Chainflex®

Design parameters | Cable and hose packages

Rules for:
- **Maximum cable diameters**
- **Separation**
- **Bend radius**

General rules for cables and hoses in E-Chains®

Data and energy supply in all forms within an Energy Chain System®

The key advantage of an igus® Energy Chain System® is the safe accommodation of various forms of data cables and energy suppliers in one system. We recommend the optimal separation layout of the cables and hoses in the E-Chain®, but you, the customer, are still afforded the final choice. It is possible, for instance, to maintain minimum distances between bus and motor cables and mix pneumatics, electric and hydraulics in the same compartments.

In addition to the quality of the cables used, the arrangement of each Cable/hose within the E-Chain® and the space allowed, are important for the service life of the system. Various separation options enable the adaptation of the E-Chains® to the specific requirements of each respective application. Generalised rules such as "No more than 80% of the clear space of Energy Chains® is allowed to be used" no longer make sense given the complexity of present-day applications. In this chapter, we give you detailed recommendations. Due to the variety of the application parameters, we strongly recommend you take advantage of our free consultation services.Simply give us a list of your cable requirements (or merely the required electrical or other services) and you will receive our recommendation.

Hydraulics and electric cables are separated from one another in this example

Orderly cables with igus® interior separation

Maximum cable and hose diameters

The maximum cable and/or hose diameter corresponds to the inner height of the selected E-Chain®/e-tube, with additional minimum clearance. This minimum clearance would be, for example, 10% for electrical round cables, 20% for hydraulic hoses. An E-Chain® is ideal if a minimum lateral gap to the next cable or hose has been factored in. Depending on the nature of the cables, the dynamics, and the expected service life, more clearance must be allowed. In specific cases, clearances may be altered further.
You may talk to us about this.

Electrical cables need at least 10% clearance space all around, hydraulic hoses need 20%

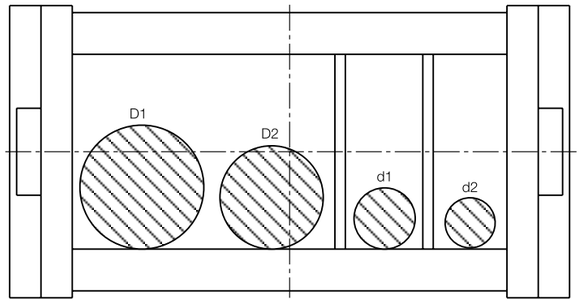
The maximum conduit diameter is specified for each series on its respective chapter

Design parameters | Cable and hose packages

Designing with igus®

Distribution in E-Chains®

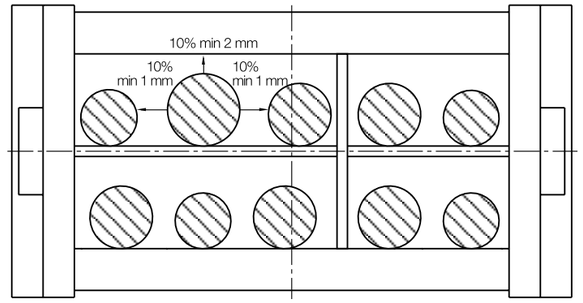
- Cables and hoses with very different diameters should be laid separately. The separation is achieved using modular separators.
- Cables and hoses must **under no circumstances** have the opportunity to tangle. Therefore, the clearance height of a compartment with several similar cables or hoses next to one another **must not amount to more than one and a half times the cable/hose diameter**.



D1 + D2 > 1.2 x hi **d1 + d2 ≤ 1.2 x hi**

Expressed in rules, this means:

Rule 1:
if D1 + D2 > 1.2 x E-Chain® inner height, no separation between the two cables/ hoses is necessary. Two cables/ hoses should never be left unguided on top of one another or be allowed to become tangled.



d1 + d2 ≤ 1.2 x hi

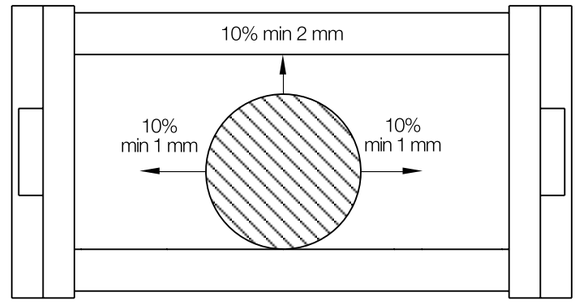
Rule 2:
if d1 + d2 ≤ 1.2 x E-Chain® inner height, a vertical separator or a horizontal shelf must be used to reduce the inner height. Thereby preventing the entanglement of d1 and d2.

