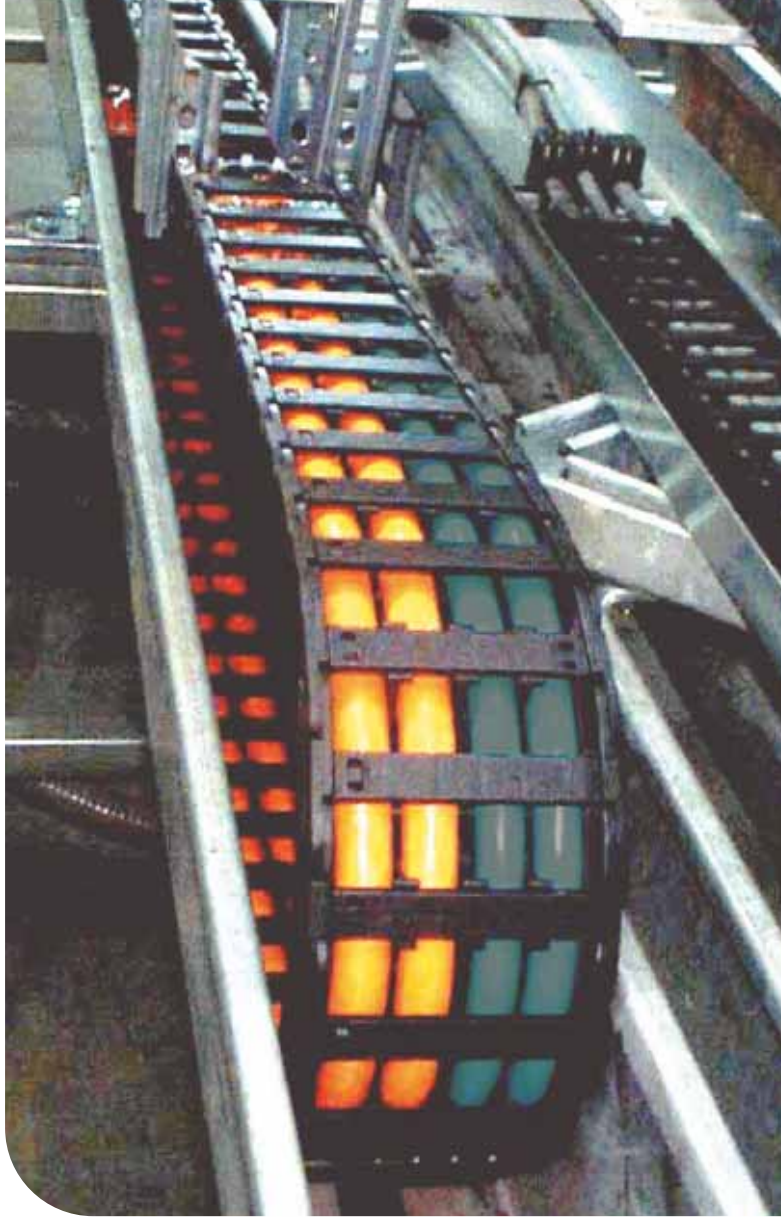
Here, the servo cables are highly flexible motor connection cables with a complete copper shield and an integrated, shielded pair of control cores. This cable type was selected due to the fact that here the problematic case of an out-of-round braid form due to the different core cross sections is a significant factor and that the various bending behaviors of the production methods are therefore emphasized.

- **Sample A: CF27.100.10.02.01.D (4x10 mm² + (2x1,0 mm²) der igus® GmbH**
- **Sample B: experimental (4x10 mm² + (2x1,0 mm²)**

Both cables are provided with identical nominal cross sections and insulation materials. Cable A is equipped with an internal jacket and cable B with a fleece taping and fillers.

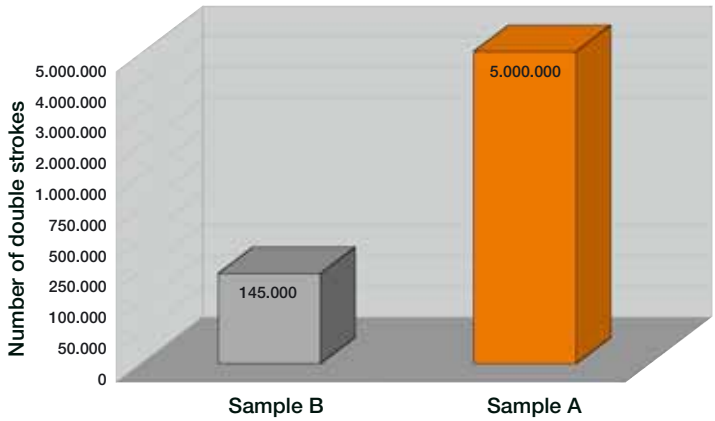
The experimental production (sample B) already shows the formation of a corkscrew after 145,000 double strokes. In the case of a cable, the so-called corkscrew refers to a wave-shaped deformation like the one that can be seen in the following picture on sample B.

Whereas, in the case of cable A, the internal jacket fills up the gussets and a round braid structure is created as a result, cable B requires fillers in the gussets. Like the core, the fillers also consist of filbrated polyethylene. They are easy to compress and are therefore hardly capable of taking over any supporting effects. Whereas the internal jacket, which is made of TPE, and the cable A center, which consists of cordage, hold the cores in a defined position, the cores of cable B are able to move about uncontrolled. During the bending process, a core has detached itself from the composite braid structure and has been shifted in the inner bending radius with respect to the center and on the outer bending radius with respect to the jacket. This results in corkscrew-type deformations that repeat themselves periodically with the pitch length.



Assessment

Despite the extremely low bending factor of 4.76, no signs of wear can be detected in sample A (CF27.100.10.02.01.D) even after 5 million double strokes. Sample B, on the other hand, with its fillers and fleece taping succumbs to a corkscrew formation already after 145,000 double strokes. Accordingly, the result therefore justifies the extra expenditure of the cable with the gusset-filled internal jacket.



Sample A: CF27.100.10.02.01.D

Sample B: experimental production

Example 2: tested, tested, tested! Technical Data Properties CAT5

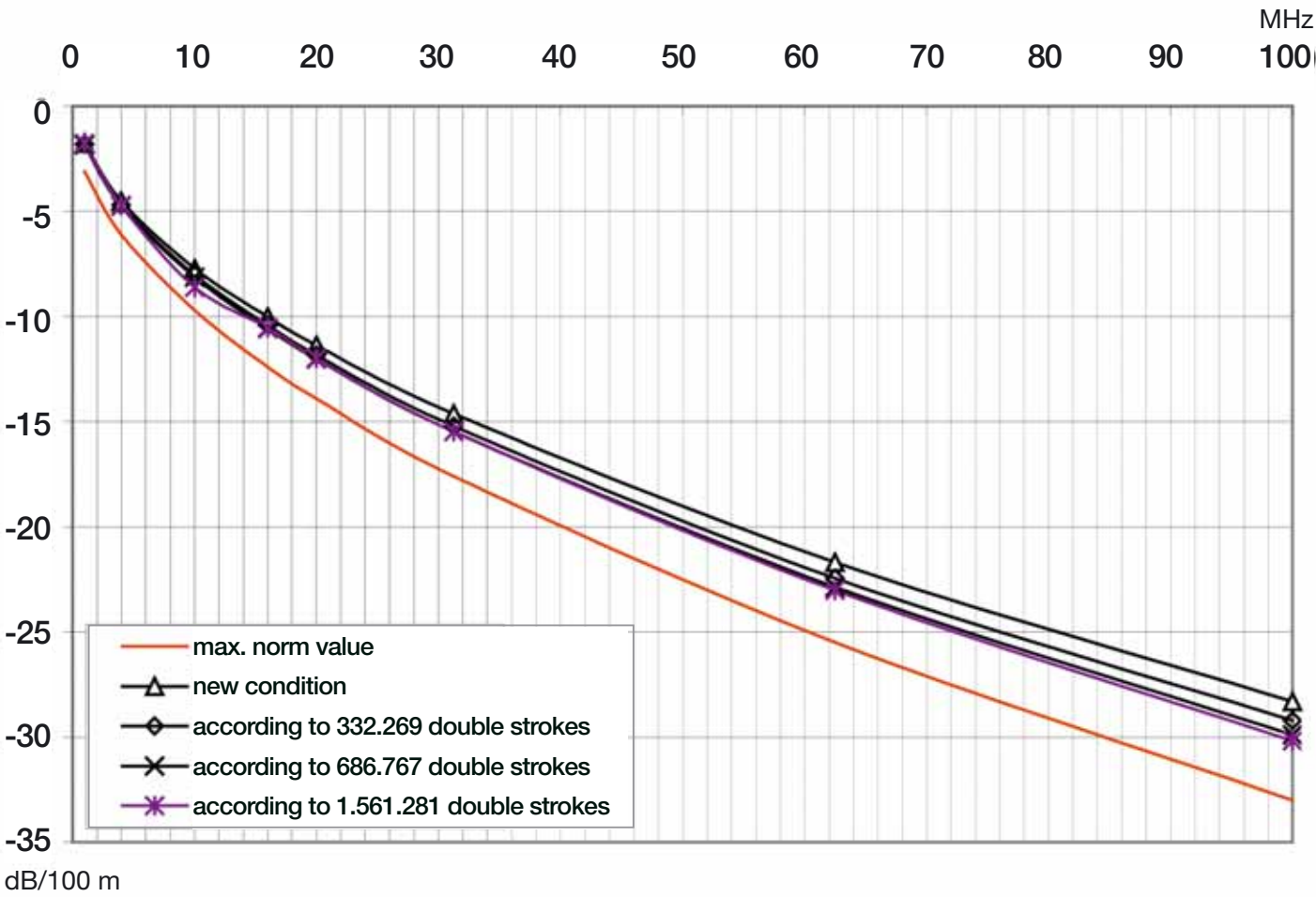
Alteration of the electrical transmission properties of a CAT5 cable when subjected to an application of stress with the minimum bending radius

High transmission rates of up to 100 Mbit/s place high demands on the cable structure and its materials. The use of the cables in Energy Chains® subjects these materials to additional stress and results in long-lasting alterations of the electrical properties. A CF 14.02.04.02.CAT5 cable was selected as a cable to be inspected for high transmission rates. Even when subjected to an application of stress with the minimum bending radius, the cable must also be able to meet the electrical requirements of the IEC 61156-6 standard. In the case of the CF14.02.04.02.CAT5 cable, four pairs of cores are stranded with one another, with each core pair possessing a nominal cross section of 0.25 mm^2. The conductor consists of bare copper wires and is surrounded by an insulation sheath consisting of foamed PE.

The following items were inspected:

- **Characteristic wave impedance of single pairs**
- **Single-pair attenuation**
- **Return loss of single pairs**
- **Near-end crosstalk attenuation of single pairs versus one another**

The test is to be carried out in order to determine whether the limit values of the IEC standard are complied with by the cable after being subjected to bending stress.



Attenuation

The maximum values of the individual attenuation for each pair of cores are specified for the corresponding nominal characteristic wave impedance in dB/100m in the DIN IEC 61156-6 standard. Accordingly, the cables are subdivided into several categories according to the transmission frequency planned to be used. For the cable being inspected, transmission frequencies of up to 100 MHz are planned to be used, which corresponds to the category 5e.

Test result

The attenuation, as a measure of the reduction of the transmitted electrical energy of a signal on the cable, remains, even after more than 1.5 million double strokes, below the specified limit value while being subjected to the application of stress of the minimum bending radius.
The characteristic electrical transmission quantities such as characteristic wave impedance, return loss and near-end crosstalk are fulfilled so that, despite applications of high mechanical stress, the electrical values of the IEC standard are complied with for a cable of the category 5.

Example 3: tested, tested, tested! “Millions of double strokes” in an energy chain

Profibus cables in permanently-moving industrial use

For users, it is hard to get an overview of the cable market. Competition between cable suppliers is intensifying and manufacturers are outshining one another in their promises to “guarantee service life for cables used in energy chains”. Catalogues claim ten million - or even as many as 50 million - double strokes when it comes to the service life of cables used in applications involving movement.

On taking a closer look at figures claimed, one must ask how testing was done, or how realistic tests carried out actually were (for example length of travel, test radii, etc.) in order to be able to provide such a guarantee.
Even information stating that cables are tested in accordance with VDE (Association of German electrical engineers) 0472, Part 603, test method H, is not helpful when it comes to determining the service life of a cable in energy chains, since the roller testing stand cannot provide any conclusive results and there is no VDE test for special cables in energy chains.

Picture: Sliding application as the basis of the test structure

Differences in service life

At the beginning of 2002, a test to determine the service life of profibus cables in a real application was commissioned in igus’ test laboratory. The aim was to examine any differences in the service life of igus’ CFBUS.001 Chainflex® cable and another market leading profibus cable. The parameters required for the test were selected on the basis of data contained in the competitor’s catalogue:

Catalogue details	**Test item “A” Twin-core profibus cable**	**Test item “B” igus® Chainflex® CFBUS.001**
Cross section	(2 x AWG24)C	(2 x 0.25 mm²)C
Guaranteed lifetime	Min. 4.0 Mio. Zyklen	To be determined in a test
Bending radius	> = 60 mm	85 mm
Diameter	8,0 mm	8,5 mm
Catalogue details	Stand 2002	Stand 2002

Test parameters according to catalogue data of the competition

A gliding application was chosen as a suitable test structure since profibus cable systems are usually used here because of their data integrity, particularly over long lengths of travel and long transmission distances.

In order to be able to carry out non-destructive testing and hence achieve a large number of bending cycles in a short period of time, a genuine profibus transmission path was erected. In a PC at the fixed end of the test chain there was a profibus master insert card. A connection to a profibus slave was located on the moving end. This enabled the transmission rate to be determined with the help of a diagnosis program. Any data packets which might have been transmitted incorrectly could be indicated. The highest-possible transmission rate of 12 megabits/s was set.

The fundamental test, which commenced at the beginning of 2002 and is still in progress today, showed that only a relatively low number of cycles (420,000) resulted in the total failure of test item “A“, which, according to the competitor’s catalogue, should have functioned safely for at least 4.0 million cycles. The actual service life achieved deviates from that indicated in the catalogue by a factor of ten.

On the other hand test item “B“, the CFBUS.001, is still undergoing testing without any faulty data transmissions.
So far, it has accomplished more than 14.0 million cycles.

Structure and materials

The main reason for the major differences in service life is the differing structural parameters of test item “A“ and test item “B“ (CFBUS.001), as well as the different materials used for producing the cables. The conductor insulation of the bus comprised of a foam material for all the test items. The electrical assets of this material ensured better transmission properties were achieved. A disadvantage of this material, however, was its weakness under reverse stresses. The forces which affect the bus pair should be absorbed by the element sheathing in order to alleviate the mechanical stress of the conductor insulation.

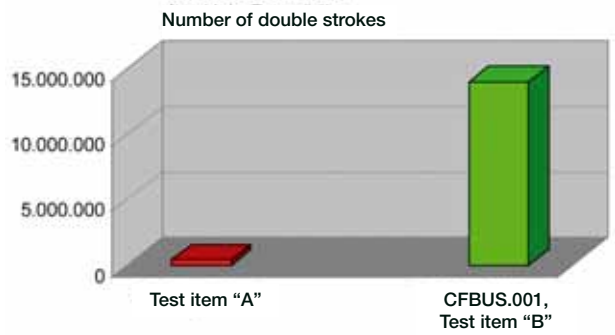
Highly-elastic element sheathing

For this reason, test item “B“ (igus®) was provided with a mechanically superior, extruded TPE inner, or element, gap-filling sheathing, in order to protect the bus pair against mechanical influences during the bending procedure. The element sheathing must be highly elastic. A mechanically inferior element sheathing made of inexpensive filling material only serves to make the bus pair round, just like frequently used fillers or banding. It is not able to protect the buses from the high degree of mechanical stress present in the chain.
Tensile and compression forces which occur mainly influence those parts of the cable core in which there is a break in the element sheathing.

The sheathing of test item ”B“ (CFBUS.001) is on the one hand characterized by a mechanically superior, gusset-filled

Test parameters	
Distance of travel:	S = 5,0 m
Speed, approx:	V = 3,5 m/s
Acceleration, approx.:	a = 7,5 m/s²
Radius, approx.:	55 mm

TPE element jacket, which mechanically relieves the bus pair, fixes the cores in a defined position and bends. The sheathing of test item ”B“ (CFBUS.001) is on the one hand characterized by a mechanically superior, gusset-filled TPE element jacket,



which mechanically relieves the bus pair, fixes the cores in a defined position and bends. The extremely short pitch of the core strands and special cable also ensure that no great tensile or compression force has an effect on a long length of core.

UL and CSA approval

Chainflex® CFBUS cables are now also available for all standard field bus systems, complete with UL and CSA approval and DESINA compliance. The highly abrasion-resistant, flame-retardant TPE outer jacket is extruded onto the fully braided shield with an adjusted twisted angle in order to provide the cable with additional stability.

The bus elements braided with a particularly short strand pitch are protected by means of a gap-filling, extruded TPE inner jacket. The bus parameters required are fulfilled by means of a choice of coordinated insulating materials and production procedures.

As with all Chainflex® cables, the new standard field bus cables of the CFBUS series are now available ex stock, without any cutting costs or extra charges for small quantities.

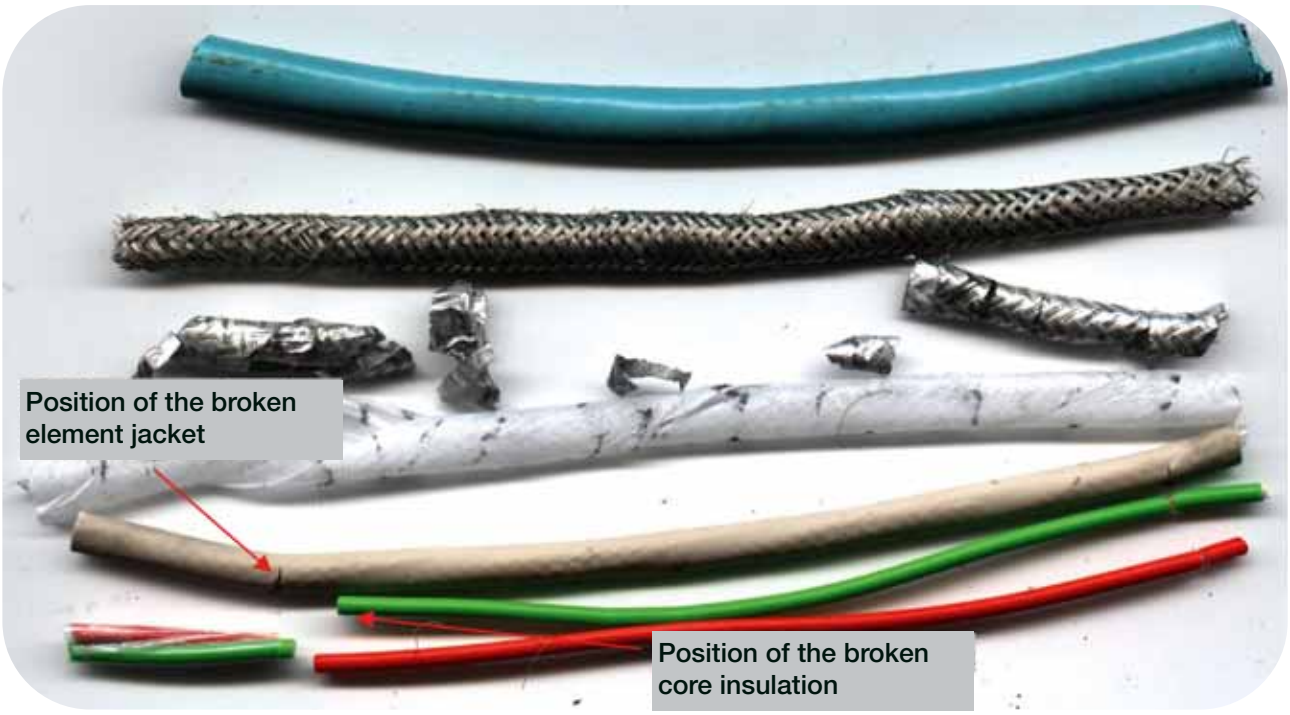


Fig. 3: A mechanically low-quality element jacket can’t protect the bus pair against the high mechanical loads inside the Energy Chain®.

Example 4:
tested, tested, tested!
CF98 with 4xd!

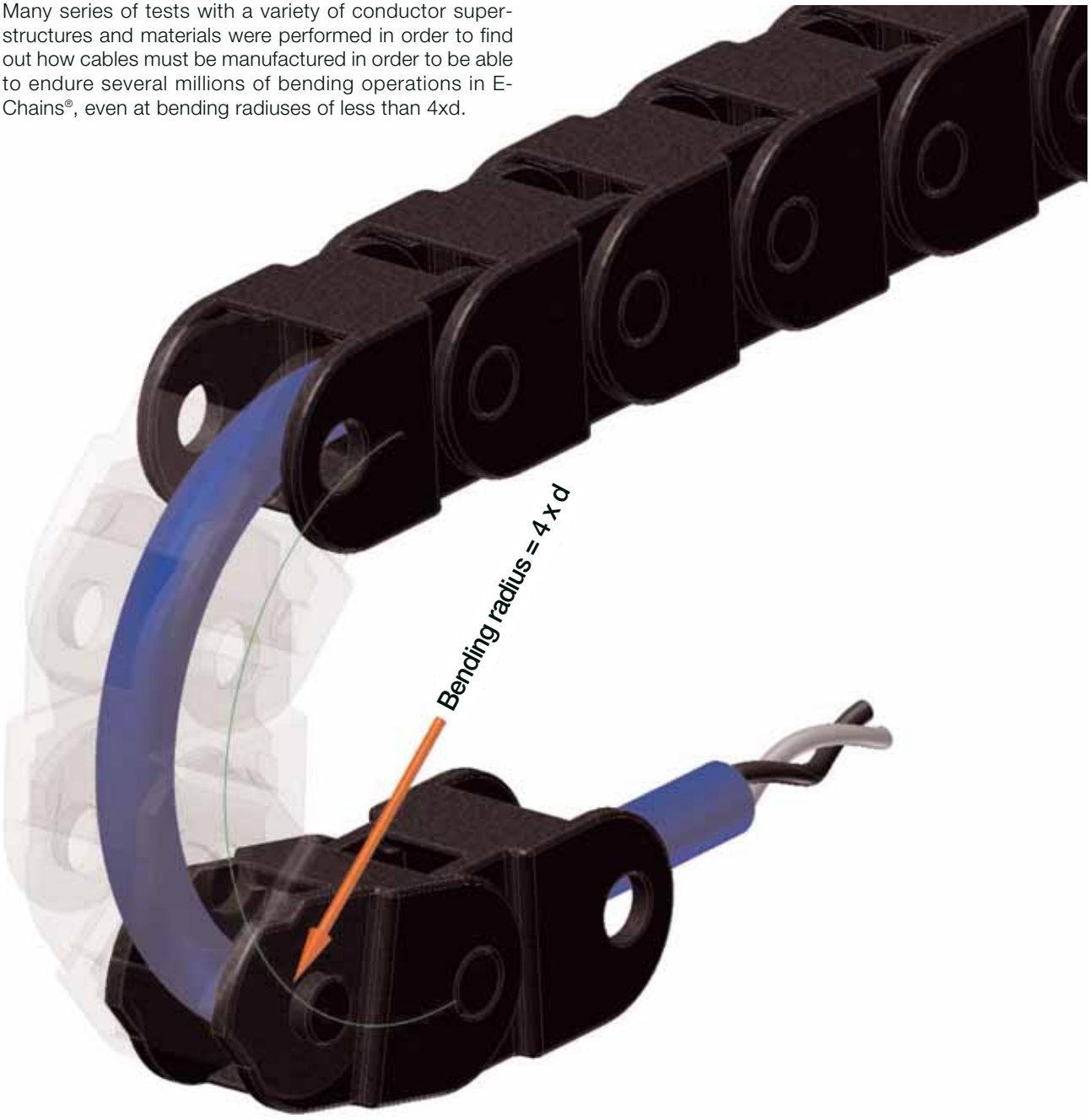
For users of very small energy supply chains with mostly very narrow bending radiuses, the question for a suitable cable for very high stroke numbers has come up frequently in the past.

At bending radiuses of less than 5xd, copper quickly reaches its physical limits, which necessitated the search for suitable substitute conductor materials or for fundamentally different conductor superstructures.

Many series of tests with a variety of conductor superstructures and materials were performed in order to find out how cables must be manufactured in order to be able to endure several millions of bending operations in E-Chains®, even at bending radiuses of less than 4xd.

Test set-up:
Horizontal, short distance of travel

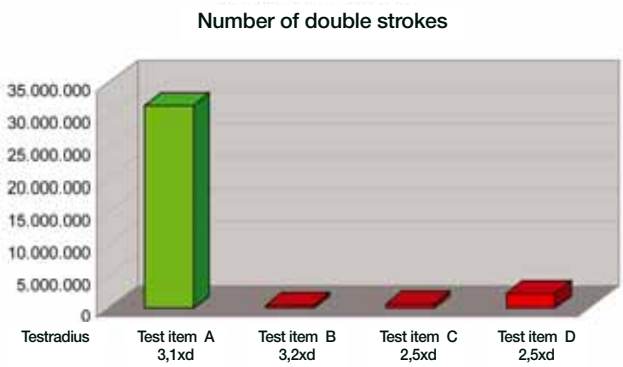
Test parameters	
Distance of travel:	S = 0,8 m
Speed, approx.:	V = 1,5 m/s
Acceleration, approx.:	a = 0,5 m/s²
Radius, approx.:	18 mm



Test 1:
Inspection of four different cable designs

Test item A – conductor with special conductor alloy
Test item B – conductor same as test item A, but in copper
Test item C – conductor in braided structure
Test item D – conductor in stranded construction
This long-term inspection, which was carried out over a period of 2 years, provided the following results:

	Number of double strokes	Cross section	d [mm]	Testradius
Test item A	31.268.000	7x0,20	5,8	3,1xd = 18
Test item B	450.000	7x0,20	5,6	3,2xd = 18
Test item C	638.000	7x0,25	7,3	2,5xd = 18
Test item D	2.350.000	7x0,25	7,3	2,5xd = 18

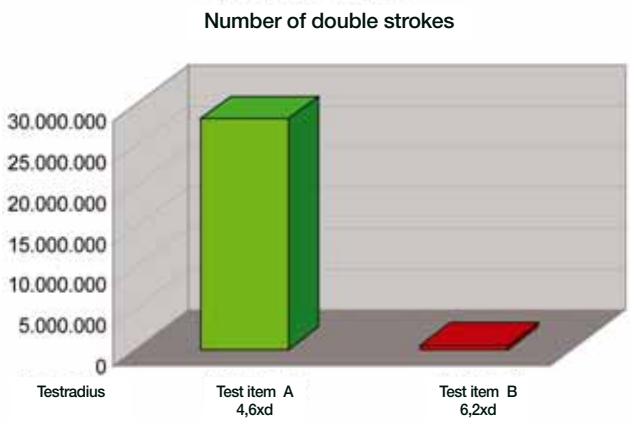


Test 2:

Two different cable designs were tested, whereby different core numbers and cross-sections were selected in comparison with test 1:
Test item A – conductor with special conductor alloy
Test item B – conductor in copper

In this case, test item B was manufactured completely identical to test item A except for the conductor material.
The test showed that not a single case of wire breakage could be detected for test item A even after 28 million double strokes. Test item B, however, only achieved approx. 1.4 million double strokes before complete destruction of the conductor was determined. This test also demonstrates that the alloy concept clearly surpasses the life of the copper conductor by more than 19 times and achieves these extraordinary results in the mechanically critical area of very small cross-sections!

	Number of double strokes	Cross section	d [mm]	Testradius
Test item A	28.267.000	2x0,14	3,9	4,6xd = 18
Test item B	1.450.000	2x0,14	2,9	6,2xd = 18



Conductivity of alloys

However, the outstanding mechanical properties of this alloy have to do with a reduced conductivity versus copper, which can be compensated by means of slightly increased cross-sections. This means that the cross-sections mentioned in the catalog meet the electrically defined cross-sections defined using the conductivity value. The conductor diameter of the alloyed conductor increases slightly compared to the conductor diameter of a copper conductor.

This compromise results in a 10% greater external diameter for the CF98 series versus a comparable CF9 type, although the service life differences to be expected between the CF98 versus the CF9 speak for themselves and increase by a multiple factor in comparison with other so-called chain-suitable cables.

As in the case of the CF9 series, further characteristics of the Chainflex® CF98 include the highly abrasion-resistant, gusset-filled extruded TPE outer jacket, the oil resistance and the UV resistance as well as the absence of any PVC and halogen compounds. Especially in areas of application that only possess minimum construction space but also demand a large number of strokes, the igus® cable offers an increased degree of operational safety and efficiency. Areas of application are available in the semiconductor and component parts industry, in the automation sector as well as in the automotive and bank sector. New possibilities of application can also be found in automatic doors for motor vehicles and trains as well as in automatic food and self-service machines and in the packaging industry.

Example 5: tested! Dispersion and attenuation

Plastic fiber-optic cables in Energy Chains®

Plastic fiber-optic cables have been introduced for data transmission in industrial applications due to their excellent interference-proof properties against electro-magnetic fields and further advantages such as the possibility of reducing dimensions and weights. The application as flexible link lines particularly in Energy supply chains places high demands on plastic fiber-optic cables.

The most important characteristic values of a fiber-optic cable are dispersion and attenuation. Dispersion is the term used to describe the scattering of the travel time of the signal in the fiber-optic cable. In plastic fiber-optic cables this is essentially caused by the mode dispersion, which arises from the different travel times of individual light beams.

Dispersion determines important transmission properties such as bandwidth, cut-off frequency or maximum bit rate. Significant changes in dispersion could not be ascertained in any of the investigations carried out.

The industrial application of igus Chainflex®-lines with plastic fiber-optic cables in supply chains for example is therefore unproblematic with regard to changes in dispersion.

The second important characteristic property, attenuation, determines the maximum possible length of a transmission path.

The attenuation of a plastic fiber, like that of the glass fiber, is also strongly dependent on the wavelength of the light used. For this reason all the investigations were carried out with a wavelength of 666nm.

Depending on the output of the transmitter and the sensitivity of the receiver the operator has a certain "attenuation budget" available for the complete transmission path including all junction and transition regions. This attenuation budget (typical value approx. 20dB) must not be exceeded if a secure transmission of the data is to be guaranteed.

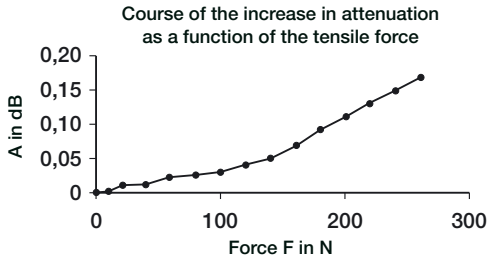
For this reason it is of great interest to the user to know whether and to what extent increases in attenuation are to be expected for his particular application so that these can be taken into account in the compilation of his own attenuation budget.

In addition to continuous bending stress, which is typical for operation in an Energy chain, further mechanical stresses that can occur during installation or operation must be taken into account. Thus, for example, relatively large tensile forces can occur when integrating the line into an Energy chain. The fixing of the lines at the ends of the energy chain using cable clamps leads to permanent transverse loads.

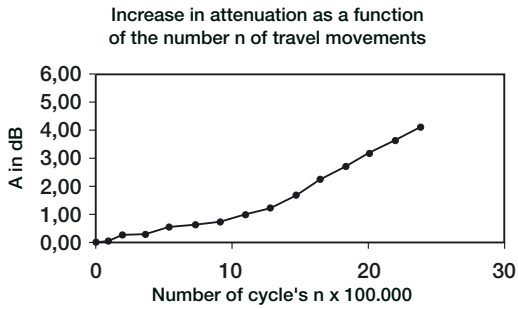
The test of the behaviour under transverse load is carried out following DIN VDE 0472, Part 223. Since the cable clamps only exercise pressure in an area covering a few centimetres, increases in attenuation are relatively low.

Attenuation under tensile load depends to a great extent of course on the composition of the line. Lines with integrated copper conductors or strain relief elements do not reveal a noticeable increase in attenuation until very much greater tensile forces are applied than is the case with pure fiber-optic cables.

Figure 1 represents test results for a Chainflex®-line with 6 fiber-optic cables. The length of the test sample is 1m and the maximum tensile load 250N.

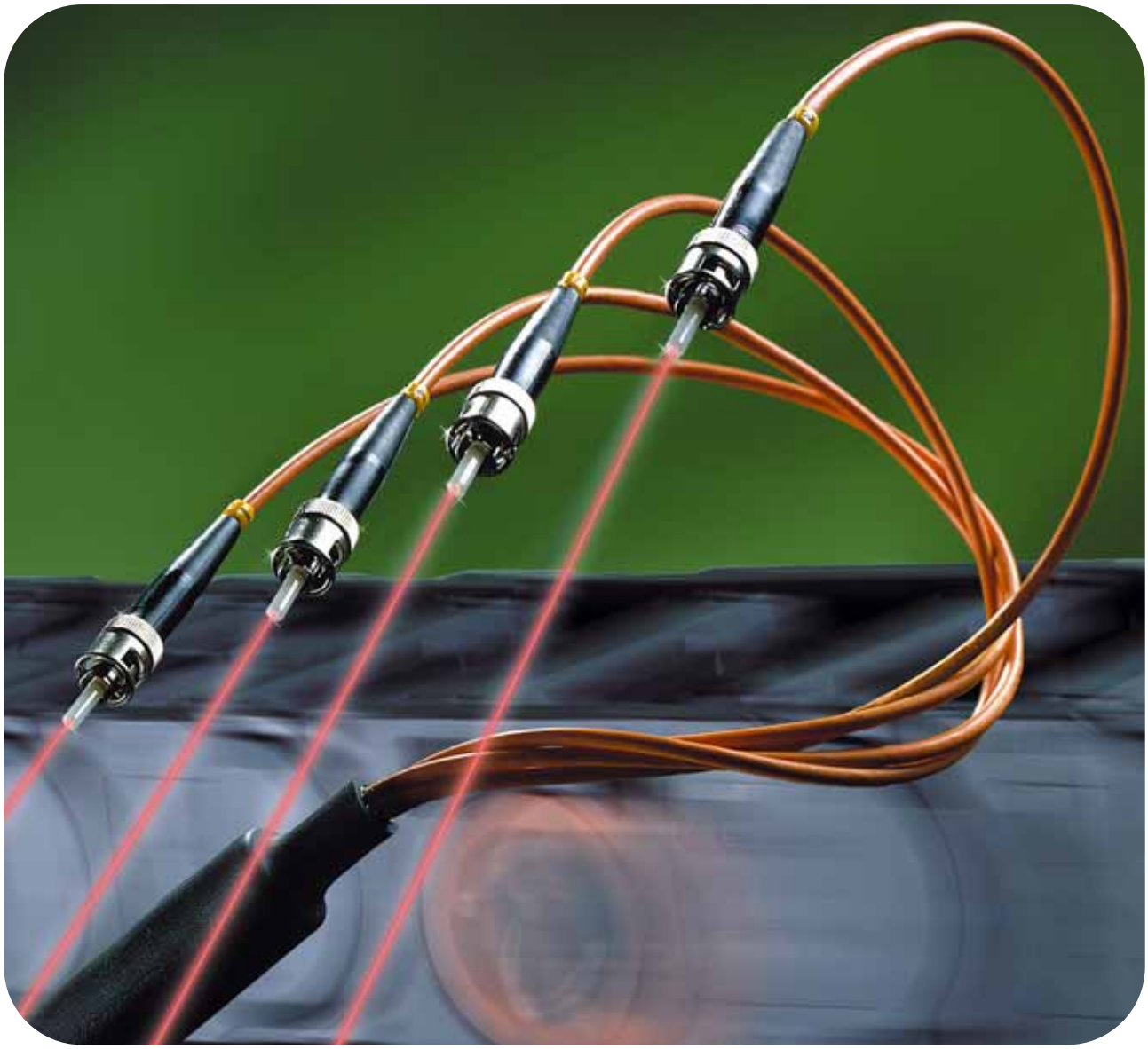


The tensile forces required to integrate fiber-optic cables in Energy Chains® are usually much lower than 250N. The increase in attenuation was 0.17dB at maximum tensile force and disappeared completely after the tensile load was released. Thus no effect on attenuation should be expected. In the case of plastic fiber-optic cables that are bent very often, as is the case in applications with Energy Chains®, then further influencing factors such as material fatigue, dulling of the materials, micro-cracks right through to complete fiber fracture must be feared, and their influence on attenuation can only be investigated in extensive practical tests such as those carried out by igus®.
Figure 2: Course of the increase in attenuation as a function of the number of cycles.



The excellent test results, shown in part here, of the Chainflex® -lines must not be taken for granted, as investigations of fiber-optic cables from other manufacturers showed, some of which even failed with complete breaks in the fibers. The investigations revealed that Chainflex® fiber-optic cables are not influenced in their function by mechanical loads such as tensile, transverse or bending stresses in Energy Chains®. Therefore they are perfectly suitable for use in the sometimes rough industrial environments for the interference-proof transfer of information between drive and control elements of machines.

Bibliography: [1] Plastic fiber-optic cables for flexible Energy supply systems: Bernfried Späth, Frank Blase



Example 6: tested! Selection from test results

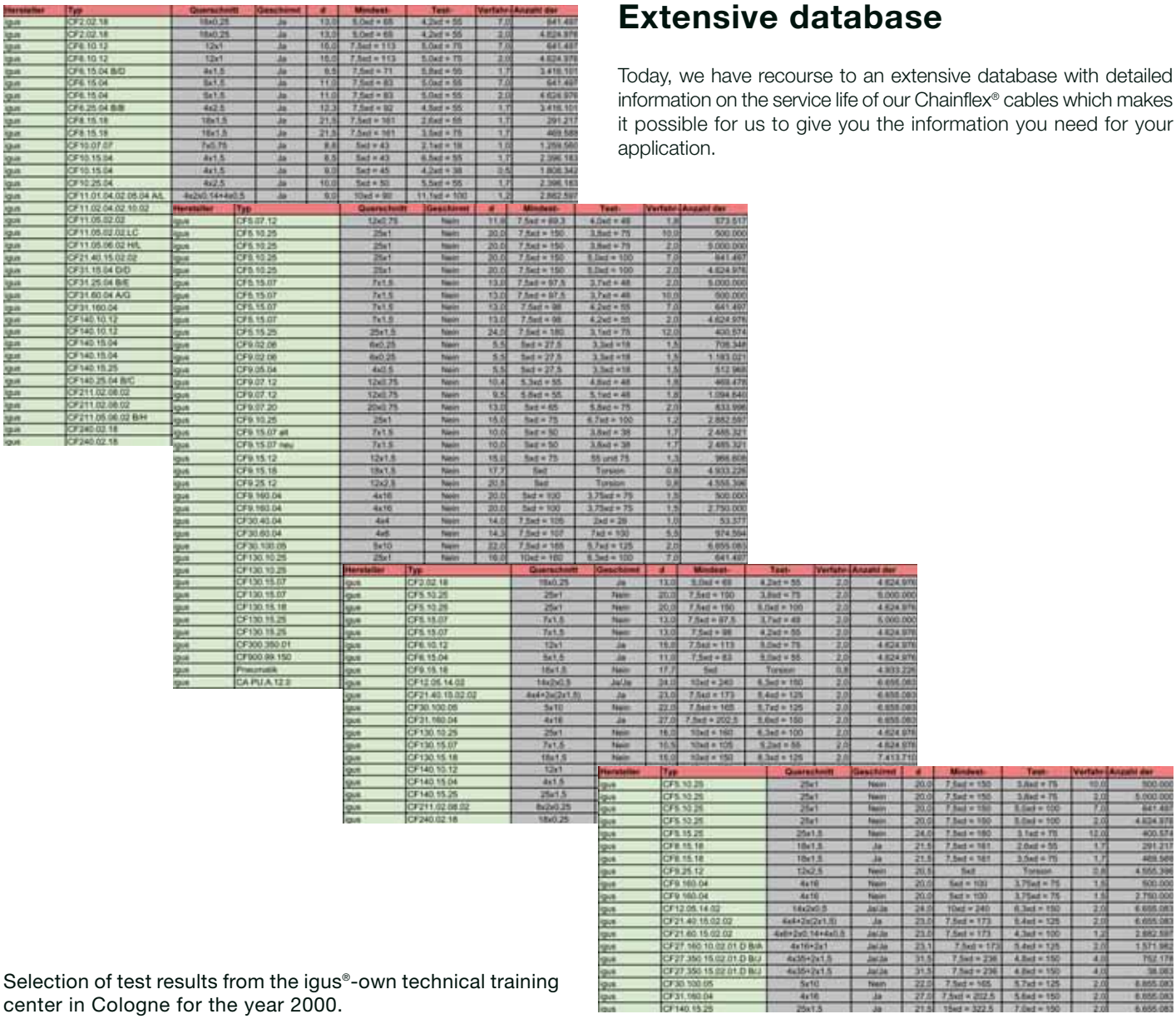
Since 1989, we have been working on the development of electrical cables.

Back then, many of our customers lost their faith in the solution with energy supply systems because the cables being used frequently failed. Core breakage, "corkscrews", jacket wear and breakage of the shields were substantial reasons for these failures.

Our Chainflex® product range was then created from this situation of emergency. And due to the fact that we knew very little about cables at that time, we had only one choice:

Testing, testing, testing, testing, testing.

Accordingly, we have since been making use of a firm principle: We almost always test our cables with a bending radius that is 30-50% less than the bending radius we mention in our catalog. We guarantee the quality requirement specified for our own products based on the production-process-accompanying sample tests that are carried out with at least 1 million reverse bending processes. During the subsequent inspection of the cable, this cable must be completely intact and, especially, none of the single wires must be broken. Newly developed types undergo considerably longer reverse bending processes in Energy Chains® before a new Chainflex® series is released.



Selection of test results from the igus®-own technical training center in Cologne for the year 2000.

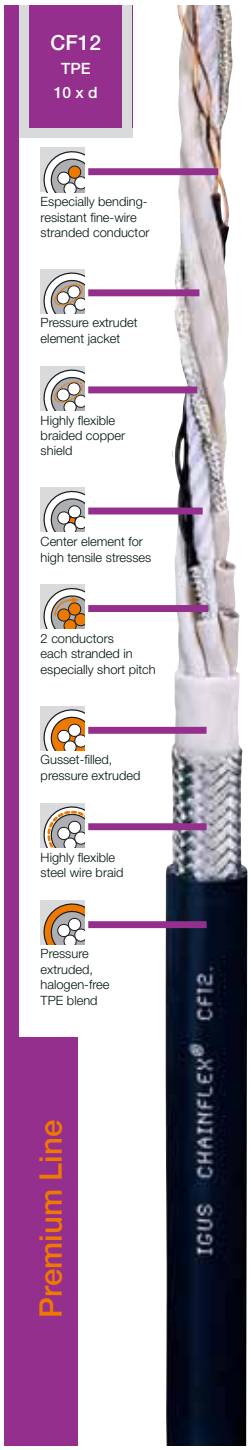
Extensive database

Today, we have recourse to an extensive database with detailed information on the service life of our Chainflex® cables which makes it possible for us to give you the information you need for your application.

Example 7: tested! EMC tests

The "electromagnetic compatibility" of Chainflex® cables

The subject of "electromagnetic compatibility (EMC)" is becoming increasingly important. For one thing, this is due to a increase in the electromagnetic interference fields in the long-distance range caused in particular by modern telecommunications and communication technology as well as in the local range caused by energy technology.



On the other hand, the requirements for data transmission are also increasing. The signals are becoming more susceptible to interference and the electromagnetic environmental influencing factors more diverse. This can be especially problematic for the coupling between cables which, as is frequently the case in energy-conducting chains, are conducted on a parallel basis over a certain distance. A heavy-current cable with interference acts as a producer of an electromagnetic interference field which, in turn, acts upon another cable, normally a signal cable, and then causes cable-conducted interference there.

Already several years ago, we therefore introduced electrical cables with fiber-optic cables made of glass that are also capable of being subjected to the mechanical stress in Energy Chains®. Even the Chainflex® cables with conventional copper conductors were tested with respect to their electromagnetic compatibility in an extensive, application-oriented test program.

An asynchronous motor, for example, was therefore connected via an unshielded heavy-current cable (Chainflex® CF30) to a frequency converter. This frequency converter with pulse width modulation becomes the generator of new spectral shares never existing previously in the primary or secondary networks. On a parallel basis with this heavy-current, Chainflex® cables were also kept available for digital signal transmission in Energy Chains®. Especially good results can be achieved here by the Chainflex® CF12 cable which was specifically designed according to the EMC aspect. This cable possesses twisted-pair cores, the pairs of which are provided with a copper shield, as well as a total shield made of a steel braid in addition. Interference over a broad frequency range can therefore be effectively prevented as a result.

The capacitive as well as the inductive coupling was also tested. In the case of the selected test conditions, it was determined that, even when the energy cables and signal cable touch one another over a longer distance, error-free data transmission is possible if a shielded Chainflex® cable is used and this shield is grounded on both sides.

In addition, tests were carried out in accordance with the existing standards on electromagnetic compatibility. These standards provide a general basis for determining the operating behavior of electrical devices that are repeatedly exposed to electrical interference. They were not introduced specifically for cables. In particular, tests with the "burst generator" were carried out. Here, fast transient interference signals are generated in pulse groups that simulate switching processes in particular. Such processes occur, e.g. during the interruption of inductive loads or during the bouncing of relay contacts. Here, too, the shielded Chainflex® cables have proved their reliability.

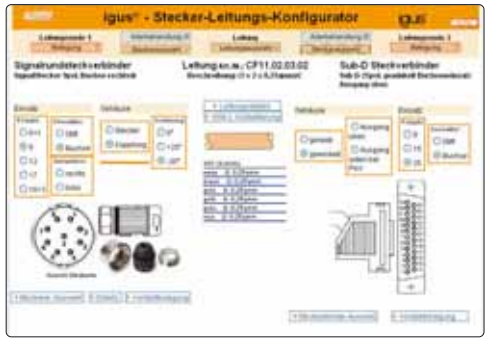
Configure and order cables online

igus® provides electronic support

Rectangular connectors, Sub D connectors, round connectors – you can now select cables yourself from your workplace or home PC. Experienced users will only need about one and a half minutes to assemble the cable they need via the Internet. The comwponents selected and all available ex-stock can then be placed in a virtual shopping basket and delivered by igus® without delay.

Filter the optimum cable out and order online

Using the QuickCable product finder, available online under **www.igus.de/quickcable**, users can first search for the optimum technical solution and then make an online inquiry or place an order. Cable selection is via a choice of parameters: electrical, dynamic, mechanical and chemical parameters and environmental questions. Direct cable selection is also possible, of course.



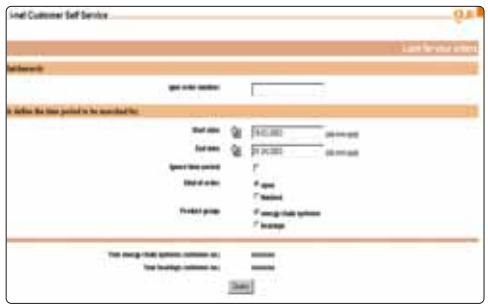
Individual pin assignment

Once the cable type has been found, the new QuickPin configurator is the next step. Under **www.igus.de/quickpin**, igus® offers all its connector types in a convenient menu, including reason test. The pin or wire contact assignment is flexible, depending on the user's requirements. The contacts can be assigned logically per mouse click, the pole images are then represented by symbols. This means that instead of a list in a table, the pin assignment can be viewed as an image on one page.

Calculate service life online

Calculate service life online – depending on the parameters **travel, bending radius and speed.** The program checks the logical plausibility of the parameters entered. The result is given in the number of double strokes to be expected. If other cable types could achieve better results on the basis of the parameters entered, this will be noted.

igus® & ePLAN



Chainflex® cable library for eplan

- The article data of all Chainflex® cables are now downloadable in **eplan** standard!
- Completely created cable type file, including information on color codes, cross-sections, shields, etc.
- Cable article file in **eplan** format for piece lists or order lists
- Fully compatible with **eplan 5**

i-net customer information system available at www.igus.de

Track your order in real time with igus® i-net. Simply apply for your password, log in and you can then track your job status via webcam. You can also use the igus® i-net carrier tracking system to track your ordered merchandise from the igus® shipping process right up to your front door.

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Good and cheap!

Remaining stock available under:

You will find a large selection of Chainflex® cables available at very attractive prices on the Internet. At www.chainflex.de, we offer a constantly updated range of Chainflex® special products that you can order online, by fax or by telephone. All offers come from our tried and tested product range of standard cables and are valid as long as supplies last. All terms and conditions mentioned on the Web are special net prices corresponding to the quantities and lengths being offered and are exclusively addressed to persons engaged in a business or trade.

Please call us or send us an e-mail:

Phone +49-22 03/96 49-278
Fax +49-22 03/96 98-278
chainflex@igus.de

Price examples: *(Prices per meter and based on purchases of remaining stock. For industrial buyers only)

CF1.05.12**
Control Cable

Unshielded, highly flexible PVC control cable for Energy Chains®, oil-proof in accordance with VDE specifications, flame-retardant

44 m

3,00€*

CF11.06.02.02**
Bus cable

TPE Energy Chain® special bus cable for heavy-duty use, shielded, Bus-type-certified, oil-resistant, PVC-free/halogen-free, UV-resistant

37 m

4,64€*

CF21.15.07.02.02.UL**
Servo Cable

PVC-highly flexible Energy Chain® Servo cable, oil-proof in accordance with VDE

17 m

4,58€*

CF30.100.04**
Motor cable

PVC highly flexible Energy Chain® motor cable, oil-proof in accordance with VDE specifications, flame-retardant, DESINA-conforming

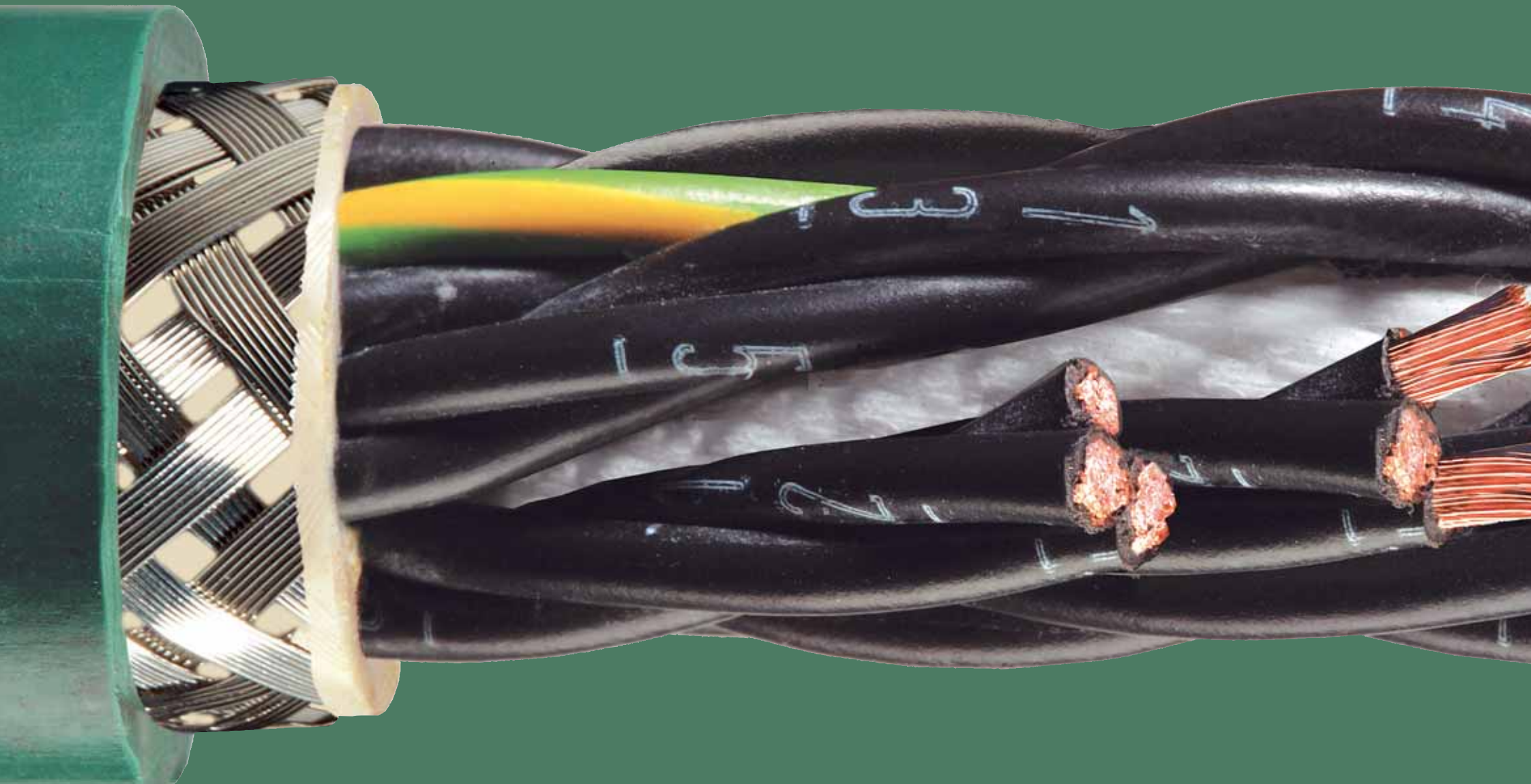
40 m

4,77€*

**Stand 13/08/2006

www.chainflex.de

Control cables



Chainflex® types

Chainflex® cable	Jacket	Shield	Bending radius moved [factor x d]	Temperatur moved from/to [°C]	Approvals and standards	Oil-resistant	Torsion resistant	V max. [m/s] unsupported	V max. [m/s] gliding	a max. [m/s²]	Page
Control cables											
CF130.UL	PVC		7,5-10	-5/ +70			✔	3	2	20	38
CF140.UL	PVC	✔	7,5-15	-5/ +70				3	2	20	42
CF5	PVC		6,8-7,5	-5/ +70		✔	✔	10	5	80	46
CF6	PVC	✔	6,8-7,5	-5/ +70		✔		10	5	80	50
CF170.D	PUR		7,5-10	-35/ +80		✔	✔	3	2	20	54
CF180	PUR	✔	7,5-15	-35/ +80		✔		3	2	20	56
CF7	PUR		6,8-7,5	-20/ +80		✔	✔	10	5	80	58
CF7.D	PUR		6,8-7,5	-20/ +80		✔	✔	10	5	80	60
CF8	PUR	✔	6,8-7,5	-20/ +80		✔		10	5	80	62
CF2	PUR	✔	5	-20/ +80		✔		10	5	80	64
CF9	TPE		5	-35/ +100		✔	✔	10	6	100	68
CF10	TPE	✔	5	-35/ +100		✔		10	6	100	72
CF98	TPE		4	-35/ +90		✔	✔	10	6	100	76
CF99	TPE	✔	4	-35/ +90		✔		10	6	100	78

CF130.UL
PVC
7,5-10xd

Fine-wire stranded conductor

Center element for high tensile stresses

Braiding in bundles around high-tensile center cord

Gusset-filled extruded

PVC Control cable Chainflex® CF130.UL

- **for medium load requirements**
- **PVC outer jacket**
- **flame-retardant**

Temperature range moved	**-5 °C to +70 °C, bending radius 7,5 x d with < 10 m travel; bending radius 10 x d with ≥ 10 m travel**
Temperature range fixed	**-20 °C to +70 °C, bending radius 5 x d**
V max. unsupported/gliding	3 m/s, 2 m/s
a max.	20 m/s²
Nominal voltage	**Number of conductors < 12:** 300/500 V **Number of conductors ≥ 12:** 300/300 V (according to DIN VDE 0245)
Testing voltage	2000 V (according to DIN VDE 0281-2).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Fine-wire stranded conductor consisting of bare copper wires (according to EN 60228).
Core insulation	**Number of conductors < 12:** mechanically high-quality PVC mixture. **Number of conductors ≥ 12:** mechanically high-quality TPE mixture (according to DIN VDE 0207 Part 4)
Core stranding	**Number of conductors < 12:** cores stranded in a layer with short pitch length. **Number of conductors ≥ 12:** cores combined in bundles and stranded together around a centre for high tensile stresses with adapted, short pitch lengths and pitch directions, especially low-torsion structure.
Core identification	**Cores < 0,5 mm²:** color code in accordance with DIN 47100 **Cores ≥ 0,5 mm²:** cores black with white numerals, one core green/yellow.
Outer jacket	Low-adhesion mixture on the basis of PVC, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: gray (similar to RAL 7001)

... no minimum order quantity

Economy Line

VDE	The cables are manufactured on the basis of VDE.
UL	**Number of conductors < 12:** Style 10076 and 20200, 300 V, 60 °C
UL/CSA	**Number of conductors ≥ 12:** Style 10493 and 20200, 300 V, 60 °C
CEI	According to CEI 20-35
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for medium load requirements
- without influence of oil
- preferably indoor applications
- especially for freely suspended travel distances and for gliding applications up 50 m
- wood/stone processing, packaging industry, supply system, handling, adjusting equipment

Tel. +49-22 03-96 49-800
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PVC Control cable
Chainflex® CF130.UL

- **for medium load requirements**
- **PVC outer jacket**
- **flame-retardant**

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF130.02.03.UL	3x0,25	4,5	8	24
CF130.02.04.UL	4x0,25	5,5	10	37
CF130.03.02.UL	2x0,34	5,0	7	33
CF130.03.05.UL	5x0,34	5,5	17	48
CF130.05.02.UL	2x0,5	5,5	10	40
CF130.05.03.UL	3G0,5	6,0	14	55
CF130.05.04.UL	4G0,5	6,5	19	60
CF130.05.05.UL	5G0,5	7,0	24	65
CF130.05.07.UL	7G0,5	8,0	34	100
CF130.05.12.UL	12G0,5	10,0	58	150
CF130.05.18.UL	18G0,5	11,5	87	220
CF130.05.25.UL	25G0,5	13,5	121	280
CF130.07.02.UL	2x0,75	6,0	15	50
CF130.07.03.UL	3G0,75	6,5	22	60
CF130.07.04.UL	4G0,75	7,0	29	80
CF130.07.05.UL	5G0,75	7,5	36	90
CF130.07.07.UL	7G0,75	8,5	50	130
CF130.07.12.UL	12G0,75	10,5	86	190
CF130.07.18.UL	18G0,75	12,5	130	270
CF130.07.25.UL	25G0,75	15,0	181	360
CF130.10.03.UL	3G1,0	7,0	29	75
CF130.10.04.UL	4G1,0	7,5	39	90
CF130.10.05.UL	5G1,0	8,0	48	110
CF130.10.07.UL	7G1,0	9,5	68	170
CF130.10.12.UL	12G1,0	12,0	116	240
CF130.10.18.UL	18G1,0	13,5	173	340
CF130.10.25.UL	25G1,0	16,0	241	440
CF130.15.03.UL	3G1,5	7,5	44	90
CF130.15.04.UL	4G1,5	8,0	58	120
CF130.15.05.UL	5G1,5	9,5	72	140
CF130.15.07.UL	7G1,5	10,5	101	210
CF130.15.12.UL	12G1,5	13,0	173	340
CF130.15.18.UL	18G1,5	15,0	260	460
CF130.15.25.UL	25G1,5	19,0	361	620

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Economy Line

... no minimum order quantity

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF130.25.03.UL	3G2,5	8,5	72	116
CF130.25.04.UL	4G 2,5	10,0	96	180
CF130.25.07.UL	7G2,5	13,0	168	350
CF130.25.12.UL	12G2,5	16,0	290	490
CF130.40.03.UL*	3G4,0	11,0	115	200
CF130.40.06.UL	6G4,0	14,0	230	390
CF130.60.04.UL	4G6,0	13,5	230	360
CF130.60.05.UL	5G6,0	15,0	288	418

* Delivery time upon inquiry.
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow x = without earthed conductor

Chainflex® CF130.UL for woodworking. E-Chain®: E4/light

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CF140.UL
PVC
7,5-15xd

Fine-wire stranded conductor

Braiding in bundles around high-tensile center cord

Gusset-filled extruded

Bending-resistant braided copper shield

Pressure extruded

PVC Control cable Chainflex® CF140.UL

- **for medium load requirements**
- **PVC outer jacket**
- **shielded**
- **flame-retardant**

Temperature range moved	**-5 °C to +70 °C, bending radius 7,5 x d with < 10 m travel; bending radius 15 x d with ≥ 10 m travel**
Temperature range fixed	**-20 °C to +70 °C, bending radius 7,5 x d**
V max. unsupported/gliding	3 m/s, 2 m/s
a max.	20 m/s²
Nominal voltage	**Number of conductors < 12:** 300/500 V **Number of conductors ≥ 12:** 300/300 V (according to DIN VDE 0245)
Testing voltage	2000 V (according to DIN VDE 0281-2).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Fine-wire stranded conductor consisting of bare copper wires (according to EN 60228).
Core insulation	**Number of conductors < 12:** mechanically high-quality PVC mixture. **Number of conductors ≥ 12:** mechanically high-quality TPE mixture (according to DIN VDE 0207 Part 4)
Core stranding	**Number of conductors < 12:** cores stranded in a layer with short pitch length. **Number of conductors ≥ 12:** cores combined in bundles and stranded together around a centre for high tensile stresses with adapted, short pitch lengths and pitch directions, especially low-torsion structure.
Core identification	**Cores < 0,5 mm²:** color code in accordance with DIN 47100 **Cores ≥ 0,5 mm²:** cores black with white numerals, one core green/yellow.
Inner jacket	PVC mixture adapted to suit the requirements in Energy Chains®.
Overall shield	Bending-resistant, tinned braided copper shield. Coverage approx. 55% linear, approx. 80% optical.

