Tested, tested, tested

chainflex® test lab

from page 24

chainflex®

Control cables

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chainflex®

Data/coax cables

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chainflex®

Bus cables

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Fibre Optic Cables

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Measuring system cables

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Servo cables

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chainflex®

Motor cables

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chainflex® CFROBOT

Twistable cables

from page 382

chainflex®

Special cables

from page 422

chainflex® CFCLEAN elements

for cleanroom applications

from page 444

chainflex®

Pneumatic hoses

from page 462

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
	CF220.UL.H	4	2	2	1
	CF111.D	4	2	3	1
	CF270.UL.D	4	2	3	1
	CF270.UL.D (motor)	4	2	3	1
	CF280.UL.H	4	2	3	1
	CFBUS.PVC	4	3	2	1
	CFBUS.PUR	4	3	3	1
New!	CF140.UL	4	4	1	1
	CF130.UL	4	4	1	2
	CF240	4	4	2	1
	CF240.PUR	4	4	3	1
New!	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
New!	CF33.UL	5	4	2	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
New!	CF211.PUR (data)	5	5	3	1
	CF77.UL.D	5	5	3	3

	chainflex® Series	Basic requirements	Travel distance	Oil resistance	Torsion
	CFROBOT2	6	1	3	3
	CFROBOT3	6	1	3	3
	CFROBOT4	6	1	3	3
	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
	CFKoax	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
	CFLG.G	7	4	4	1
New!	CFLG.LB	7	5	4	1
	CF99.PLUS	7	5	4	1
	CFFLAT	7	5	4	1
	CF98.PLUS	7	5	4	2
	CFBUS.LB	7	6	4	1
	CF10	7	6	4	1
	CF29.D	7	6	4	1
New!	CF38	7	6	4	1
New!	CF340	7	6	4	1
	CF9	7	6	4	2
	CF37.D	7	6	4	2
New!	CF330.D	7	6	4	2

Control cables ... chainflex® types

Guarantee igus chainflex 4 YEARS up to 4 years guarantee

Control cables

52

Guaranteed service life for these series (Details ▶ Page 28-29)

Selection table ▶ From page 54

	chainflex® cable		Jacket	Shield	Minimum bend radius, e-chain® [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
	CF880		PVC		12.5	+5/ +70	●●●		✓					3		20	3.1.1.1	58
	CF881		PVC	✓	12.5	+5/ +70	●●●		✓					3		20	3.1.1.1	62
	CF130.UL		PVC		7.5	+5/ +70	●●●		✓				✓	3	2	20	4.4.1.2	66
	CF140.UL	New!	PVC	✓	7.5	+5/ +70	●●●		✓					3	2	20	4.4.1.1	70
	CF150.UL	New!	PVC		7.5	+5/ +70	●●●		✓	✓		✓	✓	3	2	20	4.4.3.2	74
	CF160.UL		PVC	✓	7.5	+5/ +70	●●●		✓	✓		✓		3	2	20	4.4.3.1	78
	CF5		PVC		6.8	+5/ +70	●●●		✓	✓		✓	✓	10	5	80	5.5.2.2	82
	CF6		PVC	✓	6.8	+5/ +70	●●●		✓	✓		✓		10	5	80	5.5.2.1	86
	CFSOFT1		PVC		5	+5/ +70	●●●		✓	✓		✓		10	5	80	7.1.2.1	90
	CFSOFT2		PVC	✓	5	+5/ +70	●●●		✓	✓		✓		10	5	80	7.1.2.1	92
	CF890		iguPUR		12.5	-20/+80	●●●		✓	✓		✓		3		20	3.1.3.1	94
	CF891		iguPUR	✓	12.5	-20/+80	●●●		✓	✓		✓		3		20	3.1.3.1	98
	CF77.UL.D		PUR		6.8	-25/ +80	●●●		✓	✓	✓	✓	✓	10	5	80	5.5.3.3	102
	CF78.UL		PUR	✓	6.8	-25/ +80	●●●		✓	✓	✓	✓		10	5	80	5.5.3.1	106
	CF2		PUR	✓	5	-20/+80	●●●		✓	✓		✓		10	5	80	6.5.3.1	110
	CF9.UL		TPE		5	-35/ +100	●●●		✓	✓		✓	✓	10	6	100	6.6.4.2	114
	CF10.UL		TPE	✓	5	-35/ +100	●●●		✓	✓		✓		10	6	100	6.6.4.1	118
	CF9		TPE		5	-35/ +100	●●●			✓	✓	✓	✓	10	6	100	7.6.4.2	122
	CF10		TPE	✓	5	-35/ +100	●●●			✓	✓	✓		10	6	100	7.6.4.1	126
	CF98.PLUS		TPE		3	-35/ +90	●●●			✓	✓	✓	✓	10	6	100	7.5.4.2	130
	CF99.PLUS		TPE	✓	3	-35/ +90	●●●			✓	✓	✓		10	6	100	7.5.4.1	134

