Product Catalog

2021

FRONTEC

FEITO PARA FAZER BEM FEITO.

MISSION

Turn the need for fastening and lashing into a practical, safe, and economical experience.

CERTIFICATION

• IATF 16949:2016 • ISO 9001:2015 • CRCC

MANIFESTO

There is "doing".
There is "doing it well".
Fasten pipes and cables using rubber strips or wire. That is doing.
Do this task with ties specifically designed for this purpose. That is doing it well.
Arrange the cables behind the table using rubber bands or string. That is doing.
Use professional cable organizers. That is doing it well.
Distinguishing wires with masking tape and pen. That is doing.
Using a proper and professional identification system. That is doing it well.
Every task can be accomplished in two ways: either by improvising, or the right way.
There are many smart people who are always bragging about their own "makeshift solutions" and amazing methods.
But smart is really the one who solves it well, who solves it right, who solves it with quality.
Because he who does it right only needs to do it once.
The competent one knows: where there is improvisation, there is no excellence.
Low durability and lack of safety are no fun at all.
Especially when there is already a professional, practical, and fast solution to the same problem.
Frontec is specialized in this type of solution.
We produce means of fastening and lashing that replace the usual improvisations and amateurishness.
We are anti-improvised solution. We are anti-quick fix.
We are pro-competence. Pro-practicality. Pro-technology.
We are pro-solving for good, solving fast, solving with professionalism.
Our products are the difference between the temporary and the permanent.
It's no quick fix. It's the solution.
We exist to help those who solve, and solve well.

Frontec.
Made to do well.

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Technical **Information**

Polyamide 6.6 properties

Polyamides are thermoplastic synthetic materials that can be molded by heating without chemical decomposition or other changes in their properties. They are also known as Nylon, a name used by Dupont, which synthesized the first polyamide in 1935 through the chemist Wallace Hume Carothers.
Polyamide 6.6 has characteristics that allow the manufacture of cable ties and fasteners with high tensile strength, high mechanical strength, and with desirable flexibility and surface hardness. It is the most widely used polyamide in the manufacture of FRONTEC cable ties and fasteners, because its characteristics are suitable for a wide range of applications.
PA 6.6 molecules are composed of two basic units with six carbon atoms in each:

$$[-NH(CH_2)_6NH-CO(CH_2)_4CO-]$$

Polyamide 4.6 properties

Polyamide 4.6 has high temperature resistance without the need for special additives. It is used in the manufacture of FRONTEC cable ties and fasteners for use in environments with temperatures of up to 135°C with peaks of up to 150°C.
PA 4.6 molecules are composed of two basic units with four carbon atoms in one and six in the other.

$$[-NH(CH_2)_4NH-CO(CH_2)_4CO-]$$

Raw material technical parameters

Material	Working temperature	Flammability	Material properties
Nylon 6.6 (PA6.6)	-40°C 85°C	UL94 V2	- high resistance to traction and abrasion; - high mechanical strength; - excellent flexibility and surface hardness.
UV stabilized Nylon 6.6 (PA6.6 UV)	-40°C 85°C	UL94 V2	- characteristics similar to PA6.6, but resistant to ultraviolet rays; - recommended for use in environments exposed to sunlight.
Heat stabilized HS Nylon 6.6 (PA6.6 HS)	-40°C 105°C	UL94 V2	- characteristics similar to PA6.6, but with greater durability in constant high-temperature applications; - recommended for applications close to vehicle engines.
Nylon 6.6 V0 (PA6.6 V0)	-40°C 85°C	UL94 V0	- characteristics similar to PA6.6, in addition to complying with the UL 94V0 standards and low levels of toxic gas and acids generated by the fire.
Nylon 4.6 (PA 4.6)	-40°C 135°C (peaks of up to 150°C)	UL94 V2	- excellent chemical resistance; - greater rigidity and dimensional stability, even at high temperatures.

Moisture content in polyamides

Polyamides are hygroscopic materials, because they absorb and release water. The moisture content of the cable ties is very important, because it affects their flexibility and tensile strength.
Polyamide 6.6 stabilizes its moisture content around 2.5% when subjected to a controlled atmosphere of 23°C and 50% relative humidity. The time required for the cable ties to acquire this moisture content varies from 7 to 50 days depending on the dimensions of the part.
When the cable ties are used, their moisture content should ideally be close to 2.5%. Once applied, since the trigger will remain static in the grooves of the cable tie body, changes in the moisture content will not cause significant changes in the mechanical properties of the parts.
FRONTEC cable ties and fasteners are packed in appropriate plastic bags and are only sold in the market when their moisture content is around 2.5%. Therefore, it is recommended that the products be kept in their original packages and used as soon as the packages are opened.
It is also recommended that when storing cable ties and fasteners, products should not be exposed to sunlight or stored near heat sources.
The ideal storage should be at 23°C with a relative humidity of 50%.

Cable ties with protection against ultraviolet (UV) rays

The cable ties in natural color are not recommended for use under sunlight exposure for long periods of time.
The colored cable ties with UV protection have a relative resistance to ultraviolet rays. Experience has shown good performance in sun exposure of up to 3 years.
The cable ties in black with UV protection are doped with special components that provide greater resistance to weathering and UV rays, and are indicated for applications exposed to sunlight for longer periods of time.
They are tested according to the ASTM G155:13 standard.

UV protection

No UV protection

Temperature resistance

The polyamides used for manufacturing cable ties are sensitive to high or low temperatures. Exposure to very high or very low temperatures can break down the molecular chain, causing low mechanical strength, fragility, and sensitivity to vibration.
The maximum recommended temperature for installation of the polyamide 6.6 cable tie is 60°C, however, the maximum temperature for continuous use is 85°C.
The minimum temperature for use of polyamide 6.6 cable ties is -40°C. However, when applying them, it is recommended that the temperature be above -10°C.
When the cable ties are used under high temperature conditions, we recommend using cable ties made of heat stabilized polyamide 6.6 (PA 6.6 HS) or those made of polyamide 4.6.

Flammability

The most widely used standard for evaluating the flame behavior of polymers is UL 94 (Underwriters Laboratories). This test classifies the material based on the speed of combustion, the flame extinction time, and the tendency for the flame to spread by dripping. The classification starts with class HB, the lowest level, which identifies the material as low burning rate. Classes V2, V1 and V0 identify materials as being self-extinguishing.

HB (horizontal burning) - According to the UL 94 standard, the material is classified as HB, considering two test specimens:

- Burning of 38.1 mm/min for a 3.2 mm thick specimen.
- Burning of 63.5 mm/min for a test specimen with thickness < 3.2 mm.

V2 (vertical burning) – The flame is extinguished within 30 seconds with dripping.

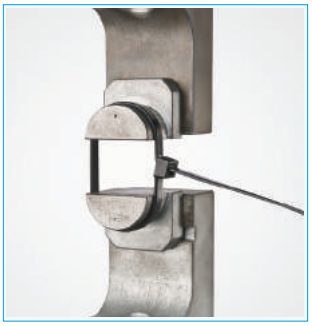
V1 (vertical burning) – The flame is extinguished within 30 seconds without dripping.

V0 (vertical burning) – The flame is extinguished within 10 seconds without dripping.

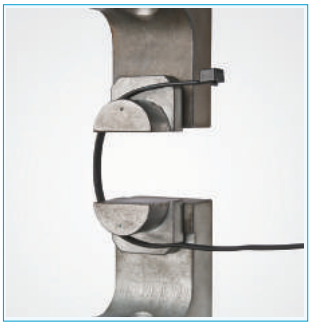
Tensile strength

All cable tie batches produced by FRONTEC are tested by sampling. The results are made available in reports containing the values obtained in each test. The minimum breaking stress represents the load a cable tie must endure without breaking.

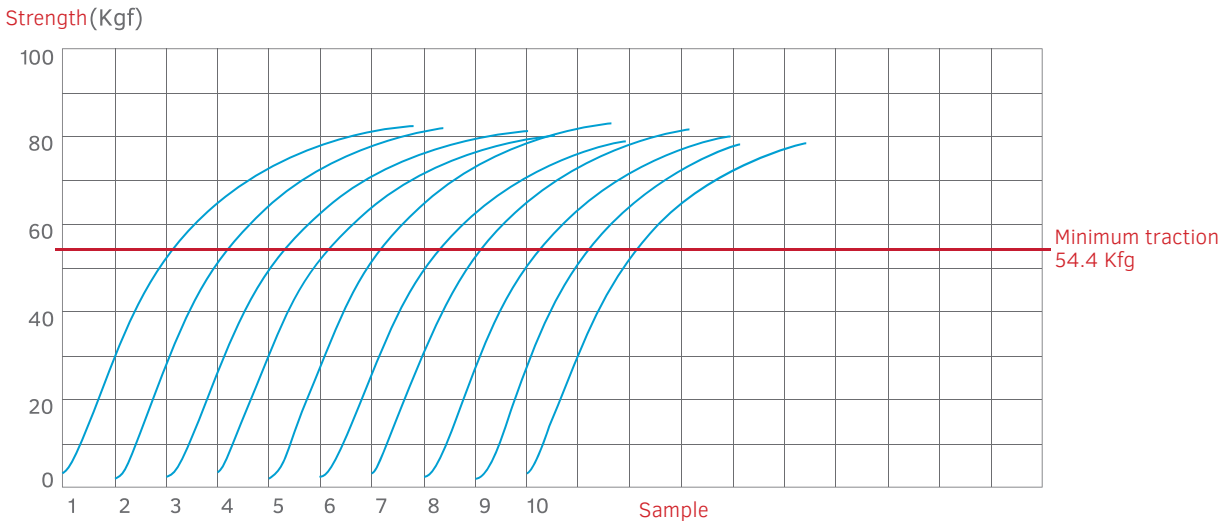
The cable tie is fixed to a mandrel with defined diameter for each cable tie model.



The mandrel is opened at constant speed.



The load at which the cable tie breaks is measured and recorded in software that graphs the test data as shown on the next page.



The graph above represents the tensile strength test conducted on 10 samples of the F7040 cable tie. The minimum expected breaking stress is 54.4 Kgf and the result presented values close to 80 Kgf (the result was 47% higher than specified in the catalog).

Traceability

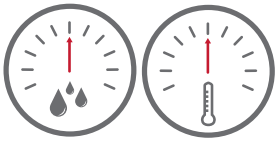
All products manufactured by FRONTEC have individual traceability by manufacturing batch, covering the various stages of the production process with the following information:

- Raw material lot (including supplier's report);
- Machine used;
- Operator and manufacturing time;
- Injection parameters used in manufacturing;
- Gravimetric doser data informing the dosages of the raw material components;

Records with date and time of tests, checks, inspections, rejections, operators, setup and stops during production;

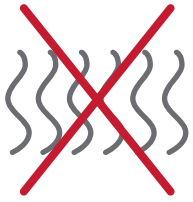
- Release report issued by the quality sector;
- Storage location in the stock;
- Data related to separation and billing (who separated the order, date, invoice number, customer etc.).

Cable tie preservation

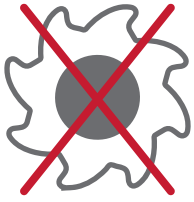


For proper preservation of the cable tie, we recommend storing it at a temperature between 10°C and 40°C and relative humidity between 30% and 70%.

After opening the package (plastic bag), the cable tie must be used as soon as possible if the humidity is below 30%.



Avoid keeping the cable tie near heat sources, as this can change the humidity of the cable ties by changing its characteristics.



Do not place or expose the cable ties under ultraviolet (UV) rays light, as they may alter their structure, making them fragile.

Resistance to chemicals

Chemicals such as acids, bases, salts, alcohols, phenols, gases, among others, can deteriorate the raw material from which the cable tie is made, changing its properties and service life. See the chemical resistance chart.

Chemical	Conc.	Resist.
Acetaldehyde - aqueous solution	40%	average
Acetamide - aqueous solution	50%	good
Amyl acetate	100%	good
Butyl acetate	100%	good
Methyl acetate	100%	good
Lead acetate - water solution	10%	average
Acetone	100%	good
Acetic acid - concentrated		low
Acetic acid - aqueous solution	10%	low
Benzoic acid - saturated aqueous solution		average
Boric acid - aqueous solution	10%	average
Butyric acid	100%	average
Citric acid - aqueous solution	10%	limited
Hydrochloric acid - aqueous solution	2%	limited
Hydrochloric acid - aqueous solution	10%	low
Hydrochloric acid - aqueous solution	36%	soluble
Chromic acid - aqueous solution	1%	average
Chromic acid - aqueous solution	10%	low
Formic acid - aqueous solution	10%	low
Formic acid - aqueous solution	85%	soluble
Phthalic acid - aqueous solution	10%	low
Lactic acid - aqueous solution	10%	average
Lactic acid - aqueous solution	90%	low
Nitric acid		low
Oleic acid	100%	good
Oxalic acid - aqueous solution	10%	average
Salicylic acid	100%	good
Sulfuric acid - concentrated	98%	soluble
Sulfuric acid - aqueous solution	2%	limited
Sulfuric acid - aqueous solution	10%	low
Tartaric acid		average
Tartaric acid - aqueous solution	10%	good
Water (sea/river/drinking/distilled)		good
Chlorinated water		average
Acrylonitrile	100%	good
Amyl alcohol	100%	good
Butyl alcohol	100%	average
Benzyl alcohol	100%	limited
Ethanol/Ethyl alcohol	96%	average
Isopropyl alcohol		average
Methyl alcohol	100%	average
Propyl alcohol		average
Ammonia	10%	good
Ammonia - gas		limited
Acetic anhydride - concentrated		soluble
Aniline	100%	average
Benzaldehyde	100%	limited
Benzene	100%	good
Mercury bichloride - aqueous solution	6%	low
Potassium bichromate - aqueous solution	5%	average
Sodium bisulfate - aqueous solution	10%	good
Bitumen		average
Potassium bromide - aqueous solution	10%	average
Sodium bromide - aqueous solution	10%	average
Butane		good
Butyl phthalate		good
Camphor	100%	good
Potassium carbonate	100%	good
Sodium carbonate - aqueous solution	10%	good
Cyclohexane	100%	good
Cyclohexanol	100%	good
Chlorine gas	100%	low
Chlorobenzene		good
Chlorobromomethane		average
Chloroform	100%	low

Chemical	Conc.	Resist.
Aluminum chloride - aqueous solution	10%	good
Barium chloride - aqueous solution	10%	good
Calcium chloride - aqueous solution	10%	good
Calcium chloride - aqueous solution	20%	soluble
Ethyl chloride	100%	average
Methyl chloride	100%	limited
Magnesium chloride - aqueous solution	10%	good
Sodium chloride - aqueous solution	10%	good
Thionyl chloride		low
Vinyl chloride	100%	good
Zinc chloride	10%	average
Ferric chloride - aqueous solution	10%	good
Decalin		good
Diacetone alcohol		good
Ethylene dichloride		good
Diethanolamine		good
Dimethylformamide	100%	good
Acetic ether	100%	good
Ethyl ether	100%	good
Glycol ether		good
Heptane		good
Hexane		average
Phenol - aqueous solution		soluble
Formaldehyde - aqueous solution	30%	good
Formamide		average
Sodium phosphate - aqueous solution	10%	good
Butyl glycol	100%	average
Ammonium hydroxide - aqueous solution	10%	good
Magnesium hydroxide - aqueous solution	10%	good
Potassium hydroxide - aqueous solution	5%	good
Potassium hydroxide - aqueous solution	10%	good
Potassium hydroxide - aqueous solution	50%	average
Sodium hypochlorite - aqueous solution		good
Isooctane		good
Mercury		good
Methyl ethyl ketone		good
Methyl isobutyl ketone		good
Naphthene		good
Potassium nitrate - aqueous solution	10%	good
Sodium nitrate - aqueous solution	5%	good
Nitrobenzene	100%	average
Nitromethane	100%	average
Mineral oil		good
Zinc oxide		good
Octyl phthalate		good
Ozone		low
Perchloroethylene		low
Hydrogen peroxide - aqueous solution	0.5%	limited
Hydrogen peroxide - aqueous solution	1%	low
Hydrogen peroxide - aqueous solution	3%	low
Hydrogen peroxide - aqueous solution	30%	low
Petroleum		good
Magnesium salts - aqueous solution	10%	good
Copper salts - aqueous solution	10%	good
Caustic soda - aqueous solution	5%	good
Caustic soda - aqueous solution	10%	good
Caustic soda - aqueous solution	50%	average
Aluminum sulfate - aqueous solution	10%	good
Copper sulfate - aqueous solution	10%	good
Sodium sulfate - aqueous solution	10%	good
Carbon disulfide	100%	good
Hydrogen sulfide - aqueous solution		low
Lead stearate	100%	good
Carbon tetrachloride		good
Trichloroethylene		average

GOOD - good resistance without changes in weight and volume.
AVERAGE – average strength with significant weight and volume loss if used for a long time.
LIMITED - limited resistance, can be used for a short period of time.
LOW - little resistance. The material is heavily attacked.

