GORE® Trackless High Flex Cables

For Semiconductor/FPD Cleanrooms
& ESD Environments

DESIGN GUIDE

Together, improving life

GORE

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Increase throughput and yield, reduce total costs

Gore offers standard trackless or anti-static high flex cables proven to solve complex automated equipment issues over time such as particulation, electrostatic buildup, vibration, size, and weight. They are certified for ISO Class 1 semiconductor and flat panel display (FPD) cleanrooms and electrostatic discharge (ESD)-sensitive environments (Figure 1).

Our trackless cables are proven to maintain the lowest possible particulation levels for repeated flexing. They have a proven flex life beyond 10 million cycles for a longer lifespan and a tighter minimum bend radius at 50 millimeters (2 inches) for easier installation. In addition, they provide increased positioning accuracy, faster speeds, quieter motion, and cleaner operation. We also deliver our cables prepped for termination with standard clamps that mount directly onto your platform.

Simpler Cable Management System

We combine electrical and pneumatic lines into one low-profile, self-supporting package for a simpler cable management system. Both versions have a lightweight, flat construction that reduces cable weight and stress as well as eliminates the need for cable chains, dividers, and shelves (Figure 2). Manufacturers can stack multiple layers of our cables to reduce the overall system footprint.

Gore's trackless cables include the components necessary to drive and control your motion system. Manufacturers can reduce overall system footprint, increase throughput and yield, reduce maintenance and downtime, and decrease total costs.

Figure 1: ISO Class 1 Cleanroom Certificate

Figure 2: Self-Supporting, Lightweight Construction

Clamp

Power / signal core types

PU tubes
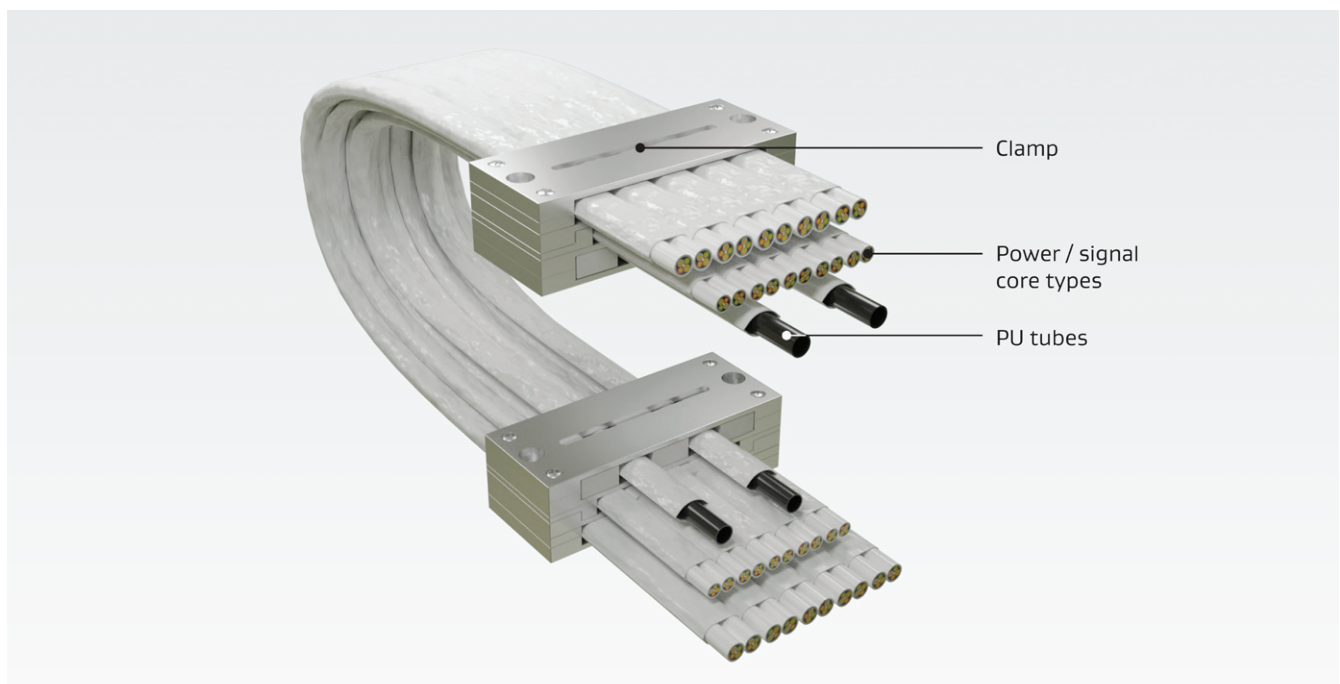
GORE® Trackless High Flex Cables

Our standard version can be reliably used in semiconductor and FPD cleanroom environments that require low particulation (Table 1). Using the calculations defined in VDI Guideline 2083 and ISO 14644-1, the Fraunhofer Institute in Germany determined our cables have less than 0.1 percent probability of emitting particulates.