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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... Data ... Coax ... chainflex® types

	chainflex® cable	Jacket	Shield	Minimum bend radius, e-chain® [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																	138
Guaranteed service life for these series (Details ▶ Page 28-29)																	Selection table ▶ Page 140
	CF240	PVC	✓	10	+5/ +70	●●●	CE	✓	✓				3	2	20	4.4.2.1	142
	CF240.PUR	PUR	✓	10	-25/ +80	●●●	CE	✓	✓	✓	✓		3	2	20	4.4.3.1	146
	CF211	PVC	✓	7.5	+5/ +70	●●●	CE	✓	✓				5	3	50	5.5.2.1	150
	CF211.PUR New!	PUR	✓	7.5	-25/ +80	●●●	CE	✓	✓	✓	✓		5	3	50	5.5.3.1	154
	CF11	TPE	✓	6.8	-35/ +100	●●●	CE		✓	✓	✓		10	6	100	6.6.4.1	158
	CF112	PUR	✓	10	-25/ +80	●●●	CE	✓	✓	✓	✓		10	5	80	6.5.3.1	162
	CF12	TPE	✓	10	-35/ +100	●●●	CE		✓	✓	✓		10	6	100	6.6.4.1	166
Coax cables																	
	CFKoax	TPE		10	-35/ +100	●●●	CE		✓		✓		10	5	100	6.6.4.1	168

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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4-years chainflex® guarantee

Guaranteed service life for predictable reliability

▶ Selection table page 140

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

igus 4-year chainflex cable guarantee and service life calculator based on 2 billion test cycles per year

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

Bus ... Ethernet ... FOC ▶▶ chainflex® types ▶▶

	chainflex® cable		Jacket	Shield	Minimum bend radius, e-chain® [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																		172
Guaranteed service life for these series (Details ▶ Page 28-29)																		Selection table ▶ Page 174
	CF888		PVC		15	+5/ +70	●●●		✓					3		20	3.1.1.1	180
	CFBUS.PVC		PVC		12.5	+5/ +70	●●●		✓	✓		✓		3	2	30	4.3.2.1	184
	CF898		iguPUR		15	-20/ +70	●●●		✓	✓		✓		3		20	3.1.3.1	188
	CFBUS.PUR		PUR		12.5	-20/ +70	●●●		✓	✓	✓	✓		3	2	30	4.3.3.1	192
	CFBUS		TPE		10	-35/ +70	●●●		✓	✓		✓		10	6	100	6.6.4.1	196
	CFBUS.LB		TPE		7.5	-35/ +70	●●●			✓	✓	✓		10	6	100	7.6.4.1	202
Fibre Optic Cables																		206
Guaranteed service life for these series (Details ▶ Page 28-29)																		Selection table ▶ Page 210
	CFLK		PUR		12.5	-20/ +60	●●●			✓	✓	✓		10	5	20	5.3.3.1	212
	CFLG88		PVC		7.5	+5/ +70	●●●		✓					3		20	3.1.1.1	214
	CFLG.LB.PUR		PUR		5	-35/ +80	●●●		✓	✓	✓	✓		10	6	20	6.5.3.1	216
	CFLG.LB	New!	TPE		5	-35/ +80	●●●			✓	✓	✓		10	6	20	7.5.4.1	220
	CFLG.G		TPE		10	-40/ +80	●●●			✓	✓	✓		10	6	20	7.4.4.1	224

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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4-years chainflex® guarantee

Guaranteed service life for predictable reliability

▶ Selection table page 174 (Bus) and page 210 (FOC)

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:

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igus 4-year 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® [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																		228
Guaranteed service life for these series (Details ▶ Page 28-29)																		Selection table ▶ Page 230
	CF884		PVC	✓	15	+5/ +70	●○○		✓					3		20	3.1.1.1	234
	CF211	New!	PVC	✓	10	+5/ +70	●○○		✓	✓				5	3	30	4.2.2.1	238
	CF894		iguPUR	✓	15	-20/+80	●○○		✓	✓		✓		3		20	3.1.3.1	244
	CF111.D		PUR	✓	10	-25/ +80	●○○		✓	✓	✓	✓		5	3	30	4.2.3.1	248
	CF113.D		PUR	✓	7.5	-25/ +80	●●○		✓	✓	✓	✓		10	5	50	6.5.3.1	254
	CF11.D		TPE	✓	6.8	-35/ +90	●●○			✓	✓	✓		10	6	100	6.6.4.1	260
Servo cables																		266
Guaranteed service life for these series (Details ▶ Page 28-29)																		Selection table ▶ Page 268
	CF887		PVC	✓	15	+5/ +70	●○○		✓					3		20	3.1.1.1	272
	CF210.UL		PVC	✓	10	+5/ +70	●○○		✓	✓		✓		10	2	50	4.2.2.1	274
	CF21.UL		PVC	✓	7.5	+5/ +70	●○○		✓	✓		✓		10	5	80	5.5.2.1	278
	CF897		iguPUR	✓	15	-20/+80	●○○		✓	✓		✓		3		20	3.1.3.1	282
	CF270.UL.D		PUR	✓	10	-25/ +80	●○○		✓	✓	✓	✓		10	2	50	4.2.3.1	284
	CF27.D		PUR	✓	7.5	-25/ +80	●●○		✓	✓	✓	✓		10	5	80	6.5.3.1	288
	CF29.D		TPE	✓	6.8	-35/ +100	●●○			✓	✓	✓		10	5	80	7.6.4.1	292
Hybrid cables																		
	CF220.UL.H		PVC	✓	10	+5/ +70	●○○		✓	✓		✓		10	2	50	4.2.2.1	294
	CF280.UL.H		PUR	✓	10	-25/ +80	●○○		✓	✓	✓	✓		10	2	50	4.2.3.1	298