... no minimum order quantity

Economy Line

Outer jacket	Low-adhesion mixture on the basis of PVC, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: gray (similar to RAL 7001)
VDE	The cables are manufactured on the basis of VDE.
UL	**Number of conductors < 12:** Style 10076 and 20200, 300 V, 60 °C
UL/CSA	**Number of conductors ≥ 12:** Style 10493 and 20200, 300 V, 60 °C
CEI	According to CEI 20-35
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC – starting from manufacturing date 1/2006.

Typical application area

- for medium load requirements
- without influence of oil
- preferably indoor applications
- especially for freely suspended travel distances and for gliding applications up 50 m
- wood/stone processing, packaging industry, supply system, handling, adjusting equipment

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PVC Control cable
Chainflex® CF140.UL

- for medium load requirements
- PVC outer jacket
- shielded
- flame-retardant

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF140.02.12.UL	(12x0,25)C	9,5	54	120
CF140.03.05.UL	(5x0,34)C	7,5	36	80
CF140.05.03.UL	(3G0,5)C	8,0	32	87
CF140.05.05.UL*	(5G0,5)C	9,0	47	130
CF140.05.18.UL	(18G0,5)C	13,5	122	270
CF140.05.36.UL	(36G0,5)C	17,5	274	450
CF140.07.03.UL	(3G0,75)C	8,5	41	90
CF140.07.04.UL	(4G0,75)C	9,0	52	130
CF140.07.05.UL	(5G0,75)C	9,5	59	150
CF140.07.07.UL	(7G0,75)C	10,5	78	170
CF140.07.12.UL	(12G0,75)C	12,5	123	260
CF140.07.18.UL	(18G0,75)C	14,5	189	350
CF140.07.25.UL	(25G0,75)C	17,5	244	450
CF140.10.03.UL	(3G1,0)C	8,5	52	130
CF140.10.04.UL	(4G1,0)C	9,5	61	150
CF140.10.05.UL	(5G1,0)C	10,0	75	170
CF140.10.07.UL	(7G1,0)C	11,5	99	200
CF140.10.12.UL	(12G1,0)C	13,5	151	290
CF140.10.18.UL	(18G1,0)C	16,0	233	420
CF140.10.25.UL	(25G1,0)C	18,5	317	540
CF140.15.03.UL	(3G1,5)C	9,5	66	150
CF140.15.04.UL	(4G1,5)C	10,0	85	180
CF140.15.05.UL	(5G1,5)C	11,0	104	220
CF140.15.07.UL	(7G1,5)C	12,5	137	260
CF140.15.12.UL	(12G1,5)C	15,0	233	380
CF140.15.18.UL	(18G1,5)C	17,5	337	530
CF140.15.25.UL*	(25G1,5)C	21,5	450	730
CF140.25.04.UL	(4G2,5)C	12,0	174	250

* Delivery time upon inquiry.
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Economy Line

... no minimum order quantity

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CF140.UL for automatic feeder units. E-Chain®: Easy Chain®

750 types from stock no cutting costs ...

(for up to 10 cuts of the same type)

PVC Control cable Chainflex® CF5

- **for high load requirements**
- **PVC outer jacket**
- **oil-proof in accordance with VDE**
- **flame-retardant**

Especially bending-resistant fine-wire stranded conductor

Center element for high tensile stresses

Braiding in bundles around high-tensile center cord

Gusset-filled extruded, oil-proof PVC mixture

Temperature range moved	**-5 °C to +70 °C, bending radius 6,8 x d with < 10 m travel; bending radius 7,5 x d with ≥ 10 m travel**
Temperature range fixed	**-20 °C to +70 °C, bending radius 4 x d**
V max. unsupported/gliding	10 m/s, 5 m/s
a max.	80 m/s²
UV-resistant	Medium
Nominal voltage	300/500 V (according to DIN VDE 0245).
Testing voltage	2000 V (according to DIN VDE 0281-2).
Oil	Oil-proof (according to DIN VDE 0207).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Fine-wire stranded conductor consisting of bare copper wires (according to EN 60228).
Core insulation	Mechanically high-quality PVC mixture (according to DIN VDE 0207 Part 4).
Core stranding	**Number of conductors < 12:** cores stranded in a layer with short pitch length. **Number of conductors ≥ 12:** cores combined in bundles and stranded together around a centre for high tensile stresses with adapted, short pitch lengths and pitch directions, especially low-torsion structure.
Core identification	**Cores < 0,5 mm²:** color code in accordance with DIN 47100 **Cores ≥ 0,5 mm²:** cores black with white numerals, one core green/yellow.
Outer jacket	Low-adhesion, oil-resistant mixture on the basis of PVC, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: green (similar to RAL 6005)

... no minimum order quantity

VDE	The cables are manufactured on the basis of VDE.
UL	**≤ 1,5 mm²:** Style 1007 and 2464, 300 V, 80 °C **≥ 2,5 mm²:** Style 1011 and 2570, 600 V, 80 °C
CSA	LL63878, 80 °C, 300 V
CEI	According to CEI 20-35
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC – starting from manufacturing date 1/2006.

Typical application area

- for high load requirements
- light oil influence
- preferably indoor applications, but also outdoor ones at temperatures > 5 °C
- especially for freely suspended and gliding travel distances up to 100 m
- storage and retrieval units for high-bay warehouses, machining units/packaging machines, quick handling, indoor cranes

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PVC Control cable
Chainflex® CF5

- for high load requirements
- PVC outer jacket
- oil-proof in accordance with VDE
- flame-retardant

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF5.02.36	36x0,25	14,5	87	275
CF5.03.15	15x0,34	10,0	49	133
CF5.03.18	18x0,34	11,5	59	172
CF5.03.25	25x0,34	13,5	82	234
CF5.05.02	2x0,5	5,5	10	34
CF5.05.03	3G0,5	6,0	15	42
CF5.05.05	5G0,5	7,0	24	72
CF5.05.07	7G0,5	8,0	34	77
CF5.05.12	12G0,5	11,5	58	158
CF5.05.18	18G0,5	13,5	86	230
CF5.05.25	25G0,5	17,0	121	310
CF5.05.30*	30x0,5	18,5	144	402
CF5.07.03	3G0,75	6,5	22	63
CF5.07.04	4G0,75	7,0	29	72
CF5.07.05	5G0,75	8,0	36	85
CF5.07.07	7G0,75	9,0	50	108
CF5.07.12	12G0,75	14,0	86	240
CF5.07.18	18G0,75	15,5	130	322
CF5.07.25	25G0,75	19,0	181	432
CF5.07.36	36G0,75	22,0	259	564
CF5.07.42	42G0,75	23,5	302	610
CF5.10.03	3G1,0	7,0	29	62
CF5.10.04	4G1,0	8,0	39	85
CF5.10.05	5G1,0	8,5	48	100
CF5.10.07	7G1,0	10,0	68	145
CF5.10.12	12G1,0	15,0	116	260
CF5.10.18	18G1,0	17,5	173	450
CF5.10.25	25G1,0	20,0	241	590
CF5.15.03	3G1,5	8,0	44	95
CF5.15.04	4G1,5	9,0	58	120
CF5.15.05	5G1,5	10,0	72	170
CF5.15.07	7G1,5	13,0	101	220
CF5.15.12	12G1,5	16,0	173	320
CF5.15.18	18G1,5	22,0	260	550
CF5.15.25	25G1,5	24,0	361	810
CF5.15.36	36G1,5	26,0	518	980

* Without PE.
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

... no minimum order quantity

High Class Line

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF5.25.04	4G2,5	11,0	96	200
CF5.25.05	5G2,5	12,0	120	250
CF5.25.07	7G2,5	15,0	168	340
CF5.25.18	18G2,5	27,5	432	970
CF5.25.25	25G2,5	31,5	600	1366
CF5.60.05	5G6,0	15,0	282	418

* Without PE.
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

CF5/CF6 for shelf control units: long travel in the longitudinal axis. E-Chain®: Serie E4/00 with igus® guide trough out of steel

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CF6
PVC
6,8-7,5xd

Especially bending-resistant fine-wire stranded conductor

Center element for high tensile stresses

Braiding in bundles around high-tensile center cord

Gusset-filled extruded

Highly flexible braided copper shield

Pressure extruded, oil-proof PVC sheath blend

PVC Control cable Chainflex® CF6

- **for high load requirements**
- **PVC outer jacket**
- **shielded**
- **oil-proof in accordance with VDE**
- **flame-retardant**

Temperature range moved	**-5 °C to +70 °C, bending radius 6,8 x d with < 10 m travel; bending radius 7,5 x d with ≥ 10 m travel**
Temperature range fixed	**-20 °C to +70 °C, bending radius 4 x d**
V max. unsupported/gliding	10 m/s, 5 m/s
a max.	80 m/s²
UV-resistant	Medium
Nominal voltage	300/500 V (according to DIN VDE 0245).
Testing voltage	2000 V (according to DIN VDE 0281-2).
Oil	Oil-proof (according to DIN VDE 0207).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Fine-wire stranded conductor consisting of bare copper wires (according to EN 60228).
Core insulation	Mechanically high-quality PVC mixture (according to DIN VDE 0207 Part 4).
Core stranding	**Number of conductors < 12:** cores stranded in a layer with short pitch length. **Number of conductors ≥ 12:** cores combined in bundles and stranded together around a centre for high tensile stresses with adapted, short pitch lengths and pitch directions, especially low-torsion structure.
Core identification	**Cores < 0,5 mm²:** color code in accordance with DIN 47100 **Cores ≥ 0,5 mm²:** cores black with white numerals, one core green/yellow.
Inner jacket	PVC mixture adapted to suit the requirements in Energy Chains®.
Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.

... no minimum order quantity

High Class Line

Outer jacket	Low-adhesion, oil-resistant mixture on the basis of PVC, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: green (similar to RAL 6005)
VDE	The cables are manufactured on the basis of VDE.
UL	**≤ 1,5 mm²:** Style 1007 and 2464, 300 V, 80 °C **≥ 2,5 mm²:** Style 1011 and 2570, 600 V, 80 °C
CSA	LL63878, 80 °C, 300 V
CEI	According to CEI 20-35
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC – starting from manufacturing date 1/2006.

Typical application area

- for high load requirements
- light oil influence
- preferably indoor applications, but also outdoor ones at temperatures > 5 °C
- especially for freely suspended and gliding travel distances up to 100 m
- storage and retrieval units for high-bay warehouses, machining units/packaging machines, quick handling, indoor cranes

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PVC Control cable Chainflex® CF6

- for high load requirements
- PVC outer jacket
- shielded
- oil-proof in accordance with VDE
- flame-retardant

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF6.02.04	(4x0,25)C	7,0	28	55
CF6.02.24*	(24x0,25)C	13,5	100	250
CF6.03.05	(5x0,34)C	7,5	34	95
CF6.05.05	(5G0,5)C	9,0	48	114
CF6.05.07	(7G0,5)C	11,0	63	142
CF6.05.09	(9G0,5)C	12,5	77	182
CF6.05.12	(12G0,5)C	13,0	93	206
CF6.05.18	(18G0,5)C	15,0	120	276
CF6.05.24*	(24G0,5)C	17,0	190	405
CF6.07.03	(3G0,75)C	8,5	52	110
CF6.07.04	(4G0,75)C	9,0	54	120
CF6.07.05	(5G0,75)C	10,0	73	150
CF6.07.07	(7G0,75)C	12,0	93	190
CF6.07.12	(12G0,75)C	14,0	138	264
CF6.07.18	(18G0,75)C	17,5	204	410
CF6.07.24*	(24G0,75)C	19,5	250	466
CF6.10.03	(3G1,0)C	8,5	61	103
CF6.10.04	(4G1,0)C	9,0	75	115
CF6.10.05	(5G1,0)C	11,0	87	170
CF6.10.07	(7G1,0)C	13,0	113	217
CF6.10.12	(12G1,0)C	15,0	171	313
CF6.10.18	(18G1,0)C	19,0	261	470
CF6.10.24*	(24G1,0)C	21,0	307	588
CF6.15.03	(3G1,5)C	10,0	81	155
CF6.15.04	(4G1,5)C	10,5	85	170
CF6.15.05	(5G1,5)C	11,0	106	190
CF6.15.07	(7G1,5)C	14,0	153	270
CF6.15.12	(12G1,5)C	18,0	232	411
CF6.15.18	(18G1,5)C	22,0	367	637
CF6.15.25	(25G1,5)C	24,5	492	819
CF6.25.04	(4G2,5)C	12,5	135	275

The Chainflex® types marked with a * refer to cables that are based on a bundling of 4 cores each. Due to their excellent electrical properties (star-quad with especially minimum crosstalk), these cables can virtually be used in all cases in which otherwise twisted-pair cables are required.
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

... no minimum order quantity

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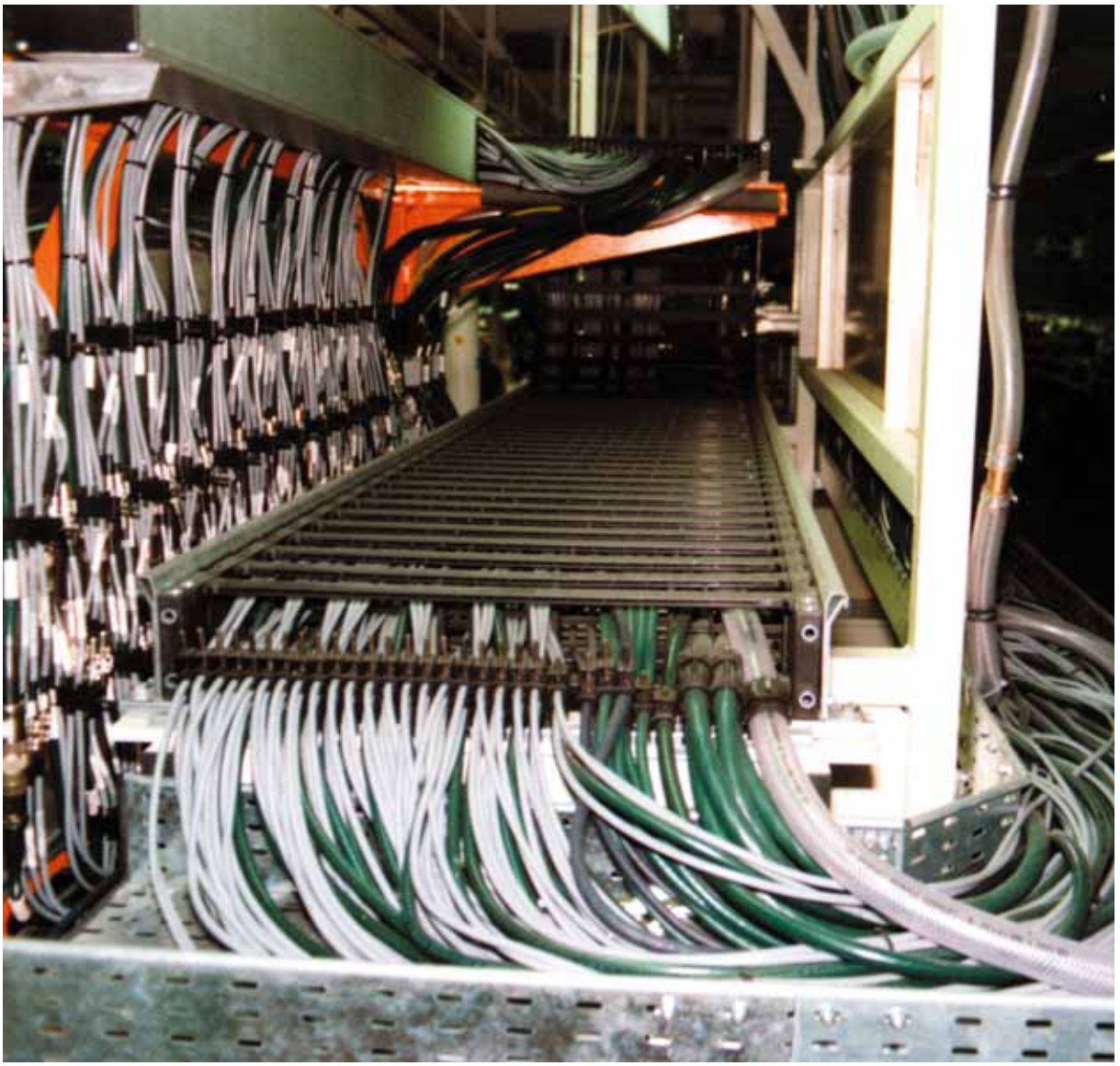

CF6 for unsupported and gliding applications up to 100 m. E-Chain®: System E4100 with Chainfix Chip Strain Relief Devices

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

CF170.D
PUR
7,5-10xd

Fine-wire stranded conductor

Center element for high tensile stresses

Braiding in layers with extremely short pitch

Gusset-filled extruded

PUR Control cable Chainflex® CF170.D

- **for medium load requirements**
- **PUR outer jacket**
- **Oil-resistant**
- **PVC-free/halogen-free**
- **low-temperature-flexible**

Temperature range moved	**-35 °C to +80 °C, bending radius 7,5 x d with < 10 m travel; bending radius 10 x d with ≥ 10 m travel**
Temperature range fixed	**-40 °C to +80 °C, bending radius 5 x d**
V max. unsupported/gliding	3 m/s, 2 m/s
a max.	20 m/s²
UV-resistant	Medium
Nominal voltage	300/500 V (according to DIN VDE 0245).
Testing voltage	2000 V (according to DIN VDE 0281-2).
Oil	Oil-resistant (according to EN 60811-2-1).
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Halogen-free	According to EN 50267-2-1.
Conductor	Fine-wire stranded conductor consisting of bare copper wires (according to EN 60228).
Core insulation	Mechanically high-quality TPE mixture.
Core stranding	Cores stranded in layers with short pitch length.
Core identification	Cores black with white numerals, one core green/yellow.
Outer jacket	Low-adhesion mixture on the basis of PUR, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: gray (similar to RAL 7040)
VDE	The cables are manufactured on the basis of VDE.
CE	According to 73/23/EWG, 93/68/EWG
DESINA	According to VDW, DESINA standardisation
Lead free	According to EU guideline (RoHS) 2002/95/EC.

... no minimum order quantity

Economy Line

Typical application area

- for medium load requirements
- almost unlimited resistance to oil
- indoor and outdoor applications without direct sun radiation
- especially for freely suspended travel distances
- machining units/machine tools, low temperature applications

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF170.05.12.D	12G0,5	10,0	58	125
CF170.05.18.D*	18G0,5	11,5	86	180
CF170.05.30.D	30G0,5	14,0	144	280
CF170.07.03.D	3G0,75	6,5	22	50
CF170.07.05.D	5G0,75	7,5	36	70
CF170.07.07.D	7G0,75	8,5	50	100
CF170.07.12.D	12G0,75	10,5	86	160
CF170.07.18.D	18G0,75	12,5	130	230
CF170.07.20.D	20G0,75	13,5	144	288
CF170.10.03.D	3G1,0	7,0	29	55
CF170.10.04.D	4G1,0	7,5	37	61
CF170.10.05.D	5G1,0	8,0	48	85
CF170.10.07.D	7G1,0	9,5	67	130
CF170.10.12.D	12G1,0	10,5	118	170
CF170.10.18.D	18G1,0	13,5	173	290
CF170.10.25.D	25G1,0	16,0	240	390
CF170.15.03.D	3G1,5	7,5	43	72
CF170.15.04.D	4G1,5	8,0	58	90
CF170.15.05.D	5G1,5	8,5	68	106
CF170.15.07.D	7G1,5	10,5	101	180
CF170.15.12.D	12G1,5	13,0	173	270
CF170.15.18.D	18G1,5	15,0	259	390
CF170.15.25.D	25G1,5	19,0	360	540
CF170.25.04.D	4G2,5	10,0	96	150
CF170.25.05.D	5G2,5	10,5	114	177
CF170.25.07.D	7G2,5	13,0	168	280
CF170.40.04.D	4G4,0	12,0	154	220
CF170.60.04.D*	4G6,0	14,0	230	320
CF170.100.04.D	4G10,0	18,0	384	530

* Delivery time upon inquiry.
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

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CF180
PUR
7,5-15xd

Fine-wire stranded conductor

Center element for high tensile stresses

Braiding in layers with extremely short pitch

Gusset-filled extruded

Bending-resistant braided copper shield

Pressure extruded, halogen-free PUR blend

PUR Control cable Chainflex® CF180

- **for medium load requirements**
- **PUR outer jacket**
- **shielded**
- **oil-resistant**
- **PVC-free/halogen-free**
- **low-temperature-flexible**

Temperature range moved	**-35 °C to +80 °C, bending radius 7,5 x d with < 10 m travel; bending radius 15 x d with ≥ 10 m travel**
Temperature range fixed	**-40 °C to +80 °C, bending radius 5 x d**
V max. unsupported/gliding	3 m/s, 2 m/s
a max.	20 m/s²
UV-resistant	Medium
Nominal voltage	300/500 V (according to DIN VDE 0245).
Testing voltage	2000 V (according to DIN VDE 0281-2).
Oil	Oil-resistant (according to EN 60811-2-1).
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Halogen-free	According to EN 50267-2-1.
Conductor	Fine-wire stranded conductor consisting of bare copper wires (according to EN 60228).
Core insulation	Mechanically high-quality TPE mixture.
Core stranding	Cores stranded in layers with short pitch length.
Core identification	Cores black with white numerals, one core green/yellow.
Inner jacket	PUR mixture adapted to suit the requirements in Energy Chains®.
Overall shield	Bending-resistant, tinned braided copper shield. Coverage approx. 55% linear, approx. 80% optical.
Outer jacket	Low-adhesion mixture on the basis of PUR, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: gray (similar to RAL 7040)

Economy Line

RoHS

... no minimum order quantity

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VDE	The cables are manufactured on the basis of VDE.
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for medium load requirements
- almost unlimited resistance to oil
- indoor and outdoor applications without direct sun radiation
- especially for freely suspended travel distances
- machining units/machine tools, low temperature applications

Delivery program **Part No.**	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF180.07.03	(3G0,75)C	7,5	40	71
CF180.07.05*	(5G0,75)C	8,5	61	95
CF180.07.07*	(7G0,75)C	10,0	79	126
CF180.07.12	(12G0,75)C	11,0	133	186
CF180.07.18*	(18G0,75)C	13,0	176	255
CF180.10.03*	(3G1,0)C	8,0	50	83
CF180.10.05*	(5G1,0)C	9,5	75	120
CF180.10.07*	(7G1,0)C	10,5	107	158
CF180.10.18*	(18G1,0)C	14,0	238	317
CF180.10.25*	(25G1,0)C	16,5	316	437
CF180.15.03*	(3G1,5)C	8,5	67	104
CF180.15.04	(4G1,5)C	9,5	85	129
CF180.15.05*	(5G1,5)C	10,0	103	150
CF180.15.07*	(7G1,5)C	11,5	146	202
CF180.15.12*	(12G1,5)C	13,5	222	290
CF180.15.18*	(18G1,5)C	16,0	322	427
CF180.25.04	(4G2,5)C	10,5	130	179
CF180.25.05*	(5G2,5)C	11,5	165	218
CF180.25.07*	(7G2,5)C	13,5	225	295

* Delivery time upon inquiry.
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

CF7
PUR
6,8-7,5xd

PUR Control cable Chainflex® CF7

- **for high load requirements**
- **PUR outer jacket**
- **oil-resistant and coolant-resistant**
- **flame-retardant**
- **notch-resistant**
- **hydrolysis-resistant and microbe-resistant**

Especially bending-resistant fine-wire stranded conductor

Center element for high tensile stresses

Braiding in bundles around high-tensile center cord

Gusset-filled extruded PUR mixture

Temperature range moved	**-20 °C to +80 °C, bending radius 6,8 x d with < 10 m travel; bending radius 7,5 x d with ≥ 10 m travel**
Temperature range fixed	**-40 °C to +80 °C, bending radius 4 x d**
V max. unsupported/gliding	10 m/s, 5 m/s
a max.	80 m/s²
UV-resistant	Medium
Nominal voltage	300/500 V (according to DIN VDE 0245).
Testing voltage	2000 V (according to DIN VDE 0281-2).
Oil	Oil-resistant (according to EN 60811-2-1).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Fine-wire stranded conductor consisting of bare copper wires (according to EN 60228).
Core insulation	Mechanically high-quality PVC mixture (according to DIN VDE 0207 Part 4).
Core stranding	**Number of conductors < 12:** cores stranded in a layer with short pitch length. **Number of conductors ≥ 12:** cores combined in bundles and stranded together around a centre for high tensile stresses with adapted, short pitch lengths and pitch directions, especially low-torsion structure.
Core identification	Cores black with white numerals, one core green/yellow.
Outer jacket	Low-adhesion, highly abrasion-resistant mixture on the basis of PUR, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: green (similar to RAL 6005)
VDE	The cables are manufactured on the basis of VDE.
UL	**≤ 1,5 mm²:** Style 1007 and 20317, 300 V, 80 °C **≥ 2,5 mm²:** Style 1011 and 20234, 600 V, 80 °C

... no minimum order quantity

High Class Line

CSA	CSA	LL63878, 80 °C, 300 V
CEI	CEI	According to CEI 20-35
CE	CE	According to 73/23/EWG, 93/68/EWG
RoHS	Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for high load requirements
- almost unlimited resistance to oil
- indoor and outdoor applications with average sun radiation
- especially for freely suspended and gliding travel distances up to 100 m
- Machining units/machine tools, storage and retrieval units for high-bay warehouses, packaging industry, quick handling, refrigerating sector

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF7.05.04	4G0,5	6,5	18	47
CF7.05.12	12G0,5	11,5	58	145
CF7.05.25	25G0,5	15,5	120	317
CF7.07.04	4G0,75	6,5	29	61
CF7.07.05	5G0,75	7,0	36	70
CF7.07.07	7G0,75	8,5	50	84
CF7.07.12	12G0,75	12,5	86	156
CF7.07.18	18G0,75	15,5	130	227
CF7.07.36	36G0,75	23,0	241	610
CF7.10.03	3G1,0	6,5	29	59
CF7.10.04	4G1,0	7,0	38	73
CF7.10.07	7G1,0	9,0	67	124
CF7.10.12	12G1,0	13,5	115	222
CF7.10.18	18G1,0	17,0	173	307
CF7.10.25	25G1,0	19,0	240	480
CF7.15.03	3G1,5	7,0	43	91
CF7.15.04	4G1,5	8,0	58	105
CF7.15.07	7G1,5	11,5	101	144
CF7.15.12	12G1,5	15,5	173	253
CF7.15.25	25G1,5	21,5	360	540
CF7.25.04	4G2,5	11,0	96	160
CF7.25.07	7G2,5	14,0	168	268

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

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CF7.D
PUR
6,8-7,5xd

Especially bending-resistant fine-wire stranded conductor

Center element for high tensile stresses

Braiding in bundles around high-tensile center cord

Gusset-filled extruded PUR mixture

PUR Control cable Chainflex® CF7.D

- **for high load requirements**
- **PUR outer jacket**
- **oil-resistant and coolant-resistant**
- **flame-retardant**
- **notch-resistant**
- **hydrolysis-resistant and microbe-resistant**

Temperature range moved	**-20 °C to +80 °C, bending radius 6,8 x d with < 10 m travel; bending radius 7,5 x d with ≥ 10 m travel**
Temperature range fixed	**-40 °C to +80 °C, bending radius 4 x d**
V max. unsupported/gliding	10 m/s, 5 m/s
a max.	80 m/s²
UV-resistant	Medium
Nominal voltage	300/500 V (according to DIN VDE 0245).
Testing voltage	2000 V (according to DIN VDE 0281-2).
Oil	Oil-resistant (according to EN 60811-2-1).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Fine-wire stranded conductor consisting of bare copper wires (according to EN 60228).
Core insulation	Mechanically high-quality PVC mixture (according to DIN VDE 0207 Part 4).
Core stranding	**Number of conductors < 12:** cores stranded in a layer with short pitch length. **Number of conductors ≥ 12:** cores combined in bundles and stranded together around a centre for high tensile stresses with adapted, short pitch lengths and pitch directions, especially low-torsion structure.
Core identification	Cores black with white numerals, one core green/yellow.
Outer jacket	Low-adhesion, highly abrasion-resistant mixture on the basis of PUR, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: gray (similar to RAL 7040)
VDE	The cables are manufactured on the basis of VDE.

... no minimum order quantity

High Class Line

UL	**≤ 1,5 mm²:** Style 1007 and 20317, 300 V, 80 °C **≥ 2,5 mm²:** Style 1011 and 20234, 600 V, 80 °C
CSA	LL63878, 80 °C, 300 V
CEI	According to CEI 20-35
CE	According to 73/23/EWG, 93/68/EWG
DESINA	According to VDW, DESINA standardisation
Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for high load requirements
- almost unlimited resistance to oil
- indoor and outdoor applications without direct sun radiation
- especially for freely suspended and gliding travel distances up to 100 m
- storage and retrieval units for high-bay warehouses, machining units/packaging machines, quick handling, indoor cranes, refrigerating sector

Delivery program **Part No.**	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF7.07.12.D	12G0,75	12,5	86	156
CF7.15.03.D	3G1,5	7,0	43	91
CF7.15.07.D	7G1,5	11,5	101	144
CF7.15.12.D	12G1,5	15,5	173	253
CF7.15.18.D	18G1,5	19,5	259	470
CF7.15.25.D	25G1,5	21,5	360	540

Additional cross sections upon inquiry.
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

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CF8
PUR
6,8-7,5xd

Especially bending-resistant fine-wire stranded conductor

Center element for high tensile stresses

Braiding in bundles around high-tensile center cord

Gusset-filled extruded

Highly flexible braided copper shield

Pressure extruded PUR blend

PUR Control cable Chainflex® CF8

- **for high load requirements**
- **PUR outer jacket**
- **shielded**
- **oil-resistant and coolant-resistant**
- **flame-retardant**
- **hydrolysis-resistant and microbe-resistant**

Temperature range moved	**-20 °C to +80 °C, bending radius 6,8 x d with < 10 m travel; bending radius 7,5 x d with ≥ 10 m travel**
Temperature range fixed	**-40 °C to +80 °C, bending radius 4 x d**
V max. unsupported/gliding	10 m/s, 5 m/s
a max.	80 m/s²
UV-resistant	Medium
Nominal voltage	300/500 V (according to DIN VDE 0245).
Testing voltage	2000 V (according to DIN VDE 0281-2).
Oil	Oil-resistant (according to EN 60811-2-1).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Fine-wire stranded conductor consisting of bare copper wires (according to EN 60228).
Core insulation	Mechanically high-quality PVC mixture (according to DIN VDE 0207 Part 4).
Core stranding	**Number of conductors < 12:** cores stranded in a layer with short pitch length. **Number of conductors ≥ 12:** cores combined in bundles and stranded together around a centre for high tensile stresses with adapted, short pitch lengths and pitch directions, especially low-torsion structure.
Core identification	Cores black with white numerals, one core green/yellow.
Inner jacket	PVC mixture adapted to suit the requirements in Energy Chains®.
Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Outer jacket	Low-adhesion, highly abrasion-resistant mixture on the basis of PUR, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: green (similar to RAL 6005)

... no minimum order quantity

High Class Line

VDE	The cables are manufactured on the basis of VDE.
UL	**≤ 1,5 mm²:** Style 1007 and 20317, 300 V, 80 °C **≥ 2,5 mm²:** Style 1011 and 20234, 600 V, 80 °C
CSA	LL63878, 80 °C, 300 V
CEI	According to CEI 20-35
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for high load requirements
- almost unlimited resistance to oil
- indoor and outdoor applications with average sun radiation
- especially for freely suspended and gliding travel distances up to 100 m
- storage and retrieval units for high-bay warehouses, machining units/packaging machines, quick handling, indoor cranes, refrigerating sector

Delivery program **Part No.**	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF8.05.05	(5G0,5)C	8,5	49	88
CF8.05.07	(7G0,5)C	9,5	60	109
CF8.05.09	(9G0,5)C	11,0	77	147
CF8.05.12	(12G0,5)C	13,0	93	221
CF8.05.18	(18G0,5)C	15,5	156	285
CF8.05.24*	(24G0,5)C	17,0	190	370
CF8.07.03	(3G0,75)C	8,0	52	82
CF8.07.05	(5G0,75)C	9,0	62	109
CF8.07.12	(12G0,75)C	14,0	138	282
CF8.07.24*	(24G0,75)C	18,5	250	427
CF8.10.03	(3G1,0)C	8,5	61	94
CF8.10.05	(5G1,0)C	9,5	87	127
CF8.10.07	(7G1,0)C	11,0	113	187
CF8.10.12	(12G1,0)C	15,0	171	300
CF8.10.24*	(24G1,0)C	20,0	307	535
CF8.15.03	(3G1,5)C	9,0	81	107
CF8.15.04	(4G1,5)C	10,0	115	133
CF8.15.07	(7G1,5)C	13,0	153	224
CF8.15.12	(12G1,5)C	17,5	187	378
CF8.15.18	(18G1,5)C	21,5	340	620
CF8.25.07	(7G2,5)C	19,0	251	540

The Chainflex® types marked with a * refer to cables that are based on a bundling of 4 cores each. Due to their excellent electrical properties (star-quad with especially minimum crosstalk), these cables can virtually be used in all cases in which otherwise twisted-pair cables are required.
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

Tel. +49-22 03-96 49-800
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CF2
PUR
5 x d

Highly flexible special conductor

Center element for high tensile stresses

Braiding in bundles around high-tensile center cord

Gusset-filled, pressure extruded

Highly flexible braided copper shield

Pressure extruded PUR blend

PUR Control cable Chainflex® CF2

- **for maximum load requirements**
- **PUR outer jacket**
- **shielded**
- **oil-resistant and coolant-resistant**
- **flame-retardant**
- **hydrolysis-resistant and microbe-resistant**

Temperature range moved	**-20 °C to +80 °C, bending radius 5 x d**
Temperature range fixed	**-40 °C to +80 °C, bending radius 4 x d**
V max. unsupported/gliding	10 m/s, 5 m/s
a max.	80 m/s²
UV-resistant	High
Nominal voltage	300/500 V (according to DIN VDE 0245).
Testing voltage	2000 V (according to DIN VDE 0281-2).
Oil	Oil-resistant (according to EN 60811-2-1).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Fine-wire stranded conductor in especially bending-resistant version consisting of bare copper wires (according to EN 60228).
Core insulation	Mechanically high-quality PVC mixture (according to DIN VDE 0207 Part 4).
Core stranding	**Number of conductors < 12:** cores stranded in a layer with short pitch length. **Number of conductors ≥ 12:** cores combined in bundles and stranded together around a centre for high tensile stresses with adapted, short pitch lengths and pitch directions, especially low-torsion structure.
Core identification	**Cores < 0,5 mm²:** color code in accordance with DIN 47100 **Cores ≥ 0,5 mm²:** cores black with white numerals, one core green/yellow.
Inner jacket	PVC mixture adapted to suit the requirements in Energy Chains®.
Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.

... no minimum order quantity

Premium Line

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Outer jacket	Low-adhesion, highly abrasion-resistant mixture on the basis of PUR, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: anthracite-gray (similar to RAL 7016)
VDE	The cables are manufactured on the basis of VDE.
UL	**≤ 0,5 mm²:** Style 1729 and 20317, 300 V, 80 °C **≤ 1,5 mm²:** Style 1007 and 20317, 300 V, 80 °C **≥ 2,5 mm²:** Style 1011 and 20234, 600 V, 80 °C
CSA	LL63878, 80 °C, 300 V
CEI	According to CEI 20-35
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil
- indoor and outdoor applications
- especially for freely suspended and gliding travel distances up to 100 m
- storage and retrieval units for high-bay warehouses, machining units/packaging machines, quick handling, indoor cranes, refrigerating sector

PUR Control cable
Chainflex® CF2

- **for maximum load requirements**
- **PUR outer jacket**
- **shielded**
- **oil-resistant and coolant-resistant**
- **flame-retardant**
- **hydrolysis-resistant and microbe-resistant**

Delivery program **Part No.**	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF2.01.04	(4x0,14)C	6,0	17	40
CF2.01.08	(8x0,14)C	8,0	29	65
CF2.01.12	(12x0,14)C	9,0	49	101
CF2.01.18	(18x0,14)C	10,0	53	125
CF2.01.24*	(24x0,14)C	12,0	65	135
CF2.01.36	(36x0,14)C	13,0	88	200
CF2.01.48	(48x0,14)C	17,0	135	310
CF2.02.04	(4x0,25)C	7,0	24	53
CF2.02.08	(8x0,25)C	8,0	41	83
CF2.02.18	(18x0,25)C	13,0	96	190
CF2.02.24*	(24x0,25)C	14,0	120	220
CF2.02.48	(48x0,25)C	20,0	230	450
CF2.05.05	(5G0,5)C	11,0	64	170
CF2.05.07	(7G0,5)C	13,0	82	210
CF2.05.09	(9G0,5)C	15,0	97	260
CF2.05.12	(12G0,5)C	18,0	145	390
CF2.05.18	(18G0,5)C	22,0	192	520
CF2.05.24*	(24G0,5)C	23,0	238	620
CF2.07.03	(3G0,75)C	10,0	51	140
CF2.07.04	(4G0,75)C	10,0	57	160
CF2.07.05	(5G0,75)C	12,0	78	210
CF2.07.07	(7G0,75)C	14,0	102	240
CF2.07.12	(12G0,75)C	19,0	183	440
CF2.07.24*	(24G0,75)C	25,0	302	720
CF2.10.03	(3G1,0)C	10,0	63	150
CF2.10.04	(4G1,0)C	10,5	68	157
CF2.10.05	(5G1,0)C	12,0	91	200
CF2.10.07	(7G1,0)C	14,0	120	260
CF2.10.12	(12G1,0)C	20,0	213	480
CF2.10.24	(24G1,0)C	26,0	363	780
CF2.15.03	(3G1,5)C	11,0	85	190
CF2.15.07	(7G1,5)C	16,0	163	340
CF2.15.12	(12G1,5)C	23,0	289	650

The Chainflex® types marked with a * refer to cables that are based on a bundling of 4 cores each. Due to their excellent electrical properties (star-quad with especially minimum crosstalk), these cables can virtually be used in all cases in which otherwise twisted-pair cables are required.
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

... no minimum order quantity

Premium Line

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CF2 cables are resistant to oil and coolants. E-Chain®: System E4/00

750 types from stock no cutting costs ...

(for up to 10 cuts of the same type)

CF9
TPE
5 x d

TPE Control cable Chainflex® CF9

- **for maximum load requirements**
- **TPE outer jacket**
- **oil-resistant**
- **bio-oil-resistant**
- **PVC-free/halogen-free**
- **low-temperature-flexible**

Highly flexible special conductor

Center element for high tensile stresses

Braiding in bundles around high-tensile center cord

Gusset-filled extruded, halogen-free TPE mixture

Temperature range moved	**-35 °C to +100 °C, bending radius 5 x d**
Temperature range fixed	**-40 °C to +100 °C, bending radius 3 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	100 m/s²
UV-resistant	High
Nominal voltage	300/500 V (according to DIN VDE 0245).
Testing voltage	2000 V (according to DIN VDE 0281-2).
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Halogen-free	According to EN 50267-2-1.
Conductor	Fine-wire stranded conductor in especially bending-resistant version consisting of bare copper wires (according to EN 60228).
Core insulation	Mechanically high-quality TPE mixture.
Core stranding	**Number of conductors < 12:** cores stranded in a layer with short pitch length. **Number of conductors ≥ 12:** cores combined in bundles and stranded together around a centre for high tensile stresses with adapted, short pitch lengths and pitch directions, especially low-torsion structure.

Premium Line

... no minimum order quantity

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Core identification

Cores < 0,75 mm²: color code in accordance with DIN 47100
Cores ≥ 0,75 mm²: cores black with white numerals, one core green/yellow.
CF9.02.03.INI: brown, blue, black
CF9.03.04.INI: brown, blue, black, white
CF9.03.05.INI: brown, blue, black, white, green-yellow
CF9.03.16.07.03.INI:
(0,75mm²): blue, green-yellow, brown
(0,34mm²): violet, red, gray, red-blue, green, grey-pink, white-green, white-yellow, white-grey, black, yellow-brown, brown-green, white, yellow, pink, grey-brown

Outer jacket

Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®.
Colour: dark-blue (similar to RAL 5011)

VDE

The cables are manufactured on the basis of VDE.

CE

According to 73/23/EWG, 93/68/EWG

Lead free

According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications, UV-resistant
- especially for freely suspended and gliding travel distances up to 400 m and more
- storage and retrieval units for high-bay warehouses, machining units/machine tools, quick handling, clean room, semiconductor insertion, outdoor cranes, low-temperature applications

Chainflex® CF9 for outdoor crane systems. E-Chain®: Serie E4/00

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

TPE Control cable
Chainflex® CF9

- **for maximum load requirements**
- **TPE outer jacket**
- **oil-resistant**
- **bio-oil-resistant**
- **PVC-free/halogen-free**
- **low-temperature-flexible**

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF9.03.16.07.03.INI	4x4x0,34+3x0,75	11,0	74	159
CF9.02.02	2x0,25	4,5	5	18
CF9.02.03.INI	3x0,25	4,5	8	20
CF9.02.06	6x0,25	5,5	15	35
CF9.02.07	7x0,25	6,0	17	42
CF9.02.08	8x0,25	6,5	20	46
CF9.02.12	12x0,25	8,0	29	70
CF9.03.04.INI	4x0,34	5,0	13	31
CF9.03.05.INI	5x0,34	5,5	17	37
CF9.03.06	6x0,34	6,0	20	43
CF9.03.08	8x0,34	6,5	26	55
CF9.05.02	2x0,5	5,0	10	31
CF9.05.03	3x0,5	5,5	15	32
CF9.05.04	4x0,5	5,5	20	36
CF9.05.05	5x0,5	6,0	24	46
CF9.05.07	7x0,5	7,0	34	78
CF9.05.12	12x0,5	9,5	58	105
CF9.05.18	18x0,5	12,5	86	165
CF9.05.25	25x0,5	13,5	120	201
CF9.05.36	36x0,5	17,5	173	368
CF9.07.05	5G0,75	6,5	36	58
CF9.07.07	7G0,75	7,0	50	76
CF9.07.12	12G0,75	11,0	86	142
CF9.07.20	20G0,75	13,0	144	231
CF9.07.25	25G0,75	14,5	180	320
CF9.10.03	3G1,0	6,0	29	49
CF9.10.04	4G1,0	6,5	38	56
CF9.10.05	5G1,0	7,0	48	70
CF9.10.12	12G1,0	11,5	115	181
CF9.10.18	18G1,0	14,0	173	267
CF9.10.25	25G1,0	17,0	241	329
CF9.15.04	4G1,5	7,5	58	86
CF9.15.05	5G1,5	8,0	72	110
CF9.15.07	7G1,5	9,0	101	140
CF9.15.12	12G1,5	14,0	173	265
CF9.15.18	18G1,5	17,0	260	400
CF9.15.25	25G1,5	20,0	360	602

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

... no minimum order quantity

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF9.25.04	4G2,5	9,0	96	128
CF9.25.05	5G2,5	10,0	120	174
CF9.25.07	7G2,5	12,0	168	301
CF9.25.12	12G2,5	17,0	288	468
CF9.25.16	16G2,5	21,0	384	600
CF9.25.18*	18G2,5	24,0	432	827
CF9.25.25	25G2,5	24,5	600	990
CF9.40.04	4G4,0	10,0	154	195
CF9.60.04	4G6,0	12,5	230	310
CF9.60.05	5G6,0	14,0	288	400
CF9.100.04**	4G10,0	15,5	384	515
CF9.160.04**	4G16,0	20,0	614	780
CF9.350.04**	4G35,0	26,0	1344	1700

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
* Nominal voltage 600/1000 V ** Nominal voltage 450/750 V
G = with earthed conductor green-yellow **x =** without earthed conductor

CF9 for maximum load requirements for both indoor and outdoor applications. E-Chain®: System E4/4

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CF10
TPE
5 x d

Highly flexible special conductor

Center element for high tensile stresses

Braiding in bundles around high-tensile center cord

Gusset-filled, pressure extruded

Highly flexible braided copper shield

Pressure extruded, halogen-free TPE blend

TPE Control cable Chainflex® CF10

- **for maximum load requirements**
- **TPE outer jacket**
- **shielded**
- **oil-resistant**
- **bio-oil-resistant**
- **PVC-free/halogen-free**
- **low-temperature-flexible**

Temperature range moved	**-35 °C to +100 °C, bending radius 5 x d**
Temperature range fixed	**-40 °C to +100 °C, bending radius 3 x d**
V max. unsupported/gliding	10 m/s, 5 m/s
a max.	100 m/s²
UV-resistant	High
Nominal voltage	300/500 V (according to DIN VDE 0245).
Testing voltage	2000 V (according to DIN VDE 0281-2).
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Halogen-free	According to EN 50267-2-1.
Conductor	Fine-wire stranded conductor in especially bending-resistant version consisting of bare copper wires (according to EN 60228).
Core insulation	Mechanically high-quality TPE mixture.
Core stranding	**Number of conductors < 12:** cores stranded in a layer with short pitch length. **Number of conductors ≥ 12:** cores combined in bundles and stranded together around a centre for high tensile stresses with adapted, short pitch lengths and pitch directions, especially low-torsion structure.
Core identification	**Cores < 0,75 mm²:** color code in accordance with DIN 47100 **Cores ≥ 0,75 mm²:** cores black with white numerals, one core green/yellow.
Inner jacket	TPE mixture adapted to suit the requirements in Energy Chains®.

... no minimum order quantity

Premium Line

Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: dark-blue (similar to RAL 5011)
VDE	The cables are manufactured on the basis of VDE.
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications, UV-resistant
- especially for freely suspended and gliding travel distances up to 400 m and more
- storage and retrieval units for high-bay warehouses, machining units/machine tools, quick handling, clean room, semiconductor insertion, outdoor cranes, low-temperature applications

Tel. +49-22 03-96 49-800
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TPE Control cable
Chainflex® CF10

- **for maximum load requirements**
- **TPE outer jacket**
- **shielded**
- **oil-resistant**
- **bio-oil-resistant**
- **PVC-free/halogen-free**
- **low-temperature-flexible**

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF10.01.12	(12x0,14)C	7,5	36	80
CF10.01.18	(18x0,14)C	10,0	67	110
CF10.02.04	(4x0,25)C	6,5	25	52
CF10.02.08	(8x0,25)C	7,5	40	75
CF10.02.12	(12x0,25)C	9,0	64	118
CF10.05.04	(4x0,5)C	7,0	38	68
CF10.05.05	(5x0,5)C	7,5	55	91
CF10.05.12	(12x0,5)C	11,5	102	192
CF10.05.18	(18x0,5)C	13,5	143	270
CF10.05.25	(25x0,5)C	14,5	167	280
CF10.07.04	(4G0,75)C	7,5	47	86
CF10.07.05	(5G0,75)C	7,5	57	95
CF10.07.07	(7G0,75)C	9,0	85	137
CF10.07.12	(12G0,75)C	12,5	138	244
CF10.07.20	(20G0,75)C	15,0	205	346
CF10.07.24	(24G0,75)C	16,5	239	419
CF10.10.02	(2x1,0)C	7,0	38	70
CF10.10.03	(3G1,0)C	7,5	47	84
CF10.10.04	(4G1,0)C	8,0	59	100
CF10.10.05	(5G1,0)C	8,0	71	101
CF10.10.07	(7G1,0)C	10,0	105	166
CF10.10.12	(12G1,0)C	13,5	169	293
CF10.10.18	(18G1,0)C	16,5	240	407
CF10.10.24	(24G1,0)C	18,0	305	506
CF10.15.04	(4G1,5)C	9,0	96	144
CF10.15.07	(7G1,5)C	11,5	155	225
CF10.15.12	(12G1,5)C	15,5	235	387
CF10.15.18	(18G1,5)C	20,0	361	585
CF10.25.04	(4G2,5)C	11,0	126	180
CF10.25.07	(7G2,5)C	13,5	221	331
CF10.25.12	(12G2,5)C	19,0	373	624
CF10.40.04	(4G4,0)C	11,5	200	290
CF10.40.05	(5G4,0)C	13,5	246	353

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Premium Line

... no minimum order quantity

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Control cable CF10 in storage and retrieval units for high-bay warehouses. E-Chain®: System E2 medium

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

CF98
TPE
4 x d

TPE Control cable Chainflex® CF98

- **for maximum load requirements and especially small radii up to 4 x d**
- **TPE outer jacket**
- **oil-resistant**
- **bio-oil-resistant**
- **PVC-free/halogen-free**
- **low-temperature-flexible**

Temperature range moved	**-35 °C to +90 °C, bending radius 4 x d**
Temperature range fixed	**-40 °C to +90 °C, bending radius 3 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	100 m/s²
UV-resistant	High
Nominal voltage	300/300 V
Testing voltage	1500 V
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Halogen-free	According to EN 50267-2-1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Conductor consisting of a highly flexible special alloy.
Core insulation	Mechanically high-quality TPE mixture.
Core stranding	Cores stranded in one layer with especially short pitch length.
Core identification	Color code in accordance with DIN 47100. **CF9.02.03.INI:** brown, blue, black **CF9.03.04.INI:** brown, blue, black, white
Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: dark-blue (similar to RAL 5011)
VDE	The cables are manufactured on the basis of VDE.
CE	According to 73/23/EWG, 93/68/EWG

... no minimum order quantity

Premium Line

RoHS **Lead free** According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements at 4 x d
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications, UV-resistant
- especially for short, very fast applications with small radii and tight design space
- automatic insertion machines, automatic doors, clean room, very quick handling

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]	
CF98.01.02	2x0,14	4,0	4,0	11	
CF98.01.03*	3x0,14	4,5	6,3	14	
CF98.01.04	4x0,14	5,0	8,5	16	
CF98.01.07*	7x0,14	6,0	14,0	21	New
CF98.01.08	8x0,14	6,5	16,0	24	
CF98.02.03.INI	3x0,25	5,0	12,0	25	
CF98.02.04	4x0,25	5,5	16,0	30	
CF98.02.07	7x0,25	6,5	26,0	53	
CF98.02.08	8x0,25	7,0	30,0	60	New
CF98.03.03*	3x0,34	5,0	14,4	28	
CF98.03.04.INI	4x0,34	5,5	19,4	35	
CF98.03.07	7x0,34	7,0	32,0	55	
CF98.03.08	8x0,34	7,5	38,0	63	
CF98.05.04	4x0,5	6,0	31,0	40	

* Delivery time upon inquiry
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Test data ▸ Page 26

Chainflex® CF98 for maximum load requirements and especially small radii at automatic doors.

