Semi Rigid Cables

Dipl. Ing. Thomas Weber

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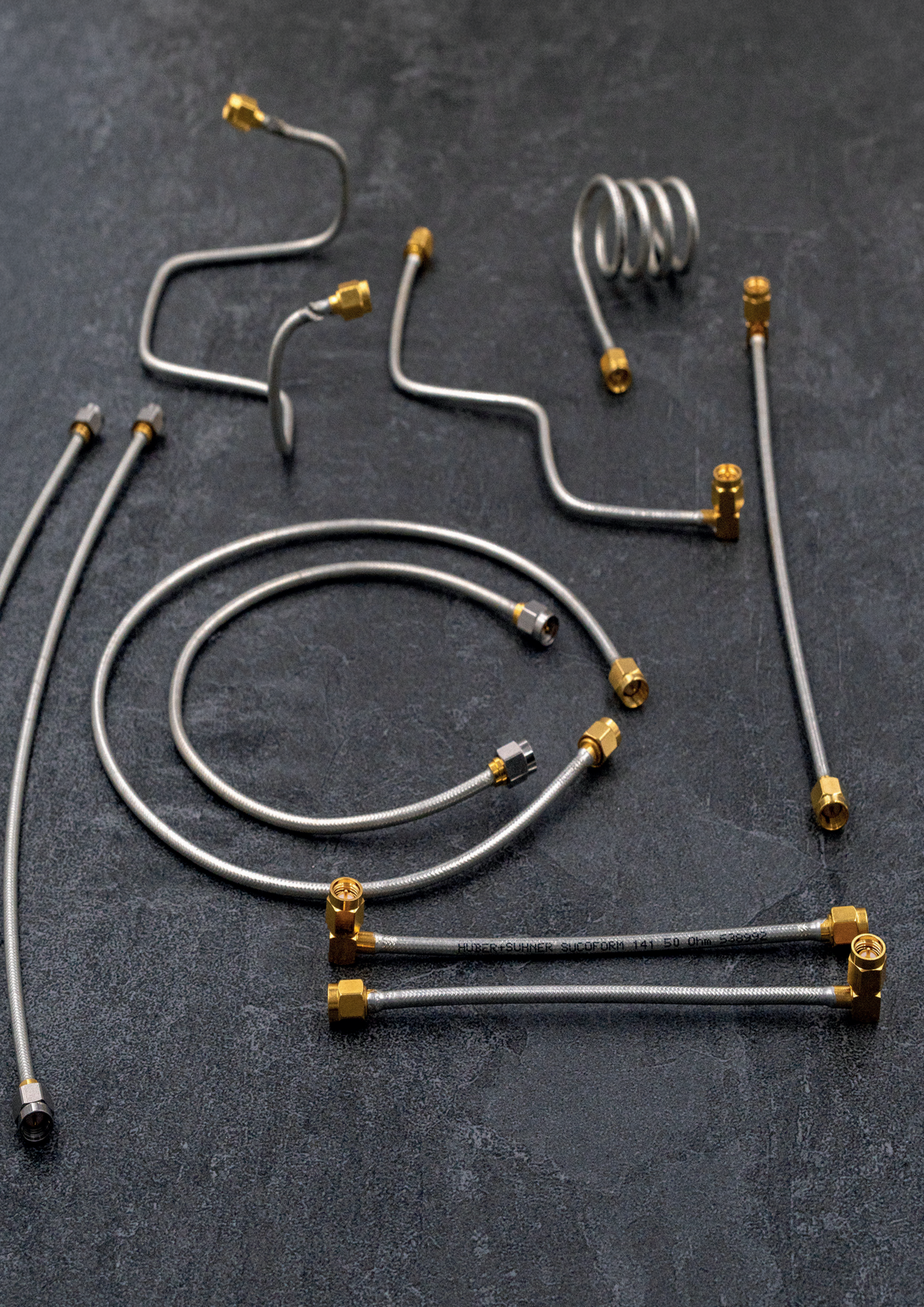
Content


HUBER+SUHNER SUCOFORM 141 50 Ohm 538992

Semi-rigid cables (fixed-jacket cables) are primarily used in applications involving very high frequencies (up to 110 GHz). The semi-rigid cable is unique because it can be easily bent into its final shape and retains its strength even after bending. This property makes it ideal for use with automated bending machines as well as for manual bending.