Typical Applications

- Advanced electronic packaging equipment
- CIS packaging and lens manufacturing equipment
- FPD in automated cleanroom equipment
- Pick and place mounter equipment

Table 1: Cable Properties

Electrical / Mechanical / Environmental

Property	Value
Maximum Acceleration g (m/sec^2)	4.0 (40)
Speed m/sec	4.0
Jacket Material	Expanded PTFE (ePTFE) Composite
Jacket Color	White
Core Types	Signal, Power, Fiber Optic, Pneumatic
Maximum Self-Supporting Stroke Length[a] mm (in)	1500 (60)
Overall Width[b] mm (in)	Up to 105 (4.1)
Minimum Bend Radius[b] mm (in)	50 (2)
Flex Life (Cycles) (BR. 50 mm up to 4G Acceleration)	> 10 million
Temperature Range °C	–40 to +80
Cleanliness Class[d] (ISO14664-1 up to 1 Mio Flex Cycle)	1
Certifications[c]	UL, CE
Particulation[d] % (ISO14664-1 / VDI Guideline 2083)	< 0.1

a. Baseplate required.
b. Standard version only.
c. UL Style 21090: 80°C, pneumatic tubes are not UL recognized.
d. Details of the Fraunhofer Institute's study available at **gore.com/particulation**.

GORE® Anti-Static High Flex Cables

This version helps prevent triboelectric charge and voltage buildup that attracts particles over time in semiconductor and FPD equipment (Table 2). Our anti-static high flex cables help to significantly reduce ESD-related failures and contamination to product damage.

The first of its kind in the industry, our next-generation cable technology can be used in an ESD-sensitive environment without any additional installation effort. This unique technology does not require extra equipment or a complex grounding system to perform. It also eliminates ionizers that are costly to calibrate and maintain. Our anti-static high flex version is also 100% compatible with our standard trackless high flex version for easy retrofit.

Typical Applications

- Electronic component packaging equipment
- Advanced bonding equipment
- Pick & place mounter equipment
- Back-end manufacturing & inspection processes
- Lens manufacturing equipment
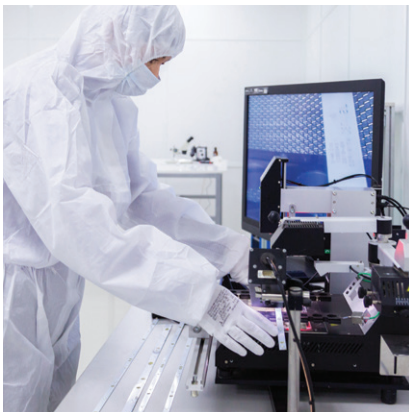- Manufacturing equipment sensitive to ESD

Table 2: Cable Properties

Electrical

Property	Value	
	Trackless Cable	Flat Cable
Maximum Acceleration g (m/sec^2)	4.0 (40)	
Speed m/sec	4.0	
Surface Resistance Ohms (ASTM-D257) 45% rH, 23°C	$\leq 1 \times 10^9$	
Typical Charge Decay[a] msec (DIN-EN 1149-5; 2008-04) 45% rH, 23°C	≤ 4	
Voltage Buildup[a] V (PLFWI-2730 up to 1000 Cycles)	<< 100	
Operating Relative Humidity rH %	45 ± 15	

Mechanical / Environmental

Property	Value	
	Trackless Cable	Flat Cable
Jacket Material[b]	Expanded PTFE Composite with Non-Carbon-Based Dissipative Treatment	
Jacket Color	White	
Core Types	Signal, Power, Fiber Optic, Pneumatics	
Maximum Self-Supporting Stroke Length[c] mm (in)	1500 (60)	500 (20)
Overall Width[d] mm (in)	Up to 105 (4.1)	Up to 300 (12)
Minimum Bend Radius[d] mm (in)	50 (2)	
Flex Life Cycles (BR. 50 mm up to 4G Accelerations)	> 10 million	> 20 million
Temperature Range °C	–40 to +80	
Cleanliness Class[e] (ISO14664-1 up to 1 Mio Flex Cycle)	1	
Particulation[f] % (ISO14664-1 / VDI Guideline 2083)	< 0.1	

a. Results may vary under different conditions. Test method details available upon request.
b. Details of Gore's patent available at **patents.justia.com/patent/9534159.**
c. Baseplate required.
d. Standard configuration only. MBR can vary with specific configurations.
e. Based on Anti-ESD Trackless Cable, GKT-FTFH-01-A, Serial Number 14111802. Qualification report available upon request.
f. Details of the Fraunhofer Institute's study available at **gore.com/particulation.**

Design Your Gore Cable

Follow the easy steps below to select the most common components used in the industry to begin designing your own cable that meets your specific application needs and requirements.

