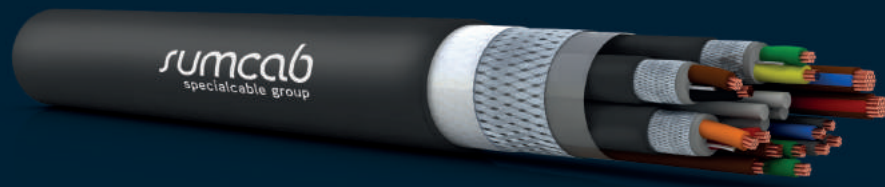


Cables for Industrial Robotics



Cables for Industrial Robotics

According to the definition by the Association of Robotics Industries, “An industrial robot is a programmable, multi-functional manipulator, capable of moving materials, pieces, tools or special devices, depending on variable trajectories, programmed in order to carry out various tasks.”

Specifically in the industrial area, robotics can be applied to: tasks of smelting, welding, application of materials, sealants and adhesives, power for machinery, processing, cutting, assembly, palletising and quality control, among many others. Its success in these tasks is principally due to a series of advantages that make it the perfect option in industry: Productivity, Speed, Safety.

These continuous “mobile” applications require special cables with an excellent mechanical resistance. In industrial robotics applications, the continuous movements rapidly deteriorate conventional cabling.

The problem is that the majority of the cables are not designed for this type of movement (bending, traction and torsion) and suffer quick wear. The repeated bending causes “cold hardening” in the copper conductors to the point that they “fracture”. The copper threads that form the conductor in the cold state are stretched beyond the permitted plastic limit. When a conductor bends (curves) around a radius that is too small, it forces it to stretch more. This action changes the internal structure of the conductor, hardening it until it becomes fragile and finally fractures.

Similarly, the friction created by the internal elements of a cable in motion can generate enough heat to cause the cable insulation, shielding and/or sheath to fail. By internal elements we are referring to the different layers and parts in a cable, such as conductors, insulation, shields, protection tapes, outer sheath, etc.

Sumflex Mechatronic

Guaranteed reliability and quality

Process automation machines are designed to operate at higher speeds than previous generations and are equipped with increasingly complex vision and control systems as well as a wide variety of sensors. This new operating environment requires more resistant and reliable cables.

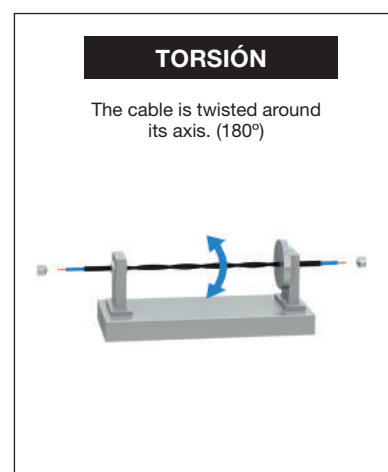
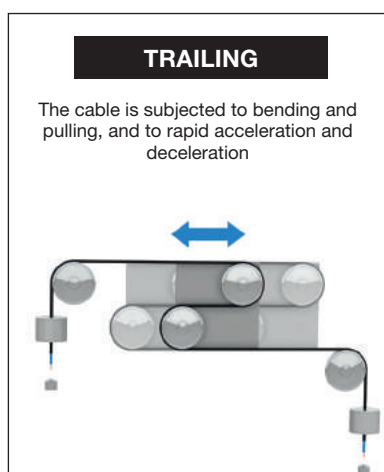
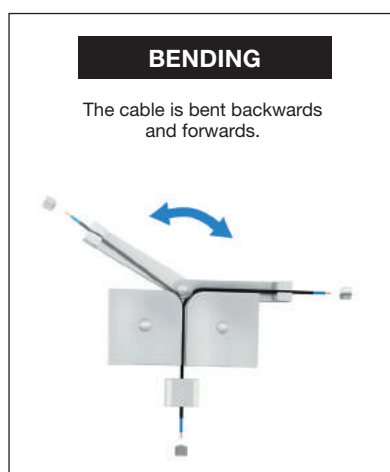
At Sumcab Tailor Made Cables we have created the Sumflex Mechatronic cable, compliant with the most stringent requirements for mechanical resistance, chemical aggression and thermal range. Designed to withstand millions of bending,

torsion and traction cycles, always with very small bending radii (up to $5 \times d$). As well as being very resistant to a wide variety of additional environmental effects, such as variable temperatures, oils/greases and chemical products.

