






# 0.5 mm<sup>2</sup> (20AWG) Flexing Control Cable CF6 Series Shielded

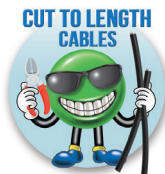
0.5 mm <sup>2</sup> (20AWG) Multi-Conductor Flexing Control Cable Specifications (Shielded)			
<b>Conductors Gauge &amp; Stranding</b>	0.5 mm <sup>2</sup> (20AWG) 16/32 bare copper	<b>Conductor Markings</b>	"#1-ONE", "2-TWO", "3-THREE", etc... @ 4.5 inch intervals, ICEA Method 4
<b>Voltage Ratings</b>	600V per UL	<b>Inner Jacket</b>	Tan PVC
	Tested to 2000V	<b>Outer Jacket</b>	Dark Green PVC
<b>Min. Bend Radius</b>	e-Chain®, 6.8 x diameter	<b>UV Resistance</b>	Yes
	Flexible*, 5.0 x diameter	<b>Oil Resistance</b>	Yes
	Fixed, 4.0 x diameter	<b>Flame Retardant</b>	According to IEC 60332-1-2, CEI 20-35, VW-1, FT-1
<b>Temperature Ratings</b>	e-Chain, +41°F to +158°F (5°C to +70°C)	<b>Silicone-free</b>	Yes
	Flexible*, +23°F to +158°F (-5°C to +70°C)		
	Fixed, +5°F to +158°F (-15°C to +70°C)		
<b>Max. Velocity</b>	Unsupported, 33 ft/s (10 m/s)	<b>Approvals</b>	UL/CSA Style 10492 and 2570, 600V, 80°C NFPA 79; Following NFPA 79-2012 chapter 12.9 EAC; Certified to no. TC RU C-DE. ME77.B.01254 CTP; Certified to no. C-DE. PB49.B.00416 Lead Free; Following 2011/65/EU (RoHS-II) CEI; Following CEI 20-35 Clean Room; According to ISO Class 2, material/cable tested by IPA According to ISO standard 14644-1 CE; Following 2014/35/EU igus chainflex CF6.xx.xx (xxGxx)C 300/500V E310776 C cRUus AWM Style 2570 VW-1 AWM I/II A/B 80+C 600V FT1 EAC / CTP CE xx/x RoHS-II conform www.igus.de
	Gliding, 16 ft/s (5 m/s)		
<b>Max. Acceleration</b>	262.5 ft/s <sup>2</sup> (80 m/s <sup>2</sup> )		
<b>Length of Travel</b>	Unsupported travel distances and for gliding applications up to 328ft (100m)	<b>Sample Print Legend</b>	
<b>Conductor Insulation</b>	Black TPE with green/yellow ground		

\* Per EN 60811-504 standard

e-Chain® is a trademarked flexible cable carrier by igus®. igus® cable can be used in any suitable cable carrier.

0.5 mm <sup>2</sup> (20AWG) Multi-Conductor Flexing Control Cable (Shielded)							
Part Number	Number of Conductors (includes ground)	AWG	Strand	Maximum O.D. (Inches ±10%)	Minimum Cut Length (ft)*	Approximate Weight (lb/ft)	Price per foot
							
<b>CF6-05-05-1</b>	5	0.5 mm <sup>2</sup> (20AWG)	16	0.33	20	0.07	\$3.15
							
<b>CF6-05-07-1</b>	7	0.5 mm <sup>2</sup> (20AWG)	16	0.39	20	0.09	\$3.86
							
<b>CF6-05-12-1</b>	12	0.5 mm <sup>2</sup> (20AWG)	16	0.51	20	0.16	\$6.41

\* See web store for maximum cut lengths



Please Note: Our prices on Flexing Control Cable are closely tied to the market price for copper. This allows us to offer the best savings possible if conditions are favorable; however, it also means that our prices may increase if market conditions warrant.

