EXPECTED FIBRE AND CABLE LIFETIME

Optical fibre cables are designed and manufactured to ensure stable and consistent fibre performances for a predicted operating lifetime of at least 25 years under the prevailing environmental conditions (underground and/or aerial installation).

All the optical fibre cable elements such as loose buffer tubes, strength members, plastic sheaths and dielectric or metallic protections are suitably designed to provide adequate means of fibre location, identification and protection during cable manufacture, storage, installation and termination. The structure of these elements and the materials used in their manufacture do not have any long term detrimental effects on fibre performance during the service life of the cable; moreover the materials of the cables are not hazardous to environment and personnel.

In order to ensure full reliability of the optical cables, the following aspects have been taken into account and described in details below:

1 - Fibre reliability

2 - Appropriate cable design

3 – Appropriate installation and working conditions

1- Fibre reliability

Each fibre is tested after the drawing process with a strain of at least 1%, according to the “Fibre Proof Test” in IEC 60793-1-30. During this test the entire length of the optical fibre is subjected to a constant strain with the purpose of ensuring that the fibre does not include flaws which could produce fractures or breaks, when an instantaneous strain is applied during the life of the fibre.

Also a Tensile Strength Test is carried out on long fibre samples, according to IEC 60794 with the purpose of ensuring that the mechanical strength of the fibres is consistent and high. Typical test

Japan Telegärtner Ltd. N-7F, N.E.S. Bldg., 22-14, Sakuragaoka-cho, Shibuya-ku Tokyo, Japan 150-0031 Tel: +81-3-6455-3210 Fax: +81-3-6455-3212
Telegärtner Karl Gärtner GmbH Lerchenstraße 35 D-71144 Steinenbronn Germany Tel: +49-7157-125-100 Fax: +49-7157-125-120

results, in a Weibull distribution form, are given in Figure 1 (The Weibull distribution is one of the most widely used tool to predict lifetime reliability).

A third parameter “Stress corrosion susceptibility” is measured according to IEC 60794; the typical value of the (dynamic) susceptibility factor "n" is about 21 ; short fibre lengths (typically 300 mm) are subjected to increasing loads, with four different strain rates, up to the break.

On a logarithmic plot (see figure 2) the breaking load versus the strain rates will result in a straight line, whose slope is 1/(n+1).

2- Cable design

In optical fibre cable design, it is particularly important to consider the protection of fibre from external stresses under all conditions of use: manufacture, storage, installation and operation.

In loose type construction, fibres are protected from external stresses, either axial or lateral, being loosely contained by a structure (plastic tube) with a high degree of mechanical strength.

The cables are designed, and also the manufacturing process is controlled, in order to assure a longitudinal fibre strain less than 0.05% (zero in practice) in the long term, and less than 1/3 of the proof test (i.e. < 0.33%) in the short term (e.g. during installation).

Furthermore the minimum bend radius of the optical fibre, after cabling process, is generally limited to 50 mm. Under these conditions, according to the Power Law theory as stated in IEC 62048 – TR Ed1, the calculated lifetime is far greater than 25 years with an insignificant failure probability.

3- Installation and working conditions

Normal installation practices and equipment can be used for duct, direct buried or aerial installation, providing that all the manufacturer’s recommendations about tensile load, crush, impact, bend, temperature and other ambient conditions like presence of water, chemicals, animals (insects, rodents, etc.) are fulfilled.