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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4-years chainflex® guarantee

Guaranteed service life for predictable reliability

▶ Selection table page 230 (measuring system) and page 268 (servo)

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Guarantee igus chainflex 4 YEARS up to 4 years guarantee

igus 4-year chainflex cable guarantee and service life calculator based on 2 billion test cycles per year

... Motor cables ... chainflex® types

Guarantee igus chainflex 4 YEARS up to 4 years guarantee

	chainflex® cable		Jacket	Shield	Minimum bend radius, e-chain® [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																		304
Guaranteed service life for these series (Details ▶ Page 28-29)														Selection table ▶ From page 306				
	CF885		PVC		15	+5/ +70	●●●		✓					3		20	3.1.1.1	310
	CF886		PVC	✓	15	+5/ +70	●●●		✓					3		20	3.1.1.1	312
	CF210.UL		PVC	✓	10	+5/ +70	●●●		✓	✓		✓		10	2	50	4.2.2.1	314
	CF30		PVC		7.5	+5/ +70	●●●		✓	✓		✓	✓	10	5	80	5.5.2.2	316
	CF31		PVC	✓	7.5	+5/ +70	●●●		✓	✓		✓		10	5	80	5.5.2.1	320
	CF33.UL	New!	PVC	✓	7,5	+5/ +70	●●●		✓	✓		✓		10	5	80	5.4.2.1	324
	CF895		iguPUR		15	-20/+80	●●●		✓	✓		✓		3		20	3.1.3.1	328
	CF896		iguPUR	✓	15	-20/+80	●●●		✓	✓		✓		3		20	3.1.3.1	330
	CF270.UL.D		PUR	✓	10	-25/ +80	●●●		✓	✓	✓	✓		10	2	50	4.2.3.1	332
	CF27.D		PUR	✓	7.5	-25/ +80	●●●		✓	✓	✓	✓		10	5	80	6.5.3.1	336
	CF34.UL.D		TPE		7.5	-35/ +90	●●●		✓	✓		✓	✓	10	6	80	6.6.4.2	340
	CF35.UL		TPE	✓	7.5	-35/ +90	●●●		✓	✓		✓		10	6	80	6.6.4.1	344
	CF37.D		TPE		7.5	-35/ +90	●●●			✓	✓	✓	✓	10	6	80	7.6.4.2	348
	CF38	New!	TPE	✓	7.5	-35/ +90	●●●			✓	✓	✓		10	6	80	7.6.4.1	352
Spindle cables/Single cores																		
	CF885		PVC		15	+5/ +70	●●●		✓					3		20	3.1.1.1	356
	CF885.PE		PVC		15	+5/ +70	●●●		✓					3		20	3.1.1.1	358
	CF886		PVC	✓	15	+5/ +70	●●●		✓					3		20	3.1.1.1	360
	CF270.UL.D		PUR	✓	10	-25/ +80	●●●		✓	✓	✓	✓		10	2	50	4.2.3.1	362
	CF300.UL.D		TPE		7.5	-35/ +90	●●●		✓	✓		✓	✓	10	6	100	6.6.4.2	364
	CFPE		TPE		7.5	-35/ +90	●●●		✓	✓		✓	✓	10	6	100	6.6.4.2	368
	CF310.UL		TPE	✓	7.5	-35/ +90	●●●		✓	✓		✓		10	6	100	6.6.4.1	370
	CF330.D	New!	TPE		7.5	-35/ +90	●●●			✓	✓	✓	✓	10	6	100	7.6.4.2	374
	CF340	New!	TPE	✓	7.5	-35/ +90	●●●			✓	✓	✓		10	6	100	7.6.4.1	376
Medium voltage cables																		
	CFCRANE.PUR		PUR	✓	10	-20/+80	●●●		✓	✓	✓	✓		10	6	50	6.6.3.1	378
	CFCRANE		igupren	✓	10	-20/+80	●●●		✓	✓		✓		10	6	50	6.6.3.1	380

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.

Twistable cables

382

Guaranteed service life for these series (Details ▶ Page 28-29)