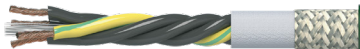




# 0.75 mm<sup>2</sup> (18AWG) Flexing Control Cable CF6 Series Shielded

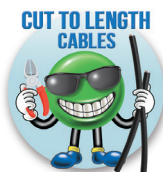
0.75mm <sup>2</sup> (18AWG) Multi-Conductor Flexing Control Cable Specifications (Shielded)			
Conductors Gauge & Stranding	0.75 mm <sup>2</sup> (18AWG) 24/32 bare copper	Conductor Markings	"#1-ONE", "2-TWO", "3-THREE", etc... @ 4.5 inch intervals, ICEA Method 4
Voltage Ratings	600V per UL	Inner Jacket	Tan PVC
	Tested to 2000V	Outer Jacket	Dark Green PVC
Min. Bend Radius	e-Chain®, 6.8 x diameter	UV Resistance	Yes
	Flexible*, 5.0 x diameter	Oil Resistance	Yes
	Fixed, 4.0 x diameter	Flame Retardant	According to IEC 60332-1-2, CEI 20-35, VW-1, FT-1
Temperature Ratings	e-Chain, +41°F to +158°F (5°C to +70°C)	Silicone-free	Yes
	Flexible*, +23°F to +158°F (-5°C to +70°C)	Approvals	UL/CSA Style 11113 and 2570, 600V, 80°C NFPA 79; Following NFPA 79-2012 chapter 12.9 EAC; Certified to no. TC RU C-DE. ME77.B.01254 CTP; Certified to no. C-DE. PB49.B.00416 Lead Free; Following 2011/65/EU (RoHS-II) CEI; Following CEI 20-35 Clean Room; According to ISO Class 2, material/cable tested by IPA According to ISO standard 14644-1 CE; Following 2014/35/EU igus chainflex CF6.xx.xx (xxGxx)C 300/500V E310776 C cRUus AWM Style 2570 VW-1 AWM I/II A/B 80+C 600V FT1 EAC / CTP CE xx/x RoHS-II conform www.igus.de
	Fixed, +5°F to +158°F (-15°C to +70°C)		
Max. Velocity	Unsupported, 33 ft/s (10 m/s)		
Max. Acceleration	Gliding, 16 ft/s (5 m/s)		
	262.5 ft/s <sup>2</sup> (80 m/s <sup>2</sup> )		
Length of Travel	Unsupported travel distances and for gliding applications up to 328ft (100m)		
Conductor Insulation	Black PVC with green/yellow ground		

\* Per EN 60811-504 standard

e-Chain® is a trademarked flexible cable carrier by igus®. igus® cable can be used in any suitable cable carrier.

0.75mm <sup>2</sup> (18AWG) Multi-Conductor Flexing Control Cable (Shielded)							
Part Number	Number of Conductors (includes ground)	AWG	Strand	Maximum O.D. (Inches ±10%)	Minimum Cut Length (ft)*	Approximate Weight (lb/ft)	Price per foot
							
<b>CF6-07-04-1</b>	4	0.75 mm <sup>2</sup> (18AWG)	24	0.33	20	0.08	\$3.29
							
<b>CF6-07-07-1</b>	7	0.75 mm <sup>2</sup> (18AWG)	24	0.41	20	0.11	\$4.51
							
<b>CF6-07-12-1</b>	12	0.75 mm <sup>2</sup> (18AWG)	24	0.55	20	0.19	\$6.98

\* See web store for maximum cut lengths



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# 1.5 mm<sup>2</sup> (16AWG) Flexing Control Cable CF6 Series Shielded