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FIGURE 1 - WEIBULL PLOT

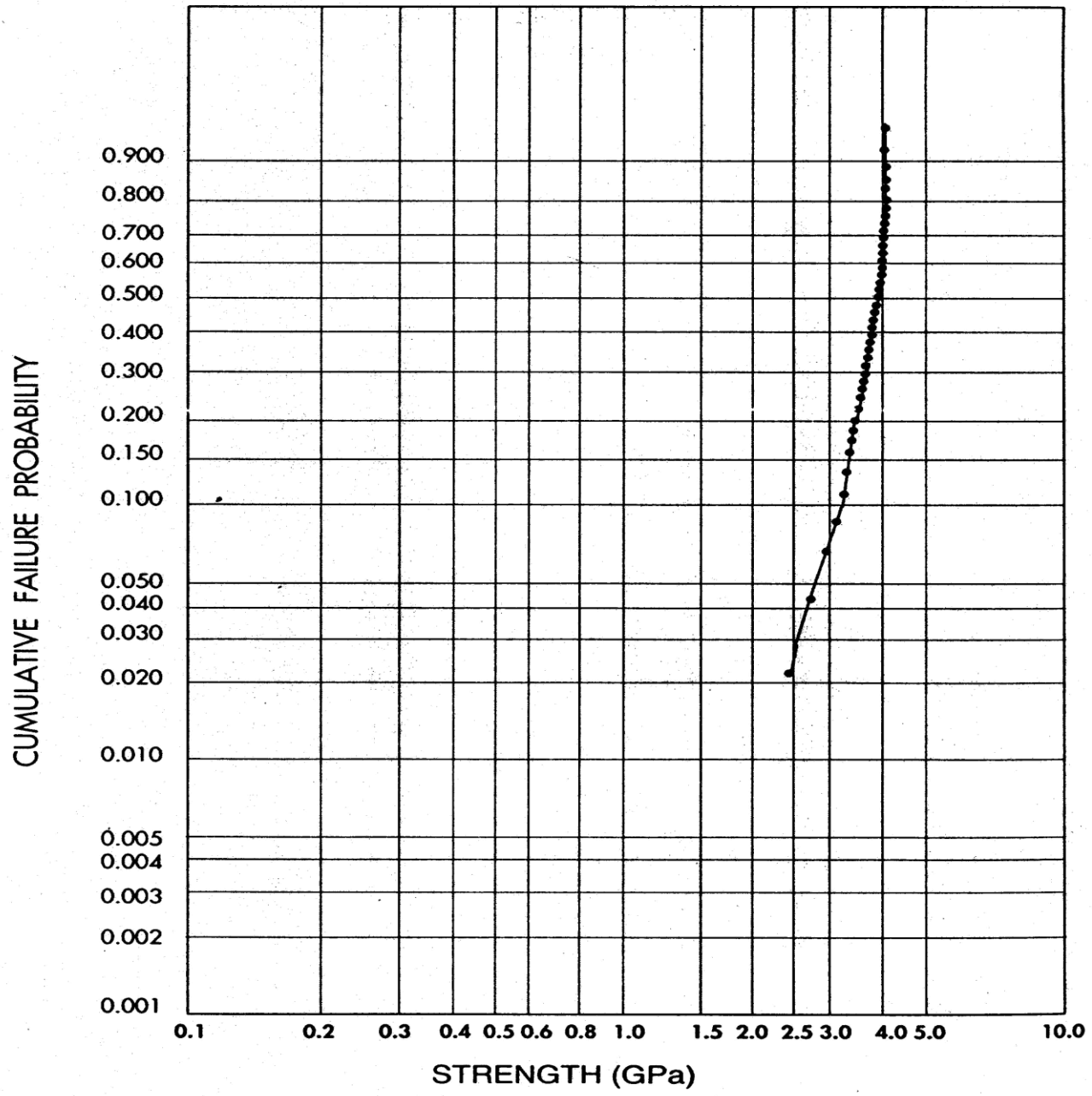

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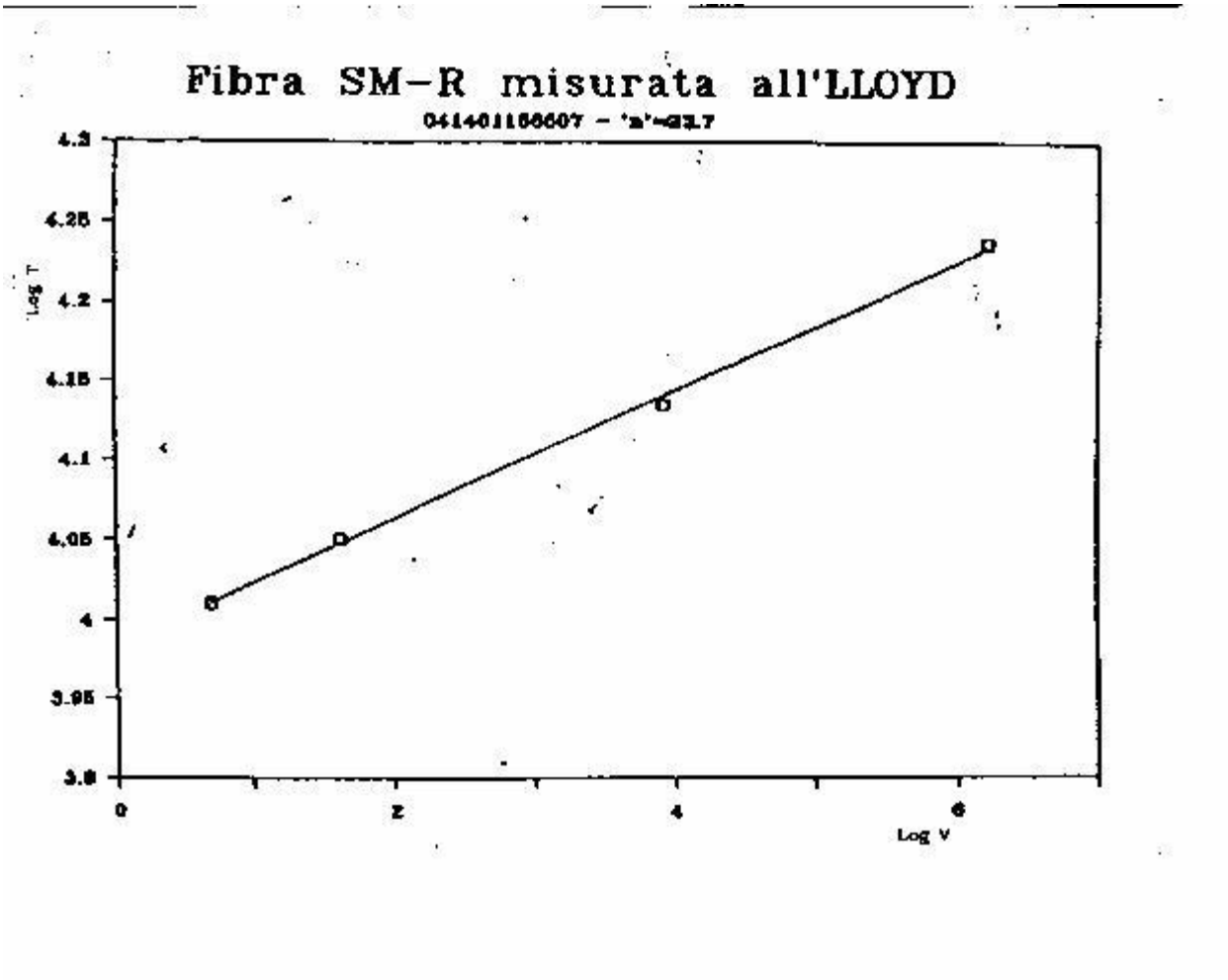
FIGURE 2 – STRESS CORROSION SUSCEPTIBILITY FACTOR (DYNAMIC CONDITIONS)



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