The reason for this rule is:
The cables and hoses must be laid so that they can move freely at all times and so that no tensile force is exerted at the radius of the E-Chains®.

For high-speed applications and high cycles, cables or hoses must not be laid on top of each other without horizontal separation.
The standard values for this are:

Travel speed over **1.64 ft/s (0.5 m/s)** and cycles over **10,000 p.a.**

igus® interior separation offers a safe solution for this situation.



Clearance space "all around" for round electrical cables

Clearance space in % for various cables

Cables	clearance space "all around"
Electrical round cables	**10%**
Electrical flat cables	**10%**
Pneumatics	**5-10%**
Hydraulics	**20%**
Media hoses	**15-20%**

Design parameters | Cable and hose packages

Further guidelines for distribution

- The cable weight should be symmetrically distributed along the width of the E-Chain®.
- Cables with different outer jacket materials must not be allowed to stick together. If necessary, they must be laid separately. All igus® Chainflex® cables can be combined with each and all other brands of cables.
- The cables should always be fixed at the moving end. The fixed end should always involve strain relief. Exceptions are made only for certain hydraulic hoses with length compensation issues or other high pressure hoses. (i.e. to "hydraulic hoses").
- Generally, the faster and more frequently the E-Chain® operates, the more important the exact positioning of the cables and hoses inside the E-Chain® becomes. Due to the wide variety of the possibilities, we strongly recommend you take advantage of our free consultation services for your specific applications.

Bend radius R

- The bend radius of your E-Chain® depends on the thickest or stiffest cable or hose in your application.
- The bend radii of the E-Chains® should be adjusted to the recommendations of the cable or hose manufacturer. The selection of a larger radius than the minimum will positively affect service life.
- The specification of minimum bend radii for cables refers to use at normal temperatures. Other bend radii may be recommended like the ones seen in our guarantee charts within eatch chapter. Please ask your cable supplier for details.

The igus® construction kit of Energy Chain Systems® solves all the requirements for interior separation known today.

igus® Chainflex® cables permit the smallest bend radius of 4 x d for one million strokes.

The igus® product range offers up to 12 different bend radii for each chain series from stock. Here series 50 in the Storebaelt bridge project.

We recommend complete E-ChainSystems® - where bend radii for all cables and hoses, interior separation and service life are optimally matched. Also ask for the igus® system guarantee. ▶ ReadyChain® **from page 780**

Design parameters | Electrical round cables

Electrical round cables

For electrical cables, the round cable is a safe, modular and cost-effective solution for E-Chain Systems®. We recommend the following criteria for selecting the proper round electrical cables:

Selection criteria:

- Small minimum bend radii and mounting heights
- Long service life at minimum bend radius
- Service life expectations for your application (short or long travel, hanging)
- Test data on service life from realistic tests
- Uncomplicated installation process - no hanging, laying out, etc, of cables
- Strain relief integrated directly into the mounting bracket
- Flexible shields for shielded cables
- Abrasion-resistant and non-adhesive outer jackets
- Large selection to avoid expensive custom designs

For bus cables and Fiber optic cables, special attention must be paid to how effective transmission rates and shielding remain after millions of cycles at the minimum bend radius.

Example at igus® experimental laboratory: constant development and testing of Chainflex® electrical round cables

