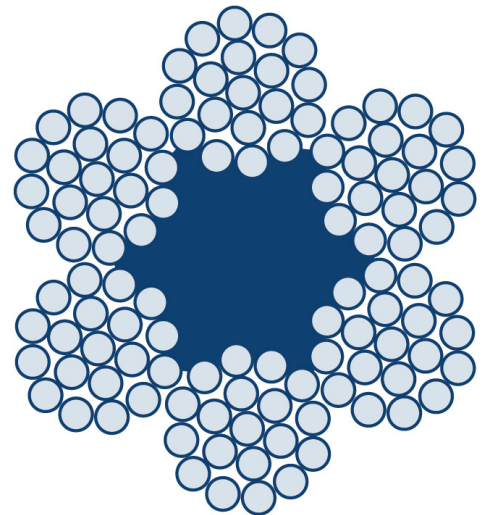


GB Instruction for use

# ROPETEX

## Steel Wire Ropes

User Manual



# ROPETEX Safety Instructions and Information for Use and Maintenance

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## 1. General

This document contains information that will help you with safe and correct use of ROPETEX steel wire ropes. Apart from the instruction manual we refer to existing national regulations on each workplace.

We declare under our sole responsibility that ROPETEX steel wire rope is in accordance with the standard EN 12385-1 to -10.

If the customer makes any modification of the product or if the customer combines the product with a non-compatible product/component, we take no responsibility for the consequences in regard to the safety of the product.

ROPETEX steel wire rope is imported through SCM Citra OY, Asessorinkatu 3-7, 20780 Kaarina, Finland and exclusively distributed by Axel Johnson International - Lifting Solutions Group companies.

All product information and manuals can be found on [www.ropetex.com](http://www.ropetex.com)

All distributors are listed on <https://www.powertex-products.com/offices>

## 2. Use and Maintenance

### 2.1. Limitations on use due to adverse environmental conditions

#### 2.1.1. Temperature

##### 2.1.1.1. Steel wire rope made from carbon steel wires

Account should be taken of the maximum temperature that may be reached by the wire rope in service. An underestimation of the temperature involved can lead to a dangerous situation.

Stranded ropes with fibre cores or fibre centres can be used up to a maximum of 100°C.

Stranded ropes with steel cores and spiral ropes (i.e. spiral strand and locked coil) can be used up to 200°C although some de-rating of the working load limit is necessary, the amount being dependent upon the exposure time at high temperature and the diameter of the wires.

For operating temperatures between 100°C and 200°C the loss in strength may be assumed to be 10%.

For temperatures above 200°C special lubricants may be necessary and greater losses in strength than stated above will need to be considered. The rope or machinery manufacturer should be contacted.

The strength of steel wire ropes will not be adversely affected by operating temperatures as low as -40°C and no reduction from the working load limit is necessary; however, rope performance may be reduced, depending upon the effectiveness of the rope lubricant at low temperatures.

When the rope is fitted with a termination, also refer to 2.1.1.2.

##### 2.1.1.2. Terminations

In addition to the limits stated above for rope, and unless otherwise specified by the rope manufacturer or the manufacturer of the machine, equipment or installation, the following operating temperatures must not be exceeded:

- Turn-back eye with aluminum ferrule: 150°C
- Ferrule-secured eye with steel ferrule: 200°C
- Socket filled with a lead-based alloy: 80°C
- Socket filled with zinc or a zinc-based alloy: 120°C
- Socket filled with resin – refer to resin socketing system designer's instructions

#### 2.1.2. Use in exceptionally hazardous conditions

In cases where exceptionally hazardous conditions are known to exist, e.g. offshore activities, the lifting of persons and potentially dangerous loads such as molten metals, corrosive materials or radioactive materials a risk assessment should be carried out and the working load limit selected or adjusted accordingly.

### 2.2. Before putting the rope into first use

#### 2.2.1. Inspecting the rope and documents

The rope should be unwrapped and examined immediately after delivery in order to check its identity and condition and to ensure that the rope and its termination(s), if any, are compatible with the machinery or equipment to which they are to be attached in service.

**Note:** If damage to the rope or its package is observed, this should be recorded on the delivery note.

The Certificate of conformity by the rope manufacturer should be kept in a safe place, e.g. with the crane handbook, for identification of the rope when carrying out periodic thorough examinations in service.

**Note:** The rope should not be used for lifting purposes without the user having a Certificate in his possession.

Ropetex steel wire ropes comes with:

- a. Declaration of Conformity
- b. 3.1 Test Certificate according to EN 10204
- c. User Instructions (on the reel)
- d. CE Marking (on the reel)

Declaration of Conformity and 3.1 Test Certificate are one document and made available to Axel Johnson International Lifting Solutions Group Companies via Intranet or Online Portal.

### 2.2.2. Storing the rope



A clean, well-ventilated, dry, dust free, undercover location should be selected. The rope should be covered with waterproof material if it cannot be stored inside.

The rope should be stored and protected in such a manner that it will not be exposed to any accidental damage during the storage period or when placing the rope in, or taking it out of, storage.

The rope should be stored where it is not likely to be affected by chemical fumes, steam or any other corrosive agents.

If supplied on a reel, the reel should be rotated periodically during long periods of storage, particularly in warm environments, to prevent migration of the lubricant from the rope.

The rope should not be stored in areas subject to elevated temperatures as this may affect its future performance.

In extreme cases its original as-manufactured breaking force could be severely reduced rendering it unfit for safe use.

The rope should not be allowed to make any direct contact with the floor and the reel should be so positioned that there is a flow of air under the reel. Please be aware that the weight of a reel with steel wire rope can easily exceed the maximum capacity of a EUR pallet.

**Note:** Failure to ensure the above may result in the rope becoming contaminated with foreign matter and start the onset of corrosion even before the rope is put into service.

