RECOMMENDATIONS FOR INSTALLATION

Silec Cable

GENERAL RECOMMENDATIONS ON INSTALLATION OF OPTICAL FIBRE CABLES

Optical cables can be installed either by using conventional methods and equipment, such as those used for installing copper cables, or by using specific methods more appropriate to smaller size and weight of optical cables.
With any type of cable, potential damages caused by incorrect installation conditions may not appear at once but can result in time in the performance of the link being more or less impaired.
Whatever the method used, optical cables shall therefore be installed with appropriate care relevant to the ever increasing and vital role they have in present communication networks.

In this framework, the purpose of this document is to remind installers and users of the main usual precautions to be recommended at the various steps of cable installation, and then to contribute to successful building of optical links able to deliver the expected performance. Most of these general recommendations are similar to those considered in the case of traditional metallic cables.
This document does not supersede the relevant rules of art, nor the generic or specific standards and regulations that may apply to installing a given optical link.

We would be pleased to provide on request more detailed advice on specific installation methods and practices, e.g.pulling or blowing in ducts. Useful information can also be found in the guide appended to the IEC 60794.1.1 Publication.

Project and works planning

- Check that the cable design and specifications (e.g. strength members and mechanical protections, moisture barrier, etc.), as well as related equipment (notably splice closures) meet the topology and environment requirements resulting from the planned cabling infrastructure, cable route, installation methods and expected service. The following aspects are especially to be verified according to the intended type of installation (ducted, buried, underwater, aerial, indoor, etc.):
    - that installation conditions are compatible with the cable characteristics as stated in the applicable product specification or technical documentation;
    - that the risks of accidental damage during and after laying are identified;
    - that likely environmental conditions, either climatic or physico-chemical (e.g.temperature, moisture, chemical agents, etc.), or biological (rodents, insects, etc.) are properly taken into account.

- Provide for the arrangements that may prove necessary and plan corresponding works.

Transportation, handling and storage of drums

- Drums of cables shall be transported in upright position and properly fastened.
- Unload using appropriate equipment, avoiding any risk of damaging the drum or the cable.
- Visually check when unloading the good state of the drum, the battens, the cable outer layer and of the watertight sealing caps on both ends. Any damaged cap shall be immediately replaced.
- Rolling of drums shall be limited to short distance and done in a direction not inducing cable uncoiling.
- Drums shall be stored on flat and firm ground, properly fastened and protected from any risk of damage, at ambient temperature within the range specified in the applicable documentation (usual range is –40 to +70°C in case of outdoor cables).

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Cable laying

- **General**
  - Check that the installation techniques and equipment used are suitable for the cable, the infrastructure and the route, and are available in sufficient number and in good working conditions. In case of lubrication (ducted cables), check that the intended lubricant, either dry (microballs) or wet (grease), is compatible with cable jacket and duct materials.
  - Temperature: cable laying shall be carried out only when the ambient temperature is within the limits stated in the applicable documentation, the usual range being -5 to +40℃ for outdoor cables with PE outer sheath. When the temperature is within -5 to +5℃, the drum of cable should be conditioned prior to laying at a temperature of 20℃ during at least 24 hours.

- **Before cable laying**
  - Survey the infrastructure and cable route (cable path and locations of closures).
  - Carry out the inspection and checking procedures (e.g.duct calibration) and the operations regarding, if necessary, clearing, cleaning, drying out the route and making required arrangements at particular places.
  - Provide for suitable means to ensure communication and synchronisation of laying operations along the route.

- **During cable laying**
  - Check that the drum can turn freely and apply suitably controlled braking, so that the cable is uncoiled (preferably from the top of the drum) smoothly, without jolt, nor loosening of coils, nor cable buckling.
  - Ensure that the tension and bending limits specified for the cable are not exceeded all along the route and during all the time of laying. Prevent any risk of damaging the cable due to twisting, kinking, shocks, crushing, abrasion or any other mechanical hazard.
  - If it is necessary to locally coil the cable, this shall only be done using the "figure 8" method and taking appropriate care regarding tension and bending.
  - Check during the laying and at accessible places that the outer jacket of the cable does not show damages liable to affect the cable moisture barrier.
  - Provide for cable extra lengths and overlapping required for further jointing.

