cables...

... No. 1 for cables in e-chains® ...

igus.com ... chainflex® cables ... 2022 ... motion plastics®...

chainflex®

chainflex® selection according to "Class"

chainflex® series	Basic requirements	Travel distance	Oil-resistance	Torsion
CF880 New	3	1	1	1
CF881 New	3	1	1	1
CF8821	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 New	3	1	1	1
CF888 New	3	1	1	1
CF890 New	3	1	3	1
CF891 New	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 New	3	1	3	1
CF130US	3	1	4	2
CF140US	3	1	4	1
CF210-UL	4	2	2	1
CF210-UL (Motor)	4	2	2	1
CF211 (MSC)	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 New	4	3	2	1
CFBUS-PUR New	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
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

chainflex® series	Basic requirements	Travel distance	Oil-resistance	Torsion
CFROBOT4	6	1	3	3
CFROBOT7 New	6	1	3	3
CFROBOT8	6	1	3	3
CFROBOT9	6	1	3	3
CFROBOT8-PLUS	6	1	3	4
CFROBOT	6	1	4	3
CFROBOT5	6	1	4	3
CFROBOT6	6	1	3	3
CF2	6	5	3	1
CF14US	6	3	4	1
CF112	6	5	3	1
CFLG-LB-PUR	6	5	3	1
CF113-D New	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 New	6	6	4	1
CF11-D	6	6	4	1
CF35-UL New	6	6	4	1
CF310-UL	6	6	4	1
CF9-UL	6	6	4	2
CF34-UL-D New	6	6	4	2
CF300-UL-D	6	6	4	2
CFPE	6	6	4	2
CFSOFT1	7	1	2	1
CFSOFT2	7	1	2	1
CF99	7	5	4	1
CF299 New	7	5	4	1
CFLG-LB	7	5	4	1
CFFLAT	7	5	4	1
CF98	7	5	4	2
CF298 New	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

Control cables ...

	chainflex® cable	Jacket	Shield	Bend radius min., E-Chain® [factor x d]	Temperature, E-Chain® from/to [°F]	Price index
Control cables						
Exclusive! Guaranteed lifetime for this series according to the guarantee conditions ▶ Page 26-27						
	CF880 New	PVC		12.5	+41/ +158	●◐○○
	CF881 New	PVC	✓	12.5	+41/ +158	●◐○○
	CF130US	PVC		8	+41/ +176	●●○○
	CF140US	PVC	✓	10	+41/ +176	●●○○
	CF130-UL	PVC		7.5	+41/ +158	●◐○○
	CF140-UL	PVC	✓	7.5	+41/ +158	●◐○○
	CF5	PVC		6.8	+41/ +158	●○○○
	CF6	PVC	✓	6.8	+41/ +158	●○○○
	CFSOFT1	PVC		5	+41/ +158	●●○○
	CFSOFT2	PVC	✓	5	+41/ +158	●●○○
	CF890 New	iguPUR		12.5	-4/ +176	●◐○○
	CF891 New	iguPUR	✓	12.5	-4/ +176	●◐○○
	CF77-UL-D	PUR		6.8	-13/ +176	●◐○○
	CF78-UL	PUR	✓	6.8	-13/ +176	●◐○○
	CF2	PUR	✓	5	-4/ +176	●●○○
	CF9	TPE		5	-31/ +212	●●◐○
	CF10	TPE	✓	5	-31/ +212	●●◐○
	CF9-UL	TPE		5	-31/ +212	●●◐○
	CF10-UL	TPE	✓	5	-31/ +212	●●◐○
	CF98	TPE		4	-31/ +194	●●◐○
	CF99	TPE	✓	4	-31/ +194	●●◐○

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

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chainflex® types

Approvals and standards	Flame-retardant	Oil-resistant	Halogen-free	UV-resistant	Torsion resistant	v max. unsupported [ft/s]	v max. gliding [ft/s]	a max. [ft/s²]	chainflex® Class	Page
										44
										Selection table ▶ Page 46
	✓					9.84		65.62	3.1.1.1	50
	✓					9.84		65.62	3.1.1.1	54
	✓	✓		✓	✓	9.84	6.56	65.62	3.1.4.2	58
	✓	✓		✓		9.84	6.56	65.62	3.1.4.1	62
	✓				✓	9.84	6.56	65.62	4.4.1.2	66
	✓					9.84	6.56	65.62	4.4.1.1	70
	✓	✓		✓	✓	32.81	16.41	262.5	5.5.2.2	74
	✓	✓		✓		32.81	16.41	262.5	5.5.2.1	78
	✓	✓		✓		32.81	16.41	262.5	7.1.2.1	82
	✓	✓		✓		32.81	16.41	262.5	7.1.2.1	84
	✓	✓		✓		9.84		65.62	3.1.3.1	86
	✓	✓		✓		9.84		65.62	3.1.3.1	90
	✓	✓	✓	✓	✓	32.81	16.41	262.5	5.5.3.3	94
	✓	✓	✓	✓		32.81	16.41	262.5	5.5.3.1	98
	✓	✓		✓		32.81	16.41	262.5	6.5.3.1	102
		✓	✓	✓	✓	32.81	19.69	328.1	7.6.4.2	106
		✓	✓	✓		32.81	19.69	328.1	7.6.4.1	110
	✓	✓		✓	✓	32.81	19.69	328.1	6.6.4.2	114
	✓	✓		✓		32.81	19.69	328.1	6.6.4.1	118
		✓	✓	✓	✓	32.81	19.69	328.1	7.5.4.2	122
		✓	✓	✓		32.81	19.69	328.1	7.5.4.1	124

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

... Data ... Special ...

	chainflex® cable	Jacket	Shield	Bend radius min., E-Chain® [factor x d]	Temperature, E-Chain® from/to [°F]	Price index
Data cables						
Exclusive! Guaranteed lifetime for this series according to the guarantee conditions ▶ Page 26-27						
	CF8821	PVC	✓	12.5	+41/ +158	●○○
	CF240	PVC	✓	10	+41/ +158	●○○
	CF240-PUR	PUR	✓	10	-13/ +176	●◐○
	CF211	PVC	✓	7.5	+41/ +158	●○○
	CF211-PUR	PUR	✓	7.5	-13/ +176	●○○
	CF11	TPE	✓	6.8	-31/ +212	●●○
	CF112	PUR	✓	10	-13/ +176	●○○
	CF12	TPE	✓	10	-31/ +212	●●◐
	CF298 New	TPE		4	-31/ +194	●●○
	CF299 New	TPE	✓	4	-31/ +194	●●○
Coax cables						
	CFKoax	TPE		10	-35/ +100	●●○

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

chainflex® types

Approvals and standards	Flame-retardant	Oil-resistant	Halogen-free	UV-resistant	Torsion resistant	v max. unsupported [ft/s]	v max. gliding [ft/s]	a max. [ft/s²]	chainflex® Class	Page
										126
										Selection table ▶ Page 128
	✓					9.84		65.62	3.1.1.1	130
	✓	✓				9.84	6.56	65.62	4.4.2.1	132
	✓	✓	✓	✓		9.84	6.56	65.62	4.4.3.1	136
	✓	✓				16.41	9.84	164.1	5.5.2.1	140
	✓	✓	✓	✓		16.41	9.84	164.1	5.5.3.1	144
		✓	✓	✓		32.81	19.69	328.1	6.6.4.1	148
	✓	✓	✓	✓		32.81	16.41	262.5	6.5.3.1	152
		✓	✓	✓		32.81	19.69	328.1	6.6.4.1	156
		✓	✓	✓	✓	32.81	19.69	328.1	7.5.4.2	158
		✓	✓	✓		32.81	19.69	328.1	7.5.4.1	160
		✓		✓		32.81	16.41	328.1	6.6.4.1	162