With the purpose of ensuring the reliability of our products, we avail of a technical laboratory with our own 3D trial system. This testing system allows us to test the cables with rapid accelerations and decelerations, as well as efforts of continuous traction, compression, bending and torsion.

Testing example for Sumflex Mechatronic cables

During and after testing (up to 10 million cycles) the cable is monitored for damage or failure in any of its components.



Sumflex Mechatronic
The most advanced solution for industrial automation

Using the right cable impacts directly on automation equipment reliability. Understanding the causes of cable failure in applications of this nature enables us to take the appropriate measures during the design phase to increase the reliability of our clients' entire production systems.

Sumflex® Mechatronic

Application: Power, control, signal or welding cables for articulated robot of 6 axes, specially designed for the movements of torsion, bending and traction. UL & CSA certified. Halogen free and flame retardant cables.



General design

Conductor	Extra-fine threads of bare or tinned copper
Insulation	TPE-E, Sumtrel, PP
Identification	Customized
Cabling	Depending on the needs, in concentric layers with optimum feed-through cabling
Shields	Thin threads of tinned copper, applied in a spiral shape, min. coverage of 95%
Exterior sheath	PUR, black colour (other colours upon request)

General features

UL & CSA	Certification for USA and Canada
UL FT2	Flame retardant
HD 22.10	Resistance to oils and industrial greases
EN 60754-1	Halogen free
Other features	Good resistance to acids, alkaline solutions, solvents, hydraulic liquids, etc.
	Resistant to abrasion and cuts
	Resistant to welding splatter
	Outer sheath with low-adherence surface
	Excellent resistance to moisture
	Totally silicone-free

General technical details

Service voltage	300 y 600V
Test voltage	2000 y 4000V
Minimum bend radius	5 x outer diameter
Service temperature	-5°C to +80°C
Bending	+/-180°
Number of cycles:	Min. 1 mio. / Max. 10 mio. Depending on the exact application. For more information, contact your Sumcab technical sales manager.

Application markets

Tool Machine
Automation
Packaging
Food & Beverage
Chemical Industry
Pharmaceutical Industry
Glass and Ceramics Industry
Electronics Industry
Aeronautical Industry
Transport & Logistics

Apart from the configurations detailed below, we design and manufacture upon request from 100 metres of minimum quantity

Nº. of conductors x mm ²	Outer diameter in mm
(25 x 0,25)	11,6
(5 x 0,34)	6,2
(9 x 0,50)	9,3
(12 x 0,50)	10,8
(18 x 0,50)	13,0
(5 x 0,75)	8,1
(12 x 0,25)	8,1
(2 x 0,50)	6,9
5 G 0,50	7,0
7 x 0,50	8,0
9 x 0,50	8,8
12 x 0,50	10,3
18 x 0,50	12,3
3 G 1	7,2
4 G 1	7,9
5 G 1	8,5
7 G 1	10,0
12 G 1	12,9
18 G 1	15,5
19 G 1	16,3
30 G 1	20,0

Nº. of conductors x mm ²	Outer diameter in mm
13x0,50+3G1+(2x0,50)	12,2
(2x1)+(3x1)+1G1	10
(4x2x0,18mm ²)	7
(4x2x0,25mm ² + 2x1mm ²)	8,6
(4x2x0,38mm ² + 4x0,50mm ²)	8,9
1x10mm ²	6,1
1x25mm ²	10,7
1x35mm ²	12,8
2x(2x0,75)mm ²	9
2x(2x0,75)mm ² + (3x0,75mm ²)	10,3
2x(2x1)+1G1+(2x0,34)+2x(2x0,34)+2x(2x0,25)	14,5
5 G 1,5mm ²	9,9
5x(2x0,25mm ²)+2x(2x1mm ²)+1G1mm ²	12,9
6x0,75mm ² + (3x0,75mm ²)	10,3
7x1mm ² + (2x0,50mm ²)	9,2
17 G 1mm ² + (2x1mm ²)	14,3
20x0,50+(3x1)+(3x0,50)+1G0,75	14,6
23 G 1mm ² + (2x1mm ²)	13,2

Sumcab reserves the right to modify these specifications with no prior notice.

Sumflex® Mechatronic HFS

Application: High frequency welding cable (up to 10 kHz) for articulated robot of 6 axes, specially designed for the movements of torsion, bending and traction. UL & CSA certified. Halogen free and flame retardant cables.