Selection table ▶ Page 386

	chainflex® cable	Jacket	Shield	Minimum bend radius, e-chain® [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
Control cables																	
	CF77.UL.D	PUR		6.8	±180	-25/ +80	●●●		✓	✓	✓	✓	✓	180	60	5.1.3.3	388
	CFROBOT2	PUR	✓	10	±180	-25/ +80	●●●		✓	✓	✓	✓	✓	180	60	6.1.3.3	392
Data cable																	
	CFROBOT3	PUR	✓	10	±180	-25/ +80	●●●		✓	✓	✓	✓	✓	180	60	6.1.3.3	394
Measuring system cable																	
	CFROBOT4	PUR	✓	10	±180	-25/ +80	●●●		✓	✓	✓	✓	✓	180	60	6.1.3.3	396
Fibre Optic Cable																	
	CFROBOT5	TPE		10	±180	-35/ +80	●●●			✓	✓	✓	✓	180	60	6.1.4.3	400
Motor cables																	
	CFROBOT6	PUR		10	±180	-25/ +80	●●●		✓	✓	✓	✓	✓	180	60	6.1.3.3	402
	CFROBOT7	PUR	✓	10	±180	-25/ +80	●●●		✓	✓	✓	✓	✓	180	60	6.1.3.3	404
Spindle cables/Single cores																	
	CFROBOT	TPE	✓	10	±180	-35/ +90	●●●		✓	✓		✓	✓	180	60	6.1.4.3	408
Bus cables																	
	CFROBOT8	PUR	✓	10	±180	-25/ +70	●●●		✓	✓		✓	✓	180	60	6.1.3.3	410
	CFROBOT8.PLUS New!	PUR	✓	10	±360	-25/ +70	●●●		✓	✓	✓	✓	✓	360	60	6.1.3.4	414
Hybrid cable																	
	CFROBOT9	PUR	✓	10	±180	-25/ +80	●●●		✓	✓	✓	✓	✓	180	60	6.1.3.3	418

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

4-years chainflex® guarantee

Guaranteed service life for predictable reliability

▶ Selection table page 386

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

igus 4-year 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® [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																	422
	CFTHERMO	PUR	✓	12.5	-25/ +80	●●●			✓	✓	✓		2	1	20	5.4.3.1	424
	CFFLAT	TPE		5	-35/ +90	●●●			✓	✓	✓		10	6	100	7.5.4.1	426
	CFSPECIAL.182	PUR	✓	10	-25/ +80	●●●		✓	✓	✓	✓		10	6	100	-	428
	CFSPECIAL.192	PUR	✓	10	-25/ +80	●●●		✓	✓	✓	✓		10	2	50	-	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	PUR	✓	10	-25/ +80	●●◐		✓	✓	✓	✓		10	2	50	-	438
	CFSPECIAL.792	PUR	✓	10	-25/ +80	●◐●		✓	✓	✓	✓		3	2	20	-	440
CFCLEAN elements for cleanroom applications																	444
	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

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® guarantee

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

Phone +49-2203 9649-0, info@igus.de

igus 4-year chainflex cable guarantee and service life calculator based on 2 billion test cycles per year

... Video ... Network ...

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

Industrial ... Robots ...

... Drive technology ...

Connectors ... Strain relief

... Technical appendix

Storage made easy ...

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 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

Just add the required CASE to your order

chainflex®
CASE M

chainflex®
CASE S

chainflex® CASE S and CASE M

chainflex® CASE Refill
Replacing cables in the chainflex® CASE made easy

New

Thanks to the new refill element, the chainflex® CASE shipping and storage solution becomes even more practical and sustainable.

- Easy refilling of the cable by replacing the roll, saving complex logistics processes
- Save up to 38% with every reorder of cables sold by the metre for an existing chainflex® CASE
- Tested and developed in collaboration with our customers
- Save up to 2.6kg of packaging waste with every refill reorder
- Simply add CASE as an option in the online shop

chainflex® is PFAS-free

New Logo for chainflex® cables

The new logo confirms that 95% of igus® chainflex® cables are already free of PFAS. This ensures their use worldwide without any restrictions - today and in the future.

Well-known products such as PTFE or well-known brand names such as Teflon are chemicals belonging to the group of per- and polyfluoroalkyl substances, or PFAS for short. Due to their durability (persistence), these substances are often referred to as “forever chemicals”.

Commonly found in everyday objects, e.g. as non-stick coatings on cookware, weatherproof clothing or smartphone screens. But also in many technical products such as seals, core insulation in high-temperature cables and many other things.

Possible EU ban

The poor degradability in combination with the long-lasting property also has an impact on the environment and poses health risks. The substance ends up in wastewater and the environment, and eventually enters the food chain of humans and animals.
The ban on certain PFAS has already been discussed at EU level because the substances do not decompose naturally and are therefore permanently found in the environment”. The European Chemicals Agency (ECHA) has published a proposal to ban at least 10,000 per- and polyfluoroalkyl substances (PFAS). This was developed within the framework of the EU chemicals regulation REACH.

Be on the safe side with chainflex®

The new “PFAS-free” logo confirms the absence of these chemicals in 95% of igus® chainflex® cables and gives customers worldwide planning safety.In some countries, the export of PFAS is already restricted or requires notification and approval.If a general ban is announced, no chainflex® cables need to be disposed of or replaced and can continue to be used worldwide without any concerns.

This claim joins a long list of approvals and standards that ensure certified use of igus® chainflex® cables worldwide. Details on the respective approvals/ standards can be found as information provided for each cable series in the web shop, catalogue and the chainflex® data sheets.

Welcome to the world ...

chainflex® approvals for all major markets

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: 968-975.

Übersicht der Zulassungen:

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

Unique: 4 years for moving cables!

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

The unique chainflex® guarantee is now being extended to a maximum of four years. With clear statements on the guaranteed service life, customers gain additional planning security. The reason is that functional reliability is essential, both from an operational-functional and legal-financial point of view. Plant and machine manufacturers must make binding statements on operational safety and reliability. However, a guarantee statement to the end customer always involves a considerable risk. The unique chainflex® guarantee on igus® cables in e-chains® not only makes this risk more calculable, but also reduces it considerably.