The cables from our manufacturers are specified to MIL-DTL-17 and can be delivered with the corresponding certificates. Available cable diameters range from 0.034 inches to 0.500 inches. Available impedance range is from 10 ohms to 100 ohms.

1. MIL-DTL-17 QPL

Our diverse range of 27 QPL cables includes copper- and aluminum-sheathed cables with diameters of .034, .047, .086, .141, and .250 inches. These are available in copper, tin-plated copper, or silver-plated copper versions.

Low-Loss 50 Ohm Cables: Low-loss semi-rigid coaxial cables transmit higher power with low transmission losses. These cables reduce attenuation by an additional 20% and extend the operating temperature range up to 250°C. Please request detailed test reports.

50 Ohm Stainless Steel Cables: Stainless steel cables are suitable for cryogenicor medical applications where low thermal conductivity is required.

Description	Shortterm	Impedance	External Diameter	Outer Conductor
M17/154-00001	CR-034-M17	50	0.034inch / 0.86mm	Copper
M17/154-00002	CR-034-M17-TP	50	0.034inch / 0.86mm	Tinned Copper
M17/151-00001	CR-047-M17	50	0.047inch / 1.2mm	Copper
M17/151-00002	CR-047-M17	50	0.047inch / 1.2mm	Tinned Copper
M17/133-RG405	CR-085-M17	50	0.085inch / 2,2mm	Copper
M17/133-00001	CR-085-M17-TP	50	0.085inch / 2,2mm	Tinned Copper
M17/130-RG402	CR-141-M17	50	0.141inch / 3.6mm	Copper
M17/130-00001	CR-141-M17-TP	50	0.141inch / 3.6mm	Tinned Copper

2. Inner Conductor

The inner conductor is a solid wire that serves as the primary electrical signal carrier for every coaxial cable. Most attenuation occurs at the surface of the inner conductor, as the "skin effect" of microwave signals makes the finish or coating a very important factor. Stranded conductors are generally used only in flexible cable designs to provide greater flexibility. In comparison, solid inner conductors have lower attenuation and tend to be more amplitude-stable when bent, while stranded inner conductors are more phase-stable when bent. History: In the past, larger semi-rigid cables used a tubular inner conductor. The tubular inner conductor reduces weight and thermal conductivity without compromising electrical performance.

- Silver-plated copper (SPC) in accordance with ASTM B-298 and silver-plated copper-clad steel, also referred to as silver-plated copper-clad steel (SPCW) in accordance with ASTM B-501, are the two most commonly used inner conductor materials.

- Silver plating is not only an excellent electrical conductor, but it also prevents oxidation during manufacturing and improves the solderability of the finished cable.

- Stainless steel and beryllium copper are also used when low thermal conductivity is a priority. Other materials, including many copper alloys, are available upon request.

3. Dielectric

The most commonly used dielectric for semi-rigid coaxial cables is polytetrafluoroethylene (PTFE), available in both full-density and low-density versions (known as low-loss, micro-pore PTFE, wound PTFE, or low-loss/micro-pore PTFE tape). PTFE is an excellent choice for a cable dielectric due to its low reactivity to chemicals and an operating temperature that withstands the heat of soldering. Cables with a low dielectric constant, which offer lower dielectric losses, also require a larger center conductor diameter to maintain the same characteristic impedance. The larger center conductor can significantly reduce overall cable attenuation. In addition, the dielectric determines the propagation speed, temperature range, power rating, phase and amplitude stability, and contributes to cable flexibility.

