

Guide ACOPTIC®

CABLE STORAGE, TRANSPORT AND INSTALLATION RULES



 **ACOME**
Building Solutions and Networks

Guide ACOPTIC®

Cable Storage, Transport and Installation Rules

This guide provides general guidelines to the customer regarding the storage, transport, handling and installation rules for optical cables.

This document should not constitute your only reference in comparison with the requirements necessary to meet, and should not replace the applicable mandatory information.

Furthermore, if there are local or specific requirements in relation to the transport, the storage or the installation of cables or even if health and safety requirements are more restrictive than those indicated in the present guide, these requirements must be complied with.

All specific indications relating to the installation and/or the handling and/ or the storage of cables are contained in a technical specification.

It is strongly recommended to follow and respect the rules/indications in accordance with the technical specifications.

ACOME reserves the right, at its sole discretion to modify /to amend or altered all information contained in this guide without prior notice.

Guide ACOPTIC®

Cable Storage, Transport and Installation Rules

Contents

1 – General information

- 1.1 Scope of application
- 1.2 Document type
- 1.3 Document purpose

2 – Recommendations for cable handling and use

- 2.1 Unwinding cables
- 2.2 Requirements for implementation of overhead cable.
- 2.3 Opening cables and accessing the fibers
- 2.4 Optical fibers cleaning

3 – Possible causes of characterization issues detected on measurement

4 – Rewinding

5 – Technical requirements

- 5.1 Protection of insulated cables
- 5.2 Packaging
- 5.3 Handling
- 5.4 Other types of packaging
- 5.5 Appearance
- 5.6 Storage conditions

Bibliography

Guide ACOPTIC®

Cable Storage, Transport and Installation Rules

1 – General information

1.1 - Scope of application:

The recommendations made in this document apply to all unimodal optical fiber cables.

Except where specific and/or contrary indications are given in individual technical specifications, these recommendations apply to all ACOME optical cables, whether designed for indoor or outdoor installation.

1.2 - Document type:

This document has been prepared by ACOME for the purpose of presenting the storage, transport and installation rules for optical cables in the form of a user guide.

1.3 - Document purpose:

The recommendations contained in this guide have been prepared by ACOME to assist its customers to ensure optimum storage, transport, handling and installation of ACOME.

2 – Recommendations for cable handling and use

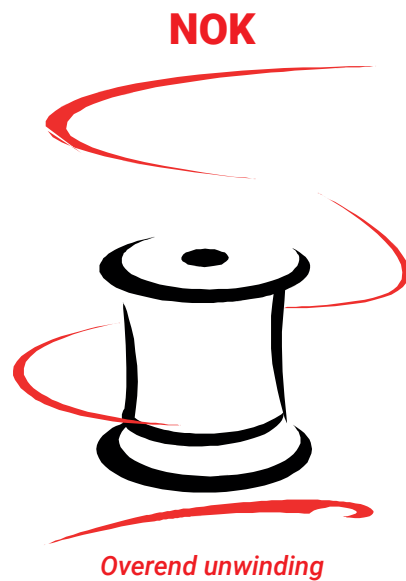
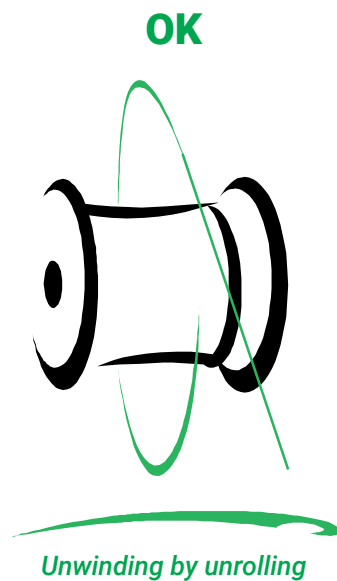
Please refer to the UTE C 30 300 and UTE C90 - 490 codes of practice for general information and key recommendations. This guide has been prepared to provide you with additional information regarding cables.

