

guarantee

igus.eu ... chainflex® cables ... 2023 ... motion plastics...

chainflex® CF98,PLUS

100,000,000

100 million cycles ...



guaranteed for CF98.PLUS and CF99.PLUS

Guarantee
igus chainflex

36

up to 36 months guarantee

igus 36-month
chainflex cable
guarantee and
service life
calculator based
on 2 billion test
cycles per year



chainflex®

chainflex® works: Worldwide No. 1 in cable tests

... and in variety ... and with 36 month guarantee ... and with more than 25 years experience ... and 100 million EUR annual sales



Available from stock.

Ready for delivery in 24–48h, earlier upon request.

The delivery times indicated correspond to the average time until the ordered goods are dispatched.



No minimum order value! No surcharges!

No minimum order value with igus®. Just order the amount you need – no cutting charges (up to 10 cuts of the same type).



From 1 metre

Because chainflex® cables are high quality you only need to order the length you require. We appreciate every order from 1 m. In addition they can be planned in 0.5 m units.



36 month guarantee

We give a 36 month guarantee on every chainflex® cable. Up to 10 million double strokes guaranteed. Due to our tests in the largest lab for moved e-chain® cables, we are able to give a unique and reliable 36 month guarantee on our cables.



"7 to 8 plus Saturday" service

Monday to Friday 7.00 am to 8.00 pm

Saturday 8.00 am to 12.00 pm



Order hotline

Phone +49-2203 9649-800

Fax +49-2203 9649-222



Onlineshop www.chainflex.eu

Our complete product range incl. product finder, lifetime calculator and much more. Order around-the-clock!



Lifetime calculator www.igus.eu/chainflexlife

With the help of the chainflex® service life calculator, you can quickly and easily calculate the expected service life of chainflex® cables specifically for your application.



Do you have any questions?

If you have any questions, simply call us or use our online tools at www.chainflex.eu

Classification of chainflex® cables according to basic requirements, travel distance, oil-resistance and torsion

The chainflex® class is composed of 4 parts:

	Basic requirements	Travel distance	Oil resistance	Torsion
	1 to 7	1 to 6	1 to 4	1 to 4
1	Basic requirements	low	1 2 3 4 5 6 7	highest
2	Travel distance	unsupported	1 2 3 4 5 6	400 m +
3	Oil-resistance	none	1 2 3 4	highest
4	Torsion	none	1 2 3 4	±360°

- 1 Basic requirements**
- 1: Flexible cables
 - 2: Highly flexible cables
 - 3: Cables without special structure (e.g. winding in layers) for use in e-chains®.
 - 4: Cables with special structure for continuous movement in e-chains® for medium duty applications and radii from 7.5 x d, speed up to 3 m/s.
 - 5: Cables for continuous movement in e-chains® for heavy duty applications and radii from 6.8 x d, speed up to 10 m/s.
 - 6: Cables for continuous movement in e-chains® for heaviest duty applications and radii from 5 x d, speed up to 10 m/s.
 - 7: Cables for continuous movement in e-chains® for heaviest duty applications and smallest radii, indoor and outdoor, radii from 4 x d, speed up to 10 m/s and more.

- 2 Travel distance**
- 1: Unsupported travel up to 10 m
 - 2: Gliding travel up to 10 m
 - 3: Gliding travel up to 20 m
 - 4: Gliding travel up to 50 m
 - 5: Gliding travel up to 100 m
 - 6: Gliding travel up to 400 m and more

- 3 Oil resistance**
- 1: No oil resistance
 - 2: Oil-resistant (following DIN EN 50363-4-1)
 - 3: Oil-resistant (following DIN EN 50363-10-2)
 - 4: Oil-resistant (following EN 60811-404), bio-oil-resistant (following VDMA 24568 with Plantocut 8 S-MB tested by DEA)

- 4 Torsion**
- 1: No torsion
 - 2: ±90°, with 1 m cable length
 - 3: ±180°, with 1 m cable length
 - 4: ±360°, with 1 m cable length


To make selection easier, we have classified all chainflex® cables according to 4 criteria: basic application requirements, travel distance, oil resistance and torsion. The higher the number the better the cable.

Example: If you are looking for a cable which is suitable for the highest mechanical load, travel distance up to 100 m for unsupported and gliding applications and oil-resistant following DIN EN 60811-2-1.

Choose from the classification overview:

- Basic requirements: 7**
Travel distance: 5
Oil resistance: 4
Torsion: 2

This results in the cable classification – here "Class 7.5.4.2". This can be found on every product page.



Control cable | TPE | chainflex® CF88

36 40 million Double strokes guaranteed | **4 x d** Bend radius, e-chain® | **100m** Travel distance, e-chain®

- For heaviest duty applications and especially small radii down to 4 x d
- TPE outer jacket
- Oil and bio-oil-resistant
- PVC and halogen-free
- Low-temperature-flexible
- Hydrolysis and microbe-resistant

Dynamic information

- Bend radius:** e-chain® linear flexible fixed: minimum 4 x d, minimum 4 x d, minimum 3 x d; e-chain® linear flexible: -30°C up to +90°C; e-chain® linear flexible: -50°C up to +90°C following DIN EN 60811-504; fixed: -50°C up to +90°C following DIN EN 50305
- v max.:** unsupported gliding: 10m/s, 6m/s
- Travel distance:** Short, very fast applications with small radii and restricted installation space, Class 5
- Torsion:** Torsion ±90°, with 1 m cable length, Class 2

Cable structure

- Conductor:** Conductor consisting of a highly flexible special alloy.
- Core insulation:** Mechanically high-quality TPE mixture.
- Core structure:** Cores wound in a layer with especially short pitch length.
- Core identification:** Colour code in accordance with DIN 47100. CF88.02.03.LINE: brown, blue, black; CF88.03.04.LINE: brown, blue, black, white
- Outer jacket:** Low-adhesion, extremely abrasion-resistant and highly flexible TPE mixture, adapted to suit the requirements in e-chains®. Colour: Steel blue (similar to RAL 5011)

Electrical information

- Nominal voltage:** 300/300V
- Testing voltage:** 1500V

Properties and approvals

- UV resistance:** High
- Oil resistance:** Oil-resistant (following DIN EN 60811-404), bio-oil-resistant (following VDMA 24568 with Plantocut 8 S-MB tested by DEA), Class 4
- Silicone-free:** Free from silicone which can affect paint adhesion (following PV 3.10.7 – status 1992)
- Halogen-free:** Following DIN EN 60754
- UL verified:** Certificate No. B129899; *igus 36-month chainflex cable guarantee and service life calculator based on 2 billion test cycles per year*

Basic requirements: 7, Travel distance: 5, Oil resistance: 4, Torsion: 2

Class 7.5.4.2

EN EAC Certificate No. RU C-DEMET7.B.0030019

REACH In accordance with regulation (EC) No. 1907/2006 (REACH)

RoHS Following 2011/65/EC (RoHS-II/RoHS-III)

Lead-free Following 2011/65/EC (RoHS-II/RoHS-III)

Clearroom According to ISO Class 1. The outer jacket material of this series complies with CF9.15.07 - tested by IPA according to standard DIN EN ISO 14644-1

CE Following 2014/35/EU

UK UNCA CA In accordance with the valid regulations of the United Kingdom (as at 08/2021)

Guaranteed service life (details see page 28-29)

Operating temperature [°C]	Class 5		Class 7	
	R min. [factor x d]	R max. [factor x d]	R min. [factor x d]	R max. [factor x d]
-35/-25	5	6	7	7
-25/-10	4	5	6	6
+10/+90	5	6	6	7

* Higher number of double strokes? Service life calculation online ▶ www.igus.eu/chainflexlife

Typical application areas

- For heaviest duty applications and especially small radii down to 4 x d, Class 7
- Especially for short, very fast applications with small radii and restricted installation space, Class 5
- Almost unlimited resistance to oil, also with bio-oils, Class 4
- Torsion ±90°, with 1 m cable length, Class 2
- Indoor and outdoor applications, UV-resistant
- Pick and place machines, automatic doors, clearroom, very quick handling

Part No.	Number of cores and conductor nominal cross section [mm²]	Outer diameter (Ø) max. [mm]	Copper index [kg/km]	Weight [kg/km]
CF88.01.02	2x0.14	4.5	5	18
CF88.01.03	3x0.14	4.5	6	20
CF88.01.04	4x0.14	5.0	8	25
CF88.01.08	8x0.14	6.5	15	43
CF88.02.03.INI	3x0.25	5.0	11	29
CF88.02.04	4x0.25	5.5	15	36
CF88.02.08 (1)	8x0.25	7.5	30	67
CF88.03.04.INI	4x0.34	6.0	15	39
CF88.05.04	4x0.5	6.0	33	53

(1) Phase-out model

Note: The given outer diameter are maximum values and may tend toward lower tolerance limits. Ø is with green/yellow earth core, ø without earth core

Cables available in the chainflex® CASE

Simple savings on delivery, storage space and re-ordering with the chainflex® CASE - ship to store by igus®.

More on this on page 34/25 and online: www.igus.de/case

igus **UL-verified chainflex® guarantee ... www.igus.eu/ul-verified**

In theory the following classes would be possible:
 Lowest "Class 1.1.1.1", highest "Class 7.6.4.4"



Tested, tested, tested
chainflex® test lab

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chainflex®
Control cables

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chainflex®
Data/coax cables

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chainflex®
Bus cables

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chainflex®
Fibre Optic Cables

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chainflex®
Measuring system cables

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Servo cables

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Motor cables

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chainflex® CFROBOT
Twistable cables

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chainflex®
Special cables

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chainflex® CFCLEAN elements
for cleanroom applications