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

Bus ... Ethernet ... FOC

	chainflex® cable	Jacket	Shield	Bend radius min., E-Chain® [factor x d]	Temperature, E-Chain® from/to [°F]	Price index
Bus cables						
Exclusive! Guaranteed lifetime for this series according to the guarantee conditions ▶ Page 26-27						
	CF888 New	PVC	✓	15	+41/ +158	●◐○○
	CFBUS-PVC New	PVC	✓	12.5	+41/ +158	●◐○○
	CF898 New	iguPUR	✓	15	-4/ +176	●◐○○
	CFBUS-PUR New	PUR	✓	12.5	-4/ +176	●◐○○
	CF14US	PUR	✓	7.5	-4/ +158	●●○○
	CFBUS New	TPE	✓	10-12.5	-31/ +158	●●○○
	CFBUS-LB	TPE	✓	7.5	-31/ +158	●●○○
Fiber optic cables						
Exclusive! Guaranteed lifetime for this series according to the guarantee conditions ▶ Page 26-27						
	CFLK	PUR		12.5	-4/ +140	●◐○○
	CFLG88	PVC		7.5	+41/ +158	●◐○○
	CFLG-LB-PUR	PUR		5	-31/ +176	●◐○○
	CFLG-LB	TPE		5	-31/ +176	●◐○○
	CFLG-G	TPE		10	-40/ +176	●●○○

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

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chainflex® types

Approvals and standards	Flame-retardant	Oil-resistant	Halogen-free	UV-resistant	Torsion resistant	v max. unsupported [ft/s]	v max. gliding [ft/s]	a max. [ft/s²]	chainflex® Class	Page
										166
										Selection table ▶ Page 168
	✓					9.84		65.62	3.1.1.1	174
	✓	✓		✓		9.84	6.56	98.43	4.3.2.1	178
	✓	✓		✓		9.84		65.62	3.1.3.1	182
	✓	✓	✓	✓		9.84	6.56	98.43	4.3.3.1	186
	✓	✓		✓		32.81	19.69	328.1	6.3.4.1	190
	✓	✓		✓		32.81	19.69	328.1	6.6.4.1	192
		✓	✓	✓		32.81	19.69	328.1	7.6.4.1	198
										202
										Selection table ▶ Page 206
		✓	✓	✓		32.81	16.41	65.62	5.3.3.1	208
	✓					9.84		65.62	3.1.1.1	210
	✓	✓	✓	✓		32.81	19.69	65.62	6.5.3.1	212
		✓	✓	✓		32.81	19.69	65.62	7.5.4.1	216
		✓	✓	✓		32.81	19.69	65.62	7.6.4.1	220

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

36 month chainflex® guarantee

Guaranteed lifetime for predictable reliability

▶ Selection table page 168 (Bus) and page 206 (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:

www.igus.com/chainflexlife

... Measuring ... Servo ...

	chainflex® cable	Jacket	Shield	Bend radius min., E-Chain® [factor x d]	Temperature, E-Chain® from/to [°F]	Price index
Measuring system cables						
Exclusive! Guaranteed lifetime for this series according to the guarantee conditions ▶ Page 26-27						
	CF884	PVC	✓	15	+41/ +158	●○○
	CF211	PVC	✓	10	+41/ +158	●○○
	CF894	iguPUR	✓	15	-4/ +176	●○○
	CF111-D	PUR	✓	10	-13/ +176	●○○
	CF113-D New	PUR	✓	7.5	-13/ +176	●●○
	CF11-D	TPE	✓	7.5	-31/ +194	●●○
Servo cables						
Exclusive! Guaranteed lifetime for this series according to the guarantee conditions ▶ Page 26-27						
	CF887 New	PVC	✓	15	+41/ +158	●○○
	CF210-UL	PVC	✓	10	+41/ +158	●○○
	CF21-UL	PVC	✓	7.5	+41/ +158	●○○
	CF897	iguPUR	✓	15	-4/ +176	●○○
	CF270-UL-D	PUR	✓	10	-13/ +176	●○○
	CF27-D	PUR	✓	7.5	-13/ +176	●◐○
	CF29-D	TPE	✓	6.8	+31/ +212	●●○
Servo cables						
	CF220-UL-H	PVC	✓	10	+41/ +158	●○○
	CF280-UL.H	PUR	✓	10	-13/ +176	●○○

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

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chainflex® types

Approvals and standards	Flame-retardant	Oil-resistant	Halogen-free	UV-resistant	Torsion resistant	v max. unsupported [ft/s]	v max. gliding [ft/s]	a max. [ft/s²]	chainflex® Class	Page
										224
										Selection table ▶ Page 226
	✓					9.84		65.62	3.1.1.1	230
	✓	✓				16.41	9.84	98.43	4.2.2.1	234
	✓	✓		✓		9.84		65.62	3.1.3.1	240
	✓	✓	✓	✓		16.41	9.84	98.43	4.2.3.1	244
	✓	✓	✓	✓		32.81	16.41	164.05	6.5.3.1	250
		✓	✓	✓		32.81	19.69	328.1	6.6.4.1	256
										262
										Selection table ▶ Page 264
	✓					9.84		65.62	3.1.1.1	268
	✓	✓		✓		32.81	6.56	164.05	4.2.2.1	270
	✓	✓		✓		32.81	16.41	262.48	5.5.2.1	274
	✓	✓		✓		9.84		65.62	3.1.3.1	278
	✓	✓	✓	✓		32.81	6.56	164.05	4.2.3.1	280
	✓	✓	✓	✓		32.81	16.41	262.48	6.5.3.1	284
		✓	✓	✓		32.81	16.41	262.48	7.6.4.1	288
	✓	✓		✓		32.81	6.56	164.05	4.2.2.1	290
	✓	✓	✓	✓		32.81	6.56	164.05	4.2.3.1	294

chainflex® types mentioned in the catalog as "resistant to bio oil" have been tested by DEA according to VDMA 24568 with Plantocut 8 S-MB.