2.1 - Unwinding cables:

- Cables should not be unwound at temperatures below 0°C.
- Where cables are unwound at a temperature below 5°C, it is important to ensure that the cable has been stored for the previous 24 hours at a temperature of at least 10°C.

When unwinding a drum:

- Do not lay the drum flat on the floor. Never use overend unwinding for optical cable.
 - Do not unwind optical cable vertically: this can cause twisting. Twisting compromises cable transmission performance and life.
- Cable must be drawn from the drum such that it is parallel to the ground.



Guide ACOPTIC®

Cable Storage, Transport and Installation Rules

We strongly recommend that cables are unwound from the drum using a disengageable winch, with systematic and continuous measurement of the pull tension. These measurements should be retained for the full cable warranty period.

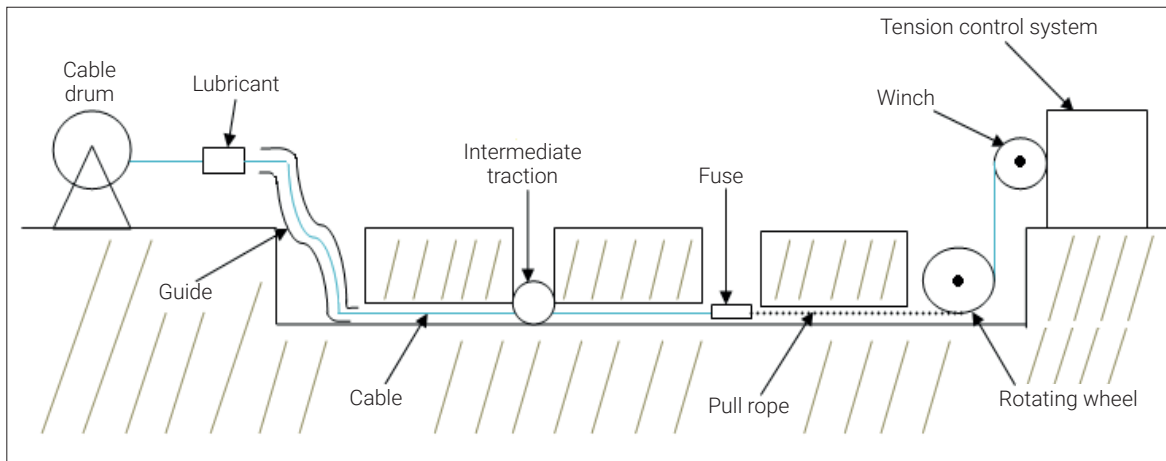
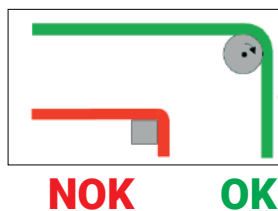


Figure : example showing the installation of optical cable in an underground duct.

If a pulled cable has to go round a corner, use a pulley, because the load on the cable will be lower and any risk of damaging the protective sheath and/or fibers will be totally avoided. It is important to check that the pulley throat diameter is greater than the cable diameter, and that the pulley radius is the same or larger than the dynamic bend radius of the cable (cf. cable technical specification) or at least 10 times the cable diameter: this eliminates any risk of distortion, cable jump and damaging twisting of the cable.

Once laid, the static bend radius of the cable must be at least 5 times the cable diameter or that referred to in the cable technical specification.



I Special circumstances where cable has to be 'unloaded' onto the ground:

Where it is necessary to lay the cable in 2 stages and unload the necessary length in the middle of the cable run, we recommend the use of appropriate cable storage equipment, such as the 'Figaro' and 'Figarino' systems.

Where cable has to be 'unloaded' onto the ground, it is essential to lay coils of cable in a 'figure of eight' pattern (see below) to avoid any twisting of the cable.