Preferably, the reel should be supported in an A-frame or cradle standing on ground which is capable of safely supporting the total mass of rope and reel.

The rope should be inspected periodically and, when necessary, a suitable rope dressing, which is compatible with the manufacturing lubricant, should be applied.

Any wet packaging, e.g. sackcloth, should be removed.

The rope marking should be checked to verify that it is legible and relates to the certificate.

When removing from store, the principle 'first in, first out' should be applied.

### 2.2.3. Checking the condition of rope related parts of the machine or installation

Before installing the new rope, the condition and dimensions of rope related parts, e.g. drums, sheaves and rope guards, should be checked to verify that they are within the operating limits as specified by the original equipment manufacturer.

For ropes working on cranes the effective groove diameter should be at least 5% above the nominal rope diameter. The groove diameter should be checked using a sheave gauge.

Sheaves should also be checked to ensure that they are free to rotate.

Under no circumstances should the actual rope diameter be greater than the pitch of the drum. In the case of multilayer coiling, the relationship between the actual rope diameter and the pitch should be assessed.

When grooves become excessively worn, it may be possible to have them re-machined. Before doing so, the sheave or drum should be examined to determine if enough strength will remain in the underlying material supporting the rope after the machining has been carried out.

Grooves should support the steel wire rope over approximately 1/3 of its diameter.

When it comes to advised values and angles for grooves of sheaves there are different standards:

- ISO16625:2013 (45°-60°)
- DIN15061 ( $\geq 45^\circ$ )
- BS 6570 (52°)
- AS 2759 (30°-55°)

We advise you to use the appropriate standard for your region.

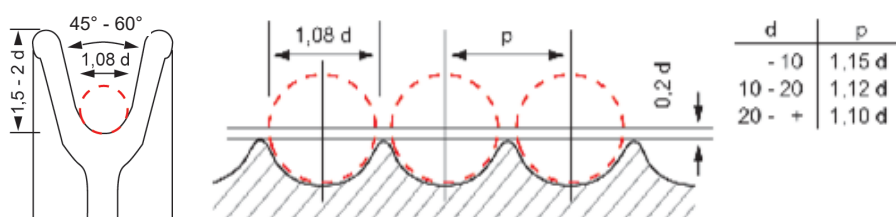


Figure 2-1 Groove diameter and distances

**Note:** When grooves become worn and the rope is pinched at its sides, strand and wire movement is restricted and the ability of the rope to bend is reduced, thus affecting rope performance.



**WARNING!** Worn sheaves should be replaced/refurbished

**WARNING!** The drum can in some cases cause damage to the rope and lead to early discard. If the drum diameter is too small this can cause permanent distortion to the rope which will cause to early discard of the rope.

## 2.3. Handling and installing the rope

### 2.3.1. General

The procedure for installing the rope should be carried out in accordance with a detailed plan issued by the user of the steel wire rope.

The rope should be checked to verify that it is not damaged when unloaded and when transported to storage compound or site. During these operations, the rope itself should not come into contact with any part of the lifting device, such as the hook of a crane or a fork of a fork lift truck. Webbing slings may be helpful.

### 2.3.2. Rope supplied in a coil

The coil of rope should be placed on the ground and rolled out straight, ensuring that it does not become contaminated with dust, grit, moisture or other harmful material.

The rope should never be pulled away from a stationary coil as this will induce turn into the rope and form kinks. If the coil is too large to physically handle it may need to be placed on a turntable which will allow the rope to be paid out as the end of the rope is pulled away from the coil. **Correct methods** of paying out rope from a coil are shown in figures 2-2 and 2-3 below. Figures 2-4 shows an **incorrect** method of paying out rope from a coil.



Figure 2-2 - correct



Figure 2-3 - correct



Figure 2-4 - incorrect

### 2.3.3. Rope supplied on a reel

A shaft of adequate strength should be passed through the reel bore and the reel placed in a suitable stand which allows it to rotate and be braked to avoid overrun during installation.

Where multi-layer coiling is involved the rope should be placed in equipment that has the capability of providing a back tension in the rope as it is being transferred from the supply reel to the drum. This is to ensure that the underlying laps of rope, particularly in the bottom layer, are wound tightly on the drum.

The supply reel should be positioned such that the fleet angle during installation is kept to a minimum. If a loop forms in the rope it should not be allowed to tighten to form a kink.

The reel stand should be mounted so as not to create a reverse bend during reeving, i.e. for a drum with an upper wind rope, take the rope off the top of the supply reel.

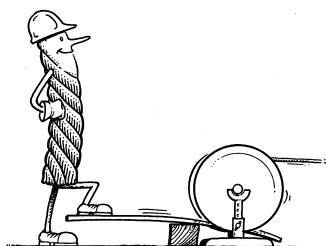


Figure 2-5 - do not create a reverse bend      Figure 2-6 - Installing rope under tension, about 10% of the nominal rope pull

When releasing the outboard end of the rope from the supply reel or coil, this should be done in a controlled manner. On release of the bindings or the rope end fixing, the rope will want to straighten itself and unless controlled this could be a violent action, which could result in injury.

The as-manufactured condition of the rope should be maintained during installation.

If installing the new rope with the aid of the old rope, one method is to fit a wire rope sock to each of the rope ends to be attached. The open end of the sock should be securely attached to the rope by a serving or alternatively by a suitable clip. The two ends should be connected via a length of fibre rope of adequate strength in order to avoid turn being transmitted from the old rope into the new rope. If a wire rope is used, it should be a rotation-resistant type or should have the same lay type and direction as the new rope. Alternatively, a length of fibre or steel rope of adequate strength may be reeved into the system for use as a pilot/messenger line. A swivel should not be used during the installation of the rope.