1.5 mm <sup>2</sup> (16AWG) Multi-Conductor Flexing Control Cable Specifications (Shielded)			
<b>Conductors Gauge &amp; Stranding</b>	1.5 mm <sup>2</sup> (16AWG) 30/30 bare copper	<b>Conductor Markings</b>	"#1-ONE", "2-TWO", "3-THREE", etc... @ 4.5 inch intervals, ICEA Method 4
<b>Voltage Ratings</b>	600V per UL	<b>Inner Jacket</b>	Tan PVC
	Tested to 2000V	<b>Outer Jacket</b>	Dark Green PVC
<b>Min. Bend Radius</b>	e-Chain <sup>®</sup> *, 6.8 x diameter	<b>UV Resistance</b>	Yes
	Flexible*, 5.0 x diameter	<b>Oil Resistance</b>	Yes
	Fixed, 4.0 x diameter	<b>Flame Retardant</b>	According to IEC 60332-1-2, CEI 20-35, VW-1, FT-1
<b>Temperature Ratings</b>	e-Chain, +41°F to +158°F (5°C to +70°C)	<b>Silicone-free</b>	Yes
	Flexible*, +23°F to +158°F (-5°C to +70°C)	<b>Approvals</b>	UL/CSA Style 11113 and 2570, 600V, 80°C NFPA 79; Following NFPA 79-2012 chapter 12.9 EAC; Certified to no. TC RU C-DE. ME77.B.01254 CTP; Certified to no. C-DE. PB49.B.00416 Lead Free; Following 2011/65/EU (RoHS-II) CEI; Following CEI 20-35 Clean Room; According to ISO Class 2, material/cable tested by IPA According to ISO standard 14644-1 CE; Following 2014/35/EU
	Fixed, +5°F to +158°F (-15°C to +70°C)		
<b>Max. Velocity</b>	Unsupported, 33 ft/s (10 m/s) Gliding, 16 ft/s (5 m/s)		
<b>Max. Acceleration</b>	262.5 ft/s <sup>2</sup> (80 m/s <sup>2</sup> )	<b>Sample Print Legend</b>	igus chainflex CF6.xx.xx (xxGxx)C 300/500V E310776 C cRUus AWM Style 2570 VW-1 AWM I/II A/B 80+C 600V FT1 EAC / CTP CE xx/x RoHS-II conform www.igus.de
<b>Length of Travel</b>	Unsupported travel distances and for gliding applications up to 328ft (100m)		
<b>Conductor Insulation</b>	Black PVC with green/yellow ground		

\* Per EN 60811-504 standard

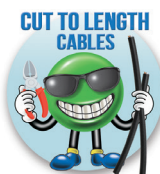
\*\* For 7 conductor cable with travel distance ≥ 5m (16.4ft) requires bending radius ≥ 17 x diameter

e-Chain<sup>®</sup> is a trademarked flexible cable carrier by igus<sup>®</sup>. igus<sup>®</sup> cable can be used in any suitable cable carrier.

1.5 mm <sup>2</sup> (16AWG) Multi-Conductor Flexing Control Cable (Shielded)							
Part Number	Number of Conductors (includes ground)	AWG	Strand	Maximum O.D. (Inches ±10%)	Minimum Cut Length (ft)**	Approximate Weight (lb/ft)	Price per foot
							
<b>CF6-15-04-1</b>	4	1.5 mm <sup>2</sup> (16AWG)	30	0.37	20	0.11	\$4.61
							
<b>CF6-15-07-1</b>	7*	1.5 mm <sup>2</sup> (16AWG)	30	0.51	20	0.18	\$6.40
							
<b>CF6-15-12-1</b>	12	1.5 mm <sup>2</sup> (16AWG)	30	0.67	20	0.26	\$9.90

\* For 7 conductor cable with travel distance ≥ 5m (16.4ft) requires bending radius ≥ 17 x diameter

\*\* See web store for maximum cut lengths



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# 2.5 mm<sup>2</sup> (14AWG) Flexing Control Cable CF6 Series Shielded

