

The background of the slide is a black and white photograph of several large spools of cable or wire arranged on a metal rack. The spools are cylindrical with black end caps. A large, semi-circular blue graphic element is positioned on the right side of the slide, containing the text.

## 6. INSTALLATION AND MANIPULATION

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# Introduction

It is very easy to damage optical cables if manipulation with them is incorrect or if important installation procedures are not followed.

The information stated below should be taken into consideration when installing and manipulating with optical cables. Violating any of the basic rules can result in worsening of the cable's transfer characteristics or it can permanently damage it and shorten its lifetime. The handbook can also serve as a guideline for solving problem not only related to the installation of new cables but also for possible problems of cables, which have already been installed.

There is an assumption that the customer has general knowledge about the design of optical cables and the terminology related to it. If necessary, please contact KDP.

Symbols Used:



# Manipulation and Storage

The drums with the cables cannot be thrown from any heights! The drums with optical cables have to always stand on the edges of the head, secured with a wedge to prevent movement. The only time when it is not necessary to secure the drums with a wedge is when the drums are mutually secured between each other by standing them crosswise. /Pic. 1

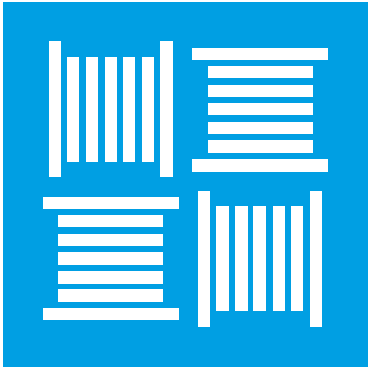
It is possible to store HEAVYDUPLEX, SIMPLEX, DUPLEX type cables and coils with cables up to 4mm in diameter by laying them on the head. However, the cable has to be fastened by shrink wrap to prevent the loosening of individual cable coils.

Cables intended for internal use can only be stored in closed areas without humidity. Cables for universal and outdoor use can be stored in outdoor conditions. However, the cable ends have to be waterproof. However, if the cable is on a plywood spool, it has to be stored in such a manner so as to prevent the effects of water on the spool.

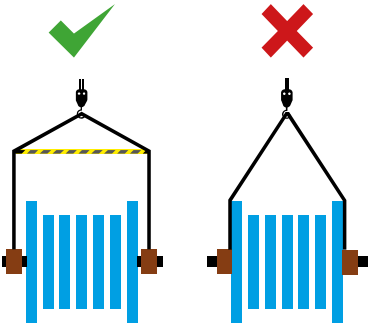
When manipulating with the drums using a crane, a spacer rod has to be placed between the load bearing ropes, so that the ropes do not exert pressure on the cable through the side drums. /Pic. 2

When lifting the drums using a forklift, the drums can only be gripped from the sides and only when the skids of the forklift are long enough for the head of the drum to be positioned on it with a safe overhang. /Pic. 3

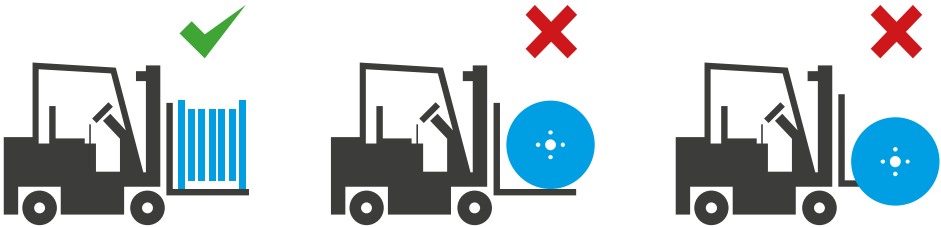
It is only possible to roll the drums short distances and only on a hard and flat surface.