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chainflex®
Pneumatic hoses

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chainflex® selection according to "Class"

chainflex® Series	Basic requirements	Travel distance	Oil resistance	Torsion
CF880	3	1	1	1
CF881	3	1	1	1
CFLG88	3	1	1	1
CF884	3	1	1	1
CF885	3	1	1	1
CF885.PE	3	1	1	1
CF886	3	1	1	1
CF887	3	1	1	1
CF888	3	1	1	1
CF890	3	1	3	1
CF891	3	1	3	1
CF894	3	1	3	1
CF895	3	1	3	1
CF896	3	1	3	1
CF897	3	1	3	1
CF898	3	1	3	1
CF210.UL	4	2	2	1
CF210.UL (motor)	4	2	2	1
New! CF211 (measuring)	4	2	2	1
New! CF220.UL.H	4	2	2	1
New! CF111.D	4	2	3	1
CF270.UL.D	4	2	3	1
CF270.UL.D (motor)	4	2	3	1
New! CF280.UL.H	4	2	3	1
CFBUS.PVC	4	3	2	1
CFBUS.PUR	4	3	3	1
CF140.UL	4	4	1	1
CF130.UL	4	4	1	2
CF240	4	4	2	1
CF240.PUR	4	4	3	1
CF150.UL	4	4	3	2
CF160.UL	4	4	3	1
CF77.UL.D (robot)	5	1	3	3
CFLK	5	3	3	1
CFTHERMO	5	4	3	1
CF6	5	5	2	1
CF21.UL	5	5	2	1
CF211 (data)	5	5	2	1
CF31	5	5	2	1
CF5	5	5	2	2
CF30	5	5	2	2
CF78.UL	5	5	3	1
CF211.PUR (data)	5	5	3	1
CF77.UL.D	5	5	3	3
CFROBOT2	6	1	3	3
CFROBOT3	6	1	3	3
CFROBOT4	6	1	3	3

chainflex® Series	Basic requirements	Travel distance	Oil resistance	Torsion
CFROBOT7	6	1	3	3
CFROBOT8	6	1	3	3
CFROBOT9	6	1	3	3
New! CFROBOT8.PLUS	6	1	3	4
CFROBOT	6	1	4	3
CFROBOT5	6	1	4	3
CFROBOT6	6	1	4	3
CF2	6	5	3	1
CF112	6	5	3	1
CFLG.LB.PUR	6	5	3	1
CF113.D	6	5	3	1
CF27.D	6	5	3	1
CF27.D (motor)	6	5	3	1
CFCRANE	6	6	3	1
CFCRANE.PUR	6	6	3	1
CF10.UL	6	6	4	1
CF11	6	6	4	1
CF12	6	6	4	1
CFKCoax	6	6	4	1
CFBUS	6	6	4	1
CF11.D	6	6	4	1
CF35.UL	6	6	4	1
CF310.UL	6	6	4	1
CF9.UL	6	6	4	2
CF34.UL.D	6	6	4	2
CF300.UL.D	6	6	4	2
CFPE	6	6	4	2
CFSOFT1	7	1	2	2
CFSOFT2	7	1	2	2
CF99	7	5	4	1
CF299	7	5	4	1
CFLG.LB	7	5	4	1
New! CF99.PLUS	7	5	4	1
CFFLAT	7	5	4	1
CF98	7	5	4	2
CF298	7	5	4	2
New! CF98.PLUS	7	5	4	2
CFBUS.LB	7	6	4	1
CFLG.G	7	6	4	1
CF10	7	6	4	1
CF29.D	7	6	4	1
CF38	7	6	4	1
CF340	7	6	4	1
CF9	7	6	4	2
CF37.D	7	6	4	2
CF330.D	7	6	4	2



chainflex® for
Video / vision / bus technology

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chainflex® for
Network technology

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Harnessed Fibre Optic Cables
FOC

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CF.INI
Sensor/actuator cables

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chainflex® cables with
Industrial connectors

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Harnessed dress packs and cables
for robots

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Cables suitable for 24 manufacturer standards
Drive technology

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Connectors, tools and accessories
Connectors

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Condition monitoring and predictive maintenance
smart plastics New!

from page
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Strain relief
chainfix

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Ready-to-install assembled e-chain systems®
readychain®

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Technical appendix

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Control cables ...

chainflex® types



chainflex® cable	Jacket	Shield	Minimum bend radius, e-chain® [factor x d]	Temperature, e-chain® from/to [°C]	Price index	Approvals and standards	Flame retardant	Oil-resistant	Halogen-free	UV-resistant	Torsion-resistant	v max. unsupported [m/s]	v max. gliding [m/s]	a max. [m/s²]	chainflex® Class	Page
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Control cables 52

Guaranteed service life for these series (Details ▶ Page 28-29) Selection table ▶ From page 54




















	CF880	PVC		12.5	+5/ +70	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓				3	20	3.1.1.1	58	
	CF881	PVC	✓	12.5	+5/ +70	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓				3	20	3.1.1.1	62	
	CF130.UL	PVC		7.5	+5/ +70	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room				✓	3	2	20	4.4.1.2	66
	CF140.UL	PVC	✓	7.5	+5/ +70	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room					3	2	20	4.4.1.1	70
	CF150.UL	PVC		7.5	+5/ +70	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓	✓	3	2	20	4.4.3.2	74
	CF160.UL	PVC	✓	7.5	+5/ +70	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓		3	2	20	4.4.3.1	78
	CF5	PVC		6.8	+5/ +70	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓	✓	10	5	80	5.5.2.2	82
	CF6	PVC	✓	6.8	+5/ +70	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓		10	5	80	5.5.2.1	86
	CF50FT1	PVC		5	+5/ +70	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓	✓	10	5	80	7.1.2.1	90
	CF50FT2	PVC	✓	5	+5/ +70	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓		10	5	80	7.1.2.1	92
	CF890	iguPUR		12.5	-20/+80	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓		3	20	3.1.3.1	94	
	CF891	iguPUR	✓	12.5	-20/+80	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓		3	20	3.1.3.1	98	
	CF77.UL.D	PUR		6.8	-25/ +80	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓	✓	10	5	80	5.5.3.3	102
	CF78.UL	PUR	✓	6.8	-25/ +80	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓	✓	10	5	80	5.5.3.1	106
	CF2	PUR	✓	5	-20/+80	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓		10	5	80	6.5.3.1	110
	CF9	TPE		5	-35/ +100	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓	✓	10	6	100	7.6.4.2	114
	CF10	TPE	✓	5	-35/ +100	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓		10	6	100	7.6.4.1	118
	CF9.UL	TPE		5	-35/ +100	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓	✓	10	6	100	6.6.4.2	122
	CF10.UL	TPE	✓	5	-35/ +100	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓		10	6	100	6.6.4.1	126
	CF98	TPE		4	-35/ +90	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓	✓	10	6	100	7.5.4.2	130
	CF99	TPE	✓	4	-35/ +90	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓		10	6	100	7.5.4.1	132
	CF98.PLUS New!	TPE		3	-35/ +90	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓	✓	10	6	100	7.5.4.2	134
	CF99.PLUS New!	TPE	✓	3	-35/ +90	●●●	UL, IEC, NEMA, CE, EAC, REACH, RoHS, clean room	✓	✓	✓		10	6	100	7.5.4.1	138

These values are based on specific applications or tests. They 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 VDMA 24568 with Plantocut 8 S-MB.


Download the EPLAN library for any type of cable ▶ www.igus.eu/EPLAN-download

Get online and use all of the tools and data ▶ www.igus.eu/chainflex

chainflex® cable	Jacket	Shield	Minimum bend radius, e-chain® [factor x d]	Temperature, e-chain® from/to [°C]	Price index	Approvals and standards	Flame retardant	Oil-resistant	Halogen-free	UV-resistant	Torsion-resistant	v max. unsupported [m/s]	v max. gliding [m/s]	a max. [m/s²]	chainflex® Class	Page	
Data cables																	
Guaranteed service life for these series (Details ▶ Page 28-29)															Selection table ▶ Page 144		
	CF240	PVC	✓	10	+5/ +70	●●●		✓	✓			3	2	20	4.4.2.1	146	
	CF240.PUR	PUR	✓	10	-25/ +80	●●●		✓	✓	✓	✓	3	2	20	4.4.3.1	150	
	CF211	PVC	✓	7.5	+5/ +70	●●●		✓	✓			5	3	50	5.5.2.1	154	
	CF211.PUR	PUR	✓	7.5	-25/ +80	●●●		✓	✓	✓	✓	5	3	50	5.5.3.1	158	
	CF11	TPE	✓	6.8	-35/ +100	●●●			✓	✓	✓	10	6	100	6.6.4.1	162	
	CF112	PUR	✓	10	-25/ +80	●●●		✓	✓	✓	✓	10	5	80	6.5.3.1	166	
	CF12	TPE	✓	10	-35/ +100	●●●			✓	✓	✓	10	6	100	6.6.4.1	170	
	CF298	TPE		4	-35/ +90	●●●			✓	✓	✓	✓	10	6	100	7.5.4.2	172
	CF299	TPE	✓	4	-35/ +90	●●●			✓	✓	✓	10	6	100	7.5.4.1	174	
Coax cables																	
	CFKoax	TPE		10	-35/ +100	●●●					✓	✓	10	5	100	6.6.4.1	176

These values are based on specific applications or tests. They 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 VDMA 24568 with Plantocut 8 S-MB.

 Download the EPLAN library for any type of cable ▶ www.igus.eu/EPLAN-download

 Get online and use all of the tools and data ▶ www.igus.eu/chainflex

36-month chainflex® guarantee
 Guaranteed service life for predictable reliability
 ▶ Selection table page 144

With the help of the chainflex® service life calculator, you can quickly and easily calculate the expected service life of chainflex® cables specifically for your application:


 www.igus.eu/chainflexlife

Guarantee
igus chainflex

36























up to 36 months guarantee

igus 36-month
chainflex cable
guarantee and
service life
calculator based
on 2 billion test
cycles per year




Bus ... Ethernet ... FOC


chainflex® types

chainflex® cable	Jacket	Shield	Minimum bend radius, e-chain® [factor x d]	Temperature, e-chain® from/to [°C]	Price index	Approvals and standards	Flame retardant	Oil-resistant	Halogen-free	UV-resistant	Torsion-resistant	v max. unsupported [m/s]	v max. gliding [m/s]	a max. [m/s²]	chainflex® Class	Page
Bus cables																180
Guaranteed service life for these series (Details ► Page 28-29)																Selection table ► Page 182
	CF888	PVC	15	+5/ +70	●●●		✓					3	20	3.1.1.1	188	
	CFBUS.PVC	PVC	12.5	+5/ +70	●●●		✓	✓		✓		3	2	30	4.3.2.1	192
	CF898	iguPUR	15	-20/ +70	●●●		✓	✓		✓		3	20	3.1.3.1	196	
	CFBUS.PUR	PUR	12.5	-20/ +70	●●●		✓	✓	✓	✓		3	2	30	4.3.3.1	200
	CFBUS	TPE	10	-35/ +70	●●●		✓	✓		✓		10	6	100	6.6.4.1	204
	CFBUS.LB	TPE	7.5	-35/ +70	●●●			✓	✓	✓		10	6	100	7.6.4.1	210
Fibre Optic Cables																214
Guaranteed service life for these series (Details ► Page 28-29)																Selection table ► Page 218
	CFLK	PUR	12.5	-20/ +60	●●●			✓	✓	✓		10	5	20	5.3.3.1	220
	CFLG88	PVC	7.5	+5/ +70	●●●		✓					3	20	3.1.1.1	222	
	CFLG.LB.PUR	PUR	5	-35/ +80	●●●		✓	✓	✓	✓		10	6	20	6.5.3.1	224
	CFLG.LB	TPE	5	-35/ +80	●●●			✓	✓	✓		10	6	20	7.5.4.1	228
	CFLG.G	TPE	10	-40/ +80	●●●			✓	✓	✓		10	6	20	7.6.4.1	232

These values are based on specific applications or tests. They 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 VDMA 24568 with Plantocut 8 S-MB.