Polyester-based powder paint

Physical and Mechanical Properties		Resistance to Chemicals	
Specific Weight	1.4 - 1.8 (DC)	**Caustic soda 10%**	600h (LA)
Solids	100%	**Caustic soda 20%**	600h (LA)
Melting Point	105 - 110°C	**Hydrochloric acid 10%**	300h (I)
Drying Time	12/15 to 200°C	**Hydrochloric acid 30%**	200h (LA)
Film Thickness	50 - 60µ	**Sulfuric acid 10%**	300h (I)
Brightness (Glass - 60°C)	90 - 100%	**Sulfuric acid 40%**	300h (I)
Hardness (Koening)	170"	**Acetic acid 10%**	300h (LA)
Flexibility (Tapered mandrel)	6 - (SF)	**Concentrated acetic acid**	no
Resists Adhesion (Scratch test)	100%	**Nitric acid 10%**	300h (LA/AM)
Cupping (Erichsen)	8mm	**Toluol (immersion)**	200h (LB/LA)
Impact (50kg/cm²)	(SD)	**Xylol (immersion)**	200h (PB/LA)
Average yield (m²/kg)	10/12	**Solvesso 100 (immersion)**	200h (LA)
Lightning resistance		**Methanol (immersion)**	200h (PB/LA)
(Q,U,V) 120h	Great (SC)	**Ammonia 10%**	100h (I)
(Q,U,V) 250h	Great (SC)	**Formol 10%**	1000h (LA)
(Q,U,V) 500h	Great (SC)	**Industrial water**	1000h (I)
Moisture test	100%/40°C	**Distilled water**	1000h (I)
500h	(I)	**Seawater**	1000h (I)
1000h	(I)	**SO2 Test (Kesternich)**	10 rounds (I)
Various detergents	800h (I)	**Weather resistance**	
Edible oils	1000h (I)	**(Weather-O-Meter)**	(SC)
Engine oils	1000h (I)	**Hardness (with Hardmuth pencil)**	2 - 4h
Butanol	100h (PB/LA)	**Natural weathering (12 months)**	(PI)
Sodium hypochlorite 5%	100h (LA/AM)		

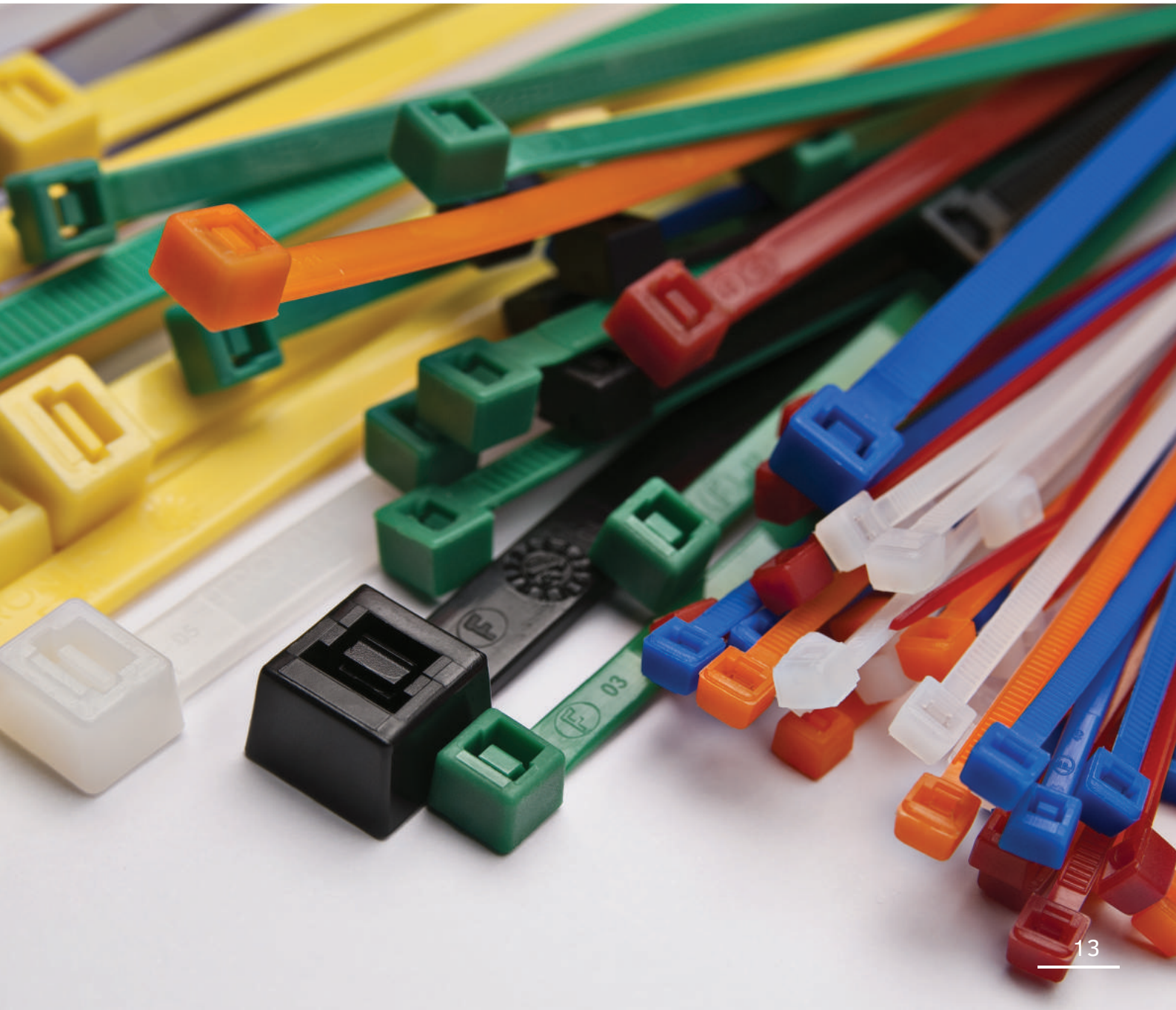
(SA) No Attack
(SD) No Scaling
(SF) No Cracks

(DC) Depending on the Colors
(SC) No Calcination
(LA) Slight Film Softening
(AM) Film Softening

(PI) Practically Unchanged
(I) Unchanged
(BP) Brightness Loss

Conventional **Cable Ties**

We produce the most complete line of cable ties available in the market, using state-of-the-art injection molding machines and with different polymers, according to the best use indication.



Conventional cable ties

PA 6.6 Cable Ties

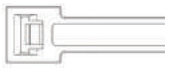
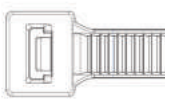
PA 6.6 cable ties with UV protection

Material	Use temperature	Use
PA 66	-40 °C to 85 °C	Construction, electrical installations, packaging, etc,...
PA 66UV		Applications subject to ultra violet rays
PA 66HS	-40 °C to 105 °C	Continuous high temperature regimes
PA 46	-40 °C to 135 °C	

Type	Ref	Width (mm)	Length (mm)	Lashing diameter (mm)	Minimum tensile strength			Color	UV Protection
					kgf	Lbs	N		
 Narrow	F7010	2.5	100	22	8.2	18	80	Natural	X
								Black	✓
	F7014		150	33				Natural	X
								Black	X
	F7019		209	55				Natural	X
								Black	✓
	F7026		260	68				Natural	X
								Black	X
	F7038		380	100				Natural	X
								Black	X
 Intermediate	F7015	3.7	151	37	13.6	30	135	Natural	X
								Black	✓
	F7020		202	51				Natural	X
								Black	✓
	F7021		250	68				Natural	X
								Black	✓
	F7031		300	80				Natural	X
								Black	✓
	F7037	3.6	370	102				Natural	X
								Black	X

*Black cable ties can also be produced with other polymers, such as: heat stabilized nylon 6.6 HS (PA 6.6 HS) and nylon 4.6 (PA 4.6), under demand analysis and according to availability. For more information on these types of raw materials, see the description of properties and technical parameters on page. 07.

Standard PA 6.6 cable ties

Type	Ref	Width (mm)	Length (mm)	Lashing diameter (mm)	Minimum tensile strength			Color	UV Protection
					kgf	Lbs	N		
 Standard	F7016	4.8	160	39	22.7	50	225	Natural	X
								Black	✓
	F7018		180	45				Natural	X
								Black	✓
	F7023		200	51				Natural	X
								Black	✓
	F7024		238	60				Natural	X
								Black	✓
	F7028		283	76				Natural	X
								Black	✓
	F7029		300	80				Natural	X
								Black	✓
	F7034		340	95				Natural	X
								Black	✓
	F7039		400	114				Natural	X
								Black	✓
	F7050		500	140				Natural	X
								Black	X
 Strong	F7022	7.6	220	50	54.4	120	535	Natural	X
								Black	X
	F7030		300	80				Natural	X
								Black	✓
	F7040		387	110				Natural	X
								Black	✓
	F7052		500	140				Natural	X
								Black	✓
	F7075		760	225				Natural	X
								Black	✓
 Very strong	F7053	8.8	535	150	68	150	670	Natural	X
								Black	✓
	F7076		765	225				Natural	X
								Black	✓
	F7082		820	245				Natural	X
								Black	✓
	F7092		925	275				Natural	X
								Black	✓
	F70109		1095	330				Natural	X
								Black	✓
 High strength	F7025	12.4	230	50	100	220	980	Natural	X
								Black	X
	F7054	13.7	536	147	115	250	1,115	Natural	X
								Black	✓

*Black cable ties can also be produced with other polymers, such as: heat stabilized nylon 6.6 HS (PA 6.6 HS) and nylon 4.6 (PA 4.6), under demand analysis and according to availability. For more information on these types of raw materials, see the description of properties and technical parameters on page. 6.

Colored cable ties resistant to weathering (UV)

Material	Use temperature	Use
PA 66	-40 °C to 85 °C	Construction, electrical installations, packaging, etc,…
PA 66UV		Applications subject to ultra violet rays. Experience has shown good performance in sun exposure for up to 3 years.

Type	Ref	Width (mm)	Length (mm)	Lashing diameter (mm)	Minimum tensile strength			Color	UV Protection
					kgf	Lbs	N		
 Narrow	F7010	2.5	100	22	8.2	18	80	Yellow Blue Orange Green Red	✓
 Intermediate	F7015	3.7	151	37	13.6	30	135	Yellow Blue Orange Green Red	✓
 Standard	F7023	4.8	200	51	22.7	50	225	Yellow Blue Orange Green Red	✓
	F7028		282	76				Yellow Blue Green Red	✓
	F7039		400	114				Yellow Blue Green Red	✓
 Strong	F7040	7.6	387	110	54.4	120	535	Yellow Blue Green Red	✓

Detectable cable ties

Material: *Polyamide 6.6 with metal particles (PA66MP)*
Color: *Blue*
Use temperature: *-40°C to 85°C*
Specifications: *FDA and HACCP*

Detectable cable ties were designed to meet the needs of the food and pharmaceutical industries. Its manufacturing process involves the inclusion of metal particles, which makes it possible to detect the cable ties, or parts of them, by metal detection and X-ray equipment. Therefore, this product line provides wire and cable ties in manufacturing process areas, without running the risk of them contaminating food or medicines.

- They can be used both on the production line and in equipment installed in areas adjacent to manufacturing processes;
- Its blue color facilitates visual identification;
- They can be included in HACCP processes;
- They are available in various sizes.

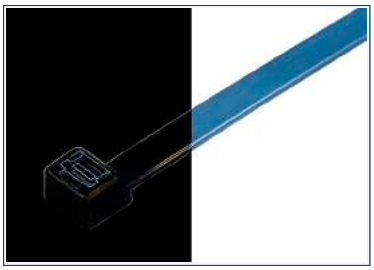
HACCP - Hazard Analysis and Critical Control Points

It is a proactive system that identifies potential hazards to food safety, from the obtainment of raw materials to consumption, greatly reducing the risk of contamination and production loss. This ensures greater accountability in the process and consumer health safety.

FDA - Food and Drug Administration

The detectable clamps are approved by the FDA, the U.S. government agency responsible for controlling food and drugs.

Types of detection



X-Ray detection

Magnetic detection

Visual detection

Group	Length X Width (mm)	Complete reference	Maximum lashing diameter (mm)	Minimum breaking stress		
				kgf	lbs	N
FD7010	100 X 2.5	FD7010NYAZ100	16	8.2	18	80
FD7015	150 X 3.6	FD7015NYAZ100	36	13.6	30	135
FD7023	200 X 4.8	FD7023NYAZ100	50	22.7	50	225
FD7039	380 X 4.8	FD7039NYAZ100	103	22.7	50	225
FD7040	380 X 7.6	FD7040NYAZ100	103	54.4	120	535

Accessories for **Cable Ties**

They are products that increase the productivity and efficiency of the fastening of various components when used together with conventional cable ties.

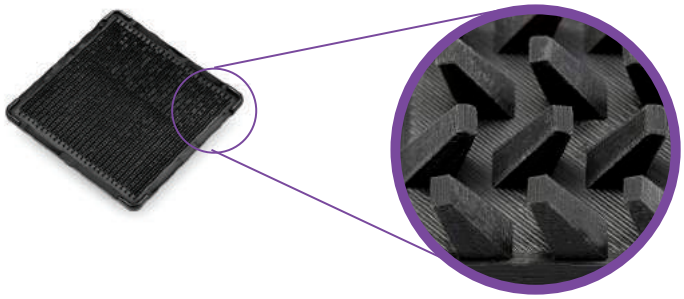
Base for fastening with glue

Material: *Nylon 6.6 with UV protection (PA 6.6 UV)*
Color: *Black*
Use temperature: -40°C to 85°C
Flammability: *UL94 V2*

This is an exclusive product. It has a surface with hundreds of asymmetrical blades, which increase the area for chemical adhesion and mechanical anchorage between the part and the FRONTEC multi-purpose glue.
It is an excellent solution for electrical installations, structured cabling, security and CATV solutions, in water tanks, in boilers, in electric panel assembly, in road and agricultural equipment, among others.

- Noiseless installation without the need for equipment and tools;
- Clean, simple, fast, quiet, efficient, and very productive service;
- The surface on which the base will be applied must be clean and free of dust, oils and detergents.

REF	Dimensions	Minimum quantity of bases per 75 g tube of glue	Cable tie type
FAB 3636	36 x 36 mm	15	Width of up to 8.8 mm



FAB3636 – (36x36 mm), when there is the need to support a higher load.

- The multipurpose glue, especially developed for this product, has an initial "TAC" that keeps the base in place immediately after it is placed on the installation surface, both on horizontal and vertical surfaces.
- The curing of the adhesive takes place through the moisture (water) present in the environment. Therefore, the curing speed depends basically on two basic aspects:

a) Surface permeability. For example, curing when the base is applied on concrete, wood or plaster is faster than in applications on glass or sheet metal.

b) Thickness of the glue layer, because the thicker it is, the longer it takes to cure inside.

*Consult the item "Multipurpose glue" for more technical information about the glue.

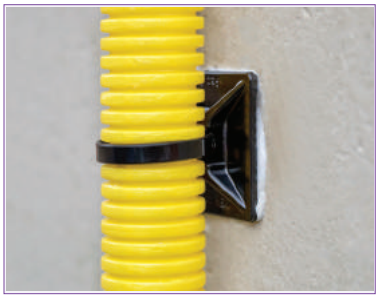
Curing time by material

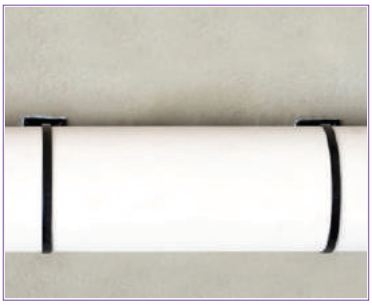
Materials	30 min.	1 hour	2 hours	3 hours	4 hours	8 hours	24 hours	72 hours
Concrete	8%	15%	59%	58%	79%	90%	99%	100%
Brick	7%	19%	42%	62%	68%	89%	97%	100%
Wood	24%	30%	42%	49%	51%	78%	100%	100%
Steel	5%	28%	44%	57%	61%	74%	98%	100%
Galvanized Steel	4%	25%	34%	49%	54%	66%	97%	100%
Steel w/ Epoxy Paint	4%	24%	39%	54%	58%	69%	100%	100%
Aluminum	4%	24%	37%	48%	51%	67%	99%	100%
Glass/Tile	5%	18%	23%	32%	44%	58%	76%	100%
Plaster	12%	22%	53%	57%	71%	88%	92%	100%
PVC	7%	14%	46%	46%	57%	67%	96%	100%

Performance on each surface type

Surfaces	Performance
Wood	Excellent
Epoxy painted plates	
Metal	
Stainless steel	
Aluminum	
Concrete Brick Masonry Glass Tile	Very good
Cementitious plates	Good
PVC plates	
Plaster	
Stucco Painted walls (except epoxy) Textures	Poor
Polyethylene plates	Very poor
Polypropylene plates	

Application examples





The FAB3636 model has two openings through which to pass the cable ties: one for widths up to 7.6 mm, and the other for widths up to 8.8 mm.
The FAB2020 model, on the other hand, has two openings through which to pass the cable ties of up to 4.8 mm.

Watch the product application video

1. Apply the glue to the base.

2. Apply the base to the surface (wait for the glue to cure).

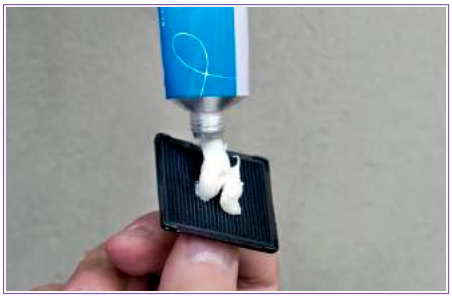
3. Pass the cable tie and fasten the piping.

* These items can also be supplied in kits containing the glue and the cable ties. Consult available options.

Multipurpose glue

Composition: *Sealant based on modified polyurethane, fillers and special additives.*
Color: *White*
UV-resistant

The multipurpose glue has excellent adhesion on the most varied surfaces such as: concrete, ceramic, porcelain tiles, metals, stainless steel and wood. The fastening base can be glued on walls or on the ceiling, because the glue does not drip during application. When there is paint on the wall or ceiling, the paint must be scraped off to obtain better adhesion results. The curing time can vary depending on the type of surface on which the glue is being applied, because water (moisture) is the curing agent of the glue. In many applications, it is already possible to tie components after one hour of curing. Total curing takes an average of 72 hours.



The multipurpose glue is available in two different sizes: 75 g and 400 g.

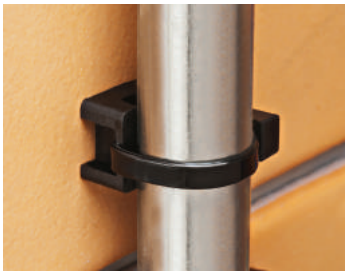
Ref: FCOLASI75

Ref: FCOLASI400

Fasteners by screw/rivet

These fasteners were developed for fastening wires, cables, and electrical harnesses to different surfaces by means of screws or rivets, with the use of a conventional cable tie.

F7808
F7809



Material	Color	Use temperature	Flammability
Nylon 6.6 (PA 6.6)	Natural and Black	-40°C to 85°C	UL94 V2
Nylon 6.6 UV (PA 6.6 UV)	Black and White	-40°C to 85°C	UL94 V2

REF	Base (mm)	Height (mm)	Hole Ø (mm)	Cable tie type
F7808 *	15 X 10	7	3.4	All models up to 4.8 mm wide
F7809 **	22 X 15	9.25	5.1	All models up to 8.8 mm wide

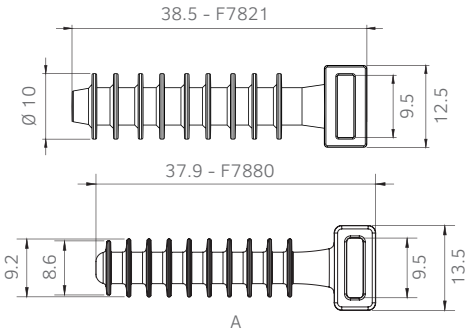
* It can be applied with a 6-mm screw/bushing, and supports up to 32 Kgf.
** It can be applied with a 6 to 8-mm screw/bushing, and supports up to 50 Kgf.

Anchor bolt

Material: *Nylon 6.6 UV - polyamide 6.6 with UV protection*
Color: *Black*
Use temperature: -40°C to 85°C
Flammability: *UL94 V2*

Goodbye bushings and screws!
These anchor bolts are designed for use in concrete, solid brick, or wood walls.
- Simple;
- Fast and highly productive;
- Clean;
- Efficient.