36 month chainflex® guarantee

Guaranteed lifetime for predictable reliability

▶ Selection table page 226 (Measuring system) and page 264 (Servo)

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.com/chainflexlife

... Motor ...

	chainflex® cable	Jacket	Shield	Bend radius min., E-Chain® [factor x d]	Temperature, E-Chain® from/to [°F]	Price index
Motor cables						
Exclusive! Guaranteed lifetime for this series according to the guarantee conditions ▶ Page 26-27						
	CF885	PVC		15	+41/ +158	●○○
	CF886	PVC	✓	15	+41/ +158	●○○
	CF210-UL	PVC	✓	10	+41/ +158	●○○
	CF30	PVC		7.5	+41/ +158	●○○
	CF31	PVC	✓	7.5	+41/ +158	●○○
	CF895	iguPUR		15	-4/ +176	●○○
	CF896	iguPUR	✓	15	-4/ +176	●○○
	CF270-UL-D	PUR	✓	10	-13/ +176	●○○
	CF27-D	PUR	✓	7.5	-13/ +176	●○○
	CF34-UL-D New	TPE		7.5	-31/ +194	●●◐
	CF35-UL New	TPE	✓	7.5	-31/ +194	●●◐
	CF37-D	TPE		7.5	-31/ +194	●●◐
	CF38	TPE	✓	7.5	-31/ +194	●●◐
Spindle cables/Single cores						
	CF885	PVC		15	+41/ +158	●○○
	CF885-PE	PVC		15	+41/ +158	●○○
	CF886	PVC	✓	15	+41/ +158	●○○
	CF270-UL-D	PUR	✓	10	-13/ +176	●○○
	CF300-UL-D	TPE		7.5	-31/ +194	●●○
	CFPE	TPE		7.5	-31/ +194	●●○
	CF310-UL	TPE	✓	7.5	-31/ +194	●●○
	CF330-D	TPE		7.5	-31/ +194	●●○
	CF340	TPE	✓	7.5	-31/ +194	●●○
Medium voltage cables						
	CFCRANE-PUR	PUR	✓	10	-4/ +176	●●○
	CFCRANE	igupren	✓	10	-4/ +176	●●●

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

chainflex® types

Approvals and standards	Flame-retardant	Oil-resistant	Halogen-free	UV-resistant	Torsion resistant	v max. unsupported [ft/s]	v max. gliding [ft/s]	a max. [ft/s²]	chainflex® Class	Page
										298
										Selection table ▶ Page 300
	✓					9.84		65.62	3.1.1.1	304
	✓					9.84		65.62	3.1.1.1	306
	✓	✓		✓		32.81	6.56	164.05	4.2.2.1	308
	✓	✓		✓	✓	32.81	16.41	262.48	5.5.2.2	310
	✓	✓		✓		32.81	16.41	262.48	5.5.2.1	314
	✓	✓		✓		9.84		65.62	3.1.3.1	318
	✓	✓		✓		9.84		65.62	3.1.3.1	320
	✓	✓	✓	✓		32.81	6.56	164.05	4.2.3.1	322
	✓	✓	✓	✓		32.81	16.41	262.48	6.5.3.1	326
	✓	✓		✓	✓	32.81	19.69	262.48	6.6.4.2	330
	✓	✓		✓		32.81	19.69	262.48	6.6.4.1	334
		✓	✓	✓	✓	32.81	19.69	262.48	7.6.4.2	338
		✓	✓	✓		32.81	19.69	262.48	7.6.4.1	340
	✓					9.84		65.62	3.1.1.1	342
	✓					9.84		65.62	3.1.1.1	344
	✓					9.84		65.62	3.1.1.1	346
	✓	✓	✓	✓		32.81	6.56	164.05	4.2.3.1	348
	✓	✓		✓	✓	32.81	19.69	328.1	6.6.4.2	350
	✓	✓		✓	✓	32.81	19.69	328.1	6.6.4.2	352
	✓	✓		✓		32.81	19.69	328.1	6.6.4.1	354
		✓	✓	✓	✓	32.81	19.69	328.1	7.6.4.2	356
		✓	✓	✓		32.81	19.69	328.1	7.6.4.1	358
		✓	✓	✓		32.81	19.69	164.05	6.6.3.1	360
	✓	✓		✓		32.81	19.69	164.05	6.6.3.1	362

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

... Robots ...

	chainflex® cable	Jacket	Shield	Bend radius min., E-Chain® [factor x d]	Torsion angle [°/m]	Temperature, E-Chain® from/to [°F]	Price index
Twistable cables							
Exclusive! Guaranteed lifetime for this series according to the guarantee conditions ▶ Page 26-27							
Control cables							
	CF77-UL-D	PUR		6.8	±180	-13/ +176	●○○
	CFROBOT2	PUR	✓	10	±180	-13/ +176	●●◐
Data cable							
	CFROBOT3	PUR	✓	10	±180	-13/ +176	●●◐
Measuring system cable							
	CFROBOT4	PUR	✓	10	±180	-13/ +176	●●○
Fiber optic cable							
	CFROBOT5	TPE		10	±180	-31/ +176	●●○
Motor cables							
	CFROBOT6	PUR		10	±180	-13/ +176	●●◐
	CFROBOT7 New	PUR	✓	10	±180	-13/ +176	●●◐
Spindle cables/Single cores							
	CFROBOT	TPE	✓	10	±180	-31/ +194	●●◐
Bus cable							
	CFROBOT8	PUR	✓	10	±180	-13/ +158	●○○
	CFROBOT8-PLUS	PUR	✓	10	±360	-13/ +158	●◐○
Hybrid cable							
	CFROBOT9	PUR	✓	10	±180	-13/ +176	●●○

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

chainflex® types

Approvals and standards	Flame-retardant	Oil-resistant	Halogen-free	UV-resistant	Torsion resistant	v max. twisted [°/s]	a max. twisted [°/s²]	chainflex® Class	Page
									366
									Selection table ▶ Page 370
	✓	✓	✓	✓	✓	180	60	5.1.3.3	372
	✓	✓	✓	✓	✓	180	60	6.1.3.3	376
	✓	✓		✓	✓	180	60	6.1.3.3	378
	✓	✓	✓	✓	✓	180	60	6.1.3.3	380
		✓	✓	✓	✓	180	60	6.1.4.3	384
	✓	✓	✓	✓	✓	180	60	6.1.3.3	386
	✓	✓	✓	✓	✓	180	60	6.1.3.3	388
	✓	✓		✓	✓	180	60	6.1.4.3	392
	✓	✓		✓	✓	180	60	6.1.3.3	394
	✓	✓	✓	✓	✓	360	60	6.1.3.4	398
	✓	✓	✓	✓	✓	180	60	6.1.3.3	402

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

... Data ... Special ...

	chainflex® cable	Jacket	Shield	Bend radius min., E-Chain® [factor x d]	Temperature, E-Chain® from/to [°F]	Price index
Special cables						
	CFTHERMO	PUR	✓	12.5	-13/ +176	●●○
	CFFLAT	TPE		5	-31/ +194	●●○
	CFSPECIAL-182	PUR	✓	10	-13/ +176	●●○
	CFSPECIAL-414			7.5	-4/ +140	●●◐
	CFSPECIAL-484		✓	12.5	-4/ +140	●◐○
	CFSPECIAL-792	PUR	✓	10	-13/ +176	◐○○

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

chainflex® types

Approvals and standards	Flame-retardant	Oil-resistant	Halogen-free	UV-resistant	Torsion resistant	v max. unsupported [ft/s]	v max. gliding [ft/s]	a max. [ft/s²]	chainflex® Class	Page
										406
		✓	✓	✓		6.56	3.28	65.62	5.4.3.1	408
		✓	✓	✓		32.81	19.69	328.1	7.5.4.1	410
	✓	✓	✓	✓		32.81	19.69	328.1	-	412
	✓	✓	✓	✓		32.81	-	65.62	-	414
	✓	✓	✓	✓		32.81	-	65.62	-	416
	✓	✓	✓	✓		9.84	6.56	65.62	-	418

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

... Video ... Network ...

