



**HV Cable Installation Guideline
and Permissible Mechanical Limits for 60–500 kV
XLPE Power Cables**

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DEPARTMENT

DEPARTMENT OFFICER

APPROVAL

Project Department Manager / Sales

Efe ELVANOĞLU

Project Department Manager / Technical

Ufuk ÇUBUK

REVISION / REASON OF CANCELLATION

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ÜZERİNDE KIRMIZI RENKLİ "KONTROLLÜ" DAMGASI TAŞIYAN BU DOKÜMAN,
İŞ SAĞLIĞI VE GÜVENLİĞİ BİRİMİ' NİN İZİNİ OLMADAN ÇOĞALTILAMAZ,
ÜÇÜNCÜ KİŞİLERE DAĞITILAMAZ. ÜZERİNDE DEĞİŞİKLİK YAPILAMAZ.
FOTOKOPİ İLE ÇOĞALTILAN NÜSHALAR KONTROLSÜZ DOKÜMAN HALİNDE
GELİR. İŞ SAĞLIĞI VE GÜVENLİĞİ SİSTEMİ İÇİNDE KULLANILAMAZLAR.

1.0. PURPOSE, SCOPE AND RESPONSIBILITY FRAMEWORK

The purpose of this document is to define the installation limits and engineering parameters applicable to Demirer Kablo manufactured high voltage XLPE power cables during installation activities.

Compliance with the limits defined in this document is necessary in order to prevent mechanical damage to the cable and to ensure the long-term electrical performance of the cable system.

This document provides general guidance for cable installation and defines the permissible mechanical limits applicable during cable pulling operations.

2.0. APPLICABILITY AND DOCUMENT CONTROL

2.1 APPLICABILITY

This guideline applies to Demirer Kablo manufactured high voltage power cables in the voltage range of 66 kV to 500 kV.

The document defines general installation practices and permissible mechanical limits applicable during cable installation.

2.2 DOCUMENT ACCESS AND REVISION CONTROL

This document may be accessed via QR codes attached to cable drums or through project documentation.

The QR code always refers to the latest revision of this document. Updated versions of the document may be issued without changing the QR code reference.

3.0. GENERAL INSTALLATION CONDITIONS

Cable installation shall be carried out by qualified personnel using equipment suitable for high voltage cable systems.

The installation method shall ensure that the cable is not subjected to mechanical stresses exceeding the permissible limits defined in this document.

Cable installation works shall be carried out in accordance with applicable **health, safety and environmental regulations**.

The installer is responsible for ensuring that all installation activities are performed by qualified personnel using appropriate safety procedures and equipment.

3.1 INSTALLATION PLANNING

Prior to the start of cable installation works, a cable pulling plan shall be prepared.

The installation plan should consider the following parameters:

- cable pulling tension
- sidewall pressure
- bending radius
- route inclinations
- friction conditions
- roller positioning
- pulling equipment capacity

Where calculated values exceed permissible limits, the installation route or method shall be adjusted prior to cable pulling.

Prior to installation, the cable route shall be inspected to ensure that no obstacles, sharp edges or debris are present which could damage the cable during installation.

Where cables enter ducts or pipes, suitable cable entry protection devices or rollers shall be used to prevent damage to the cable sheath during installation.

3.2 MONITORING OF INSTALLATION PARAMETERS

During cable installation, pulling parameters may be monitored using suitable measuring equipment.

Typical monitored parameters include:

- pulling tension
- pulling speed
- pulling distance

These parameters are commonly recorded by the pulling winch monitoring system.

3.3 PULLING ACCESSORIES

Cable pulling operations shall be performed using suitable pulling accessories.

The pulling force shall be applied to the cable using an appropriate pulling eye attached to the conductor. Pulling operations shall not be carried out by applying force to the cable sheath, screen, armour or other cable components.

A swivel (rotating joint) shall be installed between the pulling rope and the pulling eye in order to prevent torsional forces from being transmitted to the cable during installation.

The swivel shall be rated for the expected pulling tension and shall be capable of rotating freely under load.

3.4 CABLE LUBRICATION

Where required, suitable cable lubricants may be used during installation in order to reduce friction forces between the cable and the installation surface, particularly for duct or pipe installations.

Only lubricants compatible with the cable outer sheath material shall be used.

3.5 CABLE DRUM HANDLING DURING PULLING

The cable shall be pulled from the top of the cable drum. The drum shall rotate in the direction indicated by the pulling direction arrow marked on the drum. Incorrect drum rotation shall be avoided.

4.0 INSTALLATION SPEED LIMITS

The maximum permissible cable pulling speed shall not exceed:

$$v_{max} = 15 \text{ m/min}$$

5.0 MINIMUM BENDING RADIUS

The permissible minimum bending radius for high voltage cables is defined below.

