

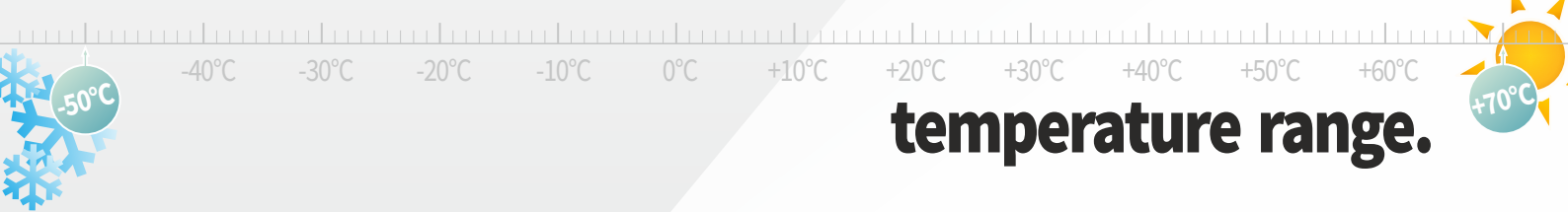
EXO-C0 ETR
EXO-CI ETR

ETR
Extended
Temperature
Range

New cables with the EXO central tube and

EXTENDED

temperature range.



Twisted optical fiber cables and work temperature

Classic twisted optical fibers cables with a loose tube have two characteristics, thanks to which we can easily design a product, that in the temperature ranging from -40°C to $+70^{\circ}\text{C}$, does not change its transmission properties or the changes can be negligible from the designers or network users point of view. They are so-called a stretch and compression window as well as the use of a central element in the form of a nonwoven glass rod.

A compression window provides the possibility of relocating an optical fiber easily, as in the low temperatures the cable elements shrink, because they are made of plastics. In contrast, the central element made of nonwoven fabric and strengthened by resin, reduces the possibility of a shrink. From the one side, the glass has the coefficient of expansion much smaller than plastics and more similar to optical fibers. But from the other, the Younga module has got much bigger coefficient than the plastics, consequently it affects a shrink reduction substantially.

The shrink of material is not the only feature which limits cable's efficiency in a low temperature. Another limiting factor is a thixotropic gel, which fills a loose tube. Consequently, a fiber is "confined" and causes higher attenuation of the transmitted signal.

Why cables with a central tube?

A cable with a central tube, which is a loose

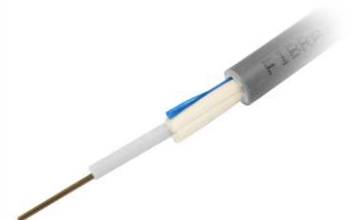
tube placed in the cable axis, has several benefits, on the contrary to twisted cables. These are:

- a diameter in the low number of fibers (up to 24),
- high pliability (as we do not use resistant rods),
- low weight,
- easy and quick preparation to install cables,
- economic choice unlike twisted cables.

However, standard cables with a central tube, available on the market, tend to have a limited scope of temperature in which they can work. A lot of suppliers limit a bottom temperature range to -20°C , -30°C or even -40°C . As a consequence, it eliminates the area of applications (e.g. such cable cannot be used in an open area in our climate) and also a lot of customers demand the -40°C range for their own requirements.

Apart from the plastics shrink, occurring at low temperatures (reversible), fiber optic

cables are susceptible to the shrinkage - after conditioning at $+50^{\circ}\text{C}$ or higher temperature, even after an hour (such examples occur for instance in summer on a open area or during storage as cables are exposed to the sun). It may lead to a substantial increase of attenuation in optical fibers at temperature above 0°C .



A cable with the ETR central tube is able to work in a temperature range from -50°C to $+70^{\circ}\text{C}$.



Bearing all these conditions in mind, the ELMAT company has designed the group of the EXO ETR cables, which are equipped with a central tube with a unique construction, working efficiently in such an extreme range of temperatures as -50°C up to $+70^{\circ}\text{C}$. In these cables a loose tube is placed axially and it is surrounded by a nonwoven glass fabric, which functions as a lengthwise reinforcement for the tensile forces. Furthermore, this nonwoven fabric is surrounded by a protective coating against UV radiation. Cables are available in two sheaths PE and LSOH in the ETR version.

Our unique solution, providing the ability to function in various external conditions, is a special selection of materials and their proper manufacturing, which eliminates the above-mentioned threats in the signal transmission. In addition, the price of cables remains attractive on the market.

To verify the results, a cable coil was placed inside a climatic chamber. Then, it was subjected to several cycles of temperature, which were constantly monitored and concerned the power change of the transmitted signal on 1550nm wavelength. The test results are shown in the attached chart (fig. 1).

As shown in the fig. 1, only lowering a surrounding temperature below -50°C results in a power drop in the transmitted signal (e.g. about 0.2 dB/km at -60°C). What is equally important, even heating a cable at 90°C , does not affect its optical properties.

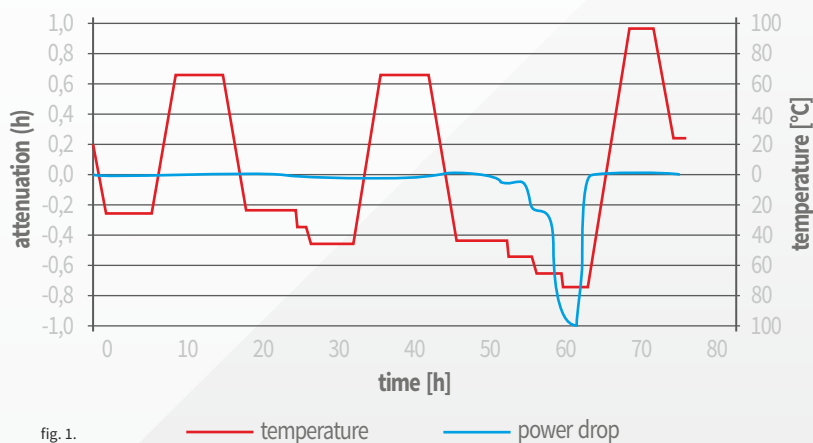


fig. 1.

— temperature — power drop