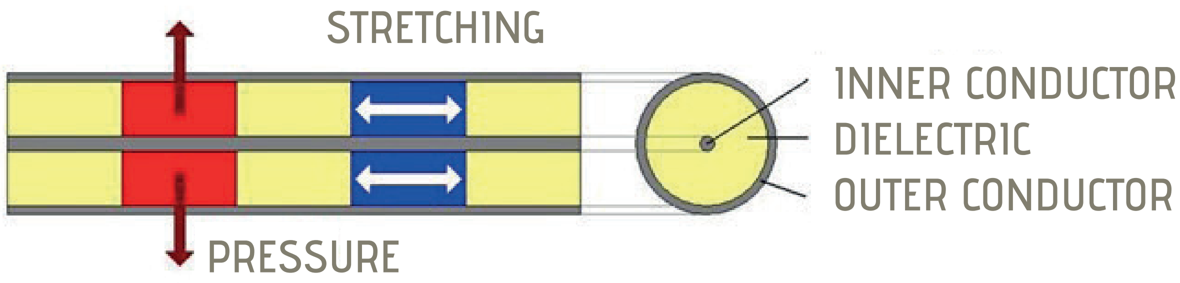
The insulating material between the center conductor and the outer conductor maintains the cable‘s spacing and geometry and ensures its mechanical integrity during forming and bending. Most transmission losses are caused either directly or indirectly by the dielectric.

4. Outer Conductor

The outer conductor serves many purposes. It acts as an electrical shield that helps dampen the cable and controls RF leakage. Through precision mechanical tolerances, the outer conductor minimizes return loss (VSWR) by maintaining a constant characteristic impedance (50 ± 1 ohms). The outer conductor is the primary connecting element that firmly attaches the connectors to the cable. It often serves to protect against environmental factors and determines the flexibility or how easily the cable can be shaped or bent. The most commonly used materials include, for example, tubes for semi-rigid cables, tinned braids for conformable cables, or a foil for flexible coaxial cables. Material selection typically involves trade-offs in terms of electrical performance, size, and flexibility.

5. How to Use the Semi-Rigid Cable

The electromechanical performance specified for semi-rigid cables is achieved through an interference fit between the outer conductor and the dielectric core, which in turn requires manufacturing processes that cause the core to deform under compression and tension. The resulting stress, which is initially uneven, tends to equalize through cold flow within a few weeks of manufacture and causes the conductor to retract into the cable. When this occurs in cables that have become part of a cable assembly, the resulting development of an air gap at the cable-connector interface can lead to an increase in VSWR. It is therefore advantageous to achieve core stress relief by preconditioning the cable before it becomes part of a cable assembly.



6. Preconditioning Process

Preconditioning is not effective for long cable lengths. The bending of cables, which is typically associated with the manufacture of cable assemblies, tends to introduce uneven core stresses; therefore, *CarlisleIT* recommends preconditioning after bending and before attaching the connectors. Since preconditioning causes the dielectric to be drawn back into the cable, a length of ¼ inch beyond the design dimensions should be allowed at each cable end when preparing the cable assembly. The outer conductor and core should not be trimmed to their final dimensions until preconditioning is complete.

- Heat the sample to the maximum operating temperature. Maintain this temperature for at least one hour.
- Bring the sample to room temperature. If necessary, trim any protruding core so that it is flush with the edge of the outer conductor.
- Let the sample sit at room temperature for at least one hour.
- Let the sample cool to -45°C and keep it at that temperature for at least one hour.
- Bring the sample to room temperature and let it sit for at least one hour.

A recommended preconditioning procedure consists of the following steps.

This procedure should be performed three times. After the final temperature cycle, allow the sample to stand at room temperature for at least 24 hours before proceeding with further processing. It is advisable to create a checklist before assembling the cables, e.g., condition of the bending fixture, quality of the stripped sections (burrs), solder joints, surface cleanliness, and tool cleanliness. The semi-rigid cable product is a complex cable system. It is important to verify the production-ready status using prototypes.