Pic. 1



Pic. 2

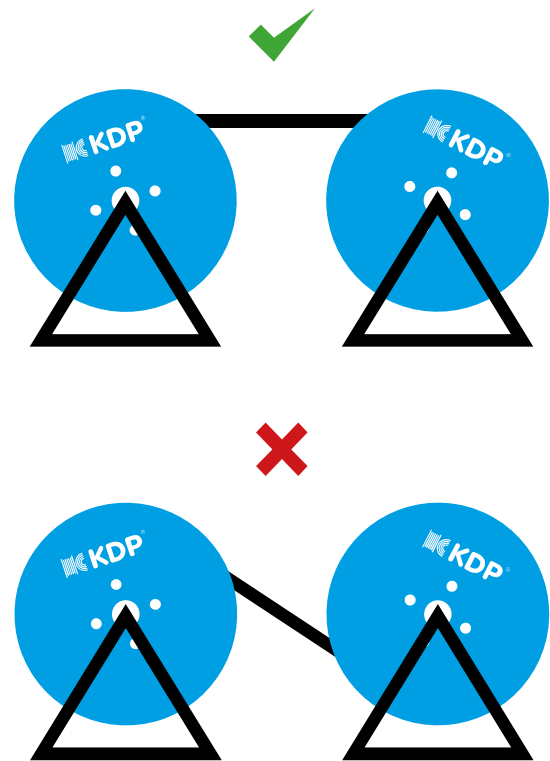


Pic. 3

# Rewinding/Unwinding of Cable

The rewinding and unwinding of cables is only possible in temperature above 5 °C. If for any reason, it is necessary to unwind the cable in a lower temperature, the cable has to be left at a minimum temperature of 20 °C for at least 24 hours beforehand. For rewinding the cable, the winding (bending) direction of the cable has to be maintained, unwinding cannot form an "S" shape. /Pic. 4

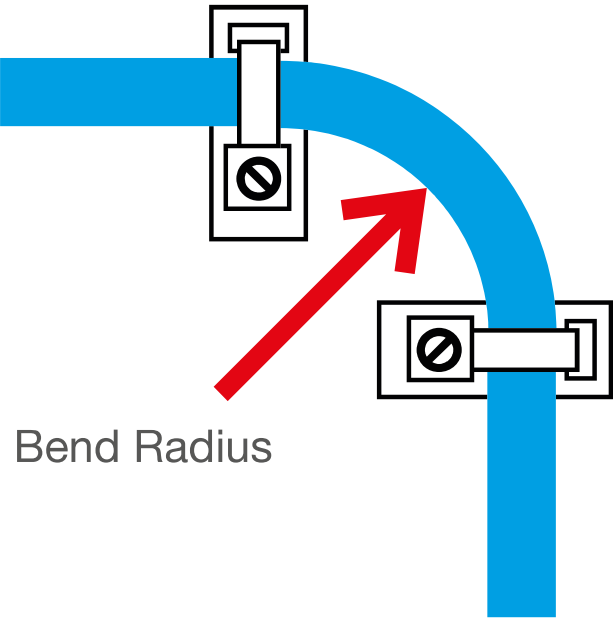
When unwinding the cable, it is necessary to maintain continuous pull without variation. Unwinding without pull can then lead to the loosening of individual rolls and to the consequent mutual under pull, possibly to the uncontrolled, sharp tugging of the cable, resulting in the damaging of the optical fibers.



Pic. 4

# Bend Radius of Cable

This value is defined by the cable manufacturer and exceeding this value can cause invisible fiber damage, which does not have to be evident immediately following installation, but later on. Therefore, it is important to follow the minimum bend diameter not only during in-stallation but also for a cable, which has already been installed.



Pic. 5

# Pull Strength of Cable

Unless stated otherwise, all optical cables manufactured at KDP are designed for conditions under which there is not pull strain exerted during operations, or only such a pull that the fiber in the cable is not strained (such an option is stated in the cable specification). If the straining of cables takes place in operations, we recommend consulting such situation with KDP prior to cable installation.

The maximum pull defined is for the purpose of cable installation and this value should never be exceeded! It is not force that snaps the cable in two, but the limit which guarantees that the fibers will not be damaged.

For checking purposes, upon installation, it is strongly recommended to place a mid-cable and a pull cable measuring pull for the continuous monitoring of the current cable pull. If necessary, also record a video of the course of installation, which then significantly aids in resolving consequent problems following installation. In order to decrease resistance when dragging, it is suitable to use a lubricant. Prior to use, verify that it is compatible with the material of the cable coating.

