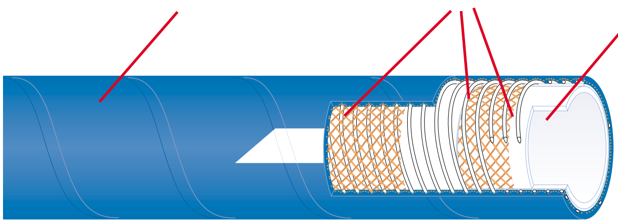
General information

The function of a hose is to transport different materials – solid, liquid or gaseous.
The different areas of use make completely different demands on the hose product.
This is also mirrored in the construction, which can vary considerably, depending on the requirements and wishes of the enduser.
We present here an overview of definitions, principles of construction, material etc. which are of interest to anyone wishing to know a little more about the background to solving different types of hose problems.

Construction of hoses

A hose consists of:

- An inner tube, with an enclosing function which should have good resistance against the transported medium.
- Reinforcement, which absorbs compression strain, positive and negative pressure, and keeps the dimensions of the tube stable under compressive load application.
- A cover, which protects the reinforcement from external stress, such as wear and ozone.

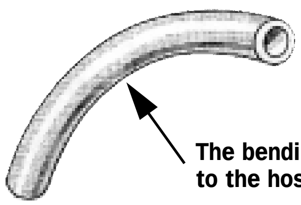


1. Inner tube
2. Reinforcement and helix
3. Cover

The picture above shows the basic principle of construction of a hose. The inner tube and the cover can be manufactured from a number of different polymer materials (rubber-plastic) in order to meet different requirements. When the hose is to be used at both positive and negative pressure, a plastic or steel helix is built into the wall of the tube.

Manageability

The flexure of a hose – manageability – is dependent on several factors such as thickness of material, type of reinforcement, type of material and design. Requirements vary for different types of hose: for example, a pressure hose for workshop tools must be ductile and flexible, with a small bending radius, whereas a pressure oil hose is designed with a large bending radius to enable lifting. The tables show the smallest bending radius of the hoses. This has been calculated as the smallest bending radius a hose can be subjected to without significantly reducing its cross section, or in some other way damaging the hose.
Normally, the cross section should not be reduced by more than about 15% at the bending radius shown, which gives a large margin against kinking of the hose.



Heat resistance

Rubber and plastic materials are subject at elevated temperatures to an ageing effect, which often leads to the materials' becoming hard and brittle.
Ageing progresses faster the higher the temperature, and the life span of a tube is in principle halved at a 10 °C elevation of temperature.

Rubber resistance at ambient air temperature

Type of rubber	Properties
Natural rubber (NR)	Bad
Styren-butadien rubber (SBR)	Good
Ethylene propylene rubber (EPDM)	Excellent
Nitrile rubber (NBR)	Bad
Neoprene (CR)	Good
Flourine rubber (FPM)	Good
Silicone rubber (Q)	Excellent

Contact with other materials than air means different life spans, since other effects than ageing then appear. At temperatures over 100 °C, the strength of the reinforcement materials is reduced, and the resistance against bursting can fall.

Effects of oils and fuels

Even oil-resistant rubber and plastic types swell on contact with mineral oils, petrol etc., but the size of the swelling depends on the type of rubber. The swelling of a single type of material increases with increasing temperature and with the level of aromatic hydrocarbons in the fuel.

Examples of the swelling of different materials.

Rubber material based on	Tenue aux huiles
Natural rubber (NR)	Bad
Styrene butadiene rubber (SBR)	Bad
Ethylene propylene rubber (EPDM)	Bad
Nitrile rubber (NBR)	Very good
Neoprene (CR)	Good
Fluorine rubber (FPM)	Excellent
Silicone rubber (Q)	Good

Effects of ozone

The ozone present in air, or ozone generated by electrical discharge, e.g. from an electric motor, can cause cracking of many rubber materials.
Cracking increases with increasing ozone levels, temperature and linear strain of the rubber. The risk of cracking increases with reduced bending radius, which leads to greater linear strain of the outer rubber which can be affected by ozone. This situation should be kept in mind when storing and installing hoses.