- **After cable laying**
  - Immediately after laying, check and, if necessary, refit the watertight caps at all cable ends, either left pending jointing or remaining on the drum.
  - Check at accessible places that the cable is not damaged and carry out with suitable care the operations relating to cable placing, final adjustments (taking up cable slack, "figure 8" coiling of overlengths), fixing, additional protections required at particular places, labelling, etc.
  - During and after jointing operations, ensure and check the proper fastening of strength members in the closures, the arrangement and coiling of fibres and modules, the closures watertightness (if required by environment conditions) and the closures fixing.

- **NOTE**
  - In addition to visually inspecting the good condition of the outer surface of the cable, as described above, optical checks and measurements (OTDR) may be performed at the different steps of the installation, depending notably on available measuring equipment and/or on contractual clauses agreed between the various parties involved.
  - Any incident noted during one operation should cause the operation to be stopped, facts to be recorded and documented, and analysis/assessment to be undertaken in order to define the causes and potential consequences of the incident, as well as the adequate preventive/corrective measures to be implemented.

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INSTALLATION IN DUCTS OF ULTRA-COMPACT ACCESS CABLES (µSHEATH® ACCESS CABLES AND µCABLES) and STANDARD CABLES (µSHEATH®, LOOSE TUBE AND UNIGAINE CABLES)

A few recommendations

1. Ultra-compact access cables (µSHEATH® ACCESS cables and µCABLES) are down-sized and flexible (for small bending radius) as compared to standard cables for ducts. They are dedicated to installation in mini-ducts and micro-ducts (mainly in urban areas) by air or water floating on typical lengths from 1000 to 2000 m (by air floating), 3000 m (by water floating) and more on routes almost in a straight line.
Even if not recommended, in some particular cases (for instance, short installation lengths), when the route configuration is suitable, these cables can be installed by traditional pulling, limiting the tensile force to the maximum value indicated in the cable data sheet (generally this maximum value corresponds to 1.5 times the cable weight/km).

For a non-problematic installation by air or water floating, previously, it's important to check that:
- **1.3 x Ø cable ≤ Ø duct inner diameter ≤ 2.5 x Ø cable,**
- **the integrity and circularity of the duct (no crush, no kinking, no pinch) is preserved by blowing a cylindrical gauge with appropriate dimensions.**

2. Standard cables for ducts (µSHEATH®, Loose Tubes and UNIGAINE) have also to comply to similar rules , with the following spécificities:
- **for air or water floating :**
  - ***cables with outer diameter ≤ 10 mm : duct inner diameter ≥ 1.3 times the cable outer diameter, but without any upper limitation,***
  - ***cables with outer diameter > 10 mm : duct inner diameter ≥ 1.5 times the cable outer diameter, but without any upper limitation.***
  - ***when the duct inner diameter is close to the minimum value (1.3 or 1.5 times the cable outer diameter), installation by water floating gives better results than air floating.***
- **for traditional pulling :**
  - ***duct inner diameter ≥ 2.5 times the cable outer diameter, but without any upper limitation.***

3. On particularly difficult routes, we recommend to install the cable in ducts having the biggest inner diameter as possible (but respecting the limitations described above) according to one (or to both, simultaneously) of the following technics :
- **preferentially use 2 cascaded floating devices (one at the beginning of the route, and a second one at the middle, for example) (*),**
- **double laying i.e. installation starting from the middle of the route using an intermediary cable coiling in an adapted device, such as a « FIGARO » for example (*).**

(*) using these technics, the laying lenghts can be incresased.

4. In all cases, the duct has to be properly installed (limitation of undulations in the vertical and horizontal plans, respect of large bending radius, avoiding severe and very close route direction changes, as far it's possible).