	Cable type		Jacket	Page
Harnessed Bus cables				426
	FireWire	Pre-harnessed cable	TPE	428
	USB 2.0	Pre-harnessed cable	PVC/PUR/TPE	430
	USB 3.0	Pre-harnessed cable	PVC/PUR	432
	GigE	Pre-harnessed cable	PUR-ROBOT/TPE	433
Harnessed coax cables				
	Koax	Pre-harnessed cable (BNC/SMA)	TPE	434
	VGA	Pre-harnessed cable	TPE	437
	DVI-D/HDMI	Pre-harnessed cable	TPE	438
Harnessed Ethernet cables				440
	CAT5 Straight		PVC/PUR/TPE	443
	CAT5e Straight		PVC/PUR/TPE	444
	CAT5e Straight		PVC/PUR/TPE	447
	CAT5e Cross-Over		PVC/PUR/TPE	448
	CAT5e with 615 connectors		PVC/PUR/TPE	449
	CAT5e with angled connectors (L/T angle)		PVC/PUR/TPE	450
	CAT6 Straight		PVC/PUR/TPE	454
	CAT6 Straight/Cross-Over		TPE	456
	CAT6A with M12 connectors		PVC/PUR/TPE	457
	CAT7 Straight		PUR/TPE	459
	Industrial Ethernet moulded		PVC/PUR	460
Harnessed Profibus cables				
	Profibus		PVC/PUR/TPE	462
Harnessed Profinet cables				
	Profinet		PVC/PUR/TPE	468
	Industrial Profinet moulded New		PVC/PUR	472

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

	Cable type	Jacket	Page
Harnessed Fiber optic cables for Video			478
	FOC 2 fibers	PVC/TPE	480
	FOC 4 fibers	TPE	481
Harnessed Fiber optic cables for Network			
	FOC 6 fibers	TPE	482
	FOC 12 fibers	TPE	482
Initiators CF9 - CF.INI (minimum bend radius 5 x d)			484
	Connection cable M12 x 1, straight/angled	TPE	487
	Linking cable M12 x 1, straight/angled	TPE	487
	Connection cable M12 x 1, straight/angled, LED	TPE	489
	Connection cable M8 x 1, straight/angled	TPE	491
	Linking cable M8 x 1, straight/angled	TPE	491
	Connection cable M8 x 1, angled, LED	TPE	493
Initiators CF10 – CF.INI (minimum bend radius 5 x d) 360° shielded			
	Connection cable M12 x 1, straight/angled	TPE	495
	Linking cable M12 x 1, straight/angled	TPE	495
Initiators CF98 - CF.INI (minimum bend radius 4 x d)			
	Connection cable M12 x 1, straight/angled	TPE	497
	Linking cable M12 x 1, straight/angled	TPE	497
	Connection cable M8 x 1, straight/angled	TPE	499
	Linking cable M8 x 1, straight/angled	TPE	499
chainflex® cables for actuator/sensor distribution box			
	Connection cable M23, straight	TPE	500
	Linking cable M23, straight/angled	TPE	500
	Connection cable M12, straight	TPE	501

Industrial ... Robots ...

		Cable type	Page
chainflex® cables with industrial connectors			**502**
	Han 6B	Harnessed cable, single locking lever at both ends, straight Harnessed cable, double locking lever at both ends, angled	504
	Han 10B	Harnessed cable, single locking lever at both ends, straight Harnessed cable, single locking lever at both ends, angled	506
	Han 10B	Harnessed cable, double locking lever at both ends, straight Harnessed cable, double locking lever at both ends, angled	506
	Han 16B	Harnessed cable, single locking lever at both ends, straight Harnessed cable, single locking lever at both ends, angled	508
	Han 16B	Harnessed cable, double locking lever at both ends, straight Harnessed cable, double locking lever at both ends, angled	508
	Han 24B	Harnessed cable, single locking lever at both ends, straight Harnessed cable, single locking lever at both ends, angled	510
	Han 24B	Harnessed cable, double locking lever at both ends, straight Harnessed cable, double locking lever at both ends, angled	510
HARTING Connector sets (“Connectors” chapter ▶ page 710)			
		Connenctors sets with pin inserts	752
		Connenctors sets Premium (Pin + Socket)	754
Dress packs for robots			**515**
	readychain® Robot	Harnessed dress packs for welding robots	515
Harnessed cables for robots			
	readycable® Kuka	Harnessed cables for Kuka robots	516
	readycable® Fanuc	Harnessed cables for Fanuc robots	522
	readycable® ABB	Harnessed cables for ABB robots	526
Direct connection cables for robots			
	readycable® Kuka	Direct connection cables for Kuka robots New	517
	readycable® Fanuc	Direct connection cables for Fanuc robots New	523
	readycable® ABB	Direct connection cables for ABB robots New	527
Cables according to AIDA specifications			
	readycable® AIDA	Harnessed cables according to AIDA specifications	532

... Drive technology...

Selection according to manufacturers			Jacket	Seite
Harnessed Drive cables				**534**
	Allen Bradley/ Rockwell	Motor/Servo/Hybrid Servo/ Brake/Feedback/Adapter cables	PVC/PUR/TPE	542
	B&R	Motor/Servo/EnDat/Encoder/ Resolver/Bus cables	PVC/PUR/TPE	543
	Baumüller	Servo/Resolver/Pulse encoder cables	PVC/PUR/TPE	543
	Beckhoff	Motor/Servo/Servo-HybridEncoder/Thermal protection/Resolver/Network cables	PVC/PUR/TPE	546
	Berger Lahr	Servo/Resolver cables	PVC/PUR/TPE	546
	Bosch Rexroth	Power/Servo/Servo Hybrid New/ Encoder cables	PVC/PUR/TPE	546
	ELAU/ Schneider Electric	Servo/Encoder/Hybrid Servo cables	PVC/PUR/TPE	549
	FAGOR	Path measuring cables	PUR/TPE	549
	Fanuc	Power/Servo/Brake/ Encoder/Signal cables	PVC/PUR/TPE	549
	Festo	Servo/Encoder/Data/ Bus/Control cables	PVC/PUR/TPE	550
	Heidenhain	Servo/Adapter cables	PVC/PUR/TPE	550
	Jetter	Motor/Servo/Resolver cables	PVC/PUR/TPE	551
	Kolmorgen/ Danaher Motion	Motor/Servo/Signal cables	PVC/PUR/TPE	551
	Lenze	Servo/Resolver/Encoder/Feedback/ Decoder/Fan cables	PVC/PUR/TPE	553
	LinMot	Motor/Servo/Encoder cables	PVC/PUR	554
	LTi DRiVES	Servo/Encoder cables	PVC/PUR/TPE	554
	Mitsubishi Electric	Motor/Encoder cables	PVC/PUR	555
	Nidec/Control Techniques	Motor/Servo/Encoder cables	PVC/PUR/TPE	555
	NUM	Power/Servo/ Encoder/Fan cables	PVC/PUR/TPE	556
	Omron	Motor/Encoder/Control cables	PVC/PUR/TPE	556
	Parker	Motor/Resolver cables	PVC/PUR/TPE	557
	SEW	Motor/Servo/Encoder/Control/ Hybrid Servo cables	PVC/PUR/TPE	557
	Siemens	Power/Servo/Signal cables	PVC/PUR/TPE	558
	Stöber	Servo/Encoder cables	PVC/PUR/TPE	562