Electrical properties

The electrical properties of different types of rubber materials can vary greatly. In most cases, this property is not significant in using a hose, but in some cases the electrical properties of the rubber can be one of the main prerequisites for the function of the hose. A typical example of this type of application is e.g. cooling water hoses in electrical equipment. These hoses must have an extremely high electrical resistance, i.e. they must be insulating. Other uses require electrically conducting or anti-static rubber, above all where there is a risk of generation of static electricity, for example when pumping fuel or during vacuum cleaning.
The electrical resistance of conducting or antistatic hoses increases to some degree with use and age. If there are special requirements with regard to electrical properties, they should be specified when ordering.

Chemical resistance

Most known chemicals can be transported in hoses from our standard range.
Ask for our special publication “Chemical resistance of hoses” for information on the correct hose for the material in question.

Dimensional tolerances

Longitudinal tolerances

Length (mm)	Tolerances (mm ou %)
L ≤ 300	± 3.0 mm
300 < L ≤ 600	± 4.5 mm
600 < L ≤ 900	± 6.0 mm
900 < L ≤ 1200	± 9.0 mm
1200 < L ≤ 1800	± 12.0 mm
L > 1800	± 1%

Wall thickness tolerances

For hoses with an inner diametre of up to 50 mm and without a built-in helix, the following tolerances for wall thickness apply:

Wall thickness (mm)	Tolerances (mm ou %)
WT ≤ 3.0	± 0.5 mm
3.1 < WT ≤ 6.0	± 0.6 mm
6.1 < WT ≤ 10.0	± 0.8 mm
WT > 10.0	± 10.0%

Where the inner diametre is larger than 50 mm, and for hoses with built-in helix, tolerance is dependent on design and method of manufacture.

Inner diameters tolerances

The following tolerances (acc. to ISO 1307) apply to Trelleborg’s standard range of hoses, unless otherwise stipulated:

<table>
<tr><th rowspan="2">Nominal inner diameter (mm)</th><th colspan="3">Tolerances</th></tr>
<tr><th>Hoses built on rigid mandrel</th><th>Hoses built on flexible mandrel</th><th>Hoses built without mandrel</th></tr>
<tr><td>3.2</td><td>± 0.30</td><td>+ 0.50 to - 0.30</td><td rowspan="3">± 0.60</td></tr>
<tr><td>4.0</td><td rowspan="5">± 0.40</td><td rowspan="5">+ 0.60 to - 0.40</td></tr>
<tr><td>5.0</td></tr>
<tr><td>6.3</td><td rowspan="3">± 0.80</td></tr>
<tr><td>8.0</td></tr>
<tr><td>10.0</td></tr>
<tr><td>12.5</td><td rowspan="4">± 0.60</td><td rowspan="2">+ 0.70 to - 0.50</td><td rowspan="4">± 0.80</td></tr>
<tr><td>16.0</td></tr>
<tr><td>19.0</td><td rowspan="3">+ 0.90 to - 0.70</td></tr>
<tr><td>20.0</td></tr>
<tr><td>25.0</td><td>± 0.80</td><td>± 1.20</td></tr>
<tr><td>31.5</td><td rowspan="3">± 1.0</td><td rowspan="3">+ 1.20 to - 0.80</td><td rowspan="3">± 1.60</td></tr>
<tr><td>38.0</td></tr>
<tr><td>40.0</td></tr>
<tr><td>50.0</td><td rowspan="3">± 1.20</td><td rowspan="2">+ 1.50 to - 1.00</td><td rowspan="11"></td></tr>
<tr><td>51.0</td></tr>
<tr><td>63.0</td><td rowspan="9"></td></tr>
<tr><td>76.0</td><td rowspan="2">± 1.40</td></tr>
<tr><td>80.0</td></tr>
<tr><td>100.0</td><td rowspan="2">± 1.60</td></tr>
<tr><td>125.0</td></tr>
<tr><td>150.0</td><td>± 2.00</td></tr>
<tr><td>200.0</td><td>± 2.50</td></tr>
<tr><td>250.0</td><td rowspan="2">± 3.00</td></tr>
<tr><td>315.0</td></tr>
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