Guide ACOPTIC®

Cable Storage, Transport and Installation Rules

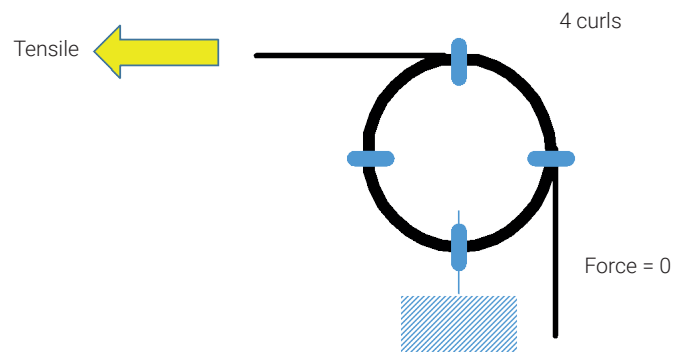
2.2 Requirements for implementation of overhead cable:

Acome requires to perform blocking coils on aerial telecom network. The blocking coil consists of at least four loops of the cable respecting the minimum bending diameter and to lock the loop between them, on a fixed point. Then these loops create an capstan effect which locks the motion of the optical core. And the resulting force at the end of the coil is almost zero. So, all the reinforcing elements contained in the cable participate in containing the effort. On an aerial span, in the presence of blocking coil, the tension applies on the cable within the limits defined by the cable design, and checked according to the standard tensile test.

In extreme cases, and without the presence of blocking coil, the tension applies to the cable casing and generating a sliding of optical core, similar to the extension of the cable.

The immediate consequence is that the fibres will be tight in the splicing enclosure / closure, and could generate the breakage of fibres in these enclosures

It is then necessary to coil the cables (input – output) referred to as a blocking coil. Four loops at minimum static bending radius of the cable:



Ideally, these loops should be made as close to the anchoring clamp. It is however possible to lock them between the anchoring point and the entrance of the box.

Guide ACOPTIC®

Cable Storage, Transport and Installation Rules

2.3 - Opening cables and accessing the fibers:

Where a cable has an integral ripcord, it is always preferable to use this to strip the sheath. It will also protect the core.

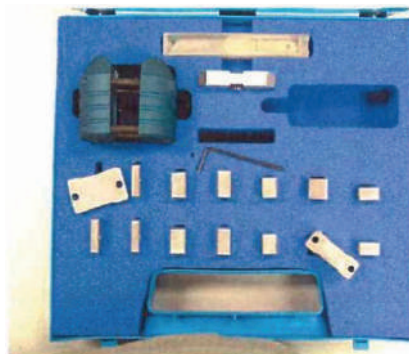
For reasons of ease and safety, the use of a special tool such as the IB3000 is recommended with Central Compact Unit (CCU) and Unitube (UNC) cable structures.



Figure 1 : opening a CU cable



Figure 2 : opening a UNC



IB 3000

2.4 – Optical fibers cleaning:

For the cleaning of optical fibers, it is recommended to use a lint-free (microfiber) cloth and a solvent to eliminate the residues of grease and dust.

If used in normal conditions, the isopropanol, the ethanol and the kerdane are adapted to clean the optical fiber.

With the help of the cloth, they can smoothly clean without damaging the optical fiber and dry quickly without leaving residues. Since it can decrease the performance of the fiber over time, the use of any other solvent needs to be tested before in order to verify if it is compatible with the ageing of the coating of the optical fiber. In this respect, in case any other solvent or derivatives not compatible with the coating of the optical fiber is used, guarantees cannot be applied.

Guide ACOPTIC®

Cable Storage, Transport and Installation Rules

3 – Possible causes of characterization issues detected on measurement

- Cable installation: twisting, kinking, excessively tight dynamic bend radius (the minimum is 10 times the cable diameter), chafing against sharp corners, excessively high pull tension, clamp distortion of the sheath.
- Cable end preparation: correct fiber coil Ø in K7 closures, pinching of fiber, etc.
- Defective connectors ($\alpha_{OK} < 0.5\text{dB}$). This may cause 'false peaks' in reflectometry.
- Incorrectly made connections.