Monitor the rope carefully as it is being pulled into the system and ensure that it is not obstructed by any part of the structure or mechanism that may damage the rope and result in a loss of control.



**Warning:** The supply reel is not specifically designed for back-tension spooling and might not be strong enough! If back tension spooling is needed, a reel of enough strength should be ordered with the steel wire rope. Else the spooling should be done to the crane drum without back tension, the hook should be lowered max, a sufficient weight (2,5% -5% of the ropes MBL) should be hooked and the steel wire rope could be tightly wound on the drum.

## 2.3.4 Cutting the rope

If it is necessary to cut the rope, secure servings should be applied on both sides of the cut mark. The length of each serving for a stranded rope should be at least equal to two rope diameters.

One serving either side of the cut mark is usually enough for preformed ropes (see EN 12385-2 and/or AS 2759). For non-preformed ropes, rotation-resistant ropes and parallel-closed ropes a minimum of two servings each side of the cut mark is recommended.

Preferably, cutting of the rope should be done using a high-speed abrasive disc cutter. Other suitable mechanical or hydraulic shearing equipment may be used although not recommended when the rope end is to be welded or brazed. When cutting, ensure adequate ventilation to avoid any build-up of fumes from the rope and its constituent parts. Find more information in Chapter 4.

**Note:** Some special ropes contain synthetic material which, when heated to a temperature higher than normal production processing temperatures, will decompose and may give off toxic fumes.

**Note:** Rope produced from carbon steel wires in the form as shipped is not considered a health hazard. During subsequent processing (e.g. cutting, welding, grinding, cleaning) dust and fumes may be produced which contain elements that may affect exposed persons.

After cutting, failure to correctly secure the rope end is likely to lead to slackness or distortions in the rope. An alternative method of cutting is by fusing and tapering, a process which is designed to prevent the wires and strands from unlaying.

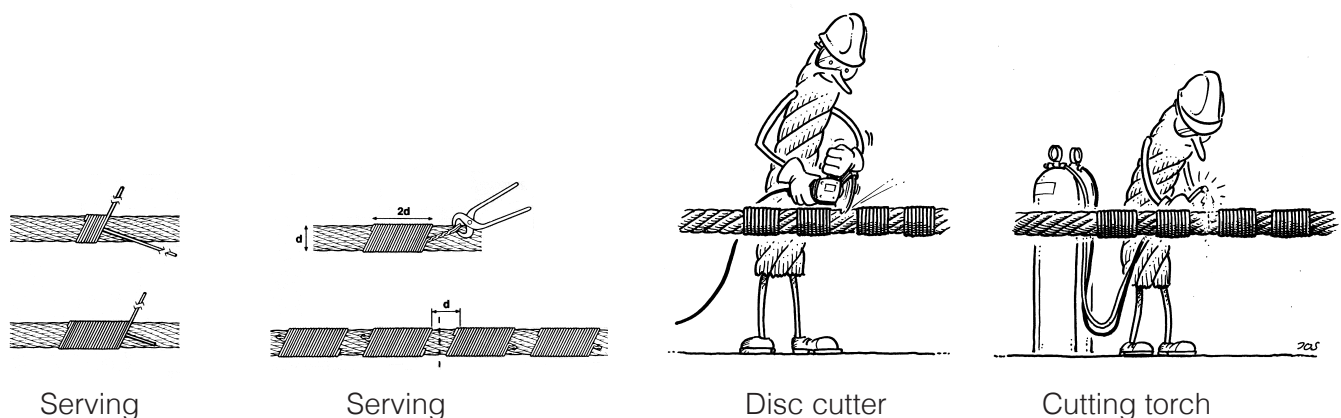


Figure 2-7

## 2.3.5. Running in the new rope

To increase lifetime of your rope its recommended to 'run in' the new rope by operating the equipment slowly, preferably with a low load (i.e. 10% of the Working Load Limit (WLL)) for several operational cycles. This enables the new rope to adjust itself gradually to the working conditions. The rope should never 'run in' with full load or even with overload.

Check that the rope is spooling correctly on the drum and that no slack occurs in the rope or cross-laps of rope develop at the drum.

**Note:** Irregular coiling will inevitably result in severe surface wear and rope distortion



## **2.4. Maintenance**

### **2.4.1. Inspecting and examining the rope**

Inspection and through examination intervals and discard criteria should be in accordance with the following:

- Crane ropes – ISO 4309 and/or AS 2759;
- Lift ropes – ISO/FDIS 4344;
- Cableway ropes – EN 12927-7

#### **2.4.1.1. Daily visual inspection**

Visual inspection of at least the working section of the steel wire rope for that day should be done daily for all attachment points where the rope touches its installation or crane such as drums, sheaves and end termination in order to observe and detect any general deterioration or mechanical damage. It should be also check if the rope can run correctly from the drum and over sheaves as it is intended to do in normal operation.

If any noticeable change in condition is detected a competent person should be contacted to carry out a more detailed inspection.

#### **2.4.1.2. Periodic inspection**

Periodic inspections shall be carried out by a competent person according to mentioned standards and observations should be recorded.

Periodic inspections has the goal to obtain information that assist in deciding for if:

- a. A rope can remain in service and when it should have its next inspection or;
- b. Need to be taken out of service (immediately or within a specific timeframe)

Frequency of this inspection shall be determined by the competent person who shall consider at least:

- a. the statutory requirements covering the application in the country of use;
- b. the type of crane and the environmental conditions in which it operates;
- c. the classification group of the mechanism;
- d. the results of previous inspection(s);
- e. experience gained from inspecting ropes on comparable cranes;
- f. the length of time the rope has been in service;
- g. the frequency of use.

#### **2.4.1.3. Assessment of the rope**

Through an appropriate assessment method, i.e. by counting, visual means and/or measurement, the severity of deterioration shall be assessed and expressed either as a percentage (e.g. 20 %, 40 %, 60 %, 80 % or 100 %) of the particular individual discard criteria or in words (e.g. slight, medium, high, very high or discard).