Note : Please consult us if an access cable has to be installed by floating inside an oversized duct (duct inner diameter ≥ 2.5 times the cable outer diameter).

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PARTICULAR CASE OF INSTALLATION IN DUCTS CONTAINING ONE PREVIOUS INSTALLED CABLE

A few recommendations

5. Ultra-compact access cables (µSHEATH® ACCESS and µCABLES) are downsized cables and more flexible cables than standard cables allowing low bending radius. They cannot be directly laid inside a duct occupied by a precious installed cable : it is necessary to insert a sub-duct inside the existing duct before laying according to recommendations listed in paragraph 1.

6. Standard cables for ducts (µSHEATH®, Loose Tubes and UNIGAINE cables) can be laid directly inside a duct occupied by a previous installed cable taking into account the following recommendations:

- **air floating :**
  - **the inner « free diameter » of the duct (DL) is considered to be equal to : $DL = (DT^2 - Dc^2)^{1/2}$ with DT = inner diameter of the existing duct and Dc = outer diameter of the cable occupying the duct**
  - ***the free diameter DL has to be about 2 and 4 times the outer diameter of the second cable to be installed.***
  - ***for the second cable to be installed it is better to use a design with a higher stiffness, for example using a design dedicated for a higher fibre-count than required.***
- **Traditional laying :**
  - ***the free diameter DL has to be about 2,5 times the outer diameter of the second cable to be installed, but without any upper limitation.***
- **In all cases :**
  - ***all recommendations described in paragraphs 3 and 4 are applicable.***
  - ***during installation, it is very important to avoid crossings between the previous installed cable and the second cable to be installed. For that, it is recommended to apply a tensile load on both ends of the existing cable and/or to use a size-adapted tap clamped on the second cable in order to maintain the existing cable at the bottom of the duct as progressively the second cable moves inside the duct.***
  - ***for air floating, it is recommended to use a lubricant***
  - ***sub-ducting of the existing duct is also a good alternative solution instead of direct installation. In this case, recommendations described in paragraph 1 are applicable.***

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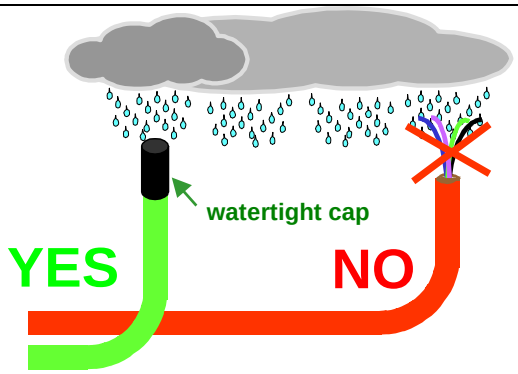
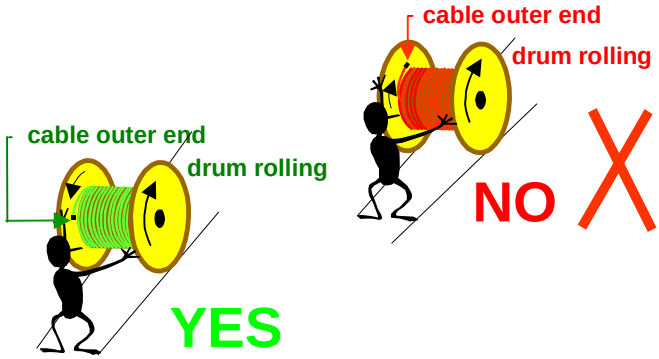
Handle cable with care !