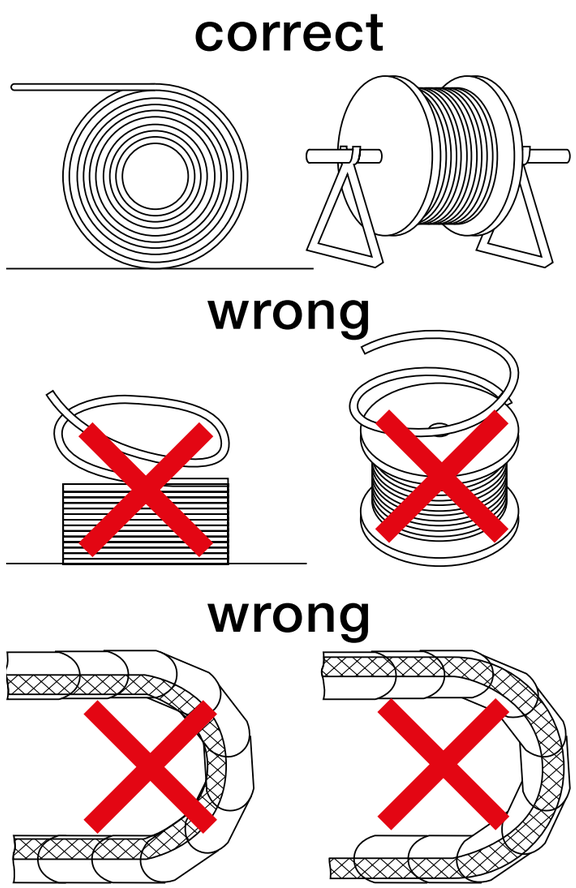
Design parameters | Electrical round cables

Installation and strain relief of round electrical cables

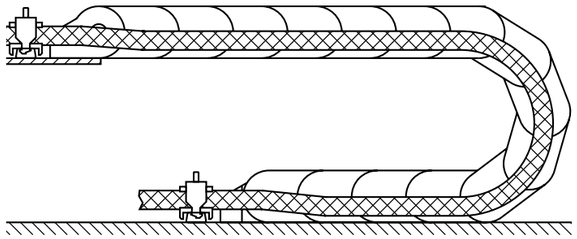
1. The cables must be laid straight, without twisting. Cables must not be uncoiled from the top of the spool. igus® Chainflex® cables are immediately ready for placement directly into the E-Chain®. They need not be disconnected or laid out before installation.
2. The cables must be laid so that each individual cable can move freely from side to side.
3. The cables must be able to move freely along the radius. This must be double-checked if the upper run operates at the cable's maximum bend radius.
4. The division of the E-Chains® interior using igus® interior separators or shelves is necessary if several cables and/or hoses with varying diameters are laid out. It is important to prevent cables and hoses from tangling.
5. For cables and hoses with different jacket materials, it is important to prevent them from "sticking" to one another. If necessary, they should be separated. igus® Chainflex® cables can be combined with all others.
6. Round electrical cables must be secured with strain relief at both ends. In exceptional cases, the cables may be fixed with strain relief at the moving end of the E-Chain® only. A gap of 10-30 x cable diameter between the end of the bend segment and the fixed point is recommended for most cables. Chainflex® cables can, on the other hand, be secured directly to the mounting bracket with strain relief (this has been confirmed with testing).

We will be pleased to provide you with recommendations for complete E-ChainSystems:
„ReadyChain®: chain-cable harnessing".

▶ ReadyChain® **from page 839**



The cables must be able to move freely along the radius



Chainflex® cables can be strain-relieved directly at the mounting bracket.

Corkscrewing: an effect of improper cable and hose placement in an E-Chain®

Design parameters | Pneumatic hoses

Pneumatic hoses

In principle, the same rules apply for pneumatic hoses as for round cables. In practice, it has been demonstrated that pneumatic hoses are less susceptible to wear. After consultation, they can be laid together more closely than the "10% all-around clearance" rule. A double-sided strain relief is required under these conditions. For pneumatic hoses made of rubber, we recommend strictly following the "10% clearance" rule because they tend to adhere to each other and to other cables and hoses.

Fully pre-assembled E-Chainsystem® with several pneumatic and hydraulic hoses

The igus® product range also offers thermo polymer pneumatic hoses called "Chainflex® CFAir and CFCleanAir" ▶ **page 406**

Information color code

DIN 47100 color code (however, deviating from DIN: without color repetition after 44th core)*

1 white	17 white-grey	33 green-red	49 white-green-black
2 brown	18 grey-brown	34 yellow-red	50 brown-green-black
3 green	19 white-pink	35 green-black	51 white-yellow-black
4 yellow	20 pink-brown	36 yellow-black	52 yellow-brown-black
5 grey	21 white-blue	37 grey-blue	53 white-grey-black
6 pink	22 brown-blue	38 pink-blue	54 grey-brown-black
7 blue	23 white-red	39 grey-red	55 white-pink-black
8 red	24 brown-red	40 pink-red	56 pink-brown-black
9 black	25 white-black	41 grey-black	57 white-blue-black
10 violet	26 brown-black	42 pink-black	58 brown-blue-black
11 grey-pink	27 grey-green	43 blue-black	59 white-red-black
12 red-blue	28 yellow-grey	44 red-black	60 brown-red-black
13 white-green	29 pink-green	45 white-brown-black	61 black-white
14 brown-green	30 yellow-pink	46 yellow-green-black	
15 white-yellow	31 green-blue	47 grey-pink-black	
16 yellow-brown	32 yellow-blue	48 red-blue-black	

*Eception: 4-core cables are braided in the color sequence white, green, brown, yellow.