After drilling, simply insert the anchor bolt with a rubber hammer, put a pass a nylon cable tie through its head, and attach the piping or component of the electrical installation.
The force supported by the assembly is limited by the tensile force of the chosen cable tie model.



Width of the cable tie (mm)	Limit stress		
	Kgf	Lbs	N
3.7	13.6	30	135
4.8	22.7	50	225
7.6	54.4	120	535
8.8	68.0	150	670

Watch the product application video

REF	Anchor bolts		Cable tie					
	Length A (mm)	Hole Ø (mm)	Length (mm)	Width (mm)	Maximum lashing Ø (mm)	Breaking stress		
						Kgf	Lbs	N
F7880	37.9	Drill bit 8 mm	Single anchor bolt					
FB7040-8			387	7.6	110	54.4	120	535
F7821	38.5	Drill bit 3/8 “	Single anchor bolt					
FB7040			387	7.6	110	54.4	120	535

The two models of anchor bolts can be supplied with other cable tie models (upon request).

Fastening system with pin

Material: *Nylon 6.6 with UV protection (PA 6.6 UV)*
Color: *Black*
Use temperature: -40°C to 85°C
Flammability: *UL94 V2*
Patented industrial design

This product, with its patented design, can be used with the different brands of gas and electric rapid-fire cable tie system machines. Using this product, the installation service of electrical and hydraulic networks becomes safe, because you only need to attach the base to the equipment's mandrel, take it to the place of fastening, and fire the shot. Since the base is clamped in the mandrel, the operator does not need to use one hand to hold it.
The load supported is approximately 68 Kgf, limited by the tensile force of the cable tie model used in lashing.

Watch the product application video

Base for fastening with pin
Ref: F7810PR50

Double head accessory

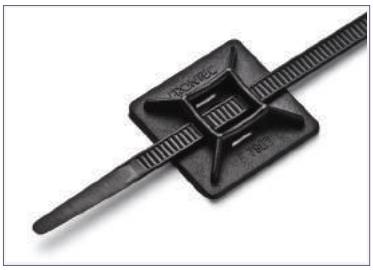
Material: *Nylon 6.6 UV (PA 6.6 UV)*
Color: *Black*
Use temperature: *-40°C to 85°C*
Flammability: *UL94 V2*

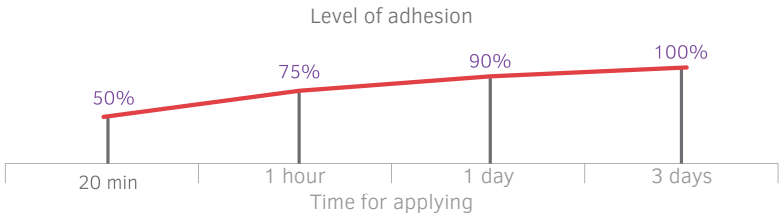
This product is used for joining cable ties in applications that require longer than conventional cable tie lengths.
It can be used outdoors, because it is produced with nylon (PA 6.6) with ultraviolet (UV) protection.
It allows the passing of cable ties up to 4.8 mm wide.

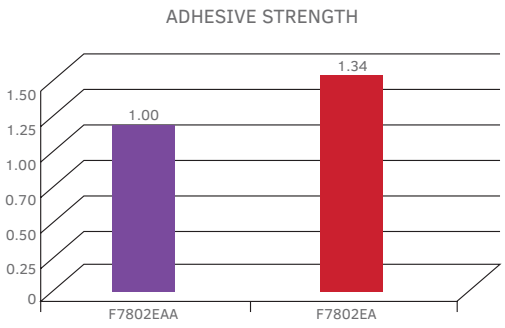
Ref: FCD48

Self-adhesive fasteners

These fasteners, when used with conventional cable ties, allow cables, hoses, and other components to be tied without the need for drilling. The adhesives are of excellent quality and can be used indoors and outdoors.
Before applying the fastener, we recommend cleaning the surface with isopropyl alcohol so that it is clean, dry and uniform. A little abrasion may be necessary when the surface is too smooth.







F7801

F7802

Adhe-sive	Level of adhesion			REF	Colors of the base	Width of the cable ties (mm)	Dimensions (mm)
	Indoors	Outdoors	Epoxy paint				
EAA	Very good	Very good	Good	F7801EAA	Natural	up to 4.8	19 x 19 x 6
				F7802EAA	Natural/Black		28 x 28 x 6
EA	Great	Great	Good	F7801EA *	Natural	up to 4.8	19 x 19 x 6
				F7802EA *	Natural/Black		28 x 28 x 6
				F7802EAUV *	Natural w/ UV protection		28 x 28 x 6

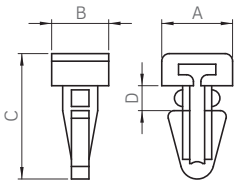
* 3M Adhesive

Items with EA adhesive have 34% more adhesion than items with EAA adhesive.

Clip for fastening to plates

Material: *Nylon 6.6 (PA 6.6)*
Color: *Neutral and Black*
Use temperature: *-40°C to 85°C*
Flammability: *UL94 V2*

This clip, used with a conventional cable tie, allow quick, easy and economical fastening of wires and cables to plates, without the need for screws or rivets;



REF	A (mm)	B (mm)	C (mm)	D (mm)	Hole Ø (mm)	Plate thickness	Cable tie model
F7830	9.5	7.5	16.6	3.3	6.4	Maximum of 3 mm	All models with width up to 3.7 mm

Clip for fastening in rectangular cutout

Material: *Polyacetal (impact modified)*
Color: *Black*
Use temperature: *-40°C to 100°C*
Flammability: *UL94 HB*

This fastener has a socket for fastening relays and a hole for inserting conventional cable ties up to 4.8 mm wide.

REF	Hole (mm)	Plate thickness	Maximum insertion force	Minimum extraction force
FC8X15	8.0 X 15.0	0.7 to 2.1 mm	5.0 kgf	70.0 kgf

Support for two lashings

Material: *PA 6.6*
Use temperature: *-40°C to 85°C*
Flammability: *UL94 V2*

This part allows the use of two parallel cable ties to fasten and separate two lashings. The cable ties can rotate at an angle of up to 90° away from each other. Very useful for separating hoses to avoid friction wear.

Ref: FSUP

Ref	Height (mm)	Diameter (mm)	Color	Cable tie model
FSUP	8.1	12	Black	Up to 4.8 mm

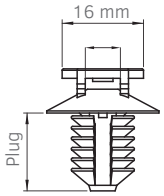
Special
Cable Ties

These cable ties are used in the automotive industry to increase the productivity and quality of the various fastening processes, making them safer and more economical.

Plugs with built-in cable ties

Plug material: *Nylon 6.6 HS - heat stabilized polyamide 6.6*
Use temperature: *-40°C to 105°C. (In some applications, the maximum temperature recommended may be lower than 105°C).*
Flammability: *UL94 V2*

This line of fasteners was designed to be used with a conventional cable tie up to 4.8 mm wide.
Its body is formed by parallel blades, making it easy to insert and very difficult to extract. (low insertion force and high extraction force).
This characteristic gives it an excellent fastening quality, and increases productivity during its application.
This type of fastener is widely used in the automotive industry for fastening electrical harnesses and other components, both in plain and threaded holes.



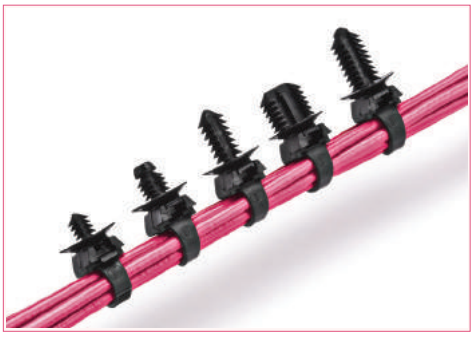
Plug dimensions (mm)	REF	Plugs			Cable ties					
		Length A (mm)	Hole Ø (mm)	Plate thickness (mm)	Length (mm)	Width (mm)	Maximum lashing Ø (mm)	Breaking stress		
								Kgf	Lbs	N
	FP6L	10.7	6.5 to 7.0 threaded hole M8	0.8 to 6.0	Single plug					
	FP6L 7010				100	2.5	22	8.2	18	80
	FP6L 7015				151	3.7	37	13.6	30	135
	FP6L 7023				200	4.8	51	22.7	50	225
	FP7	12.7	6.5 to 7.0 threaded hole M8	0.8 to 7.0	Single plug					
	FP7 7010				100	2.5	22	8.2	18	80
	FP7 7015				151	3.7	37	13.6	30	135
	FP7 7023				200	4.8	51	22.7	50	225
	FP8	11.1	7.7 to 8.0 threaded hole M10	0.8 to 6.0	Single plug					
	FP8 7010				100	2.5	22	8.2	18	80
	FP8 7015				151	3.7	37	13.6	30	135
	FP8 7023				200	4.8	51	22.7	50	225

The three models of plugs can be supplied with other cable tie models (upon request).

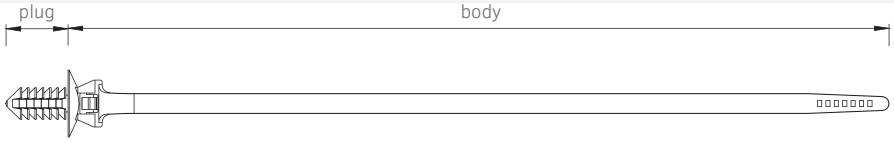
Product	Material	Use temperature	Flammability
Plug	Nylon 6.6 HS - heat stabilized polyamide 6.6	-40°C to 105 °C	UL94 V2
Cable tie	Nylon 6.6 HS - heat stabilized polyamide 6.6	-40°C to 105 °C	
	Nylon 6.6 - polyamide 6.6	- 40 °C to 85°C	

Cable ties with built-in fastening plug

FRONTEC manufactures several models of cable ties with the fastening plug built into the part. The plug is built with a technology that makes it possible to apply the product with low insertion force and high extraction force, enabling quality and productivity gains in the fastening of electric harnesses or other components.



Material	Color	Use temperature	Flammability
Nylon 6.6 HS (PA 6.6 HS)	Natural and Black	-40°C to 105°C	UL94 V2
Nylon HS IM (PA 6.6 HS IM)	Black	-40°C to 105°C	UL94 V2



Ordinary Knurled

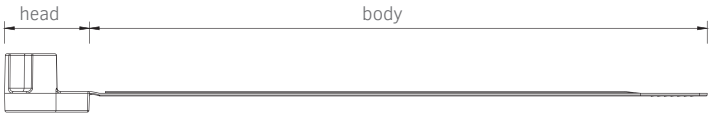
REF	Length (mm)		Width (mm)	Maximum lashing Ø (mm)	Minimum breaking stress			Hole of the plate	Plate thickness (mm)	Plug
	Body	Plug			kgf	Lbs	N			
F5 8023	198	7	4.8	51	22.7	50	225	Ø 5 mm or threaded hole M6	0.7 to 3	
F6 8023	198	9.3	4.8	51	22.7	50	225	Ø 6.3 to 7 mm or threaded hole M8	0.7 to 2.5	
F6L 8023	198	15	4.8	51	22.7	50	225	Ø 6.3 to 7 mm or threaded hole M8	0.7 to 7	
F8 8023	198	17.5	4.8	51	22.7	50	225	Ø 8 ± 0.25 mm or threaded hole M10	0.7 to 7	
FOB 8023	198	11.1	4.8	51	22.7	50	225	6.2 x 12.2 mm	0.7 to 6	

Reverse knurled

F6I 8023	198	9.3	4.8	51	22.7	50	225	Ø 6.3 to 7 mm or threaded hole M8	0.7 to 2.5	

Cable ties for threaded pin fastening

This cable tie was designed for fastening electrical harnesses or other components directly on screws or threaded pins.



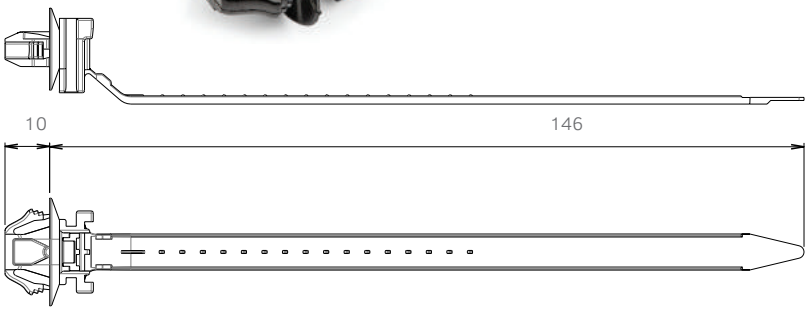
Material	Color	Use temperature	Flammability
Nylon 6.6 HS (PA 6.6 HS)	Natural and Black	-40°C to 105°C	UL94 V2
Nylon HS IM (PA 6.6 HS IM)	Black	-40°C to 105°C	UL94 V2

REF	Length (mm)		Width (mm)	Maximum lashing Ø (mm)	Minimum breaking stress			Screw threaded pin
	Body	Head			kgf	Lbs	N	
FM56 8023	187	25.4	6.20	45	22.7	50	225	M5 or M6
FM8 8023	187	25.9	6.20	45	22.7	50	225	M8

Cable tie with oblong clip

Material: *Polypropylene (PP)*
Color: *Black*
Use temperature: *-40°C to 105°C*
Flammability: *UL94 HB*

The cable tie with built-in oblong fastening clip is a product developed for fastening cables, hoses, and electric harnesses on metal plates.

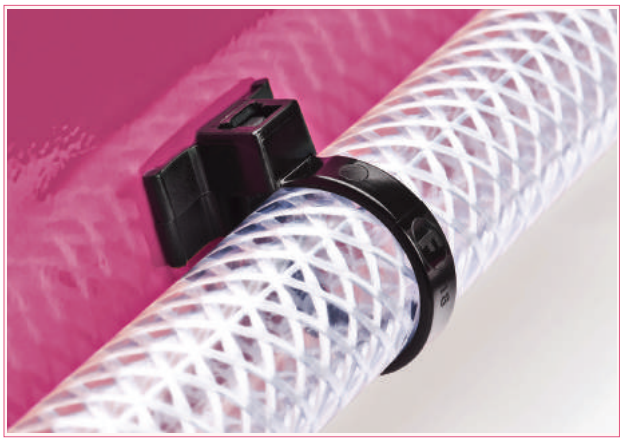


REF	Length (mm)		Width (mm)	Maximum lashing Ø (mm)	Minimum breaking stress			Oblong hole	Plate thickness (mm)
	Body	Clip			kgf	Lbs	N		
FCOB8015PP	145	10	7.0	25	18	40	180	ø 7 x 12 mm	0.6 to 2.6

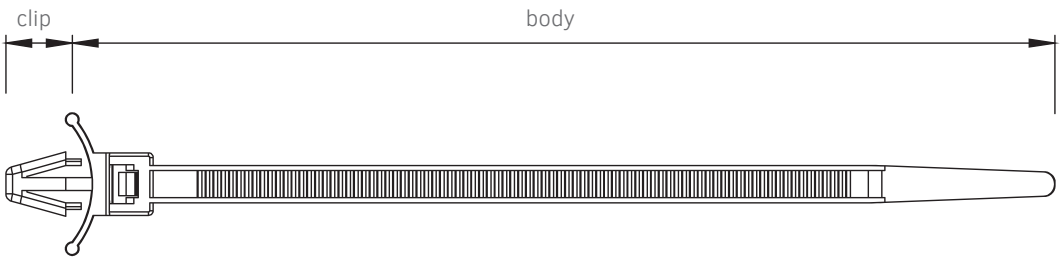
This product can also be produced in nylon or other polymers, upon request.

Cable ties with fastening clip

These cable ties have an arrow-shaped fastening clip and are widely used to fasten harnesses or hoses to metal plates.



Material	Color	Use temperature	Flammability
Nylon 6.6 (PA 6.6)	Natural and Black	-40°C to 85°C	UL94 V2
Nylon HS (PA 6.6 HS)	Black	-40°C to 105°C	UL94 V2
Nylon 6.6 V0 (PA V0)	White	-40°C to 85°C	UL94 V0

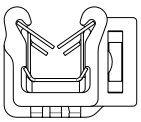


REF	Length (mm)			Width (mm)	Maximum lashing Ø (mm)	Minimum breaking stress			plate hole Ø (mm)	Plate thick-ness (mm)	Clip
	Total	Clip	Body			kgf	Lbs	N			
FC7010	100	7	93	2.5	19	8	18	80	4.75 ± 0.1	3 max	
FC7013	135	10	125	4.8	24	22.7	50	225	6.3 ± 0.2	0.8 to 2.7	
FC7014	135	10	125	4.8	24	22.7	50	225	4.7 ± 0.1	3.2 to 4	

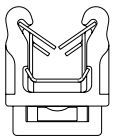
Clip for fastening to edges

Plastic component material: *Nylon 6.6 HSUV - heat stabilized polyamide 6.6 with ultraviolet (UV) protection*
Metal lock material: *spring steel with heat and surface treatment*
Use temperature: *-40°C to 105 °C*
Flammability: *UL94 V2*

These clips consist of a metal lock inserted in a heat stabilized nylon 66 component with UV (ultraviolet ray) protection. They were designed to be used together with FRONTEC's conventional nylon cable ties to fasten wire harnesses, power cables, conduits, pipes or other components on the edges of plates.
The clip is attached to the edge of the sheet manually and does not require the use of drilling tools and screws.
It is an excellent solution for fastening in places where it is not possible to drill or use adhesives. They are very useful for solving many fastening problems in the most varied industrial segments, in the automotive industry, and in the installation of solar panels, because they are highly resistant to weather, and keep the cabling firmly fixed to the metal structure.



Position a

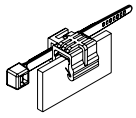


Position b

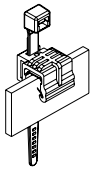
REF	Position			Edge thickness (mm)	Color
FCB13L	a)		Side	1.0 to 3.0	Black
FCB36L				3.0 to 6.0	
FCB13S	b)		Top	1.0 to 3.0	
FCB36S				3.0 to 6.0	

This product is formed by the assembly of one of the fastening clips with a cable tie model.
The cable ties can be attached to the clip, either parallel to the metal profile or transversal to it.
Upon request, other cable tie models can be used, according to the customer's needs.