Any damage that might have occurred to the rope prior to it being run in and entering service shall be assessed by a competent person and observations shall be recorded.

A list of the more common modes of deterioration and whether each one can be readily quantified (i.e. by counting or measuring) or must be subjectively assessed (i.e. by visual means) by the competent person is shown below in table 1.

**Table 1** – Modes of deterioration and assessment methods

Mode of deterioration	Assessment method
Number of visible broken wires (including those which are randomly distributed, localized groupings, valley wire breaks and those that are at, or in the vicinity of, the termination)	By counting
Decrease in rope diameter (resulting from external wear/abrasion, internal wear and core deterioration)	By measurement
Fracture of strand(s)	Visual
Corrosion (external, internal and fretting)	Visual
Deformation	Visual and by measurement (wave only)
Mechanical damage	Visual
Heat damage (including electric arcing)	Visual

#### 2.4.2. Discard criteria

As deterioration often results from a combination of different modes at the same position in the rope, the competent person shall assess the “combined effect”, one method of which can be found in Annex G of ISO 4309:2017. If, for whatever reason, there is a noticeable change in the rate of deterioration of the rope, the reason for this shall be investigated and, wherever possible, corrective action taken. In extreme cases, the competent person may decide to discard the rope or amend the discard criteria, for example by reducing the allowable number of visible broken wires.

In those instances where a long length of rope has suffered deterioration over a relatively short section, the competent person may decide that it is not necessary to discard the whole length of rope, provided that the affected section can be satisfactorily removed and the remaining length is in a serviceable condition.

In general, below list of criteria lead to discard of a steel wire rope

- Broken strand
- Local concentration of wire breaks
- Deformations (corkscrew, caging, kinks, basket)
- At least two wire breaks in strand valleys or adjacent strands within one lay
- length (~ 6x d)
- Significant external and internal corrosion
- Loose rope structure
- Kinks or flattened areas
- Bends or other deformations
- Wire breaks at end terminations
- Protruding wires in loops
- Reduction of rope diameter due to damage of rope core
- Local increase of rope diameter
- Uniform decrease of rope diameter through wear
- Heat effects or electric arc
- Achievement of type and number of wire breaks according to the tables below

#### 2.4.2.1. Visible broken wires

The discard criteria for the various natures of visible broken wire shall be as specified in Table 2.

**Table 2** - Discard criteria for visible broken wires

	Nature of visible broken wire	Discard criteria
1	Wire breaks occurring randomly in sections of rope which run through one or more steel sheaves and spool on and off the drum when single-layer spooling or occurring at sections of rope which are coincident with cross-over zones when multi-layer spooling	See Table 3 for single-layer and parallel-closed ropes and Table 4 for rotation-resistant ropes.
2	Localized grouping of wire breaks in sections of rope which do not spool on and off the drum	If grouping is concentrated in one or two neighbouring strands it might be necessary to discard the rope, even if the number is lower than the values over a length of 6d, which are given in Tables 3 and 4.
3	Valley wire breaks	Two or more wire breaks in a rope lay length (approximately equivalent to a length of 6d)
4	Wire breaks at a termination	Two or more wire breaks

If the rope is a single-layer or parallel-closed rope, apply the corresponding Rope Category Number (RCN) – you can read this on the document specifications on the ROPETEX website - and read off the discard values in Table 3 for broken wires over a length of 6d and 30d. If the construction is not shown, determine the total number of load-bearing wires in the rope (by adding together all of the wires in the outer layer of strands except for any filler wires) and read off the discard values in Table 3 for broken wires over a length of 6d and 30d for the appropriate conditions.

If the rope is a rotation-resistant rope, apply the corresponding RCN and read off the discard values in Table 4 for broken wires over a length of 6d and 30d. If the construction is not shown, determine the number of outer strands and the total number of load-bearing wires in the outer layer of strands in the rope (by adding together all of the wires in the outer layer of strands except for any filler wires) and read off the discard values in Table 4 for broken wires over a length of 6d and 30d for the appropriate conditions.

**Table 3** - Number of wire breaks, reached or exceeded, of visible broken wires occurring in single-layer and parallel-closed ropes, signaling discard of rope (acc. to ISO 4309:2017)

Rope category number RCN	Total number of load-bearing wires in the outer layer of strands in the rope (a) $n$	Number of visible broken outer wires (b)					
		Sections of rope working in steel sheaves and/or spooling on a single-layer drum (wire breaks randomly distributed)				Sections of rope spooling on a multi-layer drum (c)	
		Classes M1 to M4 or class unknown (d)				All classes	
		Ordinary lay		Lang lay		Ordinary and Lang lay	
		Over a length of $6d$ (e)	Over a length of $30d$ (e)	Over a length of $6d$ (e)	Over a length of $30d$ (e)	Over a length of $6d$ (e)	Over a length of $30d$ (e)
1	$n \leq 50$	2	4	1	2	4	8
2	$51 \leq n \leq 75$	3	6	2	3	6	12
3	$76 \leq n \leq 100$	4	8	2	4	8	16
4	$101 \leq n \leq 120$	5	10	2	5	10	20
5	$121 \leq n \leq 140$	6	11	3	6	12	22
6	$141 \leq n \leq 160$	6	13	3	6	12	26
7	$161 \leq n \leq 180$	7	14	4	7	14	28
8	$181 \leq n \leq 200$	8	16	4	8	16	32
9	$201 \leq n \leq 220$	9	18	4	9	18	36
10	$221 \leq n \leq 240$	10	19	5	10	20	38
11	$224 \leq n \leq 260$	10	21	5	10	20	42
12	$261 \leq n \leq 280$	11	22	6	11	22	44
13	$281 \leq n \leq 300$	12	24	6	12	24	48
	$n > 300$	$0,04 \times n$	$0,08 \times n$	$0,02 \times n$	$0,04 \times n$	$0,08 \times n$	$0,16 \times n$

**NOTE** Ropes having outer strands of Seale construction where the number of wires in each strand is 19 or less (e.g. 6x19 Seale) are placed in this table two rows above that row in which the construction would normally be placed based on the number of load bearing wires in the outer layer of strands

(a) For the purposes of this International Standard, filler wires are not regarded as load-bearing wires and are not included in the values of  $n$ .

