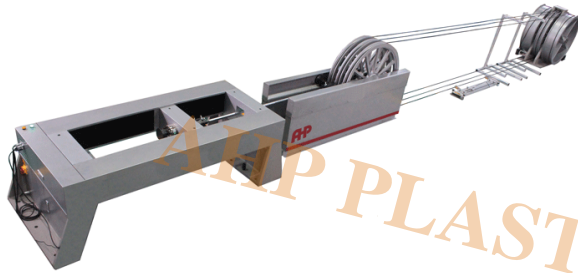


IEC 60794-1-21 Basic Optical Cable Test Procedures – Mechanical Test Methods – Method E1: Tensile Performance

Description



3 Method E1: Tensile performance

3.1 Object

This test method applies to optical fibre cables which are tested at a particular tensile strength in order to examine the behaviour of the attenuation and/or the fibre elongation strain as a function of the load on a cable which may occur during installation and operation. This method is intended to be non-destructive.

3.2 Sample length

Length under tension ≈ 50 m unless otherwise defined in the relevant specification. For cables requiring specialized anchoring devices (e.g. OPGW, all-dielectric self-supporting (ADSS), heavy wire armored cables, etc.), the minimum length shall be 25 m. Short lengths in the tensile test will adversely affect the accuracy of the measurement. The lengths shown above are the recommended minimum lengths for this test. Total sample length is longer than the length under tension to allow for clamping and connection to test equipment.

3.3 Apparatus

The apparatus consists of

- a) an attenuation measuring apparatus for the determination of attenuation changes (see IEC 60793-1-40), and/or a fibre elongation strain measuring apparatus (see IEC 60793_1_22:2001, Method C: Fibre elongation);
- b) a tensile strength measuring apparatus which is able to accommodate the minimum length to be tested. Transfer devices may be used for testing longer samples under tension (see Figure 2). The diameters of sheaves in the transfer device shall be no smaller than the minimum bending

diameter of the cable under test; typically 1 m diameter;

c) a load cell with a maximum error of $\pm 3\%$ of its maximum range;

d) a clamping device to secure all cable components at the ends of the length under test: care should be taken that the specific method of capturing the cable components does not affect the results. A mandrel is frequently an appropriate device, with a diameter typically 1 m, but not less than the minimum bending diameter specified for the cable;

e) if required, mechanical or electrical means for measuring the cable load or elongation, per the detail specification shall be provided. Examples of suitable apparatus are shown in Figure 1 and Figure 2.

3.4 Procedure

3.4.1 General requirements

a) Unless otherwise specified, the conditions for testing shall be in accordance with the expanded test conditions as defined in IEC 60794-1-20.

b) Load the cable onto the tensile rig and secure it. At both ends of the tensile rig, a method of securing the cable shall be used, which uniformly locks the cable so that all components of the cable, including fibres, are restricted in their movement. For most cable constructions (e.g. stranded type cables), clamping on cable elements, except the fibres, is practical and sufficient to obtain attenuation changes and/or both the maximum allowable pulling load and the strain margin of the cable. However, for certain cable constructions (e.g. single loose tube), it may be necessary to prevent the fibres from slipping in order to obtain the correct strain margin figures.

For aerial cable types, if required by the detail specification, the fixing of the cable may be made by means of the anchoring devices relevant to the type of cable considered. For certain heavily armoured cables, a clamping device involving a stocking grip or similar anchoring device may be used.

c) Connect the test fibre of the cable under tensile test to the measurement apparatus. For the pulse delay (time of flight) technique of Method C of IEC 60793-1-22:2001, care shall be taken that, during the pulling of the sample, the reference length does not change.

d) The tension shall be continuously increased to the required value(s) given in the relevant specification.

e) The change of attenuation and/or fibre strain shall be recorded, as a function of cable load or elongation.

f) For cables with a large number of fibres, a multiple attenuation and/or fibre strain measuring device can be used.

g) A representative number of fibres and/or a number of test cycles (typically one) shall be agreed between manufacturer and customer.

h) The readings taken at the end of the time periods stated in 3.4.2 should be stable (i.e. within measurement uncertainty) before the loads are changed or the test completed. If the readings are still fluctuating then the load holding period should be extended until they are stable.

3.4.2 Procedure

Measure the optical attenuation and/or determine the fibre strain before the start of the test as a baseline:

a) apply the short-term load to the cable;

b) hold this load for 10 min;

c) determine fibre strain, if required;

- d) if required, change the applied load to the long term load
- “ hold this load for 10 min,
- “ measure the attenuation and/or determine the fibre strain;
- e) remove the load;
- f) allow the cable to rest for 5 min;
- g) measure the attenuation and/or determine the fibre strain. Different steps and load levels can be used if agreed between customer and supplier.

3.5 Requirements

The attenuation change and/or fibre strain of the sample shall not exceed the values given in the relevant specification.

3.6 Details to be specified

The relevant specification shall include the following:

- “ length under tension if different from this method;
- “ TL long term load: load applied, limits on fibre strain, and/or change of attenuation;
- “ TS short term load: load applied, limits on fibre strain (if required);
- “ Tafter the test: limits on fibre strain and/or change in attenuation.