5.1 DURING INSTALLATION

Cable Construction	Minimum Bending Radius During Laying
Laminated tape sheath / corrugated Al sheath / lead sheath / Cu wire + lead sheath	20D
Smooth aluminium sheath (with or without fibre optic integration)	25D
Laminated tape sheath with fibre optic integration	20D

5.2 AFTER INSTALLATION (STATIC CONDITION)

Cable Construction	Minimum Radius After Installation (Static)
Laminated tape sheath / corrugated Al sheath / lead sheath / Cu wire + lead sheath	15D
Smooth aluminium sheath (with or without fibre optic integration)	20D
Laminated tape sheath with fibre optic integration	15D

Where D = overall cable diameter (mm).

6.0 CABLE PULLING LIMITS

Cable pulling calculations shall be carried out prior to installation in order to verify that the permissible pulling tension and sidewall pressure limits defined in this document will not be exceeded.

6.1 CABLE DATA REQUIRED

The following cable data are required for pulling calculations:

- Overall cable diameter (mm)
- Conductor cross sectional area (mm²)
- Unit weight of cable (kg/m)

6.2 PERMISSIBLE PULLING TENSION

The permissible pulling tension depends on conductor material and pulling method.

Maximum permissible pulling tension is determined by:

$$F_{max} = A \times \delta_{max}$$

Where;

A = conductor cross sectional area (mm²)

δ_{max} = maximum permissible tensile stress

Values used:

50 N/mm² for copper conductors

30 N/mm² for aluminium conductors

6.3 MAXIMUM CABLE PULLING TENSIONS

Cross Section	Max Pulling Tension Copper	Max Pulling Tension Aluminium
630 mm ² XLPE	3150 kg	1850 kg
800 mm ² XLPE	4000 kg	2100 kg
1000 mm ² XLPE	5000 kg	3000 kg
1200 mm ² XLPE	6000 kg	3600 kg
1600 mm ² XLPE	8000 kg	4800 kg
2000 mm ² XLPE	10000 kg	6000 kg
2500 mm ² XLPE	12500 kg	7500 kg

6.4 SIDEWALL PRESSURE

When cables are pulled around bends, radial loads act on the cable.

If these loads exceed permissible values, mechanical damage to the cable may occur.

Permissible sidewall pressure limits:

Condition	Limit
Rollers in bends	5000 N/m
Rollers in bends (FO integrated cable)	3000 N/m
Pipe wall in bends	7500 N/m
Pipe wall in bends (FO integrated cable)	5000 N/m

6.5 ROLLER LOAD AND SPACING

Maximum cable load per roller during straight pulling:

$$F_{roller} \leq 1500 N$$

Roller spacing shall be arranged such that the cable does not sag or touch the ground between rollers.

Additional rollers shall be installed where required regardless of calculated loads.

6.6 CABLE PULLING FORCE CALCULATIONS

Cable pulling forces shall be calculated considering route geometry.

a) Horizontal cable route

$$F = W \times L \times \mu$$

Where

W = cable weight (kg/m)

L = cable route length (m)

μ = coefficient of friction

b) Sloping cable route

The pulling force increases for uphill installation and decreases for downhill installation.

$$F = W \times L \times (\mu \cos\beta \pm \sin\beta)$$

Where

β = slope angle

"+" for uphill installation

"-" for downhill installation

For slopes up to approximately 20° the following approximation may be used:

$$F = (W \times L \times \mu) \pm (W \times h)$$

Where

h = difference in elevation

c) Curved cable path

When the cable is pulled around bends, the pulling force increases according to:

$$F_o = F_i \times e^{(\mu\theta)}$$

Where

Fo = force at exit of bend

Fi = force at entry of bend

μ = coefficient of friction

θ = bend angle (radians)

7.0 ENVIRONMENTAL CONDITIONS

Cable installation shall not be carried out when the cable temperature is below:

$$T_{min} = -5 \text{ } ^\circ\text{C}$$

8.0 INSPECTION AND TESTS**8.1 VISUAL INSPECTION**

Cables shall be visually inspected prior to installation to ensure that no mechanical damage is present.

8.2 OUTER SHEATH TEST

The outer sheath integrity shall be tested before cable installation and after cable installation.

Test standard: IEC 60229

Test voltage = 10 kV DC

Test duration = 1 minute

8.3 FIBRE OPTIC VERIFICATION

For cables with integrated fibre optic elements, attenuation measurements shall be performed using OTDR before installation and after installation according to the fibre optic cable specification.

9.0 COMPLIANCE AND INSTALLATION RECORDS

Installation parameters may be evaluated against the limits defined in this document. Where installation records indicate that the permissible limits have been exceeded, the cable installation shall be assessed before accessory installation works continue. If required, the cable manufacturer shall be informed for technical evaluation.

The installation limits defined in this document represent the maximum permissible mechanical limits for Demirer Kablo cables. Cable installation works are performed under the responsibility of the installer.

Demirer Kablo shall not be responsible for damages resulting from installation practices where the limits defined in this document are exceeded or where installation is performed without compliance with these guidelines.