






Diepa[®]

Translation of the
Original operating manual
DIEPA Special Wire Rope
acc. Machinery Directive 2006/42/EC


Symbols




	DANGER
	Dangerous situation with the risk of physical injury

	CAUTION
	Dangerous situation with the risk of material damage

	NOTICE
	Helpful information for use

General safety measures

	Wear gloves
	Handling steel wire ropes basically involves the risk of serious injuries and irritations of the skin due to rope lubricants.

  	If required additional safety measures must be taken:
	<ul style="list-style-type: none"> - wear safety shoes - wear helmet - use eye protection

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1 General information

1.1 Intended use

This operating manual exclusively aims on DIEPA special wire ropes used in materials handling equipment like cranes and hoisting devices. Typical applications are e. g. lifting ropes, whip ropes, trolley ropes, pendant ropes, or auxiliary purpose ropes. This operating manual exclusively is valid for stranded ropes for general lifting applications according to DIN EN 12385-4. Those are not suitable to be used as ropes in lifts or mining pits, as slinging ropes or as ropes in rope ways.

1.2 Rope selection

Rope selection is done considering various aspects regarding safety, function, and characteristic rope wear. Basically, when selecting a suitable rope, relevant information given in the equipment's handbook must be considered. In case of doubt the equipment manufacturer or the rope manufacturer must be consulted.

	DANGER
	<p>An inadequate rope selection may lead to severe malfunctions or to premature rope failure. This can lead to serious injuries or death.</p>

Generally, before using a rope the following points must be considered regarding their conformity to the requirements:



- rotation resistant rope / non-rotation resistant rope
- rope diameter
- minimum breaking force of the rope
- direction of lay of the rope

1.3 Basic rope characteristics





Rotational properties

rotation resistant ropes	non-rotation resistant ropes
use when	
<ul style="list-style-type: none"> - unguided loads in single-fall operation - unguided loads in multiple fall operation, when lifting height > 1000 x rope diameter - if rope end is not secured against rotation 	<ul style="list-style-type: none"> - guided loads - use in pairs - unguided loads in multiple fall operation, when lifting height < 1000 x rope diameter

Direction of lay

direction of the outer strands of the rope			
righthanded R		lefthanded L	

Type of lay

direction of the outer wire in the outer strand and of the outer strands of the rope			
Ordinary lay		Lang's lay	
lefthanded LHOL	righthanded RHOL	lefthanded LHLL	righthanded RHLL
			

Other characteristics

rope core	independent wire rope core (IWRC) parallel wire rope core (PWRC) independent wire rope core with plastic impregnation (EPIWRC)
compaction	non-compacted (outer) strands compacted rope compacted
surface treatment	ungalvanized (U) galvanized class B (B)

2 Handling and storage

2.1 Initial check

The condition of the rope and/or its packing should be inspected on the delivery truck or when unloaded. Any mechanical damage to the rope or damage caused during transportation can then be recorded on the delivery document.

2.2 Transport

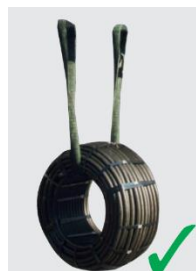
Damage to the rope can result from incorrect or careless handling techniques. Contact with sharp objects or the edges of the arms of a forklift truck will invariably result in damage to the rope:



Alternatively, other methods may be considered, such as the use of a bar through the middle hole of the reel. The reel can then be lifted with a forklift or directly with a sling attached to a crane.



If the arms of the forklift are long enough it is possible to lift the reel directly with the forklift by placing the arms underneath both flanges of the reel. The use of textile slings is very appropriate for lifting coils.



2.3 Storage

Ropes should be stored under dry and dust free conditions and protected against any potential mechanical damage. Any wet packing material must be removed. Storage under high temperatures may negatively affect the useability of ropes. The identification markings of the rope should not be misplaced.

Storage in the open for short periods of time is possible under certain conditions. Direct contact with the ground should be prevented, e. g. by using a pallet. Covering with a plastic foil requires continuous control and regular inspections of the foil for ruptures, which could allow water to penetrate or condensation to build up.

If superficial corrosion has appeared after storage for a longer period under hot and /or moist conditions, this is harmless if detected in time. This phenomenon normally is limited to the outmost winding layer. The affected rope section must be retreated with usual oil or grease or by applying commercial rope care products.