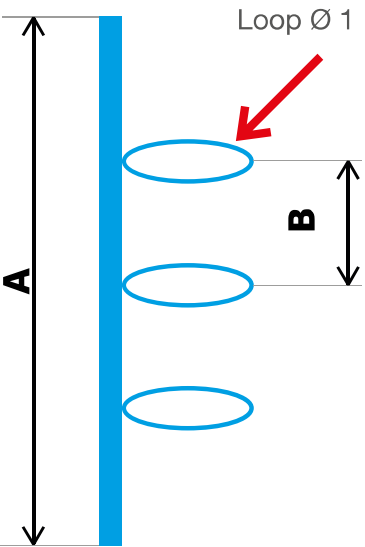
# Vertical Installation

A gel, resistant to dripping up to 70 °C for a period of 24 hours, is used in optical KDP cables. This gel is also excludes oil and maintains its characteristics for the entire lifetime of the cable. Therefore, it is possible to install optical cables with independent secondary protection, a gel-filled tube, vertically, either as a construction with one central tube as well as multi-tube cables. This does not apply for multi-tubes, where the inner cable tube (the space between the individual tubes) is filled with gel. We do not recommend installing such cables vertically.

Conditions for the bend radius of the pull strength and other parameters are the same as for any common horizontal installation. The procedure applies for installation outdoors as well as indoors, sewage systems, etc.

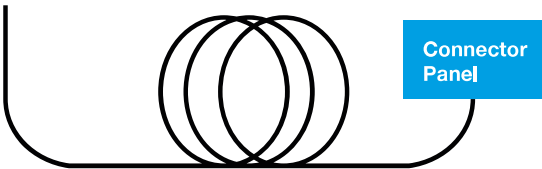
The vertical placement of cables has to be fastened by clamps, to prevent sliding. The maximum distance between individual clamps has to be such, where the weight of the cables between the clamps exceeds the pull strength and does not strain the fibers in the cable. Horizontal loops will form on vertically running cable as a relief element and protection against the possible movement of the cable in case of vibration of the load bearing construction against fixed mounting in the lower part of the cable. The distance of the loops depends on the inner diameter of the tubes in the cable. /Pic. 6

If the cable in the lower part directly enters into the connector panel, it should enter by 3 loops. The purpose of this is to compare the change in the lengths of cables given the change in temperatures. This is from the lower part of the panel, /Pic. 7



Tube Diameter		
A	500 m	300 m
B	20 m	20 m

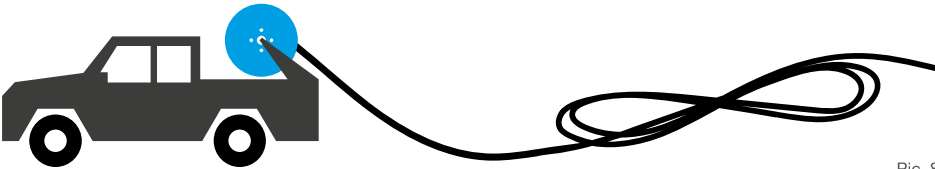
Pic. 6



Pic. 7

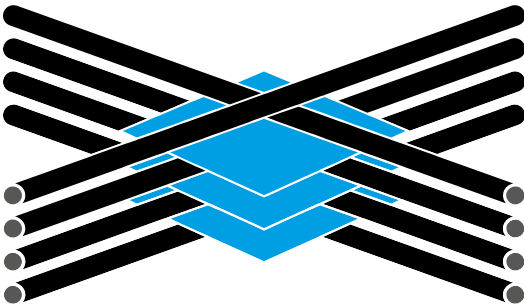
# Twist of Cable

Avoid twisting the cable during installation because this can cause stress to the fiber. If you install a cable longer than 30 m and you are pulling it through a narrower section (for example, underground), unwind the cable beforehand. Place cables freely in a figure eight on the floor. /Pic. 8. Placing cables in a loop prevents twisting. The diameter of the loop should be 2–4 m, depending on the rigidity of the cable. The length of the figure eight is 8–10 m.



Pic. 8

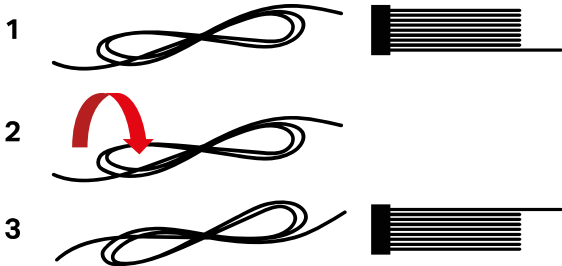
It is recommended to place for example, cardboard paper between individual rolls. /Pic. 9



Pic. 9

Prior to taking the cable from the figure eight, tilt it by 180°, with the aid of other individuals, so that the beginning of the cable is facing upward. /Pic. 10

After pulling it through, do not wind it back up onto the drum, but place it back in a figure eight for further laying.



Pic. 10