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36-month chainflex® guarantee

Guaranteed service life for predictable reliability

► Selection table page 182 (Bus) and page 218 (FOC)

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igus 36-month chainflex cable guarantee and service life calculator based on 2 billion test cycles per year

... measuring system ... servo ...

chainflex® types



chainflex® cable	Jacket	Shield	Minimum bend radius, e-chain® [factor x d]	Temperature, e-chain® from/to [°C]	Price index	Approvals and standards	Flame retardant	Oil-resistant	Halogen-free	UV-resistant	Torsion-resistant	v max. unsupported [m/s]	v max. gliding [m/s]	a max. [m/s²]	chainflex® Class	Page	
Measuring system cables																	236
Guaranteed service life for these series (Details ► Page 28-29)																	Selection table ► Page 238
	CF884	PVC	✓	15	+5/ +70	●●●	UL, IEC, NFPA, EAC, REACH, RoHS, CE, UK	✓				3	20	3.1.1.1	242		
	CF211	New! PVC	✓	10	+5/ +70	●●●	UL, IEC, NFPA, EAC, REACH, RoHS, clean room, CE, UK	✓	✓			5	3	30	4.2.2.1	246	
	CF894	iguPUR	✓	15	-20/+80	●●●	UL, IEC, NFPA, EAC, REACH, RoHS, CE, UK	✓	✓	✓		3	20	3.1.3.1	252		
	CF111.D	New! PUR	✓	10	-25/ +80	●●●	UL, IEC, NFPA, EAC, REACH, RoHS, clean room, CE, UK	✓	✓	✓	✓	5	3	30	4.2.3.1	256	
	CF113.D	PUR	✓	7.5	-25/ +80	●●●	UL, IEC, NFPA, EAC, REACH, RoHS, clean room, CE, UK	✓	✓	✓	✓	10	5	50	6.5.3.1	262	
	CF11.D	TPE	✓	6.8	-35/ +90	●●●	UL, IEC, NFPA, EAC, REACH, RoHS, clean room, CE, UK		✓	✓	✓	10	6	100	6.6.4.1	268	
Servo cables																	274
Guaranteed service life for these series (Details ► Page 28-29)																	Selection table ► Page 276
	CF887	PVC	✓	15	+5/ +70	●●●	UL, IEC, NFPA, EAC, REACH, RoHS, CE, UK	✓				3	20	3.1.1.1	280		
	CF210.UL	PVC	✓	10	+5/ +70	●●●	UL, IEC, NFPA, EAC, REACH, RoHS, clean room, CE, UK	✓	✓		✓	10	2	50	4.2.2.1	282	
	CF21.UL	PVC	✓	7.5	+5/ +70	●●●	UL, IEC, NFPA, EAC, REACH, RoHS, clean room, CE, UK	✓	✓		✓	10	5	80	5.5.2.1	286	
	CF897	iguPUR	✓	15	-20/+80	●●●	UL, IEC, NFPA, EAC, REACH, RoHS, CE, UK	✓	✓		✓	3	20	3.1.3.1	290		
	CF270.UL.D	PUR	✓	10	-25/ +80	●●●	UL, IEC, NFPA, EAC, REACH, RoHS, clean room, CE, UK	✓	✓	✓	✓	10	2	50	4.2.3.1	292	
	CF27.D	PUR	✓	7.5	-25/ +80	●●●	UL, IEC, NFPA, EAC, REACH, RoHS, clean room, CE, UK	✓	✓	✓	✓	10	5	80	6.5.3.1	296	
	CF29.D	TPE	✓	6.8	-35/ +100	●●●	UL, IEC, NFPA, EAC, REACH, RoHS, clean room, CE, UK		✓	✓	✓	10	5	80	7.6.4.1	300	
Hybrid cables																	
	CF220.UL.H	New! PVC	✓	10	+5/ +70	●●●	UL, IEC, NFPA, EAC, REACH, RoHS, clean room, CE, UK	✓	✓		✓	10	2	50	4.2.2.1	302	
	CF280.UL.H	New! PUR	✓	10	-25/ +80	●●●	UL, IEC, NFPA, EAC, REACH, RoHS, clean room, CE, UK	✓	✓	✓	✓	10	2	50	4.2.3.1	306	

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36-month chainflex® guarantee

Guaranteed service life for predictable reliability

► Selection table page 238 (measuring system) and page 276 (servo)

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... Motor cables ...

chainflex® types












chainflex® cable	Jacket	Shield	Minimum bend radius, e-chain® [factor x d]	Temperature, e-chain® from/to [°C]	Price index	Approvals and standards	Flame retardant	Oil-resistant	Halogen-free	UV-resistant	Torsion-resistant	v max. unsupported [m/s]	v max. gliding [m/s]	a max. [m/s²]	chainflex® Class	Page
Motor cables																
Guaranteed service life for these series (Details ▶ Page 28-29)														Selection table ▶ From page 314		
	CF885	PVC	15	+5/ +70	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, CE, UK, CB, ✓	✓					3	20	3.1.1.1	318	
	CF886	PVC	✓	15	+5/ +70	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, CE, UK, CB, ✓	✓				3	20	3.1.1.1	320	
	CF210.UL	PVC	✓	10	+5/ +70	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, clean room, CE, UK, CB, ✓, ✓	✓		✓		10	2	50	4.2.2.1	322
	CF30	PVC	7.5	+5/ +70	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, clean room, CE, UK, CB, ✓, ✓	✓	✓		✓	✓	10	5	80	5.5.2.2	324
	CF31	PVC	✓	7.5	+5/ +70	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, clean room, CE, UK, CB, ✓, ✓	✓	✓		✓	10	5	80	5.5.2.1	328
	CF895	iguPUR	15	-20/+80	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, CE, UK, CB, ✓, ✓	✓	✓		✓		3	20	3.1.3.1	332	
	CF896	iguPUR	✓	15	-20/+80	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, CE, UK, CB, ✓, ✓	✓	✓		✓	3	20	3.1.3.1	334	
	CF270.UL.D	PUR	✓	10	-25/ +80	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, clean room, CE, UK, CB, ✓, ✓, ✓, ✓	✓	✓	✓	✓	10	2	50	4.2.3.1	336
	CF27.D	PUR	✓	7.5	-25/ +80	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, clean room, CE, UK, CB, ✓, ✓, ✓, ✓	✓	✓	✓	✓	10	5	80	6.5.3.1	340
	CF34.UL.D	TPE	7.5	-35/ +90	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, clean room, CE, UK, CB, ✓, ✓	✓	✓		✓	✓	10	6	80	6.6.4.2	344
	CF35.UL	TPE	✓	7.5	-35/ +90	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, clean room, CE, UK, CB, ✓, ✓	✓	✓		✓	10	6	80	6.6.4.1	348
	CF37.D	TPE	7.5	-35/ +90	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, clean room, CE, UK, CB, ✓, ✓, ✓, ✓	✓	✓	✓	✓	✓	10	6	80	7.6.4.2	352
	CF38	TPE	✓	7.5	-35/ +90	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, clean room, CE, UK, CB, ✓, ✓, ✓	✓	✓	✓	✓	10	6	80	7.6.4.1	354
Spindle cables/Single cores																
	CF885	PVC	15	+5/ +70	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, CE, UK, CB, ✓	✓					3	20	3.1.1.1	356	
	CF885.PE	PVC	15	+5/ +70	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, CE, UK, CB, ✓	✓					3	20	3.1.1.1	358	
	CF886	PVC	✓	15	+5/ +70	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, CE, UK, CB, ✓	✓				3	20	3.1.1.1	360	
	CF270.UL.D	PUR	✓	10	-25/ +80	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, clean room, CE, UK, CB, ✓, ✓, ✓, ✓	✓	✓	✓	✓	10	2	50	4.2.3.1	362
	CF300.UL.D	TPE	7.5	-35/ +90	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, clean room, CE, UK, CB, ✓, ✓	✓	✓		✓	✓	10	6	100	6.6.4.2	364
	CFPE	TPE	7.5	-35/ +90	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, clean room, CE, UK, CB, ✓, ✓	✓	✓		✓	✓	10	6	100	6.6.4.2	366
	CF310.UL	TPE	✓	7.5	-35/ +90	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, clean room, CE, UK, CB, ✓, ✓	✓	✓		✓	10	6	100	6.6.4.1	368
	CF330.D	TPE	7.5	-35/ +90	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, clean room, CE, UK, CB, ✓, ✓, ✓, ✓	✓	✓	✓	✓	✓	10	6	100	7.6.4.2	370
	CF340	TPE	✓	7.5	-35/ +90	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, clean room, CE, UK, CB, ✓, ✓, ✓	✓	✓	✓	✓	10	6	100	7.6.4.1	372
Medium voltage cables																
	CFCRANE.PUR	PUR	✓	10	-20/+80	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, CE, UK, CB, ✓, ✓, ✓, ✓	✓	✓	✓	✓	10	6	50	6.6.3.1	374
	CFCRANE	igupren	✓	10	-20/+80	●●●	UL, IEC, NFPA, C, UL, A, EAC, REACH, RoHS, CE, UK, CB, ✓, ✓, ✓	✓	✓		✓	10	6	50	6.6.3.1	376

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... Robots ... Torsion ...