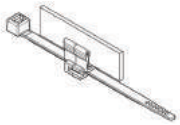
Clips for fastening on edges with built-in cable ties



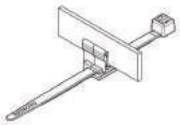
Position c



Position d



Position e



Position f

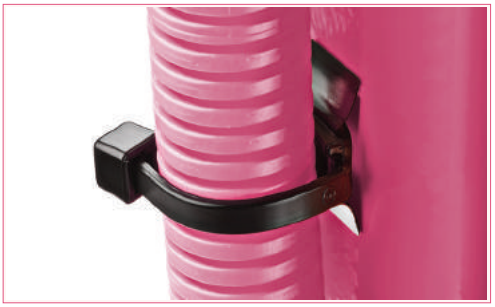
REF	Position		Edge thickness (mm)	Cable tie							
				Length	Width	Max. lashing Ø (mm)	Force (Kgf)	Color	Material	Position of the cable tie	
FCB13L 7023P	a)	Side	1.0 to 3.0	200 mm	4.6 mm	51	22.7	Black	Nylon 6.6 UV	c)	Parallel
FCB36L 7023P			3.0 to 6.0								
FCB13L 7023T			1.0 to 3.0							d)	Transversal
FCB36L 7023T			3.0 to 6.0								
FCB13S 7023P	b)	Top	1.0 to 3.0	200 mm	4.6 mm	51	22.7	Black	Nylon 6.6 UV	e)	Parallel
FCB36S 7023P			3.0 to 6.0								
FCB13S 7023T			1.0 to 3.0							f)	Transversal
FCB36S 7023T			3.0 to 6.0								

It can be made available with other cable tie models (upon request).

Cable tie with clip and central fastening

Material: *PA 6.6*
Use temperature: *-40°C to 85°C*
Flammability: *UL94 V2*
**Patented*

This cable tie allows cables, hoses, or other components to be fastened centrally, regardless of their diameter. It has claws on part of the belt to prevent the lashed volume from slipping down the cable tie belt, and side flaps that keep the clip pressed into the hole.

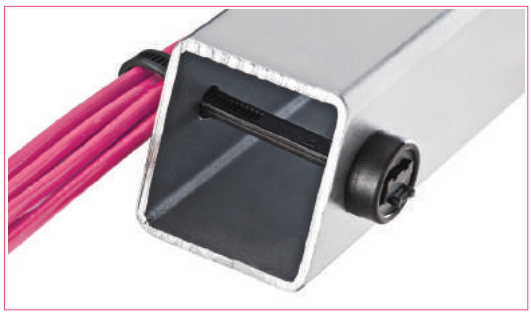


REF	Dimensions of the cable tie	Length of the clip	Hole Ø of the plate	Thickness of the plate	Cable tie lashing Ø
FCT8023	209 x 4.7 mm	6.4 mm	6.4 ± 0.1 mm	0.6 to 3.0 mm	50 mm

Cable tie for chassis

Material: *Nylon 6.6 UV (PA 6.6 UV)*
Color: *Black*
Use temperature: *-40°C to 85°C*
Flammability: *UL94 V2*

This part is widely used to fasten electrical harness and hoses along bus and truck chassis. The strip of the cable tie loops around the wiring harness or the component to be fastened and returns to the head of the part where it is locked (on the other side of the chassis).

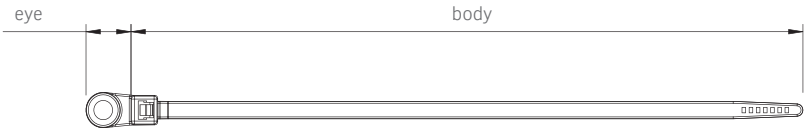


REF	Length (mm)	Width (mm)	Maximum lashing Ø (mm)	Hole Ø (mm)	Minimum breaking stress		
					kgf	Lbs	N
F7300	300	6	80	7 to 12	18	40	180

Cable tie with eye

Material: *Nylon HS (PA 6.6 HS)*
Color: *Natural and Black*
Use temperature: *-40°C to 105°C*
Flammability: *UL94 V2*

This cable tie model is used to fasten cables, hoses, or other components, using screws or rivets.

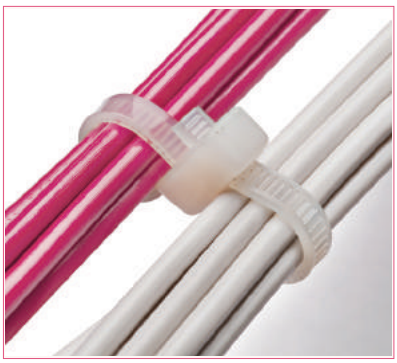


REF	Length (mm)		Width (mm)	Maximum lashing Ø (mm)	Hole Ø (mm)	Minimum breaking stress		
	Eye	Body				kgf	Lbs	N
FO8023	12.5	187.5	4.8	45	5.2	22.7	50	225

Cable ties with double head

Material: *Nylon 6.6 (PA 6.6)*
Color: *Natural*
Use temperature: *-40°C to 85°C*
Flammability: *UL94 V2*

Ideal for fastening two parallel harnesses or components with the use of two loops.



REF	Length (mm)	Width (mm)	Maximum lashing Ø (mm)	Minimum lashing Ø (mm)	Minimum breaking stress		
					kgf	Lbs	N
FCD7023	195	4.8	a: 47 b: 45	a: 2.5 b: 2	22.2	49	218

Reusable cable ties

Material: *Nylon 6.6 (PA 6.6)*
Color: *Natural*
Use temperature: *-40°C to 85°C*
Flammability: *UL94 V2*

These parts have a latch that allows them to be reused. Indicated for organizing telephone and logic networks.

REF	Length (mm)	Width (mm)	Maximum lashing Ø (mm)	Minimum breaking stress		
				kgf	Lbs	N
FRE7015	150	7.6	35	22.2	48	217
FRE7025	250	7.6	66	22.2	48	217

Tools for polyamide cable ties

A12001-0 (professional)
Hand tool manufactured by the company Avery Dennison.
Application: cable ties with width up to 4.8 mm

A12500-0 (professional)
Pneumatic tool manufactured by the company Avery Dennison.
Application: cable ties with width up to 4.8 mm

Cable tie width (mm)	Degree of force
2.5	2
3.7	2
4.8	3

FG7003
Hand tool.
Application: Cable ties up to 4.8 mm wide.
It has 3 degrees of force for adjustment according to the application required.

F8006
Hand tool.
Application: Cable ties with width of 7.9 or 8.8 mm.

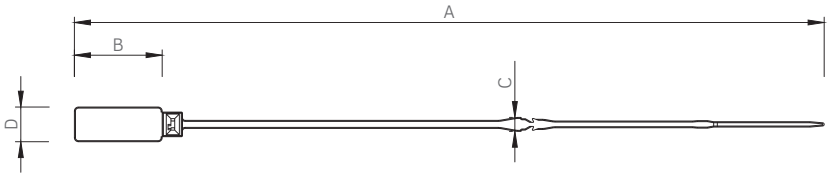
Width of the cable tie (mm)	Degree of force
7.6	2
8.8	3

Seals

Seal with limiter

This product was developed to improve traceability systems, when the use of plastic or paper labels is required, and has the following characteristics:

- Base for sequential engraving of up to 11 digits;
- Sealing function;
- Limiter to avoid damaging the label.



Material	Color	Use temperature	Flammability
Nylon 6.6 HS (PA 6.6 HS)	Natural and Black	-40°C to 105°C	UL94 V2
Nylon 6.6 (PA 6.6)	Natural, Black and Colored	-40°C to 85°C	ULV4 V2

REF	A (mm)	B (mm)	C (mm)	D (mm)	Maximum lashing Ø (mm)	Minimum breaking stress		
						kgf	Lbs	N
FL7027	280	32.2	5.2	13	39	13.6	30	135

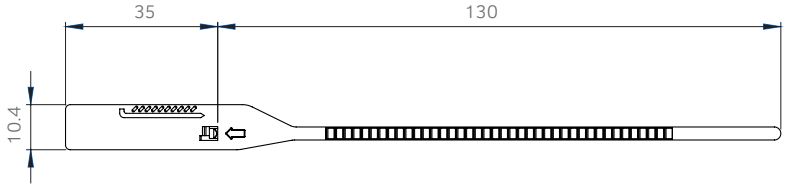
Only number engraving is available.

FL165 Seal

***Material:** Polypropylene (PP)*
***Color:** Black, Blue, Red, Orange and Yellow*
Use temperature: -40°C to 85°C

This seal is made of special polypropylene. It has the "easy cut" system, allowing it to be broken with the hands, without the use of tools such as pliers or scissors. It comes in sets of 5 units.
It can be used in banks, meat packing plants, carriers, airlines, postal services, among others.

It is available in several colors and can be engraved:
- Hot stamping - sequential numbers;
- Laser printing - conventional or 2D barcode, sequential number, or logo;
- Print area - 6 x 28 mm and can contain sequential numbers.



REF	Material	Length (mm)		Width (mm)	Maximum lashing Ø (mm)	Minimum breaking stress		
		Body	plate			kgf	Lbs	N
FL165PP	PP	130	35	3	27	8.2	18	80

Stainless Steel **Cable Ties**

We manufacture the most complete line of stainless steel cable ties with the locking system by latch and ball. We can also deliver cable ties in the most suitable length for each project.

Stainless steel cable ties without coating

Material: *AISI 316L stainless steel*
Use temperature: *-80°C to 538°C*

FRONTEC stainless steel cable ties were designed to be used in highly severe environments and conditions and have the following characteristics:

- High mechanical strength and resistance to chemicals;
- They allow fastening of the most varied materials and objects;
- They do not loosen with vibrations;
- They can be used in extreme temperature situations and highly corrosive environments;
- The loops are very strong and firm;
- They are very easy to install and have rounded corners that do not hurt either the operator or the components being fastened.

We manufacture any length "just in time" to suit your project

REF	Length (mm)	Width (mm)	Maximum lashing Ø (mm)	Minimum breaking stress		
				kgf	Lbs	N
FA0127	127	4.6	25	110	242	1078
FA0201	201	4.6	50			
FA0259	259	4.6	69			
FA0362	362	4.6	102			
FA0521	521	4.6	152			
FA0681	681	4.6	203			
FA0838	838	4.6	254			
FA0998	998	4.6	304			
FA1156	1156	4.6	355			
FA1205	1205	4.6	370			
FAL0201	201	7.9	50	230	506	2254
FAL0259	259	7.9	69			
FAL0362	362	7.9	102			
FAL0521	521	7.9	152			
FAL0681	681	7.9	203			
FAL0838	838	7.9	254			
FAL0998	998	7.9	304			
FAL1156	1156	7.9	355			
FAL1205	1205	7.9	370			
FALL0434	434	12.7	122	325	715	3185
FALL0594	594	12.7	173			
FALL0754	754	12.7	224			
FALL0912	912	12.7	275			
FALL1072	1072	12.7	325			
FALL1205	1205	12.7	370			

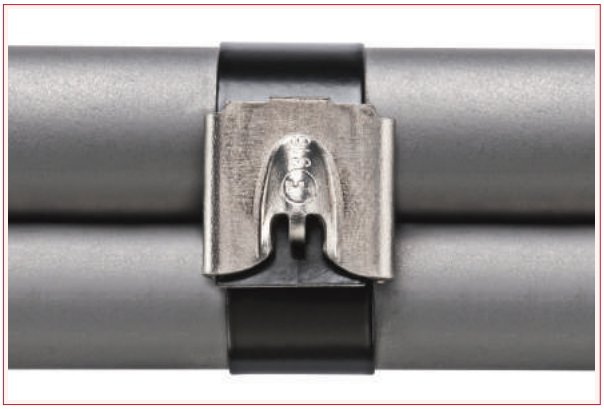
* Thickness: 0.28 +- 0.02 mm.

Stainless steel cable ties with polyester

Material: *AISI 316L stainless steel with polyester coated strip*
Use temperature: *-40°C to 150°C*

Polyester coated stainless steel cable ties are especially suitable for naval applications. They are highly resistant to corrosion and weathering.

- AISI 316L Steel;
- Good resistance to UV rays and sea air
- They are fully coated, avoiding chemical pile up;
- They are very easy to install;
- They do not hurt the operator or the fastened components;
- For chemical resistance of the raw material, see the table on page 11.



We manufacture any length "just in time" to suit your project

REF	Length (mm)	Width (mm)	Maximum lashing Ø (mm)	Minimum breaking stress		
				kgf	Lbs	N
FARP 0127	127	4.6	25	110	242	1078
FARP 0201	201	4.6	50			
FARP 0259	259	4.6	69			
FARP 0362	362	4.6	102			
FARP 0521	521	4.6	152			
FARP 0681	681	4.6	203			
FARP 0838	838	4.6	254			
FARP 0998	998	4.6	304			
FARP 1156	1156	4.6	355			
FARP 1205	1205	4.6	370			
FALRP 0201	201	7.9	50	230	506	2254
FALRP 0259	259	7.9	69			
FALRP 0362	362	7.9	102			
FALRP 0521	521	7.9	152			
FALRP 0681	681	7.9	203			
FALRP 0838	838	7.9	254			
FALRP 0998	998	7.9	304			
FALRP 1156	1156	7.9	355			
FALRP 1205	1205	7.9	370			
FALLRP 0434	434	12.7	122	325	715	3185
FALLRP 0594	594	12.7	173			
FALLRP 0754	754	12.7	224			
FALLRP 0912	912	12.7	275			
FALLRP 1072	1072	12.7	325			
FALLRP 1205	1205	12.7	370			

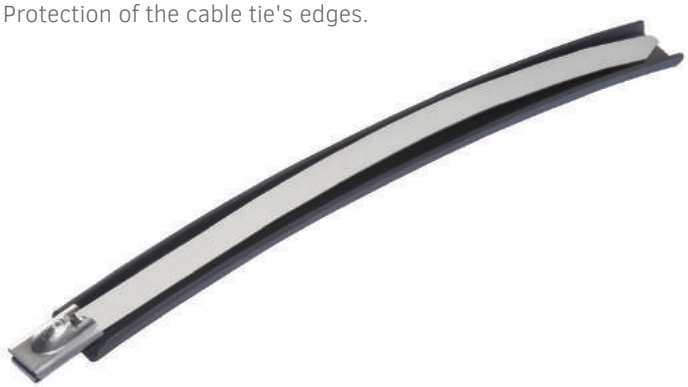
* Thickness: 0.40 to 0.55 mm

Protective strip for stainless steel cable ties

Material: *Flame retardant polyethylene with UV protection*
Color: *Black*
Use temperature: *-40°C to 90°C*
Flammability: *Flame retardant UL94-V0 classification*

The use of stainless steel cable ties with the protective strip provides the lashing with:

• Separation between metals of different characteristics by avoiding chemical piling;
• Absorption of the small return, characteristic of the type of ball latch used, eliminating the gap at the lashing point;
• Protection of the cable tie's edges.



REF	Width (mm)	A (±0.3)	B (±0.3)	C (±0.3)	D	Packaging
STRIP4.6PE	4.6	3.2	6.5	1.4	9.3	25 m
STRIP7.9PE	7.9	3.7	10.5	1.4	13.3	25 m
STRIP12.7PE	12.7	4.7	16.7	1.4	19.5	25 m

Stainless steel cable ties with double loop without coating

Material: *AISI 316L stainless steel*
Use temperature: *-80°C to 538°C*

The cable tie body passes twice through the head, providing a significant increase in the minimum tensile strength.

REF	Length (mm)	Width (mm)	Maximum lashing Ø (mm)	Minimum breaking stress		
				kgf	Lbs	N
FALD20470	470	7.9	51	414	912	4059
FALD20711	711		102			
FALD20863	863		127			
FALD21016	1016		152			
FALLD20749	749	12.7	102	585	1289	5736
FALLD21054	1054		152			
FALLD21359	1359		203			

Stainless steel strip in coil

Feito no Brasil.

This product is indicated for applications in cases where it is not possible to determine the required lengths in advance.
The strip and latch are made of AISI 316L stainless steel and packed in packaging that facilitates storage and use.

Without coating

REF	Width (mm)	Length of the strip in the box (m)	Minimum breaking stress		
			kgf	Lbs	N
FA4.6STRIPA6050	4.6	50	110	242	1078
FAL7.9STRIPA6050	7.9	50	230	506	2254
FALL12.7STRIPA6050	12.7	50	325	715	3185

With polyester coating

REF	Width (mm)	Length of the strip in the box (m)	Minimum breaking stress		
			kgf	Lbs	N
FARP4.6STRIPA6050	4.6	50	110	242	1078
FALRP7.9STRIPA6050	7.9	50	230	506	2254
FALLRP12.7STRI-PA6050	12.7	50	325	715	3185

Latches

REF	Latch for strip - width (mm)	Quantity in the box (pieces)
FA4.6LATCHA6100	4.6	100
FAL7.9LATCHA6050	7.9	50
FALL12.7LATCHA6025	12.7	25

Stainless steel markers - Already engraved

Feito no Brasil.

Material: *AISI 316L stainless steel*
Use temperature: *-80°C to 538°C*

Used for identifying cables and pipes in harsh environments such as: oil rigs, ships, petrochemical industry, shipbuilding, steel mills, railroads, subways, mines, among others. Design with lowered holes to facilitate passing of the cable tie.

REF	Length (mm)	Width (mm)	Cable tie model	Number of characters
FAIG10X90	90	10	With width up to 7.9 mm	Up to 18 characters
FAIG20X90	90	20	With width up to 7.9 mm	Up to 32 characters (2 lines with 16 each)

Tools for stainless steel cable ties

F8003
Hand tool.

Application
Cable ties with
width up to 7.9 mm.

It has a button to adjust the tension according to the cable tie width. Use allows for constant tensioning and cutting of the cable tie close to the head.

F8001
Hand tool.

Application
Cable tie with
width up to 12.7 mm.

The cable tie is cut by moving the lever.

F8004
Hand tool for finishing
the stainless steel cable tie.

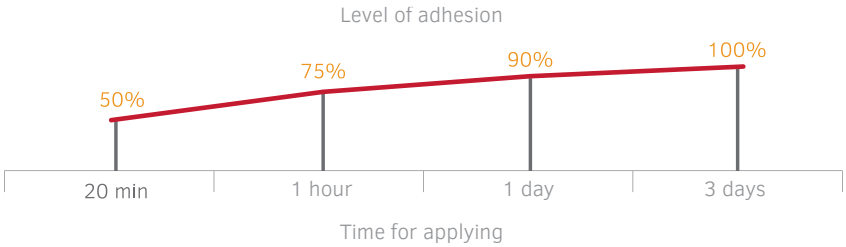
Application
Cable ties with
width up to 12.7 mm.

Fasteners

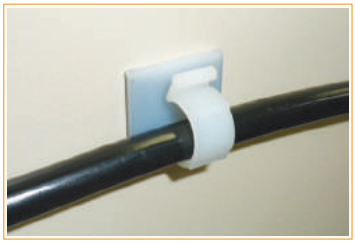
These products allow fastening of the most varied components in a fast, safe, economical, and durable way.

Self-adhesive clip

This product is indicated for the fastening of hoses and cables with diameters of about 13 mm.



Two types of adhesives are available, EA and EAA, both of which are high quality and can be used indoors and outdoors. Before the clip is applied, we recommend cleaning the surface with isopropyl alcohol.