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CF99
TPE
4 x d

Extremely highly flexible special alloy

Braiding in layers with extremely short pitch

Gusset-filled extruded

Extremely highly flexible special shield made of alloyed wires

Pressure extruded, halogen-free TPE blend

TPE Control cable Chainflex® CF99

- **for maximum load requirements and especially small radii up to 4 x d**
- **TPE outer jacket**
- **shielded**
- **oil-resistant**
- **bio-oil-resistant**
- **PVC-free/halogen-free**
- **low-temperature-flexible**

Temperature range moved	**-35 °C to +90 °C, bending radius 4 x d**
Temperature range fixed	**-40 °C to +90 °C, bending radius 3 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	100 m/s²
UV-resistant	High
Nominal voltage	300/300 V
Testing voltage	1500 V
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Halogen-free	According to EN 50267-2-1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Conductor consisting of a highly flexible special alloy.
Core insulation	Mechanically high-quality TPE mixture.
Core stranding	Cores stranded in one layer with especially short pitch length.
Core identification	Color code in accordance with DIN 47100.
Inner jacket	TPE mixture adapted to suit the requirements in Energy Chains®.
Overall shield	Highly flexible alloyed special shield. Coverage approx. 70% linear, approx. 90% optical.
Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: dark-blue (similar to RAL 5011)

... no minimum order quantity

Premium Line

VDE	VDE	The cables are manufactured on the basis of VDE.
CE	CE	According to 73/23/EWG, 93/68/EWG
RoHS	Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements at 4 x d
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications, UV-resistant
- especially for short, very fast applications with small radii and tight design space
- automatic insertion machines, automatic doors, clean room, very quick handling

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF99.01.02**	(2x0,14)C	5,5	13,5	33,0
CF99.01.03**	(3x0,14)C	6,0	16,5	37,0
CF99.01.04**	(4x0,14)C	6,0	21,0	43,0
CF99.01.07**	(7x0,14)C	7,5	31,5	62,0
CF99.01.08**	(8x0,14)C	8,0	36,0	69,0
CF99.02.03**	(3x0,25)C	6,5	25,0	48,0
CF99.02.04**	(4x0,25)C	6,5	30,0	56,0
CF99.02.07**	(7x0,25)C	8,0	48,0	85,0
CF99.02.08**	(8x0,25)C	8,5	54,0	93,0
CF99.03.03**	(3x0,34)C	6,5	27,0	51,0
CF99.03.04**	(4x0,34)C	7,0	35,0	62,0
CF99.03.07**	(7x0,34)C	8,5	56,0	94,0
CF99.03.08**	(8x0,34)C	9,0	64,0	105,0

** Delivery time upon inquiry
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

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Data cables

Bus cables Encoder cables Fibre optic cables

Chainflex® types

Chainflex® cable	Jacket	Shield	Bending radius moved [factor x d]	Temperature moved from/to [°C]	Approvals and standards	Oil-resistant	Torsion resistant	V max. [m/s] unsupported	V max. [m/s] gliding	a max. [m/s²]	Page
Data cables											
CF240	PVC	✔	10-12	-5/ +70		✔		3	2	20	82
CF211	PVC	✔	10	-5/ +70		✔		5	3	50	84
CF11	TPE	✔	10	-35/ +100		✔		10	6	100	86
CF12	TPE	✔	10	-35/ +100		✔		10	6	100	88
Bus cables (with selection chart for Chainflex® bus cables)											90
CFBUS	TPE	✔	10-12,5	-35/ +70		✔		10	6	100	92
CF11.LC	TPE	✔	10	-35/ +70		✔		10	6	100	96
CF11.LC.D	TPE	✔	10	-35/ +70		✔		10	6	100	98
CF14 CAT5	TPE	✔	12,5	-35/ +70		✔		10	6	100	100
Measuring system cables											
CF211	PVC	✔	10	-5/ +70		✔		5	3	50	102
CF111.D	TPE	✔	12	-35/ +100		✔		2		30	106
CF11.D	TPE	✔	10	-35/ +100		✔		10	6	100	110
Fibre optic cable (FOC)											
CFLG	PVC		10	-5/ +70		✔		10	5	20	114
CFLG.2HG.MF	PUR		12,5	-20/ +60		✔		10	6	20	116
CFLK	PUR		12,5	-20/ +70		✔		10	5	20	118
CFLG. G.T	TPE		15	-20/ +60		✔		10	6	20	120
Koax cables											
KOAX 1	TPE		10	-35/ +100		✔		10	5	100	122

CF240
PVC
10-12 x d

PVC Data cable
Chainflex® CF240

- **for high load requirements**
- **PVC outer jacket**
- **shielded**
- **oil-proof in accordance with VDE**
- **flame-retardant**

Fine-wire special conductor

Braiding in layers with extremely short pitch

Highly flexible braided copper shield

Pressure extruded

Temperature range moved	**-5 °C to +70 °C, bending radius 10 x d with < 10 m travel; bending radius 12 x d with ≥ 10 m travel**
Temperature range fixed	**-20 °C to +70 °C, bending radius 5 x d**
V max. unsupported/gliding	3 m/s, 2 m/s
a max.	20 m/s²
Nominal voltage	300/300 V (according to DIN VDE 0245).
Testing voltage	1500 V
Oil	Oil-proof (according to DIN VDE 0207).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Very finely stranded special cores of particularly high-flex design made of bare copper wires.
Core insulation	Mechanically high-quality PVC mixture (according to DIN VDE 0207 Part 4).
Core stranding	The individual cores are stranded in layers with short pitch lengths.
Core identification	Color code in accordance with DIN 47100.
Intermediate sheath	Foil taping over the external layer.
Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Outer jacket	Low-adhesion, oil-resistant mixture on the basis of PVC, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: gray (similar to RAL 7001)
VDE	The cables are manufactured on the basis of VDE.
UL	Style 1729 and 2464, 300 V, 80 °C
CSA	LL63878, 80 °C, 300 V

... no minimum order quantity

Economy Line

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CEI	According to CEI 20-35
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC – starting from manufacturing date 1/2006.

Typical application area

- for high load requirements
- light oil influence
- preferably indoor applications, but also outdoor ones at temperatures > 5 °C
- especially for freely suspended and gliding travel distances up to 50 m
- storage and retrieval units for high-bay warehouses, machining units/packaging machines, handling, indoor cranes

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF240.01.03	(3x0,14)C	5,0	16	35
CF240.01.04	(4x0,14)C	5,0	18	38
CF240.01.05	(5x0,14)C	5,5	20	42
CF240.01.07	(7x0,14)C	6,0	25	51
CF240.01.14	(14x0,14)C	7,0	42	76
CF240.01.18	(18x0,14)C	8,0	48	90
CF240.01.24	(24x0,14)C	8,5	60	113
CF240.02.03	(3x0,25)C	5,5	21	40
CF240.02.04	(4x0,25)C	5,5	24	48
CF240.02.05	(5x0,25)C	6,0	27	52
CF240.02.07	(7x0,25)C	7,0	35	66
CF240.02.08	(8x0,25)C	7,5	40	74
CF240.02.14	(14x0,25)C	8,0	57	100
CF240.02.18	(18x0,25)C	9,0	71	122
CF240.02.24	(24x0,25)C	11,0	92	174
CF240.03.03	(3x0,34)C	5,5	24	45
CF240.03.04	(4x0,34)C	6,0	28	51
CF240.03.05	(5x0,34)C	6,5	32	58
CF240.03.07	(7x0,34)C	7,0	43	75
CF240.03.10	(10x0,34)C	8,5	55	110
CF240.03.14	(14x0,34)C	8,5	71	116
CF240.03.18	(18x0,34)C	9,0	87	140
CF240.03.24	(24x0,34)C	12,0	115	203

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

CF211
PVC
10 x d

Center element for high tensile stresses

Fine-wire special conductor

2 conductors each stranded with short pitch

Highly flexible braided copper shield

Pressure extruded

PVC Data cable Chainflex® CF211

- **for high load requirements**
- **PVC outer jacket**
- **shielded**
- **oil-proof in accordance with VDE**
- **flame-retardant**

Temperature range moved	**-5 °C to +70 °C, bending radius 10 x d**
Temperature range fixed	**-20 °C to +70 °C, bending radius 5 x d**
V max. unsupported/gliding	5 m/s, 3 m/s
a max.	50 m/s²
Nominal voltage	300/300 V (according to DIN VDE 0245).
Testing voltage	1500 V
Oil	Oil-proof (according to DIN VDE 0207).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Very finely stranded special cores of particularly high-flex design made of bare copper wires.
Core insulation	Mechanically high-quality PVC mixture (according to DIN VDE 0207 Part 4).
Core stranding	2 cores each stranded in pairs with short pitch lengths, core pairs also stranded with short pitch lengths.
Core identification	Color code in accordance with DIN 47100.
Intermediate sheath	Foil taping over the external layer.
Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Outer jacket	Low-adhesion, oil-resistant mixture on the basis of PVC, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: gray (similar to RAL 7001)
VDE	The cables are manufactured on the basis of VDE.
UL	Style 1729 and 2464, 300 V, 80 °C
CSA	LL63878, 80 °C, 300 V

... no minimum order quantity

Economy Line

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CEI	According to CEI 20-35
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC – starting from manufacturing date 1/2006.

Typical application area

- for high load requirements
- light oil influence
- preferably indoor applications, but also outdoor ones at temperatures > 5 °C
- especially for freely suspended and gliding travel distances up to 100 m
- storage and retrieval units for high-bay warehouses, machining units/packaging machines, handling, indoor cranes

Delivery program Data cable Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF211.02.01.02	(1x(2x0,25))C	5,0	16	35
CF211.02.02.02	(2x(2x0,25))C	7,0	28	60
CF211.02.03.02	(3x(2x0,25))C	7,5	37	73
CF211.02.04.02	(4x(2x0,25))C	8,0	44	85
CF211.02.05.02	(5x(2x0,25))C	8,5	51	97
CF211.02.06.02	(6x(2x0,25))C	9,5	58	110
CF211.02.08.02	(8x(2x0,25))C	11,5	75	160
CF211.02.10.02	(10x(2x0,25))C	13,0	93	195
CF211.02.14.02	(14x(2x0,25))C	13,5	109	205
CF211.03.03.02	(3x(2x0,34))C	8,0	37	79
CF211.05.01.02	(1x(2x0,5))C	5,5	23	50
CF211.05.02.02	(2x(2x0,5))C	8,0	44	80
CF211.05.03.02	(3x(2x0,5))C	9,0	57	100
CF211.05.04.02	(4x(2x0,5))C	9,5	68	120
CF211.05.05.02	(5x(2x0,5))C	11,0	80	145
CF211.05.06.02	(6x(2x0,5))C	12,5	99	185
CF211.05.08.02	(8x(2x0,5))C	14,0	124	230
CF211.05.10.02	(10x(2x0,5))C	16,0	175	320
CF211.05.14.02	(14x(2x0,5))C	17,0	187	335

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Delivery program Measuring system cable

▸ **Page 100, CF211** (PVC-Economy Line)
▸ **Page 104, CF111.D** (TPE-Economy Line)
▸ **Page 108, CF11.D** (TPE-Premium Line)

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

CF11
TPE
10 x d

Especially bending-resistant fine-wire stranded conductor

2 conductors each stranded in especially short pitch

Gusset-filled extruded

Highly flexible braided copper shield

Pressure extruded, halogen-free TPE blend

TPE Data cable Chainflex® CF11

- **for maximum load requirements**
- **TPE outer jacket**
- **shielded**
- **oil-resistant**
- **bio-oil-resistant**
- **PVC-free/halogen-free**

Temperature range moved	**-35 °C to +100 °C, bending radius 10 x d**
Temperature range fixed	**-40 °C to +100 °C, bending radius 5 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	100 m/s²
UV-resistant	High
Nominal voltage	300/300 V (according to DIN VDE 0245).
Testing voltage	1500 V
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Halogen-free	According to EN 50267-2-1.
Conductor	Fine-wire stranded conductor in especially bending-resistant version consisting of bare copper wires (according to EN 60228).
Core insulation	Mechanically high-quality TPE mixture.
Core stranding	2 cores each stranded in pairs with short pitch lengths, core pairs also stranded with short pitch lengths.
Core identification	**Cores < 1,0 mm²:** color code in accordance with DIN 47100 **Cores ≥ 1,0 mm²:** cores black with white numerals
Inner jacket	TPE mixture adapted to suit the requirements in Energy Chains®.
Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: dark-blue (similar to RAL 5011)

... no minimum order quantity

Premium Line

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VDE	The cables are manufactured on the basis of VDE.
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications, UV-resistant
- especially for freely suspended and gliding travel distances up to 400 m and more
- storage and retrieval units for high-bay warehouses, machining units/machine tools, quick handling, clean room, semiconductor insertion, outdoor cranes, low-temperature applications

Delivery program Bus cable Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF11.01.04.02	(4x(2x0,14))C	7,0	28	64
CF11.01.18.02	(18x(2x0,14))C	14,0	86	164
CF11.02.02.02	(2x(2x0,25))C	7,0	30	50
CF11.02.03.02	(3x(2x0,25))C	9,0	34	60
CF11.02.04.02	(4x(2x0,25))C	9,0	44	80
CF11.02.05.02	(5x(2x0,25))C	9,0	55	100
CF11.02.09.02	(9x(2x0,25))C	12,5	92	198
CF11.02.10.02	(10x(2x0,25))C	13,0	99	200
CF11.03.08.02	(8x(2x0,34))C	12,5	90	154
CF11.05.04.02	(4x(2x0,5))C	10,0	91	108
CF11.05.06.02	(6x(2x0,5))C	13,0	95	190
CF11.05.08.02	(8x(2x0,5))C	14,0	131	250
CF11.07.03.02	(3x(2x0,75))C	11,0	77	131
CF11.10.04.02	(4x(2x1,0))C	12,0	121	180
CF11.15.06.02	(6x(2x1,5))C	17,0	242	419
CF11.25.03.02	(3x(2x2,5))C	16,5	210	410

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Delivery program Measuring system cable

▸ **Page 102, CF211** (PVC-Economy Line)
▸ **Page 106, CF111.D** (TPE-Economy Line)
▸ **Page 110, CF11.D** (TPE-Premium Line)

CF12
TPE
10 x d

Especially bending-resistant fine-wire stranded conductor

Pressure extrudet element jacket

Highly flexible braided copper shield

Center element for high tensile stresses

2 conductors each stranded in especially short pitch

Gusset-filled, pressure extruded

Highly flexible steel wire braid

Pressure extruded, halogen-free TPE blend

TPE Data cable Chainflex® CF12

- **for maximum load requirements**
- **TPE outer jacket**
- **double-shielded**
- **oil-resistant**
- **bio-oil-resistant**
- **PVC-free/halogen-free**

Temperature range moved	**-35 °C to +100 °C, bending radius 10 x d**
Temperature range fixed	**-40 °C to +100 °C, bending radius 5 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	100 m/s²
UV-resistant	High
Nominal voltage	300/300 V (according to DIN VDE 0245).
Testing voltage	1500 V
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Halogen-free	According to EN 50267-2-1.
Conductor	Fine-wire stranded conductor in especially bending-resistant version consisting of bare copper wires (according to EN 60228).
Core insulation	Mechanically high-quality TPE mixture.
Core stranding	2 cores each stranded in pairs with short pitch lengths, core pairs also stranded with short pitch lengths.
Core identification	**Cores < 0,5 mm²:** color code in accordance with DIN 47100 **Cores ≥ 0,5 mm²:** cores black with white numerals
Element shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Element jacket	TPE mixture adapted to suit the requirements in Energy Chains® over pair shield.
Inner jacket	TPE mixture adapted to suit the requirements in Energy Chains®.
Overall shield	Highly flexible shield consisting of galvanized steel wire braid. Coverage approx. 70% linear, approx. 90% optical.

... no minimum order quantity

Premium Line

Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: dark-blue (similar to RAL 5011)
VDE	The cables are manufactured on the basis of VDE.
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications, UV-resistant
- especially for freely suspended and gliding travel distances up to 400 m
- storage and retrieval units for high-bay warehouses, machining units/machine tools, quick handling, clean room, semiconductor insertion, outdoor cranes, low-temperature applications, for especially high EMC safety

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF12.02.04.02	(4 x (2 x 0,25)C)C	12,0	74	135
CF12.02.05.02	(5 x (2 x 0,25)C)C	12,0	93	220
CF12.05.03.02	(3 x (2 x 0,5) C)C	13,0	66	210
CF12.05.04.02	(4 x (2 x 0,5) C)C	14,0	88	255
CF12.05.05.02	(5 x (2 x 0,5) C)C	15,0	110	297
CF12.05.06.02	(6 x (2 x 0,5) C)C	17,0	132	360
CF12.05.08.02	(8 x (2 x 0,5) C)C	20,0	177	477
CF12.05.10.02	(10 x (2 x 0,5) C)C	22,0	221	548
CF12.05.14.02	(14 x (2 x 0,5) C)C	24,0	309	723
CF12.10.06.02	(6 x (2 x 1,0) C)C	20,0	198	542

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Test data ▸ Page 33

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Selection chart for Chainflex® bus cables

Chainflex® cable	Profibus	Interbus	CAN Bus	DeviceNet	Ethernet/CAT5
CFBUS					
CFBUS.001	✔				
CFBUS.002	✔				
CFBUS.003	✔				
CFBUS.010		✔			
CFBUS.011		✔			
CFBUS.020			✔		
CFBUS.021			✔		
CFBUS.022			✔		
CFBUS.030				✔	
CFBUS.031				✔	
CFBUS.040					✔
CFBUS.041					✔
CFBUS.042					✔
CFBUS.044					✔
CFBUS.050 CAT6					CAT6
CFBUS.055 FireWire					
CF11.LC					
CF11.05.01.02.LC			✔		
CF11.05.02.02.LC			✔		
CF11.02.03.02.IB-S		✔			
CF11.02.03.02.10.03.IB-S		✔			
CF11.LC.D					
CF11.02.02.02.LC.D			✔		
CF11.05.01.02.LC.D			✔		
CF11.05.02.02.LC.D			✔		
CF11.02.01.02.PBA.LC.D	✔				
CF11.02.02.07.03.PBA.LC.D	✔				
CF11.02.02.15.04.PBA.LC.D	✔				
CF14 CAT5					
CF14.02.02.02.CAT5					✔
CF14.02.04.02.CAT5					✔
CF14.02.05.02.CAT5					✔

... no minimum order quantity

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FireWire	Characteristic wave impedance [Ω]	flame-retardant	CE	RoHS	VDE		cULus	Halogen-free	Page
	150	✔	✔	✔	✔	✔	✔	✔		92
	150	✔	✔	✔	✔	✔	✔	✔		92
	150	✔	✔	✔	✔	✔	✔	✔		92
	100	✔	✔	✔	✔	✔	✔	✔		92
	100	✔	✔	✔	✔	✔	✔	✔		92
	120	✔	✔	✔	✔	✔	✔	✔		92
	120	✔	✔	✔	✔	✔	✔	✔		92
	120	✔	✔	✔	✔	✔	✔	✔		92
	120	✔	✔	✔	✔	✔	✔	✔		92
	120	✔	✔	✔	✔	✔	✔	✔		92
	100	✔	✔	✔	✔	✔	✔	✔		92
	100	✔	✔	✔	✔	✔	✔	✔		92
	100	✔	✔	✔	✔	✔	✔	✔		92
	100	✔	✔	✔	✔	✔	✔	✔		92
	100	✔	✔	✔	✔	✔	✔	✔		92
✔	100	✔	✔	✔	✔	✔	✔	✔		92
	120		✔	✔	✔				✔	96
	120		✔	✔	✔				✔	96
	100		✔	✔	✔				✔	96
	100		✔	✔	✔				✔	96
	120		✔	✔	✔			✔	✔	98
	120		✔	✔	✔			✔	✔	98
	120		✔	✔	✔			✔	✔	98
	150		✔	✔	✔			✔	✔	98
	150		✔	✔	✔			✔	✔	98
	150		✔	✔	✔			✔	✔	98
	100		✔	✔	✔			✔	✔	100
	100		✔	✔	✔			✔	✔	100
	100		✔	✔	✔			✔	✔	100

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

CFBUS
TPE
10-12,5 x d

TPE Bus cable
Chainflex® CFBUS

- **for maximum load requirements**
- **TPE outer jacket**
- **shielded**
- **oil-resistant**
- **bio-oil-resistant**
- **flame-retardant**

Temperature range moved	**-35 °C to +70 °C, bending radius 10-12,5 x d**
Temperature range fixed	**-40 °C to +70 °C, bending radius 5 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	100 m/s²
UV-resistant	Medium
Nominal voltage	30 V
Testing voltage	150 V
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Fine-wire stranded conductor in especially bending-resistant version consisting of bare copper wires (according to EN 60228).
Core insulation	According to bus specification.
Core stranding	According to bus specification.
Core identification	According to bus specification ▶ Schedule delivery program
Inner jacket	TPE mixture adapted to suit the requirements in Energy Chains®.
Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: violet (similar to RAL 4001)

Premium Line

DESINA

cULus

DVE

RoHS

CE

... no minimum order quantity

	VDE	The cables are manufactured on the basis of VDE.
	UL/CSA	Style 1589 and 21371, 30 V, 80 °C
	CE	According to 73/23/EWG, 93/68/EWG
	DESINA	According to VDW, DESINA standardisation
	Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications without direct sun radiation
- especially for freely suspended and gliding travel distances up to 400 m
- bus connection cable for storage and retrieval units for high-bay warehouses, machining units/machine tools, quick handling, clean room, semiconductor insertion, indoor cranes, low-temperature applications

Test data ▸ Page 26

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TPE Bus cable
Chainflex® CFBUS

- **for maximum load requirements**
- **TPE outer jacket**
- **shielded**
- **oil-resistant**
- **bio-oil-resistant**
- **flame-retardant**

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
Profibus (bending radius 10 x d)				
CFBUS.001	(2x0,25)C	8,5	23	70
CFBUS.002	4x1,5+(2x0,25)C	12,5	96	175
CFBUS.003	3x0,75+(2x0,25)C	11,0	58	121
Interbus (bending radius 10 x d)				
CFBUS.010	(3x(2x0,25))C	8,5	42	83
CFBUS.011	(3x(2x0,25)+3x1,0)C	10,0	74	135
CAN-BUS/Fieldbus (bending radius 10 x d)				
CFBUS.020	(2x(2x0,25))C	8,5	33	66
CFBUS.021	(2x0,5)C	8,5	36	77
CFBUS.022	(2x(2x0,5))C	8,5	45	83
DeviceNet (bending radius 10 x d)				
CFBUS.030 Drop	(1x2xAWG24+1x2xAWG22)C	7,5	33	65
CFBUS.031 Trunk	(1x2xAWG18+1x2xAWG15)C	11,5	96	110
Ethernet/CAT5 (bending radius 12,5 x d)				
CFBUS.040**	(2x(2x0,25))C	7,0	33	43
CFBUS.041	(4x(2x0,25))C	10,0	46	101
CFBUS.042*	(5x(2x0,25))C	10,5	53	106
CFBUS.044	(4x(2x0,15))C	8,0	35	79
Ethernet/CAT6 (bending radius 12,5 x d)				
CFBUS.050	(4x(2x0,14)C)C	10,0	77	131
FireWire (bending radius 12,5 x d)				
CFBUS.055	2x(2x0,15)C+2x(0,34)C	7,5	42	118

* Delivery time upon inquiry
The Chainflex® types marked with ** are cables designed as a star-quad.
Other types available on request.
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x=** without earthed conductor

Premium Line

DESINA

cULus

DVE

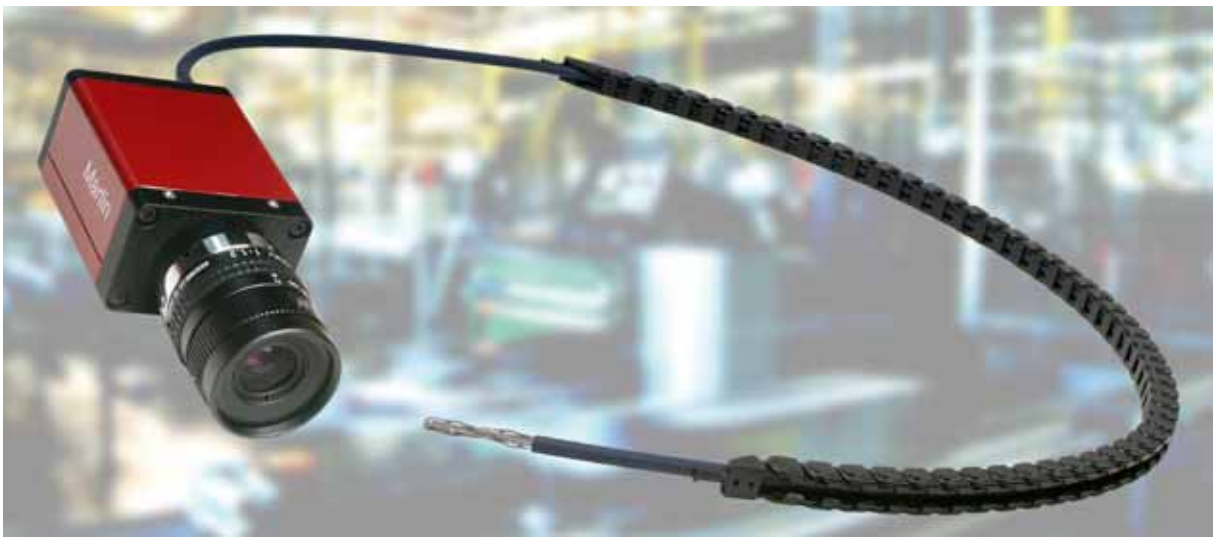
RoHS

CE

... no minimum order quantity

Delivery program Part No. Profibus	Characteris- tic wave impedance approx. [Ω]	Number of cores and conductor nominal cross section [mm²]	Colour code
CFBUS.001	150	(2x0,25)C	red, green
CFBUS.002	150	4x1,5+	black with white numbers
		(2x0,25)C	red, green
CFBUS.003	150	3x0,75+	black, blue, green-yellow
		(2x0,25)C	red, green
Interbus			
CFBUS.010	100	(3x(2x0,25))C	white, brown, green, yellow, gray, pink
CFBUS.011	100	(3x1,0+	red, blue, green-yellow
		3x(2x0,25))C	white, brown, green, yellow, gray, pink
CAN-BUS/Fieldbus			
CFBUS.020	120	(2x(2x0,25))C	white, green, brown, yellow (star-quad stranding)
CFBUS.021	120	(2x0,5)C	white, brown
CFBUS.022	120	(2x(2x0,5))C	white, green, brown, yellow (star-quad stranding)
DeviceNet			
CFBUS.030	120	(1x2xAWG24)+	white, blue
		(1x2xAWG22)C	red, black
CFBUS.031	120	(1x2xAWG18)+	white, blue
		(1x2xAWG15)C	red, black
Ethernet/CAT5			
CFBUS.040	100	(2x(2x0,25))C	white, green, brown, yellow (star-quad stranding)
CFBUS.041	100	(4x(2x0,25))C	white, brown, green, yellow, gray, pink, blue, red
CFBUS.042**	100	(5x(2x0,25))C	white, brown, green, yellow, gray, pink, blue, red, black, violet
CFBUS.044	100	(4x(2x0,15))C	white, brown, green, yellow, gray, pink, blue, red
Ethernet/CAT6			
CFBUS.050	100	(4x(2x0,14)C)C	white, blue, white, orange, white, green, white, brown
FireWire			
CFBUS.055	100	2x(2x0,15)C+	orange/blue, green/red
		2x(0,34)C	black, white

** Delivery time upon inquiry
G = with earthed conductor green-yellow **x =** without earthed conductor



FireWire cable for moving energy supplies in digital camera technology.

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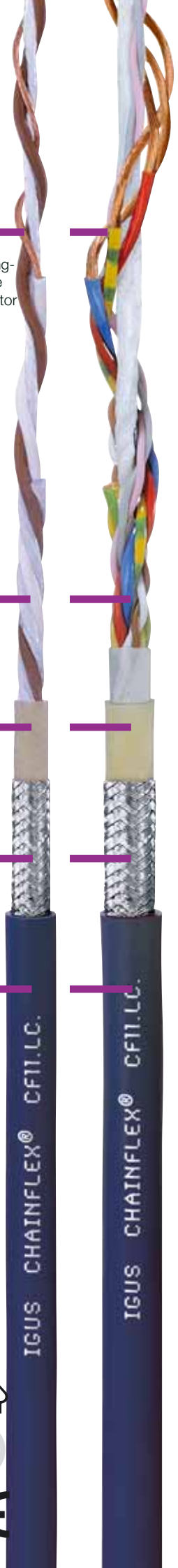
CF11.LC
TPE
10 x d



Especially bending-resistant fine-wire stranded conductor

Conductors stranded in short pitch

Gusset-filled extruded

Highly flexible braided copper shield

Pressure extruded, halogen-free TPE blend

TPE Bus cable
Chainflex® CF11.LC (low capacitance)

- **for maximum load requirements**
- **TPE outer jacket**
- **shielded**
- **oil-resistant**
- **bio-oil-resistant**
- **PVC-free/halogen-free**
- **UV-resistant**

Temperature range moved	**-35 °C to +70 °C, bending radius 10 x d**
Temperature range fixed	**-40 °C to +70 °C, bending radius 5 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	100 m/s²
UV-resistant	High
Nominal voltage	30 V
Testing voltage	150 V
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Halogen-free	According to EN 50267-2-1.
Conductor	Fine-wire stranded conductor in especially bending-resistant version consisting of bare copper wires (according to EN 60228).
Core insulation	According to bus specification.
Core stranding	According to bus specification.
Core identification	According to bus specification ▶ Schedule delivery program
Inner jacket	TPE mixture adapted to suit the requirements in Energy Chains®.
Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: dark-blue (similar to RAL 5011)

Premium Line

... no minimum order quantity

VDE	VDE	The cables are manufactured on the basis of VDE.
CE	CE	According to 73/23/EWG, 93/68/EWG
RoHS	Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications, UV-resistant
- especially for freely suspended and gliding travel distances up to 400 m
- bus connection cable for storage and retrieval units for high-bay warehouses, machining units/machine tools, quick handling, clean room, semiconductor insertion, indoor cranes, low-temperature applications

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]	
e.g. Interbus					
CF11.02.03.02.IB-S	(3x(2x0,25))C	8,5	42	83	
CF11.02.03.02.10.03.IB-S	(3x(2x0,25)+3x1,0)C	10,0	74	135	
e.g. CAN-Bus					
CF11.05.01.02.LC	(2x0,5)C	8,5	36	77	
CF11.05.02.02.LC*	(2x(2x0,5))C	8,5	45	83	
e.g. Profibus					
CF11.02.02.02.PBA.LC	(2x(2x0,25))C	8,0	33	80	New

G = with earthed conductor green-yellow **x =** without earthed conductor

The Chainflex® types marked with * are cables designed as a star-quad.

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

Delivery program Part No.	Characteristic wave impedance approx. [Ω]	Number of cores and conductor nominal cross section [mm²]	Colour code	
Interbus				
CF11.02.03.02.IB-S	100	(3x(2x0,25))C	white, brown, green yellow, gray, pink	
CF11.02.03.02.10.03.IB-S	100	(3x2x0,25+ 3x1,0)C	white, brown, green yellow, gray, pink red, blue, green-yellow	
CAN-Bus				
CF11.05.01.02.LC	120	(2x0,5)C	white, brown	
CF11.05.02.02.LC	120	(2x(2x0,5))C	white, green, brown, yellow (star-quad stranding)	
e.g. Profibus				
CF11.02.02.02.PBA.LC	150	(2x(2x0,25))C	green, red, yellow, brown	New

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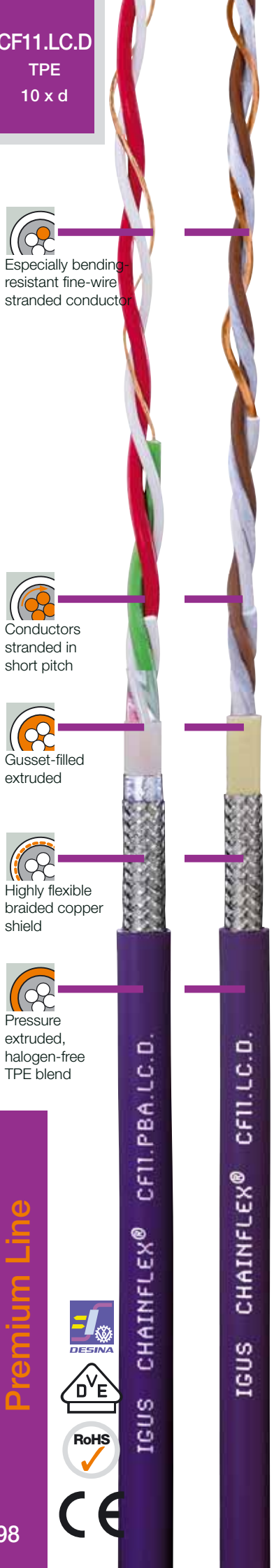
CF11.LC.D
TPE
10 x d



TPE Bus cable
Chainflex® CF11.LC.D (low capacitance)

- **for maximum load requirements**
- **TPE outer jacket**
- **shielded**
- **PVC-free/halogen-free**
- **oil-resistant**
- **bio-oil-resistant**

Temperature range moved	**-35 °C to +70 °C, bending radius 10 x d**
Temperature range fixed	**-40 °C to +70 °C, bending radius 5 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	100 m/s²
UV-resistant	Medium
Nominal voltage	30 V
Testing voltage	150 V
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Halogen-free	According to EN 50267-2-1.
Conductor	Fine-wire stranded conductor in especially bending-resistant version consisting of bare copper wires (according to EN 60228).
Core insulation	According to bus specification.
Core stranding	According to bus specification.
Core identification	According to bus specification ▶ Schedule delivery program
Inner jacket	TPE mixture adapted to suit the requirements in Energy Chains®.
Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: violet (similar to RAL 4001)
VDE	The cables are manufactured on the basis of VDE.

... no minimum order quantity

Premium Line

CE	**CE**	According to 73/23/EWG, 93/68/EWG
DESINA	**DESINA**	According to VDW, DESINA standardisation
RoHS	**Lead free**	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications without direct sun radiation
- especially for freely suspended and gliding travel distances up to 400 m
- bus connection cable for storage and retrieval units for high-bay warehouses, machining units/machine tools, quick handling, clean room, semiconductor insertion, indoor cranes, low-temperature applications

Delivery program **Part No.** **Profibus**	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF11.02.01.02.PBA.LC.D	(1x(2x0,25))C	8,5	23	70
CF11.02.02.15.04.PBA.LC.D	(4x1,5+(2x0,25)C)	12,5	96	175
CF11.02.02.07.03.PBA.LC.D	(3x0,75+(2x0,25)C)	11,0	58	121
Fieldbus (CAN-Bus)				
CF11.02.02.02.LC.D**	(2x(2x0,25))C	8,5	33	66
CF11.05.01.02.LC.D	(1x(2x0,5))C	8,5	36	77

The Chainflex® types marked with ** are cables designed as a star-quad.
Other types available on request.
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Delivery program **Part No.** **Profibus**	Characteristic wave impedance approx. [Ω]	Number of cores and conductor nominal cross section [mm²]	Colour code
CF11.02.01.02.PBA.LC.D	150	(1x(2x0,25))C	red, green
CF11.02.02.15.04.PBA.LC.D	150	(4x1,5+	black with white numbers
		(2x0,25)C)	red, green
CF11.02.02.07.03.PBA.LC.D	150	(3x0,75+	black, blue, green-yellow
		(2x0,25)C)	red, green
Fieldbus (CAN-Bus)			
CF11.02.02.02.LC.D	120	(2x(2x0,25))C	white, green, brown, yellow (star-quad stranding)
CF11.05.01.02.LC.D	120	(1x(2x0,5))C	white, brown

Test data ▸ Page 26

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CF14
TPE
12,5 x d

Especially bending-resistant fine-wire stranded conductor

2 conductors each stranded in especially short pitch, PP special insulation

Gusset-filled extruded

Highly flexible braided copper shield

Pressure extruded, halogen-free TPE blend

TPE Bus cable
Chainflex® CF14 CAT5

- **Ethernet special cable for maximum load requirements**
- **TPE outer jacket**
- **oil-resistant**
- **bio-oil-resistant**
- **PVC-free/halogen-free**
- **UV-resistant**

Temperature range moved	**-35 °C to +70 °C, bending radius 12,5 x d**
Temperature range fixed	**-40 °C to +70 °C, bending radius 7 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	100 m/s²
UV-resistant	Medium
Nominal voltage	30 V
Testing voltage	150 V
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Halogen-free	According to EN 50267-2-1.
Conductor	19-wire conductor consisting of bare copper wires in especially bending-resistant braiding quality.
Core insulation	Special PP-isolating mixture.
Core stranding	2 cores each stranded in pairs with short pitch lengths, core pairs also stranded with short pitch lengths.
Core identification	Color code in accordance with DIN 47100
Inner jacket	TPE mixture adapted to suit the requirements in Energy Chains®.
Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: violet (similar to RAL 4001)
VDE	The cables are manufactured on the basis of VDE.

... no minimum order quantity

Premium Line

CE	**CE**	According to 73/23/EWG, 93/68/EWG
DESINA	**DESINA**	According to VDW, DESINA standardisation
RoHS	**Lead free**	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications without direct sun radiation
- especially for freely suspended and gliding travel distances up to 100 m
- ethernet cable for Storage and retrieval units for high-bay warehouses, machining units/machine tools, quick handling, clean room, semiconductor insertion, indoor cranes, low-temperature applications

Delivery program **Part No.** **Ethernet CAT5**	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF14.02.02.02.CAT5**	(2x(2x0,25))C	7,0	33	43
CF14.02.04.02.CAT5	(4x(2x0,25))C	10,0	46	101
CF14.02.05.02.CAT5	(5x(2x0,25))C	10,5	53	106

The Chainflex® types marked with ** are cables designed as a star-quad.
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Delivery program **Part No.** **Ethernet CAT5**	Characteristic wave impedance approx. [Ω]	Number of cores and conductor nominal cross section [mm²]	Colour code
CF14.02.02.02.CAT5	100	(2x(2x0,25))C	white, green, brown, yellow (star-quad stranding)
CF14.02.04.02.CAT5	100	(4x(2x0,25))C	white, brown, green yellow, gray, pink, blue, red
CF14.02.05.02.CAT5	100	(5x(2x0,25))C	white, brown, green yellow, gray, pink, blue, red, black, violet

Test data ▸ Page 24
More CAT5/CAT6 cables ▸ Page 92, CFBUS

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CF211
PVC
10 x d

Center element for high tensile stresses

Fine-wire special conductor

conductors each stranded with short pitch

Highly flexible braided copper shield

Pressure extruded

PVC Measuring system cable Chainflex® CF211

- **for medium load requirements**
- **PVC outer jacket**
- **shielded**
- **oil-proof in accordance with VDE**
- **flame-retardant**

Temperature range moved	**-5 °C to +70 °C, bending radius 10 x d**
Temperature range fixed	**-20 °C to +70 °C, bending radius 5 x d**
V max. unsupported/gliding	5 m/s, 3 m/s
a max.	50 m/s²
Nominal voltage	30 V
Testing voltage	150 V
Oil	Oil-proof (according to DIN VDE 0207).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Very finely stranded special cores of particularly high-flex design made of bare copper wires.
Core insulation	Mechanically high-quality PP mixture.
Core stranding	According to measuring system specification.
Core identification	According to measuring system specification ▶ Schedule delivery program
Element shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Intermediate sheath	Foil taping over the external layer.
Element jacket	TPE mixture adapted to suit the requirements in Energy Chains® over pair shield.
Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Outer jacket	Low-adhesion, oil-resistant mixture on the basis of PVC, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: gray (similar to RAL 7001)

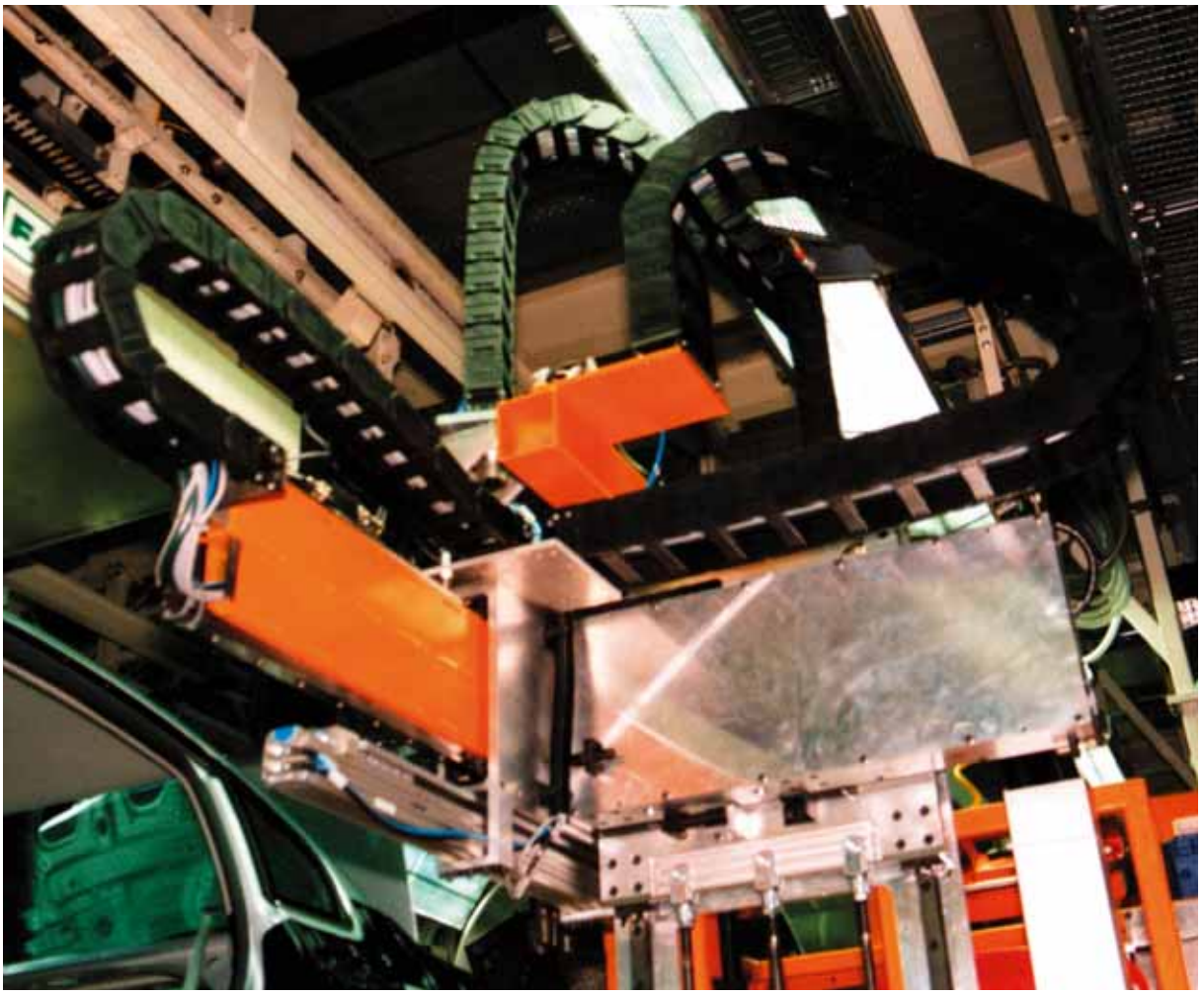
... no minimum order quantity

Economy Line

VDE	The cables are manufactured on the basis of VDE.
UL/CSA	Style 1589 and 2502, 30 V, 80 °C
CEI	According to CEI 20-35
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC – starting from manufacturing date 1/2006.

Typical application area

- for high load requirements
- light oil influence
- preferably indoor applications, but also outdoor ones at temperatures > 5 °C
- especially for freely suspended and gliding travel distances up to 100 m
- storage and retrieval units for high-bay warehouses, machining units/packaging machines, handling, indoor cranes



Three Energy Chain Systems® in several axes fitted with specially cables from igus®. E-Chain®: System E4/00 and System E4/0

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PVC Measuring system cable Chainflex® CF211

- for medium load requirements
- PVC outer jacket
- shielded
- oil-proof in accordance with VDE
- flame-retardant

Delivery program* Measuring system cable Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF211.001	(3x(2x0,14)C+(4x0,14)+(2x0,5))C	9,0	61	100
CF211.002	(3x(2x0,14)C+(2x0,5C))C	9,0	63	110
CF211.006	(3x(2x0,14)C+(2x0,5+2x0,14)+(4x0,23+2x0,14))C	9,5	72	120
CF211.009	(4x(2x0,25)+(2x0,5))C	9,0	51	111
CF211.010	(4x(2x0,25)+(2x1,0))C	9,5	74	141
CF211.011	(4x(2x0,34)+(4x0,5))C	9,0	75	135
CF211.014	(4x(2x0,25)C+ (2x0,5))C	13,0	84	211
CF211.016	(3x(2x0,25)C)C	11,0	85	170
CF211.017	(4x(2x0,14)+(4x1,0)+(4x0,14)C)C	9,0	85	124
CF211.018	(2x(2x0,25)+(2x0,5))C	7,0	41	62
CF211.019	((3x0,25)+3x(2x0,25)C+(2x1,0))C	9,0	82	115
CF211.027	(5x(2x0,14)+(2x0,5))C	9,0	45	102

* Previous product numbers – see reference list on page 262
Other types available on request.
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Economy Line

... no minimum order quantity

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	Single core	Colour code
CF211.001	(3x(2x0,14)C+	3x(2x0,14)C	yellow/green, black/brown, red/orange
	(4x0,14)+(2x0,5))C	4x0,14	gray, blue, white-yellow, white-black
		2x0,5	brown-red, brown-blue
CF211.002	(3x(2x0,14)C+	3x(2x0,14)C	green/yellow, black/brown, red/orange
	(2x0,5C))C	2x0,5C	black, red
CF211.006	(3x(2x0,14)C+	3x(2x0,14)C	green/yellow, black/brown, red/orange
	(2x0,5+2x0,14)+	4x0,14	gray, blue, white-yellow, white-black
	(4x0,23+2x0,14))C	4x0,23	brown-yellow, brown-grey, green-black, green-red
		2x0,5	brown-red, brown-blue
CF211.009	(4x(2x0,25)+(2x0,5))C	4x(2x0,25)	brown/green, blue/violet, gray/pink, red/black
		2x0,5	white, brown
CF211.010	(4x(2x0,25)+(2x1,0))C	4x(2x0,25)	brown/green, blue/violet, gray/pink, red/black
		2x1,0	white, brown
CF211.011	(4x(2x0,34)+(4x0,5))C	4x(2x0,34)	black/brown, red/orange, yellow/green, blue/violet
		4x0,5	blue-white, black-white, red-white, yellow-white
CF211.014	(4x(2x0,25)C+	4x(2x0,25)C	white/brown, green/yellow, gray/pink, blue/red
	(2x0,5))C	2x0,5	black (numeral printing 1-2)
CF211.016	(3x(2x0,25)C)C	3x(2x0,25)C	white/brown, green/yellow, gray/pink
CF211.017	(4x(2x0,14)+	(4x0,14)C	blue-black, red-black, yellow-black, green-black
	(4x1,0)+(4x0,14)C)C	4x(2x0,14)	red/black, green/brown, yellow/violet, pink/gray
		4x1,0	white-green, brown-green, blue, white
CF211.018	(2x(2x0,25)+(2x0,5))C	2x(2x0,25)	red/black, gray/pink
		2x0,5	white, brown
CF211.019	((3x0,25)+	3x(2x0,25)	brown/green, pink/gray, red/black
	3x(2x0,25)C+(2x1,0))C	(3x0,25)	blue, yellow, violet
		(2x1,0)	white, brown
CF211.027	(5x(2x0,14)	5x(2x0,14)	green/brown, gray/yellow, white/violet, black/red, blue/pink
	+(2x0,5))C	2x0,5	white/green, white/red

G = with earthed conductor green-yellow **x =** without earthed conductor

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CF111.D
TPE
12 x d

Center element for high tensile stresses

Fine-wire special conductor

Conductors stranded with short pitch

Bending-resistant braided copper shield

Pressure extruded, flame-retard TPE blend

TPE Measuring system cable Chainflex® CF111.D

- **for medium load requirements**
- **TPE outer jacket**
- **shielded**
- **oil-resistant**
- **bio-oil-resistant**
- **Flame-retardant**

Temperature range moved	**-35 °C to +100 °C, bending radius 12 x d**
Temperature range fixed	**-40 °C to +100 °C, bending radius 6 x d**
V max. unsupported	2 m/s
a max.	30 m/s²
UV-resistant	Medium
Nominal voltage	30 V
Testing voltage	150 V
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Very finely stranded special cores of particularly high-flex design made of bare copper wires.
Core insulation	Mechanically high-quality PP mixture.
Core stranding	According to measuring system specification.
Core identification	According to measuring system specification ▶ Schedule delivery program
Element shield	Bending-resistant, tinned braided copper shield. Coverage approx. 55% linear, approx. 80% optical.
Intermediate sheath	Foil taping over the external layer.
Overall shield	Bending-resistant, tinned braided copper shield. Coverage approx. 55% linear, approx. 80% optical.
Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: green (similar to RAL 6018)

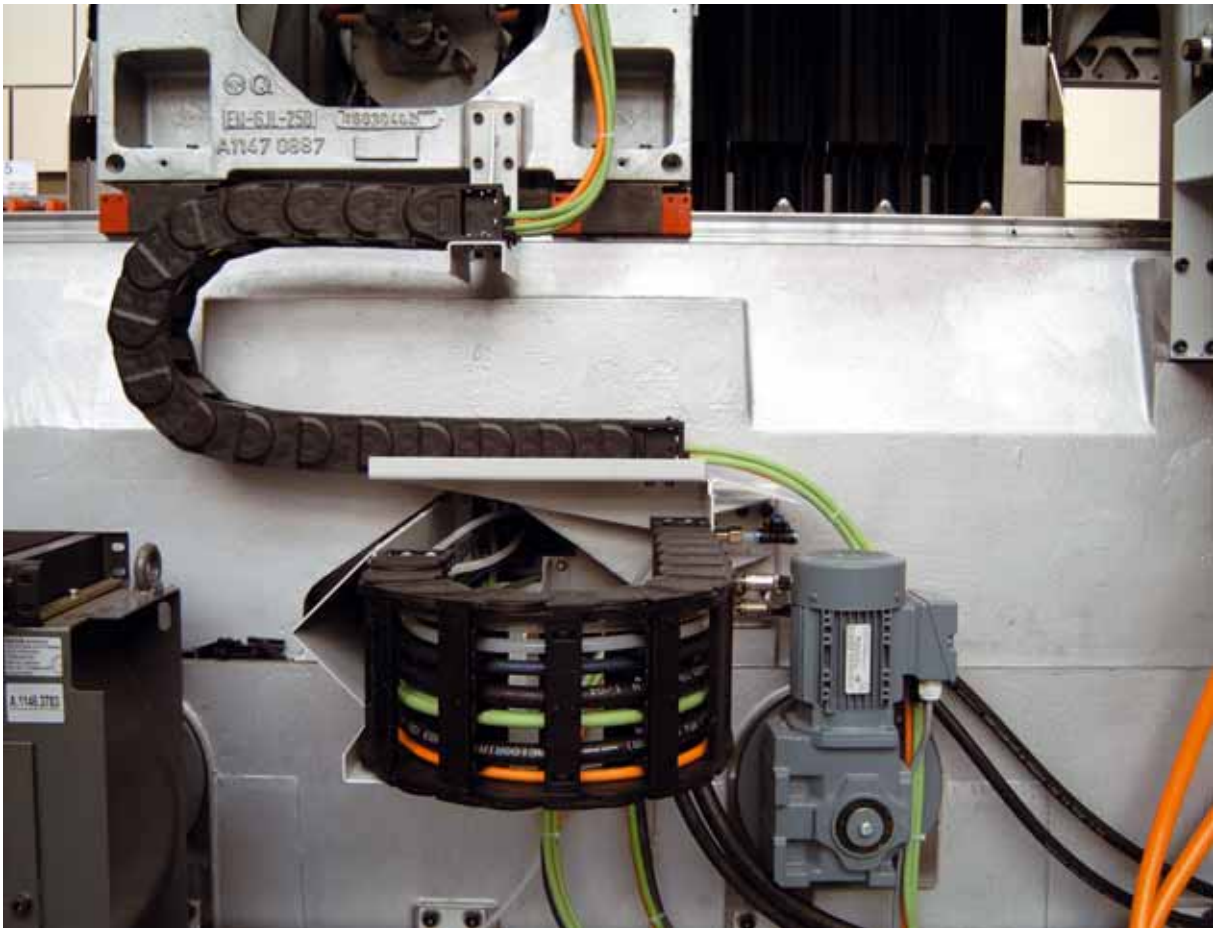
... no minimum order quantity

Economy Line

	VDE	The cables are manufactured on the basis of VDE.
	UL/CSA	Style 1589 and 21371, 30 V, 80 °C
	CEI	According to CEI 20-35
	CE	According to 73/23/EWG, 93/68/EWG
	DESINA	According to VDW, DESINA standardisation
	Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for high load requirements
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications without direct sun radiation
- especially for freely suspended travel distances
- machining units/machine tools, low temperature applications



The ReadyChain® systems from igus® are completely pre-harnessed with Chainflex® cables, hoses, screw attachments, metal parts etc.