NOTICE

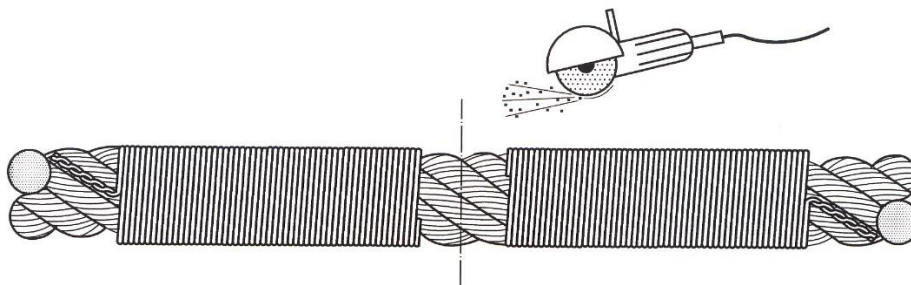
Information on the compatibility of rope lubricants and on agents for re-lubrication is available from the rope manufacturer.

2.4 Cutting of ropes

When cutting DIEPA special wire ropes the following aspects must be considered to prevent damage or negative impact on rope structure.

All **non-rotation-resistant** DIEPA- special wire ropes are especially pre-formed. Hence, especially for smaller rope diameters it is sufficient to secure the rope end by using e. g. an adhesive tape. Ropes of bigger diameters must be treated like rotation-resistant ropes.

Rotation-resistant DIEPA-special wire ropes must be seized with wire on both sides of the cutting point.




Cutting must be done perpendicularly to the rope axis by using a disc cutter.

3 Installation and initial operation

3.1 Rope drive inspection

It is basically advised to inspect a rope drive thoroughly before installing a new rope. Special attention must be applied that all sheaves, drums or any other elements contacting the rope are in a proper condition without showing extraordinary wear, like e. g. increased sheave groove diameters.

	CAUTION The proper condition of the rope drive elements has major influence on the process of rope wear. This must be considered when repeatedly equipping existing applications with new ropes.
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3.2 Spooling off a reel or ring

It is not necessary to unreel ropes on the ground before installation. To prevent damages the following points have to be considered:

a) Spooling off a reel

To prevent the formation of kinks the supply reel should be set up as shown in figure below on the left side. The rope shall never be pulled from a reel which is laying on its side (see picture below right side).



Wooden boards should be used on one or both sides of the reel flange(s) for use as brakes (picture below left side) to prevent the rope from running loose and forming loops on the reel, which could become damaged or displaced over the flange of the reel.



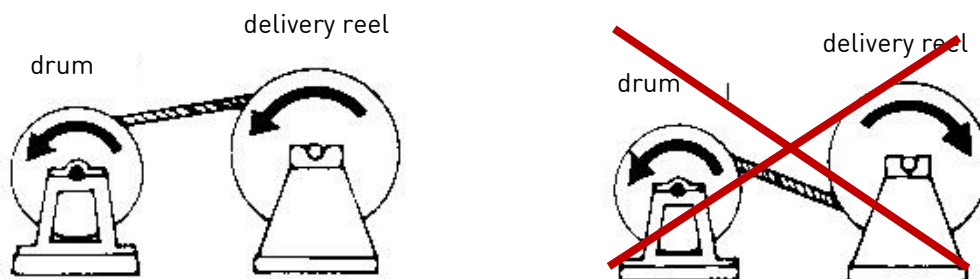
b) Unwinding from a coil

There are two possibilities. The coil can be placed on a turning block (swift) and the rope pulled off (picture below left), or in the case of smaller coils, the rope can be rolled out (picture below middle). Under no circumstances shall the rope be pulled from a coil that lays on its side, otherwise the rope will form loops and be kinked.



3.3 Installing the rope

When the rope is unwound from a reel it is advantageous to maintain the direction of bending as it leaves the reel, thus avoiding any reverse bending of the rope (picture below left).



There are two ways to change a rope: either the old rope is removed, and the new rope is fed on by hand; or the old one is used as a lead rope to pull the new one through the reeving system.

In the latter case it is necessary to ensure that there is a good connection between both ropes. The connection should not be rigid, otherwise any twist present in the old rope will be transferred to the new one. Connecting both ropes with a Chinese finger is, therefore, preferable. When using a Chinese finger ensure that it is firmly secured and unable to slide. Remove any restrictions, such as rope guards, that might affect the smooth passage of the rope through the system before installing the new rope.



For lead ropes only use rotation resistant ropes (semi-rotation resistant ropes) or ropes with the same direction of lay as the rope being installed.