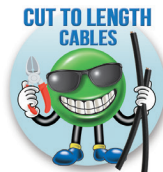
2.5 mm <sup>2</sup> (14AWG) Multi-Conductor Flexing Control Cable Specifications (Shielded)				
Conductors Gauge & Stranding	2.5 mm <sup>2</sup> (14AWG) 50/30 bare copper	Conductor Markings	"#1-ONE", "2-TWO", "3-THREE", etc... @ 4.5 inch intervals, ICEA Method 4	
Voltage Ratings	600V per UL	Inner Jacket	Tan PVC	
	Tested to 2000V	Outer Jacket	Dark Green PVC	
Min. Bend Radius	e-Chain®, 6.8 x diameter	UV Resistance	Yes	
	Flexible*, 5.0 x diameter	Oil Resistance	Yes	
	Fixed, 4.0 x diameter	Flame Retardant	According to IEC 60332-1-2, CEI 20-35, VW-1, FT-1	
Temperature Ratings	e-Chain, +41°F to +158°F (5°C to +70°C)	Silicone-free	Yes	
	Flexible*, +23°F to +158°F (-5°C to +70°C)	Approvals	UL/CSA Style 11113 and 2570, 600V, 80°C NFPA 79; Following NFPA 79-2012 chapter 12.9 EAC; Certified to no. TC RU C-DE. ME77.B.01254 CTP; Certified to no. C-DE. PB49.B.00416 Lead Free; Following 2011/65/EU (RoHS-II) CEI; Following CEI 20-35 Clean Room; According to ISO Class 2, material/cable tested by IPA According to ISO standard 14644-1 CE; Following 2014/35/EU	
	Fixed, +5°F to +158°F (-15°C to +70°C)			
Max. Velocity	Unsupported, 33 ft/s (10 m/s)			
Max. Acceleration	Gliding, 16 ft/s (5 m/s)	Sample Print Legend		igus chainflex CF6.xx.xx (xxGxx)C 300/500V E310776 C cRUus AWM Style 2570 VW-1 AWM I/II A/B 80+C 600V FT1 EAC / CTP CE xx/x RoHS-II conform www.igus.de
	262.5 ft/s <sup>2</sup> (80 m/s <sup>2</sup> )			
Length of Travel	Unsupported travel distances and for gliding applications up to 328ft (100m)			
Conductor Insulation	Black PVC with green/yellow ground			

\* Per EN 60811-504 standard

e-Chain® is a trademarked flexible cable carrier by igus®. igus® cable can be used in any suitable cable carrier.

2.5 mm <sup>2</sup> (14AWG) Multi-Conductor Flexing Control Cable (Shielded)							
Part Number	Number of Conductors (includes ground)	AWG	Strand	Maximum O.D. (Inches ±10%)	Minimum Cut Length (ft) *	Approximate Weight (lb/ft)	Price per foot
 igus chainflex CF6.25.04							
<b>CF6-25-04-1</b>	4	2.5 mm <sup>2</sup> (14AWG)	50	0.45	20	0.16	\$5.47

\* See web store for maximum cut lengths



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## Flexible Cable or Flexing Cable?

While it may seem there should be no difference between a cable described as flexible and one described as flexing, there are actually big differences in the design, manufacture, and application of flexible cable and flexing cable.

A flexible cable allows for easier installation in a control panel or machine as it can be easily bent and routed as needed. However, once routed and installed a flexible cable will generally be static during its service life.

A flexing (or more descriptively continuous flexing) cable during its service life will be exposed to continuous motion in the form of rolling, bending, torsional, or variable flexing operations. To provide a long service life under these rigorous applications especially when exposed to harsh industrial environmental conditions, special design and manufacturing characteristics are required to produce a continuous flexing rated cable.

Additionally, factors such as temperature, velocity, acceleration, travel distance, minimum bend radius, torsion, and minimum number of cycles must be considered when selecting a continuous flexing rated cable for a specific application.

## Cable Failures

Misapplied flexible cables or poorly designed/manufactured flexing cables will quickly fail when exposed to the rigors of continuous flexing applications in harsh industrial environments.

### **Loss of continuity**

The copper conductors can break or become severed causing a loss of continuity when insulated conductors are twisted with incorrect pitch length/direction. The cable core cannot absorb the mechanical load caused by the cable's flexing, transferring the force to the copper conductors and causing them to break under the increased tensile load.

### **Insulation damage**

Insulation damage occurs when the insulation integrity of a cable's conductors are compromised. This is caused by material fatigue under constant bending stress, abrasion within the cable structure and/or conductor strand breakage, which in turn perforates the insulation.