Connectors ... Strain relief

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	SERIE A 623	Signal connector	712
	SERIE B 923	Power connector	717
	SERIE C 940	Power connector	722
	SERIE D 958	Power connector	725
	SERIE 615/915	Signal and power connector	727
	SERIE M17 617/917	Signal and power connector	735
	SERIE S 623	Power connector	740
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	igus® ibow	Angle adapter for power connector 923 size 1	743
	Tools and accessories		744
	SUB-D	Signal connector	746
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	Clips high tensile strength, modular clip-on strain relief		784
	Strain relief separators with integrated teeth		786
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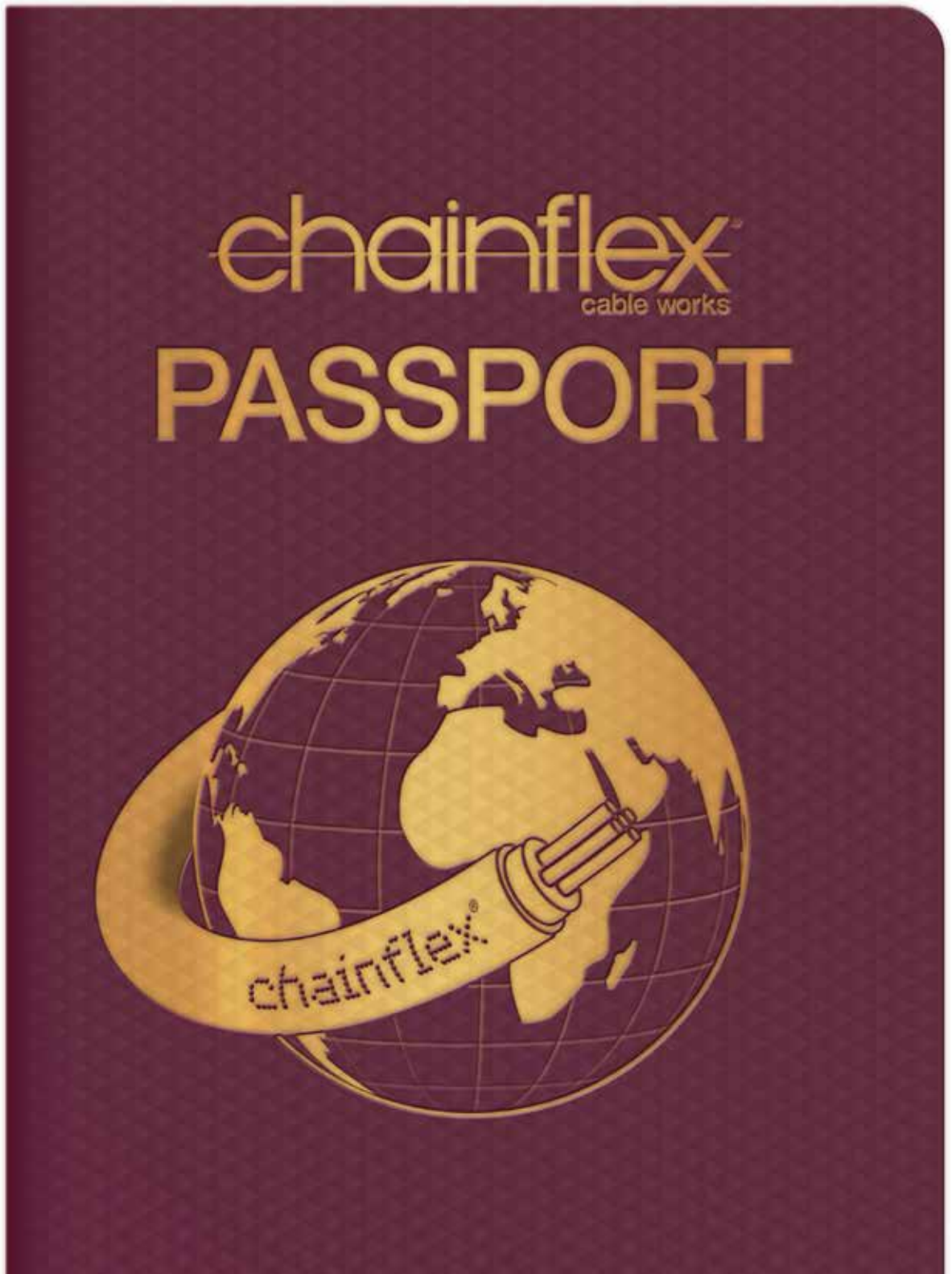
At home across the world ... chainflex® approvals for all major markets

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-GL approval for use in the offshore sector.

Details on this can be found on the following pages: 844 to 849.

Approvals overview

- CE ... 1,354 cables
- DESINA ... 300 cables
- NFPA ... 947 cables
- UL-Listed ... 29 cables
- UL-AWM ... 1,032 cables
- UL-verified ... 1,317 cables
- EAC ... 1,273 cables
- DNV-GL ... 381 cables
- CC-Link IE Field ... 8 cables
- Cleanroom ... 1,063 cables
- Ethercat ... 13 cables
- Profinet ... 10 cables
- Profibus ... 27 cables

36 months guarantee – on every chainflex® cable in this catalog

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

Safety is of utmost essence, 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 also reduces it significantly. With the unique 36-month guarantee on every chainflex® cable in this catalog, we assume a part of the responsibility and create a 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 even under liability law. Predictable reliability for every user!

Guarantee instead of mere warranty or defects liability expands the assurance qualitatively 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 measuring data: igus® "AutΩMeS" system

Direct overview of the service life by means of the selection tables "cycles"

For each chainflex® series you will find a selection table called "Cycles – 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 service life guarantee of 5, 7.5 or 10 million cycles is applicable depending on the application. The service life itself, measured by the number of possible cycles, can even be significantly higher.

1 Temperature, from/to [°F]

2 Guaranteed cycles

3 Bend radius min. [factor x d]

Guaranteed service life (details see page 22-23)

Cycles*	2 5 million	2 7.5 million	2 10 million
Temperature, from/to [°F]	R min. [factor x d]	R min. [factor x d]	R min. [factor x d]
1 -31/-13	6.8	7.5	8.5
1 -13/+194	5 3	6 3	7 3
1 +194/+212	6.8	7.5	8.5

* Higher number of cycles? Online lifetime calculation ▶ www.chainflex.com/chainflexlife

Example: Selection table "Guaranteed service life" for CF9

Example:

A cable with a diameter of 12 mm in an energy chain® with a radius of 100 mm results in a bending factor of 8.3 (100 mm/12 mm). In order to determine the guaranteed durability, you set the technical conditions from the ranges 1-2. In range 3, you can now see that (with an assumed temperature range of -13/+194°F) with 8.3 x d the effective bending factor is above the minimum limit of 7 and for the cable you have a guaranteed operation of 10 million cycles. Should the temperature become higher or lower, the necessary factor for this guarantee level would be 8.5, that is, the number of guaranteed cycles is reduced to 7.5 million. This very clear statement provides reliability and planning safety for your entire facility and can be further refined with the online service life calculator.

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

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

Over 25 years of testing experience in the chainflex® laboratory

The chainflex® laboratory specialises in trials and tests, which, apart from the rather theoretical standard procedures, also investigates concrete applications as they occur in the everyday field experience of mechanical engineering 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 the determination of service life and function. On a laboratory floor area of 29,600 ft^2, 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 well-coordinated 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 hand. However, it is precisely here that the question arises 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 represent the standards, which means they give generalising answers to generalised questions. The customer, however, wants a concrete answer and solution for his specific problem, which is often not, or only partially addressed by the standards. It is precisely these individual customer requirements that the igus® laboratory devotes itself to. Besides that, a further consequence of our intensive research and laboratory activities is the development of standard tests and production standards for chainflex® cables for the 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 such as conductors, insulating materials and jacket materials are developed. Differences that are considerable but not obvious emerge 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, only slightly different manufacturing processes can lead to significantly different effects in the case of moving applications.