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

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TPE Measuring system cable Chainflex® CF111.D

- for medium load requirements
- TPE outer jacket
- shielded
- oil-resistant
- bio-oil-resistant
- Flame-retardant

Delivery program Measuring system cable Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF111.001.D	(3x(2x0,14)C+ (4x0,14)+(2x0,5))C	8,5	56	87
CF111.004.D	(4x(2x0,14)+ (4x0,14)C+(4x0,5))C	10,5	72	113
CF111.006.D	(3x(2x0,14)C+ (2x0,5+2x0,14)+ (4x0,23+2x0,14))C	10,0	69	112
CF111.011.D	(4x(2x0,34)+(4x0,5))C	9,5	69	106
CF111.015.D	(4x(2x0,14)+(4x0,5))C	8,0	49	76
CF111.021.D	((6x0,5)+5x(2x0,25))C	10,0	79	125
CF111.022.D	((5x0,5)+(2x0,25))C	7,5	49	78
CF111.027.D	(5x(2x0,14)+2x0,5)C	9,0	54	109
CF111.028.D	(2x(2x0,15)+(2x0,38))C	7,5	41	64

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Economy Line

DESINA

cULus

RoHS

CE

... no minimum order quantity

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Part No.	Number of cores and conductor nominal cross section [mm²]	Single core	Colour code
CF111.001.D	(3x(2x0,14)C+(4x0,14)+(2x0,5))C	3x(2x0,14)C	yellow/green, black/brown, red/orange
		4x0,14	gray, blue, white-yellow, white-black
		2x0,5	brown-red, brown-blue
CF111.004.D	(4x(2x0,14)+(4x0,14)C+(4x0,5))C	4x(2x0,14)	brown/green, violet/yellow, gray/pink, red/black
		(4x0,14)C	yellow-black, red-black, green-black, blue-black
		4x0,5	brown-green, white-green, blue, white
CF111.006.D	(3x(2x0,14)C+(2x0,5+2x0,14)+	3x(2x0,14)C	green/yellow, black/brown, red/orange
	(4x0,23+2x0,14))C	4x0,14	gray, blue, white-yellow, white-black
		4x0,22	brown-yellow, brown-grey, green-black, green-red
		2x0,5	brown-red, brown-blue
CF111.011.D	(4x(2x0,34)+(4x0,5))C	4x(2x0,34)	black/brown, red/orange, yellow/green, blue/violet
		4x0,5	blue-white, black-white, red-white, yellow-white
CF111.015.D	(4x(2x0,14)+(4x0,5))C	4x(2x0,14)	brown/green, violet/yellow, gray/pink, red/black
		4x0,5	blue, white, brown-green, white-green
CF111.021.D	((6x0,5)+5x(2x0,25))C	(3x0,5)	black with numerals 1-3
		(3x0,5)	red with numerals 1-3
		(5x2x0,25)	yellow/white, gray/white, black/orange, white/brown, black/gray
CF111.022.D	((5x0,5)+(2x0,25))C	(5x0,5)	blue, green, yellow, gray, pink
		(2x0,25)	white, brown
CF111.027.D	(5x(2x0,14)+2x0,5)C	5x(2x0,14)	green/brown, gray/yellow, white/violet, black/red, blue/pink
		2x0,5	white/green, white/red
CF111.028.D	(2x(2x0,15)+(2x0,38))C	2x(2x0,15)	green/yellow, pink/blue
		2x0,38	red, black

G = with earthed conductor green-yellow **x =** without earthed conductor

CF11.D
TPE
10 x d

Especially bending-resistant fine-wire stranded conductor

Extrem Highly flexible braided copper shield

Center element for high tensile stresses

Conductors stranded in short pitch

Gusset-filled extruded

Highly flexible braided copper shield

Pressure extruded, halogen-free TPE blend

TPE Measuring system cable Chainflex® CF11.D

- **for maximum load requirements**
- **TPE outer jacket**
- **shielded**
- **oil-resistant**
- **bio-oil-resistant**
- **PVC-free/halogen-free**

Temperature range moved	**-35 °C to +100 °C, bending radius 10 x d**
Temperature range fixed	**-40 °C to +100 °C, bending radius 5 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	100 m/s²
UV-resistant	Medium
Nominal voltage	30 V
Testing voltage	150 V
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Halogen-free	According to EN 50267-2-1.
Conductor	Fine-wire stranded conductor in especially bending-resistant version consisting of bare copper wires (according to EN 60228).
Core insulation	Mechanically high-quality PP mixture.
Core stranding	According to measuring system specification.
Core identification	According to measuring system specification ▶ Schedule delivery program
Element shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Inner jacket	TPE mixture adapted to suit the requirements in Energy Chains®.
Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: green (similar to RAL 6018)

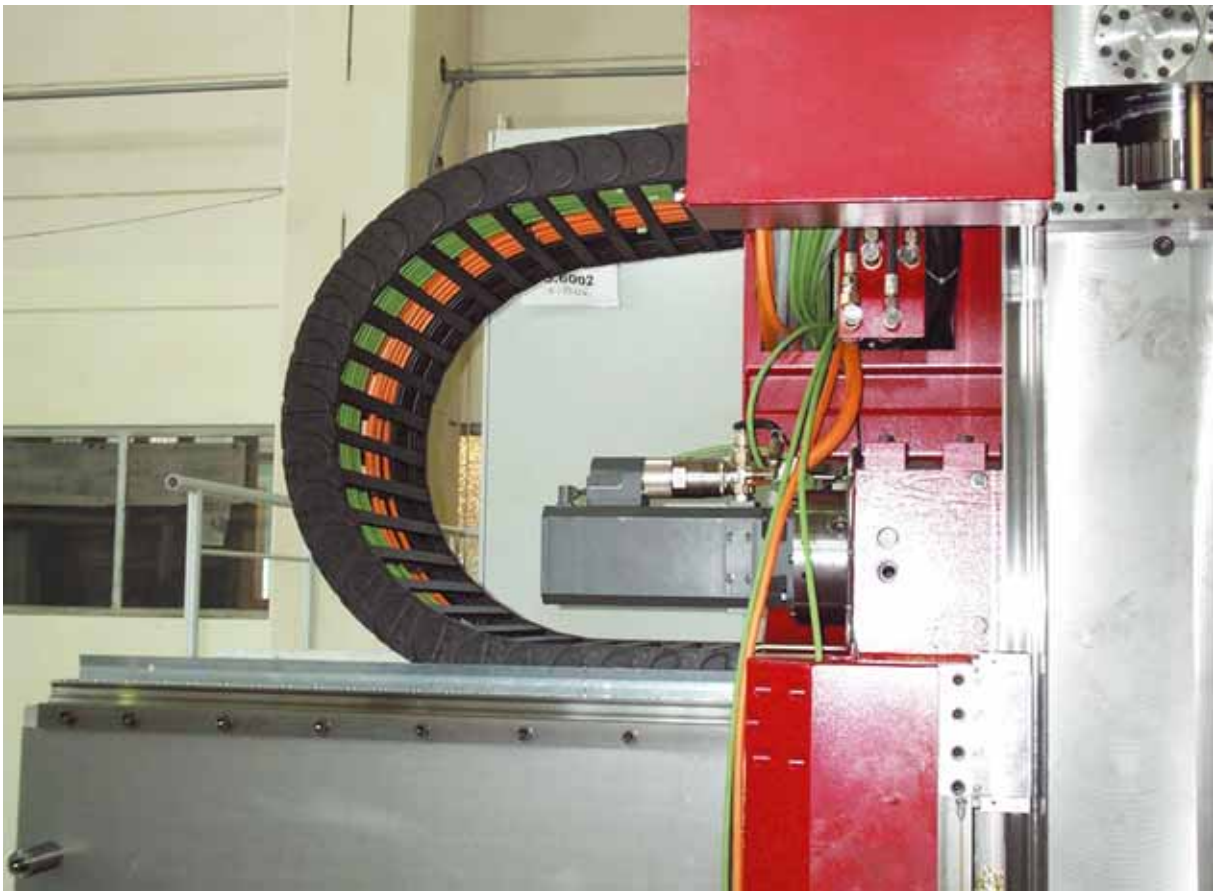
... no minimum order quantity

Premium Line

VDE	The cables are manufactured on the basis of VDE.
CE	According to 73/23/EWG, 93/68/EWG
DESINA	According to VDW, DESINA standardisation
Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications without direct sun radiation
- especially for freely suspended and gliding travel distances up to 400 m
- storage and retrieval units for high-bay warehouses, machining units/machine tools, quick handling, clean room, semiconductor insertion, outdoor cranes, low-temperature applications



Pre-harnessed igus® energy supply systems for machine tool manufacture. E-Chain®: System E4/4

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TPE Measuring system cable Chainflex® CF11.D

- for maximum load requirements
- TPE outer jacket
- shielded
- twisted-pair
- oil-resistant
- bio-oil-resistant
- PVC-free/halogen-free

Delivery program* Measuring system cable Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF11.001.D	(3x(2x0,14)C+(4x0,14)+(2x0,5))C	10,5	78	130
CF11.002.D	(3x(2x0,14)C+(2x0,5C))C	10,5	66	120
CF11.003.D	(3x(2x0,14)+(2x1,0))C	8,0	50	90
CF11.004.D	(4x(2x0,14)+(4x0,14)C+(4x0,5))C	12,0	93	184
CF11.005.D	(4x(2x0,14)+(4x0,5))C	9,0	64	105
CF11.006.D	(3x(2x0,14)C+(2x0,5+2x0,14)+(4x0,23+2x0,14))C	11,5	81	125
CF11.007.D	(2x(2x0,34))C	7,5	31	70
CF11.008.D	(3x(2x0,25))C	8,5	35	85
CF11.009.D	(4x(2x0,25)+(2x0,5))C	9,5	63	115
CF11.010.D	(4x(2x0,25)+(2x1,0))C	9,5	75	130
CF11.011.D	(4x(2x0,34)+(4x0,5))C	10,5	77	130
CF11.012.D	(3x(2x0,14)C+(2x0,5+6x0,14)+(3x0,14)C)C	12,5	94	163
CF11.013.D	(3x(2x0,14)C+(2x0,5))C	9,5	78	115
CF11.015.D	(4x(2x0,14)+(4x0,5))C	9,0	64	105
CF11.017.D	(4x(2x0,14)+(4x1,0)+(4x0,14)C)C	9,0	85	160
CF11.018.D	(2x(2x0,25)+(2x0,5))C	7,0	41	57
CF11.019.D	((3x0,25)+3x(2x0,25)C+(2x1,0))C	9,0	82	112
CF11.021.D	((6x0,5)+5x(2x0,25))C	12,5	105	171
CF11.022.D	((5x0,5)+ (2x0,25))C	8,5	60	90
CF11.025.D	(3x(2x0,14)C+(2x0,5)C)C	12,5	120	170
CF11.027.D	(5x(2x0,14)+2x0,5)C	9,5	59	113

* Previous product numbers – see reference list on page 263
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Premium Line

DESINA

DVE

RoHS

CE

... no minimum order quantity

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Part No.	Number of cores and conductor nominal cross section [mm²]	Single core	Colour code
CF11.001.D	(3x(2x0,14)C+	3x(2x0,14)C	yellow/green, black/brown, red/orange
	(4x0,14)+(2x0,5))C	4x0,14	gray, blue, white-yellow, white-black
		2x0,5	brown-red, brown-blue
CF11.002.D	(3x(2x0,14)C+	3x(2x0,14)C	green/yellow, black/brown, red/orange
	(2x0,5C))C	2x0,5C	black, red
CF11.003.D	(3x(2x0,14)+(2x1,0))C	3x(2x0,14)	white/brown, green/yellow, gray/pink
		2x1,0	blue, red
CF11.004.D	(4x(2x0,14)+	4x(2x0,14)	brown/green, violet/yellow, gray/pink, red/black
	(4x0,14)C+(4x0,5))C	(4x0,14)C	yellow-black, red-black, green-black, blue-black
		4x0,5	brown-green, white-green, blue, white
CF11.005.D	(4x(2x0,14)+(4x0,5))C	4x(2x0,14)	white/brown, green/yellow, gray/pink, blue/red
		4x0,5	black, violet, grey-pink, red-blue
CF11.006.D	(3x(2x0,14)C+	3x(2x0,14)C	green/yellow, black/brown, red/orange
	(2x0,5+2x0,14)+	4x0,14	gray, blue, white-yellow, white-black
	(4x0,23+2x0,14))C	4x0,23	brown-yellow, brown-grey, green-black, green-red
		2x0,5	brown-red, brown-blue
CF11.007.D	(2x(2x0,34))C	4x0,34	white, brown, green, yellow
CF11.008.D	(3x(2x0,25))C	3x(2x0,25)	white/brown, green/yellow, gray/pink
CF11.009.D	(4x(2x0,25)+(2x0,5))C	4x(2x0,25)	brown/green, blue/violet, gray/pink, red/black
		2x0,5	white, brown
CF11.010.D	(4x(2x0,25)+(2x1,0))C	4x(2x0,25)	brown/green, blue/violet, gray/pink, red/black
		2x1,0	white, brown
CF11.011.D	(4x(2x0,34)+(4x0,5))C	4x(2x0,34)	black/brown, red/orange, yellow/green, blue/violet
		4x0,5	blue-white, black-white, red-white, yellow-white
CF11.012.D	(3x(2x0,14)C+	3x(2x0,14)C	green/yellow, white/gray, blue/red
	(2x0,5+6x0,14)+	(3x0,14)C	red, green, brown
	(3x0,14)C)C	6x0,14	blue, gray, gray, yellow, pink, violet
		2x0,5	brown-red, brown-blue
CF11.013.D	(3x(2x0,14)C+(2x0,5))C	3x(2x0,14)C	white/brown, green/yellow, gray/pink
		2x0,5	red, blue
CF11.015.D	(4x(2x0,14)+(4x0,5))C	4x(2x0,14)	brown/green, violet/yellow, gray/pink, red/black
		4x0,5	blue, white, brown-green, white-green
CF11.017.D	(4x(2x0,14)+	(4x0,14)C	blue-black, red-black, yellow-black, green-black
	(4x1,0)+ (4x0,14)C)C	4x(2x0,14)	red/black, green/brown, yellow/violet, pink/gray
		4x1,0	white-green, brown-green, blue, white
CF11.018.D	(2x(2x0,25)+(2x0,5))C	2x(2x0,25)	red/black, gray/pink
		2x0,5	white, brown
CF11.019.D	((3x0,25)+	3x(2x0,25)C	brown/green, pink/gray, red/black
	3x(2x0,25)C+2x1,0))C	3x0,25	blue, yellow, violet
		2x1,0	white, brown
CF11.021.D	((6x0,5)+5x(2x0,25))C	(3x0,5)	black with numerals 1-3
		(3x0,5)	red with numerals 1-3
		(5x2x0,25)	yellow/white, gray/white, black/orange, white/brown, black/gray
CF11.022.D	((5x0,5)+ (2x0,25))C	(5x0,5)	blue, green, yellow, gray, pink
		(2x0,25)	white, brown
CF11.025.D	(3x(2x0,14)C+	3x(2x0,14)	green/yellow, blue/red, gray/pink
	(2x0,5)C)C	(2x0,5)	white, brown
CF11.027.D	(5x(2x0,14)+	5x(2x0,14)	green/brown, gray/yellow, white/violet, black/red, blue/pink
	2x0,5)C	2x0,5	white/green, white/red

G = with earthed conductor green-yellow x = without earthed conductor

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

CFLG
PVC
10 x d

Especially bending-resistant copper conductor

Glass-fibre yarn twisting over 200/230 µm glass fibres

Elements stranded with short pitch

Highly abrasion-resistant, low-adhesion PVC jacket blend

PVC Fibre optic cable (FOC) Chainflex® CFLG

- **step-index glass-fibre cable (200/230-µm) with supply cores for high load requirements**
- **PVC outer jacket**
- **oil-resistant**
- **flame-retardant**

Temperature range moved	**-5 °C to +70 °C, bending radius 10 x d**
Temperature range fixed	**-15 °C to +70 °C, bending radius 5 x d**
V max. unsupported/gliding	10 m/s, 5 m/s
a max.	20 m/s²
UV-resistant	Medium
Nominal voltage	300/500 V (according to DIN VDE 0245).
Testing voltage	2000 V (according to DIN VDE 0281-2).
Oil	Oil-proof (according to DIN VDE 0207).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Very finely stranded special cores of particularly high-flex design made of bare copper wires.
Core insulation	Mechanically high-quality PVC mixture.
Fibre optic cable	200/230 µm glass fibres
Core stranding	Cores and FOC-fibres stranded with short pitch length.
Core identification	**Supply cores:** black, blue **FOC-fibres:** orange with identification
Outer jacket	Low-adhesion, oil-resistant mixture on the basis of PVC, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: dark-blue (similar to RAL 5011)
VDE	The cables are manufactured on the basis of VDE.
CEI	According to CEI 20-35

... no minimum order quantity

Premium Line

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CE According to 73/23/EWG, 93/68/EWG

Lead free According to EU guideline (RoHS) 2002/95/EC – starting from manufacturing date 1/2006.

Typical application area

- for high load requirements
- maximum EMC protection, with high transmission qualities in terms of glass-specific requirements
- light oil influence
- preferably indoor applications
- especially for freely suspended travel distances and for gliding applications up 50 m
- wood/stone processing, packaging industry, supply system, handling, adjusting equipment

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CFLG.07.02.02	2x0,75 Fibre diameter in µm approx. 2x200/230	9,0	14	70

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Delivery program Part No.	Bandwidth with 850 nm [MHz x km]	Attenuation with 850 nm [dB/km]	Colour code
CFLG.07.02.02	20	6	orange, range with identification

CFLG.2HG.MF
PUR
12,5 x d

Gradient fibres

Plastic covered special fibre

Gel-filled, armored hollow core

Armored hollow cores with optimized pitch length stranded around a strain relief element

Gusset-filled extruded PUR mixture

PUR Fibre optic cable (FOC)
Chainflex® CFLG.2HG.MF.62,5/125
Chainflex® CFLG.2HG.MF.50/125

- **gradient fibre glass cable for high stressing capacity**
- **PUR outer jacket**
- **metal-free**
- **halogen-free**

Temperature range moved	**-20 °C to +60 °C, bending radius 12,5 x d**
Temperature range fixed	**-25 °C to +60 °C, bending radius 7,5 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	20 m/s²
UV-resistant	High
Oil	Oil-resistant (according to EN 60811-2-1).
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Halogen-free	According to EN 50267-2-1.
Fibre optic cable	50/125 µm, 62,5/125 µm fibres in gel-filled hollow cores.
Core stranding	Hollow cores with integrated FOC-fibres stranded with two strain relief elements.
Core identification	Cores black with white numerals.
Outer jacket	Low-adhesion mixture on the basis of PUR, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: black
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements
- maximum EMC protection, with high transmission qualities in terms of glass-specific requirements
- almost unlimited resistance to oil
- indoor and outdoor applications
- only for freely suspended and gliding travel distances up to 100 m
- Storage and retrieval units for high-bay warehouses, machining units/packaging machines, quick handling, cranes, refrigerating sector

... no minimum order quantity

Premium Line

Delivery program Part No.	Number of fibres	Fibre diameter approx. [µm]	External diameter approx. [mm]	Weight [kg/km]
CFLG.2HG.MF.62,5/125	2	62,5 / 125	9,0	85
CFLG.2HG.MF.50/125	2	50 / 125	9,0	85

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Delivery program Part No. FOC	Bandwidth with 850 nm [MHz x km]	Attenuation with 850 nm [dB/km]	Bandwidth with 1300 nm [MHz x km]	Attenuation with 1300 nm [dB/km]	Colour code
CFLG.2HG.MF.62,5/125	160 - 200	3,2	200 - 500	0,9	black with white numbers
CFLG.2HG.MF.50/125	200 - 600	2,5 - 3,5	600 - 12000	0,7 - 1,5	black with white numbers

Metal-free fibre optic cables for fast handling applications. E-Chain®: System E2/000

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CFLK
PUR
12,5 x d

PUR Fibre optic cable (FOC) Chainflex® CFLK

- **POF fibres for high stressing capacity and interference-free transmission**
- **PUR outer jacket**
- **oil-resistant**

Temperature range moved	**-20 °C to +70 °C, bending radius 12,5 x d**
Temperature range fixed	**-25 °C to +70 °C, bending radius 7,5 x d**
V max. unsupported/gliding	10 m/s, 5 m/s
a max.	20 m/s²
UV-resistant	Medium
Oil	Oil-resistant (according to EN 60811-2-1).
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Halogen-free	According to EN 50267-2-1.
Fibre optic cable	980/1000 µm fibre with PE isolation.
Core stranding	POF fibre with stranded high-tensile plastic reinforcement.
Core identification	Black core.
Outer jacket	Low-adhesion mixture on the basis of PUR, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: violet (similar to RAL 4001)
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC.

... no minimum order quantity

Premium Line

Typical application area

- for high load requirements
- maximum EMC protection
- almost unlimited resistance to oil
- preferably indoor applications
- especially for freely suspended and gliding travel distances up to 15 m
- wood/stone processing, packaging industry, supply system, handling, adjusting equipment

Delivery program Part No.	Number of fibres	Fibre diameter approx. [µm]	External diameter approx. [mm]	Weight [kg/km]
CFLK.L1.01*	1	980/1000	5,0	25

* Delivery time upon inquiry

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

Delivery program Part No.	Bandwidth with 650 nm [MHz x km]	Attenuation with 650 nm [dB/km]	Colour code
CFLK.L1.01	40	200	black

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CFLG. GT
TPE
15 x d

TPE Fibre optic cable (FOC)
Chainflex® CFLG. G.62,5/125.T
Chainflex® CFLG. G.50/125.T

- **gradient glass-fibre cable for heavy-duty use**
- **TPE outer jacket**
- **halogen-free**

Temperature range moved	**-20 °C to +70 °C, bending radius 15 x d**
Temperature range fixed	**-25 °C to +70 °C, bending radius 8,5 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	20 m/s²
UV-resistant	High
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Halogen-free	According to EN 50267-2-1.
Fibre optic cable	50/125 µm, 62,5/125 µm fibres in gel-filled hollow cores.
Core stranding	Stranded GRP rods with integrated torsion protection braid in the outer jacket over gel-filled fiber sheath..
Core identification	▶ Schedule delivery program
Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: black
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements
- maximum EMC protection, with high transmission qualities in terms of glass-specific requirements
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications
- only for freely suspended and gliding travel distances up to 500 m and more
- outdoor ship to shore, crane applications, conveyer technology

... no minimum order quantity

Premium Line

Delivery program Part No.	Number of fibres*	Fibre diameter approx. [µm]	External diameter approx. [mm]	Weight [kg/km]
CFLG.6G.62,5/125.T	6	62,5/125	11,5	238
CFLG.12G.62,5/125.T	12	62,5/125	11,5	238
CFLG.6G.50/125.T	6	50/125	11,5	238
CFLG.12G.50/125.T	12	50/125	11,5	238

Other number of fibers upon inquiry
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Delivery program Part No. FOC	Bandwidth with 850 nm [MHz x km]	Attenuation with 850 nm [dB/km]	Bandwidth with 1300 nm [MHz x km]	Attenuation with 1300 nm [dB/km]	Colour code
CFLG.6G.62,5/125.T	160 - 200	3,2	200 - 500	0,9	ecru, yellow, green, red, violet, blue
CFLG.12G.62,5/125.T	160 - 200	3,2	200 - 500	0,9	ecru, yellow, green, red, violet, blue, lightblue, gray, brown, black, orange, pink
CFLG.6G.50/125.T	200 - 600	2,5 - 3,5	600 - 12000	0,7 - 1,5	ecru, yellow, green, red, violet, blue
CFLG.12G.50/125.T	200 - 600	2,5 - 3,5	600 - 12000	0,7 - 1,5	ecru, yellow, green, red, violet, blue, lightblue, gray, brown, black, orange, pink

igus® fibre optic cables with 441 m travel. E-Chain®: System E4/4

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

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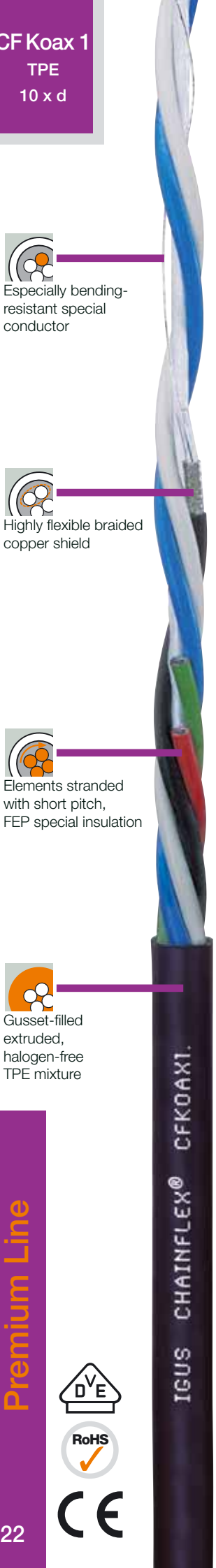
TPE Koax cable
Chainflex® CF Koax 1

- **75 Ω koax cable for maximum load requirements**
- **TPE outer jacket**
- **oil-resistant**
- **bio-oil-resistant**
- **UV-resistant**



Especially bending-resistant special conductor

Highly flexible braided copper shield

Elements stranded with short pitch, FEP special insulation

Gusset-filled extruded, halogen-free TPE mixture

Temperature range moved	**-35 °C to +100 °C, bending radius 10 x d**
Temperature range fixed	**-40 °C to +100 °C, bending radius 7,5 x d**
V max. unsupported/gliding	10 m/s, 5 m/s
a max.	100 m/s²
UV-resistant	High
Nominal voltage	300/300 V (according to DIN VDE 0245).
Testing voltage	1500 V
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Multi-wire; adapted in single-wire diameter and pitch length to suit the requirements in Energy Chains®.
Core insulation	Special FEP-isolating mixture.
Core stranding	Cores stranded in one layer with especially short pitch length.
Core identification	▶ Schedule delivery program
Element shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Element jacket	TPE mixture adapted to suit the requirements in Energy Chains®.
Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: dark-blue (similar to RAL 5011)
VDE	The cables are manufactured on the basis of VDE.
CE	According to 73/23/EWG, 93/68/EWG

... no minimum order quantity

Premium Line

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RoHS **Lead free** According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications, UV-resistant
- especially for freely suspended and gliding travel distances up to 400 m
- storage and retrieval units for high-bay warehouses, machining units/machine tools, quick handling, clean room, semiconductor insertion, outdoor cranes, low-temperature applications

Delivery program **Part No.**	Number of cores	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CFKoax 1.01	1 coaxial element	4,5	9	25
CFKoax 1.05	5 coaxial elements	10,0	47	135

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Delivery program **Part No.** **Koax Elemente**	Characteristic wave impedance approx. [Ω]	Number of cores	Colour code
CF Koax 1.01	75	1 coaxial element	black
CF Koax 1.05	75	5 coaxial elements	red, green, blue, white, black

Koax cables and other Chainflex® cables in platform technology. E-Chain®: System E4/4

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

Servo cables

Chainflex® types

Chainflex® cable	Jacket	Shield	Bending radius moved [factor x d]	Temperature moved from/to [°C]	Approvals and standards	Oil-resistant	Torsion resistant	V max. [m/s] unsupported	V max. [m/s] gliding	a max. [m/s²]	Page
Servo cables											
CF21.UL	PVC	✔	7,5	-5/ +70		✔		10	5	80	126
CF260	PUR	✔	10	-20/ +80		✔		10		50	130
CF27.D	PUR	✔	7,5	-20/ +80		✔		10	5	80	132

CF21.UL
PVC
7,5 x d

Highly flexible special conductor

Energy conductor with signal pair elements stranded around high-tensile center cord

Extremely highly flexible braided-pair copper shield

Gusset-filled, pressure extruded

Highly flexible braided copper shield

Pressure extruded, oil-proof PVC sheath blend

PVC Servo cable Chainflex® CF21.UL

- **for high load requirements**
- **PVC outer jacket**
- **shielded**
- **oil-proof in accordance with VDE**
- **flame-retardant**

Temperature range moved	**-5 °C to +70 °C, bending radius 7,5 x d**
Temperature range fixed	**-20 °C to +70 °C, bending radius 4 x d**
V max. unsupported/gliding	10 m/s, 5 m/s
a max.	80 m/s²
UV-resistant	Medium
Nominal voltage	600/1000 V (according to DIN VDE 0250).
Testing voltage	4000 V (according to DIN VDE 0281-2).
Oil	Oil-proof (according to DIN VDE 0207).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Fine-wire stranded conductor in especially bending-resistant version consisting of bare copper wires (according to EN 60228).
Core insulation	Mechanically high-quality, especially low-capacitance TPE mixture.
Core stranding	Energy conductor with signal pair elements stranded around high-tensile center cord.
Core identification	**Energy conductor:** cores black with white numerals, one core green/yellow. 1. core: U / L1 / C / L+ 2. core: V / L2 3. core: W / L3 / D / L- 4. core: 4 / N **1 control pair:** cores black with white numerals. 1. control pair: 4 2. control pair: 5 **2 control pairs:** cores black with white numerals. 1. control pair: 5 2. control pair: 6 3. control pair: 7 4. control pair: 8
Element shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.

... no minimum order quantity

High Class Line

Inner jacket	PVC mixture adapted to suit the requirements in Energy Chains®.
Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Outer jacket	Low-adhesion, oil-resistant mixture on the basis of PVC, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: green (similar to RAL 6005)
VDE	The cables are manufactured on the basis of VDE.
UL/CSA	Style 10492 and 2570, 1000 V, 80 °C
CEI	According to CEI 20-35
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC – starting from manufacturing date 1/2006.

Typical application area

- for high load requirements
- light oil influence
- preferably indoor applications, but also outdoor ones at temperatures > 5 °C
- especially for freely suspended and gliding travel distances up to 100 m
- storage and retrieval units for high-bay warehouses, machining units/packaging machines, quick handling, indoor cranes

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PVC Servo cable
Chainflex® CF21.UL

- for high load requirements
- PVC outer jacket
- shielded
- oil-proof in accordance with VDE
- flame-retardant

Delivery program Part No. 1 control pair shielded	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF21.07.05.02.01.UL	(4G0,75+(2x0,5)C)C	11,0	95	172
CF21.15.10.02.01.UL	(4G1,5+(2x1,0)C)C	12,5	125	250
CF21.15.15.02.01.UL*	(4G1,5+(2x1,5)C)C	13,0	140	280
CF21.25.10.02.01.UL	(4G2,5+(2x1,0)C)C	13,5	177	300
CF21.25.15.02.01.UL*	(4G2,5+(2x1,5)C)C	14,0	182	312
CF21.40.10.02.01.UL	(4G4,0+(2x1,0)C)C	15,5	232	372
CF21.40.15.02.01.UL	(4G4,0+(2x1,5)C)C	16,0	241	390
CF21.60.10.02.01.UL*	(4G6,0+(2x1,0)C)C	18,0	327	495
CF21.60.15.02.01.UL*	(4G6,0+(2x1,5)C)C	18,5	357	605
CF21.100.10.02.01.UL*	(4G10+(2x1,0)C)C	22,0	530	786
CF21.100.15.02.01.UL*	(4G10+(2x1,5)C)C	22,5	540	925
CF21.160.10.02.01.UL	(4G16+(2x1,0)C)C	24,5	700	1050
CF21.160.15.02.01.UL*	(4G16+(2x1,5)C)C	24,5	716	1165
CF21.250.15.02.01.UL*	(4G25+(2x1,5)C)C	29,5	1056	1466
CF21.350.15.02.01.UL*	(4G35+(2x1,5)C)C	33,0	1557	2090
2 control pairs shielded				
CF21.07.03.02.02.UL	(4G0,75+2x(2x0,34)C)C	12,5	113	210
CF21.10.07.02.02.UL	(4G1,0+2x(2x0,75)C)C	13,5	146	266
CF21.15.07.02.02.UL	(4G1,5+2x(2x0,75)C)C	14,5	175	310
CF21.25.15.02.02.UL	(4G2,5+2x(2x1,5)C)C	17,0	265	370
CF21.40.15.02.02.UL	(4G4,0+2x(2x1,5)C)C	18,5	304	435
CF21.60.15.02.02.UL	(4G6,0+2x(2x1,5)C)C	20,5	397	697
CF21.100.15.02.02.UL	(4G10+2x(2x1,5)C)C	24,0	560	1025
CF21.160.15.02.02.UL	(4G16+2x(2x1,5)C)C	27,0	790	1270
CF21.250.15.02.02.UL*	(4G25+2x(2x1,5)C)C	31,0	1140	1910
CF21.350.15.02.02.UL*	(4G35+2x(2x1,5)C)C	34,0	1597	2175

* **Delivery time upon inquiry.**
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

High Class Line

... no minimum order quantity

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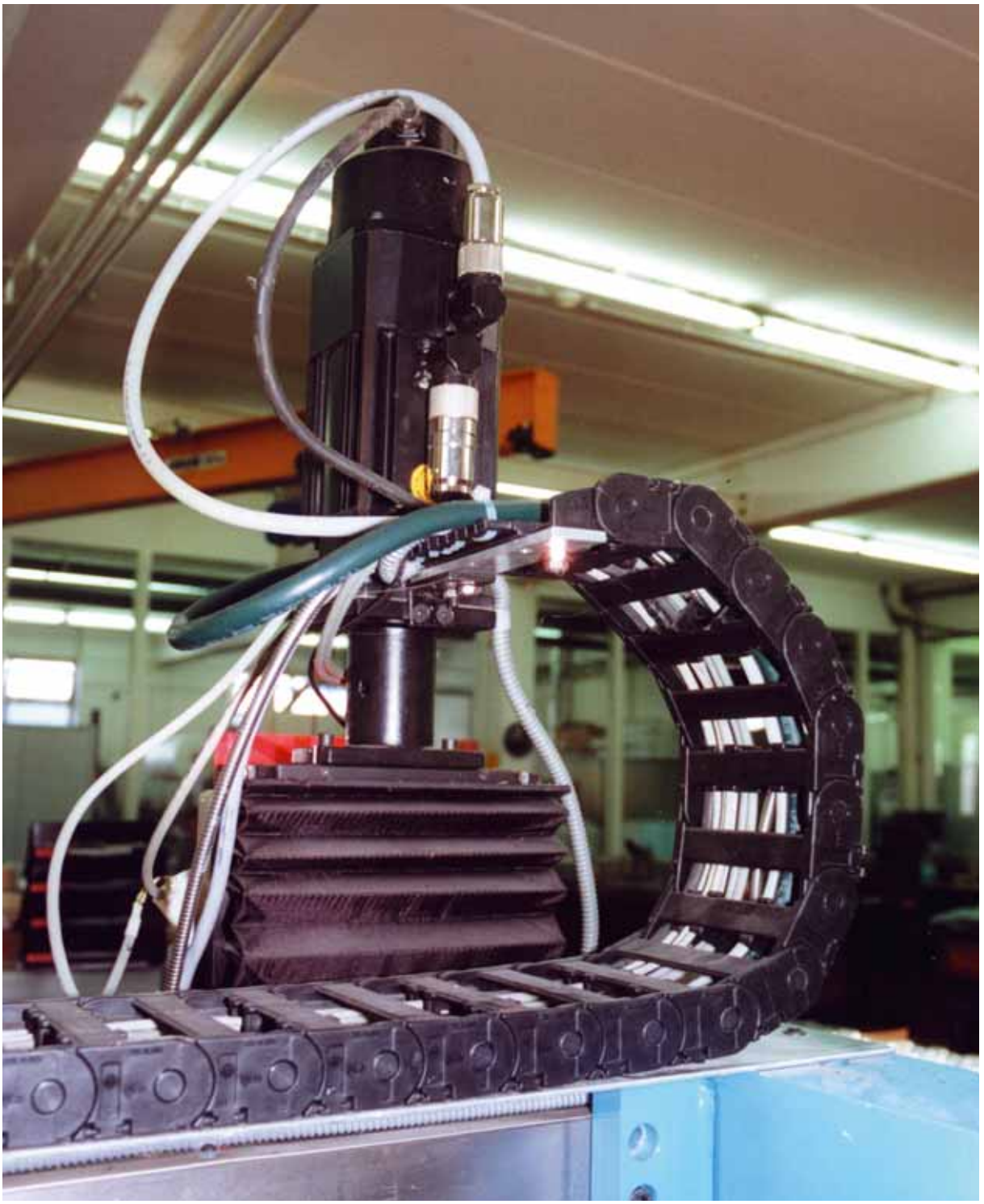

Chainflex® CF21.UL: cables for energy supply systems in spinneret production. E-Chain®: Serie E2/000

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

CF260
PUR
10 x d

Bending-resistant conductor

Bending-resistant pair twisting

Energy conductor with signal pair elements stranded around high-tensile center cord

Bending-resistant braided copper shield

PUR blend outer jacket

PUR Servo cable Chainflex® CF260

- **for medium load requirements**
- **PUR outer jacket**
- **shielded**
- **oil-resistant**
- **PVC-free/halogen-free**

Temperature range moved	**-20 °C to +80 °C, bending radius 10 x d**
Temperature range fixed	**-40 °C to +80 °C, bending radius 5 x d**
V max. unsupported	10 m/s
a max.	50 m/s²
UV-resistant	Medium
Nominal voltage	600/1000 V (according to DIN VDE 0250).
Testing voltage	4000 V (according to DIN VDE 0281-2).
Oil	Oil-resistant (according to EN 60811-2-1).
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Halogen-free	According to EN 50267-2-1.
Conductor	Fine-wire stranded conductor in bending-resistant version consisting of bare copper wires (according to EN 60228).
Core insulation	Mechanically high-quality, especially low-capacitance TPE mixture.
Core stranding	Energy conductor with signal pair elements stranded around high-tensile center cord.
Core identification	**Energy conductor:** cores black with white numerals, one core green/yellow. 1. core: U / L1 / C / L+ 2. core: V / L2 3. core: W / L3 / D / L- 4. core: 4 / N **1 control pair:** cores black with white numerals. 1. control pair: 4 2. control pair: 5 **2 control pairs:** cores black with white numerals. 1. control pair: 5 2. control pair: 6 3. control pair: 7 4. control pair: 8
Element shield	Bending-resistant, tinned braided copper shield. Coverage approx. 55% linear, approx. 80% optical.

... no minimum order quantity

Economy Line

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Intermediate sheath	Foil taping over the external layer.
Overall shield	Bending-resistant, tinned braided copper shield. Coverage approx. 55% linear, approx. 80% optical.
Outer jacket	Low-adhesion mixture on the basis of PUR, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: orange (similar to RAL 2003)
VDE	The cables are manufactured on the basis of VDE.
CE	According to 73/23/EWG, 93/68/EWG
DESINA	According to VDW, DESINA standardisation
Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

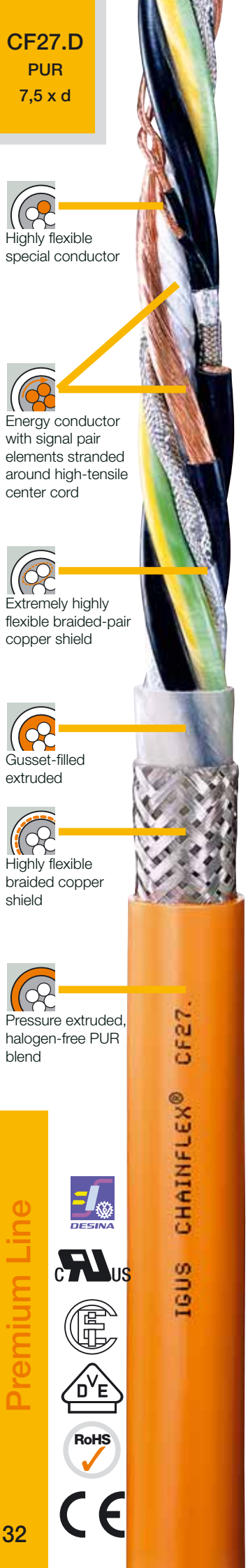
- for medium load requirements
- almost unlimited resistance to oil
- indoor and outdoor applications without direct sun radiation
- especially for freely suspended travel distances
- machining units/machine tools, low temperature applications

Delivery program Part No. 1 control pair shielded	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF260.15.10.02.01	(4G1,5+(2x1,0)C)C	11,0	120	178
CF260.25.10.02.01	(4G2,5+(2x1,0)C)C	12,5	160	229
CF260.40.10.02.01	(4G4,0+(2x1,0)C)C	13,5	235	309
CF260.60.10.02.01	(4G6,0+(2x1,0)C)C	15,0	309	402
CF260.100.10.02.01	(4G10,0+(2x1,0)C)C	20,0	530	690
CF260.160.10.02.01	(4G16,0+(2x1,0)C)C	21,5	753	905
2 control pairs shielded				
CF260.10.07.02.02	(4G1,0+2x(2x0,75)C)C	12,0	148	295
1 star quad shielded				
CF260.25.05.04	(4G2,5+(4x0,5)C)C	13,0	181	258
CF260.60.05.04	(4G6,0+(4x0,5)C)C	16,0	344	430
Without control pair				
CF260.15.04	(4G1,5)C	8,5	76	113
CF260.25.04	(4G2,5)C	10,5	128	155
CF260.40.04	(4G4,0)C	12,0	193	231
CF260.100.04	(4G10,0)C	17,5	441	548
CF260.160.04	(4G16,0)C	20,5	672	801

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

CF27.D
PUR
7,5 x d



PUR Servo cable Chainflex® CF27.D

- **for maximum load requirements**
- **PUR outer jacket**
- **shielded**
- **oil-resistant and coolant-resistant**
- **notch-resistant**
- **flame-retardant**
- **hydrolysis-resistant and microbe-resistant**
- **PVC-free/halogen-free**

Temperature range moved	**-20 °C to +80 °C, bending radius 7,5 x d**
Temperature range fixed	**-40 °C to +80 °C, bending radius 4 x d**
V max. unsupported/gliding	10 m/s, 5 m/s
a max.	80 m/s²
UV-resistant	Medium
Nominal voltage	600/1000 V (according to DIN VDE 0250).
Testing voltage	4000 V (according to DIN VDE 0281-2).
Oil	Oil-resistant (according to EN 60811-2-1).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Halogen-free	According to EN 50267-2-1.
Conductor	Fine-wire stranded conductor in especially bending-resistant version consisting of bare copper wires (according to EN 60228).
Core insulation	Mechanically high-quality, especially low-capacitance TPE mixture.
Core stranding	Energy conductor with signal pair elements stranded around high-tensile center cord.
Core identification	**Energy conductor:** cores black with white numerals, one core green/yellow. 1. core: U / L1 / C / L+ 2. core: V / L2 3. core: W / L3 / D / L- 4. core: 4 / N **1 control pair:** cores black with white numerals. 1. control pair: 4 2. control pair: 5 **2 control pairs:** cores black with white numerals. 1. control pair: 5 2. control pair: 6 3. control pair: 7 4. control pair: 8

... no minimum order quantity

Premium Line

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Element shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Inner jacket	PUR mixture adapted to suit the requirements in Energy Chains®.
Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Outer jacket	Low-adhesion, highly abrasion-resistant mixture on the basis of PUR, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: orange (similar to RAL 2003)
VDE	The cables are manufactured on the basis of VDE.
UL/CSA	Style 10492 and 2570, 1000 V, 80 °C
CEI	According to CEI 20-35
CE	According to 73/23/EWG, 93/68/EWG
DESINA	According to VDW, DESINA standardisation
Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil
- indoor and outdoor applications, UV-resistant
- especially for freely suspended and gliding travel distances up to 100 m
- storage and retrieval units for high-bay warehouses, machining units/machine tools, quick handling, clean room, semiconductor insertion, outdoor cranes, low-temperature applications

PUR Servo cable
Chainflex® CF27.D

- for maximum load requirements
- PUR outer jacket
- shielded
- oil-resistant and coolant-resistant
- notch-resistant
- flame-retardant
- hydrolysis-resistant and microbe-resistant
- PVC-free/halogen-free

Delivery program Part No. 1 control pair shielded	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF27.07.05.02.01.D	(4G0,75+(2x0,5)C)C	11,5	95	171
CF27.15.10.02.01.D	(4G1,5+(2x1,0)C)C	12,5	125	220
CF27.15.15.02.01.D*	(4G1,5+(2x1,5)C)C	12,5	140	260
CF27.25.10.02.01.D	(4G2,5+(2x1,0)C)C	13,5	177	286
CF27.25.15.02.01.D*	(4G2,5+(2x1,5)C)C	14,0	182	300
CF27.40.10.02.01.D	(4G4,0+(2x1,0)C)C	15,5	232	356
CF27.40.15.02.01.D*	(4G4,0+(2x1,5)C)C	15,5	241	375
CF27.60.10.02.01.D	(4G6,0+(2x1,0)C)C	17,5	327	481
CF27.60.15.02.01.D*	(4G6,0+(2x1,5)C)C	17,5	357	580
CF27.100.10.02.01.D	(4G10+(2x1,0)C)C	20,5	530	740
CF27.100.15.02.01.D*	(4G10+(2x1,5)C)C	21,5	540	900
CF27.160.10.02.01.D	(4G16+(2x1,0)C)C	24,0	700	1023
CF27.160.15.02.01.D*	(4G16+(2x1,5)C)C	24,5	716	1150
CF27.250.15.02.01.D	(4G25+(2x1,5)C)C	28,5	1056	1435
CF27.350.15.02.01.D	(4G35+(2x1,5)C)C	32,5	1553	2079
2 control pairs shielded				
CF27.10.07.02.02.D	(4G1,0+2x(2x0,75)C)C	13,5	143	251
CF27.15.07.02.02.D	(4G1,5+2x(2x0,75)C)C	14,5	175	295
CF27.25.15.02.02.D	(4G2,5+2x(2x1,5)C)C	16,0	265	349
CF27.40.15.02.02.D	(4G4,0+2x(2x1,5)C)C	18,0	303	405
CF27.60.15.02.02.D	(4G6,0+2x(2x1,5)C)C	19,5	397	643
CF27.100.15.02.02.D	(4G10+2x(2x1,5)C)C	23,5	560	1000
CF27.160.15.02.02.D	(4G16+2x(2x1,5)C)C	26,0	790	1250
CF27.250.15.02.02.D	(4G25+2x(2x1,5)C)C	30,0	1140	1890
CF27.350.15.02.02.D*	(4G35+2x(2x1,5)C)C	33,5	1597	2150
1 star quad shielded				
CF27.15.05.04.D*	(4G1,5+(4x0,5)C)C	14,5	142	310
CF27.25.05.04.D*	(4G2,5+(4x0,5)C)C	15,0	199	325
CF27.40.05.04.D*	(4G4,0+(4x0,5)C)C	17,0	256	480
CF27.60.05.04.D*	(4G6,0+(4x0,5)C)C	18,0	371	550
Without control pair				
CF27.07.04.D	(4G0,75)C	9,5	52	113
CF27.10.04.D	(4G1,0)C	10,0	62	126
CF27.15.04.D	(4G1,5)C	10,5	86	160
CF27.25.04.D	(4G2,5)C	12,0	140	260
CF27.500.04.D	(4G50,0)C	37,5	2230	3200

* Delivery time upon inquiry.
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

... no minimum order quantity

Premium Line

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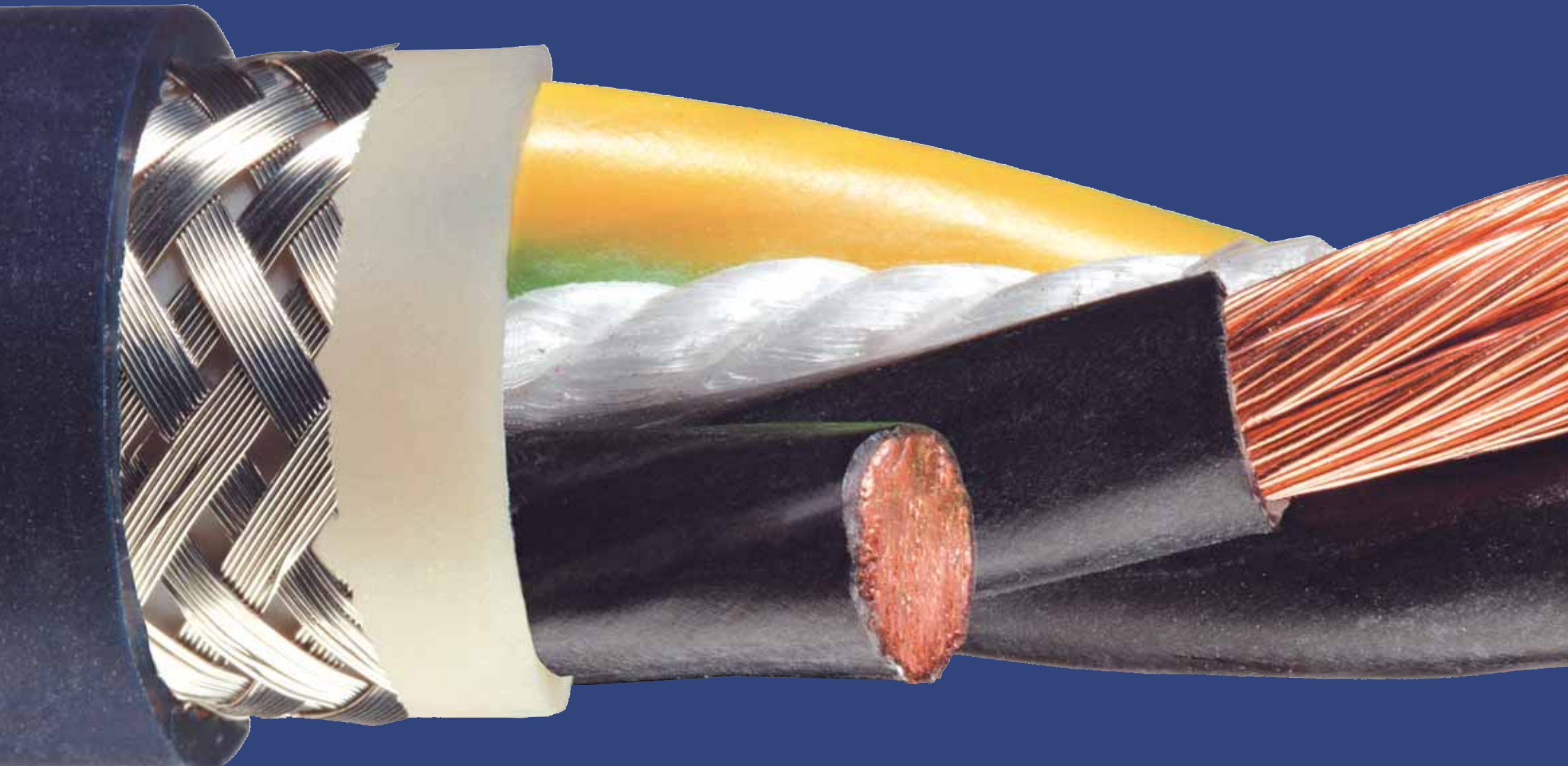
Modular design, easy to retrofit: igus® E4 energy supply system and Chainflex® cables.

750 types from stock no cutting costs ...

(for up to 10 cuts of the same type)

Power cable



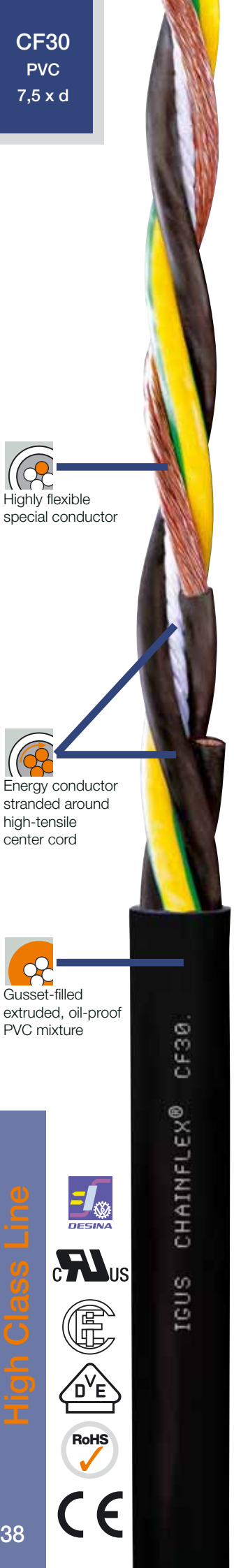
Chainflex® types

Chainflex® cable	Jacket	Shield	Bending radius moved [factor x d]	Temperature moved from/to [°C]	Approvals and standards	Oil-resistant	Torsion resistant	*V* max. [m/s] unsupported	*V* max. [m/s] gliding	*a* max. [m/s²]	Page
Power cables											
CF30	PVC		7,5	-5/ +70		✔	✔	10	5	80	138
CF31	PVC	✔	7,5	-5/ +70		✔		10	5	80	140
CF34	TPE		7,5	-35/ +90		✔	✔	10	6	80	142
CF35	TPE	✔	7,5	-35/ +90		✔		10	6	80	144
CF300.UL	TPE		7,5	-35/ +90		✔		10	6	100	146
CFPE	TPE		7,5	-35/ +90		✔		10	6	100	148
CF310.UL	TPE	✔	7,5	-35/ +90		✔		10	6	100	150
CF.BRAID	TPE	✔	7,5	-35/ +70		✔		10	6	80	152
CFCRANE	iguprene	✔	10	-20/ +80		✔		10	6	50	154
Pneumatic hose											
CF.Air	PU		10	-25/ +80		✔		10	5	50	156

CF30
PVC
7,5 x d

PVC Power cable Chainflex® CF30

- **for high load requirements**
- **PVC outer jacket**
- **oil-proof in accordance with VDE**
- **flame-retardant**



Temperature range moved	**-5 °C to +70 °C, bending radius 7,5 x d**
Temperature range fixed	**-20 °C to +70 °C, bending radius 4 x d**
V max. unsupported/gliding	10 m/s, 5 m/s
a max.	80 m/s²
UV-resistant	Medium
Nominal voltage	600/1000 V (according to DIN VDE 0250).
Testing voltage	4000 V (according to DIN VDE 0281-2).
Oil	Oil-proof (according to DIN VDE 0207).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	**< 10 mm²:** Fine-wire stranded conductor in especially bending-resistant version consisting of bare copper wires (according to EN 60228). **≥ 10 mm²:** conductor cable consisting of pre-leads (according to EN 60228).
Core insulation	Mechanically high-quality, especially low-capacitance TPE mixture.
Core stranding	Cores stranded in short pitch lengths over a centre for high tensile stresses.
Core identification	**Energy conductor:** cores black with white numerals, one core green/yellow. 1. core: U / L1 / C / L+ 2. core: V / L2 3. core: W / L3 / D / L- 4. core: 4 / N
Outer jacket	Low-adhesion, oil-resistant mixture on the basis of PVC, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: black

... no minimum order quantity

High Class Line

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	VDE	The cables are manufactured on the basis of VDE.
	UL/CSA	Style 10492 and 2570, 1000 V, 80 °C
	CEI	According to CEI 20-35
	CE	According to 73/23/EWG, 93/68/EWG
	DESINA	According to VDW, DESINA standardisation
	Lead free	According to EU guideline (RoHS) 2002/95/EC – starting from manufacturing date 1/2006.

Typical application area

- for high load requirements
- light oil influence
- preferably indoor applications, but also outdoor ones at temperatures > 5 °C
- especially for freely suspended and gliding travel distances up to 100 m
- storage and retrieval units for high-bay warehouses, machining units/packaging machines, quick handling, indoor cranes

Delivery program **Part No.**	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF30.15.04	4G1,5	8,5	55	102
CF30.25.04	4G2,5	10,5	95	164
CF30.25.05*	5G2,5	11,5	127	207
CF30.40.04	4G4,0	12,0	152	235
CF30.40.05	5G4,0	13,5	188	285
CF30.60.04	4G6,0	14,5	227	339
CF30.60.05	5G6,0	15,5	282	405
CF30.100.04	4G10,0	18,0	391	556
CF30.100.05	5G10,0	20,0	489	699
CF30.160.04	4G16,0	21,0	610	835
CF30.160.05	5G16,0	24,0	763	1021
CF30.250.04	4G25,0	26,0	944	1317
CF30.350.04	4G35,0	29,0	1329	1722
CF30.500.04	4G50,0	35,0	1898	2436

* Delivery time upon inquiry
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

CF31
PVC
7,5 x d

Highly flexible special conductor

Energy conductor stranded around high-tensile center cord

Gusset-filled extruded

Highly flexible braided copper shield

Pressure extruded, oil-proof PVC sheath blend

PVC Power cable Chainflex® CF31

- **for high load requirements**
- **PVC outer jacket**
- **shielded**
- **oil-proof in accordance with VDE**
- **flame-retardant**

Temperature range moved	**-5 °C to +70 °C, bending radius 7,5 x d**
Temperature range fixed	**-20 °C to +70 °C, bending radius 4 x d**
V max. unsupported/gliding	10 m/s, 5 m/s
a max.	80 m/s²
UV-resistant	Medium
Nominal voltage	600/1000 V (according to DIN VDE 0250).
Testing voltage	4000 V (according to DIN VDE 0281-2).
Oil	Oil-proof (according to DIN VDE 0207).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	**< 10 mm²:** Fine-wire stranded conductor in especially bending-resistant version consisting of bare copper wires (according to EN 60228). **≥ 10 mm²:** conductor cable consisting of pre-leads (according to EN 60228).
Core insulation	Mechanically high-quality, especially low-capacitance TPE mixture.
Core stranding	Cores stranded in short pitch lengths over a centre for high tensile stresses.
Core identification	**Energy conductor:** cores black with white numerals, one core green/yellow. 1. core: U / L1 / C / L+ 2. core: V / L2 3. core: W / L3 / D / L- 4. core: 4 / N
Inner jacket	PVC mixture adapted to suit the requirements in Energy Chains®.
Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Outer jacket	Low-adhesion, oil-resistant mixture on the basis of PVC, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0282 Part 10). Colour: black

... no minimum order quantity

High Class Line

VDE	The cables are manufactured on the basis of VDE.
UL/CSA	Style 10492 and 2570, 1000 V, 80 °C
CEI	According to CEI 20-35
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC – starting from manufacturing date 1/2006.