7. Assembly Techniques

Cutting Semi-Rigid Coaxial Cables to Length:

Semi-rigid cables with copper and aluminum outer conductors are cut using circular saws equipped with metal saw blades made of high-speed steel or cobalt steel. Several bench-top machines are available for this specific task. Special cutting techniques may be required for conductors made of copper-plated steel, stainless steel, or copper alloys. Grinding cut-off discs of suitable thickness are generally sufficient, although deburring may be necessary.
Dry cutting is preferable to cutting with liquid cooling or lubrication to prevent any liquids from penetrating the cable ends.

Stripping the insulation:

Sections of solid tubular outer conductors can be separated by making a circumferential groove or scoring mark and snapping the conductor along that mark. (This is similar to cutting glass: scoring a line and snapping along that line.) The scoring line should be of sufficient depth, be continuous, and the ends should touch. The burr on the outer circumference of the conductor edge should be minimized. When scoring the outer jacket, do not penetrate the dielectric. Scoring the PTFE causes the outer conductor edge to be rolled into the dielectric. This would result in an electrical discontinuity at that point.

Cutting the outer conductor with a rotating saw blade or a jeweler's saw requires subsequent planing and the careful removal of all chips embedded in the dielectric. This method is not recommended for applications that require higher electrical power. The torn-off outer conductor section is removed by snapping the conductor quickly (similar to breaking a piece of glass) by bending it in two opposite directions. Do not bend too far, as this will cause deformation of the conductor edge. The piece can then be pulled off with pliers. If a flush strip to the center conductor is required here, the dielectric can be cut with a razor blade. A twist removes both the conductor and the dielectric at the same time.