All types of Chainflex® cables are tested in moving applications in E-Chains®

The chainflex® cables must also prove themselves in field experience 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 algorithms. The laboratory tests up to 20% of all completed cables in a continuous bending test and then carries out the necessary structural examinations.

4. Long-time tests of service life

These test projects, which have to be carried out over a period of up to 5 years, 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 at the right time.

5. Customer-specific applications

A special service is customer-specific examinations according to the igus® standard. This type of test is based on the customer-specific movement sequences of the application and offers in critical applications the significant advantage of test-defined stress limits and a feasible, potential optimisation before the start of mass production.

Rotary movement tests: Demanding chain applications with small radii

Test for combined motions: simulation of complex motions in robot applications

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

... 29,600 ft² test laboratory with over 65 test stations, two climatic containers (40 feet each), and 200 m of outdoor testing facilities ...

2 billion test strokes every year

250 million cycles in batch testing per year

Anyone who wants to carry out systematic, comparative and reproducible tests with a volume of more than 2 billion cycles and 1.4 million electrical measurements must, of course, provide the necessary spatial, technical and personnel requirements. On a total of 65 test stands, various test series are carried out according to the special igus® test standards. The laboratory team consisting of technically qualified and committed employees tests and monitors thousands of measuring points in E-Chains® and cables on a wide range of travel paths, in horizontal or hanging applications and always under the most real-life conditions possible in field experience. Multi-dimensionally moving E-Chains® such as the triflex® series from the robotics range are also tested for torsional strength on special test rigs.

Special test equipment for the special something

In addition to the normal quality and service life tests, special testing rigs are also available for custom tests. Thus, for example, abrasion and media tests for materials are carried out under considerably more accurate experimental conditions than in tests for storage and aging carried out according to UL or VDE standards. The optimum matching of igus® outer jacket materials to the materials in the energy supply systems is a tribologically clearly noticeable result. The influence of thermal factors on moving cables can be analysed in two special climatic containers for a temperature curve of -40°F to +140°F. Both are equipped with a 19.69 ft long axis, which can be operated with different radii and E-Chains®. In contrast to the standard winding mandrel test (for details see page 36) according to VDE, one can test the aging in very different temperature curves in continuous motion in E-Chains®.

... UL verified ...

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

36-month guarantee

Consistent monitoring and accurate test documentation

Necessary condition for successful and meaningful tests is the systematic and effective monitoring as well as exact documentation of the results. Here, monitoring systems developed by igus® are used, which, in addition to a permanent online monitoring, ensure documentation with very high accuracy. Therefore wear can also be detected before the failure. This early detection – without a destructive test – allows prompt adjustments. After each test, all the cables are separated into their elements according to predetermined sequences, examined in detail and their properties documented.

Due to these careful test conditions, qualified data on all chainflex® cables are available and offer the user planning security for his cable selection.

Facts and figures

- The industry‘s largest test lab for moving cables
- 25 years of experience
- 29,600 ft^2 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)

Safe cable selection – the different test methods in detail

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 33-34)

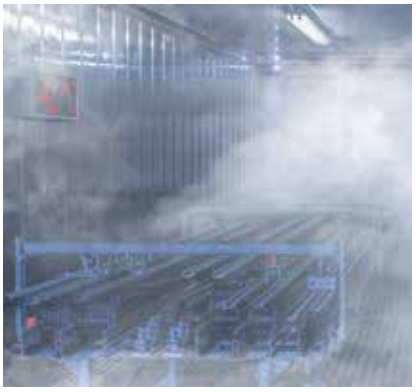
Depending on the application and the place of use, there are different requirements regarding the flame-retardant properties of a cable. To meet this, igus® offers a wide variety of tests in order to guarantee the product is appropriate.

Media tests (page 35)

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 36)

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 37)

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 method | **Fire tests**

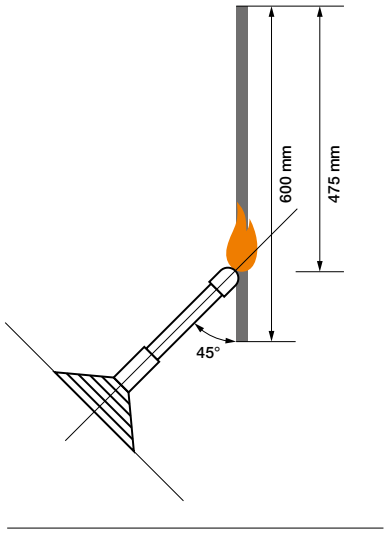
Test	Specification	Design

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

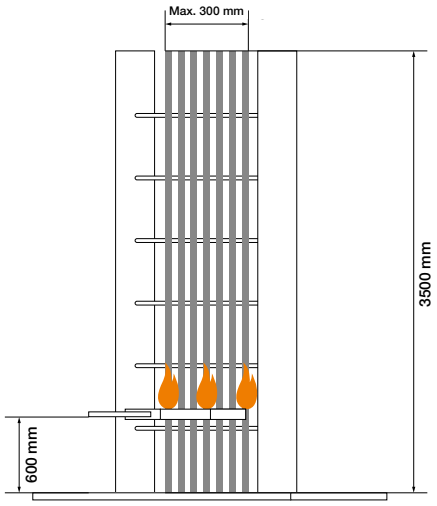


IEC 60332-3-22/-23/-24/-25

Testing vertical flame propagation of vertically arranged bundles of cables or insulated cables

Sample length:	3500mm
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

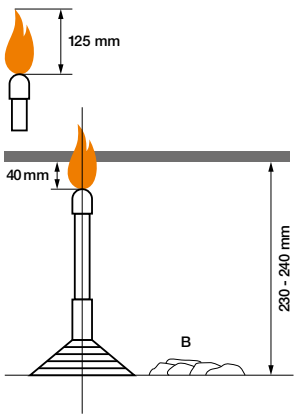


FT2 Flame Test

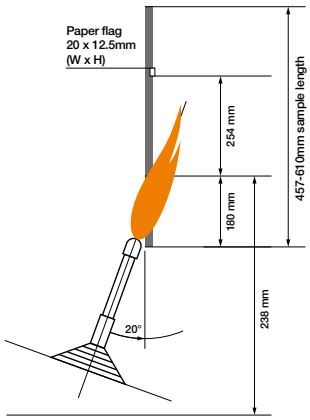
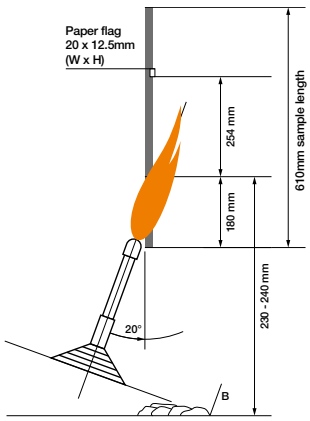
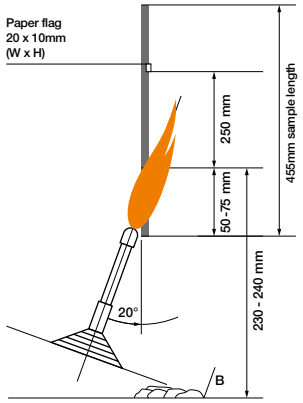
UL 1581, § 1100 (FT2 Flame Test)

Sample length:	250mm-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.