DANGER

Connecting ropes for the purpose of installation has to be done in a way that ensures the required length of the new rope cannot drop uncontrolled. This can lead to serious injuries or death.

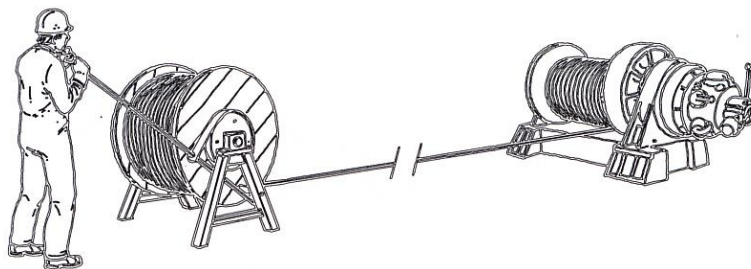
If welded attachments are fitted to facilitate installation, they should be attached to a thinner strand or rope of sufficient strength to withstand the forces that will be induced during installation, see picture below. The distance between the two ropes should be long enough to enable the connecting strand or rope to take up any twist that might be present.



3.4 Pre-tensioned installation in multilayer systems

The installation of a rope on a multiple-layer coiling system must be carried out very carefully. Particular attention must be paid to ensure that the rope sits properly in the bottom of the grooves immediately after leaving the flange or barrel of the drum. This area presents a special problem in that it is where the rope switches from the second to the third layer. If the rope does not sit properly it will suffer an over proportional amount of fatigue in this area.

The rope should be installed under as much load (pre-tension) as possible. The recommended pre-tension is at least 2% of the minimum breaking force of the rope. If the site conditions do not allow this force range, then the supply reel or mounting reel should receive as much braking as physically possible.



It is also advantageous to thread the rope through the bottom hook block as many times as possible so that the rope can be driven out as far as the last couple of coils. Afterwards, several lifts should be carried out alternatively with loads and without loads attached to the bottom hook block. This will help the rope adjust to the reeving system, to the bends in the guiding system and especially to the spooling arrangement at the drum.

4 Operation


4.1 Basic rules for failure free and safe operation

Basically, before operating a rope drive it must be ensured that it is in a proper technical condition. Although during operation a wide variety of harmful influences can appear. The table below summarizes such fundamental harmful effects and their possible influence on the rope:

harmful influence	result on the rope
moving over sharp edges	mechanical abrasion deterioration of the rope structure
torsion along the rope axis (twist)	deterioration of the rope structure
high fleet angles	mechanical abrasion deterioration of the rope structure
rope-to-rope contact (multilayer appl.)	mechanical abrasion premature wire breaks
overload	rope breakage
sudden load release	deterioration of the rope structure
heavily corrosive surrounding	loss of material premature wire breaks
extreme temperatures	see 4.2

A distortion of the original rope structure can cause overloading of single rope elements, such as rope core or single strands. This can result in a premature rope failure, i. e. rope breakage.

Mechanical abrasion decreases the load-bearing metallic area of the rope and thus leads to a reduction of the breaking force. Moreover, it favours the premature development of wire breaks.

	DANGER
<p>Wire ropes are subject to a variety of harmful effects during operation and therefore must be checked regularly. Undetected rope damages can lead to rope breakage. This can lead to serious injuries or death.</p>	

4.2 Operating temperature limitations

Safe operation of wire ropes is limited to a certain temperature range. The level of temperature and its duration must be considered regarding the wire strength, the rope lubrication performance, and the rope terminations. Below table provides guiding values for temperature limits:

critereon	temperature range	rating
tensile strength	-50°C – 100°C 100°C – 200°C	uncritical reduction of breaking force up to 10% may be considered
rope lubrication	-40°C - +90°C > 90°	uncritical potential loss of rope lubrication; increased friction, premature wear
rope end termination		
aluminium ferrule	-40°C - +150°C	uncritical
steel ferrule	-40°C - +200°C	uncritical
metal socketing	-45°C – +120°C	uncritical
resin socketing	-50°C – +110°C	uncritical

If the above-mentioned temperature limitations are exceeded or undercut during operation, the rope manufacturer must be contacted.

5 Maintenance

5.1 Re-lubrication

DIEPA special wire ropes are originally equipped with a special lubrication and corrosion protection, offering high durability and adhesion. Beyond the rope surface, also the internal of the rope is intensively covered with lubricant.