Typical application area

- for high load requirements
- light oil influence
- preferably indoor applications, but also outdoor ones at temperatures > 5 °C
- especially for freely suspended and gliding travel distances up to 100 m
- storage and retrieval units for high-bay warehouses, machining units/packaging machines, quick handling, indoor cranes

Delivery program **Part No.**	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF31.15.04	(4G1,5)C	11,0	82	169
CF31.25.04	(4G2,5)C	12,5	128	237
CF31.25.05	(5G2,5)C	13,5	156	278
CF31.40.04	(4G4,0)C	14,0	192	319
CF31.40.05	(5G4,0)C	15,5	246	388
CF31.60.04	(4G6,0)C	17,0	290	464
CF31.60.05	(5G6,0)C	18,5	349	558
CF31.100.04	(4G10,0)C	21,0	477	747
CF31.100.05*	(5G10,0)C	23,0	598	904
CF31.160.04	(4G16,0)C	24,0	737	1047
CF31.250.04	(4G25,0)C	29,5	1081	1577
CF31.350.04	(4G35,0)C	33,5	1483	2080
CF31.500.04	(4G50,0)C	38,5	2081	2851
CF31.700.04	(4G70,0)C	47,0	2961	4650

* Delivery time upon inquiry
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

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CF34
TPE
7,5 x d

TPE Power cable Chainflex® CF34

- **for maximum load requirements**
- **TPE outer jacket**
- **oil-resistant**
- **bio-oil-resistant**
- **UV-resistant**
- **flame-retardant**

Temperature range moved	**-35 °C to 90 °C, bending radius 7,5 x d**
Temperature range fixed	**-40 °C to +90 °C, bending radius 4 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	80 m/s²
UV-resistant	High
Nominal voltage	600/1000 V (according to DIN VDE 0250).
Testing voltage	4000 V (according to DIN VDE 0281-2).
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	**< 10 mm²:** Fine-wire stranded conductor in especially bending-resistant version consisting of bare copper wires (according to EN 60228). **≥ 10 mm²:** conductor cable consisting of pre-leads (according to EN 60228).
Core insulation	Mechanically high-quality, especially low-capacitance TPE mixture.
Core stranding	Cores stranded in short pitch lengths over a centre for high tensile stresses.
Core identification	**Energy conductor:** cores black with white numerals, one core green/yellow. 1. core: U / L1 / C / L+ 2. core: V / L2 3. core: W / L3 / D / L- 4. core: 4 / N
Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: black
VDE	The cables are manufactured on the basis of VDE.
UL/CSA	Style 10492 and 21184, 1000 V, 80 °C

... no minimum order quantity

Premium Line

	CEI	According to CEI 20-35
	CE	According to 73/23/EWG, 93/68/EWG
	DESINA	According to VDW, DESINA standardisation
RoHS	**Lead free**	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications, UV-resistant
- especially for freely suspended and gliding travel distances up to 400 m and more
- storage and retrieval units for high-bay warehouses, machining units/machine tools, quick handling, clean room, semiconductor insertion, outdoor cranes, low-temperature applications

Delivery program **Part No.**	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF34.15.04	4G1,5	9,0	55	106
CF34.25.04	4G2,5	10,5	95	157
CF34.40.04	4G4,0	12,0	152	233
CF34.60.04	4G6,0	14,0	227	335
CF34.60.05	5G6,0	15,0	282	390
CF34.100.04	4G10,0	17,5	391	532
CF34.100.05	5G10,0	19,0	489	657
CF34.160.04	4G16,0	20,0	610	789
CF34.160.05	5G16,0	24,0	763	1031
CF34.250.04	4G25,0	24,5	944	1217
CF34.100.04.O.PE*	4x10	16,5	358	515
CF34.500.03.O.PE*	3x50	29,5	1390	1900

* without green-yellow core
Additional cross sections upon inquiry.
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

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CF35
TPE
7,5 x d

Highly flexible special conductor

Energy conductor stranded around high-tensile center cord

Gusset-filled, pressure extruded TPE inner jacket

Highly flexible braided copper shield

Pressure extruded TPE blend

TPE Power cable Chainflex® CF35

- **for maximum load requirements**
- **TPE outer jacket**
- **shielded**
- **oil-resistant**
- **bio-oil-resistant**
- **UV-resistant**
- **flame-retardant**

Temperature range moved	**-35 °C to 90 °C, bending radius 7,5 x d**
Temperature range fixed	**-40 °C to +90 °C, bending radius 4 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	80 m/s²
UV-resistant	High
Nominal voltage	600/1000 V (according to DIN VDE 0250).
Testing voltage	4000 V (according to DIN VDE 0281-2).
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	**< 10 mm²:** Fine-wire stranded conductor in especially bending-resistant version consisting of bare copper wires (according to EN 60228). **≥ 10 mm²:** conductor cable consisting of pre-leads (according to EN 60228).
Core insulation	Mechanically high-quality, especially low-capacitance TPE mixture.
Core stranding	Cores stranded in short pitch lengths over a centre for high tensile stresses.
Core identification	**Energy conductor:** cores black with white numerals, one core green/yellow. 1. core: U / L1 / C / L+ 2. core: V / L2 3. core: W / L3 / D / L- 4. core: 4 / N
Inner jacket	TPE mixture adapted to suit the requirements in Energy Chains®.
Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.

... no minimum order quantity

Premium Line

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Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: black
VDE	The cables are manufactured on the basis of VDE.
UL/CSA	Style 10492 and 21184, 1000 V, 80 °C
CEI	According to CEI 20-35
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications, UV-resistant
- especially for freely suspended and gliding travel distances up to 400 m and more
- storage and retrieval units for high-bay warehouses, machining units/machine tools, quick handling, clean room, semiconductor insertion, outdoor cranes, low-temperature applications

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF35.15.04	(4G1,5)C	10,0	55	106
CF35.25.04	(4G2,5)C	11,5	95	157
CF35.40.04	(4G4,0)C	14,0	152	233
CF35.60.04	(4G6,0)C	15,5	227	335
CF35.100.04	(4G10,0)C	20,0	391	532
CF35.160.04	(4G16,0)C	22,5	610	789
CF35.250.04	(4G25,0)C	27,5	944	1217

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

CF300.UL
TPE
7,5 x d

Highly flexible special conductor

Pressure extruded TPE blend

Pressure extruded TPE blend

TPE Power cable Chainflex® CF300.UL

- **for maximum load requirements**
- **TPE outer jacket**
- **oil-resistant**
- **bio-oil-resistant**
- **flame-retardant**
- **UV-resistant**

Temperature range moved	**-35 °C to +90 °C, bending radius 7,5 x d**
Temperature range fixed	**-40 °C to +90 °C, bending radius 4 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	100 m/s²
UV-resistant	High
Nominal voltage	600/1000 V (according to DIN VDE 0250).
Testing voltage	4000 V (according to DIN VDE 0281-2).
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Conductor cable consisting of pre-leads (according to EN 60228).
Core insulation	Mechanically high-quality TPE mixture.
Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: black
VDE	The cables are manufactured on the basis of VDE.
CE	According to 73/23/EWG, 93/68/EWG
UL/CSA	Style 10492 and 21184, 1000 V, 80 °C
CEI	According to CEI 20-35
Lead free	According to EU guideline (RoHS) 2002/95/EC.

... no minimum order quantity

Premium Line

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications, UV-resistant
- especially for freely suspended and gliding travel distances up to 400 m and more
- storage and retrieval units for high-bay warehouses, machining units/machine tools, quick handling, clean room, semiconductor insertion, outdoor cranes, low-temperature applications

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]	
CF300.60.01.UL*	1x6,0	7,0	56	77	New
CF300.100.01.UL*	1x10,0	8,0	96	119	New
CF300.160.01.UL*	1x16,0	9,5	151	183	New
CF300.250.01.UL*	1x25,0	11,5	239	281	New
CF300.350.01.UL*	1x35,0	13,0	333	377	New
CF300.500.01.UL*	1x50,0	14,5	479	525	New
CF300.700.01.UL*	1x70,0	16,0	623	676	New
CF300.950.01.UL*	1x95,0	20,0	848	927	New
CF300.1200.01.UL*	1x120,0	21,5	1059	1145	New
CF300.1500.01.UL*	1x150,0	23,0	1318	1411	New
CF300.1850.01.UL*	1x185,0	25,5	1699	1775	New

* Delivery time upon inquiry.
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF300.60.01**	1x6,0	7,5	58	85
CF300.100.01**	1x10,0	8,0	96	130
CF300.160.01**	1x16,0	9,5	154	190
CF300.250.01**	1x25,0	11,5	240	280
CF300.350.01**	1x35,0	13,0	336	400
CF300.500.01**	1x50,0	14,5	480	520
CF300.700.01**	1x70,0	16,0	672	720
CF300.950.01**	1x95,0	20,0	912	1050
CF300.1200.01**	1x120,0	21,5	1152	1220
CF300.1500.01**	1x150,0	23,0	1440	1500
CF300.1850.01**	1x185,0	25,5	1776	1940

*** Phase-out model, is replaced by UL-type.**
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

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CFPE
TPE
7,5 x d

Highly flexible special conductor

Pressure extruded TPE blend

Pressure extruded, flame-retard TPE blend

TPE Power cable Chainflex® CFPE

- **for maximum load requirements**
- **TPE outer jacket**
- **oil-resistant**
- **bio-oil-resistant**
- **flame-retardant**
- **UV-resistant**

Temperature range moved	**-35 °C to +90 °C, bending radius 7,5 x d**
Temperature range fixed	**-40 °C to +90 °C, bending radius 4 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	100 m/s²
UV-resistant	High
Nominal voltage	600/1000 V (according to DIN VDE 0250).
Testing voltage	4000 V (according to DIN VDE 0281-2).
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Conductor cable consisting of pre-leads (according to EN 60228).
Core insulation	Mechanically high-quality TPE mixture.
Core identification	green-yellow
Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: black
VDE	The cables are manufactured on the basis of VDE.
UL/CSA	Style 10492 and 21184, 1000 V, 80 °C
CEI	According to CEI 20-35
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC.

... no minimum order quantity

Premium Line

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications, UV-resistant
- especially for freely suspended and gliding travel distances up to 400 m and more
- storage and retrieval units for high-bay warehouses, machining units/machine tools, quick handling, clean room, semiconductor insertion, outdoor cranes, low-temperature applications

Delivery program **Part No.**	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CFPE.40.01	1G4,0	6,0	38	61
CFPE.60.01	1G6,0	7,5	56	81
CFPE.100.01	1G10,0	8,0	96	123
CFPE.160.01	1G16,0	9,5	151	191
CFPE.250.01*	1G25,0	11,5	239	291
CFPE.350.01	1G35,0	13,0	333	387

* Delivery time upon inquiry
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® CFPE for machining units. E-Chain®: Serie E2 medium

750 types from stock no cutting costs ...

(for up to 10 cuts of the same type)

Tel. +49-22 03-96 49-800
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CF310.UL
TPE
7,5 x d

Highly flexible special conductor

Pressure extruded TPE blend

Highly flexible braided copper shield

Pressure extruded TPE blend

TPE Power cable Chainflex® CF310.UL

- **for maximum load requirements**
- **TPE outer jacket**
- **shielded**
- **oil-resistant**
- **bio-oil-resistant**
- **flame-retardant**
- **UV-resistant**

Temperature range moved	**-35 °C to +90 °C, bending radius 7,5 x d**
Temperature range fixed	**-40 °C to +90 °C, bending radius 4 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	100 m/s²
UV-resistant	High
Nominal voltage	600/1000 V (according to DIN VDE 0250).
Testing voltage	4000 V (according to DIN VDE 0281-2).
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Conductor cable consisting of pre-leads (according to EN 60228).
Core insulation	Mechanically high-quality TPE mixture.
Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: black
VDE	The cables are manufactured on the basis of VDE.
UL/CSA	Style 10492 and 21184, 1000 V, 80 °C
CEI	According to CEI 20-35
CE	According to 73/23/EWG, 93/68/EWG

... no minimum order quantity

Premium Line

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RoHS **Lead free** According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications, UV-resistant
- especially for freely suspended and gliding travel distances up to 400 m and more
- storage and retrieval units for high-bay warehouses, machining units/machine tools, quick handling, clean room, semiconductor insertion, outdoor cranes, low-temperature applications

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]	
CF310.40.01.UL*	(1x4,0)C	6,5	55	74	New
CF310.60.01.UL*	(1x6,0)C	7,5	75	97	New
CF310.100.01.UL*	(1x10,0)C	9,0	120	144	New
CF310.160.01.UL*	(1x16,0)C	10,0	178	210	New
CF310.250.01.UL*	(1x25,0)C	12,0	272	314	New
CF310.350.01.UL*	(1x35,0)C	13,5	380	423	New
CF310.500.01.UL*	(1x50,0)C	15,0	524	568	New
CF310.700.01.UL*	(1x70,0)C	17,5	689	748	New
CF310.950.01.UL*	(1x95,0)C	20,5	920	997	New
CF310.1200.01.UL*	(1x120,0)C	22,0	1140	1233	New
CF310.1500.01.UL*	(1x150,0)C	24,0	1436	1549	New
CF310.1850.01.UL*	(1x185,0)C	26,5	1829	1906	New

* Delivery time upon inquiry.
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF310.40.01**	(1x4,0)C	7,0	53	75
CF310.60.01**	(1x6,0)C	8,0	78	95
CF310.100.01**	(1x10,0)C	9,0	124	170
CF310.160.01**	(1x16,0)C	10,0	186	220
CF310.250.01**	(1x25,0)C	12,0	278	340
CF310.350.01**	(1x35,0)C	13,5	384	460
CF310.500.01**	(1x50,0)C	15,0	530	580
CF310.700.01**	(1x70,0)C	17,5	753	820
CF310.950.01**	(1x95,0)C	20,5	1006	1200
CF310.1200.01**	(1x120,0)C	22,0	1257	1350
CF310.1500.01**	(1x150,0)C	24,0	1562	1680
CF310.1850.01**	(1x185,0)C	26,5	1895	2000

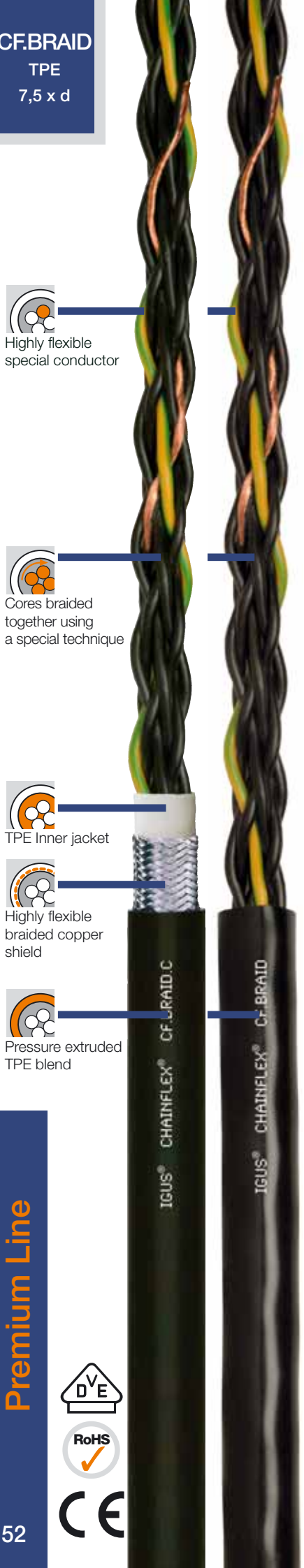
*** Phase-out model, is replaced by UL-type.**
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

CF.BRAID
TPE
7,5 x d

TPE Power cable Chainflex® CF.BRAID

- **for maximum load requirements**
- **TPE outer jacket**
- **unshielded/shielded**
- **oil-resistant**
- **bio-oil-resistant**
- **UV-resistant**



Temperature range moved	**-35 °C to 70 °C, bending radius 7,5 x d**
Temperature range fixed	**-40 °C to +70 °C, bending radius 4 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	80 m/s²
UV-resistant	High
Nominal voltage	600/1000 V (according to DIN VDE 0250).
Testing voltage	4000 V (according to DIN VDE 0281-2).
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (according to PV 3.10.7 – status 1992).
Conductor	Fine-wire stranded conductor in especially bending-resistant version consisting of bare copper wires (according to EN 60228).
Core insulation	Mechanically high-quality TPE mixture (according to DIN VDE 0207 Part 4).
Core stranding	Cores braided together using a special technique.
Core identification	Cores black with white numerals, one core green-yellow.
Inner jacket	TPE mixture adapted to suit the requirements in Energy Chains® (for shielded types).
Overall shield	Extremely bending-resistant, tinned braided copper shield. Coverage approx. 70% linear, approx. 90% optical.
Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: black

Premium Line

... no minimum order quantity

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VDE	The cables are manufactured on the basis of VDE.
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC.

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil, also with bio-oils
- indoor and outdoor applications, UV-resistant
- especially for freely suspended and gliding travel distances up to 400 m and more
- Storage and retrieval units for high-bay warehouses, quick handling, in- and outdoor cranes, low-temperature applications

What is special about CF.BRAID?

Due to their unique type of design and especially in the case of cross-sections ≥ 2.5 mm² and long distances of travel with large numbers of cycles, cables with 7 cores have an increased tendency toward the formation of corkscrews. Due to the special design of the CF.BRAID with 8 braided cores, corkscrews can be completely ruled out.

Delivery program **Part No.**	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CF.BRAID.25.08	8G2,5	20,0	192	398
CF.BRAID.25.08.C	(8G2,5)C	23,5	320	625

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

CF CRANE
PUR
7,5 x d

igupren Power cable Chainflex® CF CRANE

- for maximum voltages and outputs
- iguprene outer jacket
- oil-resistant
- flame-retardant

Temperature range moved	**-25 °C to +80 °C, bending radius 10 x d**
Temperature range fixed	**-30 °C to +80 °C, bending radius 7,5 x d**
V max. unsupported/gliding	10 m/s, 6 m/s
a max.	50 m/s²
a max.	30 m/s²
UV-resistant	High
Nominal voltage	6/10 kV (according to DIN VDE 0250), other voltages upon inquiry.
Testing voltage	17 kV (according to DIN VDE 0250, part 813).
Oil	Oil-resistant (according to EN 60811-2-1).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Conductor	Highly flexible cable consisting of tinned copper wires (according to VDE 0295).
Core insulation	Inner and outer semiconducting layer made of conductive rubber. Insulating sheath made of high-quality, heat-resistant and ozone-proof ethylene propylene rubber (EPR).
Overall shield	Extremely bending-resistant, tinned copper shield. Coverage approx. 80% optical.
Outer jacket	Low-adhesion mixture on the basis of iguprene, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains® (according to DIN VDE 0207 Part 21). Colour: red
VDE	The cables are manufactured on the basis of VDE.
CE	According to 73/23/EWG, 93/68/EWG
Lead free	According to EU guideline (RoHS) 2002/95/EC.

... no minimum order quantity

Premium Line

Typical application area

- for maximum load requirements
- almost unlimited resistance to oil
- indoor and outdoor applications, UV-resistant
- especially for freely suspended and gliding travel distances up to 500 m and more
- outdoor ship to shore, crane applications, conveyer technology

Delivery program Part No.	Number of cores and conductor nominal cross section [mm²]	External diameter approx. [mm]	Copper index [kg/km]	Weight [kg/km]
CFCRANE1x25/16-6/10kV*	(1x25/16)C	27,0	468	940
CFCRANE1x35/16-6/10kV*	(1x35/16)C	29,0	576	1110
CFCRANE1x50/16-6/10kV*	(1x50/16)C	30,0	712	1350
CFCRANE1x70/16-6/10kV*	(1x70/16)C	32,0	912	1550
CFCRANE1x95/16-6/10kV*	(1x95/16)C	34,0	1145	1820

* Delivery time upon inquiry
Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® CFCRANE for 500 m and more of travel. E-Chain®: igus® Rol E-Chain®

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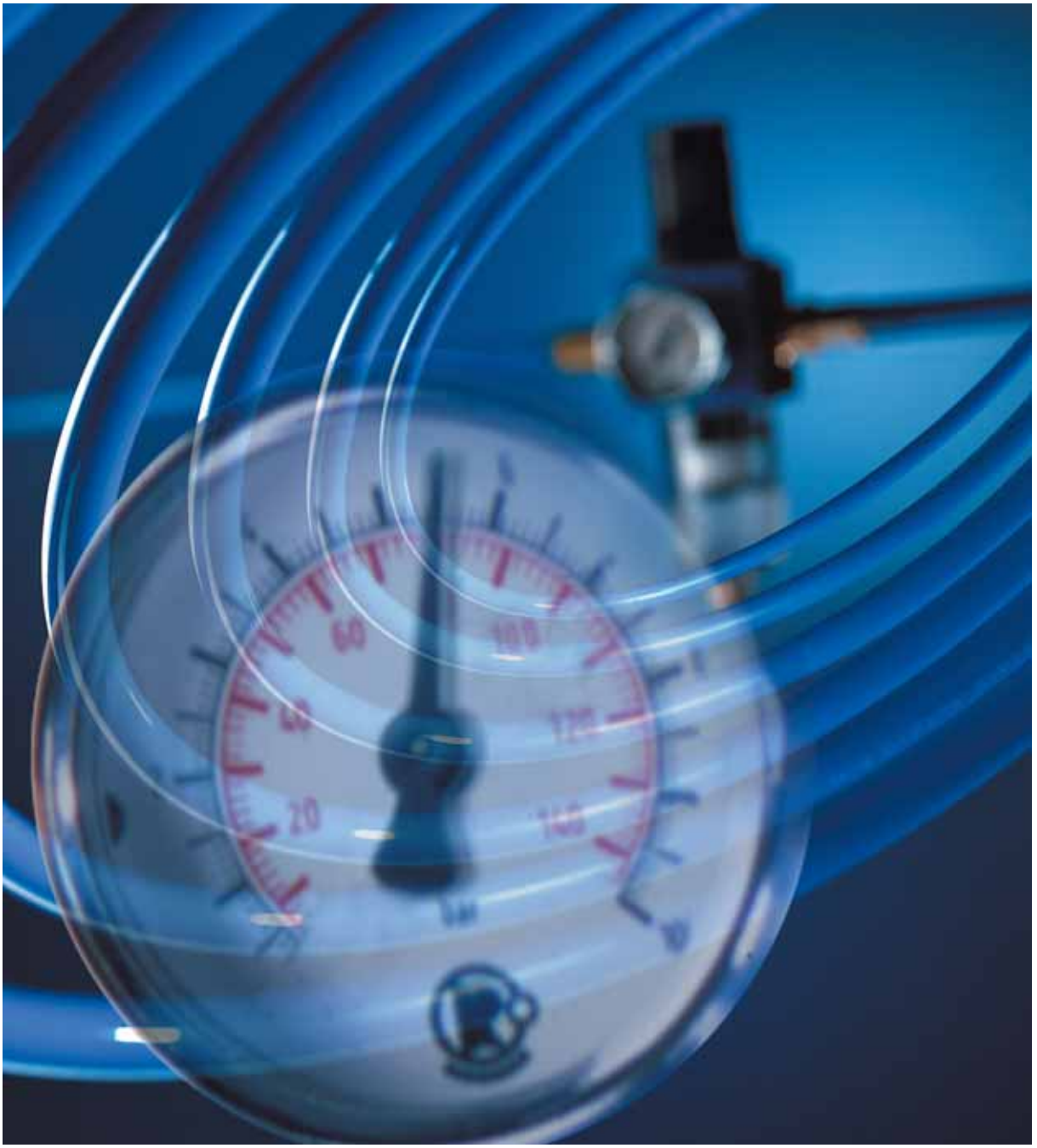
Pneumatic hose Chainflex® CF.Air

- **for maximum load requirements**
- **PU hose**
- **oil-resistant and coolant-resistant**
- **abrasion-resistant**
- **outside-toleranced**

Temperature range moved	**-25 °C to +80 °C, bending radius 10 x d**
Temperature range fixed	**-40 °C to +85 °C, bending radius 8 x d**
Dimensions	Outside-toleranced
Operating pressure	12 bar at 20 °C
Vacuum	-1 bar at 20 °C
Oil	Oil-resistant.
Material	Low-adhesion mixture on the basis of Polyurethan, highly abrasion-resistant , adapted to suit the requirements in Energy Chains®. Colour: blue
Lead free	According to EU guideline (RoHS) 2002/95/EC.

... no minimum order quantity

Delivery program Part No.	Max. package length [km]	Internal diameter approx. [mm]	Wall thickness approx. [mm]	External diameter approx. [mm]	Weight [g/m]
CA PU.A.04.0	1,5	2,7	0,65	4	8
CA PU.A.06.0	1,5	4,0	1,00	6	19
CA PU.A.08.0	1,0	5,7	1,15	8	30
CA PU.A.10.0	0,1	7,0	1,50	10	48
CA PU.A.12.0	0,1	8,0	2,00	12	76
CA PU.A.16.0	0,1	11,0	2,50	16	127



igus® Chainflex® CF.Air pneumatic hoses were tested over several million bending cycles in E-Chains®. Their outstanding features include flexibility, high abrasion resistance and very good resistance to oil and coolants.

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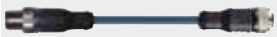
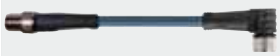
Drive technology

Chainflex® harnessed

Chainflex® harnessed

	Harnessed according to standard	Cable type	Jacket	Page
Initiators CF9				
	CF.INI	Direct line M12 x 1, straight	TPE	224
	CF.INI	Direct line M12 x 1, angled	TPE	224
	CF.INI	Direct line M12 x 1, straight, LED	TPE	225
	CF.INI	Direct line M12 x 1, angled, LED	TPE	225
	CF.INI	Connection cable M12 x 1, straight	TPE	226
	CF.INI	Connection cable M12 x 1, angled	TPE	226
	CF.INI	Direct line M8 x 1, straight	TPE	227
	CF.INI	Direct line M8 x 1, angled	TPE	227
	CF.INI	Direct line M8 x 1, angled, LED	TPE	228
	CF.INI	Connection cable M8 x 1, straight	TPE	229
	CF.INI	Connection cable M8 x 1, angled, LED	TPE	229
Initiators CF98				
	CF.INI	Direct line M12 x 1, straight	TPE	230
	CF.INI	Direct line M12 x 1, angled	TPE	230
	CF.INI	Connection cable M12 x 1, straight	TPE	231
	CF.INI	Connection cable M12 x 1, angled	TPE	231
	CF.INI	Direct line M8 x 1, straight	TPE	232
	CF.INI	Direct line M8 x 1, angled	TPE	232
	CF.INI	Connection cable M8 x 1, straight	TPE	233
	CF.INI	Connection cable M8 x 1, angled	TPE	233

Chainflex® Servo cable
harnessed according to Siemens standard

Technical information

- Oil-resistant and coolant-resistant
- Shielded
- Cut-proof, notch-resistant, hydrolysis-resistant and microbe-resistant
- Intermediate sheath on the basis of PUR
- **Signal pairs:** pair shielding of extremely readily bending/firm cooper shield, coverage approx. 70% linear, 90% optical, and metal foil

Chainflex® PUR Servo cable: Basic cables

Siemens Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
6FX8002-5DA01	MAT9060001	(4G1,5+(2x1,0)C)C	12,5	7,5 x d
6FX8002-5DA11	MAT9060002	(4G2,5+(2x1,0)C)C	13,5	7,5 x d

6FX8002-5DA21	MAT9060003	(4G1,5+(2x1,0)C)C	12,5	7,5 x d
6FX8002-5DA31	MAT9060004	(4G2,5+(2x1,0)C)C	13,5	7,5 x d
6FX8002-5DA41	MAT9060005	(4G4,0+(2x1,0)C)C	15,5	7,5 x d
6FX8002-5DA51	MAT9060006	(4G6,0+(2x1,0)C)C	17,5	7,5 x d
6FX8002-5DA61	MAT9060007	(4G10,0+(2x1,0)C)C	20,5	7,5 x d

6FX8002-5DA23	MAT9060008	(4G16,0+(2x1,0)C)C	24,0	7,5 x d
6FX8002-5DA33	MAT9060009	(4G25,0+(2x1,5)C)C	28,5	7,5 x d
6FX8002-5DA43	MAT9060010	(4G35,0+(2x1,5)C)C	32,5	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

... no minimum order quantity

- **Nominal voltage:** 600/1000 V
- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Temperature range (moved):** -20 °C to +80 °C
- **Minimum bending radius for use in Energy Chains®:** 7,5 x cable diameter
- Colour: orange (similar to RAL 2003)

Chainflex® PUR Servo cable: Extension cables

Siemens Extension cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
6FX8002-5DA05	MAT9061001	(4G1,5+(2x1,0)C)C	12,5	7,5 x d
6FX8002-5DA15	MAT9061002	(4G2,5+(2x1,0)C)C	13,5	7,5 x d
				
6FX8002-5DA28	MAT9061003	(4G1,5+(2x1,0)C)C	12,5	7,5 x d
6FX8002-5DA38	MAT9061004	(4G2,5+(2x1,0)C)C	13,5	7,5 x d
6FX8002-5DA48	MAT9061005	(4G4,0+(2x1,0)C)C	15,5	7,5 x d
6FX8002-5DA58	MAT9061006	(4G6,0+(2x1,0)C)C	17,5	7,5 x d
6FX8002-5DA68	MAT9061007	(4G10,0+(2x1,0)C)C	20,5	7,5 x d
				
6FX8002-5DX28	MAT9061008	(4G16,0+(2x1,0)C)C	24,0	7,5 x d
6FX8002-5DX38	MAT9061009	(4G25,0+(2x1,5)C)C	28,5	7,5 x d
6FX8002-5DX48	MAT9061010	(4G35,0+(2x1,5)C)C	32,5	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

Chainflex® Servo cable
harnessed according to Siemens standard

Technical information

- Oil-proof in accordance with VDE
- Flame-retardant, shielded
- Intermediate sheath on the basis of PVC
- **Signal pairs:** pair shielding of extremely readily bending/firm cooper shield, coverage approx. 70% linear, 90% optical, and metal foil.
- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical

Chainflex® PVC Servo cable, oil-proof: Basic cables

Siemens Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
6FX8002-5DA01	MAT9160001	(4G1,5+(2x1,0)C)C	12,5	7,5 x d
6FX8002-5DA11	MAT9160002	(4G2,5+(2x1,0)C)C	13,5	7,5 x d

6FX8002-5DA21	MAT9160003	(4G1,5+(2x1,0)C)C	12,5	7,5 x d
6FX8002-5DA31	MAT9160004	(4G2,5+(2x1,0)C)C	13,5	7,5 x d
6FX8002-5DA41	MAT9160005	(4G4,0+(2x1,0)C)C	15,5	7,5 x d
6FX8002-5DA51	MAT9160006	(4G6,0+(2x1,0)C)C	18,0	7,5 x d
6FX8002-5DA61	MAT9160007	(4G10,0+(2x1,0)C)C	22,0	7,5 x d

6FX8002-5DA23	MAT9160008	(4G16,0+(2x1,0)C)C	24,5	7,5 x d
6FX8002-5DA33	MAT9160009	(4G25,0+(2x1,5)C)C	29,5	7,5 x d
6FX8002-5DA43	MAT9160010	(4G35,0+(2x1,5)C)C	33,0	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

... no minimum order quantity

- **Temperature range (moved):** -5 °C to +70 °C
- **Nominal voltage:** 600/1000 V
- **Minimum bending radius for use in Energy Chains®:** 7,5 x cable diameter
- Colour: green (similar to RAL 6005)

Chainflex® PVC Servo cable, oil-proof: Extension cables

Siemens Extension cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
6FX8002-5DA05	MAT9161001	(4G1,5+(2x1,0)C)C	12,5	7,5 x d
6FX8002-5DA15	MAT9161002	(4G2,5+(2x1,0)C)C	13,5	7,5 x d

6FX8002-5DA28	MAT9161003	(4G1,5+(2x1,0)C)C	12,5	7,5 x d
6FX8002-5DA38	MAT9161004	(4G2,5+(2x1,0)C)C	13,5	7,5 x d
6FX8002-5DA48	MAT9161005	(4G4,0+(2x1,0)C)C	15,5	7,5 x d
6FX8002-5DA58	MAT9161006	(4G6,0+(2x1,0)C)C	18,0	7,5 x d
6FX8002-5DA68	MAT9161007	(4G10,0+(2x1,0)C)C	22,0	7,5 x d

6FX8002-5DX28	MAT9161008	(4G16,0+(2x1,0)C)C	24,5	7,5 x d
6FX8002-5DX38	MAT9161009	(4G25,0+(2x1,5)C)C	29,5	7,5 x d
6FX8002-5DX48	MAT9161010	(4G35,0+(2x1,5)C)C	33,0	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® Power cable
harnessed according to Siemens standard

Technical information

- Oil-resistant and coolant-resistant
- Flame-retardant
- Shielded
- Cut-proof, notch-resistant, for maximum load requirements
- intermediate sheath on the basis of TPE
- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical

Chainflex® TPE Power cable: Basic cables

Siemens Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
6FX8002-5CA01	MAT9050001	(4G1,5)C	10,0	7,5 x d
6FX8002-5CA11	MAT9050002	(4G2,5)C	11,5	7,5 x d
				
6FX8002-5CA21	MAT9050003	(4G1,5)C	10,0	7,5 x d
6FX8002-5CA31	MAT9050004	(4G2,5)C	11,5	7,5 x d
6FX8002-5CA41	MAT9050005	(4G4,0)C	13,0	7,5 x d
6FX8002-5CA51	MAT9050006	(4G6,0)C	15,0	7,5 x d
6FX8002-5CA61	MAT9050007	(4G10,0)C	20,0	7,5 x d
				
6FX8002-5CA23	MAT9050008	(4G16,0)C	22,0	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

... no minimum order quantity

- **Temperature range (moved):** -35 °C to +90 °C
- **Nominal voltage:** 600/1000 V
- **Minimum bending radius for use in Energy Chains®:** 7,5 x cable diameter
- Colour: black

Chainflex® TPE Power cable: Extension cables

Siemens Extension cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
6FX8002-5CA05	MAT9051001	(4G1,5)C	10,0	7,5 x d
6FX8002-5CA15	MAT9051002	(4G2,5)C	11,5	7,5 x d
				
6FX8002-5CA28	MAT9051003	(4G1,5)C	10,0	7,5 x d
6FX8002-5CA38	MAT9051004	(4G2,5)C	11,5	7,5 x d
6FX8002-5CA48	MAT9051005	(4G4,0)C	13,0	7,5 x d
6FX8002-5CA58	MAT9051006	(4G6,0)C	15,0	7,5 x d
6FX8002-5CA68	MAT9051007	(4G10,0)C	20,0	7,5 x d
				
6FX8002-5CX28	MAT9051008	(4G16,0)C	22,0	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

Chainflex® Power cable
harnessed according to Siemens standard

Technical information

- Oil-proof in accordance with VDE
- Flame-retardant
- Shielded
- Intermediate sheath on the basis of PVC
- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Temperature range (moved):** -5 °C to +70 °C

Chainflex® PVC Power cable, oil-proof: Basic cables

Siemens Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
6FX8002-5CA01	MAT9150001	(4G1,5)C	12,5	7,5 x d
6FX8002-5CA11	MAT9150002	(4G2,5)C	15,0	7,5 x d
				
6FX8002-5CA21	MAT9150003	(4G1,5)C	12,5	7,5 x d
6FX8002-5CA31	MAT9150004	(4G2,5)C	15,0	7,5 x d
6FX8002-5CA41	MAT9150005	(4G4,0)C	16,0	7,5 x d
6FX8002-5CA51	MAT9150006	(4G6,0)C	19,0	7,5 x d
6FX8002-5CA61	MAT9150007	(4G10,0)C	24,0	7,5 x d
				
6FX8002-5CA23	MAT9150008	(4G16,0)C	27,0	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

... no minimum order quantity

- **Nominal voltage:** 600/1000 V
- **Minimum bending radius for use in Energy Chains®:** 7,5 x cable diameter
- Colour: anthracite-gray (similar to RAL 7016)

Chainflex® PVC Power cable, oil-proof: Extension cables

Siemens Extension cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
6FX8002-5CA05	MAT9151001	(4G1,5)C	12,5	7,5 x d
6FX8002-5CA15	MAT9151002	(4G2,5)C	15,0	7,5 x d
				
6FX8002-5CA28	MAT9151003	(4G1,5)C	12,5	7,5 x d
6FX8002-5CA38	MAT9151004	(4G2,5)C	15,0	7,5 x d
6FX8002-5CA48	MAT9151005	(4G4,0)C	16,0	7,5 x d
6FX8002-5CA58	MAT9151006	(4G6,0)C	19,0	7,5 x d
6FX8002-5CA68	MAT9151007	(4G10,0)C	24,0	7,5 x d
				
6FX8002-5CX28	MAT9151008	(4G16,0)C	27,0	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® Signal cable
harnessed according to Siemens standard

Technical information

- Oil-resistant and coolant-resistant, shielded
- Cut-proof, thin-walled, halogen-free
- **Minimum bending radius for use in Energy Chains®:** 10 x cable diameter
- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Temperature range (moved):** -35 °C to +100 °C

Chainflex® TPE Signal/encoder cable, oil-resistant: Basic cables

Siemens Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
6FX8002-2AD00	MAT9070001	(3x(2x0,14)C+(4x0,14)+(2x0,5))C	10,5	10 x d
6FX8002-2CA11	MAT9070002	(4x(2x0,34)+4x0,5)C	9,5	10 x d
6FX8002-2CA15	MAT9070003	(3x(2x0,14)C+(4x0,14)+(2x0,5))C	10,5	10 x d

6FX8002-2CA31	MAT9070004	(3x(2x0,14)C+(2x0,5+2x0,14)+(4x0,23+2x0,14))C	11,5	10 x d

6FX8002-2CA51	MAT9070005	(3x(2x0,14)C+(4x0,14)+(2x0,5))C	10,5	10 x d
6FX8002-2CA71	MAT9070006	(4x(2x0,34)+4x0,5)C	9,5	10 x d

6FX8002-2CB31	MAT9070007	(12x0,25)C	9,0	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

... no minimum order quantity

Tel. +49-22 03-96 49-800
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- **Nominal voltage:** 30 V
- Colour: green (similar to RAL 6018)

Chainflex® TPE Signal/encoder cable, oil-resistant: Basic cables

Siemens Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
6FX8002-2CB51	MAT9070008	(4x(2x0,34)+4x0,5)C	9,5	10 x d
6FX8002-2CC11	MAT9070009	(4x(2x0,34)+4x0,5)C	9,5	10 x d
6FX8002-2CD01	MAT9070010	(4x(2x0,34)+4x0,5)C	9,5	10 x d
				
6FX8002-2CF02	MAT9070011	(3x(2x0,14)C+ (4x0,14)+(2x0,5))C	10,5	10 x d
6FX8002-2CG00	MAT9070012	(4x(2x0,34)+4x0,5)C	9,5	10 x d
6FX8002-2CH00	MAT9070013	(3x(2x0,14)C+ (4x0,14)+(2x0,5))C	10,5	10 x d
				
6FX8002-2CK00	MAT9070014	(3x(2x0,14)C+ (2x0,5C))C	10,5	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® Signal cable
harnessed according to Siemens standard

Technical information

- Oil-resistant and coolant-resistant, shielded
- Cut-proof, thin-walled, halogen-free
- **Minimum bending radius for use in Energy Chains®:** 10 x cable diameter
- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Temperature range (moved):** -35 °C to +100 °C

Chainflex® TPE Signal/encoder cable, oil-resistant: Basic cables

Siemens Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
6FX8002-2CL00	MAT9070015	(3x(2x0,14)C+ (2x0,5C))C	10,5	10 x d

6FX8002-2EQ00	MAT9070016	(3x(2x0,14)C+ (2x0,5+2x0,14)+ (4x0,23+2x0,14))C	11,5	10 x d
6FX8002-2EQ10	MAT9070017	(3x(2x0,14)C+ (2x0,5+2x0,14)+ (4x0,23+2x0,14))C	11,5	10 x d

6FX8002-2AH00	MAT9070018	(4x(2x0,34)+4x0,5)C	9,5	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

... no minimum order quantity

- **Nominal voltage:** 30 V
- Colour: green (similar to RAL 6018)

Chainflex® TPE Signal/encoder cable, oil-resistant: Extension cables

Siemens Extension cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
6FX8002-2AD04	MAT9071001	(3x(2x0,14)C+(4x0,14)+(2x0,5))C	10,5	10 x d
6FX8002-2CB54	MAT9071002	(4x(2x0,34)+4x0,5)C	9,5	10 x d
6FX8002-2CA54	MAT9071003	(3x(2x0,14)C+(4x0,14)+(2x0,5))C	10,5	10 x d
6FX8002-2CA34	MAT9071004	(3x(2x0,14)C+(2x0,5+2x0,14)+(4x0,23+2x0,14))C	11,5	10 x d
				
6FX8002-2CB34	MAT9071007	(12x0,25)C	9,0	10 x d
				
6FX8002-2CC14	MAT9071009	(4x(2x0,34)+4x0,5)C	9,5	10 x d
6FX8002-2CF04	MAT9071011	(3x(2x0,14)C+(4x0,14)+(2x0,5))C	10,5	10 x d
6FX8002-2EQ14	MAT9071017	(3x(2x0,14)C+(2x0,5+2x0,14)+(4x0,23+2x0,14))C	11,5	10 x d
6FX8002-2AH04	MAT9071018	(4x(2x0,34)+4x0,5)C	9,5	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® Signal cable
harnessed according to Siemens standard

Technical information

- Oil-proof in accordance with VDE
- Flame-retardant
- Shielded
- **Temperature range (moved):** -5 °C to +70 °C
- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Nominal voltage:** 30 V

Chainflex® PVC Signal/encoder cable, oil-proof: Basic cables

Siemens Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
6FX8002-2AD00	MAT9170001	(3x(2x0,14)C+ (4x0,14)+(2x0,5)+ (4x0,23))C	9,5	10 x d
6FX8002-2CA11	MAT9170002	(4x(2x0,34)+4x0,5)C	9,0	10 x d
6FX8002-2CA15	MAT9170003	(3x(2x0,14)C+ (4x0,14)+(2x0,5)+ (4x0,23))C	9,5	10 x d
				
6FX8002-2CA31	MAT9170004	(3x(2x0,14)C+ (4x0,14)+(2x0,5)+ (4x0,23))C	9,5	10 x d
				
6FX8002-2CA51	MAT9170005	(3x(2x0,14)C+ (4x0,14)+(2x0,5)+ (4x0,23))C	9,5	10 x d
6FX8002-2CA71	MAT9170006	(4x(2x0,34)+4x0,5)C	9,0	10 x d
6FX8002-2CB51	MAT9170008	(4x(2x0,34)+4x0,5)C	9,0	10 x d
6FX8002-2CC11	MAT9170009	(4x(2x0,34)+4x0,5)C	9,0	10 x d
6FX8002-2CD01	MAT9170010	(4x(2x0,34)+4x0,5)C	9,0	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

... no minimum order quantity

G = with earthed conductor green-yellow **x =** without earthed conductor

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- **Minimum bending radius for use in Energy Chains®:**
  10 x cable diameter
- Colour: gray (similar to RAL 7001)

Chainflex® PVC Signal/encoder cable, oil-proof: Basic cables

Siemens Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
6FX8002-2CF02	MAT9170011	(3x(2x0,14)C+ (4x0,14)+(2x0,5)+ (4x0,23))C	9,5	10 x d
6FX8002-2CG00	MAT9170012	(4x(2x0,34)+4x0,5)C	9,0	10 x d
				
6FX8002-2CH00	MAT9170013	(3x(2x0,14)C+ (4x0,14)+(2x0,5)+ (4x0,23))C	9,5	10 x d
				
6FX8002-2CK00	MAT9170014	(3x(2x0,14)C+ (2x0,5C))C	9,0	10 x d
6FX8002-2CL00	MAT9170015	(3x(2x0,14)C+ (2x0,5C))C	9,0	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

Chainflex® Signal cable
harnessed according to Siemens standard

Technical information

- Oil-proof in accordance with VDE
- Flame-retardant
- Shielded
- **Temperature range (moved):** -5 °C to +70 °C
- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Nominal voltage:** 30 V

Chainflex® PVC Signal/encoder cable, oil-proof: Basic cables

Siemens Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
6FX8002-2EQ00	MAT9170016	(3x(2x0,14)C+ (4x0,14)+(2x0,5)+ (4x0,23))C	9,5	10 x d
				
6FX8002-2EQ10	MAT9170017	(3x(2x0,14)C+ (4x0,14)+(2x0,5)+ (4x0,23))C	9,5	10 x d
				
6FX8002-2AH00	MAT9170018	(4x(2x0,34)+4x0,5)C	9,0	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

... no minimum order quantity

Tel. +49-22 03-96 49-800
Fax +49-22 03-96 49-222

- **Minimum bending radius for use in Energy Chains®:**
  10 x cable diameter
- Colour: gray (similar to RAL 7001)

Chainflex® PVC Signal/encoder cable, oil-proof: Extension cables

Siemens Extension cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
6FX8002-2AD04	MAT9171001	(3x(2x0,14)C+(4x0,14)+(2x0,5)+(4x0,23))C	9,5	10 x d
6FX8002-2CB54	MAT9171002	(4x(2x0,34)+4x0,5)C	9,0	10 x d
6FX8002-2CA54	MAT9171003	(3x(2x0,14)C+(4x0,14)+(2x0,5)+(4x0,23))C	9,5	10 x d
6FX8002-2CA34	MAT9171004	(3x(2x0,14)C+(4x0,14)+(2x0,5)+(4x0,23))C	9,5	10 x d
6FX8002-2CC14	MAT9171009	(4x(2x0,34)+4x0,5)C	9,0	10 x d
6FX8002-2CF04	MAT9171011	(3x(2x0,14)C+(4x0,14)+(2x0,5)+(4x0,23))C	9,5	10 x d
6FX8002-2EQ14	MAT9171017	(3x(2x0,14)C+(4x0,14)+(2x0,5)+(4x0,23))C	9,5	10 x d
6FX8002-2AH04	MAT9171018	(4x(2x0,34)+4x0,5)C	9,0	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® Servo cable
harnessed according to Lenze standard

Technical information

- Ooil-resistant and coolant-resistant
- Shielded
- Cut-proof, notch-resistant, hydrolysis-resistant and microbe-resistant
- Intermediate sheath on the basis of PUR
- **Signal pairs:** pair shielding of extremely readily bending/firm cooper shield, coverage approx. 70% linear, 90% optical, and metal foil.

Chainflex® PUR Servo cable: Basic cables

PUR Lenze Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLMxxxGMS-015C	MAT9120001	(4G1,5+ (2x1,0)C)C	12,5	7,5 x d
EWLMxxxGMS-025	MAT9120002	(4G2,5+ (2x1,0)C)C	13,5	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

LENZE

... no minimum order quantity

Tel. +49-22 03-96 49-800
Fax +49-22 03-96 49-222

- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Temperature range (moved):** -20 °C to +80 °C
- **Nominal voltage:** 600/1000 V
- **Minimum bending radius for use in Energy Chains®:** 7,5 x cable diameter
- Colour: orange (similar to RAL 2003)

Chainflex® PUR Servo cable: Linking cables

PUR Lenze Linking cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
EWLMxxxZM-015C	MAT9120006	(4G1,5+ (2x1,0)C)C	12,5	7,5 x d
EWLMxxxZM-025	MAT9120007	(4G2,5+ (2x1,0)C)C	13,5	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® Servo cable
harnessed according to Lenze standard

Technical information

- Oil-proof in accordance with VDE
- Flame-retardant
- Shielded
- Intermediate sheath on the basis of PVC
- **Signal pairs:** pair shielding of extremely readily bending/firm cooper shield, coverage approx. 70% linear, 90% optical, and metal foil.
- **Temperature range (moved):** -5 °C to +70 °C

Chainflex® PVC Servo cable, oil-proof: Basic cables

PVC Lenze Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLMxxxGMS-015C	MAT9130001	(4G1,5+ (2x1,0)C)C	12,5	7,5 x d
EWLMxxxGMS-025	MAT9130002	(4G2,5+ (2x1,0)C)C	13,5	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

LENZE

... no minimum order quantity

- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Nominal voltage:** 600/1000 V
- **Minimum bending radius for use in Energy Chains®:** 7,5 x cable diameter
- Colour: green (similar to RAL 6005)

Chainflex® PVC Servo cable, oil-proof: Linking cables

PVC Lenze Linking cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLMxxxZM-015C	MAT9130006	(4G1,5+ (2x1,0)C)C	12,5	7,5 x d
EWLMxxxZM-025	MAT9130007	(4G2,5+ (2x1,0)C)C	13,5	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® Power cable
harnessed according to Lenze standard

Technical information

- Oil-resistant and coolant-resistant
- Shielded
- Cut-proof, notch-resistant, hydrolysis-resistant and microbe-resistant
- Intermediate sheath on the basis of PUR
- **Signal pairs:** pair shielding of extremely readily bending/firm cooper shield, coverage approx. 70% linear, 90% optical, and metal foil

Chainflex® PUR Power cable: Basic cables

PUR Lenze Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLMxxxGMS-015C	MAT9120011	(4G1,5)C	10,5	7,5 x d
EWLMxxxGMS-025	MAT9120012	(4G2,5)C	12,0	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

LENZE

... no minimum order quantity

- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Temperature range (moved):** -20 °C to +80 °C
- **Nominal voltage:** 600/1000 V
- **Minimum bending radius for use in Energy Chains®:** 7,5 x cable diameter
- Colour: orange (similar to RAL 2003)

Chainflex® PUR Power cable: Linking cables

PUR Lenze Linking cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLMxxxZM-015C	MAT9120016	(4G1,5)C	10,5	7,5 x d
EWLMxxxZM-025	MAT9120017	(4G2,5)C	12,0	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® Power cable
harnessed according to Lenze standard

Technical information

- Oil-proof in accordance with VDE
- Flame-retardant
- Shielded
- Intermediate sheath on the basis of PVC
- **Overall shield:** extremely readily bending/firm cooper shield, coverage approx. 70% linear, 90% optical
- **Temperature range (moved):** -5 °C to +70 °C

Chainflex® PVC Power cable, oil-proof: Basic cables

PVC Lenze Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLMxxxGMS-015C	MAT9130011	(4G1,5)C	12,5	7,5 x d
EWLMxxxGMS-025	MAT9130012	(4G2,5)C	15,0	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

LENZE

... no minimum order quantity

- **Nominal voltage:** 600/1000 V
- **Minimum bending radius for use in Energy Chains®:** 7,5 x cable diameter
- Colour: anthracite-gray (similar to RAL 7016)

Chainflex® PVC Power cable, oil-proof: Linking cables

PVC Lenze Linking cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLMxxxZM-015C	MAT9130016	(4G1,5)C	12,5	7,5 x d
EWLMxxxZM-025	MAT9130017	(4G2,5)C	15,0	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® Resolver cable
harnessed according to Lenze standard

Technical information

- Oil-resistant and coolant-resistant
- Shielded
- Cut-proof, thin-walled, halogen-free
- **Temperature range (moved):** -35 °C to +100 °C
- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Nominal voltage:** 30 V

Chainflex® TPE Signal/encoder cable, oil-resistant: Basic cables

TPE Lenze Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius

EWLRxxxGM-T	MAT9120021	(3x(2x0,14)C+ 2x0,5)C	12,5	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

LENZE

DESINA

RoHS

CE

... no minimum order quantity

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- **Minimum bending radius for use in Energy Chains®:** 10 x cable diameter
- Colour: green (similar to RAL 6018)

Chainflex® TPE Signal/encoder cable, oil-resistant: Linking cables

TPE Lenze Linking cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLRxxxZMST	MAT9120022	(3x(2x0,14)C+ 2x0,5)C	12,5	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

Chainflex® TPE Signal/encoder cable, oil-resistant: Terminal box connection cable

TPE, Lenze Terminal box connection cable Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLRxxxGX-T	MAT9120023	(3x(2x0,14)C+ 2x0,5)C	12,5	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® Resolver cable
harnessed according to Lenze standard

Technical information

- Oil-proof in accordance with VDE
- Flame-retardant
- Shielded
- **Temperature range (moved):** -5 °C to +70 °C
- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Nominal voltage:** 30 V

Chainflex® PVC Signal/encoder cable, oil-proof: Basic cables

PVC Lenze Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLRxxxGM-T	MAT9130021	(3x(2x0,14)C+ (2x0,5C))C	9,0	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

LENZE

... no minimum order quantity

- **Minimum bending radius for use in Energy Chains®:**
  10 x cable diameter
- Colour: gray (similar to RAL 7001)

Chainflex® PVC Signal/encoder cable, oil-proof: Linking cables

PVC Lenze Linking cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLRxxxZMST	MAT9130022	(3x(2x0,14)C+ (2x0,5C))C	9,0	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

Chainflex® PVC Signal/encoder cable, oil-proof: Terminal box connection cable

PVC, Lenze Terminal box connection cable Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLRxxxGX-T	MAT9130023	(3x(2x0,14)C+ (2x0,5C))C	9,0	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® Encoder cable
harnessed according to Lenze standard

Technical information

- Oil-resistant and coolant-resistant
- Shielded
- Cut-proof, thin-walled, halogen-free
- **Temperature range (moved):** -35 °C to +100 °C
- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Nominal voltage:** 30 V

Chainflex® TPE Signal/encoder cable, oil-resistant: Basic cables

TPE Lenze Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLExxxGM-T	MAT9120026	(4x(2x0,25)+ 2x1,0)C	9,5	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

LENZE

DESINA

RoHS

CE

... no minimum order quantity

- **Minimum bending radius for use in Energy Chains®:**
  10 x cable diameter
- Colour: green (similar to RAL 6018)

Chainflex® TPE Signal/encoder cable, oil-resistant: Linking cables

TPE Lenze Linking cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLExxxZMST	MAT9120027	(4x(2x0,25)+ 2x1,0)C	9,5	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

Chainflex® TPE Signal/encoder cable, oil-resistant: Terminal box connection cable

TPE, Lenze Terminal box connection cable Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLExxxGX-T	MAT9120028	(4x(2x0,25)+ 2x1,0)C	9,5	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® Encoder cable
harnessed according to Lenze standard

Technical information

- Oil-proof in accordance with VDE
- Flame-retardant
- Shielded
- **Temperature range (moved):** -5 °C to +70 °C
- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Nominal voltage:** 30 V

Chainflex® PVC Signal/encoder cable, oil-proof: Basic cables

PVC Lenze Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLExxxGM-T	MAT9130026	(4x(2x0,25)+ 2x1,0)C	9,5	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

LENZE

... no minimum order quantity

- **Minimum bending radius for use in Energy Chains®:**
  10 x cable diameter
- Colour: gray (similar to RAL 7001)

Chainflex® PVC Signal/encoder cable, oil-proof: Linking cables

PVC Lenze Linking cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLExxxZMST	MAT9130027	(4x(2x0,25)+ 2x1,0)C	9,5	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

Chainflex® PVC Signal/encoder cable, oil-proof: Terminal box connection cable

PVC, Lenze Terminal box connection cable Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLExxxGX-T	MAT9130028	(4x(2x0,25)+ 2x1,0)C	9,5	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® Fan cable
harnessed according to Lenze standard

Technical information

- Oil-resistant and coolant-resistant
- PVC-free/halogen-free
- Cut-proof, notch-resistant, for maximum load requirements
- **Temperature range (moved):** -35 °C to +100 °C
- **Nominal voltage:** 300/500 V
- **Minimum bending radius for use in Energy Chains®:** 5 x cable diameter
- Colour: dark-blue (similar to RAL 5011)

Chainflex® TPE Control cable: Basic cables

TPE Lenze Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLLxxxGMS	MAT9120031	3G1,0	6,0	5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

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Chainflex® TPE Control cable: Linking cables

TPE Lenze Linking cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLLxxxZM	MAT9120032	3G1,0	6,0	5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® Fan cable
harnessed according to Lenze standard

Technical information

- Oil-proof in accordance with VDE
- Flame-retardant
- **Temperature range (moved):** -5 °C to +70 °C
- **Nominal voltage:** 300/500 V
- **Minimum bending radius for use in Energy Chains®:** 7,5 x cable diameter
- Colour: green (similar to RAL 6005)

Chainflex® PVC Control cable, oil-proof: Basic cables

PVC Lenze Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
EWLLxxxGMS	MAT9130031	3G1,0	7,0	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

LENZE

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Chainflex® PVC Control cable, oil-proof: Linking cables

PVC Lenze Linking cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
EWLLxxxZM	MAT9130032	3G1,0	7,0	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® Power cable
harnessed according to Indramat standard

Technical information

- Oil-resistant and coolant-resistant
- Shielded
- Cut-proof, notch-resistant, hydrolysis-resistant and microbe-resistant
- Intermediate sheath on the basis of PUR
- **Temperature range (moved):** -20 °C to +80 °C
- **Signal pairs:** pair shielding of extremely readily bending/firm cooper shield, coverage approx.

Chainflex® PUR Servo cable: Basic cables

Indramat Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
* 				
IKG4009	MAT9090001	(4G1,0+2x (2x0,75)C)C	13,5	7,5 x d
IKG4017	MAT9090002	(4G1,0+2x (2x0,75)C)C	13,5	7,5 x d
IKG4018	MAT9090003	(4G1,0+2x (2x0,75)C)C	13,5	7,5 x d
IKG4020	MAT9090004	(4G1,0+2x (2x0,75)C)C	13,5	7,5 x d
IKG4055	MAT9090005	(4G1,5+2x (2x0,75)C)C	14,5	7,5 x d
IKG4060	MAT9090006	(4G1,5+2x (2x0,75)C)C	14,5	7,5 x d
IKG4067	MAT9090007	(4G2,5+2x (2x1,5)C)C	16,0	7,5 x d
IKG4070	MAT9090008	(4G2,5+2x (2x1,5)C)C	16,0	7,5 x d
IKG4087	MAT9090009	(4G4,0+2x (2x1,5)C)C	18,0	7,5 x d
IKG4090	MAT9090010	(4G4,0+2x (2x1,5)C)C	18,0	7,5 x d
IKG4107	MAT9090011	(4G6,0+2x (2x1,5)C)C	19,5	7,5 x d
IKG4150	MAT9090012	(4G6,0+2x (2x1,5)C)C	19,5	7,5 x d
IKG4167	MAT9090013	(4G10,0+2x (2x1,5)C)C	23,5	7,5 x d
IKG0331	MAT9090014	(4G0,75+ (2x0,5)C)C	11,5	7,5 x d
IKG0332	MAT9090015	(4G0,75+ (2x0,5)C)C	11,5	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

... no minimum order quantity

* Image exemplary.