The first color indicates the basic color of the core insulation, and the second color indicates the color of the printed-on ring. In the case of three colors, the second and third colors are printed on the basic color.

Copper wire dimensions according to AWG numbers

AWG/MCM No.	Diameter [mm]	Cross section [mm²]	AWG/MCM No.	Diameter [mm]	Cross section [mm²]
500	17.96	253.00	18	1.024	0.823
350	15.03	177.00	20	0.813	0.519
250	12.70	127.00	22	0.643	0.324
4/0	11.88	107.20	24	0.511	0.205
3/0	10.40	85.00	26	0.405	0.128
2/0	9.27	67.50	28	0.320	0.0804
1/0	8.25	53.50	30	0.255	0.0507
1	7.35	42.40	32	0.203	0.0324
2	6.54	33.60	34	0.160	0.0200
4	5.19	21.20	36	0.127	0.0127
6	4.12	13.30	38	0.102	0.00811
8	3.26	8.37	40	0.079	0.00487
10	2.59	5.26	42	0.064	0.00317
12	2.05	3.31	44	0.051	0.00203
14	1.63	2.08			
16	1.29	1.31			

Information | Load-carrying capacity of cables

The values from the tables on the side of this page have been taken from the standard DIN VDE 0298, Part 4. These values have been simplified and only apply approximately. For each user, it is advisable to obtain and comply with the regulations that apply to each individual case of application (e.g. measures for protection in case of indirect contact in accordance with DIN VDE 0100 Part 410, overcurrent protective devices in accordance with DIN VDE 0100 Part 430 or voltage drop in accordance with DIN VDE 0100 Part 520). It is not possible to provide all the regulations or overviews in this catalog. Due to the harmonisation that has been carried out, it is possible that different load-carrying values may be permissible for the same cable in some cases. For the selection of the relevant cross sections, the load capacity in undisturbed operation is the determining factor, i.e. the use with permissible operating temperature or permissible maximum temperature on the conductor.
The load-bearing capacity according to table 1 on this page applies to operating-current-carrying conductors.

Normally, these are 2 loaded conductors in the case of 2-core and 3-core cables, as well as 3 loaded conductors in the case of 4-core and 5-core cables. Please take this into account when planning for the use of multi-core cables in electrical installation conduits or Energy Chains®. This information is based on an ambient temperature of 30°C and a non-loaded cable. Please apply the conversion factors according to table 2 in case the air temperature is increased due to the heat loss of the cables (please take thermal radiation into account as well, e.g. effects of exposure to the sun).

The possible cable installation types in Energy Chains® result in such a broad range of loading profiles that no generalised conversion factors can be mentioned for this large accumulation of cables. The installation type and the conversion factors must be looked up in table 3 according to each individual application.

Table 3: Conversion factors for multi-core cables with cable cross sections up to 10 mm²

Loaded Conductors	Conversion Factor
5	0.75
7	0.65
10	0.55
14	0.50
19	0.45
24	0.40
40	0.35
61	0.30

Table 1: Cables for fixed installation in energy-conducting chains and tubes

Insulation material	PVC	TPE
Chainflex® type	CF5, CF6, CF2, CF880, CF881, CF890, CF891 CF130 US CF140US	CF130.UL, CF140.UL, CF77. UL.D, CF78.UL, CF9, CF10, CF9. UL, CF10.UL, CF98, CF99, CF240, CF211, CF112, CF11, CF12, CF211, CF113.D, CF111.D, CF11.D, CF210.UL, CF21.UL, CF270.UL.D, CF27.D, CF30, CF31, CF34.UL.D, CF35.UL, CF37.D, CF38, CF300. UL.D, CFPE, CF310.UL, CF330.D, CF340, CFBRAID, CFROBOT, CFROBOT 6,7,9, CF884, CF894 CF885, CF886, CF895, CF896 CF887, CF897, CF220.UL.H, CF280.UL.H, CF430.D, CF440
Number of conductors	2 or 3	
Installation		

