Coaxial cable

Specifications

| | Type C | Type SC | Type SS | Type SR |
|---|---|---|------------------------------------|----------------------------------|
| Dimensions | | | | |
| Center conductor—AWG (diameter) | 32 (0.2032 mm [0.008 in]) | 32 (0.2032 mm [0.008 in]) | 32 (0.2032 mm [0.008 in]) | 37 (0.1143 mm [0.004 in]) |
| Dielectric/insulating material (diameter) | 0.56 mm (0.022 in) | 0.406 mm (0.016 in) | 0.406 mm (0.016 in) | 0.38 mm (0.015 in) |
| Shield (diameter) | 0.025 mm (0.001 in) thickness | 0.711 mm (0.028 in) | 0.711 mm (0.028 in) | 0.51 mm (0.02 in) |
| Drain wire (parallel to conductor) | 32 AWG (0.203 mm [0.008 in]) | NA | NA | NA |
| Jacket outer dimension | 0.7874 mm × 1.016 mm (0.031 in × 0.039 in) | 1.0 mm (0.04 in) | 1.0 mm (0.04 in) | 0.51 mm (0.02 in) |
| Material | | | | |
| Center conductor | Silver-plated copper | Stranded copper ¹ | 304 stainless steel ² | Carbon steel ³ |
| Dielectric/insulating material | Gore-Tex® expanded PTFE | Teflon® FEP | Teflon® FEP | Teflon® PTFE |
| Shield | Aluminized polyester⁴ | Braided gold-plated copper ⁵ | 304 braided stainless ⁶ | 304 stainless steel ⁷ |
| Drain wire | Silver-plated copper | NA | NA | NA |
| Jacket material | FEP | Teflon® FEP | Teflon® FEP | NA |
| Jacket color | Blue | Gold | Gray | NA |
| Electrical properties | | | | |
| Resistance Ω/m (Ω/ft) | | | | |
| Center conductor at 293 K (20 °C) | 0.541 (0.165) | 0.282 (0.086) | 23.62 (7.2) | 4.30 (1.31) |
| Shield at 296 K (23 °C) | NA | 0.085 (0.026) | 3.61 (1.1) | 8.63 (2.63) |
| Drain wire at 296 K (23 °C) | 0.541 (0.165) | NA | NA | NA |
| Center conductor maximum DC voltage | 150 V | 600 V | 600 V | 700 V |
| Center conductor maximum DC current | 150 mA | 200 mA | 200 mA | 200 mA |
| Temperature range | 10 mK to 400 K | <1 K to 400 K | 10 mK to 473 K | 10 mK to 400 K |
| Characteristic impedance | 50 Ω (±5 Ω) | 35 Ω at 10 MHz | 40 Ω at 10 MHz | 50 Ω (±2 Ω) |
| Nominal capacitance at 5 kHz | 79 pF/m (24 pF/ft) | 154.2 pF/m (47 pF/ft) | 173.9 pF/m (53 pF/ft) | 95.14 pF/m (29 pF/ft) |

¹ 65 strands of 50 AWG





² 64 strands of 50 AWG 304 SS wire

³ Silver-plated copper-clad carbon steel (0.103 mm outer diameter carbon steel covered by 0.0057 mm thick copper cladding covered by 0.001 mm thick silver plating

⁴ Aluminized polyester laminated tape, spirally applied at a 40–50% overlap, aluminum side in

⁵ 12 × 3 matrix of 42 AWG wire ⁶ 12 × 4 matrix of 44 AWG wire

⁷ A seamless tubular metal jacket serves as the outer conductor/shield

Coaxial cable

Ultra miniature coaxial cable - Type C, SC, SS

- Very flexible
- Long flex life
- Available in three configurations:

C – solid copper center conductor, drain wire, and aluminized/polyester shield

SC – stranded copper conductors

SS – stranded 304 stainless steel conductors

Ultra miniature coaxial cable is for use when a strong and flexible cable is needed. Type C and SC are recommended when low conductor resistance is a prime consideration. Type SC and type SS are mechanically the most flexible, due to their braided construction. Type SS is recommended for use when both shielding and low thermal losses are important.

For technical specifications on types SS, C, SC and SR, see page 147.

Thermal conductivity of copper—units are $W/(m \cdot K)$

| | 4 K | 20 K | 30 K | 77 K | 300 K |
|--------------|-----|------|------|------|-------|
| $RRR^8 = 20$ | 122 | 719 | 870 | 502 | 397 |
| RRR = 100 | 460 | 2460 | 2070 | 533 | 407 |

8 RRR = residual resistance ratio

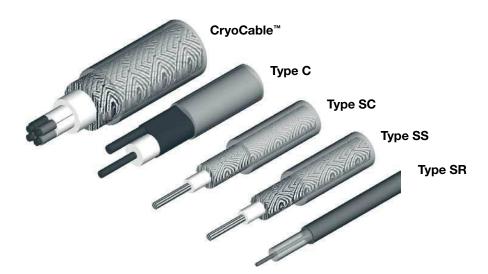
$$\frac{R_{273K}}{R_{43K}} = RRR$$

| | Normal attenuation (dB/m) | | |
|---------|---------------------------|-------|--------|
| | C ⁽¹⁾ | SC | SS |
| 1 MHz | 0.092 | 0.108 | 0.569 |
| 5 MHz | 0.167 | 0.240 | 1.272 |
| 10 MHz | 0.224 | 0.344 | 1.799 |
| 15 MHz | 0.257 | 0.421 | 2.850 |
| 20 MHz | 0.294 | 0.486 | 2.545 |
| 50 MHz | 0.427 | 0.769 | 4.031 |
| 100 MHz | 0.623 | 1.090 | 5.694 |
| 500 MHz | 1.312 | 2.453 | 12.749 |
| 1 GHz | 1.886 | 3.488 | 18.048 |
| 2 GHz | 2.625 | _ | _ |
| 5 GHz | _ | 7.968 | 40.526 |

 Type C has a bandwidth to at least 3 GHz—above that, the aluminum/polyester becomes a less effective shield.