70% linear, 90% optical, and metal foil

- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Nominal voltage:** 600/1000 V
- **Minimum bending radius for use in Energy Chains®:** 7,5 x cable diameter
- Colour: orange (similar to RAL 2003)

Chainflex® PUR Servo cable: Connection cables with adapter plugs

Connection cables with adapter plugs Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
* 				
IKG4006	MAT9091001	(4G1,0+2x (2x0,75)C)C	13,5	7,5 x d
IKG4016	MAT9091002	(4G1,0+2x (2x0,75)C)C	13,5	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

* Image exemplary.

Chainflex® Power cable
harnessed according to Indramat standard

Technical information

- Oil-proof in accordance with VDE
- Flame-retardant
- Shielded
- Intermediate sheath on the basis of PVC
- **Temperature range (moved):** -5 °C to +70 °C
- **Signal pairs:** pair shielding of extremely readily bending/firm cooper shield, coverage approx. 70% linear, 90% optical, and metal foil

Chainflex® PVC Servo cable: Basic cables

Indramat Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
* 				
IKG4009	MAT9190001	(4G1,5+2x (2x0,75)C)C	14,5	7,5 x d
IKG4017	MAT9190002	(4G1,5+2x (2x0,75)C)C	14,5	7,5 x d
IKG4018	MAT9190003	(4G1,5+2x (2x0,75)C)C	14,5	7,5 x d
IKG4020	MAT9190004	(4G1,5+2x (2x0,75)C)C	14,5	7,5 x d
IKG4055	MAT9190005	(4G1,5+2x (2x0,75)C)C	14,5	7,5 x d
IKG4060	MAT9190006	(4G1,5+2x (2x0,75)C)C	14,5	7,5 x d
IKG4067	MAT9190007	(4G2,5+2x (2x1,5)C)C	16,5	7,5 x d
IKG4070	MAT9190008	(4G2,5+2x (2x1,5)C)C	16,5	7,5 x d
IKG4087	MAT9190009	(4G4,0+2x (2x1,5)C)C	18,5	7,5 x d
IKG4090	MAT9190010	(4G4,0+2x (2x1,5)C)C	18,5	7,5 x d
IKG4107	MAT9190011	(4G6,0+2x (2x1,5)C)C	20,5	7,5 x d
IKG4150	MAT9190012	(4G6,0+2x (2x1,5)C)C	20,5	7,5 x d
IKG4167	MAT9190013	(4G10,0+2x (2x1,5)C)C	24,0	7,5 x d
IKG0331	MAT9190014	(4G0,75+ (2x0,5)C)C	11,0	7,5 x d
IKG0332	MAT9190015	(4G0,75+ (2x0,5)C)C	11,0	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
G = with earthed conductor green-yellow **x =** without earthed conductor

... no minimum order quantity

* Image exemplary.

- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Nominal voltage:** 600/1000 V
- **Minimum bending radius for use in Energy Chains®:** 7,5 x cable diameter
- Colour: green (similar to RAL 6005)

Chainflex® PVC Servo cable: Connection cables with adapter plugs

Connection cables with adapter plugs Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
* 				
IKG4006	MAT9191001	(4G1,5+2x (2x0,75)C)C	14,5	7,5 x d
IKG4016	MAT9191002	(4G1,5+2x (2x0,75)C)C	14,5	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

* Image exemplary.

Chainflex® Encoder cable
harnessed according to Indramat standard

Technical information

- Oil-resistant and coolant-resistant
- Shielded
- Cut-proof, thin-walled, halogen-free
- **Temperature range (moved):** -35 °C to +100 °C
- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Nominal voltage:** 30 V

Chainflex® TPE Signal/encoder cable, oil-resistant: Basic cables

Indramat Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
* 				
IKS4103	MAT9100001	(4x(2x0,25)+ 2x0,5)C	9,5	10 x d
IKS4374	MAT9100002	(4x(2x0,25)+ 2x0,5)C	9,5	10 x d
IKS4375	MAT9100003	(4x(2x0,25)+ 2x0,5)C	9,5	10 x d
IKS4314	MAT9100004	(4x(2x0,25)+ 2x0,5)C	9,5	10 x d
IKS4384	MAT9100005	(3x0,25+ 3x(2x0,25)C+ 2x1,0)C	9,0	10 x d
IKS4020	MAT9100006	(4x2x0,14+ 4x1,0+ (4x0,14)C)C	9,0	10 x d
IKS4142	MAT9100007	(4x2x0,14+ 4x1,0+ (4x0,14)C)C	9,0	10 x d
IKS0230	MAT9100008	(2x(2x0,25)+ 2x0,5)C	7,0	10 x d
IKS0232	MAT9100009	(2x(2x0,25)+ 2x0,5)C	7,0	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

... no minimum order quantity

* Image exemplary.

- **Minimum bending radius for use in Energy Chains®:**
  10 x cable diameter
- Colour: green (similar to RAL 6018)

Chainflex® TPE Signal/encoder cable, oil-resistant: Connection cables with adapter plugs

Connection cables with adapter plugs Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
* 				
IKS4065	MAT9101001	(4x(2x0,25)+ 2x0,5)C	9,5	10 x d
IKS4151	MAT9101002	(4x(2x0,25)+ 2x0,5)C	9,5	10 x d
IKS4153	MAT9101003	(4x(2x0,25)+ 2x0,5)C	9,5	10 x d
IKS4376	MAT9101004	(4x(2x0,25)+ 2x0,5)C	9,5	10 x d
IKS4322	MAT9101005	(4x(2x0,25)+ 2x0,5)C	9,5	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

* Image exemplary.

Chainflex® Encoder cable
harnessed according to Indramat standard

Technical information

- Oil-proof in accordance with VDE
- Flame-retardant
- Shielded
- **Temperature range (moved):** -5 °C to +70 °C
- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Nominal voltage:** 30 V

Chainflex® PVC Signal/encoder cable, oil-proof: Basic cables

Indramat Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
* 				
IKS4103	MAT9110001	(4x(2x0,25)+ 2x0,5)C	9,0	10 x d
IKS4374	MAT9110002	(4x(2x0,25)+ 2x0,5)C	9,0	10 x d
IKS4375	MAT9110003	(4x(2x0,25)+ 2x0,5)C	9,0	10 x d
IKS4314	MAT9110004	(4x(2x0,25)+ 2x0,5)C	9,0	10 x d
IKS4384	MAT9110005	(3x0,25+ 3x(2x0,25)C+ 2x1,0)C	9,0	10 x d
IKS4020	MAT9110006	(4x2x0,14+ 4x1,0+ (4x0,14)C)C	9,0	10 x d
IKS4142	MAT9110007	(4x2x0,14+ 4x1,0+ (4x0,14)C)C	9,0	10 x d
IKS0230	MAT9110008	(2x(2x0,25)+ 2x0,5)C	7,0	10 x d
IKS0232	MAT9110009	(2x(2x0,25)+ 2x0,5)C	7,0	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

... no minimum order quantity

* Image exemplary.

- **Minimum bending radius for use in Energy Chains®:**
  10 x cable diameter
- Colour: gray (similar to RAL 7001)

Chainflex® PVC Signal/encoder cable, oil-proof: Connection cables with adapter plugs

Connection cables with adapter plugs Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
* 				
IKS4065	MAT9111001	(4x(2x0,25)+ 2x0,5)C	9,0	10 x d
IKS4151	MAT9111002	(4x(2x0,25)+ 2x0,5)C	9,0	10 x d
IKS4153	MAT9111003	(4x(2x0,25)+ 2x0,5)C	9,0	10 x d
IKS4376	MAT9111004	(4x(2x0,25)+ 2x0,5)C	9,0	10 x d
IKS4322	MAT9111005	(4x(2x0,25)+ 2x0,5)C	9,0	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

* Image exemplary.

Chainflex® Power cable Premium
harnessed according to Fanuc standard

Technical information

- Oil-resistant and coolant-resistant
- Shielded
- Cut-proof, notch-resistant, hydrolysis-resistant and microbe-resistant
- Intermediate sheath on the basis of PUR
- **Signal pairs:** pair shielding of extremely readily bending/firm cooper shield, coverage approx. 70% linear, 90% optical, and metal foil

Chainflex® PUR Servo cable: Basic cables

PUR Fanuc Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
LX660-8077-T261	MAT9210061	(4G1,5)C	10,5	7,5 x d

LX660-8077-T264	MAT9210064	(4G2,5)C	12,0	7,5 x d
LX660-8077-T266	MAT9210066	(4G2,5)C	12,0	7,5 x d

LX660-8077-T265	MAT9210065	(4G2,5)C	12,0	7,5 x d
LX660-8077-T267	MAT9210067	(4G2,5)C	12,0	7,5 x d

LX660-8077-T270*	MAT9210070	(4G4,0)C	15,5	7,5 x d
LX660-8077-T272	MAT9210072	(4G10,0)C	20,5	7,5 x d

* Delivery time upon inquiry

LX660-8077-T271*	MAT9210071	(4G4,0)C	15,5	7,5 x d
LX660-8077-T273	MAT9210073	(4G10,0)C	20,5	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
* Delivery time upon inquiry
G = with earthed conductor green-yellow **x =** without earthed conductor

- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Temperature range (moved):** -20 °C bis +80 °C
- **Nominal voltage:** 600/1000 V
- **Minimum bending radius for use in Energy Chains®:** 7,5 x cable diameter
- Colour: orange (similar to RAL 2003)

Chainflex® PUR Servo cable: Basic cables

PUR Fanuc Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
LX660-8077-T291	MAT9210091	(4G2,5)C	12,0	7,5 x d
LX660-8077-T293*	MAT9210093	(4G4,0)C	15,5	7,5 x d

* Delivery time upon inquiry

LX660-8077-T292*	MAT9210092	(4G4,0)C	15,5	7,5 x d

* Delivery time upon inquiry

LX660-8077-T296	MAT9210096	(4G2,5)C	12,0	7,5 x d

LX660-8077-T298*	MAT9210098	(4G4,0)C	15,5	7,5 x d

* Delivery time upon inquiry

LX660-8077-T300	MAT9210300	(4G2,5)C	12,0	7,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® Power cable Economy
harnessed according to Fanuc standard

Technical information

- Oil-resistant
- Shielded
- Halogen-free
- **Temperature range (moved):** -20 °C to +80 °C
- **Signal pairs:** pair shielding of extremely readily bending/firm cooper shield, coverage approx. 70% linear, 80% optical
- **Nominal voltage:** 600/1000 V

Chainflex® PUR Servo cable: Basic cables

PUR Fanuc Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
LX660-8077-T261	MAT9200061	(4G1,5)C	8,5	10 x d

LX660-8077-T264	MAT9200064	(4G2,5)C	10,5	10 x d
LX660-8077-T266	MAT9200066	(4G2,5)C	10,5	10 x d

LX660-8077-T265	MAT9200065	(4G2,5)C	10,5	10 x d
LX660-8077-T267	MAT9200067	(4G2,5)C	10,5	10 x d

LX660-8077-T270*	MAT9200070	(4G4,0)C	12,0	10 x d
LX660-8077-T272	MAT9200072	(4G10,0)C	17,5	10 x d

* Delivery time upon inquiry

LX660-8077-T271*	MAT9200071	(4G4,0)C	12,0	10 x d
LX660-8077-T273	MAT9200073	(4G10,0)C	17,5	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.
* Delivery time upon inquiry
G = with earthed conductor green-yellow **x =** without earthed conductor

- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 80% optical
- Colour: orange (similar to RAL 2003)
- **Minimum bending radius for use in Energy Chains®:** 10 x cable diameter

Chainflex® PUR Servo cable: Basic cables

PUR Fanuc Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
LX660-8077-T291	MAT9200091	(4G2,5)C	10,5	10 x d
LX660-8077-T293*	MAT9200093	(4G4,0)C	12,0	10 x d

* Delivery time upon inquiry

				
LX660-8077-T292*	MAT9200092	(4G4,0)C	12,0	10 x d

* Delivery time upon inquiry

				
LX660-8077-T296	MAT9200096	(4G2,5)C	10,5	10 x d

				
LX660-8077-T298*	MAT9200098	(4G4,0)C	15,5	10 x d

* Delivery time upon inquiry

				
LX660-8077-T300	MAT9200300	(4G2,5)C	12,0	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

Chainflex® Signal cable Premium
harnessed according to Fanuc standard

Technical information

- Oil-resistant and coolant-resistant
- Shielded
- Cut-proof, thin-walled, halogen-free
- **Temperature range (moved):** -35 °C to +100 °C
- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 90% optical
- **Nominal voltage:** 30 V

Chainflex® TPE Signal/encoder cable, oil-resistant: Basic cables

TPE Fanuc Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
LX660-4077-T296	MAT9310296	(5x0,5+ 1x2x0,25)C	8,5	10 x d
				
LX660-4077-T297	MAT9310297	(5x0,5+ 1x2x0,25)C	8,5	10 x d
				
LX660-4077-T302	MAT9310302	(5x0,5+ 2x2x0,25)C	12,5	10 x d
				
LX660-4077-T303	MAT9310303	(5x0,5+ 2x2x0,25)C	12,5	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

... no minimum order quantity

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- **Minimum bending radius for use in Energy Chains®:**
  10 x cable diameter
- Colour: green (similar to RAL 6018)

Chainflex® TPE Signal/encoder cable, oil-resistant: Basic cables

TPE Fanuc Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
LX660-4077-T319	MAT9310319	(6x0,5+ 5x2x0,25)C	12,5	10 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

Chainflex® Signal cable Economy
harnessed according to Fanuc standard

Technical information

- Oil-resistant and coolant-resistant
- Shielded
- Cut-proof, thin-walled
- **Temperature range (moved):** -35 °C to +100 °C
- **Overall shield:** extremely readily bending/solid copper shield, coverage approx. 70% linear, approx. 80% optical
- **Nominal voltage:** 30 V

Chainflex® TPE Signal/encoder cable, oil-resistant: Basic cables

TPE Fanuc Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
LX660-4077-T296	MAT9300296	(5x0,5+ 1x2x0,25)C	7,5	12 x d
				
LX660-4077-T297	MAT9300297	(5x0,5+ 1x2x0,25)C	7,5	12 x d
				
LX660-4077-T302	MAT9300302	(5x0,5+ 2x2x0,25)C	9,6	12 x d
				
LX660-4077-T303	MAT9300303	(5x0,5+ 2x2x0,25)C	9,6	12 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

... no minimum order quantity

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- **Minimum bending radius for use in Energy Chains®:**
  12 x cable diameter
- Colour: green (similar to RAL 6018)

Chainflex® TPE Signal/encoder cable, oil-resistant: Basic cables

TPE Fanuc Basic cables Part No.	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
LX660-4077-T319	MAT9300319	(6x0,5+ 5x2x0,25)C	9,6	12 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

G = with earthed conductor green-yellow **x =** without earthed conductor

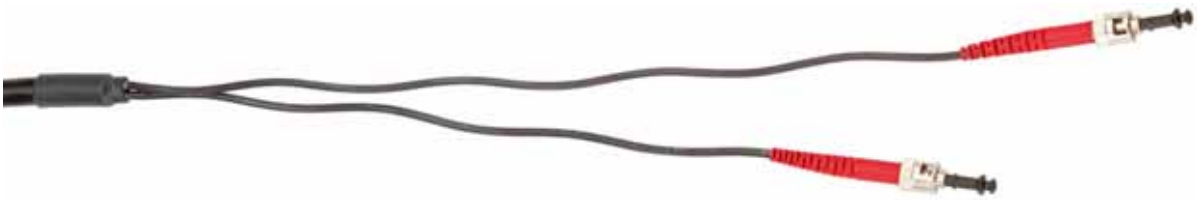
750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

Chainflex® Fibre optic
Fiber optic cables harnessed

Technical information

- Oil-resistant
- UV-resistant
- Halogen-free
- External jacket on the basis of PUR
- **Fiber optic cables:** diameter of fibers 62,5/125 µm and 50/125 µm
- **Minimum bending radius for use in Energy Chains®:** 12,5 x cable diameter

Chainflex® PUR Gradient glass-fibre cable

PUR Fibre optic	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
On both ends BFOC(ST) connectors	LWL9040001	2x50/125	9,0	12,5 x d
On both ends BFOC(ST) connectors incl. conversion to SC	LWL9040002	2x50/125	9,0	12,5 x d
On both ends BFOC(ST) connectors incl. conversion to LC	LWL9040003	2x50/125	9,0	12,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

RoHS

CE

... no minimum order quantity

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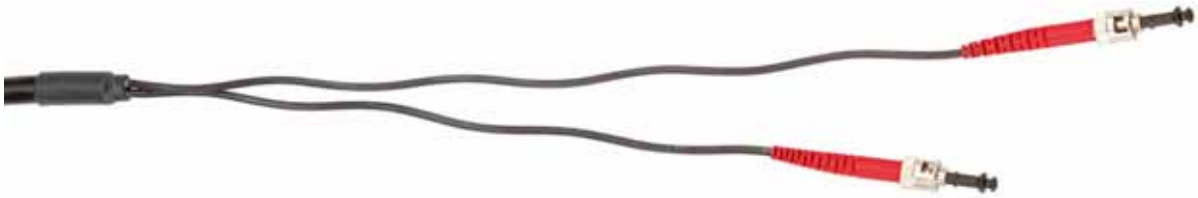
- **Temperature range (moved):** -20 °C to +60 °C
- Colour: black

Chainflex® PUR Gradient glass-fibre cable

PUR Fibre optic	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
On both ends BFOC(ST) connectors	LWL9040015	2x62,5/125	9,0	12,5 x d
On both ends BFOC(ST) connectors incl. conversion to SC	LWL9040016	2x62,5/125	9,0	12,5 x d
On both ends BFOC(ST) connectors incl. conversion to LC	LWL9040017	2x62,5/125	9,0	12,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

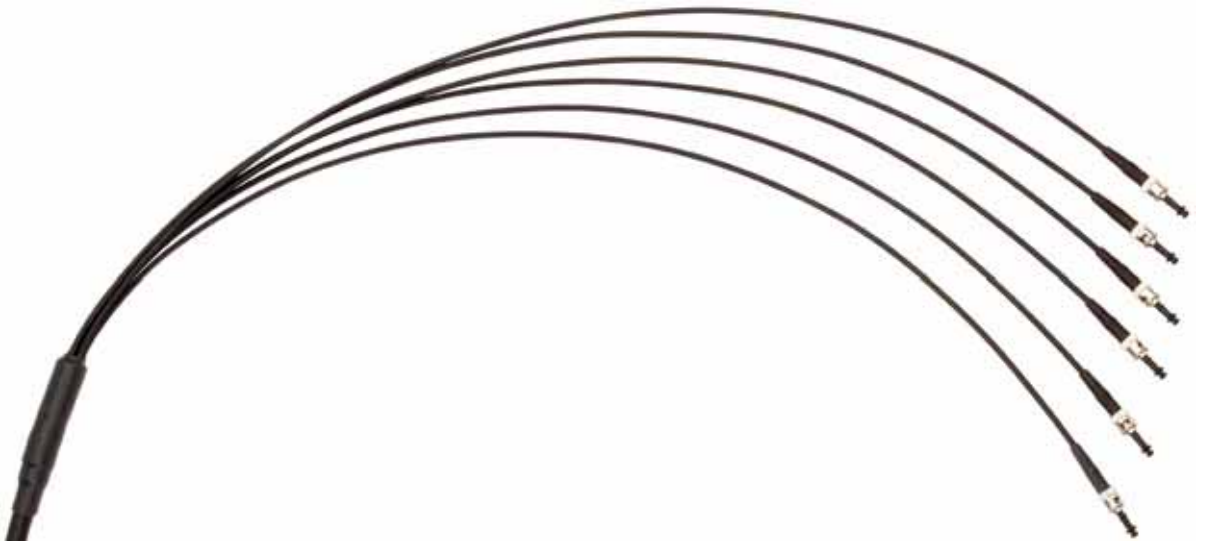
Chainflex® Fibre optic
Fiber optic cables harnessed

Technical information

- Oil-resistant
- UV-resistant
- Halogen-free
- External jacket on the basis of TPE
- **Fiber optic cables:** diameter of fibers 62,5/125 µm and 50/125 µm
- **Minimum bending radius for use in Energy Chains®:** 15 x cable diameter

Chainflex® TPE Gradient glass-fibre cable

TPE Fibre optic	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius



On both ends BFOC(ST) connectors	LWL9040030	6x50/125	11,5	15 x d
On both ends BFOC(ST) connectors incl. conversion to SC	LWL9040031	6x50/125	11,5	15 x d
On both ends BFOC(ST) connectors incl. conversion to LC	LWL9040032	6x50/125	11,5	15 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

RoHS

CE

... no minimum order quantity

- **Temperature range (moved):** -20 °C to +90 °C
- Colour: black

Chainflex® TPE Gradient glass-fibre cable

TPE Fibre optic	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
On both ends BFOC(ST) connectors	LWL9040045	6x62,5/125	11,5	15 x d
On both ends BFOC(ST) connectors incl. conversion to SC	LWL9040046	6x62,5/125	11,5	15 x d
On both ends BFOC(ST) connectors incl. conversion to LC	LWL9040047	6x62,5/125	11,5	15 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

Chainflex® Fibre optic
Fiber optic cables harnessed

Technical information

- Oil-resistant
- UV-resistant
- Halogen-free
- External jacket on the basis of TPE
- **Fiber optic cables:** diameter of fibers 62,5/125 µm and 50/125 µm
- **Minimum bending radius for use in Energy Chains®:** 15 x cable diameter

Chainflex® TPE Gradient glass-fibre cable

TPE Fibre optic	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
On both ends BFOC(ST) connectors	LWL9040060	12x50/125	11,5	15 x d
On both ends BFOC(ST) connectors incl. conversion to SC	LWL9040061	12x50/125	11,5	15 x d
On both ends BFOC(ST) connectors incl. conversion to LC	LWL9040062	12x50/125	11,5	15 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

RoHS

CE

... no minimum order quantity

- **Temperature range (moved):** -20 °C to +90 °C
- Colour: black

Chainflex® TPE Gradient glass-fibre cable

TPE Fibre optic	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
On both ends BFOC(ST) connectors	LWL9040075	12x62,5/125	11,5	15 x d
On both ends BFOC(ST) connectors incl. conversion to SC	LWL9040076	12x62,5/125	11,5	15 x d
On both ends BFOC(ST) connectors incl. conversion to LC	LWL9040077	12x62,5/125	11,5	15 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

Chainflex® Network technique
Harnessed CAT5 cables

Technical information

- Oil-resistant
- UV-resistant
- Halogen-free
- External jacket on the basis of TPE
- **Shield:** extremely bending-resistant copper shield with greatest possible coverage over aluminium-coated plastic foil.
- **Temperature range (moved):** -35 °C to +90 °C

Chainflex® TPE Energy Chains® Ethernet special cable

TPE CAT5 Straight	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
CAT5 – 4-pole **Straight**	**CAT9040001**	(2x2x0,25)C	7,0	12,5 x d
				
CAT5 – 8-pole **Straight**	**CAT9040020**	(4x2x0,15)C	8,0	12,5 x d
				
CAT5 – 8-pole **Straight**	**CAT9040060**	(4x2x0,15)C	8,0	12,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

... no minimum order quantity

- **Minimum bending radius for use in Energy Chains®:**
  12,5 x cable diameter
- Colour: violet (similar to RAL 4001)

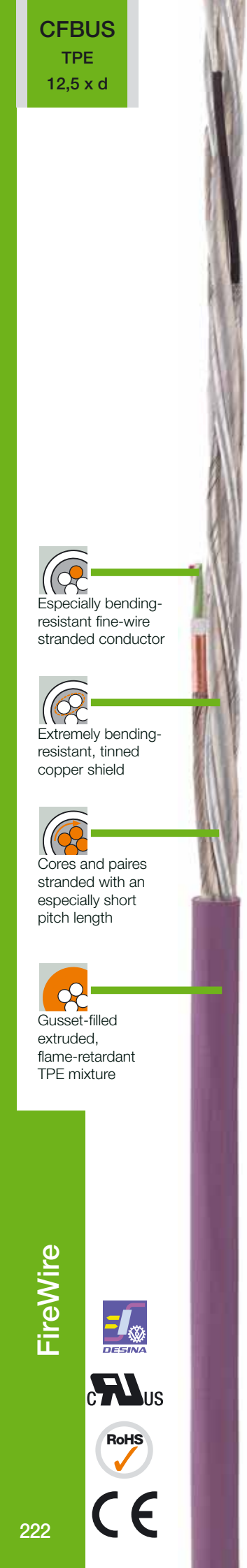
Chainflex® TPE Energy Chains® Ethernet special cable

TPE CAT5 Cross-Over	igus® Part No.	Number of cores and conductor nominal cross section in mm²	Diameter mm	Bending radius
				
CAT5 – 8-pole **Cross-Over**	**CAT9040040**	(4x2x0,15)C	8,0	12,5 x d
				
CAT5 – 8-pole **Cross-Over**	**CAT9040080**	(4x2x0,15)C	8,0	12,5 x d

Note: The mentioned external diameters are maximum values and may tend toward lower tolerance limits.

TPE Bus cable
Chainflex® CFBUS.055 FireWire

- for the toughest of demands in digital camera technology
- TPE outer jacket
- oil-resistant
- flame-retardant



Temperature range moved	**-35 °C to +70 °C, bending radius 12,5 x d**
Temperature range fixed	**-40 °C to +70 °C, bending radius 5 x d**
V max. unsupported/gliding	10 m/s, 5 m/s
a max.	50 m/s²
Nominal voltage	30 V
Testing voltage	150 V
Oil	Oil-resistant (according to EN 60811-2-1), bio-oil-resistant (according to VDMA 24568).
Flame-retardant	According to IEC 332-1, CEI 20-35, FT1.
Silicon-free	Free from silicon which can affect paint adhesion (in compliance with PV 3.10.7 – status 1992).
Lead free	According to EU guideline (RoHS) 2002/95/EC.
Conductor	Fine-wire stranded conductor in especially bending-resistant version consisting of bare copper wires (according to EN 60228).
Core insulation	Mechanically high-quality PE mixture.
Core stranding	Cores and paires stranded with an especially short pitch length.
Core identification	**Cores 0,15 mm²:** orange/blue, green/red. **Cores 0,34 mm²:** black, white.
Element shield	Extremely flexible, tinned copper shield over foil taping. Coverage approx. 70% linear, approx. 90% optical.
Outer jacket	Low-adhesion mixture on the basis of TPE, especially abrasion-resistant and highly flexible, adapted to suit the requirements in Energy Chains®. Colour: violet (similar to RAL 4001)
UL/CSA	Style 1589 and 21371, 30 V, 80 °C
DESINA	According to VDW, DESINA standardisation.
CE	According to 73/23/EWG, 93/68/EWG.

... no minimum order quantity

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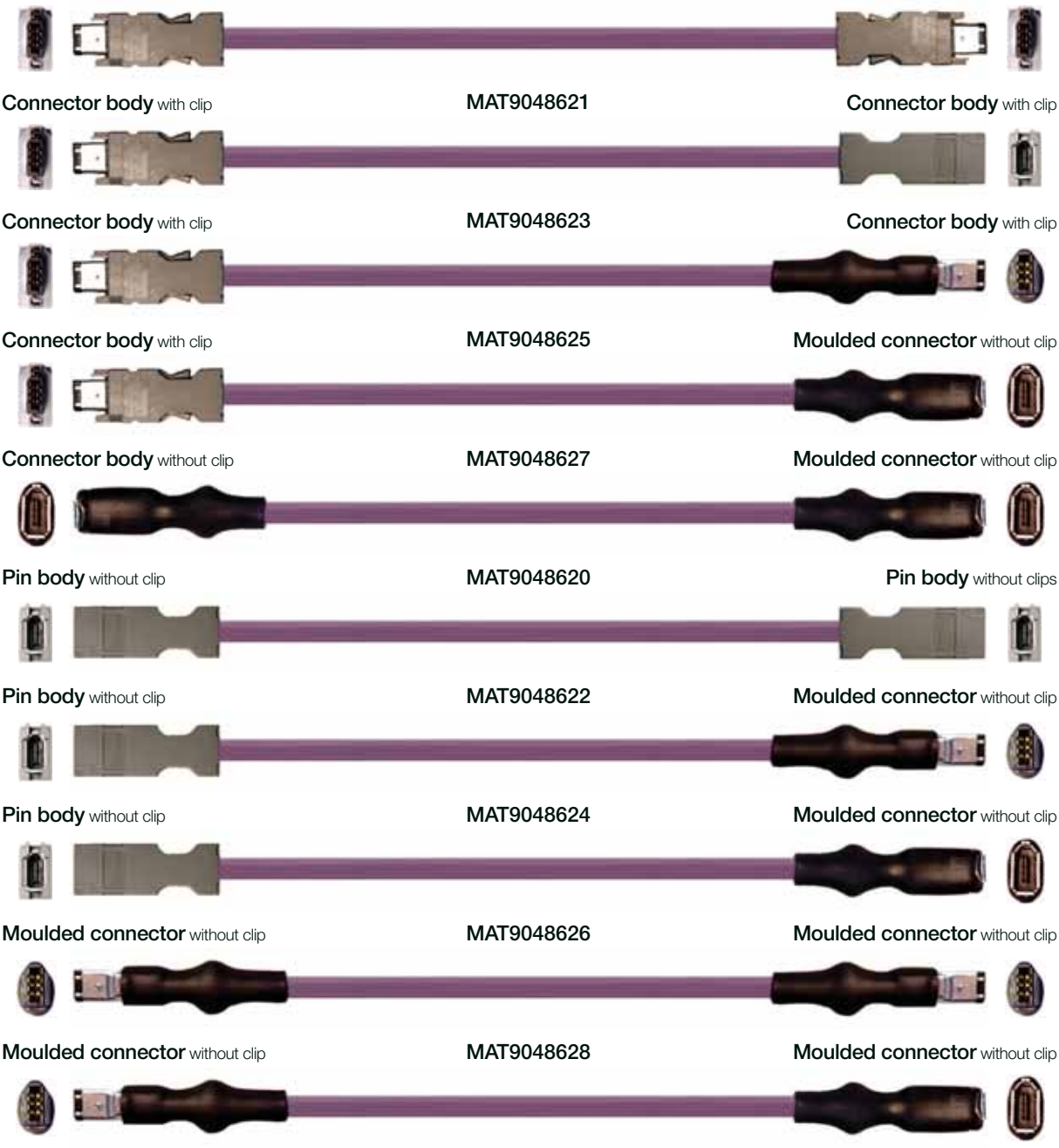
At last! The FireWire connecting cables standard in digital camera technology are now available for Energy Chain® applications.

- Two shielded bus pairs and two shielded supply cores stranded with an optimised short pitch length
- Gusset-filled extruded, flame-retardant TPE outer jacket
- Transmission lengths of up to 10 m
- Transmission rates of up to 400 MBit/s (IEEE1394a)
- Minimum bending radius for use in Energy Chains®: 12.5 x cable diameter
- Available ex stock
- Can be delivered harnessed to required length in 2-4 working days

Already, more than 6.0 million movements in 10 m cable length and approx. 1 m travel distance have been tested successfully with the CFBUS.055 – 2 x (2 x 0.15)C+2(0.34)C.

Connector body with clip	MAT9048160	**Connector body** with clip
Connector body with clip	MAT9048621	**Connector body** with clip
Connector body with clip	MAT9048623	**Connector body** with clip
Connector body with clip	MAT9048625	**Moulded connector** without clip
Connector body without clip	MAT9048627	**Moulded connector** without clip
Pin body without clip	MAT9048620	**Pin body** without clips
Pin body without clip	MAT9048622	**Moulded connector** without clip
Pin body without clip	MAT9048624	**Moulded connector** without clip
Moulded connector without clip	MAT9048626	**Moulded connector** without clip
Moulded connector without clip	MAT9048628	**Moulded connector** without clip



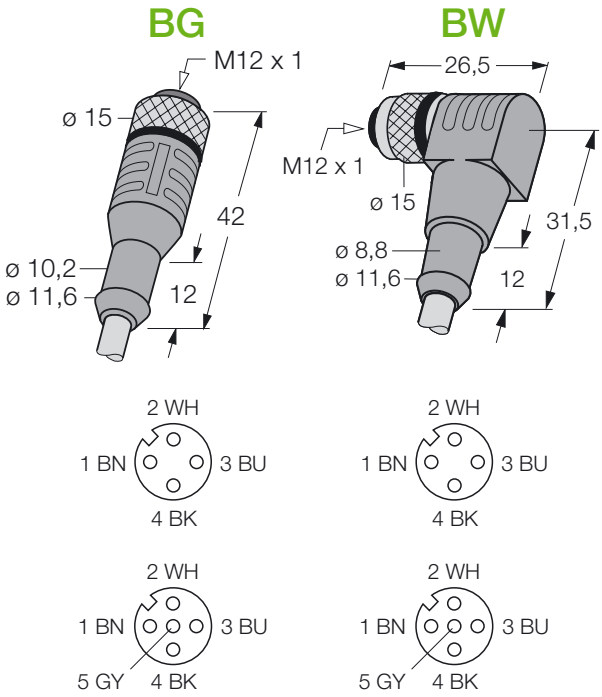
750 types from stock no cutting costs ...
(for up to 10 cuts of the same type)

CF.INI

Chainflex® Sensor/actuator cables with 5xd for Energy Chains®

Direct line M12 x 1, socket with free cable end

Plug-type connector	Coupling, M12 x 1
Handle base	Plastic, PP, black
Union nut/screw	Metal, CuZn, nickel-plated
Contact base	Plastic, PP, black
Contacts	Metal, CuZn, gold-plated
Seal	Plastic, FPM (Viton)
Number of poles	4-pole
Ampacity	4 A
Rated voltage of a winding	max. 250 V
Number of poles	5-pole (4-pole + PE)
Ampacity	4 A
Rated voltage of a winding	max. 60 V
Insulation resistance	≥ 10^9 Ohm
Contact resistance	≥ 5 m Ohm
Degree of soiling	3/2
Ambient temperature of plug-type connector	-40 ... +105 °C
Protection class	IP69K, in screwed state
Mechanical service life	max. 100 insertion cycles



CF9.03.04.INI* (4 x 0,34) Type	Part No.	Number of poles	Cable length [m]
CF.INI-P4-M12-BG-3	MAT9043700	4	3,0
CF.INI-P4-M12-BG-5	MAT9043701	4	5,0
CF.INI-P4-M12-BG-7	MAT9043702	4	7,0
CF.INI-P4-M12-BG-10	MAT9043703	4	10,0
CF.INI-P4-M12-BG-15	MAT9049426	4	15,0
CF9.03.05.INI* (5 x 0,34)			
CF.INI-P5-M12-BG-3	MAT9043737	5	3,0
CF.INI-P5-M12-BG-5	MAT9043738	5	5,0
CF.INI-P5-M12-BG-7	MAT9043739	5	7,0
CF.INI-P5-M12-BG-10	MAT9043740	5	10,0
CF.INI-P5-M12-BG-15	MAT90410077	5	15,0
CF9.03.04.INI* (4 x 0,34)			
CF.INI-P4-M12-BW-3	MAT9043704	4	3,0
CF.INI-P4-M12-BW-5	MAT9043705	4	5,0
CF.INI-P4-M12-BW-7	MAT9043706	4	7,0
CF.INI-P4-M12-BW-10	MAT9043707	4	10,0
CF.INI-P4-M12-BW-15	MAT9049430	4	15,0
CF9.03.05.INI* (5 x 0,34)			
CF.INI-P5-M12-BW-3	MAT9043742	5	3,0
CF.INI-P5-M12-BW-5	MAT9043743	5	5,0
CF.INI-P5-M12-BW-7	MAT9043744	5	7,0
CF.INI-P5-M12-BW-10	MAT9043745	5	10,0
CF.INI-P5-M12-BW-15	MAT90410078	5	15,0

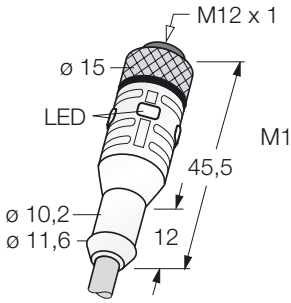
* Technical information ▶ page 70.

... no minimum order quantity

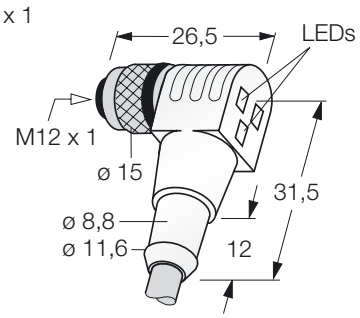
Direct line M12 x 1, socket with free cable end, LED

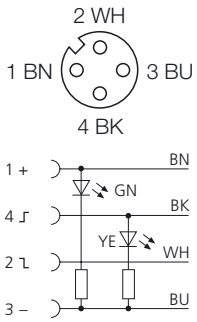
Plug-type connector	Coupling, M12 x 1
Handle base	Plastic, TPU, transparent
Union nut/screw	Metal, CuZn, nickel-plated
Contact base	Plastic, PA6GF, transparent
Contacts	Metal, CuZn, gold-plated
Seal	Plastic, FPM (Viton)
Number of poles	4-pole
Ampacity	4 A
Rated voltage of a winding	10...30 V
Insulation resistance	≥ 10^9 Ohm
Contact resistance	≥ 5 m Ohm
Degree of soiling	3/2
Operating voltage display	LED green
Switching state display	LED yellow/yellow
Switching function	pnp
Ambient temperature of plug-type connector	-40... +105 °C
Protection class	IP66, in screwed state
Mechanical service life	max. 100 Steckzyklen

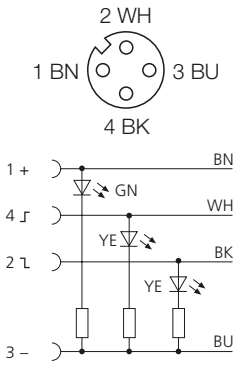
BGL



BGL







CF9.03.04.INI* (4 x 0,34) Type	Part No.	Number of poles	Cable length [m]
CF.INI-P4-M12-BGL2-3	MAT9043708	4	3,0
CF.INI-P4-M12-BGL2-5	MAT9043709	4	5,0
CF.INI-P4-M12-BGL2-7	MAT9043710	4	7,0
CF.INI-P4-M12-BGL2-10	MAT9043711	4	10,0
CF.INI-P4-M12-BGL2-15	MAT90410087	4	15,0

CF9.03.04.INI* (4 x 0,34)			
CF.INI-P4-M12-BWL3-3	MAT9043712	4	3,0
CF.INI-P4-M12-BWL3-5	MAT9043713	4	5,0
CF.INI-P4-M12-BWL3-7	MAT9043714	4	7,0
CF.INI-P4-M12-BWL3-10	MAT9043715	4	10,0
CF.INI-P4-M12-BWL3-15	MAT90410088	4	15,0

* Technical information ▶ page 70.

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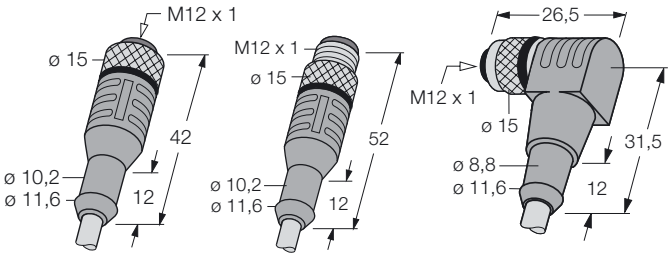
CF.INI

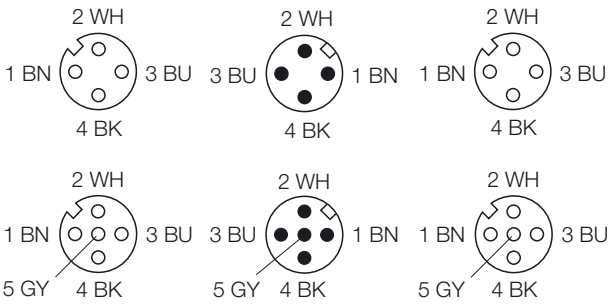
Chainflex® Sensor/actuator cables with 5xd for Energy Chains®

Connection cable M12 x 1

Plug-type connector	Coupling, M12 x 1
Handle base	Plastic, PP, black
Union nut/screw	Metal, CuZn, nickel-plated
Contact base	Plastic, PP, black
Contacts	Metal, CuZn, gold-plated
Seal	Plastic, FPM (Viton)
Plug-type connector	Stecker, M12 x 1
Handle base	Plastic, PP, black
Union nut/screw	Metal, CuZn, nickel-plated
Contact base	Plastic, TPU, black
Contacts	Metal, CuZn, gold-plated
Rated voltage of a winding	4-pole: max. 250 V 5-pole (4-pole+PE): max. 60 V
Ampacity	4 A
Insulation resistance	≥ 10^9 Ohm
Contact resistance	≥ 5 m Ohm
Degree of soiling	3/2
Ambient temperature of plug-type connector	-40 ... +105 °C
Protection class	IP69K, in screwed state
Mechanical service life	max. 100 insertion cycles

BG SG BW





CF9.03.04.INI* (4 x 0,34) Type	Part No.	Number of poles	Cable length [m]
CF.INI-P4-M12-BG / M12-SG-2	MAT90410312	4	2,0
CF.INI-P4-M12-BG / M12-SG-5	MAT90410313	4	5,0
CF.INI-P4-M12-BG / M12-SG-10	MAT90410314	4	10,0
CF9.03.05.INI* (5 x 0,34)			
CF.INI-P5-M12-BG / M12-SG-2	MAT90410339	5	2,0
CF.INI-P5-M12-BG / M12-SG-5	MAT90410340	5	5,0
CF.INI-P5-M12-BG / M12-SG-10	MAT90410341	5	10,0

CF9.03.04.INI* (4 x 0,34)			
CF.INI-P4-M12-BW / M12-SG-2	MAT90410315	4	2,0
CF.INI-P4-M12-BW / M12-SG-5	MAT90410316	4	5,0
CF.INI-P4-M12-BW / M12-SG-10	MAT90410317	4	10,0
CF9.03.05.INI* (5 x 0,34)			
CF.INI-P5-M12-BW / M12-SG-2	MAT90410342	5	2,0
CF.INI-P5-M12-BW / M12-SG-5	MAT90410343	5	5,0
CF.INI-P5-M12-BW / M12-SG-10	MAT90410344	5	10,0

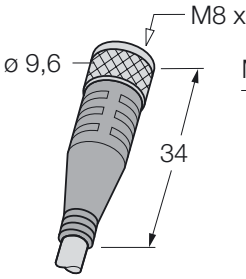
* Technical information ▶ page 70.

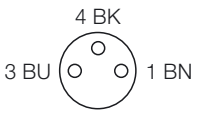
... no minimum order quantity

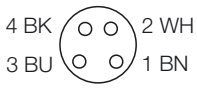
Direct line M8 x 1, socket with free cable end

Plug-type connector	Coupling, M8 x 1
Handle base	Plastic, PP, black
Union nut/screw	Metal, CuZn, nickel-plated
Contact base	Plastic, PP, black
Contacts	Metal, CuZn, gold-plated
Seal	Plastic, FPM (Viton)
Number of poles	3-pole
Ampacity	4 A
Rated voltage of a winding	max. 60 V
Number of poles	4-pole
Ampacity	4 A
Rated voltage of a winding	max. 30 V
Insulation resistance	≥ 10^9 Ohm
Contact resistance	≥ 5 m Ohm
Degree of soiling	3/2
Ambient temperature of plug-type connector	-40...+105 °C
Protection class	IP69K, in screwed state
Mechanical service life	max. 100 insertion cycles

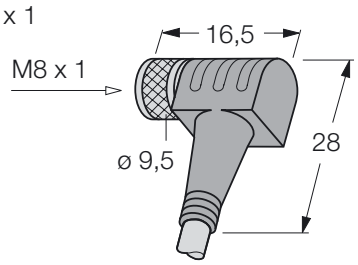
BG

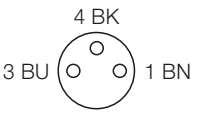


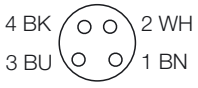




BW







CF9.02.03.INI* (3 x 0,25) Type	Part No.	Number of poles	Cable length [m]
CF.INI-P3-M8-BG-3	MAT9043716	3	3,0
CF.INI-P3-M8-BG-5	MAT9043717	3	5,0
CF.INI-P3-M8-BG-7	MAT9043718	3	7,0
CF.INI-P3-M8-BG-10	MAT9043719	3	10,0
CF.INI-P3-M8-BG-15	MAT9049416	3	15,0
CF9.03.04.INI* (4 x 0,34)			
CF.INI-P4-M8-BG-3	MAT9043728	4	3,0
CF.INI-P4-M8-BG-5	MAT9043729	4	5,0
CF.INI-P4-M8-BG-7	MAT9043730	4	7,0
CF.INI-P4-M8-BG-10	MAT9043731	4	10,0
CF.INI-P4-M8-BG-15	MAT9049466	4	15,0

CF9.02.03.INI* (3 x 0,25)			
CF.INI-P3-M8-BW-3	MAT9043724	3	3,0
CF.INI-P3-M8-BW-5	MAT9043725	3	5,0
CF.INI-P3-M8-BW-7	MAT9043726	3	7,0
CF.INI-P3-M8-BW-10	MAT9043727	3	10,0
CF.INI-P3-M8-BW-15	MAT9049419	3	15,0
CF9.03.04.INI* (4 x 0,34)			
CF.INI-P4-M8-BW-3	MAT9043732	4	3,0
CF.INI-P4-M8-BW-5	MAT9043733	4	5,0
CF.INI-P4-M8-BW-7	MAT9043734	4	7,0
CF.INI-P4-M8-BW-10	MAT9043735	4	10,0
CF.INI-P4-M8-BW-15	MAT9049467	4	15,0

* Technical information ▶ page 70.

Chainflex®-Systeme
für Initiatoren

Tel. 0 22 03-96 49-0
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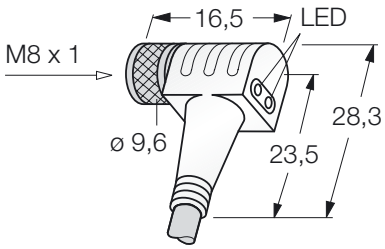
CF.INI

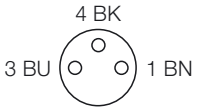
Chainflex® Sensor/actuator cables with 5xd for Energy Chains®

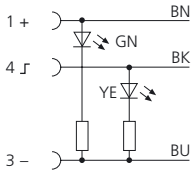
Direct line M8 x 1, socket with free cable end, LED

Plug-type connector	Coupling, M8 x 1
Handle base	Plastic, TPU, transparent
Union nut/screw	Metal, CuZn, nickel-plated
Contact base	Plastic, PA6GF, black
Contacts	Metal, CuZn, gold-plated
Seal	Plastic, FPM (Viton)
Number of poles	3-pole
Ampacity	4 A
Rated voltage of a winding	10...30 V
Insulation resistance	≥ 10^9 Ohm
Contact resistance	≥ 5 m Ohm
Degree of soiling	3/2
Operating voltage display	LED green
Switching state display	LED yellow
Switching function	pnp
Ambient temperature of plug-type connector	-40... +105 °C
Protection class	IP66K, in screwed state
Mechanical service life	max. 100 insertion cycles

BWL







CF9.02.03.INI* (3 x 0,25) Type	Part No.	Number of poles	Cable length [m]
CF.INI-P3-M8-BWL2-3	MAT9043720	3	3,0
CF.INI-P3-M8-BWL2-5	MAT9043721	3	5,0
CF.INI-P3-M8-BWL2-7	MAT9043722	3	7,0
CF.INI-P3-M8-BWL2-10	MAT9043723	3	10,0
CF.INI-P3-M8-BWL2-15	MAT90410196	3	15,0

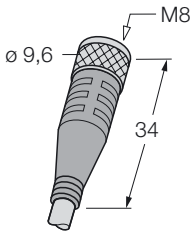
* Technical information ▶ page 70.

... no minimum order quantity

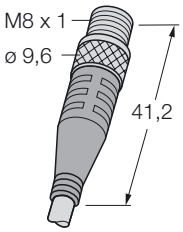
Connection cable M8 x 1

Plug-type connector	Coupling, M8 x 1
Handle base	Plastic, PP, black
Union nut/screw	Metal, CuZn, nickel-plated
Contact base	Plastic, PP, black
Contacts	Metal, CuZn, gold-plated
Seal	Plastic, FPM (Viton)
Plug-type connector	Stecker, M8 x 1
Handle base	Plastic, PP, black
Union nut/screw	Metal, CuZn, nickel-plated
Contact base	Plastic, PP, black
Contacts	Metal, CuZn, gold-plated
Rated voltage of a winding	3-pole: max. 60 V 4-pole: max. 30 V
Ampacity	4 A
Insulation resistance	≥ 10^9 Ohm
Contact resistance	≥ 5 m Ohm
Degree of soiling	3/2
Ambient temperature of plug-type connector	-40 ... +105 °C
Protection class	IP69K, in screwed state
Mechanical service life	max. 100 insertion cycles

BG



SG



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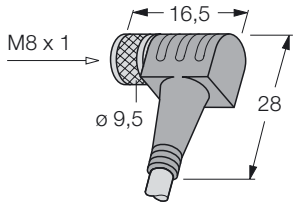

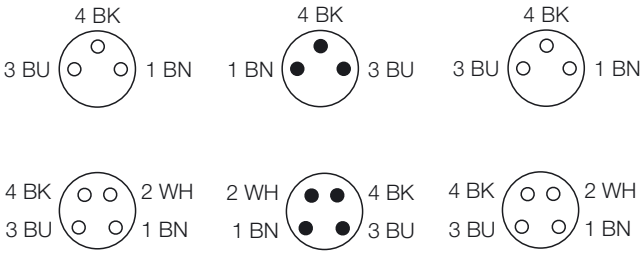

CF9.02.03.INI* (3 x 0,25) Type	Part No.	Number of poles	Cable length [m]
CF.INI-P3-M8-BG / M8-SG-2	MAT90410324	3	2,0
CF.INI-P3-M8-BG / M8-SG-5	MAT90410325	3	5,0
CF.INI-P3-M8-BG / M8-SG-10	MAT90410326	3	10,0
CF9.03.04.INI* (4 x 0,34)			
CF.INI-P4-M8-BG / M8-SG-2	MAT90410333	4	2,0
CF.INI-P4-M8-BG / M8-SG-5	MAT90410334	4	5,0
CF.INI-P4-M8-BG / M8-SG-10	MAT90410335	4	10,0

CF9.02.03.INI* (3 x 0,25)			
CF.INI-P3-M8-BW / M8-SG-2	MAT90410330	3	2,0
CF.INI-P3-M8-BW / M8-SG-5	MAT90410331	3	5,0
CF.INI-P3-M8-BW / M8-SG-10	MAT90410332	3	10,0
CF9.03.04.INI* (4 x 0,34)			
CF.INI-P4-M8-BW / M8-SG-2	MAT90410336	4	2,0
CF.INI-P4-M8-BW / M8-SG-5	MAT90410337	4	5,0
CF.INI-P4-M8-BW / M8-SG-10	MAT90410338	4	10,0

* Technical information ▶ page 70.

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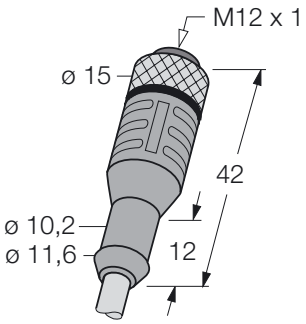
CF.INI

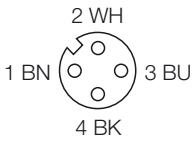
Chainflex® Sensor-/Aktor-Leitungen mit 4 x d für E-Ketten®

Direct line M12 x 1, socket with free cable end

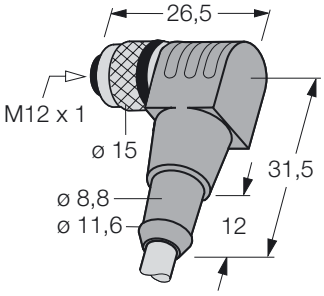
Plug-type connector	Coupling, M12 x 1
Handle base	Plastic, PP, black
Union nut/screw	Metal, CuZn, nickel-plated
Contact base	Plastic, PP, black
Contacts	Metal, CuZn, gold-plated
Seal	Plastic, FPM (Viton)
Number of poles	4-pole
Ampacity	4 A
Rated voltage of a winding	max. 250 V
Insulation resistance	≥ 10^9 Ohm
Contact resistance	≥ 5 m Ohm
Degree of soiling	3/2
Ambient temperature of plug-type connector	-40 ... +105 °C
Protection class	IP69K, in screwed state
Mechanical service life	max. 100 insertion cycles

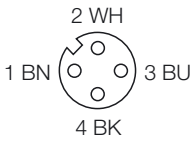
BG





BW





CF98.03.04.INI* (4 x 0,34) Type	Part No.	Number of poles	Cable length [m]	Leitungspreis €
CF98.INI-P4-M12-BG-3	MAT90410235	4	3,0	45,45
CF98.INI-P4-M12-BG-5	MAT90410236	4	5,0	63,00
CF98.INI-P4-M12-BG-7	MAT90410237	4	7,0	80,55
CF98.INI-P4-M12-BG-10	MAT90410238	4	10,0	119,34
CF98.INI-P4-M12-BG-15	MAT90410239	4	15,0	150,75

CF98.03.04.INI* (4 x 0,34)				
CF98.INI-P4-M12-BW-3	MAT90410240	4	3,0	45,78
CF98.INI-P4-M12-BW-5	MAT90410241	4	5,0	63,33
CF98.INI-P4-M12-BW-7	MAT90410242	4	7,0	80,88
CF98.INI-P4-M12-BW-10	MAT90410243	4	10,0	119,64
CF98.INI-P4-M12-BW-15	MAT90410244	4	15,0	151,08

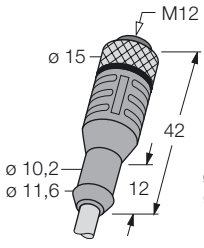
* Technical information ▶ page 70.

... no minimum order quantity

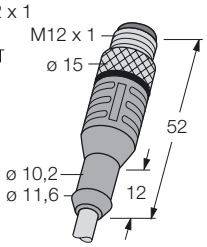
Connection cable M12 x 1

Plug-type connector	Coupling, M12 x 1
Handle base	Plastic, PP, black
Union nut/screw	Metal, CuZn, nickel-plated
Contact base	Plastic, TPU, black
Contacts	Metal, CuZn, gold-plated
Seal	Plastic, FPM (Viton)
Plug-type connector	Stecker, M12x1
Handle base	Plastic, PP, black
Union nut/screw	Metal, CuZn, nickel-plated
Contact base	Plastic, TPU, black
Contacts	Metal, CuZn, gold-plated
Rated voltage of a winding	4-pole: max. 250V
Ampacity	4A
Insulation resistance	≥ 10^9 Ohm
Contact resistance	≥ 5m Ohm
Degree of soiling	3/2
Ambient temperature of plug-type connector	-40 ... +105 °C
Protection class	IP69K, in screwed state
Mechanical service life	max. 100 Steckzyklen

BG



SG



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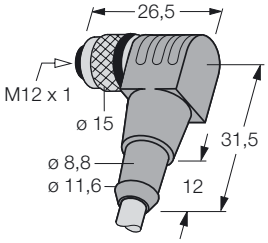

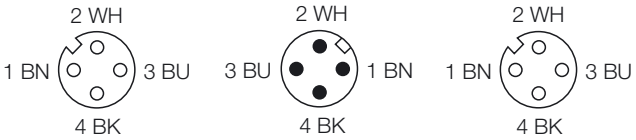

CF98.03.04.INI* (4 x 0,34) Type	Part No.	Number of poles	Cable length [m]	Leitungspreis €
CF98.INI-P4-M12-BG / M12-SG-2	MAT90410300	4	2,0	38,01
CF98.INI-P4-M12-BG / M12-SG-5	MAT90410301	4	5,0	71,54
CF98.INI-P4-M12-BG / M12-SG-10	MAT90410302	4	10,0	127,41

CF98.03.04.INI* (4 x 0,34)				
CF98.INI-P4-M12-BW / M12-SG-2	MAT90410303	4	2,0	38,37
CF98.INI-P4-M12-BW / M12-SG-5	MAT90410304	4	5,0	71,90
CF98.INI-P4-M12-BW / M12-SG-10	MAT90410305	4	10,0	127,77

* Technical information ▶ page 70.