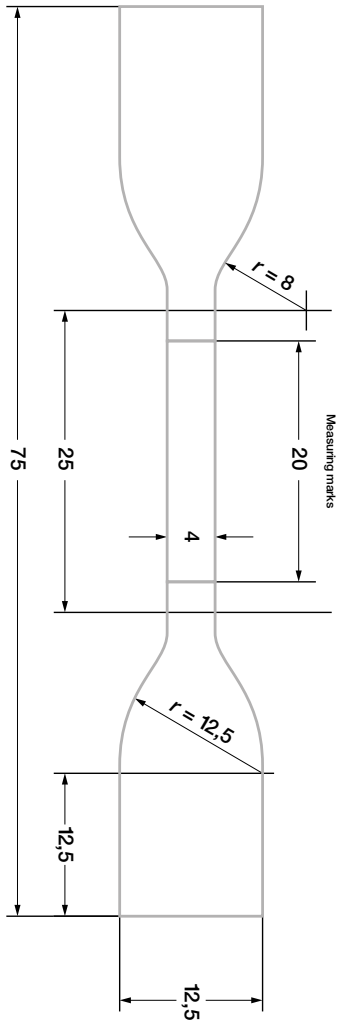
Dripping material must not ignite the underlying cotton (B).



Test method | **Fire tests**

Test	Specification	Design
Vertical Flame and FT1	**UL 1581, § 1060 (Vertical Flame and FT1 Test)** Sample length: 457mm-610mm Burner: Bunsen burner with additional air supply (Tirril gas burner) Ø9.5mm Test temperature: 500 W 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: 500 W 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: 500 W 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 24 h 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 24 h 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 24 h 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 ▶ Page 834-837

Test method | **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

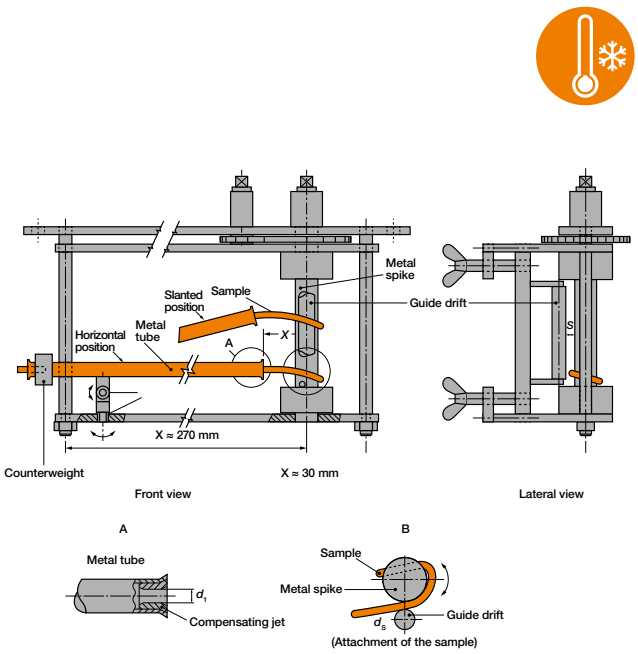
Mandrel diameter 4-5 times the sample diameter (there must be at least 2 samples)

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 be no 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

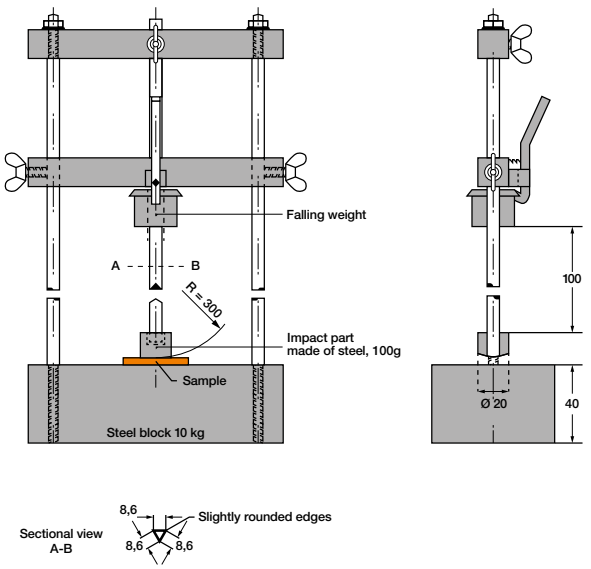
Diameter of the cable (D) [mm]	Dimensions of the the hammer [g]	Dimensions of the intermediate sample [g]	Fall height [mm]
D < 15	1000	200	100
15 < D ≤ 25	1500	200	150
D > 25	2000	200	200

3 pieces, length at least 5x the outer diameter or 150mm

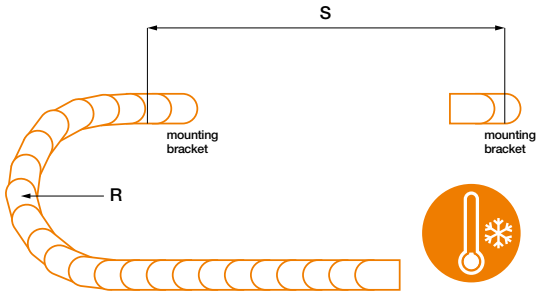
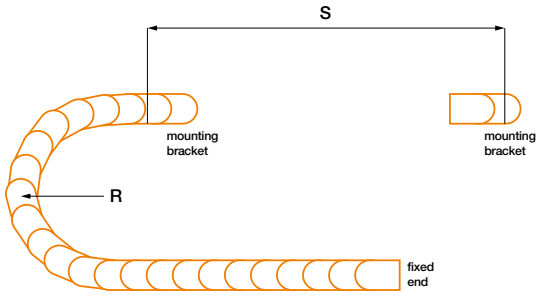
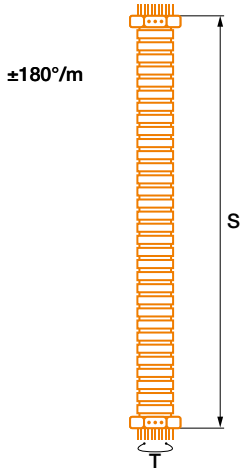
Storage of test equipment and samples > 16hrs at test temperature

Heat to room temperature

When viewed with the naked eye or visual aid without magnification, there should be no cracks in the outer jacket.



Test method | **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 length 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 length S: up to about 7.5m Temperature: approx. +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: approx. 1m Rotation angle: according to catalogue (about ±180°) Target: **minimum** 5,000,000 cycles	

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

Control cables are still a measure of all things in automation. This makes it all the more important for the control cable for the permanent use in E-Chain® to have a safe construction in order to meet the increasingly stringent mechanical requirements in the long term.

The special features of the chainflex® control cables are:

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

Every design proposal has to be tested time and again under real conditions, in order to be able to calculate a binding guarantee, or 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.chainflex.com/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.chainflex.com/test2233

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

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

Although data cables must have different electrical requirements than bus cables, data cables provide a specific requirement for EMC protection. Especially in the case of the permanent movement in the E-Chain®, the EMC shielding is subjected to very high mechanical loads.
To ensure that this load does not lead to failures in the communication, a safe construction and manufacturing is important, especially in the field of shielding.