Ordering information

| Part number | Description |
|-------------|------------------------------------|
| CC-C-25 | Solid copper, 7.6 m (25 ft) |
| CC-C-50 | Solid copper, 15 m (50 ft) |
| CC-C-100 | Solid copper, 30 m (100 ft) |
| CC-C-500 | Solid copper, 152 m (500 ft) |
| CC-SC-25 | Stranded copper, 7.6 m (25 ft) |
| CC-SC-50 | Stranded copper, 15 m (50 ft) |
| CC-SC-100 | Stranded copper, 30 m (100 ft) |
| CC-SC-500 | Stranded copper, 152 m (500 ft) |
| CC-SS-25 | Stranded stainless, 7.6 m (25 ft) |
| CC-SS-50 | Stranded stainless, 15 m (50 ft) |
| CC-SS-100 | Stranded stainless, 30 m (100 ft) |
| CC-SS-500 | Stranded stainless, 152 m (500 ft) |





Coaxial cable

Semi-rigid coaxial cable—type SR

- Easily bent, coiled, stripped, machined, soldered, or connected without impairing performance
- Solid center conductor provides the optimum geometrical surface for transmission
- Low standing wave ratio (SWR) with a dielectric controlled to exacting tolerances
- Low thermal conductivity (\approx 0.4 W/(m·K) at 4.2 K) 9
- Matching minimizes reflective power loss
- Provides shielding isolation for virtually no extraneous signal pickup
- Tubular outer conductor offers minimum size and maximum conductor integrity; stainless steel jacket can be soldered directly to circuit boards
- 37 AWG, silver-plated copper-weld steel center conductor
- Thermal conductivity at low temperatures is dominated by the copper cladding around the center conductor

This cable transmits and receives high-speed, high-frequency microwave signals. Typically used for transmission lines in cryogenic-vacuum test systems.

To remove the outer conductor:

- Score jacket
- 2. Bend at score until shield kinks, fatigues, and breaks
- Slide off outer conductor

Extreme caution must be used in this process to avoid damage to the cable

| SR coaxial cable frequency response specifications | | |
|--|--------------|-----|
| Insertion loss Power CW dB/m (dB/ft) (20 °C, sea level, W) | | |
| 0.5 GHz | 4.43 (1.35) | 7.6 |
| 1.0 GHz | 6.27 (1.91) | 5.3 |
| 5.0 GHz | 14.09 (4.30) | 2.4 |
| 10.0 GHz | 20.01 (6.10) | 1.7 |
| 20.0 GHz | 28.45 (8.67) | 1.2 |

Ordering information

| Part number | Description |
|-------------|-------------------------|
| CC-SR-10 | Semi-rigid, 3 m (10 ft) |

CryoCable[™]—type CYRC

- Robust: the NbTi wire cores are strong and fatigue resistant, and the cable overbraid of 304 stainless steel adds significant strength and crush resistance
- Low heat leak due to all metal alloy and Teflon[®] construction
- Solderable: the CuNi wire surface is easy to solder with conventional rosin fluxes
- Cryo-compatible: all Teflon® (PFA) insulation is heat strippable for ease of preparation

A robust, 4-wire cable for use in cryogenic environments to room temperature is now available. The cable is designed around 32 AWG (203 μ m) diameter superconductive wires consisting of a NbTi core (128 μ m diameter) and a Cu-10% Ni jacket.

Minimum bend radius: 15 mm (0.6 in) Critical temperature: 9.8 K Critical field: 10 T

The cable is constructed as follows:

- 4 superconductive wires are overcoated with 75
 μm (0.003 in) thick Teflon® (PFA) of the following
 colors: white, yellow, green, and black.
- 4 lengths of Teflon®-jacketed wire, one of each color, twisted together with a twist pitch of about 25 mm (1 in). Teflon® (PFA) is extruded over the 4 wires to a total diameter of about 1.2 mm (0.048 in)
- Cable is overbraided with 304 stainless steel (5 × 36 AWG). The overbraid is tight and presents complete visual coverage.
- Teflon® (PFA) extruded over the entire cable for protection of the metal overbraid. The total finished cable is nearly round with a diameter of about 2.4 ±0.2 mm (0.094 ±0.008 in).

| | Temperature (K) | | |
|--|-----------------|------|------|
| | 295 | 77 | 4.2 |
| Wire resistance — per wire (Ω/m) | 9.2 | 8.4 | 010 |
| Overbraid resistance (Ω/m) | 0.90 | 0.64 | 0.62 |
| Thermal conductivity — entire cable assembly $(\Omega/(m\cdot K))$ | 7.6 | 2.8 | 0.17 |

¹⁰ Superconducting

| Field | Critical current (per wire) |
|-------|-----------------------------|
| 3 T | 35 A |
| 5 T | 25 A |
| 7 T | 15 A |
| 9 T | 6 A |

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|-------------|--|
| Part number | Description |
| CRYC-32-25 | CryoCable™, 7.6 m (25 ft) |
| CRYC-32-50 | CryoCable™, 15 m (50 ft) |
| CRYC-32-100 | CryoCable [™] , 30 m (100 ft) |