(b) A broken wire has two ends (counted as one wire).

(c) The values apply to deterioration that occurs at the cross-over zones and interference between wraps due to fleet angle effects

(and not to those sections of rope which only work in sheaves and do not spool on the drum).

(c) Twice the number of broken wires listed may be applied to ropes on mechanisms whose classification is known to be M5 to M8.

(e)  $d$  = nominal diameter of rope.

**Table 4** - Number of wire breaks, reached or exceeded, of visible broken wires occurring in rotation-resistant ropes, signaling discard of rope (acc. to ISO 4309:2017)

Rope category number RCN	Total number of load-bearing wires in the outer layer of strands in the rope (a) <i>n</i>	Number of visible broken outer wires (b)			
		Sections of rope working in steel sheaves and/or spooling on a single-layer drum (wire breaks randomly distributed)		Sections of rope spooling on a multi-layer drum (c)	
		Over a length of $6d_{(d)}$	Over a length of $30d_{(d)}$	Over a length of $6d_{(d)}$	Over a length of $30d_{(d)}$
21	<b>4 strands</b> $n \leq 100$	2	4	2	4
22	3 or 4 strands $n \leq 100$	2	4	4	8
	At least 11 outer strands				
23-1	$71 \leq n \leq 100$	2	4	4	8
23-2	$101 \leq n \leq 120$	3	5	5	10
23-3	$121 \leq n \leq 140$	3	5	6	11
24	$141 \leq n \leq 160$	3	6	6	13
25	$161 \leq n \leq 180$	4	7	7	14
26	$181 \leq n \leq 200$	4	8	8	16
27	$201 \leq n \leq 220$	4	9	9	18
28	$221 \leq n \leq 240$	5	10	10	19
29	$241 \leq n \leq 260$	5	10	10	21
30	$261 \leq n \leq 280$	6	11	11	22
31	$281 \leq n \leq 300$	6	12	12	24
	$n > 300$	6	12	12	24

**NOTE** Ropes having outer strands of Seale construction where the number of wires in each strand is 19 or less (e.g. 18x9 Seale – WSC) are placed in this table two rows above that row in which the construction would normally be placed based on the number of wires in the outer layer of strands.

(a) For the purposes of this International Standard, filler wires are not regarded as load-bearing wires and are not included in the values of *n*.

(b) A broken wire has two ends.

(c) The values apply to deterioration that occurs at the cross-over zones and interference between wraps due to fleet angle effects (and not to those sections of rope that only work in sheaves and do not spool on the drum).

(d) *d* = nominal diameter of rope.

#### 2.4.2.2. Decrease in rope diameter

ROPETEX steel wire ropes are produced with a plus tolerance to the nominal diameter. When measuring the decrease in rope diameter its important to start from the reference diameter, which should be recorded right after installation of the rope but before putting the rope into normal operation. If this reference diameter is not available the diameter most close to the end termination can be measured and taken instead.

Formula according to ISO 4309 for calculating the diameter reduction:  $[(d_{ref} - d_m) / d] * 100\%$

Where

$d_{ref}$  = reference diameter

$d_m$  = measured actual diameter

d = nominal diameter

Single-layer rope with fibre core should be discarded when outcome	$\geq 10\%$
Single layer rope with steel core or parallel closed rope should be discarded when outcome	$\geq 7,5\%$
Rotation resistant rope should be discarded when outcome	$\geq 5\%$

When there is a strong and obvious local decrease in wire rope diameter, i.e. in case of a sunken strand', the rope should be discarded immediately.

In case the Australian standard AS 2759 is followed the rope should be discarded (even if no wire breaks are visible) when the diameter of the rope has diminished to 95% or less of the nominal rope diameter. Also, where surface wires are reduced in diameter by more than one third, the rope shall be replaced.

#### 2.4.2.3. Fracture of strands

If a complete strand fracture occurs, the rope shall be immediately discarded.

#### 2.4.2.4. Corrosion

Corrosion will occur more in marine environments and environments where there is a high degree of air pollution. Besides these external influences corrosion is mainly due to a lack of proper maintenance and maintaining the rope is well lubricated. Corrosion will influence the lifetime and breaking strength of a steel wire rope.

ISO4309-2010 gives guidance on discard criteria for corrosion:

External corrosion that can be wiped clean and/or brushed clean	No discard
External corrosion with a rough to touch wire surface	60% of discard
External corrosion with heavily pitted and slack wires	discard
Obvious internal corrosion (i.e. visible through the valleys between outer strands)	discard

#### 2.4.2.5. Waviness

Waviness in a steel wire rope is a form of deformation. Deformation of the rope construction leads (over time) to unequal distribution of forces in the wire rope. The wire rope should be discarded when waviness is detected.

#### 2.4.2.6. Basket deformation

Ropes with a basket or lantern shall be immediately discarded or provided the remaining length of rope is in a serviceable condition, have the affected section removed.

#### 2.4.2.7. Protruding core or strands

Ropes with core or strand protrusion shall be immediately discarded or provided the remaining length of rope is in a serviceable condition, have the affected section removed.