chainflex® types

chainflex® cable	Jacket	Shield	Minimum bend radius, e-chain® [factor x d]	Torsion angle [°/m]	Temperature, e-chain® from/to [°C]	Price index	Approvals and standards	Flame retardant	Oil-resistant	Halogen-free	UV-resistant	Torsion-resistant	v max. twisted [°/s]	a max. twisted [°/s²]	chainflex® Class	Page	
Twistable cables																	
Guaranteed service life for these series (Details ▶ Page 28-29) Selection table ▶ Page 382																	
Control cables																	
	CF77.UJ.D	PUR	6.8	±180	-25/ +80	●●●	UL, FM, TPC, NEMA, C-UL-A, EAC, REACH, RoHS, clean room, CE, UK, PA	✓	✓	✓	✓	✓	180	60	5.1.3.3	384	
	CFROBOT2	PUR	✓	10	±180	-25/ +80	●●●	UL, FM, TPC, NEMA, C-UL-A, EAC, REACH, RoHS, clean room, CE, UK, PA	✓	✓	✓	✓	✓	180	60	6.1.3.3	388
Data cable																	
	CFROBOT3	PUR	✓	10	±180	-25/ +80	●●●	UL, FM, TPC, NEMA, C-UL-A, EAC, REACH, RoHS, clean room, CE, UK, PA	✓	✓	✓	✓	✓	180	60	6.1.3.3	390
Measuring system cable																	
	CFROBOT4	PUR	✓	10	±180	-25/ +80	●●●	UL, FM, TPC, NEMA, C-UL-A, EAC, REACH, RoHS, clean room, CE, UK, PA	✓	✓	✓	✓	✓	180	60	6.1.3.3	392
Fibre Optic Cable																	
	CFROBOT5	TPE	10	±180	-35/ +80	●●●	UL, FM, TPC, NEMA, C-UL-A, EAC, REACH, RoHS, clean room, CE, UK, PA	✓	✓	✓	✓	✓	180	60	6.1.4.3	396	
Motor cables																	
	CFROBOT6	PUR	10	±180	-25/ +80	●●●	UL, FM, TPC, NEMA, C-UL-A, EAC, REACH, RoHS, clean room, CE, UK, PA	✓	✓	✓	✓	✓	180	60	6.1.3.3	398	
	CFROBOT7	PUR	✓	10	±180	-25/ +80	●●●	UL, FM, TPC, NEMA, C-UL-A, EAC, REACH, RoHS, clean room, CE, UK, PA	✓	✓	✓	✓	✓	180	60	6.1.3.3	400
Spindle cables/Single cores																	
	CFROBOT	TPE	✓	10	±180	-35/ +90	●●●	UL, FM, TPC, NEMA, C-UL-A, EAC, REACH, RoHS, clean room, CE, UK, PA	✓	✓	✓	✓	✓	180	60	6.1.4.3	404
Bus cables																	
	CFROBOT8	PUR	✓	10	±180	-25/ +70	●●●	UL, FM, TPC, NEMA, C-UL-A, EAC, REACH, RoHS, clean room, CE, UK, PA	✓	✓	✓	✓	✓	180	60	6.1.3.3	406
	CFROBOT8.PLUS New!	PUR	✓	10	±360	-25/ +70	●●●	UL, FM, TPC, NEMA, C-UL-A, EAC, REACH, RoHS, clean room, CE, UK, PA	✓	✓	✓	✓	✓	360	60	6.1.3.4	410
Hybrid cable																	
	CFROBOT9	PUR	✓	10	±180	-25/ +80	●●●	UL, FM, TPC, NEMA, C-UL-A, EAC, REACH, RoHS, clean room, CE, UK, PA	✓	✓	✓	✓	✓	180	60	6.1.3.3	414

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36-month chainflex® guarantee
 Guaranteed service life for predictable reliability
 ▶ Selection table page 382

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Guarantee
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36



































up to 36 months guarantee

igus 36-month chainflex cable guarantee and service life calculator based on 2 billion test cycles per year




... Special ... CFCLEAN ...

chainflex® types

chainflex® cable	Jacket	Shield	Minimum bend radius, e-chain® [factor x d]	Temperature, e-chain® from/to [°C]	Price index	Approvals and standards	Flame retardant	Oil-resistant	Halogen-free	UV-resistant	Torsion-resistant	v max. unsupported [m/s]	v max. gliding [m/s]	a max. [m/s²]	chainflex® Class	Page
Special cables																
	CFTHERMO	PUR	✓	12.5	-25/ +80	●●●		✓	✓	✓		2	1	20	5.4.3.1	420
	CFFLAT	TPE		5	-35/ +90	●●●		✓	✓	✓		10	6	100	7.5.4.1	422
	CFSPECIAL.182	PUR	✓	10	-25/ +80	●●●		✓	✓	✓	✓	10	6	100	-	424
	CFSPECIAL.192 New!	PUR	✓	10	-25/ +80	●●●		✓	✓	✓	✓	10	2	50	-	426
	CFSPECIAL.414			7.5	-20/+80	●●●		✓	✓	✓	✓	10	-	20	-	428
	CFSPECIAL.484		✓	12.5	-20/+80	●●●		✓	✓	✓	✓	10	-	20	-	430
	CFSPECIAL.532	PUR	✓	10	-25/ +80	●●●		✓	✓	✓	✓	10	2	50	-	432
	CFSPECIAL.562.PE	PUR	✓	10	-25/ +80	●●●		✓	✓	✓	✓	10	2	50	-	434
	CFSPECIAL.572	PUR	✓	10	-25/ +80	●●●		✓	✓	✓	✓	10	2	50	-	436
	CFSPECIAL.592 New!	PUR	✓	10	-25/ +80	●●●		✓	✓	✓	✓	10	2	50	-	438
	CFSPECIAL.792	PUR	✓	10	-25/ +80	●●●		✓	✓	✓	✓	3	2	20	-	440
CFCLEAN elements for cleanroom applications																
	CFCLEAN1 New!		✓	70mm	-10/ +80	●●●		✓				2	-	40		450
	CFCLEAN2 New!		✓	70mm	-10/ +80	●●●		✓				2	-	40		452
	CFCLEAN3 New!		✓	70mm	-10/ +80	●●●		✓				2	-	40		454
	CFCLEAN4 New!		✓	70mm	-10/ +80	●●●		✓				2	-	40		456
	CFCLEAN7 New!		✓	70mm	-10/ +80	●●●		✓				2	-	40		458
	CFCLEAN8 New!		✓	70mm	-10/ +80	●●●		✓				2	-	40		460

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chainflex® guarantee

























These series are solutions for special applications, please contact igus® for information about the service life guarantee:

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igus 36-month chainflex cable guarantee and service life calculator based on 2 billion test cycles per year

... Video ... Network ...


















Cable type	Jacket	Page
Harnessed bus cables		
 FireWire	Pre-harnessed cable	TPE 468
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 USB 3.0	Pre-harnessed cable	PVC/PUR 471
 GigE	Pre-harnessed cable	PUR-ROBOT/TPE 472
 DVI-D/HDMI	Pre-harnessed cable	TPE 473
Harnessed coax cables		
 Coax	Pre-harnessed cable (BNC/SMA)	TPE 474
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 Profibus	PVC/PUR/TPE	500
Harnessed Profinet cables		
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 DeviceNet with Binder M12 a-coded New	TPE	513

... FOC ... Sensor ... Actuator ...

Cable type	Jacket	Page
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 FOC 2 fibres	PVC/TPE	520
 FOC 4 fibres	TPE	521
Harnessed Fibre Optic Cables for network		
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 FOC 12 fibres	TPE	522
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 Linking cable M12 x 1, straight/angled	TPE	527
 Connection cable M12 x 1, straight/angled, LED	TPE	529
 Connection cable M8 x 1, straight/angled	TPE	531
 Linking cable M8 x 1, straight/angled	TPE	531
 Connection cable M8 x 1, angled, LED	TPE	533
Sensor/actuator CF10 - CF.INI (minimum bend radius 5 x d) 360° shielded		
 Connection cable M12 x 1, straight/angled	TPE	535
 Linking cable M12 x 1, straight/angled	TPE	535
Sensor/actuator CF98 - CF.INI (minimum bend radius 4 x d)		
 Connection cable M12 x 1, straight/angled	TPE	537
 Linking cable M12 x 1, straight/angled	TPE	537
 Connection cable M8 x 1, straight/angled	TPE	539
 Linking cable M8 x 1, straight/angled	TPE	539
chainflex® cables for actuator/sensor distribution box		
 Connection cable M23, straight	TPE	540
 Linking cable M23, straight/angled	TPE	540
 Connection cable M12, straight	TPE	541



























Industrial ... Robots ...

























Cable type	Page
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 Han 10B	Harnessed cable, single locking lever at both ends, straight Harnessed cable, single locking lever at both ends, angled 546
 Han 10B	Harnessed cable, double locking lever at both ends, straight Harnessed cable, double locking lever at both ends, angled 546
 Han 16B	Harnessed cable, single locking lever at both ends, straight Harnessed cable, single locking lever at both ends, angled 548
 Han 16B	Harnessed cable, double locking lever at both ends, straight Harnessed cable, double locking lever at both ends, angled 548
 Han 24B	Harnessed cable, single locking lever at both ends, straight Harnessed cable, single locking lever at both ends, angled 550
 Han 24B	Harnessed cable, double locking lever at both ends, straight Harnessed cable, double locking lever at both ends, angled 550
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... Drive technology ...



Selection according to manufacturer	Jacket	Page
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 Allen Bradley/ Rockwell	Motor/servo/hybrid servo/ brake/feedback/adaptor cables	PVC/PUR/TPE 584
 B&R	Motor/servo/EnDat/encoder/ resolver/bus cable	PVC/PUR/TPE 585
 Baumüller	Servo/resolver/pulse encoder cables	PVC/PUR/TPE 585
 Baumüller, SpeedTec New!	Servo/resolver/pulse encoder cables	PVC/PUR/TPE 588
 Beckhoff	Motor/servo/hybrid servo/encoder/thermal protection/resolver/network cables	PVC/PUR/TPE 590
 Berger Lahr	Servo/resolver cables	PVC/PUR/TPE 590
 Bosch Rexroth	Motor/servo/hybrid servo/ encoder cables	PVC/PUR/TPE 590
 ELAU/ Schneider Electric	Servo/hybrid servo/encoder cables	PVC/PUR/TPE 593
 FAGOR	Path measuring cables	PUR/TPE 593
 Fanuc	Motor/servo/brake/signal cables	PVC/PUR/TPE 593
 Festo	Servo/control/encoder/data/ bus cables	PVC/PUR/TPE 594
 Heidenhain	Servo/adaptor cables	PVC/PUR/TPE 594
 Jetter	Motor/servo/resolver cables	PVC/PUR/TPE 595
 Kollmorgen/ Danaher Motion	Motor/servo/signal cables	PVC/PUR/TPE 595
 Lenze	Servo/fan/decoder/encoder/ feedback/resolver cables	PVC/PUR/TPE 598
 LinMot	Motor/servo cables	PVC/PUR 599
 LTi DRIVES	Servo/encoder cables	PVC/PUR/TPE 599
 Mitsubishi Electric	Motor/encoder cables	PVC/PUR 599
 Nidec/Control Techniques	Motor/servo/encoder cables	PVC/PUR/TPE 598
 NUM	Power/servo/fan/encoder cables	PVC/PUR/TPE 601
 Omron	Motor/control/encoder cables	PVC/PUR/TPE 601
 Parker	Motor/resolver cables	PVC/PUR/TPE 601
 SEW	Motor/servo/hybrid servo/ control/encoder cables	PVC/PUR/TPE 602
 Siemens	Power/servo/signal cables	PVC/PUR/TPE 603
 Siemens, Speedtec	Power/servo/signal cables	PVC/PUR/TPE 606
 Stöber	Servo/encoder cables	PVC/PUR/TPE 607

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Storage made easy ...

chainflex® CASE S and CASE M



The chainflex® CASE is a cardboard box that allows cable drum shipping without a pallet. This means that the goods can be sent by a parcel carrier. The chainflex® CASE is not only used for transport, but also works as a storage system for cable drums. The cable can be easily unreeled directly from the box. Thanks to its stackability, you can set up flexible storage facilities. The QR code on the shipping box makes online re-ordering easy. All in all, this system helps you save shipping, process and storage costs.



chainflex® CASE application example from the field: BSH Hausgeräte GmbH
"The maintenance staff at the BSH plant in Bad Neustadt an der Saale have implemented a real "out of the box" solution. Electrical cables no longer arrive by hank or cable drum, but in the "chainflex CASE" shipping and storage solution. This saves costs, space and waste."

chainflex® CASE allows cable drums to be shipped in a cardboard box via parcel carriers. Very simple and you can save up to 84% shipping cost compared to standard shipping on a pallet by a freight forwarder.