3.7 Details to be reported

Values for all attributes from 3.6 shall be reported plus the following:

- “ end preparation;
- “ rate of tension increase;
- “ temperature, if different from that indicated for standard test conditions.

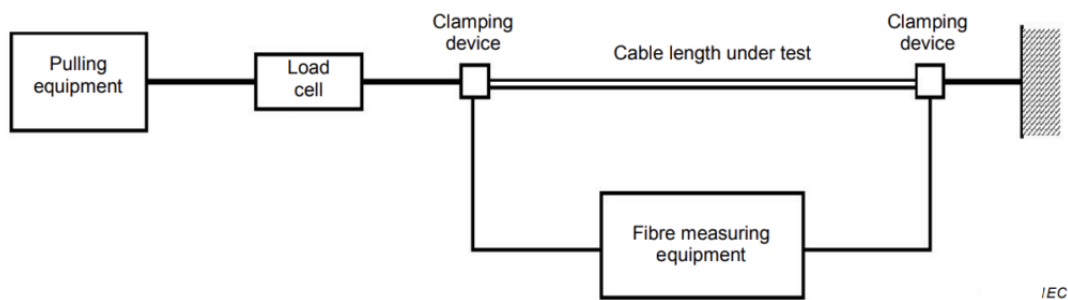


Figure 1 – Tensile performance measuring apparatus

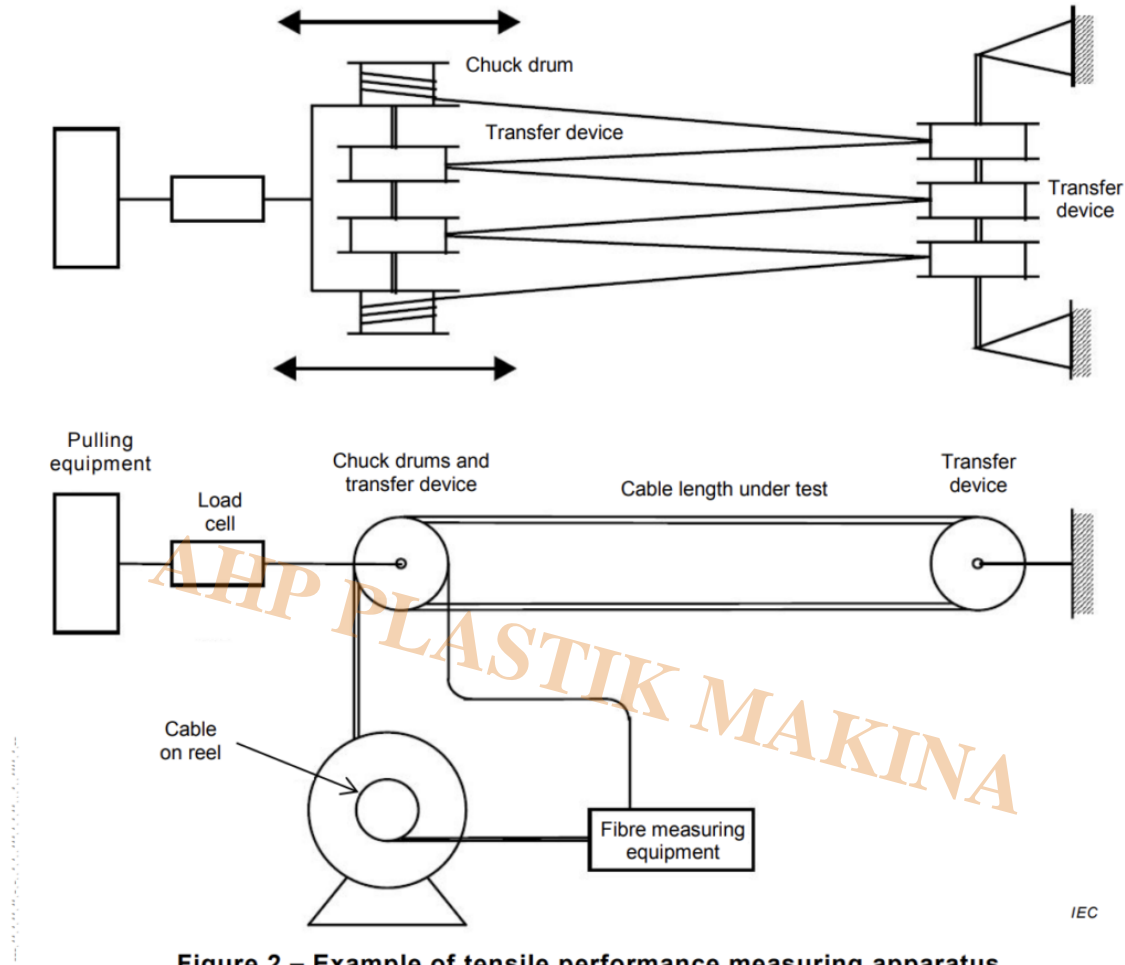


Figure 2 – Example of tensile performance measuring apparatus using transfer devices and chuck drums

Category

1. Equipment for Standards
2. Standards