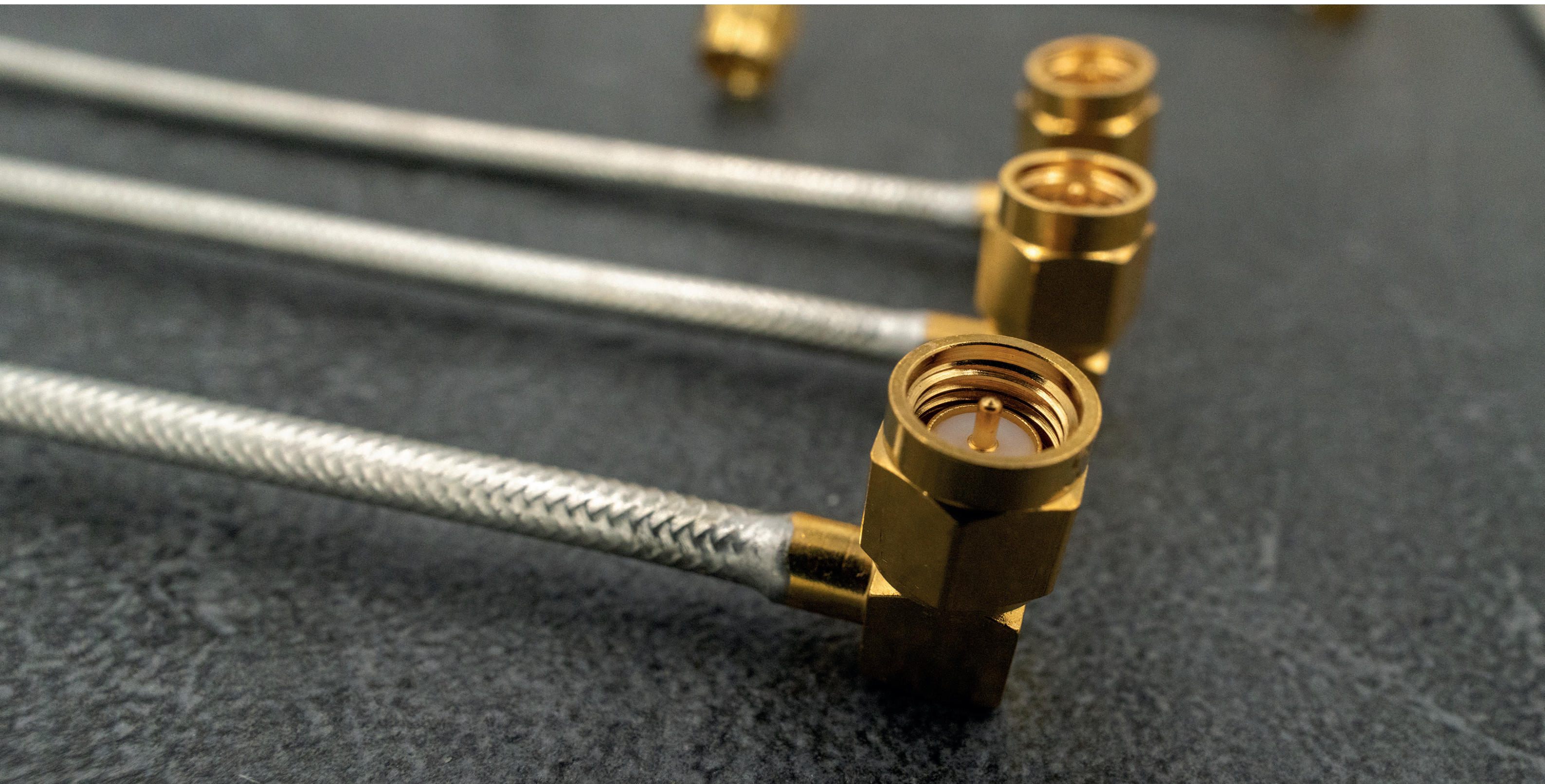
When cutting the dielectric, it is important to use a guide to limit penetration in order to prevent damage to the central conductor. Such damage would not only impair electrical performance, but mechanical stresses during subsequent manufacturing or operating conditions could also cause the conductor to break.

Bending Semi Rigid coaxial cable:

When bending semi-rigid cables, a suitable device should be used that includes a clamping mechanism for the cable and a mandrel with the appropriate dimensions. An ideal mandrel should have a profiled surface to allow the cable to flow smoothly. A sharp edge on the bending mandrel must be avoided at all costs. The tool used to bend the cable should also be profiled so that the cable is fully secured at the bending tangent point.

Large-diameter bends can be performed on flat mandrels with little or no deformation. Due to the complexity of the shapes, special tools may be required, but automated or semi-automated, universally programmable machines are available. To prevent the cable from wrinkling in the bend area, pressure must be applied to the cable at the bend tangent, pressing the cable against the mandrel.

Excessive pressure causes a bulge in the outer conductor at the end of the bend area on the inner side. The cable exhibits a small amount of "springback," so the mandrel must be slightly smaller than the specified bend radius. This is not predictable behavior, so some experimentation is necessary (generally, the larger the bend, the greater the springback). Please observe the bending radii specified in the datasheet and do not fall below them. Otherwise, electrical and mechanical performance will be impaired.



Do You Have Questions?

+49 8171 4357-0
sales@elspecgroup.de

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Impressum

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Concept, Text: Dipl. Ing. Thomas Weber
Photos: Yevhen Pashchynskyi
Layout and Design: Monika Köteles-Stephan, Maisach

el-spec GmbH
Lauterbachstraße 23c
82538 Geretsried
CEO: Thomas Weber
www.elspecgroup.de

Notes

el-spec GmbH
Lauterbachstraße 23c
82538 Geretsried
Tel.: +49 8171 4357-0
Fax: +49 8171 4357-99
E-Mail: sales@elspecgroup.de
www.elspecgroup.de