Remove expensive storage systems for cable drums. Unreel the cable immediately from the chainflex® CASE. Carrying handles and stackability allow for individual storage spaces.

This system makes storage mobile and can be used directly on construction sites, for instance. Expensive special shelving is not required, instead, it can be stored simply in standard shelving systems.

With the QR code on every chainflex® CASE, you can re-order your cable online in a few seconds. Simply use your smartphone's scanner.

► www.igus.eu/cf-case



Two sizes ... can be ordered separately ...

Just add the required CASE to your order



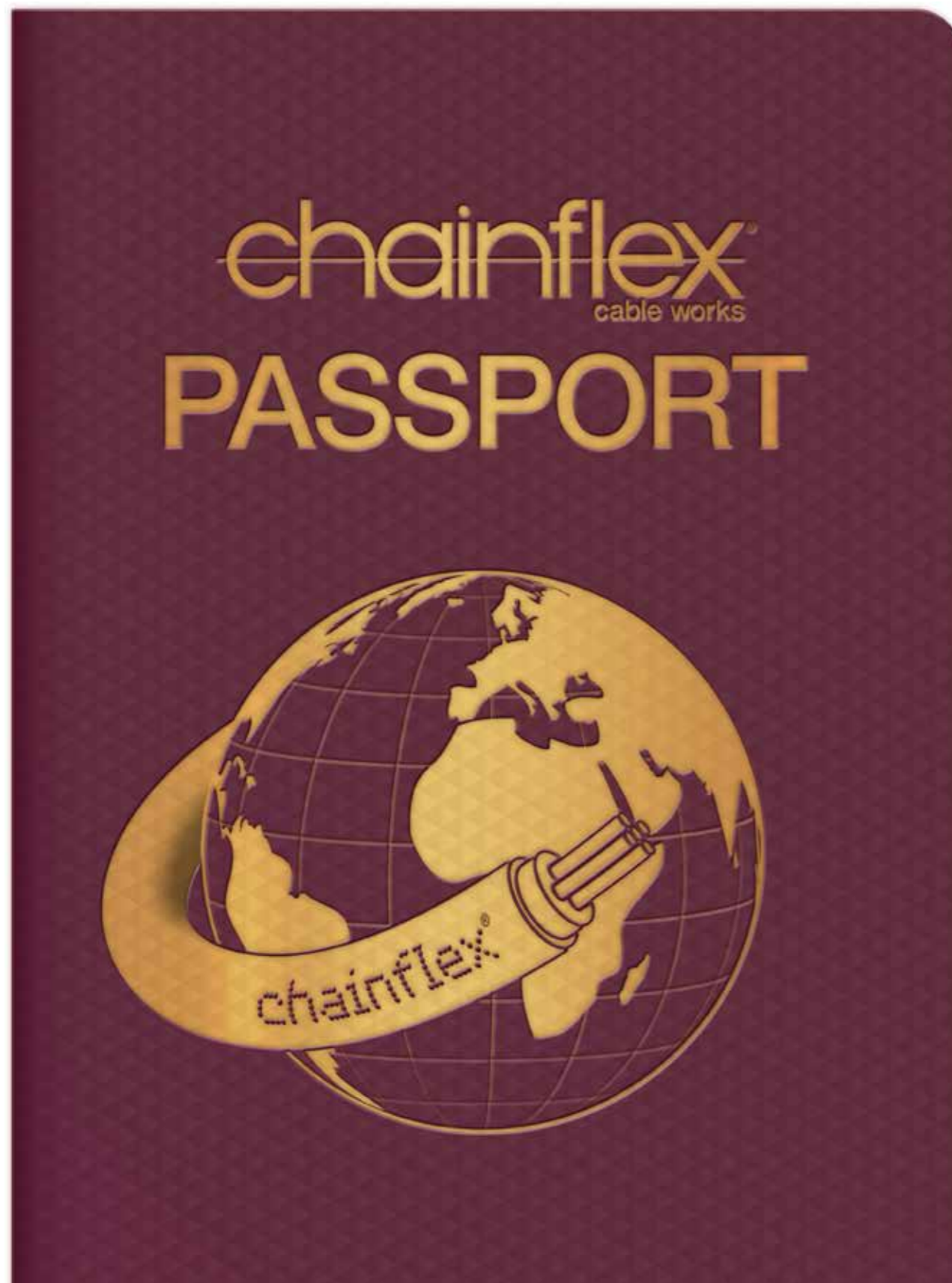
chainflex® CASE



chainflex® CASE S

Welcome to the world ... chainflex® approvals for all major markets

Design confidence, reduced costs, simple supply



One cable for all major markets ...

You benefit from the worldwide common approvals for chainflex® cables

Today, almost all plant and machine builders export their products. Depending on the region, there are very different standards and approvals required for different products. Cables for moving applications are no exception.

Therefore igus® has been working for many decades to obtain as many approvals as possible for chainflex® cables. Due to the special nature of chainflex® cables running in e-chains® this is a challenge, as the varied applications are not described in any standard or approval.

Therefore igus® had to work out concepts with the certification authorities over many years to enable the approval of chainflex® cables.

Today, for example, igus® is the only company worldwide to offer cables with DNV approval for use in the offshore sector.

Details on this can be found on the following pages: 962-969.

Approvals overview

- CE ... 1,377 cables
- UKCA ... 1,377 cables
- DESINA ... 270 cables
- NFPA ... 972 cables
- UL-Listed ... 63 cables
- UL-AWM ... 1,042 cables
- UL-verified ... 1,317 cables
- EAC ... 1,269 cables
- DNV ... 381 cables
- CC-Link IE Field ... 8 cables
- Cleanroom ... 1,063 cables
- Ethercat ... 13 cables
- Profinet ... 10 cables
- Profibus ... 27 cables

36-month guarantee on every chainflex® cable in this catalogue

Guarantee
igus chainflex
36
up to 36 months guarantee

igus 36-month chainflex cable guarantee and service life calculator based on 2 billion test cycles per year




The chainflex® guarantee - predictable safety through laboratory and field experience

Safety is of utmost importance, operationally, legally and financially. Plant and machine constructors have to make binding statements about operational safety and reliability. However, a guarantee declaration to the end customer always entails a considerable risk. The chainflex® guarantee on igus® cables in e-chains® now makes this risk not only more predictable, but reduces it significantly. With the unique 36 month guarantee on every chainflex® cable in this catalogue, we assume part of the responsibility and create valuable planning security for the manufacturer. Twenty-five years of experience from tried and tested applications and from intensive tests in the world's largest test laboratory for cables and e-chains® allow us to make reliable and verifiable statements about durability and service life. Predictable reliability for every user!

"In case of guarantee the buyer is entitled to the rights under the guarantee as per the terms set down in the guarantee statement vis-à-vis the person who has given the guarantee, regardless of the legal claims (§ 443 I BGB)."

In Germany, quality and durability guarantees are used. The latter in particular is of great importance for many customers. A mere extension of the guarantee is not enough for them, they want binding statements on the durability. The chainflex® guarantee based on the reliable data from laboratory and field experience, was created precisely for this purpose.



Analysis of the measured data: igus® "AutΩMeS" system

Guarantee instead of just warranty or defects liability expands the assurance in legal terms

The assurance of a guarantee is done voluntarily by the manufacturer, and goes beyond the mandatory assurance or warranty by the seller. For the customer not only receives the promise to obtain a defect-free product, but also the ability to function over a certain period.

Direct overview of the service life using the "double strokes" selection tables

For each chainflex® series you will find a selection table called "Double strokes - guaranteed service life" This gives the technical parameters for using the respective chainflex® cable. If the cable is operated in accordance with the operating conditions specified in the selection table, a guaranteed service life of 5, 7.5 or 10 million double strokes is applicable depending on the application. The service life itself, measured by the number of possible double strokes, can even be

- 1 Temperature, from/to [°C]
- 2 Double strokes guaranteed
- 3 Minimum bend radius [factor x d]

Guaranteed lifetime according to guarantee conditions (Page 22-23)

Double strokes*	2 5 million	2 7.5 million	2 10 million
Temperature, from/to [°C]	R min. [factor x d]	R min. [factor x d]	R min. [factor x d]
1 -35/-25	6.8	7.5	8.5
-25/+90	5 3	6 3	7 3
+90/+100	6.8	7.5	8.5

Example:
Selection table "Guaranteed service life" for CF9

* Higher number of double strokes? Online lifetime calculation: www.igus-asean.com/chainflexlife

Example:

A cable with a diameter of 12mm in an energy chain with a radius of 100mm results in a bending factor of 8.3 (100mm/12mm). In order to determine the guaranteed durability, you set the technical conditions from the data ranges 1 & 2. In data range 3, you can now see that (with an assumed temperature range of -25/+90°C) with 8.3 x d the effective bending factor is above the minimum limit of 7 and therefore for that cable you have a guaranteed operation of 10 million double strokes. Should the temperature become higher or lower, the

necessary factor for this guarantee level would be 8.5, meaning that the number of guaranteed double strokes is reduced to 7.5 million. This very clear statement provides reliability and planning safety for your machine and can be further refined with the **online service life calculator**.

 Calculate service life online:
www.igus.eu/chainflexlife

Testing, testing, testing ... specific tests for specific requirements

Over 25 years of testing experience in the chainflex® laboratory

The chainflex® laboratory specialises in tests which, apart from just theoretical procedures, also investigate real applications as they would occur in the real world of mechanical and production engineering. For more than 25 years, specific data has been collected in the largest test laboratory for moving cables, which is indispensable for determining service life and function. On a laboratory floor area of 3,800 m², 700 tests are currently running in parallel, which help to constantly monitor and improve the interplay of e-chains® and cables in dynamic applications. The combination of e-chains® and chainflex® cables on the one hand, and of e-chains® and other cables that are sold as "chain-compatible" by a large number of cable providers on the market on the other. However, it is here that questions arise for the customer as to the extent to which these cables are actually suitable for use in energy chains and what is the expected service life. The conventional standard tests give generalised answers to generalised questions. The customer, however, wants a concrete answer and solution for their specific problem, which is often not, or only partially, addressed by the normal standards. It is precisely these individual customer requirements that the igus® laboratory devotes itself to.