#### 2.4.2.8. Protruding wires in loops

Ropes with protruding wires, usually occurring in groups on the opposite side of the rope to that which is in contact with a sheave groove, shall be immediately discarded. If it's only a single wire that is protruding it can be removed by bending it until it breaks, close to the inside of the strand in order to avoid this wire damaging surrounding wires and strands. See figure 2-8.

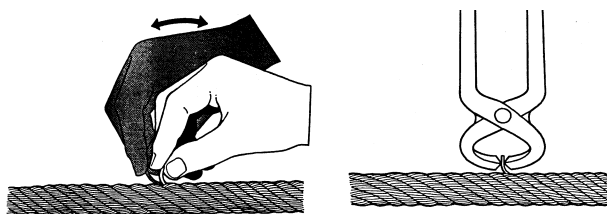


Figure 2-8 removing protruding wires

### 2.4.3. Lubricating the rope in service

The protection provided by the original manufacturing lubricant is normally adequate to prevent deterioration due to corrosion during shipment, storage and the early life of the rope; however, in order to obtain optimum performance, most ropes will benefit from the application of a service lubricant, the type of which will be dependent upon the rope application and the environmental conditions to which the rope is exposed. Lubrication has also an important role in decreasing internal friction of individual wires rubbing against each other.

It's therefore important to re-lubricate the rope on a regular basis, depending on its use.



**WARNING!** An unlubricated or incorrectly lubricated rope has a significantly reduced life.

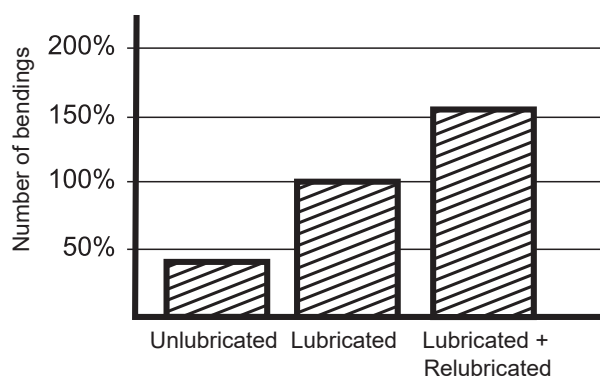


Figure 2-9 Importance of relubrication of a rope

The service lubricant must be compatible with the original manufacturing lubricant and in the case of a traction drive rope, not impair its frictional characteristics. Refer to the recommendations of the rope manufacturer or the original equipment manufacturer.

Typical methods of applying the service lubricant are by brush, drip feed, portable pressurized spray or high pressure. This latter system is generally designed to force the service lubricant into the rope under high pressure while simultaneously cleaning the rope and removing moisture, residual lubricant and other contaminants.

Failure to apply a service lubricant could result in a reduction in the performance of the rope and at worst, lead to undetectable internal corrosion.

Application of too much and the wrong type of lubricant may lead to an accumulation of foreign debris on the surface of the rope. This could result in abrasive damage to the rope, the sheave and the drum. It may also make it difficult to determine the true condition of the rope for evaluation against discard criteria.

### 3. Rope selection

#### 3.1. Construction in relation to abrasion and wear

Wire rope will become progressively weaker when subject to abrasion and wear. This occurs when a rope contacts another body, such as when it passes through a sheave or over a roller, coils onto a drum or is dragged through or along abrasive material.

Where abrasion is known to be the primary mode of deterioration, consideration should be given to selecting a rope with as larger outer wires as possible, but also taking into account whether there is any additional need to fulfil any bending fatigue requirements.

Lang lay rope (subject to both ends of the rope being fixed and prevented from rotating) and compacted strand rope can be advantageous under abrasive conditions.

**Note:** although expected to occur mainly on the crowns of the wires, wear may also take place at the strand-core and strand interfaces within the rope.

#### 3.2. Type of core in relation to crushing of the rope at the drum

Crushing can occur due to several reasons but more likely when the rope is subject to multi-layer coiling at the drum. Also, greater radial pressure will be experienced between the rope and a smooth or plain-faced drum than with a grooved drum.

Stranded ropes containing fibre should not be used where coiling extends into multi-layers. Ropes with steel cores and compacted strand ropes are more resistant to crushing and distortion.

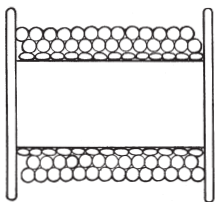


Figure 3-1 Example of crushing on a drum

#### 3.3. Wire finish in relation to corrosion

If corrosion is expected or known to be a primary mode of deterioration, it is preferable to use a rope containing zinc (or zinc alloy Zn95/Al5) coated wires.

Consideration should be given to selecting a rope with as larger wires as possible, considering whether there is any additional need to fulfil any bending fatigue requirements.

A rope with a large number of small wires is more susceptible to corrosion than a rope with a small number of large wires.

#### 3.4. Direction of lay and type

##### 3.4.1. Connecting ropes to each other (series) or working alongside each other (parallel)

If it is necessary to connect one rope to another (i.e. in series), whether during installation or in operation, it is essential that they are of the same lay direction and type, e.g. right lay ordinary (sZ) to right lay ordinary (sZ).

**Note:** Connecting a 'left' lay rope to a 'right' lay rope will result in rope rotation and unlaying of the strands when loaded. If the ropes are also hand spliced at the connection the splices will open up and pull apart.



Some applications, e.g. grabs and container cranes, demand the use of a left lay rope operating alongside a right lay rope (i.e. in parallel) in order to balance out the rotational effects of the two ropes.

### 3.4.2. Direction of coiling

Unless specified otherwise in the original equipment manufacturer's instructions, the direction of coiling should be in accordance with figures below.