### **Corkscrewing**

This failure type is named for its easily recognizable mechanical deformation of the entire cable. The corkscrew, sometimes called pigtail, effect is caused when the torsional forces incurred during the cabling process are allowed to release during continuous-flexing operation. These forces are released because the cable configuration, pitch length and pitch direction are incorrect. Cables constructed using the layering process are typically more susceptible to corkscrewing.

### **Jacket abrasion**

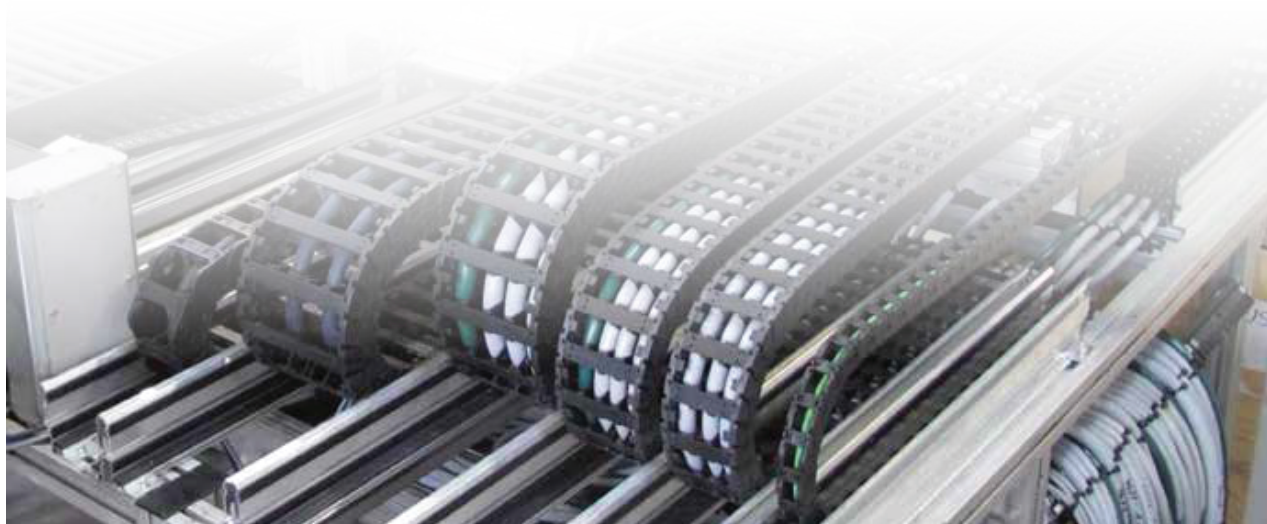
When the outer jacket of a cable wears through to the underlying layers of shielding or conductors, jacket abrasion occurs. This mechanical failure is common when soft jacket materials or a thin jacket extrusion is used.

### **Jacket swelling/cracking**

A cable's outer jacket usually swells because of exposure to oil or chemicals the cable was not designed to withstand. Jacket cracking occurs when the jacket breaks so that the shield can be seen, and is an effect of excessively high/low temperatures.

### **Shielding losses/EMC problems**

Increased electromagnetic interfaces (EMI) occurs when the shield designed to protect the cable signals from electromagnetic fields break and abrade due to continuous flexing. To avoid this, the tensile load of the shield wires along the outer radius of the cable must be considered in the cable design and manufacturing. If an unfavorable braiding angle is added, the tensile load can increase even further causing shield wire breakage. This breakage can result in reduced shielding properties or short circuits if the sharp broken wires penetrate into the conductors.





# Flexing Cable



## igus® Cable Design and Testing

Based on more than 25 years of experience and testing, various design principles for igus Chainflex® cables have been developed to prevent premature cable failures in demanding continuous flexing applications.

### Strain-relieving center element

The center core is filled with a high-quality, high tensile strength center element to protect conductors from falling into the center of the cable.