With the unique and now extended guarantee of up to four years on every chainflex® cable in our catalogue, we assume part of the responsibility and create valuable planning reliability for the manufacturer.

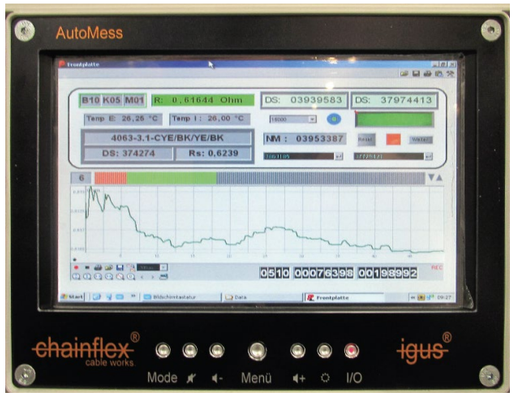
This is only possible because igus® has amassed more than 30 years of experience and an enormous amount of test data in the largest laboratory for cables and e-chains® with a 3,800m² floor area. This enables the generation of reliable statements about the durability and service life of chainflex® cables.

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.

"**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

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 significantly higher.

1 Temperature, from/to [°C]

2 Double strokes guaranteed

3 Minimum bend radius [x d]

Guaranteed service life (details see page 28-29)

Double strokes*	2 5 million	2 7.5 million	2 12.5 million
Temperature, from/to [°C]	R min. [x d]	R min. [x d]	R min. [x d]
1 -35/-25	6.8	7.5	8.5
1 -25/+90	5 3	6 3	7 3
1 +90/+100	6.8	7.5	8.5

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

Example: Selection table "Guaranteed service life" for CF9

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.

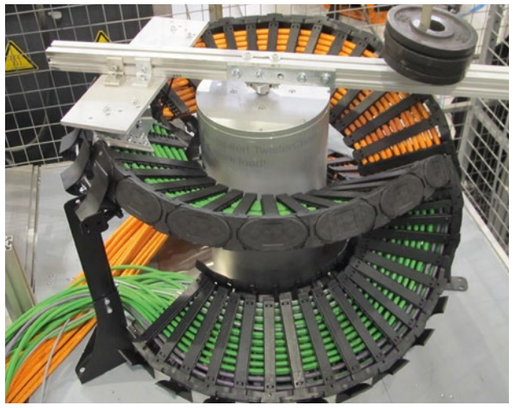
2. Tests of the technical design
These tests systematically evaluate new designs, manufacturing methods and the associated influences on service life. As the studies have shown, tiny differences in manufacturing processes can lead to significantly different outcomes in moving applications.

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

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

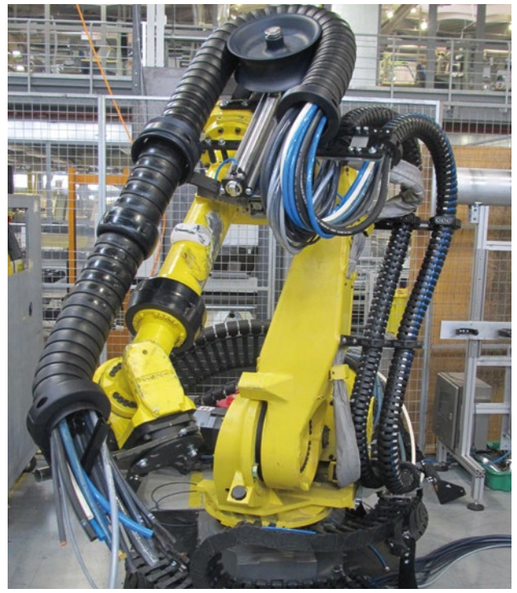
3. Quality tests during production
After production, a random number of cables are subjected to the VDE or UL standard tests, as well as other special igus® tests according to certain selection criteria. The laboratory batch tests up to 20% of all finished cables in a continuous bending test and then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



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

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.



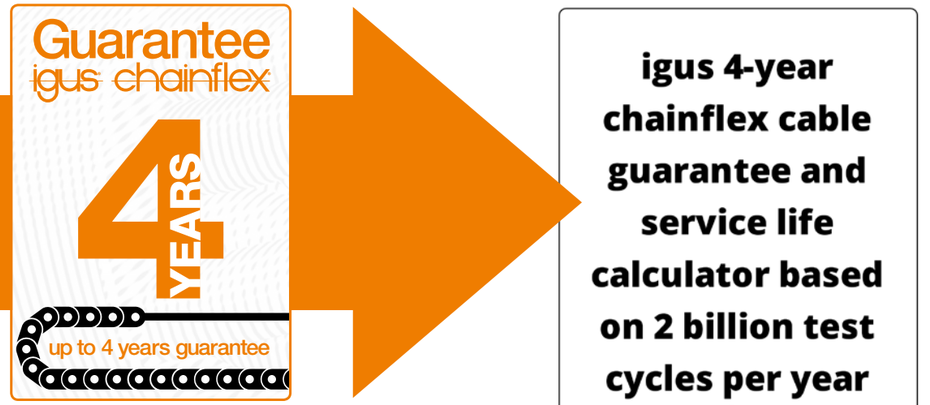
Test for complex movements by simulating multi-axis applications on robots

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 ...