Reflectometry measurement equipment (OTDR):

- Measurement of lengths too short for the equipment.
- Where values are strong, take measurements in both directions and average the two values obtained in order to approve the link.
- Defective connector cords: these should be changed regularly, at least every 500 measurements.
- Pigtail NOK: the length of fiber must be $> 2\text{ km}$, or the type of fiber pigtail is not compatible with the fiber to be characterized (mode field Ø).
- Contact inside connectors or quality of insertion:
 - o Fiber core alignment
 - o Index liquid
- Measurement accuracy: some OTDR units are not particularly accurate for certain wavelengths (refer to the manufacturer's manual).
- OTDR configuration:
 - o Refractive index 'n'
 - o Pulse width
 - o Measurement averaging
 - o Resolution/Scale selected

4 – Rewinding

Where optical cables need to be rewound, a number of precautions must be taken to ensure that the cable retains all its key characteristics.

In practical terms, rewinding poses a risk of damaging the cable. To avoid such damage, the cable must be constantly checked and the pull effort applied during rewinding must be that required by the relevant technical specifications and/or standards.

To achieve this, unwinding and rewinding stands must be fitted with a cable tension adjustment system in order to avoid shock loads when stopping and starting operations. The radii of pulleys fitted to rewinding equipment must always be larger than the dynamic bend radius of the cable, or at least 10 times the cable diameter. Cables must be rewound in joining coils across the full width of the drum, and there must be no riding turns between coils.



Guide ACOPTIC®

Cable Storage, Transport and Installation Rules

5 – Technical requirements

5.1 - Protection of insulated cables:

5.1.1 - Capping of cable ends:

a) The purpose of capping:

The component elements of a cable are usually protected by its external sheath. Nevertheless, these elements can be damaged at either end of the cable if precautions are not taken.

Such damage may result from:

- corrosion of metal components
- moisture penetration and the downgrading of insulation properties
- etc.

It is therefore advisable to protect cable ends using appropriate devices and apply the following principles:

Any isolated cable exposed to the exterior must be suitably capped.

The use of elastomer or adhesive tapes alone should be avoided at all costs.

b) Methods:

- double-coated with hot-melt adhesive
- a flexible plastic cap of suitable diameter
- single-coated plus cap
- crimped metal cap
- double-coated plus cap
- welded metal cap
- heat-shrink cap with or without adhesive

This list is not comprehensive, and each customer may request different methods to be used in order to ensure suitable performance.

5.1.2 - Protection against physical damage and impact:

All (insulated) cables and their packaging are sensitive to impact and physical damage.

a) End fixings:

The fixing method used must prevent the end of the cable from becoming detached or losing tension, thereby creating slack coils, and must not cause unacceptable damage to the cable end. Generally speaking, regardless of the type of cable or wooden drum, the cable is attached to the inside of the side flange, either directly or by means of a connector.

Never cross one coil over another.

It is absolutely prohibited to attach the cable end by capping it beneath the previous coil.

5.2 - Packaging:

5.2.1 - Drums:

With the exception of small cables and optical modules, which may be supplied on reels or tubes (small drums), products are delivered on drums of sufficient capacity and mechanical strength for the dimensions, weights and lengths of cable supplied.

5.2.2 - Coils:

Small diameter cables may be packaged as coils held in place by heat-shrink film and/or ties of a type that will not damage the product, but are sufficiently tight to ensure safe transport of the product. The use of adhesive tape applied directly to the cable should be avoided at all costs. Coils are delivered either individually or grouped on pallets. They are of very limited length, due to their diameter and weight, and to avoid any unwinding problems at the point of installation.

Where coils are palletized, they are shrink-wrapped or heat-shrink-wrapped to each other and to the pallet to provide sufficient damage-free resistance to handling and transport.

5.3 - Handling:

Precautions must be taken when handling, storing, loading, transporting and unloading products to ensure that there is no damage to the product that could prevent or impede its subsequent use.