If, caused by certain circumstances, a lack of lubrication becomes apparent at the rope surface, a re-lubrication is necessary. Such done in time has a positive effect on rope lifetime.

Commercially available rope maintenance agents, commonly used oils and greases are suitable for re-lubrication.



NOTICE

Information on the compatibility of rope lubricants and on agents for re-lubrication is available from the rope manufacturer.

However, subsequently applied rope lubricants do not expand deeply into the rope anymore. Hence it is not recommended to re-lubricate excessively. Surplus rope lubricant remains at the rope surface and hinders the detection of wire breaks.

5.2 Shortening (setting back) of ropes

Sometimes, very long lengths of rope in a **single layer coiling system** suffer most of the wear and tear in areas associated with rope that most often bends over the guiding sheaves and/or at the drum. By shortening the rope **at the rope anchorage** (not at the end in the drum) in a timely manner, the affected areas will be re-positioned, thus promoting a longer service life for the rope.


In a **multi-layer coiling system**, the rope wears out mainly at the so-called crossover zones ('S' shaped form assumed by the rope). To offset this wear, it is sometimes possible to shorten the rope **at the drum end**. It is recommended that a length equivalent to approximately one third of the circumference of the drum is cut off. This will have the effect of placing the concentrated areas of wear away from the cross over zones, significantly improving the service life of the rope. Depending on the rope length, it may be possible to repeat this action a second time. A remarkable extension of rope service life can be achieved.

6 Inspection

6.1 When to check?

Wire ropes do wear out and must be inspected at regular intervals by qualified (competent) personnel. The inspection intervals must be scheduled in a way to allow timely identification of deterioration and damage. Moreover a daily visual inspection is required by ISO 4309. A non-linear increase of wire during service time must be considered:



	CAUTION
	Depending on the rope's actual state of wear and the operating conditions of the rope drive the inspection intervals must be adapted and shortened if necessary.

6.2 Where to check?

For ropes operating in **single layer coiling systems**, special attention should be given to those sections of the rope that are bent the most by sheaves and/or the drum. Another critical area of the rope is that section which is running into the sheaves and/or onto the drum when the load is picked-up.

In **multi-layer coiling systems**, the areas of rope that require greater attention are those that get into contact with the flanges of the drum and the cross-over areas where the top layer crosses over the underlying layer.

The inspection procedures should be conducted in accordance with ISO 4309.

6.3 The discard criteria



NOTICE

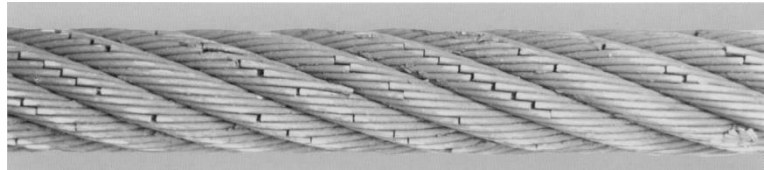
In case of doubt when judging the discard or the rope's state of wear, please contact the rope manufacturer.

Following is a condensed description of the most important discard criteria:

- Wire breaks

This is the most regular form of wear on ropes used conventionally.

Depending on the Rope-Category-Number RCN



the maximum admissible number of wire breaks is defined in ISO 4309. The RCN is determined on basis of the numbers of load bearing wires in the outer strands. The RCN is included in included in our product catalogues as well as on the specific rope certificate.

Counted are the externally apparent wire breaks in the mostly worn rope section. As a reference length $6xd$ (= 6 times nominal rope diameter) and $30xd$ (= 30 times nominal rope diameter) respectively is defined.

If the number of wire breaks defined in ISO 4309 is reached or exceeded on a reference length of $6xd$ or $30xd$, the rope must be discarded.

- Broken strand

If a broken strand is detected the rope must be discarded immediately.

- Reduction of the rope's diameter

Mechanically induced abrasion of wire material on the outside, as well as internal wear result in a reduction of the rope diameter.

The evaluation of how much diameter reduction contributes to discard has to be done according to ISO 4309.

- Corrosion

Due to a lack of wire rope lubricant and / or the presence of corrosive atmosphere (e. g. maritime environment), corrosion signs of different extent may appear on the rope surface. This evokes the loss of wire material and forwards the development of wire breaks due to increased surface roughness.

The evaluation of how much corrosion contributes to discard has to be done according to ISO 4309.

7 Disposal

Ropes made from steel wire must be disposed as regular steel scrap. Further local regulations must be followed.

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