General design

Filling	Central filling
Conductor	Extra-fine threads of bare copper with PTFE tape over each group of threads
Insulation	TPE-E
Protection	PTFE tape
Exterior sheath	PUR, black colour (other colours upon request)

General technical details

Service voltage	1000V
Test voltage	4000V
Minimum bend radius	7.5 x outer diameter
Service temperature	-5°C to +80°C
Bending	+/-380°
Number of cycles:	Min. 1 mio. / Max. 10 mio. Depending on the exact application. For more information, contact your Sumcab technical sales manager.

General features

UL & CSA	Certification for USA and Canada
UL FT2	Flame retardant
HD 22.10	Resistance to oils and industrial greases
EN 60754-1	Halogen free
Other features	Good resistance to acids, alkaline solutions, solvents, hydraulic liquids, etc.
	Resistant to abrasion and cuts
	Resistant to welding splatter
	Outer sheath with low-adherence surface
	Excellent resistance to moisture
	Totally silicone-free

Application markets

Automation

N°. of conductors x mm ²	Outer diameter in mm
1 x 16	12

Sumcab reserves the right to modify these specifications with no prior notice.

Sumflex Mechatronic HFS for high frequency welding

High frequency welding serves to join two pieces (A+B) by supplying high frequency (HF) energy in the form of an electromagnetic field and pressure through compression (P).

The energy is generated by a generator, the power is supplied by an electrode.

The electric energy generates movement of the molecules of the material and thus generates heat.

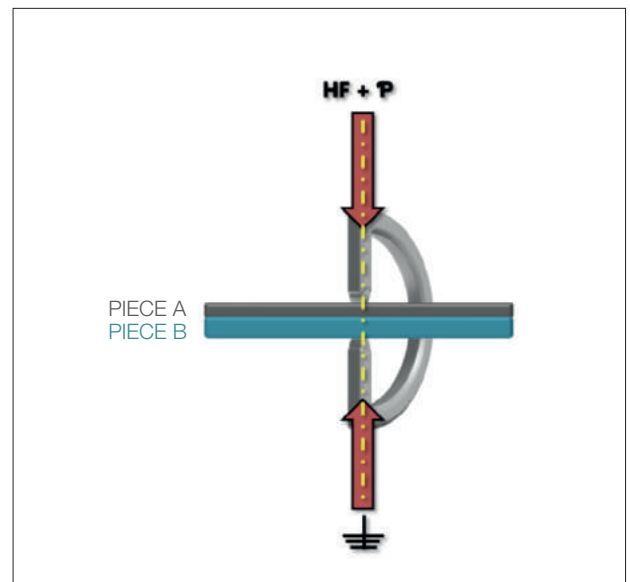
This process, along with the constant compression pressures, melts both pieces.

Unlike conventional welding, the heat is created inside the pieces themselves and does not come from an external source. When the material cools down, a higher quality welding point has been created. This results in a highly resistant and effective welding.

The four principal factors that determine the results of this type of welding are:

- Compression pressure
- Welding strength
- Welding time
- Cooling time

The primary benefit of this method is the fact that it is a constant process. In other words, it can be applied to larger surfaces without having to interrupt and/or remove the welding clamp, which increases productivity significantly. The process is usually clean and very accurate as just the joining area/point will be heated.



Most common materials:

PVC (polyvinyl chloride)
PA (Polyamide)
PUR (polyurethane)
Other dipole materials

Fields of application (examples):

Marine Industry	
Military Industry	
Railway Industry	
Automotive Industry	

(in industrial robots - see image)

Sumflex® Mechatronic HFS

Due to the Skin-Effect* that is generated at frequencies of 10 KHz, it is necessary to use a special customized cable. Sumcab Tailor Made Cables has developed the Sumflex Mechatronic HFS for high frequency applications. This cable has been created to transmit energy efficiently. Its design serves to optimise the current density distribution of the conductor.

The cable is formed by various groups of braided conductors of bare, extra-flexible copper. Each group is insulated by a special tape.

Moreover, our cable Sumflex Mechatronic HFS complies with the most demanding requirements regarding mechanical resistance, chemical aggression and thermal range. Designed to withstand millions of bending, torsion and traction cycles, always with very small bending radii (up to 5 x d).