5.3.1 - Handling method for drums in the horizontal position:

a) When using a manual or motorized lift truck of suitable load capacity:

The following rules apply:

- set the gap between the forks so that it is suitable for the diameter of the drum, and cradle the drum to ensure load stability during the handling
- align the lift truck with the central axis of the drum
- set the forks horizontal
- position the forks either side of the drum, and ensure that the forks project beyond the flange furthest from the lift truck
- If the lift truck has a tilting mast, tilt the mast towards the lift truck so as to elevate the flange furthest from the mast
- transport the drum to its storage location
- lower the drum into position only when the lift truck has come to a halt

Guide ACOPTIC®

Cable Storage, Transport and Installation Rules

b) Using a hoist:

Where slings are used, the following are prohibited: - locating slings on the external staves of the drum or, worse still, the cable itself

- locating slings in such a way as to pose a risk of breaking the flanges of the drum or distorting the flanges to such a degree as to crush the cable.

Where slings are used with a crosspiece, they must be of equal length and support the drum using a bar strong enough for the purpose located through the central axis of the drum. The use of a crosspiece is recommended where the load to be lifted weighs more than 1,500 daN.

c) By hand:

This method is not recommended, except for short distances of just a few meters. The ground must be flat, horizontal and hard enough to ensure that the drum flanges do not sink into it to any appreciable degree. With the exception of extremely short distances, drums should be rolled in the direction in which the cable is wound (this may be indicated by an arrow on the drum): the direction of winding is also the direction which enables the cable to be tightened onto the drum.

N.B.:

- customers may request that the drum is marked with the direction in which the cable should be unwound.

Where this is the case, the direction arrow (in the opposite direction to the arrow referred to above) is accompanied by the words: 'unwinding direction'.

- Where manual handling equipment is used (lever arm, trackmobile, etc.), it should be applied to the tread of the drum flange, and not to the cable.

- Where slopes are involved - no matter how steep or gentle - great care should be taken to ensure that the drum cannot gain speed as it rolls. This can quickly become extremely dangerous for people, equipment and the cables themselves. On any slope, the handling process must include at least two people, one of whom is ready at all times to insert a chock to stop the drum if its speed of rotation can no longer be controlled.

5.3.2 - Handling of drums in the upright position:

Drums should not be handled by inserting forks beneath the upper flange, which could damage both the drum and the cable.

a) When using manual or motorized lift trucks to turn and/or straighten drums : precautions must be taken to

ensure that drum integrity is protected. Drums are normally handled on pallets. Where they are handled without a pallet, care must be taken to avoid damaging the lower flange when loading and unloading by lift truck, by using two strong battens as supports (for example).

5.3.3 - Handling of pallets and drums on pallets:

Pallets should be handled using a manual or motorized pallet or forklift truck. The handling equipment/pallet combination must be designed such that neither the pallet nor the product it carries are damaged during the handling process. More specifically, the width and length of forks and the gap between them must be such that they can lift the pallet across its entire length/width without causing damage.

5.3.4 - In-depot storage:

Cables intended for indoor installation must be stored under cover.

5.3.5 - Loading drums and pallets for transport:

All handling operations must be carried out in accordance with the instructions given in paragraphs 2.3.1, 2.3.2 and 2.3.3. The vehicle must be equipped and arranged in such a way that no damage can occur during transport; if it contains goods other than cables, these must be secured and packaged such that they pose no risk of damage to the cables in transit.

a) Where drums are palletized for transport:

Drums loaded in the horizontal position must be chocked in position using an appropriate method (substantial battens, lengths of timber, etc.) that will not damage the product in transit and will prevent any impact between the product and its surroundings, including when subject to the jolts and bumps inevitable in a moving vehicle. Where drums are loaded in the horizontal position, no other goods must be placed on top of them unless an appropriate system is used (suitable pallets to support drums of the same diameter, staved drums, etc.).

b) Where drums are in the upright position:

If they are movable by hand within the meaning of current legislation, they may be loaded vertically without palletization, subject to the use of an appropriate chocking system to ensure their protection in transit. If they are not movable by hand within the meaning of current legislation, each layer of drum(s) must rest on a

Guide ACOPTIC®

Cable Storage, Transport and Installation Rules

pallet; however two parallel substantial battens may be used for the bottom layer in place of a pallet, to enable loading with a forklift truck.