The rotation direction and the attachment point of the rope determines whether right- or left-hand lay rope should be used. To determine the correct rope the following rule should be followed:

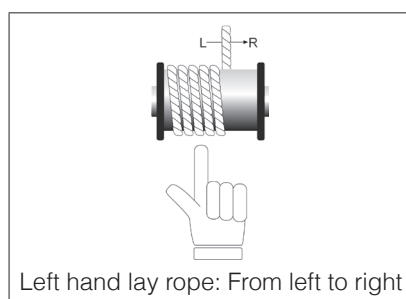
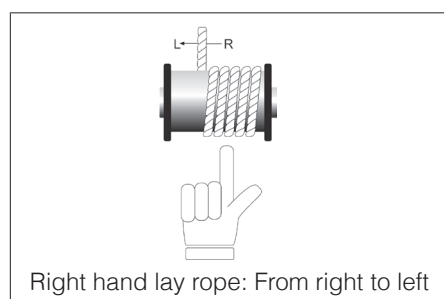
- Right thread groove on the drum - left hand lay rope.
- Left thread groove on the drum - right hand lay rope.



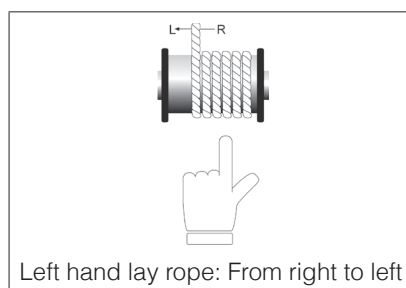
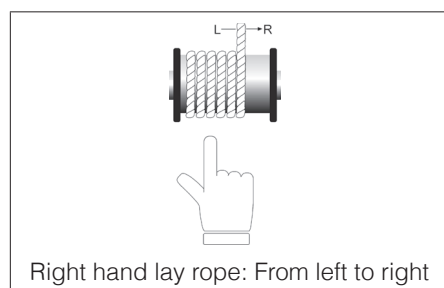
**WARNING!** Incorrect choice of lay can adversely affect rope performance.

The direction of coiling in figures below generally applies to both smooth and grooved drums.

Under wind



Upper wind



### 3.5. Rotational characteristics and use of a swivel

'Cabling' of hoist ropes in a multi-part (fall) reeving arrangement due to block rotation can occur if the rope selected has inferior torsional properties for the intended height of lift, rope spacing and loading. In such cases lifting can be severely limited or even halted. Applications involving high lifts are particularly vulnerable to this condition.

**Note:** Cabling is a term used to describe the condition in a multi-fall reeving arrangement where the falls of rope become untangled as they wrap around themselves.

When taking the torsional property of a rope into account the probability of cabling for a given reeving system can be assessed. Refer to the rope manufacturer or the original equipment manufacturer. With rotation-resistant ropes where the outer strands are generally laid in the opposite direction to those of the underlying layer, (i) the amount of torque generated under load when both ends of the rope are fixed and prevented from rotating or (ii) the amount of rotation under load when one end of the rope is free to rotate, will be expected to be far less than that which would be experienced with single layer ropes.

To limit the hazard of a rotating load during a lifting operation and to ensure the safety of personnel within the lifting zone, it is preferable to select a rotation-resistant rope that will only rotate a small amount when loaded, see a) below. With such ropes, the usefulness of a swivel is to relieve the rope of any induced rotation resulting from angular deflections at a sheave or drum.

Other rotation-resistant ropes, having less resistance to rotation when loaded, see b) below, are likely to require the assistance of a swivel to minimize the hazard. In such cases, however, it should be recognized that excessive rope rotation can have an adverse effect on rope performance and can also result in a reduction in breaking force of the rope, the amounts of which will depend on the rotational property of the selected rope and the magnitude of the load being lifted.

The following is a summary of general guidance on the use of a swivel based on the rotational property of the rope.

Where:

- 1 turn =  $360^\circ$ ;
- $d$  = nominal rope diameter
- $F_{min}$  = minimum breaking force of the rope

Then:

- a) rotational property less than or equal to 1 turn/1 000 $d$  lifting a load equivalent to 20 %  $F_{min}$   
a swivel can be used.
- b) rotational property greater than 1 turn but no greater than 4 turns/1 000 $d$  lifting a load equivalent to 20 %  $F_{min}$ .  
a swivel may be used subject to the recommendations of the rope manufacturer and/or approval of a competent person;
- c) rotational property greater than 4 turns/1 000 $d$  at a load equivalent to 20 %  $F_{min}$  -  
a swivel should not be used.

### 3.6. Fleet angle

Too large a fleet angle can cause excessive wear of the rope against the adjacent flange on the drum. This can also lead to torsional problems.

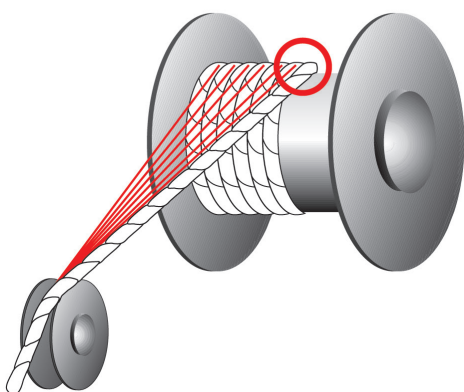


Figure 3-2 too large fleet angle can cause excessive wear

Where a fleet angle exists as the rope enters a sheave, it initially contacts the flange of the groove. As the rope continues to pass over the sheave it moves down the flange until it sits in the bottom of the sheave groove. In doing so the rope will roll as well as slide. As a result of the rolling action the rope will rotate about its own axis causing turn to be induced into or taken out of the rope, either shortening or lengthening the rope lay, resulting in a reduction in fatigue performance and, in the worst case, structural da-

mage to the rope in the form of a 'birdcage' or core protrusion. As the fleet angle increases so does the amount of rotation.

The fleet angle should be no greater than 2° for rotation-resistant ropes and no greater than 4° for single layer ropes.