### Conductor structure

The copper stranding in Chainflex® continuous-flex cables is chosen in accordance with tested and proven designs. The test results from the igus® lab indicate that a medium to fine conductor strand diameter is preferable. Many competitive cable manufacturers will employ an extra-fine conductor strand, which has the tendency to kink when subjected to a high number of cycles. Using findings from long-term cable testing, igus® uses a combination of conductor strand diameter, pitch-length, and pitch direction to achieve the best service life and performance, even in the most demanding applications.

### Conductor insulation

Igus uses only the highest quality high-pressure extruded PVC or TPE conductor insulation materials to support the stranded individual wires of the conductor and help prevent the conductors from adhering to one another within the cable.

### Cable core

Individual conductors are bundled into groups, which are cabled together in a single layer surrounding the cable core. This design enables pulling and compressing forces of the bending motion to balance and cancel out torsional forces. Special attention is given to pitch length and direction. The cable's inner jacket will also help to maintain the integrity of the cable core and provide a continuous surface for the overall shield.

### Inner jacket

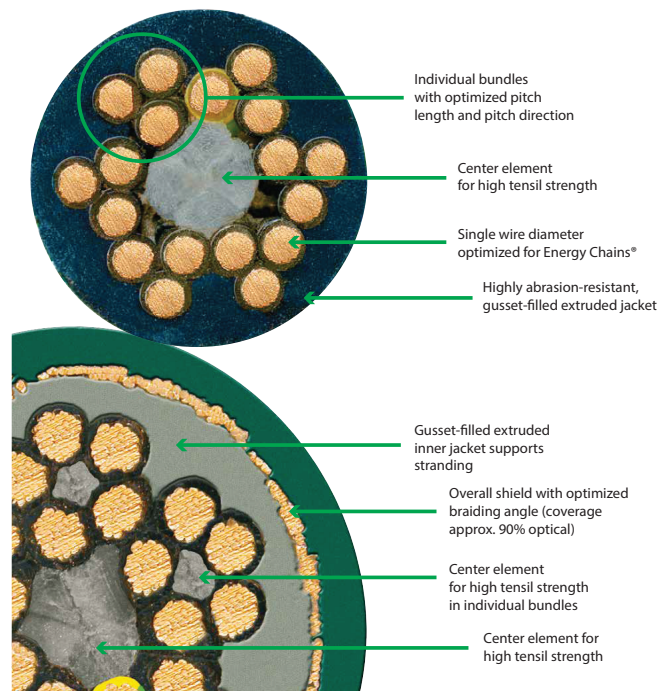
A pressure extruded inner jacket is used in igus continuous flexing cables, as opposed to inexpensive fleece wrap or filler. This extruded inner jacket both ensures that the insulated conductors are efficiently guided, as well as maintaining the integrity of the cable core and providing a continuous surface for the overall shield.

### Shield design

A high-quality braided shield provides electromagnetic interference (EMI) protection for the cable. An optimized braid angle prevents the shield strands from breaking over the linear axis and increases torsional stability. The shield has an optical coverage of approximately 90%, providing maximum shield effectiveness.

### Outer jacket

Igus outer jacket material is resistant to UV radiation, abrasion, oils, and chemicals, as well as being cost-effective. Additionally the outer jacket is resistant to abrasion, and remains flexible while providing support of the cable for dynamic applications. For best wear rates and service life, igus outer jackets are extruded under pressure compared to other cables which are extruded as a "tube" that does not support the conductors during constant bending.







## Cycles Selection Tables - Guaranteed Service Life

For each Chainflex cable system, you will find a lifetime calculation table, expressed in cycles, using technical parameters for the specific cable series. For the Chainflex Guarantee to remain valid, the cables must be used in accordance with these parameters.