1. Identify the mechanical conditions of the cable linear motion space by providing the length, width, and height (Figure3). Gore will recommend and design the cable mounted height (CMH).

2. Specify the speed and acceleration requirements for the cable motion (Figure 4).

3. Select a standard cable clamp (Table 3 and Figure 5).

4. Select the core type for each pod (Table 4). For more options or assistance in identifying core types, contact a Gore representative.

5. Send your completed information via email to a Gore representative.

Once you submit your information, a Gore representative will review your requirements, contact you with a recommendation, and provide a drawing.

If you have any questions or to discuss your specific application needs and requirements, contact a Gore representative today at **gore.com/trackless-high-flex-cables-contact.**

Figure 3: Cable Linear Motion Space
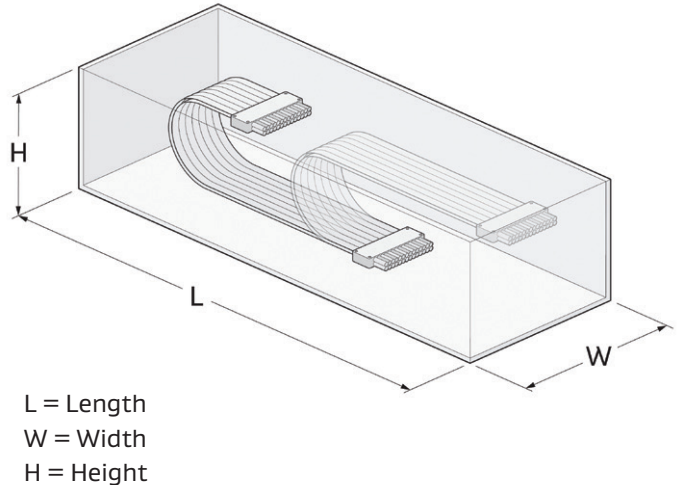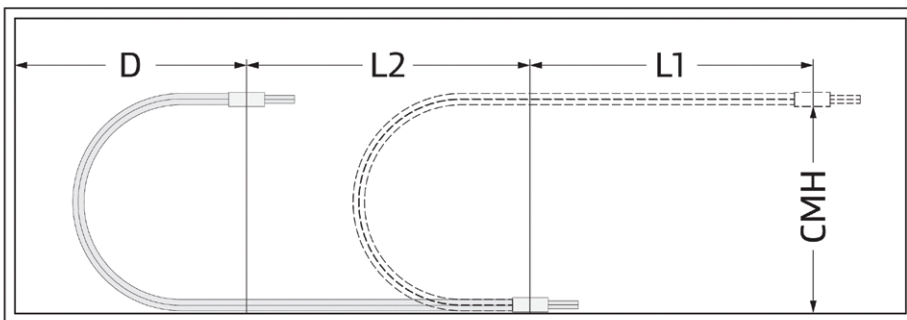

L = Length
W = Width
H = Height

Figure 4: Cable Speed & Acceleration Requirements

D = Distance to space wall
L1 / L2 = Stroke length
CMH = Cable mounted height

Table 3: Standard Cable Clamp Dimensions

Gore Part Number	Dimensions mm (in)	
	A (Overall Clamp Width)	B (Mounting Width)
KCL-2C	48.0 (1.89)	38.0 (1.50)
KCL-3C	62.0 (2.44)	52.0 (2.05)
KCL-4C	76.0 (2.99)	66.0 (2.60)
KCL-5C	90.0 (3.54)	80.0 (3.15)
KCL-6C	104.0 (4.09)	94.0 (3.70)
KCL-7C	118.0 (4.65)	108.0 (4.25)