A further consequence of our intensive research and laboratory activities is the development of standard tests and production standards for chainflex® cables for long-term use in e-chains®.

In principle, there are five main focus areas:

1. Tests of materials

In line with customer requirements, new materials for the conductors, insulation and outer jackets are developed. Differences arise that are significant but not obvious, particularly in the case of conductor and jacket materials. To this end, up to eight different chainflex® standards are used in the tests.

2. Tests of the technical design

These tests systematically evaluate new designs, manufacturing methods and the associated influences on service life. As the studies have shown, tiny differences in manufacturing processes can lead to significantly different outcomes in moving applications.

3. Quality tests during production

After production, a random number of cables are subjected to the VDE or UL standard tests, as well as other special igus® tests according to certain selection criteria. The laboratory batch tests up to 20% of all finished cables in a continuous bending test and then carries out the necessary structural examinations afterwards.

4. Long-time tests of service life

These tests have to be carried out over a period of up to 5 years and investigate the actual maximum service life of the selected cables. The focus here is on a continuous monitoring of the electrical and mechanical parameters in order to detect a failure.

5. Customer-specific applications

A special service is offered for customer-specific tests according to the igus® standard. This type of test is based on the customer-specific movement sequences and offers the significant advantage of test-defined limits and the potential for optimisation before the start of mass production.



The chainflex® cables must also prove themselves in real applications under extreme conditions



Linear chain tests of all chainflex® cables with different radii and travels



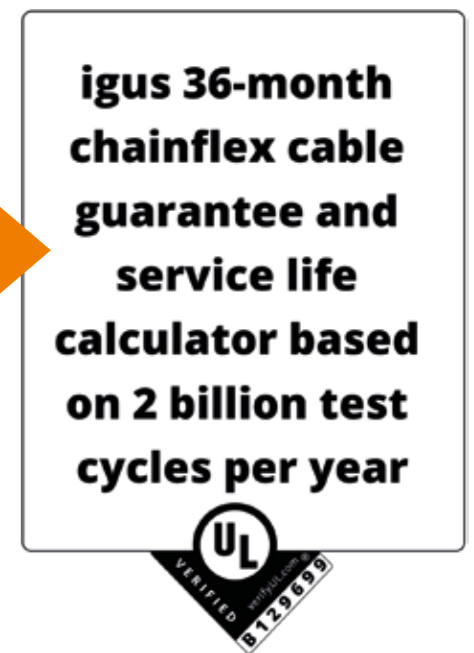
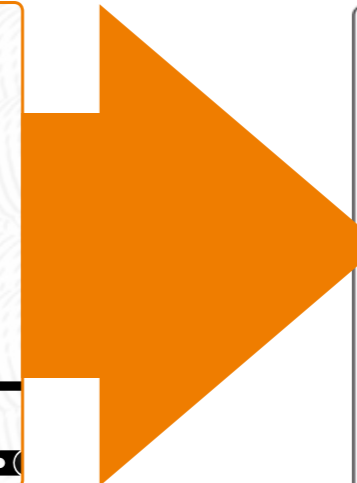
Rotary movement tests in very demanding chain applications using igus® twisterchain®



Test for complex movements by simulating multi-axis applications on robots

chainflex® in the laboratory – the largest test lab for moving cables in the world

... 3,800m² test laboratory with over 65 test stations, two climatic containers (40 feet each), and 200m of outdoor testing facilities ...



2 billion test strokes every year

250 million cycles in batch testing per year

36-month guarantee

Anyone who wants to carry out systematic, comparative and reproducible tests for more than 2 billion double strokes and 1.4 million electrical measurements must invest in the necessary space and resources. On a total of 65 test stations, various test series are carried out according to the igus® test standards. The laboratory team is made up of technically qualified employees who test and monitor thousands of measuring points in e-chains® and cables over a wide range of travel lengths, in horizontal or vertical applications and always under the most real-life conditions possible. Multi-axis e-chains® such as the triflex® series from the robot range are also tested for torsional strength on special test rigs.

Special test equipment for special applications
In addition to the normal service life and quality tests, special test rigs are also available for custom tests. For example, abrasion and media tests for materials are carried out under more demanding experimental conditions than carried out according to UL or VDE standards for storage and aging. The optimum matching of igus® cable outer jacket materials to the energy supply system materials is vital. The influence of thermal factors on moving cables can be analysed in two special 40 foot climatic containers covering a temperature range of -40°C to +60°C. Both are equipped with a 6m long travel, which can be operated with different radii and e-chains®. In contrast to the standard VDE winding mandrel test (for details see page 34), one can test the aging in very different temperature profiles during continuous motion in e-chains®.

Consistent monitoring and accurate test documentation

A necessary condition for successful and meaningful testing is the systematic monitoring and documentation of the results. Here, monitoring systems developed by igus® are used which, in addition to offering constant online monitoring, ensure documentation with a very high accuracy. In this way wear can also be detected before failure. This early detection - without a destructive test - allows design modifications to be made. After each test, all the cables are dissected into their elements, examined in detail and their properties documented.

Because of these test programs, good quality data on all chainflex® cables are available and offer the user planning reliability for their cable selection.

Facts and figures

- The industry's largest test lab for moving cables
- 25 years of experience
- 3,800m² test area
- 65 test stations
- 800 tests conducted in parallel
- 2 billion double strokes a year
- 1.4 million electric measurements per year
- Audited and certified by Underwriter Laboratories (UL)

World's first

3xd

Guarantee
igus chainflex
36
up to 36 months guarantee

igus 36-month
chainflex cable
guarantee and
service life
calculator based
on 2 billion test
cycles per year



100,000,000
chainflex® CF99.PLUS

100 million
double strokes
in e-chains®
guaranteed!

Smaller and smaller installation spaces, shorter and shorter cycle times, 99% availability. These are the requirements that innovative automation specialists must meet.

To do this, igus® has been working on an unprecedented innovation for more than ten years.

The new generation of chainflex® **CF98.PLUS** (unshielded) and chainflex® **CF99.PLUS** (shielded) control cables are a consistent development of the well-known, highly successful CF98/CF99 and CF298 and CF299 control cable series.

Systematic research on process technology and insulation and conductor materials supported by a wide variety of test series in the igus® laboratory enabled igus® to develop this new generation of control cables.

The result is cable series that can be used reliably with a minimum **bend radius of just 3 x d** (3 x cable diameter).

The cross-sectional areas range from 0.14mm² to 0.5mm² in both the shielded and unshielded versions.

This makes igus® the first and only manufacturer to offer catalogue goods for use in an e-chain® with a guaranteed service life of 100 million double strokes.

This is with acceleration values of up to 100m/s².

You will find the complete information about the new generation of chainflex® control cables in this catalogue:

chainflex® CF98.PLUS ▶ Page 134

chainflex® CF99.PLUS ▶ Page 138

World first: High-end TPE cables ...

... with UL approval

Avoid machine fires with high-end TPE cables

... cold ...

... hot ...

... long ...

... small ...



According to the US National Fire Protection Association (NFPA), machine fires are the fourth leading cause of fires in industrial environments in the USA, closely followed by electrical fires. NFPA analyses state that leading causes of unclassified fires in manufacturing buildings involved flammable or combustible liquids or gases, pipelines or filters, but also included fires started by electrical wire or cable insulation. In addition to loose clamp connections, this is also caused by overloading or cable breaks. Cables that are exposed to continuous movement and the smallest bending radii are therefore particularly at risk. If these conditions apply, the cables used in such applications must have jacket materials that can withstand these dynamics over very long periods of time.

igus® has been developing and testing cables for moving applications for more than 30 years. Their different types are adapted to various electrical and mechanical challenges of customers in the industrial environment via different types of stranding, bundled cores and jacket materials. The result is a product range of different cable

types with jacket materials made of PVC, iguPUR, PUR and TPE, which guarantee the same electrical properties in every version.

This selection opens up all possibilities for customers to find the right cable for completely different and very specific applications.

igus® categorises the jacket materials of the chainflex® cables in terms of media resistance, temperature resistance, flexural strength and the properties "flame-retardant" or "halogen-free", among others.

Many thousands of test series and over 30 years of experience in the field also led to the realisation that the halogen-free, non-flame-retardant igus® TPE jacket materials show by far the highest breaking strength at a high bending load and at small bending radii within an e-chain®.

However, although these cable series easily achieved the best performance under continuous bending in

e-chains®, they also had a major disadvantage; since the material was not flame-retardant, an UL AWM approval was not possible.

In cooperation with the Underwriters Laboratories (UL) igus® has now been able to prove that an AWM approval of the high-end TPE jacket material can indeed follow the UL standards.

The basis of the argument is the comparison of fire safety and reliable functionality of a cable: UL specifies the following requirements for approval, that cables must ensure maximum safety and prevent the spread of fire in an application.

igus® was able to prove to Underwriters Laboratories that using halogen-free high-end TPE reliably prevents premature ageing of the outer jackets in highly dynamic applications; indeed, it rules them out almost completely. This means that the voltage-carrying cores are protected even under maximum bending stress and are so safe that even the development of fires can be avoided.

The fact that the cables reliably avoid a reduction of the

cable cross-section even under the highest load and with the tightest radii reliably excludes an increase of the current density and thus an excessive heating of the cable up to a possible fire.

By granting the unique new igus® UL AWM approval for chainflex® cables with high-end TPE jackets, the UL thus acknowledges that ensuring the function of cables in motion is of equal relevance to all factors that prevent the spread of fire.

Thus, igus® can expand its high-end chainflex® cable product range with UL AWM approval.

Safe cable selection – the different test methods

The movements carried out by cables in industrial applications range from simple linear strokes to 6-axis robot applications. Systematic, repeated series of tests under realistic conditions are essential in order to be able to predict the service life of cables.

On the following pages, igus® provides an overview of the test methods that are used for chainflex® cables, depending on the requirements and the materials used. The tabular overview enables the speedy selection of cables that meet your requirements.

Fire tests (page 39-40)

Depending on the application and the place of use, there are different requirements regarding the flame-retardant properties of a cable. To meet this, igus® offers a wide variety of tests in order to guarantee the product is appropriate.

Media tests (page 41)

Media resistance is a very important factor when selecting the optimum jacket material. Due to the test series, the properties of the products are clearly defined and, if the correct material is chosen, cost-intensive failures during operation can be avoided.

Temperature tests (page 42)

Near the respective temperature limits, moving cables can fail quickly with fractures in the jacket due to the molecular structure of the thermoplastic material used. As a result of multiple test series, igus® has been able to demonstrate that standards based tests do not provide enough adequate information about the use of cables in energy chains as they do not replicate the real stresses and loads that cables are subjected to in the real world. Today, igus® is the only manufacturer in the world, to supply cables with tested jacket materials that are guaranteed to withstand the stresses of movements in e-chains® at the indicated ambient temperatures, because they have been tested under such real conditions.