Nominal cross section of copper cable [mm²]	AWG	Load-carrying capacity [A]	
		PVC insulation	TPE insulation
0.14	26	2.5	2.5
0.25	24	4	5
0.34	22	5	7
0.50	20	8	10
0.75	18	12	14
1	17	15	17
1.50	16	185	21
2.50	14	26	30
4	12	34	41
6	10	44	53
10	8	61	7 4
16	6	82	99
25	4	108	131
35	2	135	162
50	1	168	202
70	2/0	207	250
95	3/0	250	301
120	4/0	292	352
150	300	335	404
185	350	382	461

Table 2: Conversion factors in case of varying ambient temperatures

Ambient temperature [°C]	Conversion Factor	
	PVC insulation	TPE insulation
10	1.22	1.15
15	1.17	1.12
20	1.12	1.08
25	1.06	1.04
30	1.00	1.00
35	0.94	0.96
40	0.87	0.91
45	0.79	0.87
50	0.71	0.82
55	0.61	0.76
60	0.50	0.71
65	–	0.65
70	–	0.58
75	–	0.50
80	–	0.41
85	–	0.29
90	–	0.14

Chemical resistance | **Selection chart**

Group	Chainflex® cable	Jacket material	1	2	3	4	Page
Control cables							
Control cable	CF880	PVC	1				66
Control cable	CF881	PVC	1				70
Control cable	CF130-UL	PVC	1				82
Control cable	CF140-UL	PVC	1				86
Control cable	CF5	PVC		2			90
Control cable	CF6	PVC		2			94
Control cable	CF77-UL-D	PUR			3		106
Control cable	CF78-UL	PUR			3		110
Control cable	CF2	PUR			3		114
Control cable	CF9	TPE				4	118
Control cable	CF10	TPE				4	122
Control cable	CF9-UL	TPE				4	126
Control cable	CF10-UL	TPE				4	130
Control cable	CF98	TPE				4	134
Control cable	CF99	TPE				4	136
Data cables							
Data cable	CF240	PVC		2			142
Data cable	CF240 -PUR	PUR			3		146
Data cable	CF211	PVC		2			150
Data cable	CF211-PUR	PUR			3		154
Data cable	CF112	PUR			3		162
Data cable	CF11	TPE				4	158
Data cable	CF12	TPE				4	166
Data cable	CFKoax	TPE				4	168
Bus cables							
Bus cable	CF888	PVC	1				180
Bus cable	CFBUS-PVC	PVC		2			182
Bus cable	CFBUS-PUR	PUR			3		190
Bus cable	CFBUS	TPE				4	194
Bus cable	CF11-LC	TPE				4	200
Bus cable	CF11-LC-D	TPE				4	204
Bus cable	CF14-CAT5	TPE				4	210
Fiber optic cables							
Fiber optic cable	CFLG88	PVC	1				220
Fiber optic cable	CFLK	PUR			3		218
Fiber optic cable	CFLG-LB-PUR	PUR			3		222
Fiber optic cable	CFLG-LB	TPE				4	226
Fiber optic cable	CFLG-G	TPE				4	230
Measuring system cables							
Measuring system cable	CF884	PVC	1				240
Measuring system cable	CF211	PVC		2			244
Measuring system cable	CF111-D	TPE				4	254
Measuring system cable	CF113-D	PUR			3		260
Measuring system cable	CF11-D	TPE				4	268