Figure 5: Standard Cable Clamp

32 mm (1.26 in)
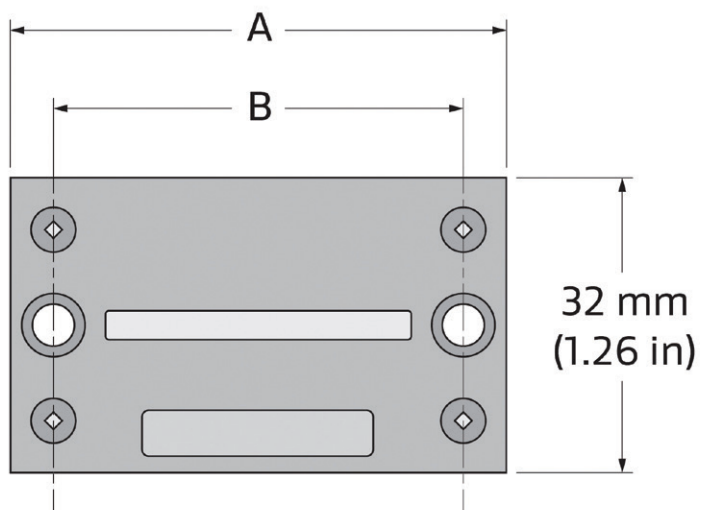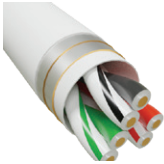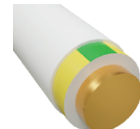
Table 4: Cable Core Types & Tubes

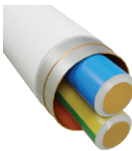| Gore Part Number	Cross-Section	Description	Specifications
Core A (201)		**Shielded Power** Design: 3 Singles (AWG 16) Binder: ePTFE Colors: Yellow/Green, Red, White	Rating: 600 Vrms Dimensions: 5.0 mm (0.20 in) Pod Usage: 0.5
Core B (202)		**Shielded Power** Design: 4 Singles (AWG 18) Binder: ePTFE Colors: Yellow/Green, Blue, Red, White	Rating: 600 Vrms Dimensions: 4.7 mm (0.18 in) Pod Usage: 0.5
Core C (203)		**Shielded Power** Design: 4 Singles (AWG 20) Binder: ePTFE Colors: Yellow/Green, Blue, Red, White	Rating: 600 Vrms Dimensions: 4.5 mm (0.18 in) Pod Usage: 0.5
Core D (204)		**Unshielded Signal** Design: 7 Twisted Pairs (AWG 26) Binder: ePTFE Colors: Black/White & Black, Blue/White & Blue, Brown/White & Brown, Green/White & Green, Orange/White & Orange, Red/White & Red, Yellow/White & Yellow	Rating: 300 Vrms Dimensions: 4.0 mm (0.16 in) Pod Usage: 0.5
Core E (205)		**Shielded Signal** Design: 5 Twisted Pairs (AWG 26) Binder: ePTFE Colors: Black/White & Black, Brown/White & Brown, Orange/White & Orange, Red/White & Red, Yellow/White & Yellow	Rating: 300 Vrms Dimensions: 4.2 mm (0.17 in) Pod Usage: 0.5
Core G		**Video Cable (RG 179B Equivalent)** Design: 3 Coaxes (AWG 30) Dielectric: PTFE Braided Shield: Silver-Plated Copper Jacket: Fluoroplastic Binder: ePTFE Color: White	Impedance: 75 Ohm Voltage: 600 V AC Dimensions: 4.8 mm (0.18 in) Pod Usage: 0.5
Core H		**Video Cable (RG 316 equivalent)** Design: 3 Coaxes (AWG 26) Dielectric: PTFE Braided Shield: Silver-Plated Copper Jacket: Fluoroplastic Binder: ePTFE Color: White	Impedance: 50 Ohm Voltage: 600 V AC Dimensions: 5.0 mm (0.20 in) Pod Usage: 0.5