The special features of the Chainflex data cables are:

- Very short balanced **braiding in pairs** according to electrical requirements
- **Braid angles** of the igus® overall shields have been specially developed and tested by igus®.
- **Pressure extruded outer jackets** for stabilising shield and stranding

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

Example of long-term test 4901 of a CF211 series data cable with short travel, with a 75 mm 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.chainflex.com/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.chainflex.com/test4901

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

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

The use of fieldbus cables, and particularly the rapid growth of the Ethernet communication nodes in the industrial environment, poses very high requirements on the design and manufacture of the bus cables. This is the only way to prevent the classic mechanical damage and the creeping loss of data transmission quality. Increasing attenuation due to shield damage or characteristic impedance changes leads to considerable reduction in data quantities. Since the attenuation values are constantly changing by and during the 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 **strandings**, 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 stabilising shield and stranding

Every design proposal has to be tested time and again under real conditions, in order to be able to calculate a binding guarantee, or 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.chainflex.com/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.chainflex.com/test3089

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

Test 4011: Fiber optic cable tested with 50 million strokes ...

FOC cables are characterised by the safest and most effective possible data transmission.
In particular, when using glass fibers, the effective length, the effective data volume and the EMC safety is inexhaustible for today's automation technology.
However, the pure glass fibers are sensitive to mechanical loads. Therefore, the chainflex® fiber optic cables are designed in such a way that the fibers are never exposed to mechanical loads at any time, but the cable elements safely absorb all forces, thus protecting the fibers.

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

- FOC **multimode or singlemode fiber** with high flexing strength
- Balanced **stranding** of the aramide-protected sub-cable elements
- High tensile **strength aramid torsion protection braid**
- With pressure extruded **outer jackets** for the stabilisation of the entire structure.

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

Example of long-term test 4011 of a multimode fiber glass cable of CFLB series tested short travel distance, with a bend 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.chainflex.com/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.chainflex.com/test4011

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

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

Measuring system cables are the important communication link between the drive and the control system. Considerable damage can occur if the electrical signals are not transmitted safely and in the correct time due to movements. Therefore, measuring system cables have a special requirement for EMC protection.
Especially in the case of the permanent movement in the E-Chain®, the EMC shielding is subjected to very high mechanical loads. To ensure that this load does not lead to failures in the measuring systems, a safe construction and manufacturing, especially in the field of shielding and stranding, is very important.

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

- **Stranding elements specifically designed for the measuring system** with the necessary element shields and optimized strand pitch lengths
- Conductor color code matched to the defined measuring system
- Gusset-filled extruded **inner jacket**
- **Shield superstructures** specially developed and tested by igus®
- With **pressure extruded outer jackets** for stabilizing shield and stranding

Every design proposal has to be tested time and again under real conditions, in order to be able to calculate a binding guarantee, or the service life online.
Example of long-term test 3479 of a measuring system cable of the CF11-D series, with a 75 mm 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.chainflex.com/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.chainflex.com/test3479

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

Test 3841: Servo cable tested with 53 million strokes

Servo cables are today the standard for drive technology in automation technology and machine construction. Due to the construction with power cores in combination with usually essential shielded pairs, servo cables are mechanically constructed often in a very unbalanced manner.
To ensure that this asymmetry does not lead to failures 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 urgently recommended.

The special properties of the chainflex® servo cables are:

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

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

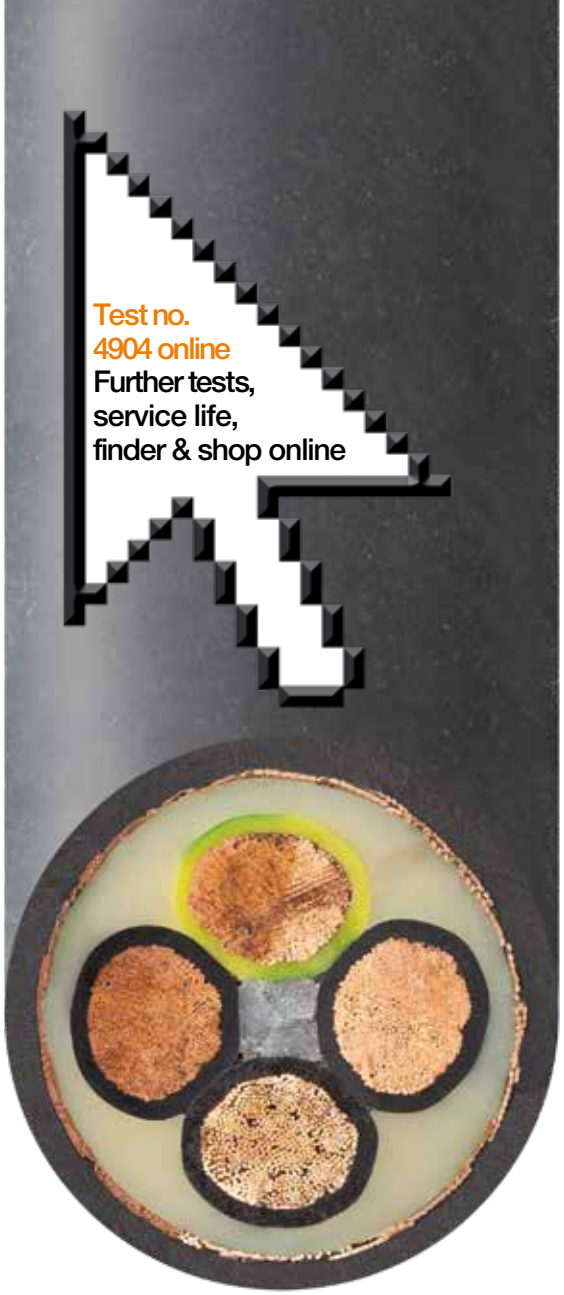
Example of long-term test 3841 of a CF21 series servo cable with a test bend factor of only 6.1 x d.

This is just one example of the numerous cable tests from the chainflex® laboratory. All current tests can be found online at ▶ www.chainflex.com/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.chainflex.com/test3841

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



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

Motor cables are today the standard for drive technology in automation technology as well as in plant and machine construction.
Due to today's high dynamics, the design features of conductors, insulation and in particular the stranding must be chosen in such a way that the drive 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 urgently recommended.

The special properties of the chainflex® motor cables are:

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

Every design proposal has to be tested time and again under real conditions, in order to be able to calculate a binding guarantee, or 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.chainflex.com/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.chainflex.com/test4904

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

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

Cables for torsion are subjected to very special stress. Particularly in the case of shielded bus cables, due to the multiple stresses a high mechanical load is exerted by the bending and torsion of the insulation materials and, in particular, by the shield.
This requires completely different structural concepts compared to cables for linear E-Chain® applications.

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

- Low-capacitance **insulating materials**
- Optimized **pitch lengths**, in combination with force-absorbing filler elements
- Highly abrasion resistant **films** between the shielded elements
- With pressure extruded **outer jacket**

Any well thought-out design still should always be tested under real conditions in order to be able to calculate a binding guarantee or the service life 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.chainflex.com/tests

A test result from the igus® database	
Test no.	3486
Cable type	CFROBOT8
Bend radius factor in E-Chain®	±180°/m
Cycle frequency without damage	22 million

Details of the test online:
www.chainflex.com/test3486

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