SEALING CABLE ENDS



DRUM ROLLING



CABLE UNWINDING

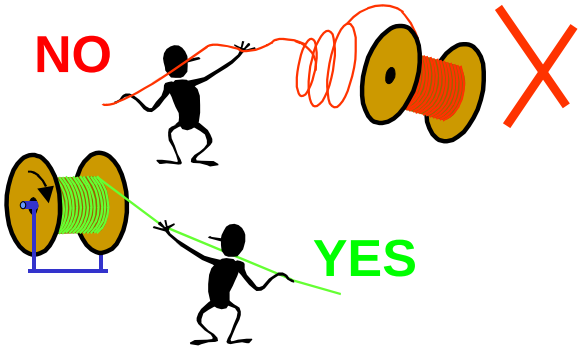
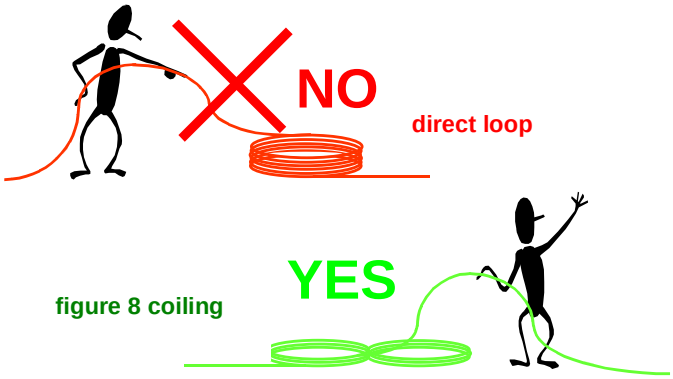
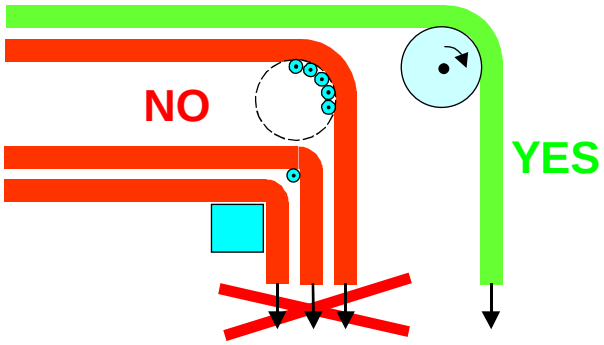


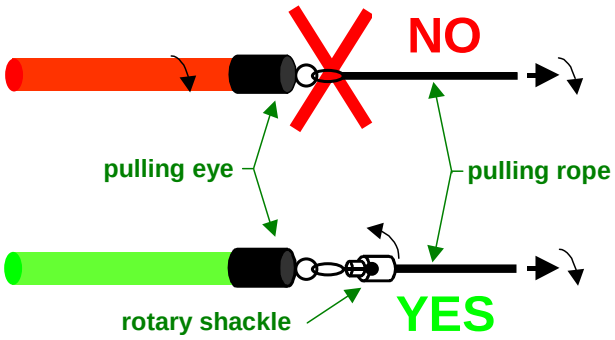
FIGURE 8 COILING



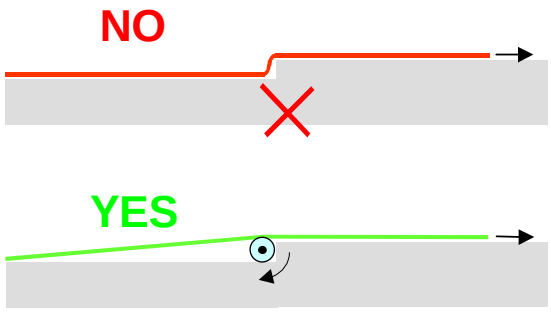
CABLE BENDING



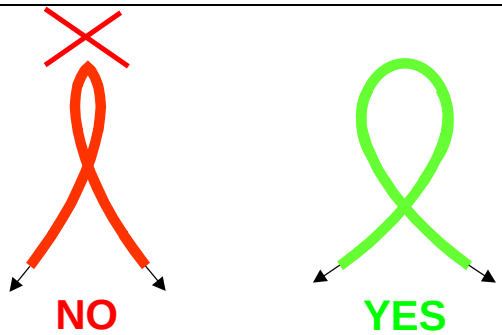
CABLE TORSION



CABLE SHEARING



CABLE KINKING



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