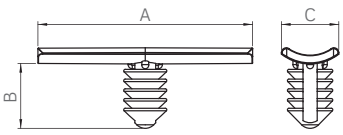
REF	Dimensions (mm)	Ø of the clip (mm)
F7813EAA	23.5 X 24	13
F7813EA *	23.5 X 24	13

* 3M Adhesive

Directing plug

Material: *Nylon 6.6 HS (PA 6.6 HS)*
Color: *Black*
Use temperature: *-40°C to 105°C*
Flammability: *UL94 V2*

This product consists of a plug and a cable duct where the electrical harness can be placed. The plug has the shape of several parallel blades that make its insertion into the hole fast and very efficient.



REF	A (mm)	B (mm)	C (mm)	Plate hole Ø (mm)	Plate thickness (mm)	Dimensions (mm)
F1291	36.3	11.1	9.7	6.5 to 6.7	0.6 to 5.1	23.5 X 24

Tree clip

Material: *Nylon 6.6 (PA 6.6)*
Color: *Gray and Black*
Use temperature: *-40°C to 85°C*
Flammability: *UL94 V2*

This clip is an excellent product for fastening trim panels in the automotive industry.

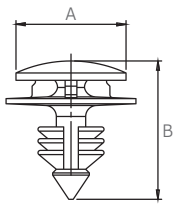
*Other colors on request.

REF	A (mm)	B (mm)	C (mm)	Hole Ø (mm)
F7822	7.8	33.7	20	6.8 to 7.2

Finishing plug

Material: *Nylon 6.6 (PA 6.6)*
Color: *Gray and Black*
Use temperature: *-40°C to 85°C*
Flammability: *UL94 V2*

This piece allows the fastening of two surfaces, one by the plug and the other by the head of the piece. It is often used to secure the foam-containing part of seats to their base, for example, bus seats.



*Other colors on request.

REF	A (mm)	B (mm)	Hole Ø (mm)	Plate thickness (mm)
F7823	15	18.8	8	3.5

Alligator Cable Tie

Material: *Nylon 6.6 (PA 6.6)*
Color: *Black*
Use temperature: -40°C to 85°C
Flammability: *UL94 V2*

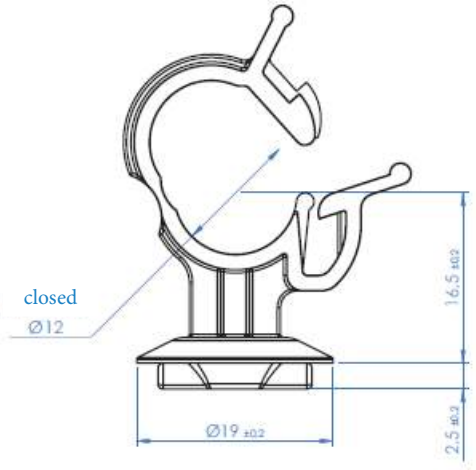
This cable tie has two sets of teeth that fit into each other when tightened together. It is very useful for joining two plastic hoses.

REF	Thickness (mm)	Width (mm)	Minimum lashing Ø (mm)	Maximum lashing Ø (mm)
FJ7718	1.8	6	19.8	22.8

Self-locking clip

Material: *Nylon 6.6 HS (PA 6.6 HS)*
Color: *Black*
Use temperature: -40°C to 105°C
Flammability: *UL94 V2*

Fastening of the hydraulic system hose of Fiat cars.



REF	Plate thickness (mm)	Maximum accommodation Ø (mm)
FCA12	0.5 to 1.3	12

Cable fasteners

Material: *Nylon 6.6 (PA 6.6)*
Color: *Natural and Black*
Use temperature: -40°C to 85°C
Flammability: *UL94 V2*

They are very useful products for fastening harnesses, oil and gas pipes, among other items.
With just a few items, it is possible to fasten lashings with various diameters.

REF	Cable Ø (mm)	Width (mm)	Length (mm)
F7901	4.8	9.5	18.1
F7902	6	11	21.8
F7903	8	11	22.5
F7904	10.3	12.3	26.2
F7906	14.5	12.3	30.3
FR7908	12.7 to 15.9	12.9	31
FR7911	15.9 to 20.6	12.7	36
FR7914	20.6 to 25.4	15.9	48.2
FR7916	27 to 31.8	19.2	56.4
FR7918	33.3 to 38.1	19.1	63

The FR items have adjustments that make it possible to fasten cables and hoses of various diameters.

Fasteners for spark plug wires

Material: *Nylon 6.6 HS (PA 6.6 HS)*
Color: *Black*
Use temperature: -40°C to 105°C
Flammability: *UL94 V2*

Application:
Fastening of GM car spark plug wires.

FGM4

FGM3

FGM2

FCGM2

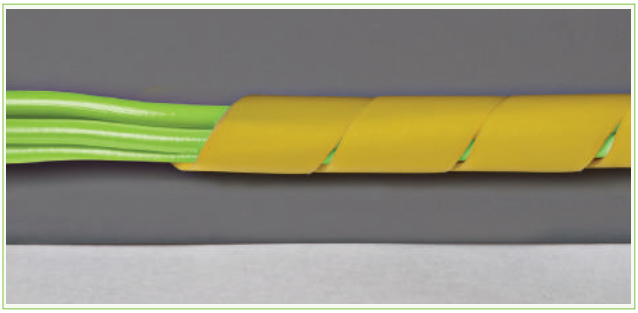
REF	Ways	Plate thickness (mm)	Fastening slot (mm)	Cable Ø (mm)
FGM2	2	1.3 to 1.7	6.4 X 8	5 to 7
FGM3	3	1.3 to 1.7	6.4 X 8	5 to 7
FGM4	4	1.3 to 1.7	6.4 X 8	5 to 7
FCGM2	2			5 to 7

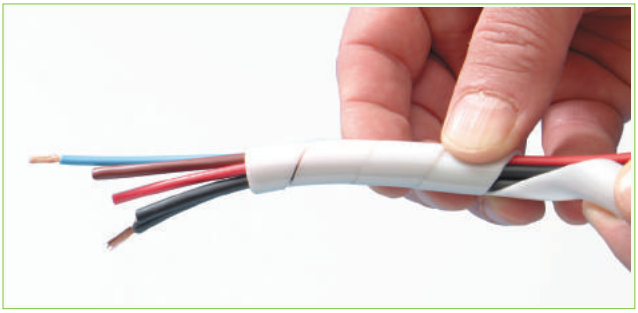
Organizers and **Identifiers**

Spiral tube

FRONTEC spiral tubes have the flexibility, wall thickness and cut patterns that allow for quick and easy handling. It is an excellent product for lashing and accommodating harnesses, allowing derivation at any point.

gray | orange | white | yellow | black | transparent





Material	Color	Use temperature	Flammability
Polyethylene RoHS	White, Black, Gray and Colored	-40°C to 80°C	UL94 HB
Polyethylene AC (flame retardant) *	Gray	-40°C to 80°C	UL94 V0
Polyethylene UV (ultraviolet protection) *.	Black	-40°C to 80°C	UL94 HB
Teflon (flame retardant) *	Transparent	-80°C to 260°C	UL94 V0

*Made to order.

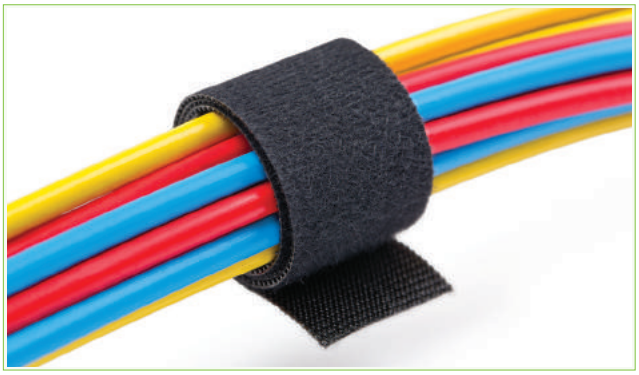
REF	Outer Ø		Thickness (mm)	Inner Ø (mm)
	In	mm		
F7118	1/8	4.8	0.9	3.0
F7114	1/4	6.5	1.0	4.5
F7138	3/8	9.5	1.2	7.1
F7112	1/2	11.2	1.3	8.6
F7158	5/8	16.0	1.6	12.8
F7134	3/4	18.0	1.8	14.4
F 7101	1	23.0	2.0	19.0

Velcro® cable ties

Ref: FV19X3.6PR

Material: *Polypropylene and polyamide*
Color: *Black.* ***Other colors on request****.*
Use temperature: *0°C to 105° C*
Length: *Rolls with 3.6 m*
Width: *19 mm*

These cable ties are recommended for use in structured cabling, telephony, and fiber optics, because the lashing does not harm the cables.
They are also very useful for temporary lashings when they are opened constantly.
It is an easy-to-handle product, with a low profile, high resistance, and can be wetted.



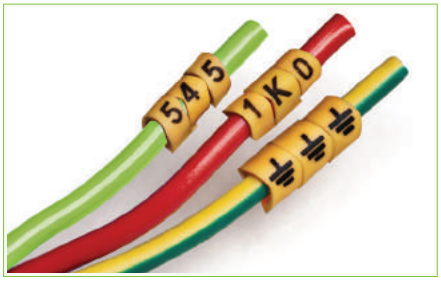
Ref: FV19X22.8PR PREMIUM ***ULTRA STRONG***

Material: *Polypropylene and polyamide*
Color: *Black.* ***Other colors on request****.*
Use temperature: *-17 °C to 105 °C*
Length: *Rolls with 22.8 m*
Width: *19 mm*

It has a longer life cycle and high resistance even for industrial use.
It has high tensile strength.

Cable markers

Wire markers are ideal for identifying wires and cables. The angled cut allows maintaining the alignment of the assembly, and its design makes it possible for a single marker model to be used on various wire or cable sizes.



Material	Color	Printing
Flexible PVC	Yellow printed on black	Letters A - Z
		Numbers 0 - 9
		Symbols + - \/

REF	Cable size	Metric series (mm²)	Number of pieces per package
FGT 0	18 AWG - 12 AWG	0.75 - 2.5 (for cables with 2 to 3.2 mm outer diameter)	100
FGT 1	18 AWG - 10 AWG	0.75 - 4 (for cables with 3 to 4.2 mm outer diameter)	100
FGT 2	12 AWG - 8 AWG	2.5 - 6 (for cables with 3.6 to 7.4 mm outer diameter)	100
FGT 3	8 AWG - 6 AWG	6 - 10 (for cables with 5.2 to 10 mm outer diameter)	50

Cable ties fro identification

Material: *Nylon 6.6 (PA 6.6)*
Color: *Natural*
Use temperature: *-40°C to 85°C*
Flammability: *UL94 V2*

These cable ties have a base for identification engraving or sticking a label.

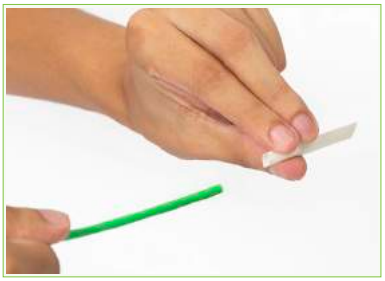
FMTI7010 FMTE7010 FMHI7023 FMHI7039

REF	Length (mm)	Width (mm)	Marker (mm)	Maximum lashing Ø (mm)	Minimum breaking stress		
					kgf	Lbs	N
FMTI7010	100	2.5	25.4 X 8	18	8.2	18	80
FMTE7010	112	2.5	20.4 X 9.1	18	8.2	18	80
FMHI7023	190	4.8	13 X 28	46	22.2	49	218
FMHI7039	370	4.8	13 X 28	102	22.2	49	218

Heat shrinkable markers

Material: *Halogen-free, cadmium-free, radiation cross-linked heat shrinkable polyolefin. (complies with the RoHs standard)*
Use temperature: *- 55 °C to 135 °C*
Minimum shrinking temperature: *90 °C*
Maximum storage temperature (recommended): *50 °C*
Shrinkage rate: *3:1*
Dielectric strength: *≥ 19.7 KV/mm*
Volumetric resistivity: *≥ 10 14 Ω - cm*
Approvals: *SAE-AS 81531*
MIL - STD - 202F/Method 215J
UL 224
Colors: *Yellow and white. Others upon request*
Printers: *Thermal*
Ribbons: *Resin (width 100 mm and length 300 m)*

This product is recommended for the identification of wires and cables in high performance or technically demanding applications.
The printing can be done by various models of thermal printers available in the market.
For the application, we recommend the use of a heat blower (See Frontec's blower models, page. 58).
After its shrinking, the marking gains excellent adhesion and does not move along the cable.



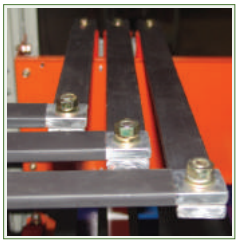
REF	Values in (mm)				
	Expanded inner Φ (D)	Inner Φ after maximum shrink-age (d)	Width Printing (L)	Height (A)	Color
F 3X 2.4-50 AM F 3X 2.4-50 BR	2.79 ± 0.20	≤ 0.79	50	5.0 ± 0.3	Yellow White
F 3X 3.2-50 AM F 3X 3.2-50 BR	3.64 ± 0.23	≤ 1.06	50	6.3 ± 0.4	Yellow White
F 3X 4.8-50 AM F 3X 4.8-50 BR	5.26 ± 0.25	≤ 1.59	50	8.9 ± 0.4	Yellow White
F 3X 6.4-50 AM F 3X 6.4-50 BR	6.92 ± 0.28	≤ 2.36	50	11.5 ± 0.4	Yellow White
F 3X 9.5-50 AM F 3X 9.5-50 BR	10.2 ± 0.32	≤ 3.18	50	16.7 ± 0.5	Yellow White
F 3X 12.7-50 AM F 3X 12.7-50 BR	13.5 ± 0.36	≤ 4.75	50	21.8 ± 0.6	Yellow White
F 3X 19-50 AM F 3X 19-50 BR	20.1 ± 0.40	≤ 6.35	50	32.2 ± 0.6	Yellow White
F 3X 25-50 AM F 3X 25-50 BR	26.7 ± 0.45	≤ 8.47	50	42.5 ± 0.7	Yellow White
F 3X 38-50 AM F 3X 38-50 BR	39.8 ± 0.51	≤ 12.9	50	63.2 ± 0.8	Yellow White
F 3X 51-50 AM F 3X 51-50 BR	53.0 ± 0.56	≤ 17.2	50	83.9 ± 0.9	Yellow White
F 3X 76-50 AM F 3X 76-50 BR	79.4 ± 0.56	≤ 25.8	50	125.3 ± 1.0	Yellow White

Heat Shrinks

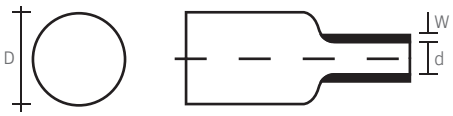
They are tubes produced with cross-linked polyolefin that contracts when subjected to heat, causing electrical insulation.

Low voltage (600V) heat shrink tubes
Normal wall - Shrinkage 2:1

- Complies with RoHs and Sony standard
- Material = flexible polyolefin
- Use temperature = -45°C to 125°C
- Shrinking temperature = start at 70°C and end at 120°C
- Flammability – UL 224 VW-1
- Longitudinal shrinkage of less than 8%
- Supplied in coils
- Black tubes have UV protection



Chemical element	Test method (mm)	Result (mg/kg)
Cd	EN1122:2001 Method B	≤ 5
Pb	EPA 3050 B	≤ 90
Cr^{6+}	EPA 3050 B	≤ 5
Hg	EPA 3052	≤ 5
F	EN 14582 Method B	≤ 200
Cl	EN 14582 Method B	≤ 800
Br	EN 14582 Method B	≤ 800
I	EN 14582 Method B	≤ 200



Properties			Test method	Values
Physical	Breaking stress (Mpa)		ASTM D2671	≥ 10.4
	Elasticity			≥ 200
	Breaking stress after aging (Mpa)		UL 224 158°C X 168 hrs	≥ 7.3
	Elasticity after aging (%)		UL 224 158°C X 168 hrs	≥ 100
	Thermal shock - heat		UL 224 250°C X 4 hrs	Does not crack or form bubbles
Electrical	Thermal shock - cold		UL 224 -30°C X 1 hr	Does not crack
	Dielectric strength (kV/mm)		IEC 243	≥ 15
	Dielectric strength	300 V	UL 224	Does not change at 1500 V
		600 V		Does not change at 2500 V
	Volumetric resistivity (Ω.cm)		IEC 93	≥ 1 X 10^{14}
Chemical	Copper corrosion		UL 224 158°C/168 hrs	Pass
	Copper stability			Pass
	Flammability		UL 224	VW - 1

REF	Expanded inner Ø (D)		Inner Ø after maximum shrinkage (d) (mm)	Wall thickness after maximum shrinkage (W) (mm)	Equivalent Ø range (mm)		Width of the flattened tube (mm)	Expanded perimeter (mm)	Quantity per coil (m)
	(mm)	(in)			Mini-mum	Maxi-mum			
W1.0	1.50±0.2	3/64	≤0.65	0.36±0.10	0.72	1.2	2.36	4.71	200
W1.5	2.00±0.2	1/16	≤0.85	0.36±0.10	0.94	1.6	3.14	6.28	200
W2	2.50±0.2	3/32	≤1.0	0.36±0.10	1.1	2	3.93	7.85	200
W2.5	3.00±0.2	3/32	≤1.30	0.45±0.10	1.43	2.4	4.71	9.42	200
W3.0	3.50±0.2	1/8	≤1.50	0.45±0.10	1.65	2.8	5.5	10.99	200
W4.5 *	5.00±0.2	3/16	≤2.30	0.56±0.10	2.53	4	7.85	15.7	100
W5	5.50±0.2	3/16	≤2.50	0.56±0.10	2.75	4.4	8.64	17.27	100
W6	6.50±0.2	1/4	≤3.00	0.56±0.10	3.3	5.2	10.21	20.41	100
W8	8.50±0.3	5/16	≤4.00	0.56±0.10	4.4	6.8	13.35	26.69	100
W10	10.5±0.3	3/8	≤5.00	0.56±0.10	5.5	8.4	16.49	32.97	100
W13	13.5±0.3	1/2	≤6.50	0.70±0.10	7.15	10.8	21.21	42.39	100
W16	16.5±0.4	5/8	≤8.00	0.70±0.10	8.8	13.6	26.7	53.38	100
W17	17.5±0.4	5/8	≤8.50	0.70±0.10	9.35	14.4	28.26	56.52	100
W18	19.0±0.5	3/4	≤9.00	0.70±0.10	9.9	15.2	29.84	59.66	100
W20	22.0±0.5	3/4	≤10.00	0.83±0.10	11	17.6	34.56	69.08	100
W22	24.0±0.5		≤11.00	0.83±0.15	12.1	19.2	37.7	75.36	100
W25	26.0±0.5	1	≤12.50	0.90±0.15	13.75	20.8	40.84	81.64	50
W28	29.0±0.5		≤14.00	0.90±0.15	15.4	23.2	45.55	91.06	50
W30	31.5±1.0		≤15.00	1.00±0.15	16.5	25.2	49.48	98.91	50
W35	36.5±1.0	1-1/4	≤17.50	1.00±0.15	19.25	29.2	57.33	114.61	50
W40	41.5±1.0	1-1/2	≤20.00	1.00±0.15	22	33.2	65.19	130.31	50
W45	46.5±1.0		≤22.50	1.00±0.20	24.75	36.8	72.25	144.44	25
W50	52.0±2.0	2	≤25.00	1.10±0.20	27.5	40.8	80.11	160.14	25
W60	62.0±3.0		≤30.0	1.10±0.20	34.1	48	94.25	188.4	25
W70	72.0±3.0		≤35.0	1.10±0.20	39.6	56	109.95	219.8	25
W80	82.0±3.0	3	≤40.0	1.20±0.20	45.1	64	125.66	251.2	25
W90	92.0±4.0		≤45.0	1.20±0.20	50.6	72	141.37	282.6	25
W100	102.0±4.0	4	≤50.0	1.20±0.20	56.1	80	157.08	314	25
W120	122.0±4.0	5	≤60.0	1.30±0.20	67.1	96	188.49	376.8	25
W150	153.0±5.0		≤75.0	1.30±0.20	83.6	120	235.61	471	25
W180	180.0		≤91.0	1.56	100.1	144	282.74	565.2	25

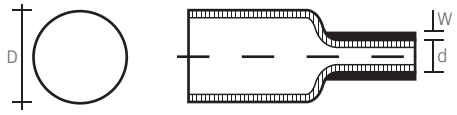
The dimensions highlighted in gray are only available in black.
* W4,5: also available in transparent-green color.