- |   |   |
|---|---|
| 1 Temperature, from/to °F                   | 4 Travel in ft.   |
| 2 Velocity, v max. unsupported/gliding ft/s | 5 Min. bend radius [factor x diameter] at 5, 7.5 or 10 million cycles |
| 3 Acceleration, a max. ft/s                 |   |

Example: Selection table "Guaranteed Lifetime"

Cycles			3	4	5 million	7.5 million	10 million
Temperature, from/to [°F]	v max. [ft/s]		a. max [ft/s²]	Travel distance [ft]	R min. [factor x d]	R min. [factor x d]	R min. [factor x d]
-31 / -13					6.8	7.5	8.5
1 -13 / +194	32.81	2	328.1	> 1,312	5	6	5 7
+194 / +212					6.8	7.5	8.5

Example:

You operate a cable with a diameter of 12 mm in an Energy Chain\* with a radius of 100 mm. This results in a bending factor of 8.3 (100 mm/12 mm). You now want to know what the guaranteed service life is.

To find this out, select the technical framework conditions from areas 1-4. In area 5, you can now see that when using 8.3 x d the effective bending factor is above the limit of 7 and the cable has a guaranteed service life for 10 million cycles.

If the temperature is higher or lower, the number of guaranteed cycles falls to 7.5 million.

This statement creates dependability and planning reliability for your entire system.





# Flexing Control Cable



AutomationDirect is pleased to offer the igus CF5 and CF6 series multi-conductor control cable for continuous flexing applications. These cables are available in sizes from 20AWG to 14AWG with 3 to 25 unshielded (CF5 series) or 4 to 12 shielded (CF6 series) conductors. Individual conductors are bare copper and stranded for flexing applications. Conductor insulation is a mechanically high-quality black TPE mixture for 20AWG and black PVC mixture for 18 through 14AWG, and individual conductors are marked with white numbers for easy identification. A convenient ground conductor is included in the conductor count of each cable and has green-yellow insulation. The cable's outer jacket is a low-adhesion pressure extruded PVC mixture that provides resistance to sunlight, oil penetration, and is flame retardant.

Unshielded Chainflex® cables have a tear strip underneath the outer jacket, shielded Chainflex® cables have it underneath the inner jacket. With a few easy steps, the jacket can be opened like a zipper to the desired length by pulling on the special tear strip. The outer jacket/inner jacket can then be removed from conductors. This not only saves time and effort for assemblers and electricians, but also means they have no need for additional tools. Cables are designed such that the strip does not cause damage to the jacket or conductors, even after millions of motion cycles.

The igus CF5 and CF6 multi-conductor control cables are specifically designed, tested, and manufactured for continuous flexing, high mechanical load application requirements, and will provide a guaranteed service life between 5 million and 10 million cycles when operated within specified conditions\*.

## Features

- 0.5 mm<sup>2</sup> to 2.5 mm<sup>2</sup> (20AWG to 14AWG), 3 to 25 conductors including ground
- Unshielded and shielded constructions
- Individual conductors have black TPE or PVC insulation and are marked with white identification numbers
- Low adhesion pressure extruded PVC mixture outer jacket that is sunlight and oil resistant and flame retardant
- Green/yellow ground wire included
- Rated for continuous flexing applications with high mechanical load requirements
- Guaranteed service life between 5 million and 10 million cycles when operated within specified conditions
- UL Recognized type AWM (appliance wiring material)
- Cut to length in 1 foot increments
- Low 20 foot minimum length
- 3 year warranty\*



- Strip cables 50% faster: The tear strip is in the outer jacket for unshielded cables and inner jacket for shielded



\* CF5 and CF6 Series Guaranteed lifetime according to guarantee conditions

Cycles		5 million		7.5 million		10 million	
Temperature, from/to [°F]	Travel distance [ft]	R min. [factor x d]		R min. [factor x d]		R min. [factor x d]	
		< 32.81 ft	≥ 32.81 ft	< 32.81 ft	≥ 32.81 ft	< 32.81 ft	≥ 32.81 ft
+41 / +59	≤ 328	7.5	10	8.5	11	9.5	12
+59 / +140		6.8	7.5	7.8	8.5	8.8	9.5
+140 / +158		7.5	10	8.5	11	9.5	12



Click on the above thumbnail or go to  
<https://www.automationdirect.com/VID-WD-0016>  
 for a short introduction on our cut to length cable