Transport of drums in the upright position is restricted to drums 1.05 meters or less in diameter (Type C drums). Drums loaded in the upright position must rest on substantial battens, and not on the loading platform of the truck. It is strictly prohibited to nail reels together and/or to planks (for the purpose of improving truck stability).

5.3.6 - Unloading:

The same precautions that applied to handling and loading also apply to the unloading of vehicles. In addition to these precautions, it is further prohibited to allow a full drum to fall to the ground from the load platform of the vehicle.

5.3.7 Handling of individual items of packaging:

The normal rules of good practice governing the handling of items of packaging apply: avoiding falls, overloading, impacts, any type of damage, tilting, over-balancing, etc.

5.4 - Other types of packaging

Cables may be stored in a number of different forms: coils, reels, tubes, box pallets, etc.

The package must be supported appropriately and be firmly attached to its support. It must also carry product identification information, such as:

- the cable reference (or part) number
- quantity
- etc.

5.5 - Appearance:

5.5.1 - Cables:

The cable should be wound in such a way as it can be unwound correctly and without the imposition of any shock loads. The cable tension must be even and regular, with no slack coils. The cable must be free of any material capable of damaging its surface (e.g.: gravel, abrasive dust, weld spatter, spillages of aggressive liquids, etc.).

5.5.2 - Drum:

The drum must be in good condition:
- all lettering must be legible

- there must be no broken staves
- the central stays and staves must be tight
- the banding welds must be intact Drum banding must not be distorted in any way that could injure the user or damage the cable.
- there must be no exposed nails, fasteners, rivets, staples or spikes on the internal faces of the drum. The presence of foreign bodies (stones, bottles, etc.) inside the hollow body of the drum is to be avoided at all costs.

NOTE: Tie bar ends that project excessively beyond the drum flange may pose a danger to users.

5.6 - Storage conditions:

5.6.1 Storage area:

- Undercover storage is obligatory for all optical cables intended for indoor installation. Failure to do so may result in degradation of the sheath and its color.
- Cables sheathed in polyethylene may be stored outdoors, but should be protected from direct sunlight until the cable has been completely installed.

5.6.2 - Cleanliness:

The floor of the storage area must be clean. It must be free from all pieces of metal or nailed wood, stones, nails, staples, etc. that could potentially damage the products.

Bibliography

UTE C 30 300: Règles de l'art - Sur le conditionnement, le stockage et la manutention des câbles, des conducteurs nus et des matériels de raccordements dans les parcs et dépôts (Best practice for the packaging, storage and handling of cables, bare conductors and connectors in storage areas).

NFC EN 60 794-1-1: Câbles optiques de télécommunication - Généralités (Optical and communication cables - General).

Guide ACOPTIC®

Cable Storage, Transport and Installation Rules

Notwithstanding any other provision herein, ACOME makes no guarantee against and shall not be liable regarding to any :

- Improper handling.
- Incorrect and/or non-compliant use which do not comply with the recommendations of transport, storage and installation determined in the present guide.
- Damages caused by impact due to a fall or an accident.
- Direct or/and indirect damages, arising from negligence or defect due to a lack of maintenance or inspection.
- Direct or /and indirect damages or wear as a result of non-compliant use and/or treatments of cables.
- Modification and/or installation of non-compliant spare parts.
- Incorrect adjustment.
- Non-compliant installation or implementation of equipment.
- Lack of maintenance or storage.
- Abnormal operating procedures of associated equipment.

The above list is non exhaustive.

Moreover, ACOME shall not be liable regarding to any use non-compliant with good professional practice, D.T.U and the technical information and/or applicable recommendations.

In any of the events susmentionned, ACOME shall be released from his responsibility/liability.

« IN THE EVENT OF ANY DICREPENCY OR INCONSISTENCY BETWEEN THE DIFFERENTS VERSIONS OF « GUIDE ACOPTIC », ONLY THE FRENCH VERSION SHALL PREVAIL ».