Motion tests (page 43)

Though there are many test standards, none of today's standards specify tests that can adequately verify the service life of a cable in an energy chain. In this regard, igus® is the only manufacturer that has more than 30 years of experience testing cables in e-chains® and performs the most comprehensive range of dynamic cable tests in the world. This includes a large number of different test series. This overview shows the igus® range of basic tests for qualifying e-chain® cables.



Test	Specification	Design										
IEC 60332-1-2	<p>Test of vertical flame propagation on a core, an insulated wire or a cable, test method 1kW - flame with gas/air mixture</p> <p>Sample length: 600mm Burner: According to IEC 60332-1-1 Test temperature: 1kW flame Position of the sample: Vertical Position of the flame: 45° to the vertical Flame duration: See table below Conditions: The damage or carbonisation must only occur between 50mm and 500mm, measured from the upper attachment point</p> <table border="1"> <thead> <tr> <th>Outer diameter of the sample [mm]</th> <th>Flame duration [s]</th> </tr> </thead> <tbody> <tr> <td><25</td> <td>60</td> </tr> <tr> <td>25-50</td> <td>120</td> </tr> <tr> <td>50-75</td> <td>240</td> </tr> <tr> <td>>75</td> <td>480</td> </tr> </tbody> </table>	Outer diameter of the sample [mm]	Flame duration [s]	<25	60	25-50	120	50-75	240	>75	480	
Outer diameter of the sample [mm]	Flame duration [s]											
<25	60											
25-50	120											
50-75	240											
>75	480											
IEC 60332-3-22/-23/-24/-25	<p>Testing vertical flame propagation of vertically arranged bundles of cables or insulated cables</p> <p>Sample length: 3,500mm Burner: Flat burner (Ribbon gas burner of American Gas Furnace Co.) Test temperature: Given by the prescribed gas and air flow rate Position of the sample: Vertical Position of the flame: Horizontal Flame duration: See table below Conditions: The burnt distance should not be more than 2.5m from the lower end of the burner, unless otherwise specified in the relevant standards.</p> <table border="1"> <thead> <tr> <th>Regulation</th> <th>Flame duration</th> </tr> </thead> <tbody> <tr> <td>IEC 60332-3-22 and -23</td> <td>40 minutes</td> </tr> <tr> <td>IEC 60332-3-24 and -25</td> <td>20 minutes</td> </tr> </tbody> </table>	Regulation	Flame duration	IEC 60332-3-22 and -23	40 minutes	IEC 60332-3-24 and -25	20 minutes					
Regulation	Flame duration											
IEC 60332-3-22 and -23	40 minutes											
IEC 60332-3-24 and -25	20 minutes											
FT2 Flame Test	<p>UL 1581, § 1100 (FT2 Flame Test)</p> <p>Length of the sample: 250 – 300mm Position of the sample: Horizontal Position of the flame: 20° to the vertical Flame duration: 30 seconds Conditions: The burnt distance must not exceed 100mm.</p> <p>Dripping material must not ignite the underlying cotton (B).</p>											

Test	Specification	Design
Vertical Flame and FT1	<p>UL 1581, § 1060 (Vertical Flame und FT1 Test)</p> <p>Sample length: 457mm-610mm Burner: Bunsen burner with additional air supply (Tirril gas burner) Ø9.5mm Test temperature: 500W flame Position of the sample: Vertical Position of the flame: 20° to the vertical Flame duration: 5 x 15 seconds with 15 second flame break each Conditions: - Paper flag up to maximum 25% charred - The sample must continue to burn for maximum 1 minute</p>	
VW-1 Flame	<p>UL 1581, § 1080 (VW-1 Flame Test)</p> <p>Sample length: 610mm Burner: Bunsen burner with additional air supply (Tirril gas burner) Ø9.5mm Test temperature: 500W flame Position of the sample: Vertical Position of the flame: 20° to the vertical Flame duration: 5 x 15 seconds with 15 second flame break each Conditions: - Paper flag up to maximum 25% charred - The sample must continue to burn for maximum 1 minute - Time noted until the flame/sample is extinguished - Dripping material must not ignite the cotton (B) lying under it</p>	
Cable Flame	<p>UL 1581, § 1061 (Cable Flame Test)</p> <p>Sample length: 455mm Burner: Bunsen burner with additional air supply (Tirril gas burner) Ø9.5mm Test temperature: 500W flame Position of the sample: Vertical Position of the flame: 20° to the vertical Flame duration: 3 x 60 seconds with 30 seconds flame break each Conditions: - Paper flag up to maximum 25% charred - The sample must continue to burn for maximum 1 minute - Dripping material must not ignite the cotton (B) lying under it</p>	

Test	Specification	Design
DIN EN 50363-4-1	<p>Testing of oil resistance for PVC jackets</p> <p>Test according to DIN EN 60811-2-1, Clause 10</p> <p>Test oil: IRM 902</p> <p>Preparation of the sample according to DIN EN 60811-501</p> <p>Test temperature: 90±2° Test duration: 7x 24hrs</p> <p>Followed by storage at room temperature of at least 16hrs, but not longer than 24hrs</p> <p>Maximum alteration of tensile strength: ±30% Maximum elongation at break: ±30%</p>	
DIN EN 50363-10-2	<p>Testing of oil resistance for PUR jacket</p> <p>Test according to DIN EN 60811-2-1, Clause 10</p> <p>Test oil: IRM 902</p> <p>Preparation of the sample according to DIN EN 60811-501</p> <p>Test temperature: 100±2° Test duration: 7x 24hrs</p> <p>Followed by storage at room temperature of at least 16hrs, but not longer than 24hrs</p> <p>Maximum alteration of tensile strength: ±40% Minimum median elongation at break: 300% Maximum elongation at break: ±30%</p>	
DIN EN 60811-404	<p>Testing of oil resistance for TPE jacket</p> <p>Test according to DIN EN 60811-2-1, Clause 10</p> <p>Test oil: IRM 902</p> <p>Preparation of the sample according to DIN EN 60811-501</p> <p>Test temperature: 100±2° Test duration: 7x 24hrs</p> <p>Followed by storage at room temperature of at least 16hrs, but not longer than 24hrs</p> <p>Maximum alteration of tensile strength: ±30% Maximum elongation at break: ±30%</p>	

Details on the media resistance of chainflex® cables ► Pages 956-959

Test	Specification	Design																
DIN EN 60811-504	<p>Bending test at low temperature for jacket</p> <p>Feed-through of the cold winding test according to 8.2 from DIN EN 60811-504</p> <p>Deviating from the standard also the outer diameter of the sample > 12.5mm</p> <p>Mandrel diameter 4-5 times the sample diameter (there must be at least 2 samples)</p> <table border="1"> <thead> <tr> <th>Outer diameter (d) of the sample [mm]</th> <th>Number of windings</th> </tr> </thead> <tbody> <tr> <td>$d \leq 2.5$</td> <td>10</td> </tr> <tr> <td>$2.5 < d \leq 4.5$</td> <td>6</td> </tr> <tr> <td>$4.5 < d \leq 6.5$</td> <td>4</td> </tr> <tr> <td>$6.5 < d \leq 8.5$</td> <td>3</td> </tr> <tr> <td>$8.5 < d$</td> <td>2</td> </tr> </tbody> </table> <p>Storage of the wound sample > 16hrs at test temperature</p> <p>Heat to room temperature</p> <p>When viewed with the naked eye or visual aid without magnification, there should not be any cracks in the outer jacket</p>	Outer diameter (d) of the sample [mm]	Number of windings	$d \leq 2.5$	10	$2.5 < d \leq 4.5$	6	$4.5 < d \leq 6.5$	4	$6.5 < d \leq 8.5$	3	$8.5 < d$	2					
	Outer diameter (d) of the sample [mm]	Number of windings																
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$8.5 < d$	2																	
DIN EN 50305	<p>Low temperature impact test for jacket</p> <p>Feed-through of the cold impact test according to 8.5 from DIN EN 60811-504</p> <p>Selection criteria according to 5.1 from DIN EN 50305</p> <table border="1"> <thead> <tr> <th>Diameter of the cable (D) [mm]</th> <th>Weight of the hammer [g]</th> <th>Weight of the intermediate sample [g]</th> <th>Fall height [mm]</th> </tr> </thead> <tbody> <tr> <td>$D < 15$</td> <td>1,000</td> <td>200</td> <td>100</td> </tr> <tr> <td>$15 < D \leq 25$</td> <td>1500</td> <td>200</td> <td>150</td> </tr> <tr> <td>$D > 25$</td> <td>2,000</td> <td>200</td> <td>200</td> </tr> </tbody> </table> <p>3 pieces, length at least 5x the outer diameter or 150mm</p> <p>Storage of test equipment and samples > 16hrs at test temperature</p> <p>Heat to room temperature</p> <p>When viewed with the naked eye or visual aid without magnification, there should not be any cracks in the outer jacket.</p>	Diameter of the cable (D) [mm]	Weight of the hammer [g]	Weight of the intermediate sample [g]	Fall height [mm]	$D < 15$	1,000	200	100	$15 < D \leq 25$	1500	200	150	$D > 25$	2,000	200	200	
Diameter of the cable (D) [mm]	Weight of the hammer [g]	Weight of the intermediate sample [g]	Fall height [mm]															
$D < 15$	1,000	200	100															
$15 < D \leq 25$	1500	200	150															
$D > 25$	2,000	200	200															

Test	Specification	Design
igus® test "Cold test" in e-chain®	<p>Horizontal travel</p> <p>Travel length S: up to about 5m</p> <p>Temperature: down to about -40°C</p> <p>Bending factor: according to the catalogue (approx. 6.8 – 10 x d)</p> <p>Target: minimum 500,000 double strokes</p>	
	<p>Horizontal travel</p> <p>Travel S: up to about 2.5m</p> <p>Temperature: down to about -20°C</p> <p>Bending factor: according to the catalogue (approx. 5 – 7.5 x d)</p> <p>Target: minimum 5,000,000 double strokes</p>	
	<p>Horizontal travel</p> <p>Travel S: up to about 7.5 m</p> <p>Temperature: approx. from +5°C to +30°C</p> <p>Bending factor: according to the catalogue (approx. 5 – 7.5 x d)</p> <p>Target: minimum 5,000,000 double strokes</p>	
igus® test "Torsion test"	<p>Twisted length S: about 1m</p> <p>Rotation angle: according to catalogue (about ±180°)</p> <p>Target: minimum 5,000,000 cycles</p>	

Test no.
2233 online
Further tests,
service life,
product finder &
shop online

Test 2233: Control cable tested for 41 million strokes ...