Gore Part Number	Cross-Section	Description	Specifications
Core I (209)		**Shielded Ethernet (Cat5e)** Design: 4 Twisted Pairs (AWG 26) Binder: ePTFE Colors: Blue/White & Blue, Brown/White & Brown, Green/White & Green, Orange/White & White	Rating: 45 Vrms Impedance: 100 ± 15 Ohm Dimensions: 4.9 mm (0.19 in) Pod Usage: 0.5
Core K (211)		**Shielded Power** Design: 1 Twisted Pair (AWG 22) Binder: ePTFE Colors: Black/White	Rating: 300 Vrms Dimensions: 2.7 mm (0.11 in) Pod Usage: 1/3
Core P (215)		**Fiber Optic** Jacket: Specialized Thermoplastic Braid: Strain-Relief Aramid Fiber Optical Fiber: Glass Binder: ePTFE Colors: Black/Natural	Rating: 62.5/125 micron Core Type: OM1 (Multi-Mode) Dimensions: 2.5 mm (0.10 in) Pod Usage: 1/3
Core S (218)		**Shielded Encoder (Heidenhain Compatible)** Design: 4 Twisted Pairs (AWG 26) Colors: Black/Red, Brown/Green, Grey/Pink, Violet/Yellow Design: 4 Leads (AWG 24) Binder: ePTFE Colors: Blue, Brown/Green, Green/White, White	Rating: 300 Vrms Dimensions: 5.0 mm (0.20 in) Pod Usage: 0.5
Core I6		**Shielded Ethernet (Cat6a)** Design: 4 Twisted Pairs (AWG 28) Binder: ePTFE Colors: Blue/White, Brown/White, Green/White, Orange/White	Rating: 30 Vrms Impedance: 100 ± 5 Ohm Dimensions: 6.7 mm (0.26 in) Pod Usage: 1.0
Core KD		**Shielded Power** Design: 7 Singles (AWG 22) Binder: ePTFE Colors: Black, Blue, Brown, Grey, Green, Red, White	Rating: 450 Vrms Dimensions: 4.0 mm (0.16 in) Pod Usage: 0.5
Core KF		**Isolated Double Shielded Encoder (Renishaw Compatible)** Design: 4 Twisted Pairs (AWG 26) Colors: Black/White, Blue/White, Brown/White, Red/White Design: 4 Leads (AWG 26) Binder: ePTFE Colors: Yellow, Grey, Orange, Green	Rating: 300 Vrms Dimensions: 5.0 mm (0.20 in) Pod Usage: 0.5

Table 4: Cable Core Types & Tubes (continued)

Gore Part Number	Cross-Section	Description	Specifications
Core KI		**Shielded Power** Design: 3 Twisted Pairs (AWG 22) Binder: ePTFE Colors: Black/White & Black, Green/White & Green, Red/White & Red	Rating: 450 Vrms Dimensions: 5.0 mm (0.20 in) Pod Usage: 0.5
Core KJ		**Shielded Signal and Power** Design: 4 Twisted Pairs (AWG 24) Binder: ePTFE Colors: Black/Brown, Yellow/Green, Red/Orange, Blue/Violet	Rating: 300 Vrms Dimensions: 5.0 mm (0.20 in) Pod Usage: 0.5
Core KM		**Shielded Thermocouple Extension Lead Type K** Design: 2 Singles (AWG 24) Binder: ePTFE Colors: Green, Red	Rating: 300 Vrms Dimensions: 2.9 mm (0.20 in) Pod Usage: 1/3
Core KP		**Unshielded Power/Ground** Design: 1 Single (AWG 14) Binder: ePTFE Colors: Yellow/Green	Rating: 600 Vrms Dimensions: 3.3 mm (0.13 in) Pod Usage: 1/3
Core U3		**USB 3.0** Design: 2 Shielded Twisted Pairs (AWG 24), 2 Twisted Pairs (AWG 22 & 26) Binder: ePTFE Colors: Blue/Yellow, Orange/Violet (USB 3.0); Green, White (USB 2.0); Red, Black (Power)	Rating: 30 Vrms Impedance: 105 ± 5 Ohm (Shielded), 90 ± 10 Ohm (Unshielded) Dimensions: 6.9 mm (0.27 in) Pod Usage: 1.0
Core AA		**Shielded Power** Design: Twisted Pair (AWG 16) Binder: ePTFE Colors: Red, White	Rating: 600 Vrms Dimensions: 4.5 mm (0.18 in) Pod Usage: 0.5
Core AG		**Shielded Power** Design: Twisted Pair (AWG 16) Binder: ePTFE Colors: Blue, Yellow/Green	Rating: 600 Vrms Dimensions: 4.5 mm (0.18 in) Pod Usage: 0.5

Gore Part Number	Cross-Section	Description	Specifications
Core A4 (213)		**PU Tube** Design: Polyurethane 85 Shore A	Rating: 0.8 MPa Max Temperature: 20°C OD: 4.0 mm (0.16 in) ID: 2.5 mm (0.10 in) Pod Usage: 0.5
Core A6 (214)		**PU Tube** Design: Polyurethane 85 Shore A	Rating: 0.8 MPa Max Temperature: 20°C OD: 6.0 mm (0.24 in) ID: 4.0 mm (0.16 in) Pod Usage: 1.0
Core A8		**PU Tube** Design: Polyurethane 85 Shore A	Rating: 0.8 MPa Max Temperature: 20°C OD: 8.0 mm (0.31 in) ID: 5.0 mm (0.20 in) Pod Usage: 1.0

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ACS-0505-R2-DAT-US-AUG25