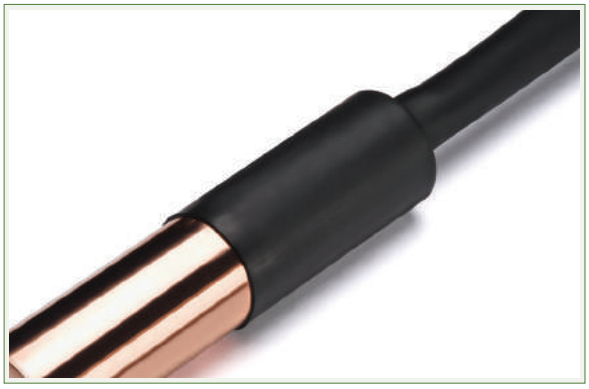
Colors:
black, white, red, yellow, green, purple, blue, gray, brown, transparent

Low voltage (600V) heat shrink tubes Adhesives - Shrinkage 3:1

The adhesive heat shrink tubes are semi-flexible and contain an internal thermoplastic adhesive liner, providing complete protection against moisture. They are indicated for use in cable ends, wire taps, connectors, splicing of electrical and telephone conductors, among other applications.

- Use temperature = -45°C to 125°C
- Shrinking temperature = start at 70°C and end at 120°C
- Material = flexible polyolefin with internal hot melt adhesive
- Longitudinal shrinkage = maximum of 8%
- Waterproof
- Supplied in coils
- Adhesive melting temperature: 70°C to 90°C
- Black tubes have UV protection





Chemical element	Test method (mm)	Result (mg/kg)
Cd	EN1122:2001 Method B	≤ 5
Pb	EPA 3050 B	≤ 90
Cr^{6+}	EPA 3050 B	≤ 5
Hg	EPA 3052	≤ 5
F	EN 14582 Method B	≤ 200
Cl	EN 14582 Method B	≤ 800
Br	EN 14582 Method B	≤ 800
I	EN 14582 Method B	≤ 200

TUBE		
Properties	**Test method**	**Values**
Breaking stress (Mpa)	ASTM D2671	≥ 12
Elasticity (%)	ASTM D2671	≥ 300
Breaking stress after aging (Mpa)	UL 224 158°C X 168 hrs	≥ 7.3
Elasticity after aging (%)	UL 224 158°C X 168 hrs	≥ 200
Dielectric strength (kV/mm)	IEC 243	≥ 15
Volumetric resistivity (Ω.cm)	IEC 93	≥ 1 X 10^{14}

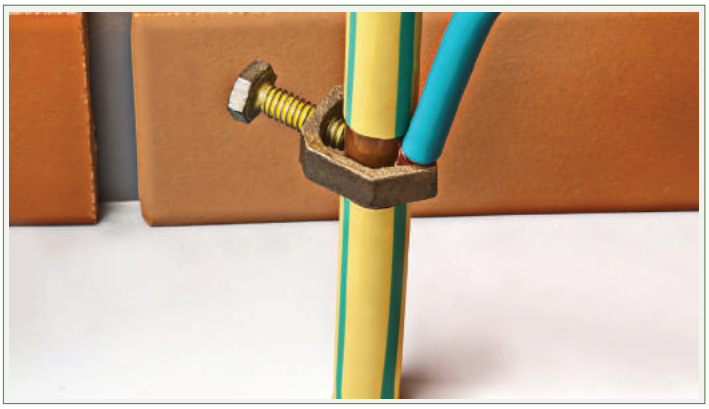
ADHESIVE		
Properties	**Test method**	**Values**
Water absorption	ASTM D570	≤ 0.2%
Softening point	ASTM E28	95°C

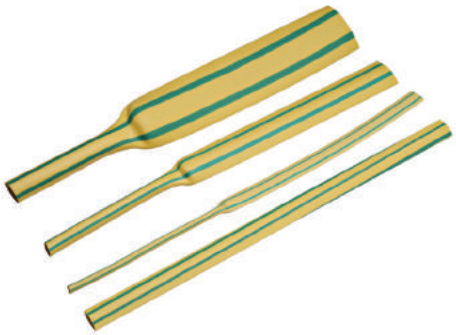
REF	Expanded inner Ø (D)		Inner Ø after maximum shrinkage (d) (mm)	Wall thickness after maximum shrinkage (W)* (mm)	Equivalent Ø range (mm)		Width of the flattened tube (L) (mm)	Expanded perimeter (P) (mm)	Quantity per coil (m)
	(mm)	(in)			Mini-mum	Maxi-mum			
WA1/8	3.2	1/8	1	0.95	1.1	2.56	5.03	10.05	200
WA 3/16	4.8	3/16	1.6	1.1	1.76	3.84	7.54	15.07	100
WA1/4	6.4	1/4	2.2	1.2	2.42	5.12	10.05	20.1	100
WA5/16	7.9	5/16	2.7	1.35	2.97	6.32	12.41	24.81	100
WA3/8	9.5	3/8	3.2	1.45	3.52	7.6	14.92	29.83	50
WA1/2	12.7	1/2	4.2	1.7	4.62	10.16	19.95	39.88	25
WA5/8	15	5/8	5.2	1.8	5.72	12	23.56	47.1	25
WA3/4	19.1	3/4	6.3	2	6.94	15.28	30	59.97	25
WA1	25.4	1	8.5	2.1	9.36	20.32	39.9	79.76	25
WA1-1/4	30	1-1/4	10.2	2.2	11.23	24	47.12	94.20	25
WA1-1/2	40	1-1/2	13.5	2.4	14.86	32	62.83	125.6	25
WA2	50	2	17	2.8	14.85	32	78.5	157	25

See available colors.

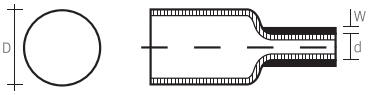
Low voltage (600V) heat shrink tubes Green-Yellow - Shrinkage 2:1

- Conforms to the RoHs standard
- Material = flexible polyolefin
- Use temperature = -55°C to 125°C
- Shrinking temperature = start at 70°C and end at 120°C
- Flammability = UL VW-1
- Longitudinal shrinkage of less than 8%





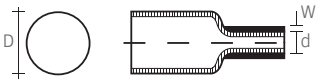
Properties	Test method	Values
Breaking stress (Mpa)	ASTM D2671	≥ 10.4
Elasticity (%)	ASTM D2671	≥ 200
Breaking stress after aging (Mpa)	UL 224 158°C X 168 hrs	≥ 7.3
Elasticity after aging (%)	UL 224 158°C X 168 hrs	≥ 100
Thermal shock - heat	UL 224 250°C X 4 hrs	Does not crack or form bubbles
Dielectric strength (kV/mm)	IEC 243	≥ 15
Volumetric resistivity (Ω.cm)	IEC 93	≥ 1 X 10^{14}
Flammability	UL 224	VW-1



REF	Expanded inner Ø		Inner Ø after maximum shrinkage (d) (mm)	Wall thickness after maximum shrinkage (W) (mm)	Equivalent Ø range (mm)		Width of the flattened tube (mm)	Expanded perimeter (mm)	Quantity per coil (m)
	(mm)	(in)			Mini-mum	Maxi-mum			
W1.5VA	1.5	1/16	0.85	0.32	0.94	1.6	3.14	6.28	200
W2.5VA	2.5	3/32	1.3	0.38	1.43	2.4	4.71	9.42	200
W3VA	3	1/8	1.5	0.4	1.65	2.8	5.5	10.99	200
W4.5VA	4.5	3/16	2.3	0.5	2.53	4	7.85	15.7	100
W6VA	6	1/4	3	0.55	3.3	5.2	10.21	20.41	100
W8VA	8	5/16	4	0.6	4.4	6.8	13.35	26.69	100
W10VA	10	3/8	5	0.6	5.5	8.4	16.49	32.97	100
W13VA	13	1/2	6.5	0.65	7.15	10.8	21.21	42.39	100
W18VA	18	3/4	9	0.8	9.9	15.2	29.84	59.66	100
W20VA	20	3/4	10	0.8	11	17.6	34.56	69.08	100
W25VA	25	1	12.5	0.9	13.75	20.8	40.84	81.64	50
W30VA	30	1-1/4	15	0.95	16.5	25.2	49.48	98.91	50
W40VA	40	1-1/2	20	1	22	33.2	65.19	130.31	50
W50VA	50	2	25	1	27.5	40.8	80.11	160.14	25
W80VA	80	3	40	1.46	45.1	64	125.66	251.2	25
W100VA	100	4	51	1.46	56.1	80	157.08	314	25

Heat shrink tubes for medium voltage

- High tracking resistance
- Material = flexible polyolefin
- Use temperature = -55°C to 125°C
- Shrinking temperature = 90°C
- Supplied in black and red



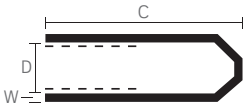
Properties	Values
Voltage (A.C.)	Insulation up to 42 kV
Voltage peak	75 kV
Dielectric strength (kV/mm)	≥ 25
Volumetric resistivity (Ω.cm)	≥ 4.3 X 10^{14}

REF (10 kV)	Expanded inner Ø (D)		Inner Ø after maximum shrinkage (d) (mm)	Wall thickness after maximum shrinkage (W) (mm)	Equivalent Ø range (mm)		Width of the flattened tube (mm)	Expanded perimeter (mm)	Quantity per coil (m)
	(mm)	(in)			Mini-mum	Maxi-mum			
WB20-10kV	20	3/4	9	2	9.91	16	31.4	62.8	25
WB30-10kV	30		13	2	14.31	24	49.48	94.2	25
WB50-10kV	50	2	20	2.5	22.02	40	80.11	157	25
WB80-10kV	80	3	32	3	35.23	64	125.66	251.2	25
WB100-10kV	100	4	40	3	44.03	80	157.08	314	25
WB120-10kV	120	5	48	3	52.84	96	188.49	376.8	25
WB180-10kV	180		70	3	77.06	144	282.74	565.2	25

Heat shrink hoods

Heat shrink hoods are indicated for closing and insulating power and communication cable ends, preventing chemical corrosion, moisture and dirt penetration.

- Material = flexible polyolefin with internal hot melt adhesive
- Color = black
- Shrinkage rate = 2:1
- Use temperature = -55°C to 100°C
- Dielectric strength = ≥ 20 kV/mm
- Longitudinal shrinkage = ≤ 10%
- Water absorption ≤ 0.1%.
- Volumetric resistivity ≥1 x 10^{14}Ω.cm
- Have UV protection



REF	Expanded inner Ø (D) (mm)	Inner Ø after maximum shrinkage (mm)	Length (C) (mm)	Wall thickness after maximum shrinkage (W) (mm)	Equivalent Ø range (mm)		Expanded perimeter (mm)
					Minimum	Maxi-mum	
WC 12/5	12	5	45	2.5	6.05	9.60	37.68
WC 16/8	16	8	70	2.5	8.26	12.80	50.24
WC 25/11	25	11	84	2.5	11.56	20.00	78.50
WC 30/16	30	16	94	3.0	18.16	24.00	94.20
WC 55/26	50	26	125	2.5	28.62	40.00	157.00
WC 75/30	70	30	145	3.2	40.73	56.00	219.80
WC 97/40	97	40	140	5.0	50.64	77.60	304.58
WC 120/57	120	57	150	4.4	62.75	96.00	376.80

Heat shrink tubes for high voltage

- High tracking resistance
- Material = flexible polyolefin
- Use temperature = -55°C to 125°C
- Shrinking temperature = 90°C
- Supplied in black and red

REF (35 kV)	Expanded inner Ø (D)		Inner Ø after maximum shrinkage (d) (mm)	Wall thickness after maximum shrinkage (W) (mm)	Equivalent Ø range (mm)		Width of the flattened tube (mm)	Expanded perimeter (mm)	Quantity per coil (m)
	(mm)	(in)			Mini-mum	Maxi-mum			
WB20-35kV	20	3/4	9	4	9.91	16	31.4	62.8	15
WB30-35kV	30		13	4	14.31	24	49.48	94.2	15
WB50-35kV	50	2	20	4.5	22.02	40	80.11	157	15
WB80-35kV	80	3	32	4.5	35.23	64	125.66	251.2	15
WB100-35kV	100	4	40	4.5	44.03	80	157.08	314	15
WB120-35kV	120	5	48	5	52.84	96	188.49	376.8	15
WB180-35kV	180		70	5.5	77.06	144	282.74	565.2	15

Heat shrink kits

Ideal for insulating electrical harnesses, electrical terminals, connectors, plugs, electronic components, cell phone charger cables, battery chargers, and electrical and electronic finishing in general.

- Conforms to RoHs and Sony standards
- Use temperature = -45°C to 125°C
- Shrinking temperature = start at 70°C and end at 120°C
- Material = flexible polyolefin with internal hot melt adhesive
- Longitudinal shrinkage = maximum of 8%
- Waterproof
- Supplied in coils
- Adhesive melting temperature: 70°C to 90°C
- Black tubes have UV protection

W1W2W3W4,5W6PR

W8W10W13

W1W2W3W4,5W6PR

REF.	Expanded inner Ø (D)	Inner ø after maximum shrinkage (d)
W1	1	0.65
W2	2	1
W3	3	1.5
W4.5	4.5	2.3
W6	6	3

The kit consists of 5 pieces of each item, cut in 8 cm.

W8W10W13

REF.	Expanded inner Ø (D)	Inner ø after maximum shrinkage (d)
W8	8	4
W10	10	5
W13	13	6.5

The kit consists of 5 pieces of each item, cut in 8 cm.

Heat blowers

Heat blowers help in the execution of various tasks in which heat is necessary, as in the case of the application of heat shrinks.

HL 520

HL 1920

REF	Power		Temperature (°C)	Temperature control	Weight (Kg)
	110V	220V			
HL520	1200	1000	230 to 400	E1 and E2 (switch)	0.6
HL1920	1500	2000	80 to 600	Regulatory wheel (1 to 9)	0.7

Heat shrink for busbars with thickness of 1/16 inch (1.59 mm)

Busbar dimensions		Perimeter	Equivalent diameter	Tube options (codes)	Equivalent Φ range (mm)		Diameter (D) mm	
Inch	(mm)	Sum of sides (mm)	Perimeter ÷ 3.14 (π)		Mini-mum	Maxi-mum	Normal	Shrunk
1/4	1.59 X 6.35	15.9	5.1	W7	3.9	6.0	7.0	3.5
				W8	4.4	6.8	8.5	4.0
3/8	1.59 X 9.52	22.2	7.1	W9	5.0	7.6	9.5	4.5
				W10	5.5	8.4	10.5	5.0
1/2	1.59 X 12.7	28.6	9.1	W13	7.2	10.8	13.0	6.5
				W16	8.8	13.6	16.5	8.0
5/8	1.59 X 15.87	34.9	11.1	W16	8.8	13.6	16.5	8.0
				W18	9.9	15.2	19.0	9.0
3/4	1.59 X 19.05	41.3	13.2	W18	9.9	15.2	19.0	9.0
				W20	11.0	17.6	21.0	10.0
7/8	1.59 X 22.22	47.6	15.2	W20	11.0	17.6	21.0	10.0
				W22	12.1	19.2	23.0	11.0
1	1.59 X 25.4	54.0	17.2	W22	12.1	19.2	23.0	11.0
				W25	13.8	20.8	26.0	12.5
1.1/4	1.59 X 31.75	66.7	21.2	W28	15.4	23.2	29.0	14.0
				W30	16.5	25.2	31.5	15.0
1.1/2	1.59 X 38.1	79.4	25.3	W35	19.3	29.2	36.5	17.5
				W40	22.0	33.2	41.5	20.0
1.3/4	1.59 X 44.45	92.1	29.3	W40	22.0	33.2	41.5	20.0
				W45	24.8	36.8	46.5	22.5
2	1.59 X 50.8	104.8	33.4	W45	24.8	36.8	46.5	22.5
				W50	27.5	40.8	50.0	25.0
2.1/4	1.59 X 57.15	117.5	37.4	W50	27.5	40.8	50.0	25.0
				W60	34.1	48.0	60.0	31.0
2.1/2	1.59 X 63.5	130.2	41.5	W60	34.1	48.0	60.0	31.0
				W70	39.6	56.0	70.0	36.0
2.3/4	1.59 X 69.85	142.9	45.5	W60	34.1	48.0	60.0	31.0
				W70	39.6	56.0	70.0	36.0
3	1.59 X 76.2	155.6	49.6	W70	39.6	56.0	70.0	36.0
				W80	45.1	64.0	80.0	41.0
3.1/4	1.59 X 82.55	168.3	53.6	W70	39.6	56.0	70.0	36.0
				W80	45.1	64.0	80.0	41.0
3.1/2	1.59 X 88.9	181.0	57.6	W80	45.1	64.0	80.0	41.0
				W90	50.6	72.0	90.0	46.0
3.3/4	1.59 X 92.25	187.7	59.8	W80	45.1	64.0	80.0	41.0
				W90	50.6	72.0	90.0	46.0
4	1.59 X 101.6	206.4	65.7	W90	50.6	72.0	90.0	46.0
				W100	56.1	80.0	100.0	51.0
4.1/2	1.59 X 114.3	231.8	73.8	W100	56.1	80.0	100.0	51.0
				W120	67.1	96.0	120.0	60.0
5	1.59 X 127	257.2	81.9	W120	67.1	96.0	120.0	60.0
5.1/2	1.59 X 139.7	282.6	90.0	W120	67.1	96.0	120.0	60.0
				W150	83.6	120.0	150.0	75.0
6	1.59 X 152.4	308.0	99.1	W150	83.6	120.0	150.0	75.0