Control cables are still used everywhere in automation. This makes it all the more important for control cables for constant movement in e-chains® to have a safe construction in order to meet increasingly stringent mechanical requirements.

The special properties of the chainflex® control cables are:

- igus® **braiding** in bundles with specially aligned short pitch lengths
- Gusset-filling extruded **inner jacket** in shielded cables
- **Braided shields** with optimised braid angle and optical covering up to 90%
- **Gusset-filled extruded outer jackets to secure the core braiding**, especially for long travels

Every design has to be tested time and again under real-world conditions, in order to be able to calculate a binding guarantee, or show the service life online.

Example of long-term test 2233 of a control cable of the CF5 series on a short travel, with a test bend radius reduced by 25%.

This is just one example of the numerous cable tests from the chainflex® laboratory. All current tests can be found online at ► www.igus.eu/tests

A test result from the igus® database

Test no.	2233
Cable type	CF5.10.25
Bend radius factor in e-chain®	5.3 x d
Number of bending strokes without damage	41 million

Details of the test online:
www.igus.eu/test2233

Calculate service life online:
www.igus.eu/chainflexlife

Test no.
4901 online
Further tests,
service life,
product finder &
shop online

Test 4901: Data cable tested for 53 million strokes ...

Although data cables have different electrical requirements than bus cables, data cables have a specific requirement for EMC protection. In the case of constant movement in e-chains®, the EMC shielding is subjected to very high mechanical loads.

To ensure that this load does not lead to failures in the data, a safe construction is important, especially in the shielding.

The special properties of the chainflex® data cables are:

- Very short balanced **winding in pairs** according to electrical requirements
- **Braid angles** overall shields have been especially developed and tested by igus®
- **Pressure extruded outer jackets** to secure the shield and core structure

Every design has to be tested time and again under real-world conditions, in order to be able to calculate a binding guarantee, or show the service life online.

Example of long-term test 4901 of a CF211 series data cable with short travel, with a 75mm test bend radius.

This is just one example of the numerous cable tests from the chainflex® laboratory. All current tests can be found online at ► www.igus.eu/tests

A test result from the igus® database

Test no.	4901
Cable type	CF211 Data
Bend radius factor in e-chain®	6.6 x d
Number of bending strokes without damage	53 million

Details of the test online:
www.igus.eu/test4901

Calculate service life online:
www.igus.eu/chainflexlife

Test no.
3089 online
Further tests,
service life,
product finder &
shop online

Test 3089: Ethernet bus cable tested for 76 million strokes ...

The use of fieldbus cables, and particularly the rapid growth of Ethernet communication in the industrial environment, places very high requirements on the design and manufacture of bus cables. This is the only way to prevent the classic mechanical damage and the gradual loss of data transmission quality.

Increasing attenuation due to shield damage or characteristic impedance changes leads to reduction in data speed. Since the attenuation values are constantly changing during movement, troubleshooting is very challenging.

The special properties of the chainflex® bus cables are:

- The **insulation material selection**, which does not change its electrical properties even after millions of cycles.
- Very **balanced cores**, which meet the bus requirements in combination with the mechanical demands
- **Braid angle** of the chainflex® overall shield developed and tested by igus®
- With **pressure extruded outer jackets** for securing the shield and core structure

Every design has to be tested time and again under real-world conditions, in order to be able to calculate a binding guarantee, or show the service life online.

This is just one example of the numerous cable tests from the chainflex® laboratory. All current tests can be found online at ► www.igus.eu/tests

A test result from the igus® database

Test no.	3089
Cable type	CFBUS.045
Bend radius factor in e-chain®	9.4 x d
Number of bending strokes without damage	76 million

Details of the test online:
www.igus.eu/test3089

Calculate service life online:
www.igus.eu/chainflexlife

Test no.
4011 online
Further tests,
service life,
product finder &
shop online

Test 4011: Fibre Optic Cable tested for 50 million strokes ...

FOC cables are the safest and most effective data transmission method.

When using glass fibres, the effective length, the effective data volume and the EMC safety is unsurpassed for today's automation technology.

However, the pure glass fibres are sensitive to mechanical loads. Therefore, chainflex® fibre optic cables are designed in such a way that the fibres are never exposed to mechanical loads at any time, but the cable structure safely absorbs all forces, thus protecting the fibres.

The special properties of the chainflex® fibre optic cables are:

- FOC **multimode or singlemode fibre** with high flexural strength
- **Balanced winding** of the aramide-protected subcable elements
- High tensile strength **aramid torsion protection braid**
- With pressure extruded **outer jackets** for securing the structure.

Every design has to be tested time and again under real-world conditions, in order to be able to calculate a binding guarantee, or show the service life online.

Example of long-term test 4011 of a multimode fibre glass cable of CFLB series tested short travel distance, with a bend radius factor of only 4.2 x d.

This is just one example of the numerous cable tests from the chainflex® laboratory. All current tests can be found online at ► www.igus.eu/tests

A test result from the igus® database

Test no.	4011
Cable type	CFLG.2LB
Bend radius factor in e-chain®	4.2 x d
Number of bending strokes without damage	50 million

Details of the test online:
www.igus.eu/test4011

Calculate service life online:
www.igus.eu/chainflexlife

Test no.
3479 online
Further tests,
service life,
product finder &
shop online



A test result from the igus® database

Test no.	3479
Cable type	CF11.002.D
Bend radius factor in e-chain®	7.1 x d
Number of bending strokes without damage	66 million

 Details of the test online:
www.igus.eu/test3479

 Calculate service life online:
www.igus.eu/chainflexlife

Test 3479: Measuring system cable tested for 66 million strokes ...

Measuring system cables are the important communication link between the drive and the control system. Damage can occur if the electrical signals are not transmitted safely and in the correct time due to motion. Therefore measuring system cables have a special requirement for EMC protection.

In the case of constant movement in e-chains®, the EMC shielding is subjected to very high mechanical loads. To ensure that this load does not lead to failures in the measuring system, a safe construction is very important, especially in the shielding and stranding.

The special properties of the chainflex® measuring system cables are:

- Stranding elements **specifically designed for the measuring system** with the necessary element shields and optimised strand pitch lengths
- Core colour code matched to the defined measuring system
- Gusset-filling extruded **inner jacket**
- **Shield structures especially** developed and tested by igus®
- With **pressure extruded outer jackets** for securing the shield and core structure

Every design has to be tested time and again under real-world conditions, in order to be able to calculate a binding guarantee, or show the service life online.

Example of long-term test 3479 of a measuring system cable of the CF11.D series, with a 75mm test bend radius.

This is just one example of the numerous cable tests from the chainflex® laboratory. All current tests can be found online at ► www.igus.eu/tests

Test no.
3841 online
Further tests,
service life,
product finder &
shop online



A test result from the igus® database

Test no.	3841
Cable type	CF21.UL
Bend radius factor in e-chain®	6.1 x d
Number of bending strokes without damage	53 million

 Details of the test online:
www.igus.eu/test3841

 Calculate service life online:
www.igus.eu/chainflexlife

Test 3841: Servo cable tested for 53 million strokes ...

Servo cables are the standard for drive technology in automation and machine construction. Servo cables are often mechanically constructed in a very unbalanced manner, because of the combination of power cores and shielded pairs.

To ensure that this asymmetry does not lead to failures when in movement in e-chains®, servo cables must have very special design features, especially in long, gliding travels. Due to the ever increasing speed of today's IGBT frequency converters, very low-capacitance insulating materials are usually needed.

The special properties of the chainflex® servo cables are:

- Low-capacitance **insulating materials**
- Short **optimised pitch lengths**, in combination with good sliding materials
- The **signal or brake pairs matched** to the drive type with optimised shielding for the highest EMC protection
- Gusset-filling extruded **inner jacket**
- **High EMC protection** due to optimised overall shield

Every design has to be tested time and again under real-world conditions, in order to be able to calculate a binding guarantee, or show the service life online.

Example of long-term test 3841 of a CF21 series servo cable with a test bend factor of only 6.1 x d.

This is just one example of the numerous cable tests from the chainflex® laboratory. All current tests can be found online at ► www.igus.eu/tests

Test no.
4904 online
Further tests,
service life,
product finder &
shop online

Test 4904: Motor cable tested for 43 million strokes ...

Motor cables are very common in drive technology for automation as well as in plant and machine construction.

Because of today's high dynamics, the design features of conductors, insulation and in particular the core winding must be chosen in such a way that the cables can safely withstand millions of strokes.

Due to the ever increasing speed of today's IGBT frequency converters, very low-capacitance insulating materials are usually needed.

The special properties of the chainflex® motor cables are:

- Low-capacitance **insulating materials**
- Short optimised **pitch lengths**, in combination with good sliding materials
- In shielded motor cables, the gusset-filled extruded **inner jacket** with optimised shielding for maximum EMC protection
- Gusset-filling extruded **outer jackets** for unshielded types

Every design has to be tested time and again under real-world conditions, in order to be able to calculate a binding guarantee, or show the service life online.

Example of long-term test 4904 of a CF38 series motor cable, with a test bend factor of only 6.5 x d.

This is just one example of the numerous cable tests from the chainflex® laboratory. All current tests can be found online at ► www.igus.eu/tests



A test result from the igus® database

Test no. 4904

Cable type CF38

Bend radius factor in e-chain® 6.5 x d

Number of bending strokes without damage 43 million

Details of the test online:
www.igus.eu/test4904

Calculate service life online:
www.igus.eu/chainflexlife

Test no.
3486 online
Further tests,
service life,
product finder &
shop online

Test 3486: Robot bus cable tested for 22 million cycles ...

Cables for torsion are subjected to very specific stresses. In the case of shielded bus cables a high mechanical load is exerted by the bending and torsion on the insulation materials and especially on the shield.

This requires completely different structural concepts when compared to cables for linear e-chains application.

The special properties of the chainflex® bus robot cables are:

- Low-capacitance **insulating materials**
- Optimised **pitch lengths**, in combination with force-absorbing filler elements
- Special sliding **films** between the shielded elements
- Pressure extruded **outer jacket**

Every design, no matter how well thought out, should be tested again and again under real conditions so that a binding guarantee or the service life can be calculated online.

Therefore, test standards are also necessary for robotic cables, which test these constructions time and again.

Example for long-term test 3486 of an Ethernet robot cable with 4 shielded Ethernet pairs of the series CFROBOT8, with a test torsion angle of $\pm 180^\circ$ on one metre.

This is just one example of the numerous cable tests from the chainflex® laboratory. All current tests can be found online at ► www.igus.eu/tests



A test result from the igus® database

Test no. 3486

Cable type CFROBOT8

Torsion angle in e-chain® $\pm 180^\circ/m$

Cycle frequency without damage 22 million

Details of the test online:
www.igus.eu/test3486

Calculate service life online:
www.igus.eu/chainflexlife