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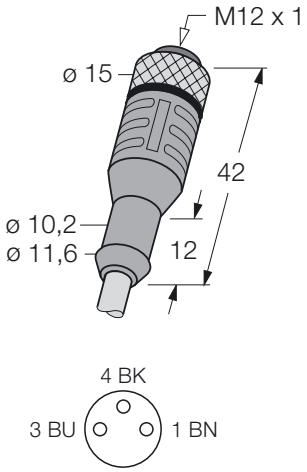
CF.INI

Chainflex® Sensor-/Aktor-Leitungen mit 4 x d für E-Ketten®

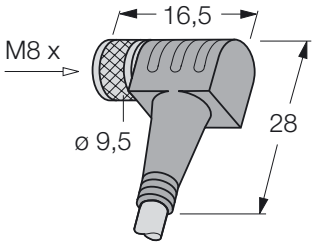
Direct line M8 x 1, socket with free cable end

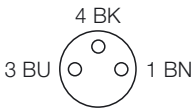
Plug-type connector	Coupling, M8 x 1
Handle base	Plastic, PP, black
Union nut/screw	Metal, CuZn, nickel-plated
Contact base	Plastic, PP, black
Contacts	Metal, CuZn, gold-plated
Seal	Plastic, FPM (Viton)
Number of poles	3-pole
Ampacity	4 A
Rated voltage of a winding	max. 60 V
Insulation resistance	≥ 10^9 Ohm
Contact resistance	≥ 5 m Ohm
Degree of soiling	3/2
Ambient temperature of plug-type connector	-40 ... +105 °C
Protection class	IP69K, in screwed state
Mechanical service life	max. 100 insertion cycles

BG



BW





CF9.02.03.INI* (3 x 0,25) Type	Part No.	Number of poles	Cable length [m]	Leitungspreis €
CF98.INI-P3-M8-BG-3	MAT90410245	3	3,0	35,37
CF98.INI-P3-M8-BG-5	MAT90410246	3	5,0	48,09
CF98.INI-P3-M8-BG-7	MAT90410247	3	7,0	60,81
CF98.INI-P3-M8-BG-10	MAT90410248	3	10,0	89,94
CF98.INI-P3-M8-BG-15	MAT90410249	3	15,0	121,74

CF9.02.03.INI* (3 x 0,25)				
CF98.INI-P3-M8-BW-3	MAT90410250	3	3,0	35,37
CF98.INI-P3-M8-BW-5	MAT90410251	3	5,0	48,09
CF98.INI-P3-M8-BW-7	MAT90410252	3	7,0	60,81
CF98.INI-P3-M8-BW-10	MAT90410253	3	10,0	89,94
CF98.INI-P3-M8-BW-15	MAT90410254	3	15,0	121,74

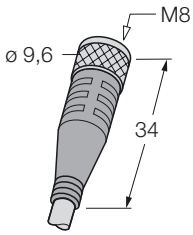
* Technical information ▶ page 70.

... no minimum order quantity

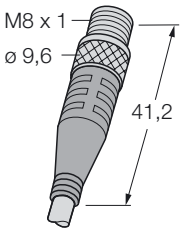
Connection cable M8 x 1

Plug-type connector	Coupling, M8 x 1
Handle base	Plastic, PP, black
Union nut/screw	Metal, CuZn, nickel-plated
Contact base	Plastic, TPU, black
Contacts	Metal, CuZn, gold-plated
Seal	Plastic, FPM (Viton)
Plug-type connector	Stecker, M8 x 1
Handle base	Plastic, PP, black
Union nut/screw	Metal, CuZn, nickel-plated
Contact base	Plastic, PP, black
Contacts	Metal, CuZn, gold-plated
Rated voltage of a winding	3-pole: max. 60 V
Ampacity	4A
Insulation resistance	≥ 10^9 Ohm
Contact resistance	≥ 5 m Ohm
Degree of soiling	3/2
Ambient temperature of plug-type connector	-40 ... +105 °C
Protection class	IP69K, in screwed state
Mechanical service life	max. 100 insertion cycles

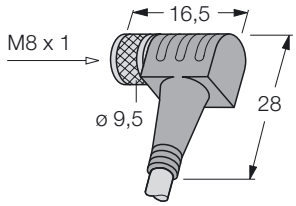
BG

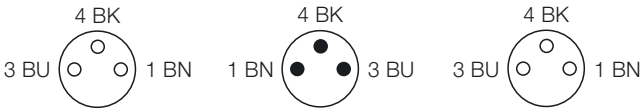


SG



BW





CF9.02.03.INI* (3 x 0,25) Type	Part No.	Number of poles	Cable length [m]	Leitungspreis €
CF98.INI-P3-M8-BG / M8-SG-2	MAT90410306	3	2,0	31,74
CF98.INI-P3-M8-BG / M8-SG-5	MAT90410307	3	5,0	56,58
CF98.INI-P3-M8-BG / M8-SG-10	MAT90410308	3	10,0	97,98

CF9.02.03.INI* (3 x 0,25)

CF98.INI-P3-M8-BW / M8-SG-2	MAT90410309	3	2,0	32,64
CF98.INI-P3-M8-BW / M8-SG-5	MAT90410310	3	5,0	57,48
CF98.INI-P3-M8-BW / M8-SG-10	MAT90410311	3	10,0	98,88

* Technical information ▶ page 70.

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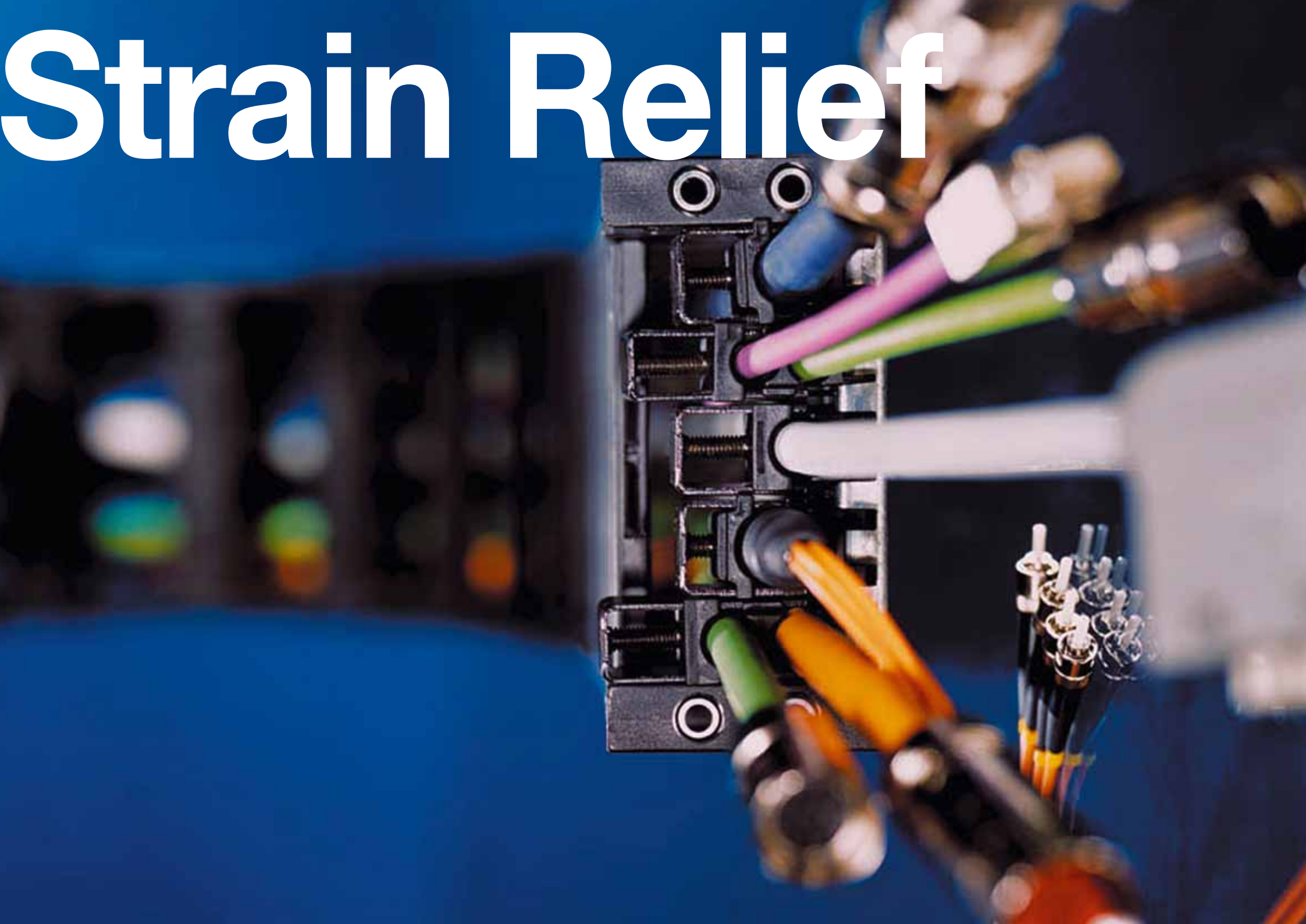
Strain Relief



Chainfix steel clamps and Chainfix stainless-steel clamps – Max. pull forces, adjustable with hexagon socket

► **Page 240**

Chainfix clips – High pull forces, plug-in Modular snap-on strain relief device

► **Page 242**

Chainfix Nugget – Strain relief for small space and cables up to 20 mm o.d.

► **Page 242**

Strain relief separator – With integrated teeth

► **Page 242**

Tiewrap plates – For cable tiewrap universal, bolted or clip-on

► **Page 243**

Chainfix-tiewrap plates – For strain relief with cable tiewraps for C-profile, clip-on

► **Page 243**

igus® Blocks – Special strain relief for hoses. A Modular, space-saving system

► **Page 245**

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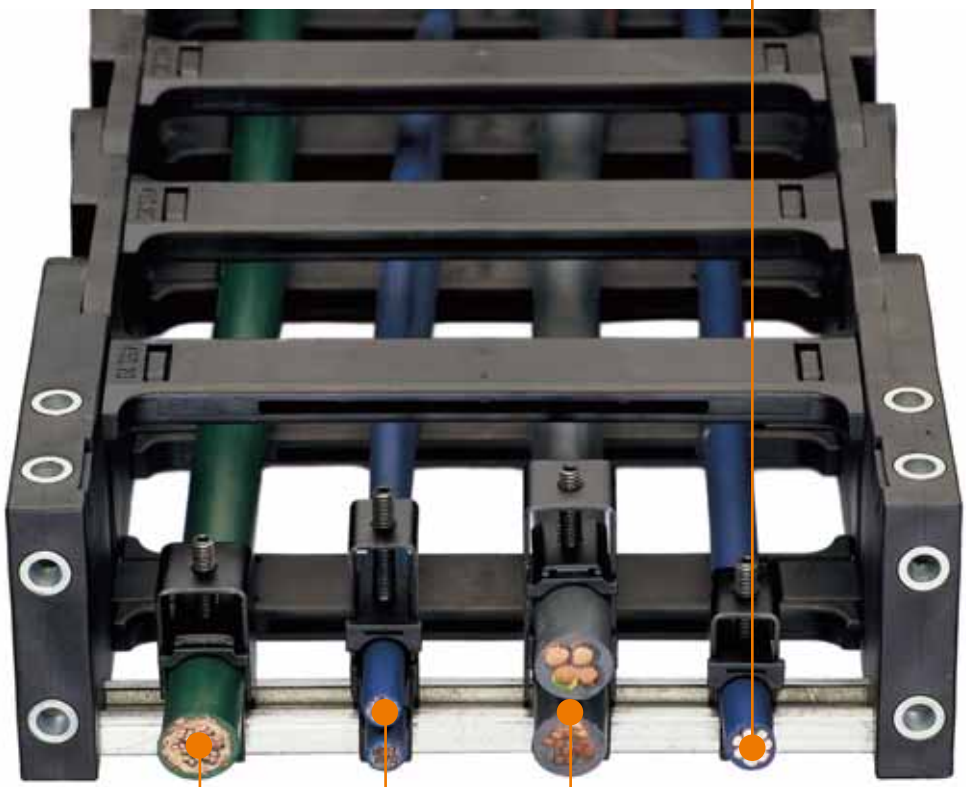
Reduced overall height

Space-saving

Long-term durability for dynamic application



Suitable for integration in the igus® connection element KMA (German abbr. = plastic-metal connection elements)

High tensile strength due to ribbed plastic troughs

For one cable, or for two or three cables on top of one another

Black painted or stainless steel from stock

Chainfix for Energy Chain Systems®

Strain relief devices for Energy Chains® with igus® strap clips and igus® press-fit elements

The principle of the strap clips has proved to be extremely reliable as a strain relief device for igus® Energy Chain Systems®.

Important improvements are characteristic features of the igus® own "Chainfix" product series:

- igus® Chainfix reduces the overall height due to optimum housing height
- Long-term durability for dynamic applications due to improved press-fit elements.
- Suitability for integration in the KMA connection element.
  – Space-saving and time-saving assembly
  – Possibility of delivery for complete systems with cables and assembled strain relief device.
- Improved foot for facilitated installation on the C profile.

Ideally, the cables must be fastened at both ends of the Energy Chains®. The cables must, however, at least be fastened to the moving mounting bracket of the Energy Chains®.

Characteristic features of the igus® Chainfix strap clips

- Optimized height due to newly developed housing.
- Improved foot for facilitated installation on the C profile.
- Good visual effects due to black housing body and black threaded setscrews.
- Easy to assemble due to setscrews that are screwed using an Allen key.

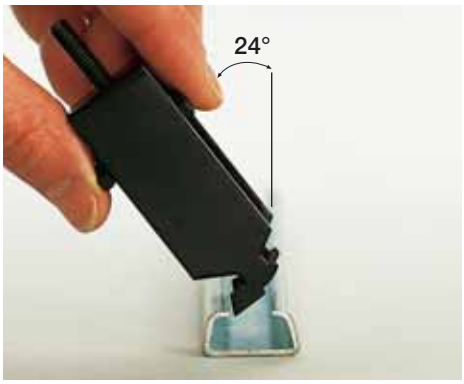
Characteristic features of the igus® press-fit elements

- Long supporting surface improves the stability of the strap clip.
- High inherent rigidity increases the operating safety.
- Integrated ribs prevent the cable from detaching itself from the strain relief device.

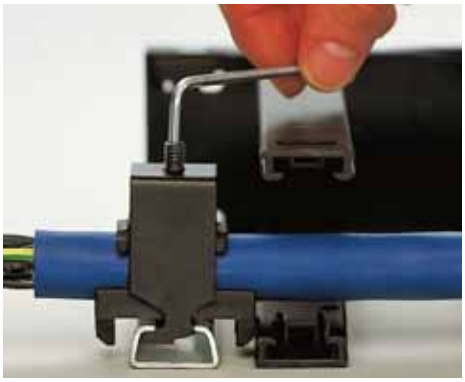
Overall height

When the Energy Chains® glide along on themselves in the case of long distances of travel, the screw heads of the strain relief device at the fixed point of the chain must possess a separating distance of at least 10 mm to the top edge of the Energy Chains®. Our newly developed clip housing with setscrews **reduce the overall height by as much as 15 mm** compared with conventional strap clips.

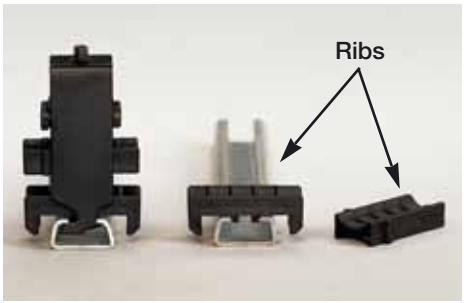
KMA connection element with integrated C profile and Chainfix



Easy installation of the strap clip due to improved foot



Reduced overall height due to setscrew and optimum housing height



New pressure trough, mating trough and press trough with ribs for better long-termi durability

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Chainfix test results

Three times higher tensile strength than with standard-type strap clips

❶ Standard-type strap clip made of hot-galvanized steel, double trough and press trough made of impact-resistant plastic (Art. no. CF14.1.Z, standard elements)

❷ Strap clip as described above, double trough and press trough made of igumid G (Art. no. CFY14.1)

❸ Strap clip "Chainfix", mating trough and press trough made of igumid G (Art. no. CFX14.1)

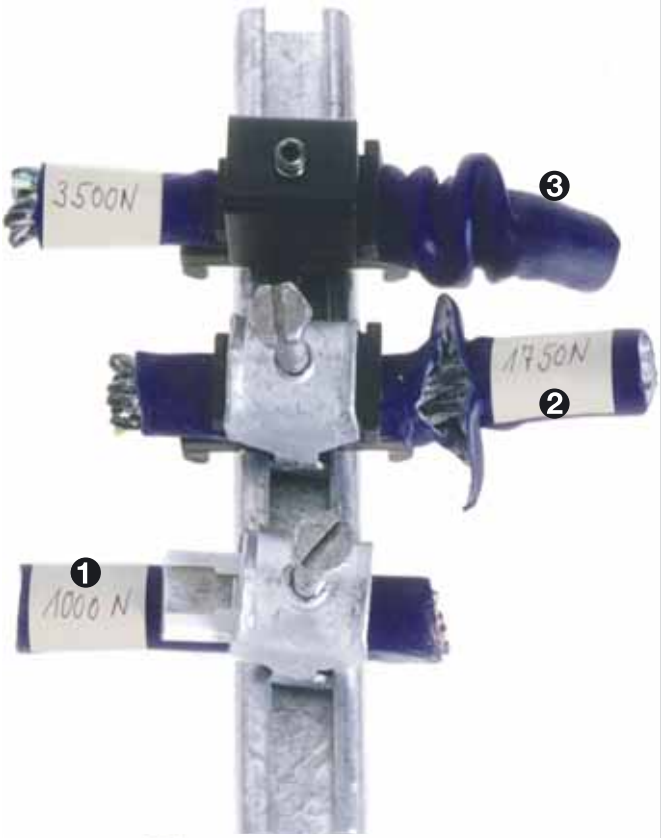
Results: Strain relief element ❶ saddle clamps loosen at 1.000 N of pull force. The resulting diagonal position of the saddle clamp distorts the screw. Strain relief element ❷ saddle clamps loosen at 1.750 N of pull force. The improved igumid G saddle clamps attempt to hold the cable, causing the outer jacket to "peel." Strain relief element (igus® Chainfix system) saddle clamps loosen and slant 5° at 1.750 N. At 2.500 N of pull force, the cable jacket bunches up behind the clamp and, at 3.500 N of pull force, the clamps loosen completely and the cable becomes inoperative.

Final result: The tensile strength of the strap clip "Chainfix" developed by igus® is three times higher than the tensile strength of standard-type strain relief devices.

Delivery program elements of the Chainfix strain relief devices:

● Chainfix strap clip with setscrew and press trough, double trough, mating trough ● C profile

Materials: igus® strap clip: black painted steel ● Setscrew: black steel ● igus® strap clip stainless steel*: bare-metal, material 1.4301 ● Setscrew: bare-metal, material 1.4301 ● Press trough, double trough and mating trough: igumid G



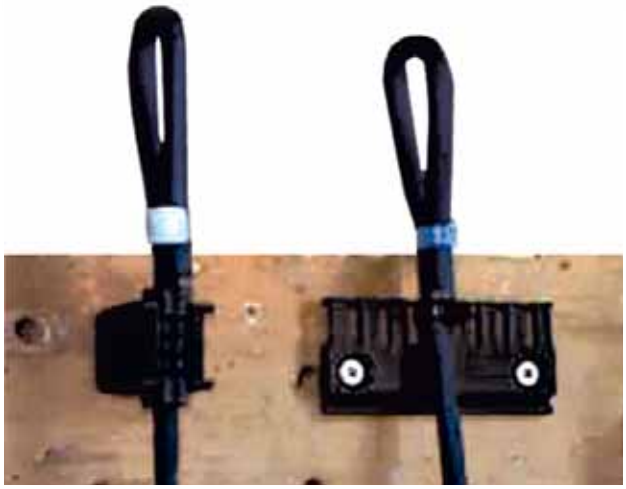
Tensile strength test example with cable Ø 10,5 mm

● **Tiewrap plate 2070ZB** with a cable tiewrap

Result: Tensile strength 290 N

● **Chainfix clip** CFC-12-M

Result: Tensile strength 350 N



Pull force test for igus® tiewrap plates with cable tiewraps

Results: Two tiewraps are more stable than one tiewrap.

If one cable tiewrap is used, the **breaking force is (approx.) 350 N.** If the cable is secured with two cable tiewraps, the **breaking force increases to 830 N,** i.e. pull force resistance more than doubles when using two cable tiewraps.

Technical data:

● Tiewrap plates: 2100.ZB/3100.ZB

● Cable: CF1.07.12

● Cable tiewraps: CFB.001

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igus® Chainfix Strain Relief

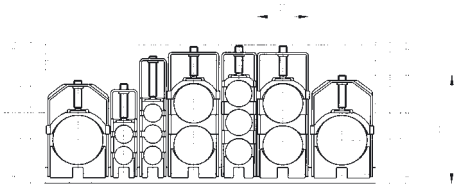
If the E-Chains® glide on themselves over long travels, the screw heads of the strain relief must be at least 10 mm away from the upper edge of the E-Chains® at the fixed end of the chain.
This restriction means that the strain relief elements described here may possibly not be able to be used on the fixed end of long E-Chains®.
Please note our clamps developed specifically for a low overall height. In the case of unsupported E-Chains®, the strain relief elements may be used with no problems.

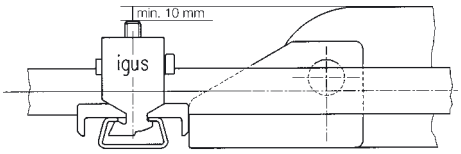
Improved housing foot clamp for easy fit into profile rail

Setscrew and reduced optimal housing height for use in long/ gliding travel applications

When using Chainfix clamps on C-Profile in the mounting bracket for Series 280, 2828, 290, 2928, R770, R7728 and a shortened mating trough must be used. The Part No. for this is: CFX...K (add letter "K" to the above Part No.)

* Material stainless steel: 1.4301





The dimensions given for H in the tables are based on the maximum cable diameter. The use of thinner cables can result in deviating dimensions.

Single clamp housing, including top/bottom saddle clamps

Steel clamp Part No.	Stainless steel clamp Part No.	ø [mm]	B	H
CFX12.1	CFX12.1.E	06 – 12	16	58
CFX14.1	CFX14.1.E	12 – 14	18	50
CFX16.1	CFX16.1.E	14 – 16	20	52
CFX18.1	CFX18.1.E	16 – 18	22	54
CFX20.1	CFX20.1.E	18 – 20	24	56
CFX22.1	CFX22.1.E	20 – 22	26	58
CFX26.1	CFX26.1.E	22 – 26	30	67
CFX30.1	CFX30.1.E	26 – 30	34	71
CFX34.1	CFX34.1.E	30 – 34	38	75
CFX38.1	CFX38.1.E	34 – 38	42	79
CFX42.1	CFX42.1.E	38 – 42	46	83

Double clamp housing, including top/bottom saddle clamps and one stacker saddle clamp

Steel clamp Part No.	Stainless steel clamp Part No.	ø [mm]	B	H
CFX12.2	CFX12.2.E	06 – 12	16	72
CFX14.2	CFX14.2.E	12 – 14	18	74
CFX16.2	CFX16.2.E	14 – 16	20	78
CFX18.2	CFX18.2.E	16 – 18	22	82
CFX20.2	CFX20.2.E	18 – 20	24	86
CFX22.2	CFX22.2.E	20 – 22	26	90
CFX26.2	CFX26.2.E	22 – 26	30	109
CFX30.2	CFX30.2.E	26 – 30	34	117
CFX34.2	CFX34.2.E	30 – 34	38	125

Triple clamp housing, including top/bottom saddle clamps and two stacker saddle clamps

Steel clamp Part No.	Stainless steel clamp Part No.	ø [mm]	B	H
CFX12.3	–	06 – 12	16	100
CFX14.3	–	12 – 14	18	96
CFX16.3	–	14 – 16	20	102
CFX18.3	–	16 – 18	22	108
CFX20.3	–	18 – 20	24	114
CFX22.3	–	20 – 22	26	120

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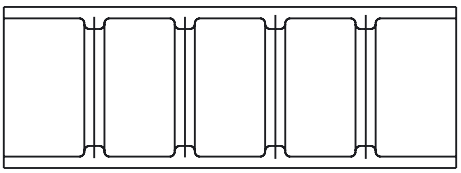
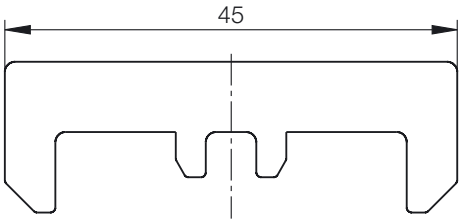
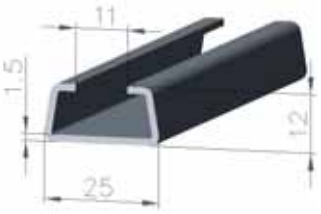
Bottom saddle clamps for single/double/triple clamp housings as separate part or insertion into C-profile

Part No.	ø [mm]
CG12	06 – 12
CG14	12 – 14
CG16	14 – 16
CG18	16 – 18
CG20	18 – 20
CG22	20 – 22
CG26	22 – 26
CG30	26 – 30
CG34	30 – 34
CG38	34 – 38
CG 42	38 – 42







Stainless steel* C profile for all clamps, also for assembly in the KMA connection element Series: 280, 2828, 28, 380, 3838, 38, 400, 4040, 40, 140, 142 und 5050, 50, 150,

Part No. CF92.42 ..... .E

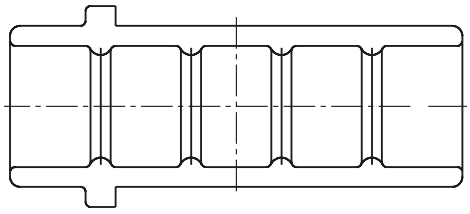
(specify length in mm)

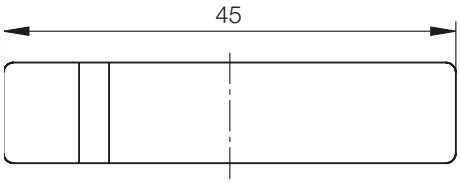
Material: stainless steel*

Ribbed strain relief saddle clamps withstands increased pull forces for long-term durability

Stacker saddle clamps for double/triple clamp housings for placement between stacked cables

Part No.	ø [mm]
CD12	06 – 12
CD14	12 – 14
CD16	14 – 16
CD18	16 – 18
CD20	18 – 20
CD22	20 – 22
CD26	22 – 26
CD30	26 – 30
CD34	30 – 34





Chainfix – Snap on Solutions

For the following E-Chains®:

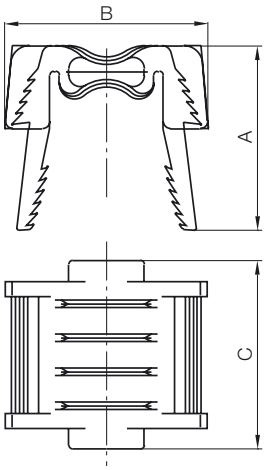
Chainfix Clip for C-profile:
For all KMA mounting brackets with C-profile-option!

Chainfix Clip for crossbars:
For most E4 and E6 E-Chains®

Chainfix Clip – Modular snap-on strain relief device

Available for all igus® E-ChainSystems with C-profiles and also suitable for assembly in the KMA mounting brackets and Clip-on strain relief for crossbars

Characteristic features: ● Series of clamps and bottom parts made of plastic for cable diameters ranging from 4 mm to 24 mm ● Quick assembly without any tools ● 2 and 3 layers on top of one another possible ● Each layer can be detached and changed later on ● High tensile forces in case of single-layer installation, decreasing with the number of layers



ø Leitung [mm]	Part No. Clamps	Part No. Bottom Part	A [mm]	B [mm]	C [mm]
04 - 08 mm	**CFC-08-M**	**CFC-08-C**	13,0	14,5	30
08 - 12 mm	**CFC-12-M**	**CFC-12-C**	24,0	23,7	36
12 - 16 mm	**CFC-16-M**	**CFC-16-C**	32,1	32,4	42
16 - 20 mm	**CFC-20-M**	**CFC-20-C**	39,1	43,2	45
20 - 24 mm	**CFC-24-M**	**CFC-24-C**	50,0	54,0	50

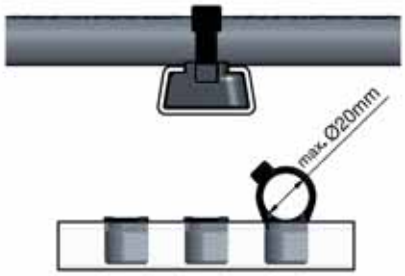
For the following E-Chains®:

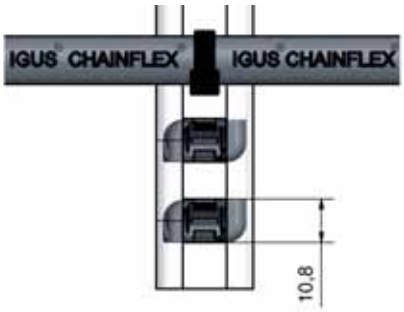
For all KMA mounting brackets with C-profile-option!

Chainfix Nugget

Characteristic features: ● Very small strain relief for the fixation of cables up to diameter of 20 mm ● **Use:** ● Accessory for all KMA with integrated c-profile ● Easy to assemble, without any screws and tools ● Adjustable to every E-Chain® filling ● Very small space requirement ● Easy strain relief due to fixation with pre-harnessed cable strap

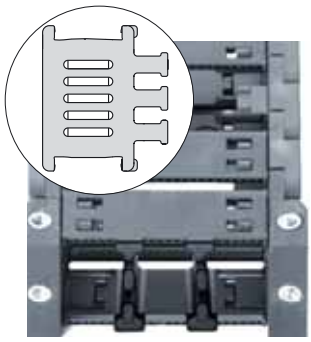
Part No.	ø Leitung max. [mm]	Breite [mm]
CFN.20	20	10,8





For the following E-Chains®:

For more details see table!



Strain relief separator

Characteristic features: ● Separator with integrated strain relief for the use in the first or last chain link ● **Use:** ● Individual part for the manufacturing of switchgear cabinets or for the assembly of machines ● Accessory for igus® E-ChainSystems® ● Easy to assemble without any screws

Part No.	Number of teeth	For Series
T2103.Z	2	**210**
E6.29.02Z	2	**E6.29**
2020.Z	2	**2400/2500**
262.Z	3	**2600/2700**

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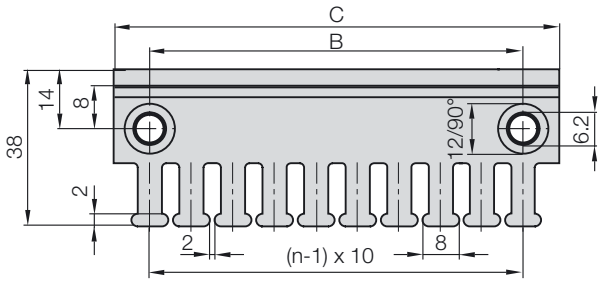
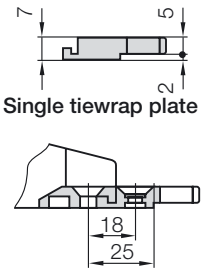
Chainfix Tiewrap Plates

Option 1: Chainfix tiewrap plates as individual parts

Characteristic features: ● As individual component screwed on KMA (plastic metal mounting brackets) ● Can be plugged in the mounting brackets ● **Use:** ● Individual part for the manufacturing of switch-gear cabinets or for the assembly of machines ● Accessory for igus® E-ChainSystems®

Series 2000 – Tiewrap plate as individual part





Single tiewrap plate

Shown assembled

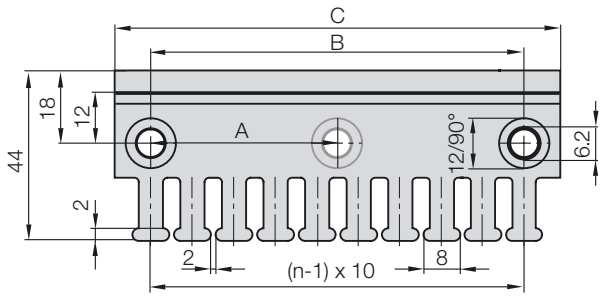
Tiewrap plate	*n* Number of teeth	Dim. C [mm]	Dim. B [mm]	Center bore (– = no / + = yes)
2020.ZB	3	30	15	–
2030.ZB	4	40	20	–
2040.ZB	5	50	30	–
2050.ZB	6	60	40	–
2070.ZB	8	80	60	–
2090.ZB (= 2030.ZB + 2040.ZB)	9	90	–	–
2100.ZB	10	100	80	–
2125.ZB (= 2050.ZB + 2050.ZB)	12	120	–	–

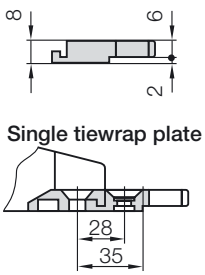
Cable tiewraps (100-piece bag)	Width x length [mm]	Max. Ø	Pull force resistance
CFB.001	4,8 x 150	36	220 N

For the following E-Chains®:

Easy Chain® Series:
● E200/Z200
System E2/000 Series:
● 2400/2500/2450
● 2600/2700/2650
● 255
System E4 Series:
● 220

Series 3000 – Tiewrap plate as individual part





Single tiewrap plate

Shown assembled

Tiewrap plate		*n* Number of teeth	Dim. C [mm]	Dim. B [mm]	Center bore (– = no / + = yes)
3050.ZB	05	–	50	30	–
3075.ZB	07	–	75	55	–
3100.ZB	10	–	100	80	–
3115.ZB	11	–	115	95	–
3125.ZB	12	–	125	105	–
3150.ZB	15	–	150	130	–
3175.ZB	17	–	175	155	–
3200.ZB	20	90	200	180	+
3225.ZB	22	102,5	225	205	+
3250.ZB	25	115	250	230	+

Cable tiewraps (100-piece bag)	Width x length [mm]	Max. Ø	Pull force resistance
CFB.001	4,8 x 150	36	222N

For the following E-Chains®:

Easy Chain® Series:
● E26/Z26
● E300/Z300
System E2/000 Series:
● 2600/2700/2650
● 3400/3500/3450
System E4 Series:
● 280/290
● 380/390
● 400/410
● 2828/2928
● 3838/3938
● 4040/4140
● 1640

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Chainfix Kettenkämme

For the following E-Chains®:

For all mounting brackets with C-Profil-option

Option 2: Tiewrap plates with clip-on connection for the C-profile

Characteristic features: ● Can be plugged into the KMA c-profile ● Easy solvable with screwdriver ● Easy to assemble without any screws. Easy solvable with screwdriver nevertheless safe stop ● **Use:** ● Individual part for the manufacturing of switchgear cabinets or for the assembly of machines ● Accessory for igus® E-ChainSystems® ● For all E-Chains® with KMA and integrated C-profile

Part No.	Width [mm]	Number of teeth
3050.ZC	50	5
3075.ZC	75	7

For the following E-Chains®:

System E2/000 Series:

For more details see table!

Option 3: Clip-on tiewrap plates for opening or fixed crossbars

Characteristic features: ● Can be plugged on the fixed crossbars ● In case of many harnessed cables with strain relief "over two floors" ● If the KMA is too small for the c-profile ● Easy to assemble without any screws ● **Use:** ● Individual part for the manufacturing of switchgear cabinets or for the assembly of machines ● Accessory for igus® E-ChainSystems®

Part No. fixed crossbar	Width [mm]	Number of teeth	For Series
2050.Z	60	6	2600/2700
3050.Z	50	5	3400/3500
Part No. opening crossbar	**Width [mm]**	**Number of teeth**	**For Series**
3035.ZS	35	3	3400/3500
3050.ZS	50	5	3400/3500
3075.ZS	75	7	3400/3500
3850.ZS	48	5	2828/280/38/3838/380/E6.62/142/14240
4550.ZS	48	5	4040/400/50/5050/E6.80/140/14040/ 15050
4575.ZS	74	7	4040/400/50/5050/E6.80/140/14040/ 15050

For the following E-Tubes:

System E2 Tubes Series:

● R58 ● R68

Option 4: Integrated strain relief for E2 Tubes - Series R

Characteristic features: ● Strain relief disappears completely in the E-Tube ● Easy to assemble without any screws ● **Use:** ● Individual part for the manufacturing of switchgear cabinets or for the assembly of machines ● Accessory for igus® E-ChainSystems®

Part No.	Width [mm]	Number of teeth	For Series
3050.Z	50	6	R68
3075.Z	75	7	R68
5850.Z	47	4	R58

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Fax +49-22 03-96 49-222
igus® GmbH 51127 Cologne
www.igus.de info@igus.de

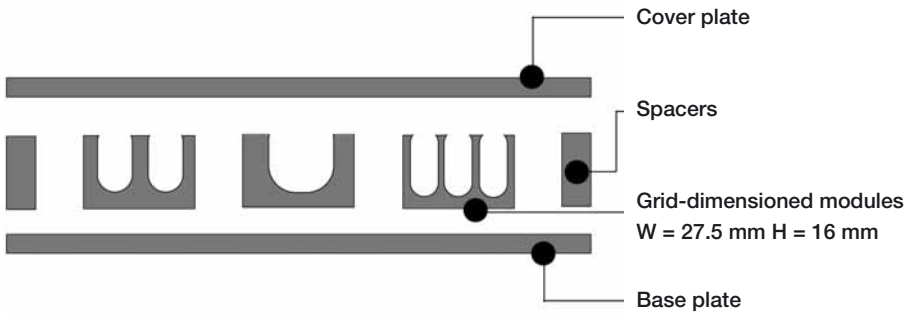
Chainfix Strain Relief Block

igus® Strain Relief Block for Small Hoses and Cables

- Modular system for great adaptability
- No hose damage
- Easy installation - pressing the hose into the locating notch provides reliable fastening without hardware
- Hoses and cables can be installed together in the same E-Chain®
- Accommodation of hose diameters from 4.3 to 14 mm

The Modular Elements of the igus® Strain Relief Block for Hoses

The modules accommodate hoses from 4.3 to 14 mm, 3 x 4.3 mm hoses can be fitted on top of each in module CFS 4.3 and 2 hoses can be fitted directly on top of each other in one notch using module CFS 6. The modules have a width of 27.5 mm, are inserted into the base plate and then fastened in position with M4 countersunk-head screws. The exception is module CFS 55.9 which offers the capacity for 5 x 9 mm hoses with twice the width. The base plate and cover plate are available in widths ranging from 75 to 240 mm. The height of the spacers and modules is 16 mm. Several layers can be installed directly above one another.



Part No. Strain Relief Block	Hose Ø [mm]	Number of hoses	Width [mm]
CFS 4,3	4,3	4 - 12	27,5
CFS 6	6,0	3 - 6	27,5
CFS 9	9,0	2	27,5
CFS 55,9	9,0	5	55,0
CFS 10	10,0	2	27,5
CFS 14	14,0	1	27,5

Part No. Base plate	Width [mm]
CFSU	75,0
CFSU	102,5
CFSU	130,0
CFSU	185,0
CFSU	212,0
CFSU	240,0

Part No. Cover plate	Width [mm]
CFSP	75,0
CFSP	102,5
CFSP	130,0
CFSP	185,0
CFSP	212,0
CFSP	240,0

Part No. Spacer	Width Ø [mm]
CFSD	16,0
CFSD	12,0

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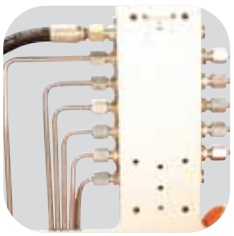
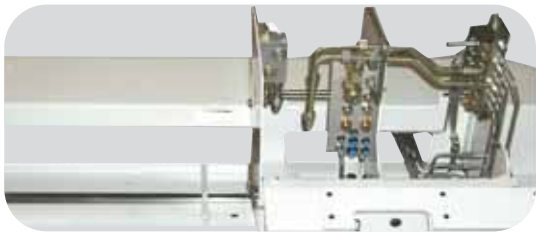
ReadyChains®
Ready-made Energy Chain Systems®

...all inclusive.



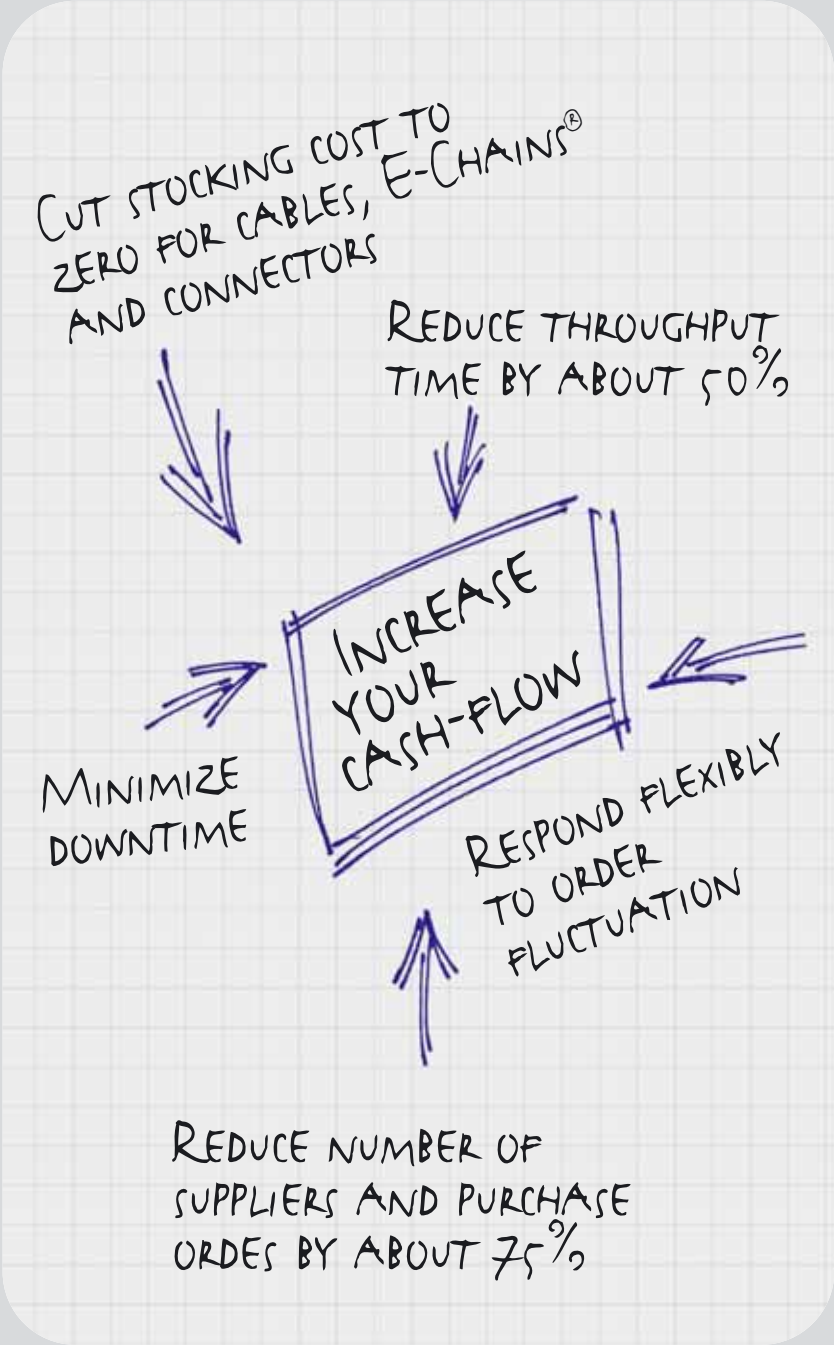


igus®.de

Readychain®

Increase cash flow

Increase your cash-flow easily and smoothly even from batch size 1.



Reduce storage costs for cables, Energy Chains® and plugs to zero

You can do without storage of high flexible cables, plugs and any other add-on pieces due to our rapid and guarantied delivery times.

Split in half flow times

Because of a polished logistic igus® delivers ready-made systems almost worldwide within 2-8 days on the guarantied date.

React flexible to contract fluctuations

With ReadyChains® you are always prepared for cyclical ups and downs. In this field you can pass the buck of capacity fluctuations to us.

Minimize machine breakdown

Play it safe, it's the little things that always cause problems. Buying numerous single parts not only increases the risk of failure of your plants, it also complicates troubleshooting.
You will get a system solution with ReadyChains®. Any system is checked in our test centre. igus® is standardized according to ISO 9001.

Reduce the number of suppliers and orders about 75%

▶ One order ▶ one invoice ▶ one delivery ▶ one partner. Don't care about looking for numerous parts from numerous suppliers. We have the knowledge to provide you quickly with the optimal parts.

+++++ We are professionals for Energy Chain® harnessing +++++

Degree of harnessing

You determine the degree of harnessing

We harness from simple Energy Chain Systems® with inserted Chainflex® cables to complex systems. These systems may include all cables and hoses (pneumatic, hydraulic), patch plugs, inner partitions, connecting elements and connecting parts as requested.

From easy... ...to the project

Any size is possible

You determine the size

Any size is possible. Because of our up-to-date production processes we can deliver fast and cheap custom-build or serial production products.

From batch size 1... ...to serial production

Choosing the travel

You determine the travel

ReadyChains® offers the whole spectrum of possible travels of the igus® Energy Chains®. We harness anything from extremely short to long travels. Safe transportation guarantees damage-free delivery of all lengths.

From short... ...to long

+++++ We are professionals for Energy Chain® harnessing +++++

igus® ReadyChain®

Increase cash-flow, reduce ordering and flow times

Component part solution

Order, component parts
Different suppliers
Different delivery periods

Goods received, structural components

Transport to stock

Outgoing stocks

Pre-mounting

Transport to machines, assembly and fitting of the component parts

ReadyChain®-solution

Chain, cable, harnessing
Ordering the structural component with an article number

Goods received, structural component

Transport to the machine and assembly - "ready for occupation"

Textile machine, more than 50 modifications, delivered to the belt with three days of leading time.

Building machines, harnessed hydraulic hoses and fittings.

Crane travel up to 100 m, assembling from the roll.

Robots, inclusive media hoses and add-on pieces.

+++++ We are professionals for Energy Chain® harnessing +++++

ReadyChain® delivery times

ReadyChain® Basic

Consists of igus® Energy Chains® with inserted igus® Chainflex® cables and all necessary components such as separators and connecting elements.

Time of delivery:
1 – 3 days
(after telephonic clarification)

ReadyChain® Standard

Consists of "basic", additionally with all patch plugs and connecting elements for igus® Energy Chains® and igus® Chainflex® cables.

Time of delivery:
3 - 5 days

ReadyChain® Premium

Consists of "standard", additionally with all patch plugs and connecting elements for igus® cables, especially designed for the interface of the machine.

Time of delivery:
3 - 10 days

+++++ We are professionals for Energy Chain® harnessing +++++

ReadyChain® Factory

Longstanding experience with harnessing of Energy Chains®

igus® Factory in Cologne:
Harnessing of Energy Chains® since1994

All-automatic crimp machines guarantee
safe connections, rationally connected

Computer-aided high-voltage testing
positions ensure tested quality

Non-spinning cable handling
for more safety

The all-automatic break down facility
allows cheap prices for highest quality

+++++ We are professionals for Energy Chain® harnessing +++++

ReadyChain® Factory

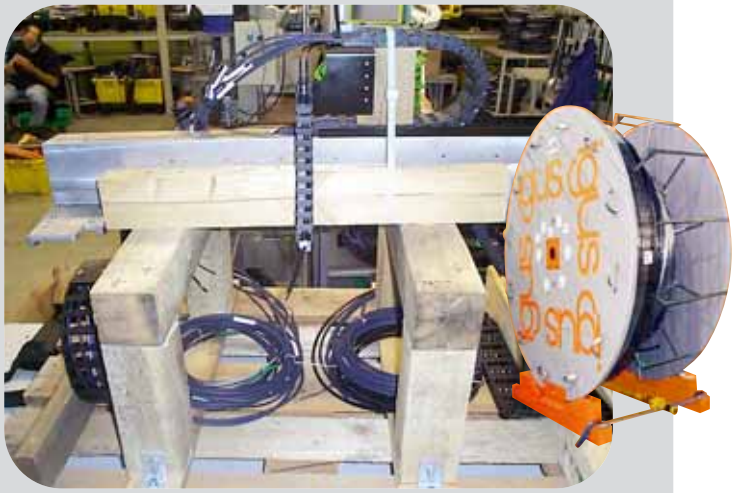
For our customers: follow-up of order by web cam

50 ReadyChain® specialists use up-to-date machines for quick planning, harnessing and final inspection of your ReadyChain® Energy Chain System®. Go and see for yourself: **www.readychain.de**

40.000 Energy Chain® components on stock

More than 600 Chainflex® Special cables for Energy Chains® are available for you ex stock: **www.igus.de**

More than 2.500 electrical components for patch plugs – available right away from the all-automatic high-bay warehouse



Many thousand on time deliveries in customer specific transport facilities

+++++ We are professionals for Energy Chain® harnessing +++++

Applications

Examples for successful applications with ReadyChain®

igus® ReadyChain® used for GEORG disposal vehicle - tested quality among hard conditions

igus® ReadyChain® used for travel axles for 6-axles robots – standard filling with additional options

igus® ReadyChain® for plastic processing machines – perfect filling for high service life

igus® ReadyChain® with industry patch plugs – faster starting-up, simple assembling

igus® ReadyChain® used for a zigzag application of an illumination cross arm, Royal Opera, London

igus® ReadyChain® used for terotechnology – serial applications with different travels

+++++ We are professionals for Energy Chain® harnessing +++++

Assembly

At home or abroad – igus® assembles the ReadyChains® for you "ready for occupancy"

The larger the building site, the more inscrutable is the team play of general businessman, subcontractors, erectors of industrial plants and individual craftsman which are participating to provide the overall performance. Today the installation of an Energy Chain System® for the use of high-grade plants often need more than 100 m travel and/or masses of several tons.

The following factors rapidly increase costs of the plant to non-calculated amounts:

- Replacement of parts
- Additional costs for assembly
- Costly waiting period
- Deadline pressure for follow-up work
- Loss of production in case of exceeding deadlines

To contribute to the increasing complexity of the installation we lately offer assembly and pre-harnessing.

As a system supplier we can yield all necessary performances until starting up from the first to the last maneuverable point. Only the electrical connection and the involved entire starting up need to be done by a technical engineer.

Ask for "ready for occupancy" Energy Chain Systems® at igus®.

igus® ReadyChains® ready to assemble "from the roll"

Treasure Island Energy Chain Systems® under water with on-site assembly

+++++ We are professionals for Energy Chain® harnessing +++++

Planning

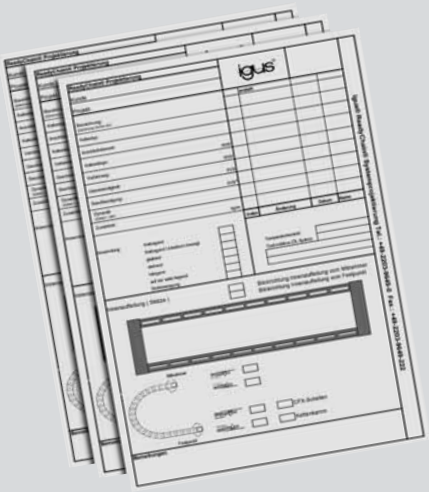
Reduce your planning expenses

Reduce your planning expenses. We relieve you from as much work as possible. Our trained staff will step by step support a smooth realization of your ReadyChain® project.

We can answer many of your questions already on the Telephone and demonstrate all advantages of ReadyChain® for your business **Tel. +49-22 03-96 49-800**

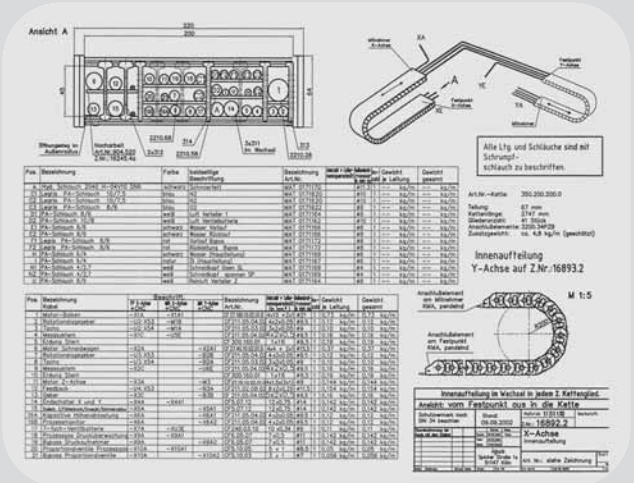
We collect on-site all necessary data for the purpose of precise planning expenses. At the same time we go into your specific application.

igus® staff at the
"on-site inspection" of a plant

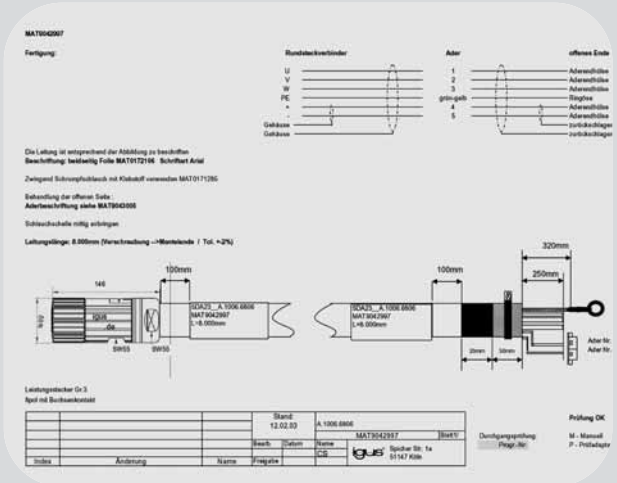


Planning with well thought-out
forms and special software

We can submit
a complex offer within a week



Drawing up
detailed design worksheets



Precise job and grouping
of cables planning for each cable

+++++ We are professionals for Energy Chain® harnessing +++++

Date:	Phone: +49-22 03-96 49-0 Fax: +49-22 03-96 49-222
Sender: Phone: Fax:	Recipient: **igus® GmbH** Technical Marketing Energy Chain Systems® P.O. Box 90 61 23 51127 Cologne, Germany

Planning of ready-made Energy Chain Systems®

Chain type:_____ **Length:**_____

Filling:

Interior separation/separators

Sketch of the arrangement of the cables

Excess length 1	Plug end 1	Screw connection 1	Excess length 2	Screw connection 2	Plug end 2

igus®.de

igus® Chainflex®
Customer-specific cables for Energy Chain Systems®

Date:	Phone: +49-22 03-96 49-0 Fax: +49-22 03-96 49-222
Sender: Phone: Fax:	Recipient: **igus® GmbH** Technical Marketing Energy Chain Systems® P.O. Box 90 61 23 51127 Cologne, Germany

Special applications in the sector of flexible energy supply systems depend on special cables that function for a long time. As a manufacturer of Energy Chains® and the corresponding cables, we will plan your specific requirement case on a customized basis – already starting from a cable length of 500 meters. Planning and calculation security will save you time and money.

The is why our offers get to the point quickly. Please help us by filling out this questionnaire as completely as possible.

With several brief items of information from the selection list, we will be glad to make you an offer. But we will also be pleased to help in person or by telephone with the clarification of technical details.

Technical information

Mechanical properties of the requested cable

Application case (short description):

_____

_____

_____

_____

_____

Energy Chain® series _____

Bending radius **R** _____

Velocity **V** _____

Acceleration **a** _____

Travel distance **S** _____

Travel frequency

Number of double strokes/ day to be expected _____

Number of manufacturing days to be expected _____

or _____

Environment

Temperature (highest/lowest) _____

Chemical influences (oils, etc.) _____

Outdoor/Indoor use **O** ☐ **I** ☐

or _____

Electrical properties of the requested cable

Voltage class

≤ 30 V ☐
300/300 V ☐
300/500 V ☐
450/750 V ☐
600/1000 V ☐
or operating voltage _____

Cable type

Data cable ☐
Twisted-pair ☐
Fibre-optic ☐
Bus specification ☐
Control cable ☐
Motor cable ☐
Servo cable ☐
or other ☐ _____

Cores

Quantity / Cross section ☐ _____

Shielding

Total shield ☐
Pair shielding ☐

Sheath material

PVC ☐
PVC oil-proof in accordance with VDE ☐
PUR ☐
TPE ☐
Pair shielding ☐
Hybrid cable ☐
or other ☐ _____

Additional options

Flame-retardant ☐
Halogen-free ☐
or other ☐ _____

Approbation

CE ☐
CSA ☐
DESINA ☐
UL ☐
or other ☐ _____

Other items

Max. Ø external _____

Numeral printing/colour code **N** ☐ **C** ☐

Estimated requirement/year _____

Fax order ☐ Fax inquiry ☐ Chainflex®

igus®.de

Fax

Harnessing

Date:	Phone: +49-2203-96 49-0 Fax +49-2203-96 49-222
Sender: Phone: Fax:	Recipient: **igus® GmbH** Technical Marketing Chainflex® Cables P.O. Box 90 61 23 D-51127 Köln

Order No.