... UL verified ...

... qualified monitoring of laboratory & manufacturing with UL ... certified chainflex® guarantee promise ...



2 billion test strokes every year

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.

250 million cycles in batch testing per year

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®.

4-years guarantee

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 4 YEARS up to 4 years guarantee

igus 4-year chainflex cable guarantee and service life calculator based on 2 billion test cycles per year

UL VERIFIED verifyUL.com® V29365O

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 130

chainflex® CF99.PLUS ► Page 134

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)

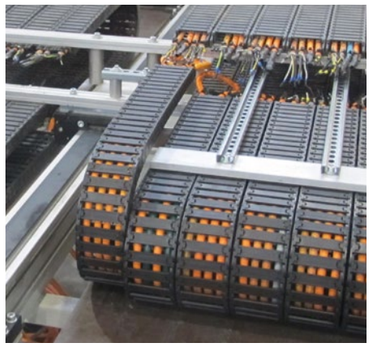
Depending on the application and the place of use, there are different requirements regarding the flame-retardant properties of a cable. To meet this, igus® offers a wide variety of tests in order to guarantee the product is appropriate.

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.

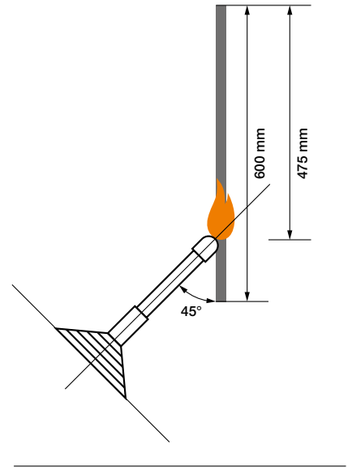
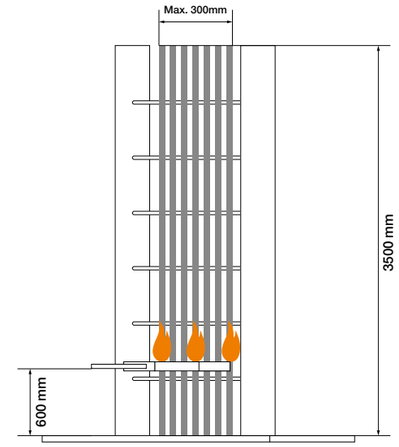
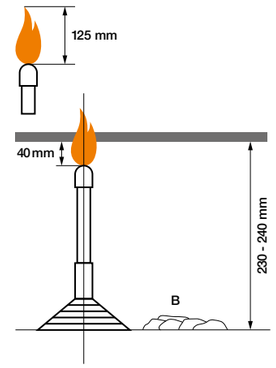
Temperature tests (page 42)

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.

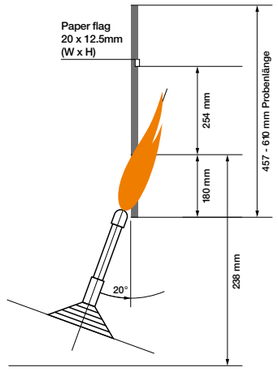
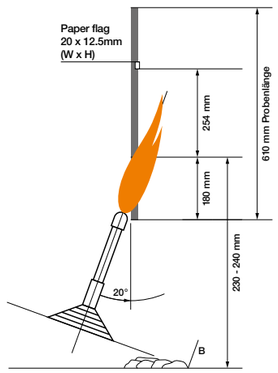
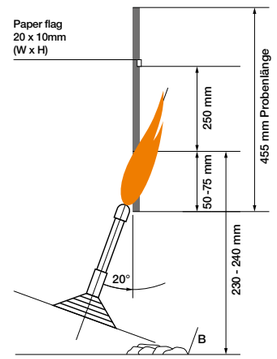


Motion tests (page 43)

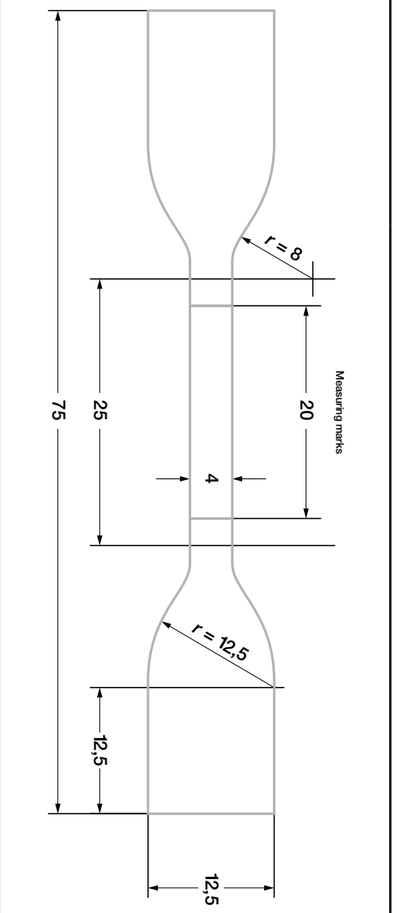
Though there are many test standards, none of today's standards specify tests that can adequately verify the service life of a cable in an energy chain. In this regard, igus® is the only manufacturer that has more than 30 years of experience testing cables in e-chains® and performs the most comprehensive 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	Test of vertical flame propagation on a core, an insulated wire or a cable, test method 1kW - flame with gas/air mixture 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 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	Testing vertical flame propagation of vertically arranged bundles of cables or insulated cables 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. Regulation / Flame duration: IEC 60332-3-22 and -23: 40 minutes IEC 60332-3-24 and -25: 20 minutes	
FT2 Flame Test	UL 1581, § 1100 (FT2 Flame Test) 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. Dripping material must not ignite the underlying cotton (B).	