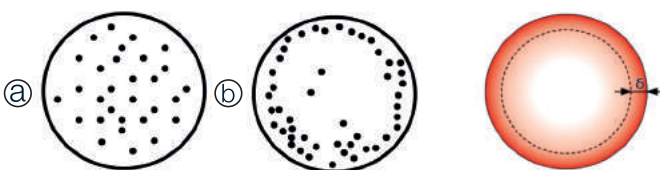
As well as being very resistant to a wide variety of additional environmental effects, such as variable temperatures, oils/greases and chemical products.

*Skin-Effect

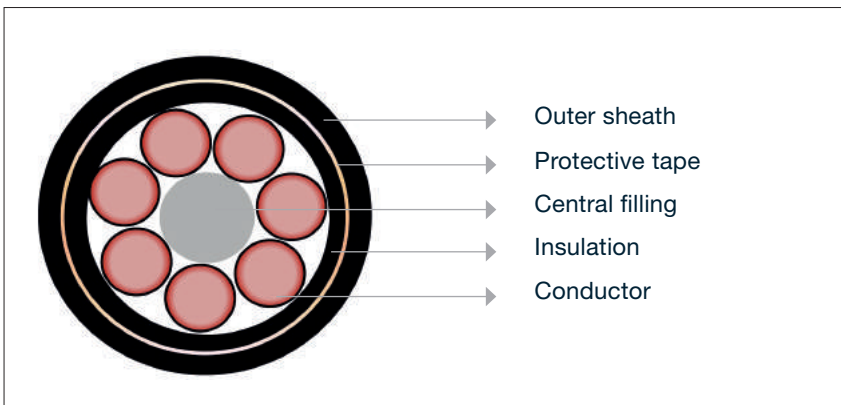
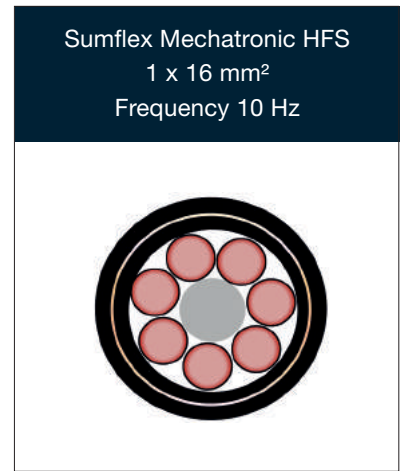
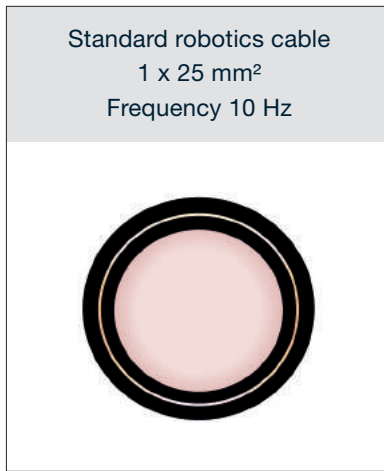
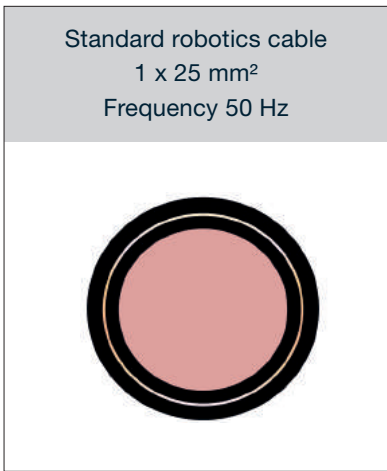
In direct current, the current density is similar along the entire conductor (figure a), but in alternate current it can be observed that the current density is higher on the surface than on the centre (figure b). This phenomenon is known as skin effect, or Kelvin effect.

This phenomenon causes the effective or alternate current resistance to be higher than the ohmic or high current resistance.

This effect causes the variation of the electric resistance in alternate current of a conductor due to the variable frequency of the electric current that travels across it.



Transverse section of the current flow distribution in a cylindrical conductor. For alternate current, most of the electrical current (63%) flows between the outer surface and skin depth, δ , depending on the frequency of the current and the electric and magnetic properties of the conductor.



ADVANTAGES
Efficient distribution of current flow
Reduced section = cost reduction
Smaller minimum bend radius
Reduced weight
More flexible

TAILOR MADE CABLES