Page_____of_____pages

We are placing our order based on the general terms and conditions of igus® GmbH. Excessive and short deliveries of ± 10 % for cables conform with contractual agreements. Deliveries can be made in part-lengths. Some Chainflex® cables have length information printed on them in metres. igus® expressly points out that these specifications are not calibrated. Statutory VAT must be added to the prices.

Item number	igus® order numbers	Quantity	Price per unit

Delivery deadline:

Signature/stamp

Phone +49-22 03-96 49-800
Fax +49-22 03-96 49-222

igus® GmbH
51127 Cologne

www.igus.de
info@igus.de

igus® System Planning

Date:	Phone: +49-22 03-96 49-0 Fax: +49-22 03-96 49-222
Sender: Phone: Fax:	Recipient: **igus® GmbH** Technical Marketing Energy Chain Systems® P.O. Box 90 61 23 51127 Cologne, Germany

Please send us information on your application data to the extent possible. Within 24 hours, you will then receive a complete analysis together with a filling proposal and offer. Please call us if you have any questions.

Installation type

(Please check off)





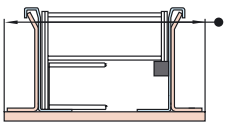




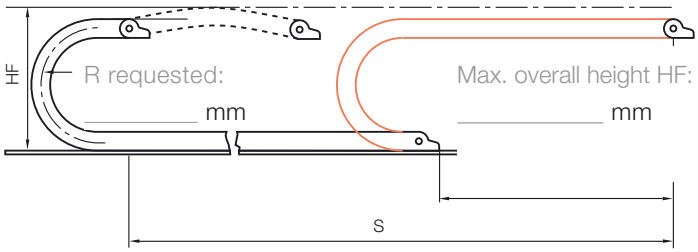
Installation space

Travel s: _____ mm

Fixed point:
Travel centre point ☐ yes
or _____ mm from centre point



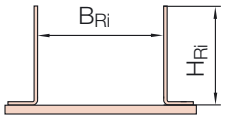
Overall width:
Max. overall width allowed?
_____ mm



R requested:
_____ mm

Max. overall height HF:
_____ mm

Guide exists?
☐ no
☐ yes. If yes, which guide:



Dimensions: B_{Ri} ___ mm

Dimensions: H_{Ri} ___ mm

Installation location/floor, wall, console: _____ mm Supporting width (standard = 2 m) _____ mm

Dynamics

Velocity: _____ (m/s) Acceleration: _____ (m/s^2)

Distances/day: _____ Days/year: _____ Ø Distance: _____

Environment

Temperature (°C): _____ Moisture (%): _____ Dust-dirt-chips: _____

Special details?: _____

Filling of the Energy Chains®

Quantity	Manufacturer/Art. no.	Cross sections	Ø	Weight kg/m	Permissible bending radius

Additional individual components requested:

Energy Chains® / Energy tube ☐
Chainflex® special cables ☐
Guiding troughs ☐
Strain relief ☐
Harnessing ☐
Assembly ☐
Other _____
igus® system guarantee requested? ☐

Energy Chains® ☐
Energy tube ☐
To be opened on both sides ☐
To be opened in outer radius ☐
To be opened in inner radius ☐

Special requests: _____


Designing

General rules for cables and hoses in Energy Chains®

Data and energy supply in all forms – in an Energy Chain System®

That is the big advantage of an igus® Energy Chain System®: You can safely accommodate many different forms of data cables and energy carriers in a system. It remains up to you, however, to decide how strictly you want to apply your rules to separating and subdividing various media. You can, for example, comply with the minimum separating distances between bus cables and motor cables and mix any pneumatic, electrical and hydraulic systems.

Rules for:

- **Maximum cable diameter**
- **Separation**
- **Bending radius**

Complete the fax form on page 257of the catalog – and receive your finished project suggestion in a few hours!

In addition to the quality of the cables being used, the arrangement of a cable within a chain as well as the space conditions. Many different separation variants make it possible to adapt the Energy Chains® to suit the specific requirements of each application. Generalized rules such as "No more than 80% of the clear space of Energy Chains® is allowed to be used" no longer make sense given the complexity of present-day applications. In this chapter, we will attempt to give you detailed recommendations. Due to the large number of application variants, we recommend that you use our free planning service in any case. Specify your requested cables – or also only the demanded electrical or other output data – and you will then receive the recommendation we have worked out for you.

Fax form on page 257+ Internet questionnaire at www.igus.de or simply give us a telephone call. Within a few hours, you will be holding a detailed system suggestion in your hands.

Hydraulic and electrical systems (in closed section) are separated from one other in this example.

Perfectly installed cables with igus® interior separation

Maximum cable diameter

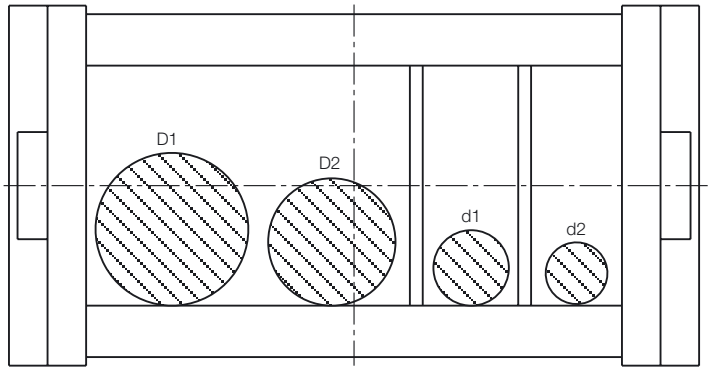
The maximum cable diameter corresponds to the clear height of the selected Energy Chains®/ energy tubes minus the reserve space. This minimum reserve space, for example, amounts to 10% for electrical round cables, and 20% for hydraulic hoses. Energy Chains® are ideally filled when a lateral minimum separating distance to the next cable or wall is provided. Depending on the structure of the cables and the dynamics and the service life, extra reserve space must be provided in addition. In cases of exception, the filling can also be designed to meet more confined space requirements.
Please discuss this subject with us.

Electrical cables require at least 10% of reserve space "all-round", hydraulic hoses 20%

The maximum cable diameter is specified for each series in the relevant chapter

Separation in Energy Chains®

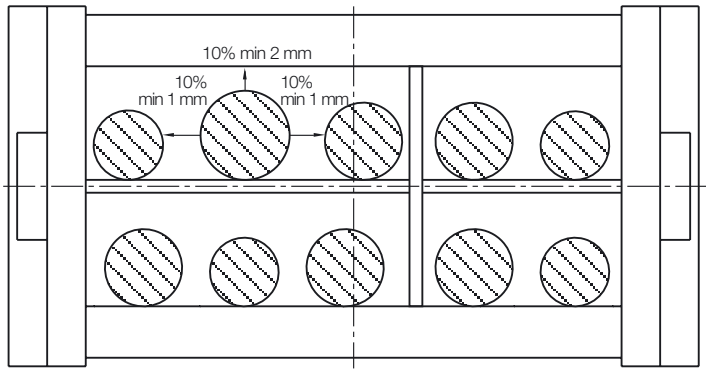
- Cables with extremely varying diameters should be installed so that they are separated from one another. The separation is provided by means of separators.
- Cables must never have the possibility of being able to push themselves over one another. This is why the clear height of a compartment with several equally thick cables lying next to one another must **never amount to more than the cable diameter plus 50%.**



D1 + D2 > 1,2 x hi **d1 + d2 ≤ 1,2 x hi**

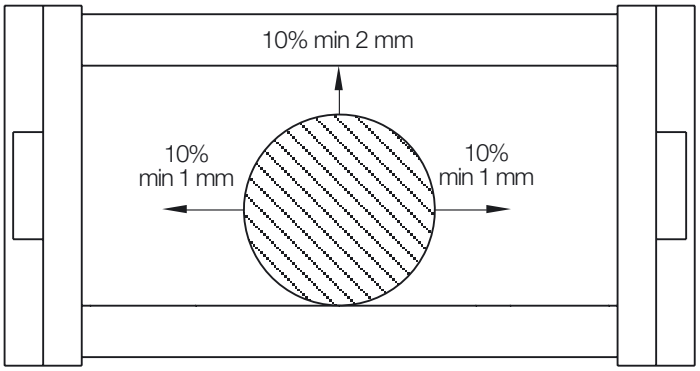
Expressed in rules, this means:

Rule 1:
If **D1 + D2 > 1.2 x chain inner height**, no separation must be made between the two cables. Two cables should never be allowed to lie on top of one another in unguided form or become tangled.



d1 + d2 ≤ 1,2 x hi

Rule 2:
If **d1 + d2 ≤ 1.2 x chain inner height**, a separator or a modular compartment bottom must be installed in order to reduce the inner height. This is done in order to prevent d1 and d2 from becoming "mixed up".



Reserve space "all-round" for electrical round cables

The reason for these rules is:
The cables must be installed and fastened so that they can move freely in longitudinal direction at any time and do not exert any tensile force in the radius on the Energy Chains®.

In case of applications with high travel velocities and many load cycles, no cables are allowed to be placed on top of one another **without a horizontal separation.**
The guidance values for these applications are:

Travel velocity exceeding **0.5 m/s** and load cycles exceeding **10,000 p.a.**

The igus® interior separation offers a reliable solution for these applications.

Reserve space capacities in % for various cables

Cables	Reserve space "all-round"
Electrical round cables	**10 %**
Electrical flat cables	**10 %**
Pneumatics	**5 - 10%**
Hydraulics	**20 %**
Media hoses	**15 - 20 %**

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Further information on the separation of cables

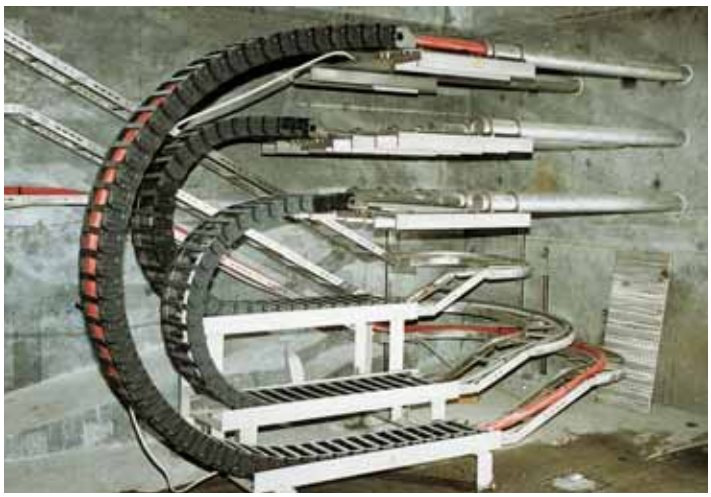
- The cable weight should be distributed symmetrically across the width of the chain.
- In the case of cables with different external jackets, it is important to make sure that they do not become "stuck together". If appropriate, they may have to be installed separately. igus® Chainflex® cables of all the series can be combined with one another.
- The cables should always be fastened with a strain relief device at the fixed end and at the moving end. Exceptions are only to be found in the case of some hydraulic hoses with length compensation or in the case of other high-pressure hoses. (see "Hydraulic hoses")
- Generally speaking, the following applies: The faster and more frequently the Energy Chains® travel, the more important the precise assignment of the cables in the chain will be. Due to the large number of variants, we will gladly advise you with your specific application.

Bending radius R

- The bending radius of your Energy Chains® is a factor of the "thickest" or "stiffest" cable or hose in your filling.
- The bending radius of the Energy Chains® should be adapted to suit the recommendations of the cable manufacturer. The selection of bending radius grater than the minimum bending radius has a positive effect on the service life to be expected.
- The specification of minimum bending radii in the case of cables applies to service use at normal temperatures. The use of other bending radii may therefore be advisable. Please ask your cable supplier.

The igus® kit of Energy Chain Systems® solves all the requirements for interior separation known today

igus® Chainflex® cables also allow for minimum bending radii of 5 x d together with millions of strokes.



The igus® product range offers up to 12 different bending radii for each chain series from stock. Here series 50 in the Storebaelt bridge project.

We will be glad to give you our recommendations for a complete Energy Chain System®. The bending radii of all cables and hoses, interior separation and service life are then perfectly adapted to suit one another in the best possible way. Also ask us about the igus® system guarantee. ▶ Harnessing, **from page 247 onwards**

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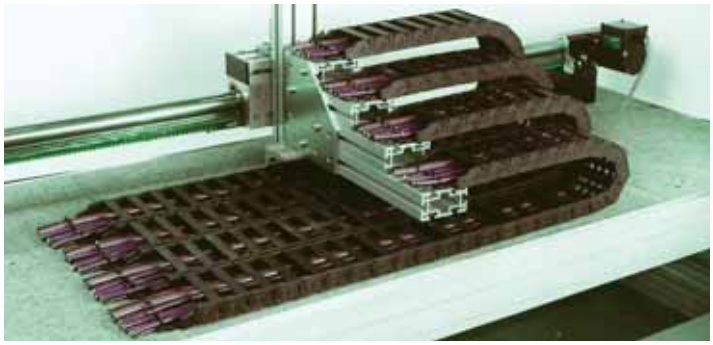
Electrical round cables

In the case of electrical cables, the round cable is a reliable, modular and low-cost solution for Energy Chain Systems®. For your purchase, we recommend that you consider the following criteria:

Selection criteria:

- Small minimum bending radii and mounting heights
- Service life with minimum bending radius
- Service life for your application case, e.g. short or long distance of travel or suspended installation use
- Test values for the service life based on practice-oriented experiments
- Uncomplicated handling during assembly, e.g. no detaching, laying out, etc.
- Strain relief device on the connection element should be possible
- Bending-resistant shields in the case of shielded cables
- Abrasion-resistant, readily gliding external jackets
- Large selection in order to avoid expensive production of single products

In the case of bus cables and fibre-optic cables, it is especially important to consider how well the transmission rates and the shielding effects are maintained after several million strokes in the minimum bending radius.



Example igus® experimental laboratory: constant development and testing of Chainflex® electrical round cables

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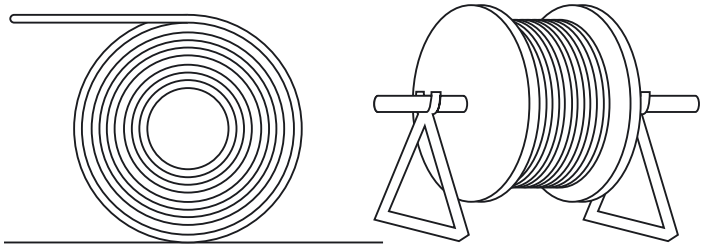
Information on assembly and strain relief of electrical round cables

1. The cables must be installed twist-free. Drums or rings are not allowed to be pulled off across the top. igus® Chainflex® cables are ready to be laid immediately. They do not need to be detached or laid out prior to the assembly procedure.
2. The cables must be laid so that each individual cable can move freely in longitudinal direction.
3. The cables must be able to move freely in the radius. This must be checked when the upper section reaches the biggest clear length.
4. The separation of the interior space by means of separators or by means of the igus® interior separation system is required whenever several or many cables with different diameters are being installed. It is important to make sure that the cables cannot wrap themselves around one another in spiral form.
5. In the case of cables with different external jackets, it is important to make sure that they do not become "stuck together". If appropriate, they may need to be separated. igus® Chainflex® cables of all the series can be combined with one another.
6. Electrical round cables must be fastened in strain-relieved form on both sides. In cases of exception, the cables must at least be fastened in strain-relieved form at the moving end of the Energy Chains®. A separating distance of 10-30 x cable diameter is recommended for most cables. Chainflex® cables, however, can be strain-relieved directly at the connection element, as confirmed by many series of tests.

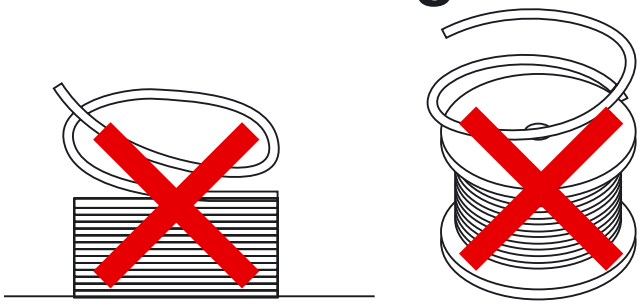
We will be glad to make you an offer on our ready-made Energy Chain Systems®: "igus® 3-K triple offer: chain, cable, harnessing".

▶ Harnessing, **from page 247 onwards**

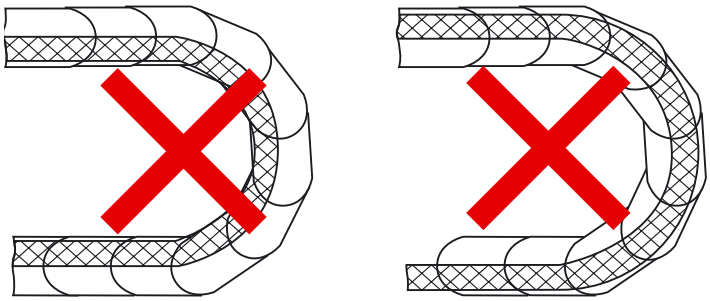
Correct!



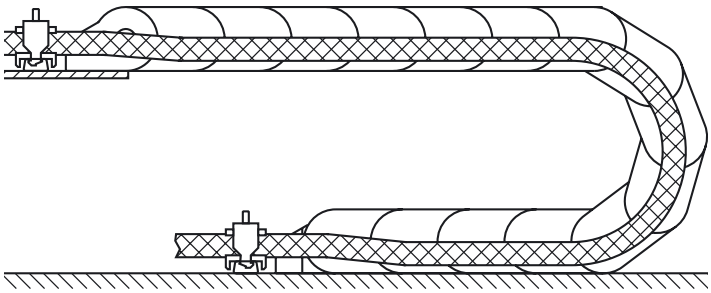
Wrong!



Wrong!



Cables must be able to move freely in the radius



Chainflex® cables can be strain-relieved directly at the connection element.

Corkscrewing: An imperfectly matched system can result in these failures.

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Pneumatic hoses

Basically, the same rules that apply to round cables also apply to pneumatic hoses. In practice, however, it can be seen that pneumatic hoses are less susceptible to malfunctions. Following proper consultation, they can also be laid to meet more confined space requirements than is provided for by the "10% reserve space all-round" rule. A strain relief device on both sides is usually the case here as well. In the case of pneumatic hoses made of rubber, we recommend strict compliance with the "10% reserve space" rule because these hoses tend to become "stuck together" among one another or with other cables.

Completely ready-made Energy Chain System® with several pneumatic hoses next to and on top of one another.

The igus® product range also offers thermoplastic pneumatic hoses "Chainflex® CF.Air".
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DIN 47100 color code (however, deviating from DIN: without color repetition after 44th core)*

1 white	17 white-grey	33 green-red	49 white-green-black
2 brown	18 grey-brown	34 yellow-red	50 brown-green-black
3 green	19 white-pink	35 green-black	51 white-yellow-black
4 yellow	20 pink-brown	36 yellow-black	52 yellow-brown-black
5 gray	21 white-blue	37 grey-blue	53 white-grey-black
6 pink	22 brown-blue	38 pink-blue	54 grey-brown-black
7 blue	23 white-red	39 grey-red	55 white-pink-black
8 red	24 brown-red	40 pink-red	56 pink-brown-black
9 black	25 white-black	41 grey-black	57 white-blue-black
10 violet	26 brown-black	42 pink-black	58 brown-blue-black
11 grey-pink	27 grey-green	43 blue-black	59 white-red-black
12 red-blue	28 yellow-grey	44 red-black	60 brown-red-black
13 white-green	29 pink-green	45 white-brown-black	61 black-white
14 brown-green	30 yellow-pink	46 yellow-green-black	
15 white-yellow	31 green-blue	47 grey-pink-black	
16 yellow-brown	32 yellow-blue	48 red-blue-black	

* Exception: 4-core cables are braided in the color sequence white, yellow, brown, green.

The first color indicates the basic color of the core insulation, and the second color indicates the color of the printed-on ring. In the case of three colors, the second and colors are printed on the basic color.

Calculation of the copper surcharge

The copper surcharge is the calculation of the difference between the calculated price (copper basis) and the fluctuating, actual price of the copper share in a cable. In calculatory terms, the list price of each Chainflex® cable is based on a copper price to the amount of € 150,-/100 kg of copper. In the end, however, this copper share is calculated on the basis of the current daily price according to the DEL (German abbr. = German electrolyte copper for conducting purposes) quotation.

The copper index specifies the weight of the copper share in a cable in kg/km. The product from the copper index (kg/km) and the price difference per kg of copper according to the DEL quotation then provides the copper surcharge in € per km of cable.

Here, the following example:

Cable:	Chainflex® CF9.15.18
Copper index:	260 kg/km
DEL quotation:	€ 189,–/100 kg Cu
Copper basis:	€ 150,–/100 kg Cu

$$\text{Copper index [kg/km]} \times \frac{\text{DEL quotation [€/100 kg]} - \text{Copper basis [€/100 kg]}}{100} = \text{Copper surcharge [€/km]}$$

$$260 \times \frac{189 - 150}{100} = \text{Copper surcharge [€/km]}$$

Copper surcharge = 101,40 €/km

For this example, the copper surcharge amounts to € 101,40/km of cable. Any discounts that are granted only apply to the cable prices but not to the copper surcharge. The copper surcharge is shown separately on our invoices.

Copper wire dimensions according to Anglo-American AWG numbers

AWG No.	Diameter mm	Cross section mm²	AWG No.	Diameter mm	Cross section mm²
500	17,96	253,00	18	1,024	0,823
350	15,03	177,00	20	0,813	0,519
250	12,70	127,00	22	0,643	0,324
4/0	11,88	107,20	24	0,511	0,205
3/0	10,40	85,00	26	0,405	0,128
2/0	9,27	67,50	28	0,320	0,0804
1/0	8,25	53,50	30	0,255	0,0507
1	7,35	42,40	32	0,203	0,0324
2	6,54	33,60	34	0,160	0,0200
4	5,19	21,20	36	0,127	0,0127
6	4,12	13,30	38	0,102	0,00811
8	3,26	8,37	40	0,079	0,00487
10	2,59	5,26	42	0,064	0,00317
12	2,05	3,31	44	0,051	0,00203
14	1,63	2,08			
16	1,29	1,31			

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The values from the tables on the side of this page have been taken from the standard DIN VDE 0298, Part 4. These values have been simplified and only apply approximately. For each user, it is advisable to obtain and comply with the regulations that apply to each individual case of application (e.g. measures for protection in case of indirect contact in accordance with DIN VDE 0100 Part 410, overcurrent protective devices in accordance with DIN VDE 0100 Part 430 or voltage drop in accordance with DIN VDE 0100 Part 520). It is not possible to provide all the regulations or overviews in this catalog. Due to the harmonization that has been carried out, it is possible that different load-carrying values may be permissible for the same cable in some cases. For the selection of the relevant cross sections, the load capacity in undisturbed operation is the determining factor, i.e. the use with permissible operating temperature or permissible maximum temperature on the conductor.

The load-bearing capacity according to Table 1 on this page applies to operating-current-carrying conductors. Normally, these are 2 loaded conductors in the case of 2-core and 3-core cables, as well as 3 loaded conductors in the case of 4-core and 5-core cables. Please take this into account when planning for the use of multi-core cables in electrical installation conduits or Energy Chains®. This information is based on an ambient temperature of 30°C and a non-loaded cable. Please apply the conversion factors according to Table 2 in case the air temperature is increased due to the heat loss of the cables (please take thermal radiation into account as well, e.g. effects of exposure to the sun).

The possible cable installation types in Energy Chains® result in such a broad range of loading profiles that no generalized conversion factors can be mentioned for this large accumulation of cables. The installation type and the conversion factors must be looked up in Table 3 according to each individual application.

Table 3: Conversion factors for multi-core cables with cable cross sections up to 10 mm²

Loaded cores	Conversion factor
5	0,75
7	0,65
10	0,55
14	0,50
19	0,45
24	0,40
40	0,35
61	0,30

Table 1: Cables for fixed installation in energy-conducting chains and tubes

Insulation material	PVC	TPE
Chainflex® type	CF2, CF5, CF6 CF7, CF8 CF130.UL CF140.UL	CF170.D, CF180, CF9, CF10 CF98, CF99, CF11, CF12 CF260, CF21.UL, CF27 CF30, CF31, CF34, CF35, CF300.UL, CF310.UL
Number of cores	2 or 3	2 or 3
Installation		

Nominal cross section	Load-carrying capacity in amperes	
Nominal cross of copper cable in mm²	PVC insulation	TPE insulation
0,14	2,5	2,5
0,25	4	5
0,34	5	7
0,50	8	10
0,75	12	14
1	15	17
1,50	18	21
2,50	26	30
4	34	41
6	44	53
10	61	74
16	82	99
25	108	131
35	135	162
50	168	202
70	207	250
95	250	301
120	292	352
150		404
185		461

Table 2: Conversion factors in case of varying ambient temperatures

Ambient temperature °C	Conversion factor	
	PVC insulation	TPE insulation
10	1,22	1,15
15	1,17	1,12
20	1,12	1,08
25	1,06	1,04
30	1,00	1,00
35	0,94	0,96
40	0,87	0,91
45	0,79	0,87
50	0,71	0,82
55	0,61	0,76
60	0,50	0,71
65	–	0,65
70	–	0,58
75	–	0,50
80	–	0,41
85	–	0,29
90	–	0,14

igus®.de Special Cables Information Color code table for CF211/CF111

New Part No.	Old Part No.	Number of cores and conductor nominal cross section [mm²]	Single core	Colour code
CF211.001	CF211.01.03.02.04.05.02	(3x(2x0,14)C+ (4x0,14)+(2x0,5))C	3x(2x0,14)C 4x0,14 2x0,5	yellow/green, black/brown, red/orange gray, blue, white-yellow, white-black brown-red, brown-blue
CF211.002	CF211.01.03.02.05.02	(3x(2x0,14)C+ (2x0,5C))C	3x(2x0,14)C 2x0,5C	green/yellow, black/brown, red/orange black, red
CF211.006	CF211.01.10.02.04.05.02	(3x(2x0,14)C+ (2x0,5+2x0,14)+ (4x0,23+2x0,14))C	3x(2x0,14)C 4x0,14 4x0,23	green/yellow, black/brown, red/orange gray, blue, white-yellow, white-black brown-yellow, brown-grey, green-black, green-red
			2x0,5	brown-red, brown-blue
CF211.009	–	(4x(2x0,25)+2x1,0)C	4x(2x0,25) 2x0,5	brown/green, blue/violet, gray/pink, red/black white, brown
CF211.010	CF211.02.04.02.10.02	(4x(2x0,25)+2x1,0)C	4x(2x0,25) 2x1,0	brown/green, blue/violet, gray/pink, red/black white, brown
CF211.011	CF211.03.04.02.05.04	(4x(2x0,34)+4x0,5)C	4x(2x0,34) 4x0,5	black/brown, red/orange, yellow/green, blue/violet blue-white, black-white, red-white, yellow-white
CF211.014	CF211.02.04.02.C.05.02	(4x(2x0,25)C+ 1x2x0,5)C	4x(2x0,25)C 2x0,5	white/brown, green/yellow, gray/pink, blue/red black (numeral printing 1-2)
CF211.016	CF211.02.C.03.02	(3x(2x0,25)C)C	3x(2x0,25)C	white/brown, green/yellow, gray/pink
CF211.017	CF211.01.04.02.10.04.01.04	(4x(2x0,14)+ 4x1,0+(4x0,14)C)C	(4x0,14)C 4x(2x0,14) 4x1,0	blue-black, red-black, yellow-black, green-black red/black, green/brown, yellow/violet, pink/gray white-green, brown-green, blue, white
CF211.018	CF211.02.02.02.05.02.	(2x(2x0,25)+2x0,5)C	2x(2x0,25) 2x0,5	red/black, gray/pink white, brown
CF211.019	CF211.02.02.03.02.03.10.02.D	(3x0,25+ 3x(2x0,25)C+2x1,0)C	3x(2x0,25)C 3x0,25 2x1,0	brown/green, pink/gray, red/black blue, yellow, violet white, brown
CF211.027	–	(5x(2x0,14) +2x0,5)C	5x(2x0,14) 2x0,5	green/brown, gray/yellow, white/violet, black/red, blue/pink white/green, white/red

Part No.	Number of cores and conductor nominal cross section [mm²]	Single core	Colour code
CF111.001.D	(3x(2x0,14)C+(4x0,14)+(2x0,5))C	3x(2x0,14)C 4x0,14 2x0,5	yellow/green, black/brown, red/orange gray, blue, white-yellow, white-black brown-red, brown-blue
CF111.004.D	(4x(2x0,14)+(4x0,14)C+4x0,5)C	4x(2x0,14) (4x0,14)C 4x0,5	brown/green, violet/yellow, gray/pink, red/black yellow-black, red-black, green-black, blue-black brown-green, white-green, blue, white
CF111.006.D	(3x(2x0,14)C+(2x0,5+2x0,14)+(4x0,23+2x0,14))C	3x(2x0,14)C 4x0,14 4x0,22 2x0,5	green/yellow, black/brown, red/orange gray, blue, white-yellow, white-black brown-yellow, brown-grey, green-black, green-red brown-red, brown-blue
CF111.011.D	(4x(2x0,34)+4x0,5)C	4x(2x0,34) 4x0,5	black/brown, red/orange, yellow/green, blue/violet blue-white, black-white, red-white, yellow-white
CF111.015.D	(4x(2x0,14)+4x0,5)C	4x(2x0,14) 4x0,5	brown/green, violet/yellow, gray/pink, red/black blue, white, brown-green, white-green
CF111.021.D	(6x0,5+5x2x0,25)C	(3x0,5) (3x0,5) (5x2x0,25)	black with numerals 1-3 red with numerals 1-3 yellow/white, gray/white, black/orange, white/brown, black/gray
CF111.022.D	(5x0,5+1x2x0,25)C	(5x0,5) (2x0,25)	blue, green, yellow, gray, pink white, brown
CF111.027.D	(5x(2x0,14)+2x0,5)C	5x(2x0,14) 2x0,5	green/brown, gray/yellow, white/violet, black/red, blue/pink white/green, white/red
CF111.028.D	(2x(2x0,15)+2x0,38)C	2x(2x0,15) 2x0,38	green/yellow, pink/blue red, black

New Part No.	Old Part No.	Number of cores and conductor nominal cross section [mm²]	Single core	Colour code
CF11.001.D	CF11.01.03.02.02.04.05.02.D	(3x(2x0,14)C+	3x(2x0,14)C	yellow/green, black/brown, red/orange
		(4x0,14)+(2x0,5))C	4x0,14	gray, blue, white-yellow, white-black
			2x0,5	brown-red, brown-blue
CF11.002.D	CF11.01.03.02.05.02.D	(3x(2x0,14)C+	3x(2x0,14)C	rün/yellow, black/brown, red/orange
		(2x0,5C))C	2x0,5C	black, red
CF11.003.D	CF11.01.03.02.10.02.D	(3x(2x0,14)+2x1,0)C	3x(2x0,14)	white/brown, green/yellow, gray/pink
			2x1,0	blue, red
CF11.004.D	CF11.01.04.02.01.04.05.04.D	(4x(2x0,14)+	4x(2x0,14)	brown/green, violet/yellow, gray/pink, red/black
		(4x0,14)C+4x0,5)C	(4x0,14)C	yellow-black, red-black, green-black, blue-black
			4x0,5	brown-green, white-green, blue, white
CF11.005.D	CF11.01.04.02.05.04.D	(4x(2x0,14)+4x0,5)C	4x(2x0,14)	white/brown, green/yellow, gray/pink, blue/red
			4x0,5	black, violet, grey-pink, red-blue
CF11.006.D	CF11.01.10.02.04.05.02.D	(3x(2x0,14)C+	3x(2x0,14)C	green/yellow, black/brown, red/orange
		(2x0,5+2x0,14)+	4x0,14	gray, blue, white-yellow, white-black
		(4x0,23+2x0,14))C	4x0,23	brown-yellow, brown-grey, green-black, green-red
			2x0,5	brown-red, brown-blue
CF11.007.D	CF11.03.02.02.D	(2x(2x0,34))C	4x0,34	white, brown, green, yellow
CF11.008.D	CF11.02.03.02.D	(3x(2x0,25))C	3x(2x0,25)	white/brown, green/yellow, gray/pink
CF11.009.D	CF11.02.04.02.05.02.D	(4x(2x0,25)+2x0,5)C	4x(2x0,25)	brown/green, blue/violet, gray/pink, red/black
			2x0,5	white, brown
CF11.010.D	CF11.02.04.02.10.02.D	(4x(2x0,25)+2x1,0)C	4x(2x0,25)	brown/green, blue/violet, gray/pink, red/black
			2x1,0	white, brown
CF11.011.D	CF11.03.04.02.05.04.D	(4x(2x0,34)+4x0,5)C	4x(2x0,34)	black/brown, red/orange, yellow/green, blue/violet
			4x0,5	blue-white, black-white, red-white, yellow-white
CF11.012.D	CF11.01.06.03.04.02.05.02.D	(3x(2x0,14)C+	3x(2x0,14)C	green/yellow, white/gray, blue/red
		(2x0,5+6x0,14)+	(3x0,14)C	red, green, brown
		(1x(3x0,14)C)C	6x0,14	blue, gray, gray, yellow, pink, violet
			2x0,5	brown-red, brown-blue
CF11.013.D	CF11.01.03.02.C.05.02.D	(3x(2x0,14)C+2x0,5)C	3x(2x0,14)C	white/brown, green/yellow, gray/pink
			2x0,5	red, blue
CF11.015.D		(4x(2x0,14)+4x0,5)C	4x(2x0,14)	brown/green, violet/yellow, gray/pink, red/black
			4x0,5	blue, white, brown-green, white-green
CF11.017.D	CF11.01.002.10.04.01.04.D	(4x(2x0,14)+	(4x0,14)C	blue-black, red-black, yellow-black, green-black
		4x1,0+(4x0,14)C)C	4x(2x0,14)	red/black, green/brown, yellow/violet, pink/gray
			4x1,0	white-green, brown-green, blue, white
CF11.018.D	CF11.02.02.02.05.02.D	(2x(2x0,25)+2x0,5)C	2x(2x0,25)	red/black, gray/pink
			2x0,5	white, brown
CF11.019.D	CF11.02.02.03.02.03.10.02.D	(3x0,25+	3x(2x0,25)C	brown/green, pink/gray, red/black
		3x(2x0,25)C+2x1,0)C	3x0,25	blue, yellow, violet
			2x1,0	white, brown
CF11.021.D	–	(6x0,5+5x2x0,25)C	(3x0,5)	black with numerals 1-3
			(3x0,5)	red with numerals 1-3
			(5x2x0,25)	yellow/white, gray/white, black/orange, white/brown, black/gray
CF11.022.D	–	(5x0,5+1x2x0,25)C	(5x0,5)	blue, green, yellow, gray, pink
			(2x0,25)	white, brown
CF11.025.D	–	(3x(2x0,14)C	3x(2x0,14)	green/yellow, blue/red, gray/pink
		+(2x0,5)C)C	(2x0,5)	white, brown
CF11.027.D	–	(5x(2x0,14)	5x(2x0,14)	green/brown, gray/yellow, white/violet, black/red, blue/pink
		+2x0,5)C	2x0,5	white/green, white/red

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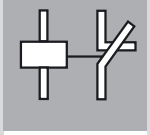

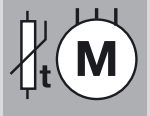

The following tables provide measured values on the electrotechnical data of the cables available at the time of the survey. The values are understood as being approximate values. For precise information on the actually available cables, individual measurements are absolutely required.

The specification of the characteristic wave impedance at high frequencies in Ω is an important quantity for a reflection-free matching of cables, e.g. in bus systems. With respect to the combination of various cables types and lengths, an adaptation must be provided via a matching resistor.

Cable type CF130.UL, Nominal cross section	0,14	0,25	0,34	0,5	0,75	1	1,5	2,5	4	6	10
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.					52	39	26,6	16			
Loop capacitance in nF/km approx.					120	125	125	125			
Loop inductance in µH/km approx.					670	670	670	670			
Characteristic wave impedance at 800 Hz in Ω					275	225	200	150			
Capacitance of one core versus all other cores in nF/km					180	190	190	190			

Cable type CF140.UL, Nominal cross section	0,14	0,25	0,34	0,5	0,75	1	1,5	2,5	4	6	10
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.					52	39	26,6				
Loop capacitance in nF/km approx.					120	130	150				
Loop inductance in µH/km approx.					670	670	670				
Characteristic wave impedance at 800 Hz in Ω					275	225	175				
Capacitance of one core versus all other cores in nF/km					200	220	250				

Cable type CF170.D, Nominal cross section	0,14	0,25	0,34	0,5	0,75	1	1,5	2,5	4	6	10
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.					52	39	26,6	16			
Loop capacitance in nF/km approx.					120	125	125	125			
Loop inductance in µH/km approx.					670	670	670	670			
Characteristic wave impedance at 800 Hz in Ω					275	225	200	150			
Capacitance of one core versus all other cores in nF/km					180	190	190	190			

Cable type CF180, Nominal cross section	0,14	0,25	0,34	0,5	0,75	1	1,5	2,5	4	6	10
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.							26,6				
Loop capacitance in nF/km approx.							85				
Loop inductance in µH/km approx.							770				
Characteristic wave impedance at 800 Hz in Ω							255				
Capacitance of one core versus all other cores in nF/km											

Cable type CF5, Nominal cross section	0,14	0,25	0,34	0,5	0,75	1	1,5	2,5	4	6	10
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.				78	52	39	26,6	16			
Loop capacitance in nF/km approx.				100	120	125	125	125			
Loop inductance in µH/km approx.				670	670	670	670	670			
Characteristic wave impedance at 800 Hz in Ω				375	275	225	200	150			
Capacitance of one core versus all other cores in nF/km				170	180	190	190	190			

Cable type CF6, Nominal cross section	0,14	0,25	0,34	0,5	0,75	1	1,5	2,5	4	6	10
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.		160		78	52	39	26,6				
Loop capacitance in nF/km approx.		100		115	120	130	150				
Loop inductance in µH/km approx.		670		670	670	670	670				
Characteristic wave impedance at 800 Hz in Ω		550		350	275	225	175				
Capacitance of one core versus all other cores in nF/km		165		190	200	220	250				

Cable type CF7/CF7.D, Nominal cross section	0,14	0,25	0,34	0,5	0,75	1	1,5	2,5	4	6	10
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.				78	52	39	26,6	16			
Loop capacitance in nF/km approx.				100	120	125	125	125			
Loop inductance in µH/km approx.				670	670	670	670	670			
Characteristic wave impedance at 800 Hz in Ω				375	275	225	200	150			
Capacitance of one core versus all other cores in nF/km				170	180	190	190	190			

Cable type CF8, Nominal cross section	0,14	0,25	0,34	0,5	0,75	1	1,5	2,5	4	6	10
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.				78	52	39	26,6				
Loop capacitance in nF/km approx.				115	120	130	150				
Loop inductance in µH/km approx.				670	670	670	670				
Characteristic wave impedance at 800 Hz in Ω				350	275	225	175				
Capacitance of one core versus all other cores in nF/km				190	200	220	250				

Cable type CF2, Nominal cross section	0,14	0,25	0,34	0,5	0,75	1	1,5	2,5	4	6	10
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.		160		78	52	39	26,6				
Loop capacitance in nF/km approx.	90	100		110	120	130	150				
Loop inductance in µH/km approx.	670	670		670	670	670	670				
Characteristic wave impedance at 800 Hz in Ω	750	550		350	275	225	175				
Capacitance of one core versus all other cores in nF/km	145	165		185	195	210	250				

Cable type CF9, Nominal cross section	0,14	0,25	0,34	0,5	0,75	1	1,5	2,5	4	6	10
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.					52	39	26,6	16			
Loop capacitance in nF/km approx.					100	110	110	120			
Loop inductance in µH/km approx.					620	620	620	620			
Characteristic wave impedance at 800 Hz in Ω					300	250	200	150			
Capacitance of one core versus all other cores in nF/km					170	170	170	190			

Cable type CF10, Nominal cross section	0,14	0,25	0,34	0,5	0,75	1	1,5	2,5	4	6	10
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.	280	160									
Loop capacitance in nF/km approx.	90	100									
Loop inductance in µH/km approx.	630	630									
Characteristic wave impedance at 800 Hz in Ω	750	525									
Capacitance of one core versus all other cores in nF/km	140	160									

Cable type CF240, Nominal cross section	0,14	0,25	0,34	0,5	0,75	1	1,5	2,5	4	6	10
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.											
Loop capacitance in nF/km approx.											
Loop inductance in µH/km approx.											
Characteristic wave impedance at 800 Hz in Ω											
Capacitance of one core versus all other cores in nF/km											

Cable type CF211, Nominal cross section	0,14	0,25	0,34	0,5	0,75	1	1,5	2,5	4	6	10
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.		160		79							
Loop capacitance in nF/km approx.		110		143							
Loop inductance in µH/km approx.		600		530							
Characteristic wave impedance at 800 Hz in Ω		530		330							
Capacitance of one core versus all other cores in nF/km		80		65							

Cable type CF11/CF11.D, Nominal cross section	0,14	0,25	0,34	0,5	0,75	1	1,5	2,5	4	6	10
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.		160			52						
Loop capacitance in nF/km approx.		130			120						
Loop inductance in µH/km approx.		625			670						
Characteristic wave impedance at 800 Hz in Ω		480			275						
Characteristic wave impedance at high frequencies in Ω											

Cable type CF11.LC/CF11.LC.D, Nominal cross section	0,14	0,25	0,34	0,5	0,75	1	1,5	2,5	4	6	10
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.				78							
Loop capacitance in nF/km approx.				35							
Loop inductance in µH/km approx.				680							
Characteristic wave impedance at 800 Hz in Ω				650							
Characteristic wave impedance at high frequencies in Ω				120							

Cable type CF12, Nominal cross section	0,14	0,25	0,34	0,5	0,75	1	1,5	2,5	4	6	10
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.		160		78		31					
Loop capacitance in nF/km approx.		180		200		370					
Loop inductance in µH/km approx.		620		520							
Characteristic wave impedance at 800 Hz in Ω		420		280		130					
Characteristic wave impedance at high frequencies in Ω		60		50		35					

Cable type CF13, Nominal cross section	0,14	0,25	0,34	0,5	0,75	1	1,5	2,5	4	6	10
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.		162	102								
Loop capacitance in nF/km approx.		43	140								
Loop inductance in µH/km approx.		878	680								
Characteristic wave impedance at 800 Hz in Ω		878	395								
Characteristic wave impedance at high frequencies in Ω											

Cable type CF14 CAT5, Nominal cross section	0,14	0,25	0,34	0,5	0,75	1	1,5	2,5	4	6	10
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.		178									
Loop capacitance in nF/km approx.		54									
Loop inductance in µH/km approx.											
Characteristic wave impedance at 800 Hz in Ω		108									
Characteristic wave impedance at 100 MHz		100									

Cable type CF260, Energy conductor	0,75	1	1,5	2,5	4	6	10	16	25	35	50
Conductor loop consisting of two adjacent cores											
Single impedance in Ω/km app.		21	14,5	8,5	5,5	3,6	2,05	1,3	0,83	0,6	
Loop capacitance in nF/km approx.											
Loop inductance in µH/km approx.											
Characteristic wave impedance at 800 Hz in Ω											
Capacitance of one core versus all other cores in nF/km											

Cable type CF260, Signal pair	0,75	1	1,5	2,5	4	6	10	16	25	35	50
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.	54	41	28								
Loop capacitance in nF/km approx.			250								
Loop inductance in µH/km approx.		760	550								
Characteristic wave impedance at 800 Hz in Ω		196	135								
Capacitance of one core versus all other cores in nF/km		352	440								

Cable type CF21.UL, Energy conductor	0,75	1	1,5	2,5	4	6	10	16	25	35	50
Conductor loop consisting of two adjacent cores											
Single impedance in Ω/km app.		21	14,5	8,5	5,5	3,6	2,05	1,3	0,83	0,6	
Loop capacitance in nF/km approx.				170		170	150				
Loop inductance in µH/km approx.				700		700	700				
Characteristic wave impedance at 800 Hz in Ω				130		90	80				
Capacitance of one core versus all other cores in nF/km				290		290	260				

Cable type CF21.UL, Signal pair	0,75	1	1,5	2,5	4	6	10	16	25	35	50
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.	54	41	28								
Loop capacitance in nF/km approx.			250								
Loop inductance in µH/km approx.		760	550								
Characteristic wave impedance at 800 Hz in Ω		196	135								
Capacitance of one core versus all other cores in nF/km		352	440								

Cable type CF27, Energy conductor	0,75	1	1,5	2,5	4	6	10	16	25	35	50
Conductor loop consisting of two adjacent cores											
Single impedance in Ω/km app.		21	14,5	8,5	5,5	3,6	2,05	1,3	0,83	0,6	
Loop capacitance in nF/km approx.											
Loop inductance in µH/km approx.			840								
Characteristic wave impedance at 800 Hz in Ω			190								
Capacitance of one core versus all other cores in nF/km			320								

Cable type CF27, Signal pair	0,75	1	1,5	2,5	4	6	10	16	25	35	50
Conductor loop consisting of two adjacent cores											
Loop resistance in Ω/km approx.	54	41	28								
Loop capacitance in nF/km approx.			250								
Loop inductance in µH/km approx.		760	550								
Characteristic wave impedance at 800 Hz in Ω		196	135								
Capacitance of one core versus all other cores in nF/km		352	440								

Cable type CF30, Nominal cross section	1	1,5	2,5	4	6	10	16	25	35	50	70
Conductor loop consisting of two adjacent cores											
Single impedance in Ω/km app.		13,5	7,61	4,8	3,3	1,91	1,21	0,78	0,53	0,37	
Loop capacitance in nF/km approx.				100	95	105	80	80			
Loop inductance in µH/km approx.				700	700	700	700	700			
Characteristic wave impedance at 800 Hz in Ω				140	120	100	100	100			
Capacitance of one core versus all other cores in nF/km				150	150	160	120	120			

Cable type CF31, Nominal cross section	1	1,5	2,5	4	6	10	16	25	35	50	70
Conductor loop consisting of two adjacent cores											
Single impedance in Ω/km app.		13,5	7,61	4,8	3,3	1,91	1,21	0,78	0,53	0,37	0,28
Loop capacitance in nF/km approx.				170	170	140	170	160	155		
Loop inductance in µH/km approx.				700	700	700	700	700	700	700	
Characteristic wave impedance at 800 Hz in Ω				110	90	80	70	70	70		
Capacitance of one core versus all other cores in nF/km				270	280	240	280	270	260	450	

Cable type CF34, Nominal cross section	1	1,5	2,5	4	6	10	16	25	35	50	70
Conductor loop consisting of two adjacent cores											
Single impedance in Ω/km app.		13,5	7,61	4,8	3,3	1,91	1,21	0,78	0,53	0,37	
Loop capacitance in nF/km approx.				100	95	105	80	80			
Loop inductance in µH/km approx.				700	700	700	700	700			
Characteristic wave impedance at 800 Hz in Ω				140	120	100	100	100			
Capacitance of one core versus all other cores in nF/km				150	150	160	120	120			

Cable type CF35, Nominal cross section	1	1,5	2,5	4	6	10	16	25	35	50	70
Conductor loop consisting of two adjacent cores											
Single impedance in Ω/km app.		13,5	7,61	4,8	3,3	1,91	1,21	0,78	0,53	0,37	
Loop capacitance in nF/km approx.				170	170	140	170	160	155		
Loop inductance in µH/km approx.				700	700	700	700	700	700	700	
Characteristic wave impedance at 800 Hz in Ω				110	90	80	70	70	70		
Capacitance of one core versus all other cores in nF/km				270	280	240	280	270	260	450	

Cable type CF300.UL, Nominal cross section	10	16	25	35	50	70	95	120	150	185	240
Resistance in Ω/km approx.	1,910	1,210	0,780	0,554	0,386	0,272	0,2060	0,161	0,129	0,106	0,0801

Cable type CF310.UL, Nominal cross section	10	16	25	35	50	70	95	120	150	185	240
Resistance in Ω/km approx.	1,910	1,210	0,780	0,554	0,386	0,272	0,2060	0,161	0,129	0,106	0,0801

Cable type	CF130.UL, CF140.UL	CF21.UL, CF30, CF31 CF5, CF6, CF240, CF211	CF170.D, CF180, CF2 CF7, CF8, CF13 CF260, CF27	CF9, CF10, CF98, CF11, CFBUS CF12, CF14, CFKoax1, CF34 CF35, CF300.UL, CFPE, CF310.UL
Inorganic chemicals				
Aqueous solutions, neutral				
Water	+	+	+	
Common salt (10%)	+	+	+	
Glauber's salt (10%)	+	+	+	
Aqueous solutions, alkaline				
Soda (10%)	O	+	O	+
Aqueous solutions, acid				
Sodium bisulfate (10%)	O	+	O	+
Aqueous solutions, oxidizing				
Hydrogen peroxide (10%)	+	+	+	
Potassium permanganate (2%)	+	+	+	
Inorganic acids				
Hydrochloric acid, concentrated	–	–	–	–
Hydrochloric acid (10%)	O	O	O	+
Sulfuric acid, concentrated	–	–	–	–
Sulfuric acid (10%)	O	O	O	+
Nitric acid, concentrated	–	–	–	–
Nitric acid (10%)	O	O	–	O
Inorganic caustic solutions				
Soda lye, concentrated	–	–	–	O
Soda lye (10%)	O	O	O	+
Potassium lye, concentrated	–	–	–	O
Potassium lye (10%)	O	O	O	+
Ammonia, concentrated	O	O	O	+
Ammonia (10%)	+	+	+	+
Organic chemicals /				
organic acids				
Acetic acid, concentrated (glacial acetic aci	–	–	–	O
Acetic acid (10% in H20)	O	+	O	+
Tartaric acid (10% in H20)	O	+	+	+
Citric acid (10% in H20)	O	+	+	+
Ketones				
Acetones	–	–	–	O
Methyl ethyl ketone (MEK)	–	–	–	O
Alcohols				
Ethyl alcohol (spirit)	–	O	O	+
Isopropyl alcohol	–	O	O	+
Diethylene glycol	O	O	+	+
Aromatic compounds				
Toluol	–	–	O	–
Xylol	–	–	O	–
Fuels				
Gasoline	–	O	+	+
Diesel fuel	–	O	+	+
Synthetic oils /				
lubricating oil				
ASTM oil #2	O	+	+	+
Hydraulic oil				
Mineral oil base	–	O	+	+
Glycol base	O	O	+	+
Synthetic ester base	–	O	+	+
Vegetable oils				
Rapeseed oil	O	+	+	+
Olive oil	O	+	+	+
Soya bean oil	O	+	+	+
Cold cleaning agent				
Cold cleaning agent	–	O	+	O

+ no or minimum negative influence

O medium reciprocal effect, short-term exposure permissible

– unstable, material partly destroyed

All information applies to room temperature

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Conditions for the use of cable and rope drums

(Status 03/2003 - www.kabeltrommel.de)

§ 1 Subject matter of the contract

The drums referred to in this contract are standard cable and rope drums from size 04 up to and including size 28.
Support materials and drum lagging are not covered by this contract..

§ 2 Entry into the contract

A contractual relationship with the following conditions is created between Kabeltrommel GmbH & Co. Kommanditgesellschaft, Cologne (hereinafter referred to as **KTG**) and the purchasers of cables or lines (hereinafter referred to as Purchaser) on the purchase from a cable manufacturer or wholesaler of cables or lines on **KTG**-marked drums at the time of arrival of the drums at the Purchaser or at the receiving point designated by the Purchaser.

§ 3 Rental

(1) For the renting of type <07 drums **KTG** will charge no rental, subject to the condition that these are returned to **KTG** within an appropriate time. If said drums are taken abroad, however, the respective selling price will be charged. Such taking of the drums abroad is to be notified to **KTG**.

(2) The following conditions apply to drums from size 07 up to and including size 28:

a) For a period of 6 months from the date on the delivery note of the respective supplier no rental will be charged. If the drums are not returned within the 6 months or notified as being free to **KTG** in writing or by telephone, **KTG** will charge a drum rental. From the 7th month this will amount to 15% of the selling price of the drums for each commenced month.

b) For drums which are not returned or notified as being free, either in writing or by telephone, to **KTG** within a period of 12 months, the full selling price, excluding any form of warranty, will be charged instead of the rental. The drums remain the property of **KTG** until the entire selling price has been paid. **KTG** is prepared to take back drums which are returned after the above-mentioned time but within a period of three years. Insofar as such drums are in a due and proper condition, **KTG** will refund 25% of the selling price.

c) The charge will be billed in each case after return of the drums or notification that they are free, but at the latest on expiry of the rental period of 12 months. Value-added tax will be charged at the statutory rate at the time of invoicing. Invoicing will take place exclusively on a Euro basis.

§ 4 Bearing of risk and liability by the Purchaser

The Purchaser bears the risk and is liable for all damage to drums from the time the contract commences up to takeover of the drums by **KTG** in accordance with § 6, insofar as they were not purchased in accordance with § 3, (2) b.

§ 5 Warranty and Liability of KTG

(1) The warranty of **KTG** for the condition and usability of the drums delivered is restricted to the technical details listed overleaf incl. the maximum loading capacity at the time of delivery to the purchaser. Any liability for invisible faults is excluded. **KTG** bears no responsibility for maintenance or repair whatsoever for drums which have been delivered.

(2) The liability of **KTG** - for whatever legal reason - is limited to the relevant indemnity given by **KTG**'s liability insurance which provides normal cover consisting of appropriate sums insured for personal injury and damage to property. Extended liability is - as far as legally permissible - excluded. Liability for wilful actions is unaffected.

§ 6 Return transport of drums

(1) The purchaser must continuously and immediately report all drums which have become free either in writing, by telephone or internet to **KTG** in order to initiate return transport. Return transport will normally be carried out via **KTG** within 5 working days of receipt of notification. After this period has expired the purchaser is requested by **KTG** to complain about any non-collection.The purchaser must enable the return transport to be carried out in a reasonable manner by the haulage company specified by **KTG**, especially with respect to providing sufficient information at the time of notification regarding the location of the drums. If the purchaser is responsible for any cancellation or delay of the return transport subsequent to notification, he is liable for compensation of the interest due on the rental until the actual time of return. §3 section 2b applies accordingly.

(2) The Purchaser must report all drums which have become free continuously and immediately in writing or by telephone to **KTG** in order to initiate return transport, which will be arranged by **KTG** within an appropriate period.

(3) **KTG** will bear the freight costs for the return transport; the Purchaser/party giving notification that the drums are free will be responsible for loading or loading costs at the place of despatch.

(4) All costs incurred because of failure to undertake the return transport in accordance with instructions will be borne by the Purchaser.

(5) If the Purchaser has taken drums abroad the Purchaser will arrange return transport at Purchaser's expense.

§ 7 Payments

KTG invoices will be paid at the latest 14 days after receipt without deduction. In the event of late payment we shall charge - in addition to reminder costs arising - interest of at least 5 % above the base lending rate of the European Central Bank or higher costs incurred by us owing to interim financing of the amount owed.

§ 8 Legal venue - Miscellaneous

(1) The legal venue for any and all disputes arising out of this contractual relationship is Cologne.

(2) **KTG** will also be entitled to take legal action at the domicile of the respective Purchaser.

(3) Changes and additions to this contract must be made in writing; this also applies to any change to this clause.

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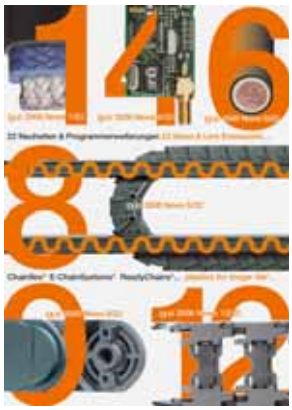

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