Test methods | **Fire tests**

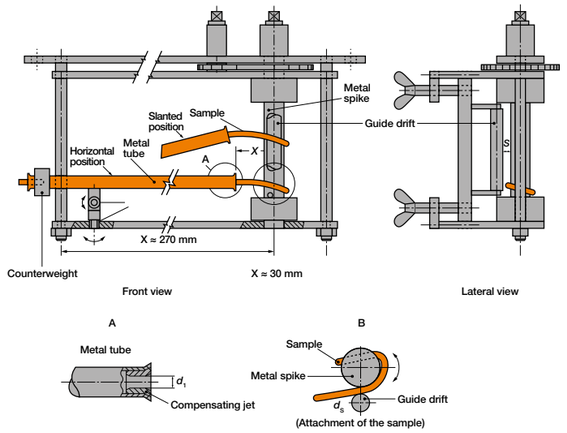
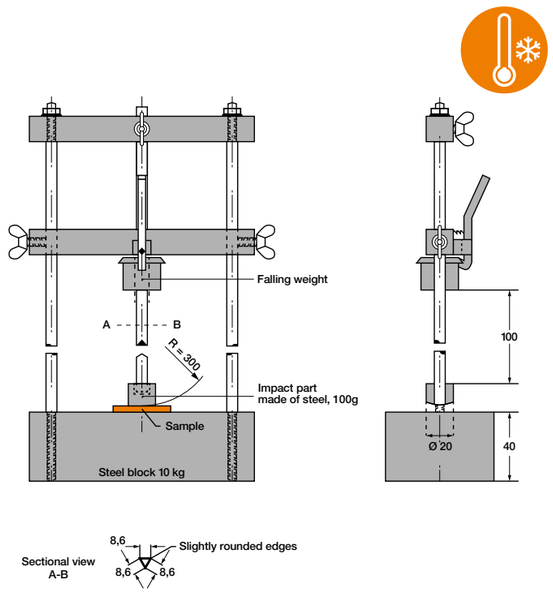
Test	Specification	Design
Vertical Flame and FT1	**UL 1581, § 1060 (Vertical Flame und FT1 Test)** Sample length: 457mm-610mm Burner: Bunsen burner with additional air supply (Tirril gas burner) Ø9.5mm Test temperature: 500W flame Position of the sample: Vertical Position of the flame: 20° to the vertical 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	
VW-1 Flame	**UL 1581, § 1080 (VW-1 Flame Test)** 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	
Cable Flame	**UL 1581, § 1061 (Cable Flame Test)** 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	

Test methods | **Media tests**

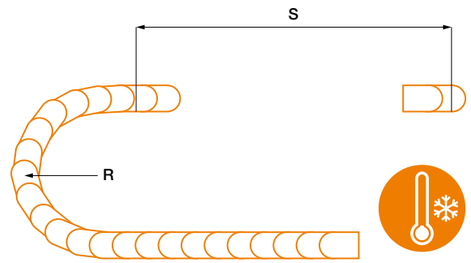
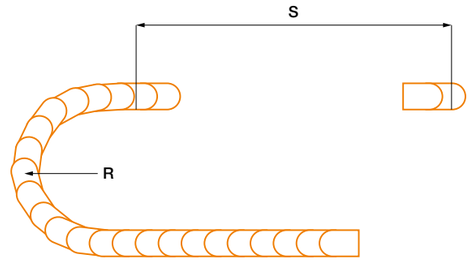
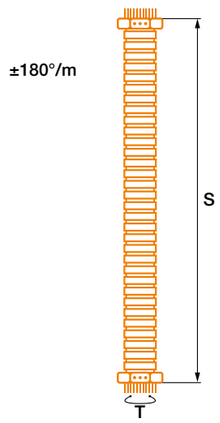
Test	Specification	Design
DIN EN 50363-4-1	**Testing of oil resistance for PVC jackets** Test according to DIN EN 60811-2-1, Clause 10 Test oil: IRM 902 Preparation of the sample according to DIN EN 60811-501 Test temperature: 90±2° Test duration: 7x 24hrs Followed by storage at room temperature of at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

