Connection technology

Cable and tubing are compatible with chain link trunking

Field of application
NEBU modular system for connecting cables and tubing for innumerable applications

Key features
- Comprehensive range of connecting cables and tubing
- Tested to ensure top quality
- Reliable, because everything comes from a single source
- For the most exacting demands

Safe in chain link trunking

For orderly installation: Tubing and cables are used for establishing connections between pneumatic and electrical components. Chain link trunking is used unreservedly to ensure that they are kept neat and tidy. Before tubing and cables are permitted to begin their life of incessant motion in the chain link trunking, Festo fully tests the connection technology for quality.
Be it the automotive, food and packaging, process or electronics industry – every industry and every application has its own particular demands. From hydrolysis resistant or flame retardant and anti-static, right on up to approved for use in the food industry – tubing and cables have to work flawlessly in any environment. Festo has anticipated demand with a comprehensive range in the area of connection technology. A wide variety of materials with different characteristics and resistance properties makes almost anything possible. Reliability is assured when all of the components and matching connection technology come from a single source.

One cable for all requirements

The NEBU modular connecting cable system ensures unlimited possibilities to meet all requirements. The flexible modular system offers application-specific cable qualities for extended cable service life. Whether standard, chain link trunking or robot variants are concerned, all are subject to demanding quality requirements. Depending upon cable quality, each cable is subjected to as many as three tests (alternate bending test, chain link trunking test and torsion test), in order to meet tough in-house standards.

In particular the demands placed upon cables in chain link trunking are highly challenging. The fact that they are in a moving component, harsh ambient conditions and intensive mechanical stress demands especially good cable quality.

The flexibility provided by the NEBU modular system doesn’t end with the selection of the appropriate cable quality. On the contrary, suitable socket connectors, plugs and cable lengths are also easily configurable. And cables which can be produced to any desired length help to reduce costs as well. Standard types can be shipped quickly, straight from stock.

Chain of evidence: tubing

Top quality, optimised flow and long service life for tubing go hand in hand with three factors: the application, being able to with-

Simple and clear-cut: Information on the resistance of various materials to a variety of media can be accessed at www.festo.com/mediareistance.
stand mechanical stress and—especially when used in chain link trunking—correct assembly. For this reason, the conditions of use have to be clarified for the respective application: How much pressure and how much heat will the tubing have to withstand? Does it have to be suitable for use in the food industry, or will it be exposed to welding splatter? Not only are the materials used in the tubing tested (e.g. polyethylene and polyurethane). Festo’s test team also subjects the tubing to endurance trials such as bursting and rupturing tests, in order to ascertain how much mechanical stressing the respective tubing types can stand. This ensures that the right tubing is available for every application. And this applies to the matching connectors as well. After all, procuring everything from the same source provides the user with additional reliability.

**Bending requirements**

Bending radius and abrasion of plastic tubing are of great importance for the more difficult conditions of use in chain link trunking. Tubing is subjected to the acid test here as well. For example, bending: Frequently, only the minimum bending radius of the tubing is measured (figure 1). However, the inside diameter and the flow rate are not taken into consideration. In order to ensure the best possible benefits for the customer, Festo measures the bending radius which is relevant for flow rate (figure 2), in order to assure that pneumatic actuators and control systems receive an adequate supply of compressed air.

In addition to this, tubing and cables which have been laid correctly in chain link trunking last longer. The most important rules for increasing the service life of the tubing is bent in the direction of its inherent curvature until 5% flattening of the outside diameter of the tubing has occurred. The smallest permissible bending radius is then calculated. This test does not involve any reduction of flow.

**Calculation of smallest permissible \( r_{\text{bmin}} \)**

\[
r_{\text{bmin}} = \frac{1}{2} \left( d_A - d_1 \right) \ [\text{mm}]
\]

- \( d_A \) outside diameter
- \( d_1 \) outside diameter of the tubing before deformation
- \( a \) permissible flattening [mm]
- \( d_1 \) inside diameter of the tubing

**Figure 1: Measuring minimum bending radius**

![Figure 1: Measuring minimum bending radius](image1)

**Figure 2: Measuring flow-rate relevant bending radius**

![Figure 2: Measuring flow-rate relevant bending radius](image2)
tubing and cables are listed in the overview under "Orderly tubing and cables: tips for laying tubing and cables in chain link trunking".

Breakout attempts ... ... cause confusion. Spaghetti syndrome in the chain link trunking, erroneous sizing or use of incorrect connecting lines impedes flow thorough the tubing at the cost of service life and function. Festo Systemtechnik regularly produces customer-specific handling systems with moving guide components. Experience gained in this way, as well as test results, lead to comprehensive know-how regarding the great demands placed on cables and tubing. Our high standards are well above the general test requirements. Established guidelines are transferred to series production, and all goods received are subjected to the same criteria. From correct selection of cables and tubing to professional installation – tested to the limit, only top quality and reliable products will reach the customer. This minimises failures and reduces costs. Combined with an uncomplicated ordering system, short lead times and Festo plug and work®, this results in the right solution for every challenge – service included.

Correctly arranged tubing and cables: tips for laying tubing and cables in chain link trunking

- Lay cables and tubing in a twist-free fashion (chain link trunking quality available with diameters of up to 28 mm)
- Take strain relief into account at both ends of the chain link trunking
- Ensure adequate radius and securing at the axes so that the chain cannot roll or slip away
- Select the chain link trunking size according to the largest tubing or cable diameter to be laid
- The bending radius of the chain link trunking should be ten times the tubing and cable diameter
- Bear in mind to reserve space for unobstructed elevation of chain link trunking
- Lay cable and tubing parallel (no crossing) in order to avoid tension. Use separators if necessary