Suitable for straight busbars, without curves

Suitable for busbars with curves

Heat shrink for busbars with thickness of 1/8 inch (3.17 mm)

Busbar dimensions		Perimeter	Equivalent diameter	Tube options (codes)	Equivalent Φ range (mm)		Diameter (D) mm	
Inch	(mm)	Sum of sides (mm)	Perimeter ÷ 3.14 (π)		Mini-mum	Maxi-mum	Normal	Shrunk
1/4	3.17 X 6.35	19.0	6.1	W8	4.4	6.8	8.5	4.0
				W9	5.0	7.6	9.5	4.5
3/8	3.17 X 9.52	25.4	8.1	W10	5.5	8.4	10.5	5.0
				W13	7.2	10.8	13.5	6.5
1/2	3.17 X 12.7	31.7	10.1	W16	8.8	13.6	16.5	8.0
				W18	9.9	15.2	19.0	9.0
5/8	3.17 X 15.87	38.1	12.1	W16	8.8	13.6	16.5	8.0
				W18	9.9	15.2	19.0	9.0
3/4	3.17 X 19.05	44.4	14.2	W18	9.9	15.2	19.0	9.0
				W20	11.0	17.6	21.0	10.0
7/8	3.17 X 22.22	50.8	16.2	W20	11.0	17.6	21.0	10.0
				W22	12.1	19.2	23.0	11.0
1	3.17 X 25.4	57.1	18.2	W22	12.1	19.2	23.0	11.0
				W25	13.8	20.8	26.0	12.5
1.1/4	3.17 X 31.75	69.8	22.2	W30	16.5	25.2	31.5	15.0
				W35	19.3	29.2	36.5	17.5
1.1/2	3.17 X 38.1	82.5	26.3	W35	19.3	29.2	36.5	17.5
				W40	22.0	33.2	41.5	20.0
1.3/4	3.17 X 44.45	95.2	30.3	W40	22.0	33.2	41.5	20.0
				W45	24.8	36.8	46.5	22.5
2	3.17 X 50.8	107.9	34.4	W45	24.8	36.8	46.5	22.5
				W50	27.5	40.8	50.0	25.0
2.1/4	3.17 X 57.15	120.6	38.4	W50	27.5	40.8	50.0	25.0
				W60	34.1	48.0	60.0	31.0
2.1/2	3.17 X 63.5	133.3	42.5	W60	34.1	48.0	60.0	31.0
				W70	39.6	56.0	70.0	36.0
2.3/4	3.17 X 69.85	146.0	46.5	W60	34.1	48.0	60.0	31.0
				W70	39.6	56.0	70.0	36.0
3	3.17 X 76.2	158.7	50.6	W70	39.6	56.0	70.0	36.0
				W80	45.1	64.0	80.0	41.0
3.1/4	3.17 X 82.55	171.4	54.6	W70	39.6	56.0	70.0	36.0
				W80	45.1	64.0	80.0	41.0
3.1/2	3.17 X 88.9	184.1	58.6	W80	45.1	64.0	80.0	41.0
				W90	50.6	72.0	90.0	46.0
3.3/4	3.17 X 92.25	196.8	62.7	W80	45.1	64.0	80.0	41.0
				W90	50.6	72.0	90.0	46.0
4	3.17 X 101.6	209.5	66.7	W90	50.6	72.0	90.0	46.0
				W100	56.1	80.0	100.0	51.0
4.1/2	3.17 X 114.3	234.9	74.8	W100	56.1	80.0	100.0	51.0
				W120	67.1	96.0	120.0	60.0
5	3.17 X 127	260.3	82.9	W120	67.1	96.0	120.0	60.0
5.1/2	3.17 X 139.7	285.7	91.0	W120	67.1	96.0	120.0	60.0
				W150	83.6	120.0	150.0	75.0
6	3.17 X 152.4	311.1	99.1	W150	83.6	120.0	150.0	75.0

Suitable for straight busbars, without curves

Suitable for busbars with curves

Heat shrink for busbars with thickness of 3/16 inch (4.76mm)

Busbar dimensions		Perimeter	Equivalent diameter	Tube options (codes)	Equivalent Φ range (mm)		Diameter (D) mm	
Inch	(mm)	Sum of sides (mm)	Perimeter ÷ 3.14 (π)		Mini-mum	Maxi-mum	Normal	Shrunk
1/4	4.76 X 6.35	22.2	7.1	W8	4.4	6.8	8.5	4.0
				W9	5.0	7.6	9.5	4.5
3/8	4.76 X 9.52	28.6	9.1	W10	5.5	8.4	10.5	5.0
				W13	7.2	10.8	13.5	6.5
1/2	4.76 X 12.7	34.9	11.1	W16	8.8	13.6	16.5	8.0
				W18	9.9	15.2	19.0	9.0
5/8	4.76 X 15.87	41.3	13.1	W18	9.9	15.2	19.0	9.0
				W20	11.0	17.6	21.0	10.0
3/4	4.76 X 19.05	47.6	15.2	W20	11.0	17.6	21.0	10.0
				W22	12.1	19.2	23.0	11.0
7/8	4.76 X 22.22	54.0	17.2	W22	12.1	19.2	23.0	11.0
				W25	13.8	20.8	26.0	12.5
1	4.76 X 25.4	60.3	19.2	W28	15.4	23.2	29.0	14.0
				W30	16.5	25.2	31.5	15.0
1.1/4	4.76 X 31.75	73.0	23.3	W30	16.5	25.2	31.5	15.0
				W35	19.3	29.2	36.5	17.5
1.1/2	4.76 X 38.1	85.7	27.3	W35	19.3	29.2	36.5	17.5
				W40	22.0	33.2	41.5	20.0
1.3/4	4.76 X 44.45	98.4	31.3	W40	22.0	33.2	41.5	20.0
				W45	24.8	36.8	46.5	22.5
2	4.76 X 50.8	111.1	35.4	W50	27.5	40.8	50.0	25.0
				W60	34.1	48.0	60.0	31.0
2.1/4	4.76 X 57.15	123.8	39.4	W60	34.1	48.0	60.0	31.0
				W70	39.6	56.0	70.0	36.0
2.1/2	4.76 X 63.5	136.5	43.5	W60	34.1	48.0	60.0	31.0
				W70	39.6	56.0	70.0	36.0
2.3/4	4.76 X 69.85	149.2	47.5	W70	39.6	56.0	70.0	36.0
				W80	45.1	64.0	80.0	41.0
3	4.76 X 76.2	161.9	51.6	W70	39.6	56.0	70.0	36.0
				W80	45.1	64.0	80.0	41.0
3.1/4	4.76 X 82.55	174.6	55.6	W80	45.1	64.0	80.0	41.0
				W90	50.6	72.0	90.0	46.0
3.1/2	4.76 X 88.9	187.3	59.7	W80	45.1	64.0	80.0	41.0
				W90	50.6	72.0	90.0	46.0
3.3/4	4.76 X 95.25	200.0	63.7	W90	50.6	72.0	90.0	46.0
				W100	56.1	80.0	100.0	51.0
4	4.76 X 101.6	212.7	67.7	W90	50.6	72.0	90.0	46.0
				W100	56.1	80.0	100.0	51.0
4.1/2	4.76 X 114.3	238.1	75.8	W100	56.1	80.0	100.0	51.0
				W120	67.1	96.0	120.0	60.0
5	4.76 X 127	263.5	83.9	W120	67.1	96.0	120.0	60.0
5.1/2	4.76 X 139.7	288.9	92.0	W120	67.1	96.0	120.0	60.0
				W150	83.6	120.0	150.0	75.0
6	4.76 X 152.4	314.3	100.1	W150	83.6	120.0	150.0	75.0

Suitable for straight busbars, without curves

Suitable for busbars with curves

Heat shrink for busbars with thickness of 1/4 inch (6.35 mm)

Busbar dimensions		Perimeter	Equivalent diameter	Tube options (codes)	Equivalent Φ range (mm)		Diameter (D) mm	
Inch	(mm)	Sum of sides (mm)	Perimeter ÷ 3.14 (π)		Mini-mum	Maxi-mum	Normal	Shrunk
1/4	6.35 X 6.35	25.4	8.1	W10	5.5	8.4	10.5	5.0
				W13	7.2	10.8	13.5	6.5
3/8	6.35 X 9.52	31.7	10.1	W16	8.8	13.6	16.5	8.0
				W18	9.9	15.2	19.0	9.0
1/2	6.35 X 12.7	38.1	12.1	W16	8.8	13.6	16.5	8.0
				W18	9.9	15.2	19.0	9.0
5/8	6.35 X 15.87	44.4	14.2	W18	9.9	15.2	19.0	9.0
				W20	11.0	17.6	21.0	10.0
3/4	6.35 X 19.05	50.8	16.2	W20	11.0	17.6	21.0	10.0
				W22	12.1	19.2	23.0	11.0
7/8	6.35 X 22.22	57.1	18.2	W22	12.1	19.2	23.0	11.0
				W22	12.1	19.2	23.0	11.0
1	6.35 X 25.4	63.5	20.2	W28	15.4	23.2	29.0	14.0
				W30	16.5	25.2	31.5	15.0
1.1/4	6.35 X 31.75	76.2	24.3	W30	16.5	25.2	31.5	15.0
				W35	19.3	29.2	36.5	17.5
1.1/2	6.35 X 38.1	88.9	28.3	W35	19.3	29.2	36.5	17.5
				W40	22.0	33.2	41.5	20.0
1.3/4	6.35 X 44.45	101.6	32.4	W45	24.8	36.8	46.5	22.5
				W50	27.5	40.8	50.0	25.0
2	6.35 X 50.8	114.3	36.4	W50	27.5	40.8	50.0	25.0
				W60	34.1	48.0	60.0	31.0
2.1/4	6.35 X 57.15	127.0	40.4	W60	34.1	48.0	60.0	31.0
				W70	39.6	56.0	70.0	36.0
2.1/2	6.35 X 63.5	139.7	44.5	W60	34.1	48.0	60.0	31.0
				W70	39.6	56.0	70.0	36.0
2.3/4	6.35 X 69.85	152.4	48.5	W70	39.6	56.0	70.0	36.0
				W80	45.1	64.0	80.0	41.0
3	6.35 X 76.2	165.1	52.6	W70	39.6	56.0	70.0	36.0
				W80	45.1	64.0	80.0	41.0
3.1/4	6.35 X 82.55	177.8	56.6	W80	45.1	64.0	80.0	41.0
				W90	50.6	72.0	90.0	46.0
3.1/2	6.35 X 88.9	190.5	60.7	W80	45.1	64.0	80.0	41.0
				W90	50.6	72.0	90.0	46.0
3.3/4	6.35 X 95.25	203.2	64.7	W90	50.6	72.0	90.0	46.0
				W100	56.1	80.0	100.0	51.0
4	6.35 X 101.6	215.9	68.8	W90	50.6	72.0	90.0	46.0
				W100	56.1	80.0	100.0	51.0
4.1/2	6.35 X 114.3	241.3	76.8	W100	56.1	80.0	100.0	51.0
				W120	67.1	96.0	120.0	60.0
5	6.35 X 127	266.7	84.9	W120	67.1	96.0	120.0	60.0
5.1/2	6.35 X 139.7	292.1	93.0	W120	67.1	96.0	120.0	60.0
				W150	83.6	120.0	150.0	75.0
6	6.35 X 152.4	317.5	101.1	W150	83.6	120.0	150.0	75.0

Suitable for straight busbars, without curves

Suitable for busbars with curves

Heat shrink for busbars with thickness of 5/16 inch (7.93 mm)

Busbar dimensions		Perimeter	Equivalent diameter	Tube options (codes)	Equivalent Φ range (mm)		Diameter (D) mm	
Inch	(mm)	Sum of sides (mm)	Perimeter ÷ 3.14 (π)		Mini-mum	Maxi-mum	Normal	Shrunk
1/4	7.93 X 6.35	28.6	9.1	W13	7.2	10.8	13.5	5.0
				W16	8.8	13.6	10.8	6.5
3/8	7.93 X 9.52	34.9	11.1	W16	8.8	13.6	13.6	8.0
				W18	9.9	15.2	15.2	9.0
1/2	7.93 X 12.7	41.3	13.1	W18	9.9	15.2	15.2	9.0
				W20	11.0	17.6	17.6	10.0
5/8	7.93 X 15.87	47.6	15.2	W20	11.0	17.6	17.6	10.0
				W22	12.1	19.2	19.2	11.0
3/4	7.93 X 19.05	54.0	17.2	W22	12.1	19.2	19.2	11.0
				W25	13.8	20.8	20.8	12.5
7/8	7.93 X 22.22	60.3	19.2	W28	15.4	23.2	23.2	14.0
				W30	16.5	25.2	25.2	15.0
1	7.93 X 25.4	66.7	21.2	W30	16.5	25.2	25.2	15.0
				W35	19.3	29.2	29.2	17.5
1.1/4	7.93 X 31.75	79.4	25.3	W30	16.5	25.2	25.2	15.0
				W35	19.3	29.2	29.2	17.5
1.1/2	7.93 X 38.1	92.1	29.3	W40	22.0	33.2	33.2	20.0
				W45	24.8	36.8	36.8	22.5
1.3/4	7.93 X 44.45	104.8	33.4	W45	24.8	36.8	36.8	22.5
				W50	27.5	40.8	40.8	25.0
2	7.93 X 50.8	117.5	37.4	W50	27.5	40.8	40.8	25.0
				W60	34.1	48.0	48.0	31.0
2.1/4	7.93 X 57.15	130.2	41.5	W60	34.1	48.0	48.0	31.0
				W70	39.6	56.0	56.0	36.0
2.1/2	7.93 X 63.5	142.9	45.5	W60	34.1	48.0	48.0	31.0
				W70	39.6	56.0	56.0	36.0
2.3/4	7.93 X 69.85	155.6	49.5	W70	39.6	56.0	56.0	36.0
				W80	45.1	64.0	64.0	41.0
3	7.93 X 76.2	168.3	53.6	W70	39.6	56.0	56.0	36.0
				W80	45.1	64.0	64.0	41.0
3.1/4	7.93 X 82.55	181.0	57.6	W80	45.1	64.0	64.0	41.0
				W90	50.6	72.0	72.0	46.0
3.1/2	7.93 X 88.9	193.7	61.7	W80	45.1	64.0	64.0	41.0
				W90	50.6	72.0	72.0	46.0
3.3/4	7.93 X 95.25	206.4	65.7	W90	50.6	72.0	72.0	46.0
				W100	56.1	80.0	80.0	51.0
4	7.93 X 101.6	219.1	69.8	W90	50.6	72.0	72.0	46.0
				W100	56.1	80.0	80.0	51.0
4.1/2	7.93 X 114.3	244.5	77.9	W100	56.1	80.0	80.0	51.0
				W120	67.1	96.0	96.0	60.0
5	7.93 X 127	269.9	85.9	W120	67.1	96.0	96.0	60.0
5.1/2	7.93 X 139.7	295.3	94.0	W120	67.1	96.0	96.0	60.0
				W150	83.6	120.0	120.0	75.0
6	7.93 X 152.4	320.7	102.1	W150	83.6	120.0	120.0	75.0

Suitable for straight busbars, without curves

Suitable for busbars with curves

Heat shrink for busbars with thickness of 3/8 inch (9.52mm)

Busbar dimensions		Perimeter	Equivalent diameter	Tube options (codes)	Equivalent Φ range (mm)		Diameter (D) mm	
Inch	(mm)	Sum of sides (mm)	Perimeter ÷ 3.14 (π)		Mini-mum	Maxi-mum	Normal	Shrunk
1/4	9.52 X 6.35	31.7	10.1	W16	8.8	13.6	16.5	8.0
				W18	9.9	15.2	19.0	9.0
3/8	9.52 X 9.52	38.1	12.1	W16	8.8	13.6	16.5	8.0
				W18	9.9	15.2	19.0	9.0
1/2	9.52 X 12.7	44.4	14.2	W18	9.9	15.2	19.0	9.0
				W20	11.0	17.6	21.0	10.0
5/8	9.52 X 15.87	50.8	16.2	W20	11.0	17.6	21.0	10.0
				W22	12.1	19.2	23.0	11.0
3/4	9.52 X 19.05	57.1	18.2	W22	12.1	19.2	23.0	11.0
				W25	13.8	20.8	26.0	12.5
7/8	9.52 X 22.22	63.5	20.2	W28	15.4	23.2	29.0	14.0
				W30	16.5	25.2	31.5	15.0
1	9.52 X 25.4	69.8	22.2	W30	16.5	25.2	31.5	15.0
				W35	19.3	29.2	36.5	17.5
1.1/4	9.52 X 31.75	82.5	26.3	W35	19.3	29.2	36.5	17.5
				W40	22.0	33.2	41.5	20.0
1.1/2	9.52 X 38.1	95.2	30.3	W40	22.0	33.2	41.5	20.0
				W45	24.8	36.8	46.5	22.5
1.3/4	9.52 X 44.45	107.9	34.4	W45	24.8	36.8	46.5	22.5
				W50	27.5	40.8	50.0	25.0
2	9.52 X 50.8	120.6	38.4	W50	27.5	40.8	50.0	25.0
				W60	34.1	48.0	60.0	31.0
2.1/4	9.52 X 57.15	133.3	42.5	W60	34.1	48.0	60.0	31.0
				W70	39.6	56.0	70.0	36.0
2.1/2	9.52 X 63.5	146.0	46.5	W60	34.1	48.0	60.0	31.0
				W70	39.6	56.0	70.0	36.0
2.3/4	9.52 X 69.85	158.7	50.6	W70	39.6	56.0	70.0	36.0
				W80	45.1	64.0	80.0	41.0
3	9.52 X 76.2	171.4	54.6	W70	39.6	56.0	70.0	36.0
				W80	45.1	64.0	80.0	41.0
3.1/4	9.52 X 82.55	184.1	58.6	W80	45.1	64.0	80.0	41.0
				W90	50.6	72.0	90.0	46.0
3.1/2	9.52 X 88.9	196.8	62.7	W80	45.1	64.0	80.0	41.0
				W90	50.6	72.0	90.0	46.0
3.3/4	9.52 X 95.52	209.5	66.7	W90	50.6	72.0	90.0	46.0
				W100	56.1	80.0	100.0	51.0
4	9.52 X 101.6	222.2	70.8	W100	56.1	80.0	100.0	51.0
				W120	67.1	96.0	120.0	60.0
4.1/2	9.52 X 114.3	247.6	78.9	W100	56.1	80.0	100.0	51.0
				W120	67.1	96.0	120.0	60.0
5	9.52 X 127	273.0	87.0	W120	67.1	96.0	120.0	60.0
5.1/2	9.52 X 139.7	298.4	95.0	W150	83.6	120.0	150.0	75.0
6	9.52 X 152.4	323.8	103.1	W150	83.6	120.0	150.0	75.0