Chemical resistance | **Selection chart**

Group	1	2	3	4
Inorganic chemicals				
Aqueous solutions, neutral				
Water	+	+	+	+
Common salt (10%)	+	+	+	+
Glauber's salt (10%)	+	+	+	+
Aqueous solutions, alkaline				
Soda (10%)	O	+	O	+
Aqueous solutions, acid				
Sodium bisulfate (10%)	O	+	O	+
Aqueous solutions, oxidising				
Hydrogen peroxide (10%)	+	+	+	+
Potassium permanganate (2%)	+	+	+	+
Inorganic acids				
Hydrochloric acid, concentrated	–	–	–	–
Hydrochloric acid (10%)	O	O	O	+
Sulfuric acid, concentrated	–	–	–	–
Sulfuric acid (10%)	O	O	O	+
Nitric acid, concentrated	–	–	–	–
Nitric acid (10%)	O	O	–	O
Inorganic caustic solutions				
Sodium hydroxide, concentrated	–	–	–	O
Sodium hydroxide (10%)	O	O	O	+
Caustic potash, concentrated	–	–	–	O
Caustic potash (10%)	O	O	O	+
Ammonia, concentrated	O	O	O	+
Ammonia (10%)	+	+	+	+
Organic chemicals / organic acids				
Acetic acid, concentrated (glacial acetic acid)	–	–	–	O
Acetic acid (10% in H_2O)	O	+	O	+
Tartaric acid (10% in H_2O)	O	+	+	+
Citric acid (10% in H_2O)	O	+	+	+
Ketone				
Acetone	–	–	–	O
Methyl ethyl ketone (MEK)	–	–	–	O
Alcohols				
Ethyl alcohol (spirit)	–	O	O	+
Isopropyl alcohol	–	O	O	+
Diethylene glycol	O	O	+	+
Aromatic compounds				
Toluol	–	–	O	–
Xylol	–	–	O	–
Fuels				
Gasoline	–	O	+	+
Diesel fuel	–	O	+	+
Synthetic oils lubricating oil				
ASTM oil #2	O	+	+	+
Hydraulic oil				
Mineral oil base	–	O	+	+
Glycol base	O	O	+	+
Synthetic ester base	–	O	+	+
Vegetable oils				
Rapeseed oil	O	+	+	+
Olive oil	O	+	+	+
Soya bean oil	O	+	+	+
Cold cleaning agent				
Cold cleaning agent	–	O	+	O

\+ no or minimum negative influence
O medium reciprocal effect, short-term exposure permissible
– unstable, material partly destroyed

All information applies to room temperature

Chemical resistance | **Selection chart**

Group	chainflex® cable	Jacket material	1	2	3	4	Page
Servo cables							
Servo cable	CF887	PVC	1				280
Servo cable	CF210-UL	PVC		2			282
Servo cable	CF220-UL-H	PVC		2			286
Servo cable	CF21-UL	PVC		2			290
Servo cable	CF270-UL-D	PUR			3		296
Servo cable	CF280-UL-H	PUR			3		300
Servo cable	CF27-D	PUR			3		304
Motor cables							
Motor cables	CF885	PVC	1				314
Motor cables	CF886	PVC	1				316
Motor cables	CF30	PVC		2			318
Motor cables	CF31	PUR		2			322
Motor cables	CF270-UL-D	TPE			3		330
Motor cables	CF34-UL-D	TPE				4	338
Motor cables	CF35-UL	TPE				4	342
Motor cables	CF37-D	TPE				4	346
Motor cables	CF38	TPE				4	348
Motor cables	CF300-UL-D	TPE				4	360
Motor cables	CFPE	TPE				4	362
Motor cables	CF310-UL	TPE				4	364
Motor cables	CF330-D	TPE				4	366
Motor cables	CF340	TPE				4	368
Motor cables	CF430-D	TPE				4	370
Motor cables	CF440	TPE				4	372
Twistable cables							
Twistable cable	CF77-UL-D	PUR			3		382
Twistable cable	CFROBOT2	PUR			3		386
Twistable cable	CFROBOT3	PUR			3		388
Twistable cable	CFROBOT4	PUR			3		390
Twistable cable	CFROBOT5	TPE				4	394
Twistable cable	CFROBOT6	PUR			3		396
Twistable cable	CFROBOT7	PUR			3		398
Twistable cable	CFROBOT	TPE				4	402
Twistable cable	CFROBOT8	PUR				4	404
Twistable cable	CFROBOT9	PUR				4	408
Special cables							
Special cable	CFTHERMO	PUR			3		414
Special cable	CFFLAT	TPE				4	418
Special cable	CFBRAID	TPE				4	420
Special cable	CFSPECIAL-182	PUR			3		422
Special cable	CFSPECIAL-414	PUR			3		424
Special cable	CFSPECIAL-792	PUR			3		426