Details on the media resistance of chainflex® cables ▶ Pages 954-957

Test methods | **Temperature tests**

Test	Specification	Design
DIN EN 60811-504	**Bending test at low temperature for jacket** Feed-through of the cold winding test according to 8.2 from DIN EN 60811-504 Deviating from the standard also the outer diameter of the sample > 12.5mm Mandrel diameter 4-5 times the sample diameter (there must be at least 2 samples) Outer diameter (*d*) of the sample [mm] / Number of windings d ≤ 2.5 — 10 2.5 < d ≤ 4.5 — 6 4.5 < d ≤ 6.5 — 4 6.5 < d ≤ 8.5 — 3 8.5 < d — 2 Storage of the wound sample > 16hrs at test temperature Heat to room temperature When viewed with the naked eye or visual aid without magnification, there should not be any cracks in the outer jacket	
DIN EN 50305	**Low temperature impact test for jacket** Feed-through of the cold impact test according to 8.5 from DIN EN 60811-504 **Selection criteria according to 5.1 from** **DIN EN 50305** 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 ≤ 25 — 1500 — 200 — 150 D > 25 — 2,000 — 200 — 200 3 pieces, length at least 5x the outer diameter or 150mm Storage of test equipment and samples > 16hrs at test temperature Heat to room temperature When viewed with the naked eye or visual aid without magnification, there should not be any cracks in the outer jacket.	

Test methods | **Motion tests**

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

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 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 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 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 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

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 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.

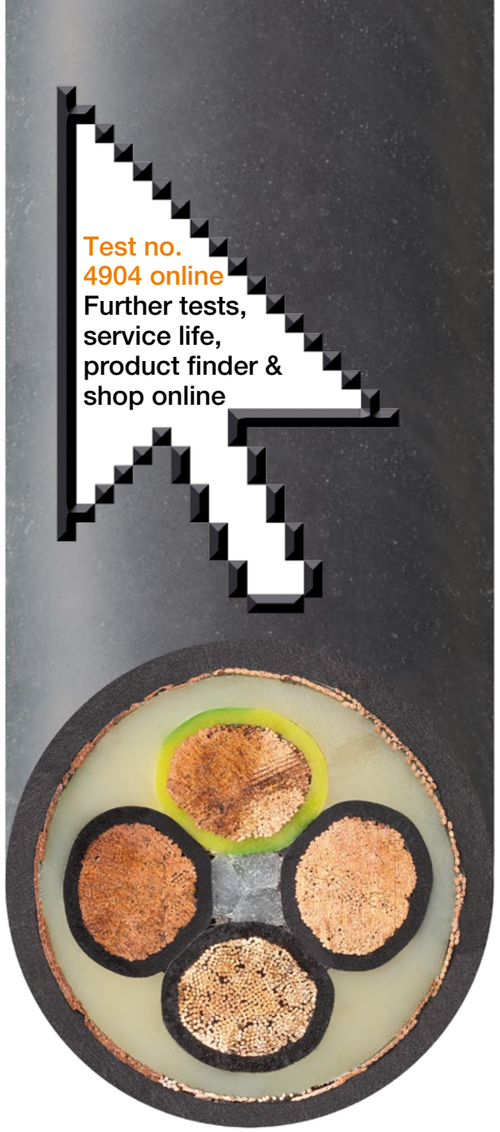
Example of long-term test 3841 of a CF21 series servo cable with a test bend factor of only 6.1 x d.

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

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 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.

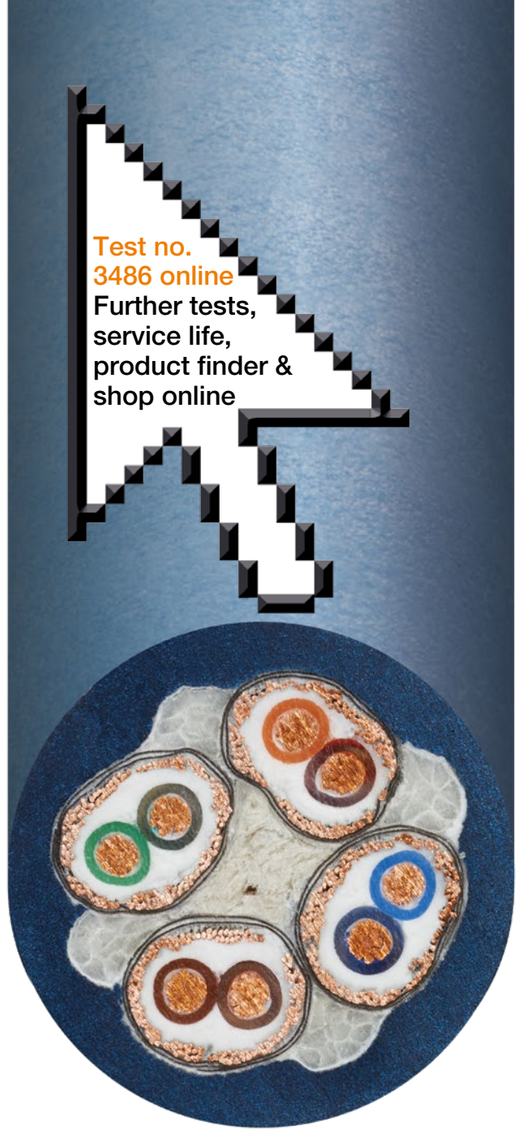
Example of long-term test 4904 of a CF38 series motor cable, with a test bend factor of only 6.5 x d.

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 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 ±180° 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®	±180°/m
Cycle frequency without damage	22 million

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

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