Suitable for straight busbars, without curves

Suitable for busbars with curves

Heat shrink for busbars with thickness of 1/2 inch (12.7 mm)

Busbar dimensions		Perimeter	Equivalent diameter	Tube options (codes)	Equivalent Φ range (mm)		Diameter (D) mm	
Inch	(mm)	Sum of sides (mm)	Perimeter ÷ 3.14 (π)		Mini-mum	Maxi-mum	Normal	Shrunk
1/4	12.7 X 6.35	38.1	12.1	W16	8.8	13.6	16.5	8.0
				W18	9.9	15.2	19.0	9.0
3/8	12.7 X 9.52	44.4	14.2	W18	9.9	15.2	19.0	9.0
				W20	11.0	17.6	21.0	10.0
1/2	12.7 X 12.7	50.8	16.2	W20	11.0	17.6	21.0	10.0
				W22	12.1	19.2	23.0	11.0
5/8	12.7 X 15.87	57.1	18.2	W22	12.1	19.2	23.0	11.0
				W25	13.8	20.8	26.0	12.5
3/4	12.7 X 19.05	63.5	20.2	W28	15.4	23.2	29.0	14.0
				W30	16.5	25.2	31.5	15.0
7/8	12.7 X 22.22	69.8	22.2	W30	16.5	25.2	31.5	15.0
				W35	19.3	29.2	36.5	17.5
1	12.7 X 25.4	76.2	24.3	W30	16.5	25.2	31.5	15.0
				W35	19.3	29.2	36.5	17.5
1.1/4	12.7 X 31.75	88.9	28.3	W35	19.3	29.2	36.5	17.5
				W40	22.0	33.2	41.5	20.0
1.1/2	12.7 X 38.1	101.6	32.4	W45	24.8	36.8	46.5	22.5
				W50	27.5	40.8	50.0	25.0
1.3/4	12.7 X 44.45	114.3	36.4	W50	27.5	40.8	50.0	25.0
				W60	34.1	48.0	60.0	31.0
2	12.7 X 50.8	127.0	40.4	W60	34.1	48.0	60.0	31.0
				W70	39.6	56.0	70.0	36.0
2.1/4	12.7 X 57.15	139.7	44.5	W60	34.1	48.0	60.0	31.0
				W70	39.6	56.0	70.0	36.0
2.1/2	12.7 X 63.5	152.4	48.5	W70	39.6	56.0	70.0	36.0
				W80	45.1	64.0	80.0	41.0
2.3/4	12.7 X 69.85	165.1	52.6	W70	39.6	56.0	70.0	36.0
				W80	45.1	64.0	80.0	41.0
3	12.7 X 76.2	177.8	56.6	W80	45.1	64.0	80.0	41.0
				W90	50.6	72.0	90.0	46.0
3.1/4	12.7 X 82.55	190.5	60.7	W80	45.1	64.0	80.0	41.0
				W90	50.6	72.0	90.0	46.0
3.1/2	12.7 X 88.9	203.2	64.7	W90	50.6	72.0	90.0	46.0
				W100	56.1	80.0	100.0	51.0
3.3/4	12.7 X 95.25	215.9	68.8	W100	56.1	80.0	100.0	51.0
				W120	67.1	96.0	120.0	60.0
4	12.7 X 101.6	228.6	72.8	W100	56.1	80.0	100.0	51.0
				W120	67.1	96.0	120.0	60.0
4.1/2	12.7 X 114.3	254.0	80.9	W120	67.1	96.0	120.0	60.0
5	12.7 X 127	279.4	89.0	W120	67.1	96.0	120.0	60.0
				W150	83.6	120.0	150.0	75.0
5.1/2	12.7 X 139.7	304.8	97.1	W150	83.6	120.0	150.0	75.0
6	12.7 X 152.4	330.2	105.2	W150	83.6	120.0	150.0	75.0
				W180	100.1	144.0	180.0	90.0

Suitable for straight busbars, without curves

Suitable for busbars with curves

Heat shrink for busbars with thickness of 5/8 inch (15.87mm)

Busbar dimensions		Perimeter	Equivalent diameter	Tube options (codes)	Equivalent Φ range (mm)		Diameter (D) mm	
Inch	(mm)	Sum of sides (mm)	Perimeter ÷ 3.14 (π)		Mini-mum	Maxi-mum	Normal	Shrunk
1/4	15.87 X 6.35	44.4	14.2	W18	9.9	15.2	19.0	9.0
				W20	11.0	17.6	21.0	10.0
3/8	15.87 X 9.52	50.8	16.2	W20	11.0	17.6	21.0	10.0
				W22	12.1	19.2	23.0	11.0
1/2	15.87 X 12.7	57.1	18.2	W22	12.1	19.2	23.0	11.0
				W25	13.8	20.8	26.0	12.5
5/8	15.87 X 15.87	63.5	20.2	W28	15.4	23.2	29.0	14.0
				W30	16.5	25.2	31.5	15.0
3/4	15.87 X 19.05	69.8	22.2	W30	16.5	25.2	31.5	15.0
				W35	19.3	29.2	36.5	17.5
7/8	15.87 X 22.22	76.2	24.3	W30	16.5	25.2	31.5	15.0
				W35	19.3	29.2	36.5	17.5
1	15.87 X 25.4	82.5	26.3	W35	19.3	29.2	36.5	17.5
				W40	22.0	33.2	41.5	20.0
1.1/4	15.87 X 31.75	95.2	30.3	W40	22.0	33.2	41.5	20.0
				W45	24.8	36.8	46.5	22.5
1.1/2	15.87 X 38.1	107.9	34.4	W45	24.8	36.8	46.5	22.5
				W50	27.5	40.8	50.0	25.0
1.3/4	15.87 X 44.45	120.6	38.4	W50	27.5	40.8	50.0	25.0
				W60	34.1	48.0	60.0	31.0
2	15.87 X 50.8	133.3	42.5	W60	34.1	48.0	60.0	31.0
				W70	39.6	56.0	70.0	36.0
2.1/4	15.87 X 57.15	146.0	46.5	W60	34.1	48.0	60.0	31.0
				W70	39.6	56.0	70.0	36.0
2.1/2	15.87 X 63.5	158.7	50.6	W70	39.6	56.0	70.0	36.0
				W80	45.1	64.0	80.0	41.0
2.3/4	15.87 X 69.85	171.4	54.6	W70	39.6	56.0	70.0	36.0
				W80	45.1	64.0	80.0	41.0
3	15.87 X 76.2	184.1	58.6	W80	45.1	64.0	80.0	41.0
				W90	50.6	72.0	90.0	46.0
3.1/4	15.87 X 82.55	196.8	62.7	W80	45.1	64.0	80.0	41.0
				W90	50.6	72.0	90.0	46.0
3.1/2	15.87 X 88.9	209.5	66.7	W90	50.6	72.0	90.0	46.0
				W100	56.1	80.0	100.0	51.0
3.3/4	15.87 X 95.25	222.2	70.8	W100	56.1	80.0	100.0	51.0
				W120	67.1	96.0	120.0	60.0
4	15.87 X 101.6	234.9	74.8	W100	56.1	80.0	100.0	51.0
				W120	67.1	96.0	120.0	60.0
4.1/2	15.87 X 114.3	260.3	82.9	W120	67.1	96.0	120.0	60.0
5	15.87 X 127	285.7	91.0	W120	67.1	96.0	120.0	60.0
				W150	83.6	120.0	150.0	75.0
5.1/2	15.87 X 139.7	311.1	99.1	W150	83.6	120.0	150.0	75.0
6	15.87 X 152.4	336.5	107.2	W150	83.6	120.0	150.0	75.0
				W180	100.1	144.0	180.0	90.0

Suitable for straight busbars, without curves

Suitable for busbars with curves

Connectors **and Terminals**

Connectors

Material: *PA 66 (Nylon 66)*
Use temperature: *-40°C to 85°C*
Flammability: *UL94 V2*

F2009

1-way connector for long male terminal 6.3

F2013

1-way connector for female terminal with lock 6.3

F2340

1-way connector for female terminal 4.8

F2011

1-way connector for short male terminal 6.3

F2014

1-way connector for female terminal without lock 6.3

F1970

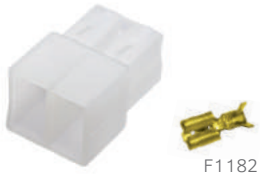
1-way connector for female terminal 2.8

F2100

1-way connector for flag terminal 4.8

F2090

1-way connector for flag terminal 6.3



F2614

2-way connector for female terminal 6.3

F1910

3-way connector for female terminal 2.8

F1930

3-way connector for male terminal 2.8

F2615

2-way connector for male terminal 6.3

F2616

2-way “T” connector for female terminal 6.3

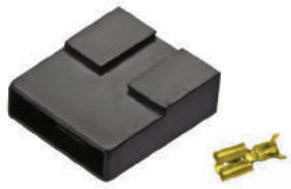
F2617

2-way “T” connector for male terminal 6.3


F1182

F3032

2-way connector with fastening for blade fuse holder


F1182

F3039

2-way connector for blade fuse holder


F1184

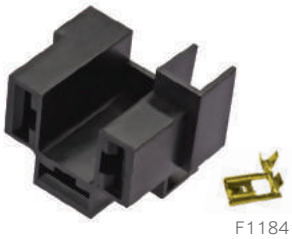
F3038

2-way connector for “MAX” blade fuse holder


F1182

F2631

Connector for alternator


F1184

F2015

3-way connector for vehicle headlight


F1182

F2618

3-way connector for female terminal 6.3


F1113

F2619

3-way connector for male terminal 6.3


F1182

F2621

4-way connector for female terminal 6.3


F1113

F2622

4-way connector for male terminal 6.3


F1182

F2642

5-way connector with fastening for relay


F1182

F2630

5-way connector for relay


F1113

F2625

6-way connector for male terminal 6.3

F2623

6-way connector for female terminal 6.3

F2626

8-way connector for female terminal 6.3

F2627

8-way connector for male terminal 6.3

Kit – Connector with terminals

F2702

2-way “T” connector kit (male and female) with 4 brass terminals

F2703

3-way connector kit (male and female) with 6 brass terminals

F2704

4-way connector kit (male and female) with 8 brass terminals

F2705

5-way connector kit with 5 terminals (for relay)

F2706

6-way connector kit (male and female) with 12 brass terminals

F2708

8-way connector kit (male and female) with 16 brass terminals

Fuse holder

FM3032

Fuse holder with tabs for fastening

Cable of 1.5 mm²

FM3039

Fuse holder

Cable of 1.5 mm²

FM3038

“MAX” fuse holder

Cable of 4.0 mm²

FD3032

Fuse holder kit

(1 connector with tabs and 2 female terminals 6.3)

FD3038

“MAX” fuse holder kit

(1 connector and 2 flag terminals 6.3)

Sockets

FM2015

Vehicle headlights in general (cable of 1.5 mm²)

FD2015

Vehicle headlight kit (1 connector and 3 flag terminals 7.2)

FM2018

Vehicle headlight lamp H7

Cable of 1.5 mm²

F3040

Universal for vehicle lamps 2 poles
- cable 1.0 mm²
- Nylon 66 socket
- working temperature from -40°C to 85°C

F3041

Universal for vehicle lamps 1 pole
- cable 1.0 mm²
- Nylon 66 socket
- working temperature from -40°C to 85°C

Terminals

Material: *brass*
The terminal images are in the real size.

F1112
Short male 6.3
Cable of 1.0 to 2.5 mm²

F1113
Long male 6.3 with lock (big sword)
Cable of 1.0 to 2.5 mm²

F1114
Male with lock 2.8 (small sword)
Cable of 0.5 to 1.0 mm²

F1115
Male without lock 2.8 (small sword)
Cable of 0.5 to 1.0 mm²

F1180
Female without lock 6.3
Cable of 1.0 to 2.5 mm²

F1181
Female with lock 9.7 (big)
Cable of 2.5 to 6.0 mm²

F1182
Female with lock 6.3
Cable of 1.0 to 2.5 mm²

F1182BG
Female with lock 6.3 (big barrel)
Cable of 4.0 to 6.0 mm²

F1185
Female with lock 4.8
Cable of 1.0 to 2.5 mm²

F1186
Female without lock 2.8 (little mosquito)
Cable of 0.5 to 1.0 mm²

F1186CT
Female with lock 2.8 (little mosquito)
Cable of 0.5 to 1.0 mm²

F1188
Hermaphrodite 6.3
Cable of 1.0 to 2.5 mm²

F1183
Flag without lock 6.3
Cable of 1.0 to 2.5 mm²

F1184
Flag with lock 7.2 (vehicle headlight)
Cable of 1.0 to 4.0 mm²

F1108
Flag without lock 4.8
Cable of 0.5 to 1.0 mm²

F1102
Eye 3 mm
Cable of 1.0 to 4.0 mm²
M3 screw

F1124
Eye 1/8” (thickness 0.52 mm)
Cable of 1.0 to 2.5 mm²
M3 screw

F1126
Eye 5/32” (thickness 0.52 mm)
Cable of 1.0 to 2.5 mm²
M4 screw

F1132
Eye 3/16” (thickness 0.38 mm)
Cable of 1.0 to 2.5 mm²
M5 screw

F1133
Eye 3/16” (thickness 0.50 mm)
Cable of 2.5 to 6.0 mm²
M5 screw

F1142
Eye 6 mm (thickness 0.50 mm)
Cable of 2.5 to 6.0 mm²
M6 screw

F1143
Eye 8 mm (thickness 0.50 mm)
Cable of 2.5 to 6.0 mm²
M8 screw

F1141
Eye ¼” (thickness 0.50 mm)
Cable of 2.5 to 6.0 mm²
M6 screw

F1144
Eye ¼”
Cable of 1.0 to 4.0 mm²
M6 screw

F1178
Eye 8.5 mm
Cable of 1.0 to 4.0 mm²
M8 screw

F1160
Eye 3/8” (thickness 0.6 mm)
Cable of 6.0 to 10.0 mm²
M8 or M10 screw

F1162
Eye 3/8” (thickness of 1.0 mm)
Cable of 6.0 to 10.0 mm²
M8 or M10 screw

F1135
Fork 3/16” (thickness 0.52 mm)
Cable of 1.0 to 2.5 mm²
M5 screw

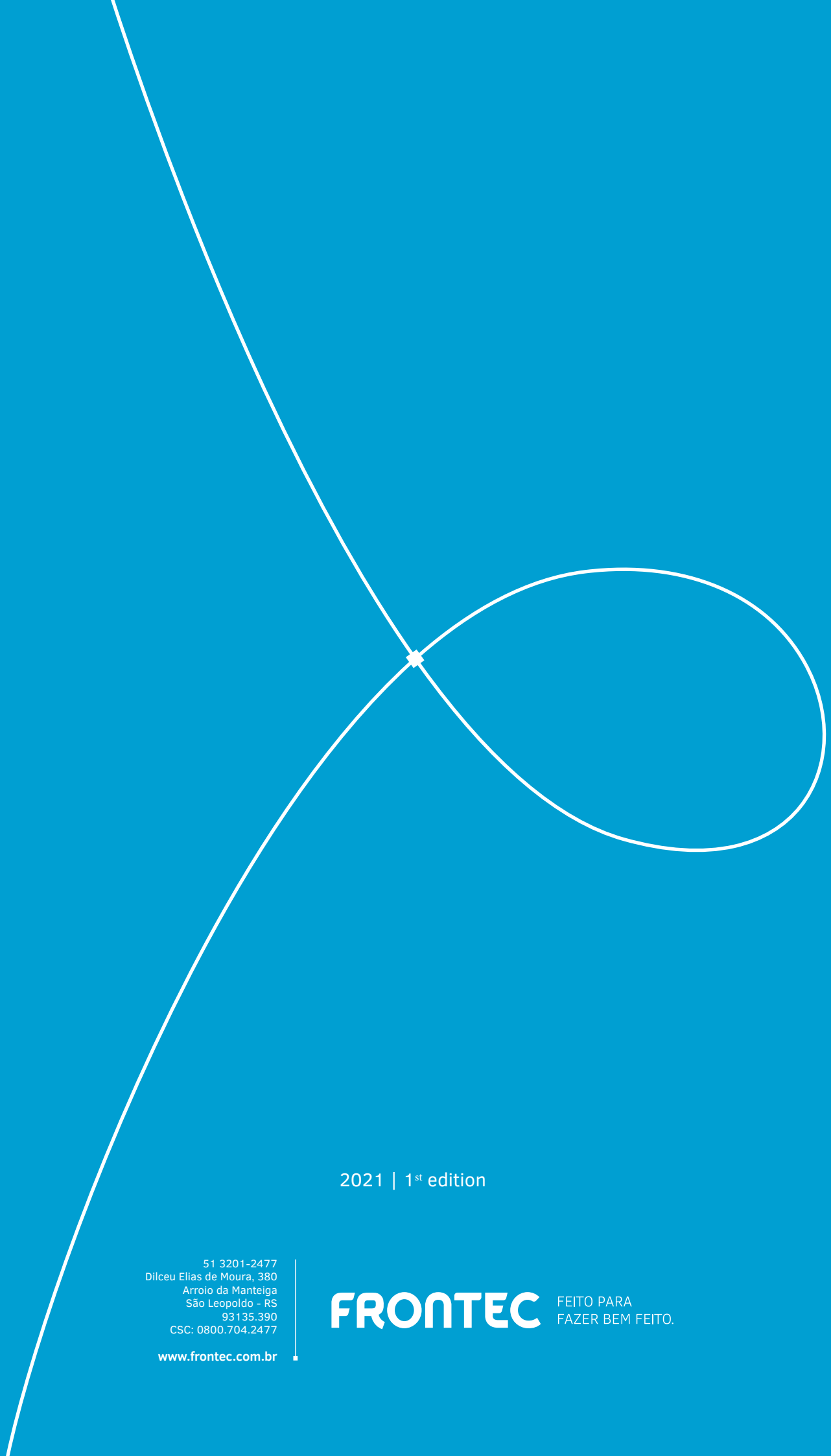
F1151
Fork ¼” (thickness 0.75 mm)
Cable of 2.5 to 6.0 mm²
M6 screw

Battery Clips

F2003
Galvanized steel for 150 A
Length of 17.5 cm

F2004
Galvanized steel for 100 A
Length of 15 cm

F2005
Galvanized steel with brass tip for 150 A
Length of 17.5 cm



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