Chemical resistance | **Selection chart**

Group	1	2	3	4
Inorganic chemicals				
Aqueous solutions, neutral				
Water	+	+	+	+
Common salt (10%)	+	+	+	+
Glauber's salt (10%)	+	+	+	+
Aqueous solutions, alkaline				
Soda (10%)	O	+	O	+
Aqueous solutions, acid				
Sodium bisulfate (10%)	O	+	O	+
Aqueous solutions, oxidising				
Hydrogen peroxide (10%)	+	+	+	+
Potassium permanganate (2%)	+	+	+	+
Inorganic acids				
Hydrochloric acid, concentrated	–	–	–	–
Hydrochloric acid (10%)	O	O	O	+
Sulfuric acid, concentrated	–	–	–	–
Sulfuric acid (10%)	O	O	O	+
Nitric acid, concentrated	–	–	–	–
Nitric acid (10%)	O	O	–	O
Inorganic caustic solutions				
Sodium hydroxide, concentrated	–	–	–	O
Sodium hydroxide (10%)	O	O	O	+
Caustic potash, concentrated	–	–	–	O
Caustic potash (10%)	O	O	O	+
Ammonia, concentrated	O	O	O	+
Ammonia (10%)	+	+	+	+
Organic chemicals / organic acids				
Acetic acid, concentrated (glacial acetic acid)	–	–	–	O
Acetic acid (10% in H20)	O	+	O	+
tartaric acid (10% in H2O)	O	+	+	+
Citric acid (10% in H2O)	O	+	+	+
Ketone				
Acetone	–	–	–	O
Methyl ethyl ketone (MEK)	–	–	–	O
Alcohols				
Ethyl alcohol (spirit)	–	O	O	+
Isopropyl alcohol	–	O	O	+
Diethylene glycol	O	O	+	+
Aromatic compounds				
Toluol	–	–	O	–
Xylol	–	–	O	–
Fuels				
Gasoline	–	O	+	+
Diesel fuel	–	O	+	+
Synthetic oils lubricating oil				
ASTM oil #2	O	+	+	+
Hydraulic oil				
Mineral oil base	–	O	+	+
Glycol base	O	O	+	+
Synthetic ester base	–	O	+	+
Vegetable oils				
Rapeseed oil	O	+	+	+
Olive oil	O	+	+	+
Soya bean oil	O	+	+	+
Cold cleaning agent				
Cold cleaning agent	–	O	+	O

\+ no or minimum negative influence
O medium reciprocal effect, short-term exposure permissible
– unstable, material partly destroyed

All information applies to room temperature

Information approbation and approvals

The following describes the typical Approvals and Standards that Chainflex® cables carry. The table of contents and respective catalog page details the actual approval.

This is an Underwriters Laboratory designation that indicates compliance to the AWM (Appliance Wire Material) standard 758. This describes cables intended for internal and external wiring components. An AWM cable is useful when obtaining a UL listing on an overall product.

This mark is the same as except approved for use in Canada and the United States. In accordance with Canadian AWM Standard C22.2 No.210 and UL AWM Standard 758 respectively.

Cables that bear this mark are in compliance to a specific Article of the National Electrical Code. For example UL 1277 Tray Cable fulfills the requirements of Article 336 of the 2002 NEC. Listed products are intended for use within residential, commercial and industrial structures

This is the mark of the Canadian Standards Association. Many Chainflex types carry CSA AWM approvals. The Canadian AWM designates compliance to CSA Standard C22.2 No. 210. These products are intended for the internal and external wiring of electronic equipment. Typical markings on cable include the following. EX “CSA AWM I/II A/B 80°C 300V FT1” Optional markings for oil resistance and wet ratings may apply.

Class I: Internal
A - Where not subject to mechanical abuse
B - Where may be subject to mechanical abuse

Class II: External
A - Where not subject to mechanical abuse
B - Where may be subject to mechanical abuse

The cable must also pass a flame test typically as described below: FT1 - Vertical Flame Test CSA 22.2

No. 3: In general a Bunsen burner applies flame at base of 18” specimen. Cotton is placed below specimen. Flame is applied 5 times more for 15 seconds FT4 - Vertical Flame Test CSA 22.2 No. 3: In general a propane burner (70,000 BTU/HR) applies flame at one end of 8 foot cable lengths arranged in open steel trays.

Information approbation and approvals

Info

Developed by VDW – Association of German Machine Tool Manufacturers. It describes a comprehensive total concept for the standardization and decentralization of the electrical and fluid-technical installation of machines and plants.

European Conformity – The CE mark on a cable designates that the product complies with relevant European health, safety and environmental protection legislations. 2014/35/EG