**Note:** For practical reasons, the design of some cranes and hoists may be unable to meet these recommended values, in which case the rope life may be affected and the rope may need to be examined more frequently.

Fleet angles can be reduced by, for example:

- a) decreasing the drum width and/or increasing the drum diameter; or
- b) increasing the distance between the sheave and the drum.

When spooling onto a drum it is generally recommended that the fleet angle is limited to between 0,5° and 2,5°. If the angle is too small, i.e. less than 0,5°, the rope will tend to pile up at the flange of the drum and fail to return across the drum in the opposite direction. In this situation the problem may be alleviated by fitting a 'kicker' device or by increasing the fleet angle through the introduction of a sheave or spooling mechanism.

If the rope can pile up it will suddenly roll away from the flange creating a shock load in the rope. Excessively high fleet angles will return the rope across the drum prematurely, creating gaps between wraps of rope close to the flanges of the drum as well as increasing the pressure on the rope at the cross-over positions.

Even where helical grooving is provided, large fleet angles will inevitably result in localized areas of mechanical damage as the wires 'pluck' against each other. This is often referred to as rope 'interference' but the amount can be reduced by selecting a lang lay rope if the reeving allows or a compacted strand rope.

## **4. Material health and safety information on steel wire rope and its components parts**

### **4.1. Material**

#### **4.1.1. General**

Steel wire rope is a composite material and dependent upon its type may contain a number of discrete materials.

The following provides details of all the individual materials that may form part of the finished rope.

The description and/or designation of the wire rope stated on the delivery note, invoice or certificate will enable identification of the component parts.

The main component of steel wire ropes covered by the various parts of EN 12385 is carbon steel, which may, in some cases, be coated with zinc or zinc alloy Zn95/Al5.

Rope produced from carbon, coated or stainless-steel wires in the as-supplied condition is not considered a health hazard. However, during any subsequent processing such as cutting, welding, grinding and cleaning, dust and fumes may be produced which contain elements that may affect the health of exposed workers.

The other three components are the core, which may be of steel of the same type as used in the outer strands or, alternatively, fibre, either natural or synthetic; the rope lubricant(s); and, where applicable, any internal filling or external covering.

#### **4.1.2. Fibre cores**

Being in the center of a stranded steel wire rope, the materials from which fibre cores are produced, usually natural or synthetic fibres, do not present a health hazard when handled. Even when the outer strands are removed (for example when the rope is being socketed) the core materials present virtually no hazard to the user, except, maybe, in the case of a used rope where, in the absence of the application of any service lubricant or as a result of heavy working causing internal abrasive wear of the core, the core may have decomposed into a fibre dust which may be inhaled, although this is considered extremely unlikely.

The principal hazard is through inhalation of fumes generated by heat, for example when the rope is being cut by a disc cutter. Under these conditions, natural fibres are likely to yield carbon dioxide, water and ash, whereas synthetic materials are likely to yield toxic fumes.

The treatment of natural fibres, such as rot-proofing, may also produce toxic fumes on burning. The concentration of toxic fumes from the cores will be almost negligible compared with the products generated by heating from other primary materials, e.g. wire and manufacturing lubricant in the rope.

The most common synthetic core material is polypropylene, although other polymers such as polyethylene and polyamide may occasionally be used.

#### **4.1.3. Filling and covering materials**

Filling and covering materials do not present a health hazard during handling of the rope in its as-supplied condition. The principal hazard is by the inhalation of toxic fumes when the rope is being cut by a disc cutter.

#### **4.1.4. Manufacturing rope lubricants**

The lubricants used in the manufacture of steel wire ropes normally present minimal hazard to the user

in the as supplied condition. The user should, however, take reasonable care to minimize skin and eye contact and also avoid breathing their vapors and mists.

A wide range of compounds is used as lubricants in the manufacture of steel wire rope. These products, in the main, consist of mixtures of oils, waxes, bitumen's, resins, gelling agents and fillers with minor concentrations of corrosion inhibitors, oxidation stabilizers and tackiness additives.

Most of them are solid at ambient temperature and provided skin contact with the fluid types is avoided, none present a hazard in normal rope usage.

To avoid the possibility of skin disorders, repeated or prolonged contact with mineral or synthetic hydrocarbons should be avoided and it is essential that all persons who come into contact with such products maintain high standards of personal hygiene.

The worker should:

- a) use oil impermeable gloves;
- b) avoid unnecessary contact by oil by wearing protective clothing;
- c) obtain first aid treatment for any injury, however slight;
- d) wash hands thoroughly before meals, before using the toilet and after work; and
- e) use conditioning cream after washing, where provided.

The worker should not:

- f) put oily rags or tools into pockets, especially trousers;
- g) use dirty or spoiled rags for wiping oil from the skin;
- h) wear oil-soaked clothing;
- i) use solvents such as paraffin, petrol, etc. to remove oil from the skin.

## **4.2. General information**

### **4.2.1. Occupational protective measures**

#### **a) Respiratory protection**

General and local exhaust ventilation should be used to keep airborne dust or fumes below established occupational exposure standards (OES's).

Operators should wear approved dust and fume respirators if OES's are exceeded. (The OES for total dust is 10 mg/m<sup>3</sup> and for respirable dust is 5 mg/m<sup>3</sup>).

#### **b) Protective equipment**

Protective equipment should be worn during operations creating eye hazards. A welding hood should be worn when welding or burning. Use gloves and other protective equipment when required.

#### **c) Other**

Principles of good personal hygiene should be followed prior to changing into street clothing or eating. Food should not be consumed in the working environment.

**4.2.2. Emergency medical procedures**

- a) Inhalation: Remove to fresh air; get medical attention.
- b) Skin: Wash areas well with soap and water.
- c) Eyes: Flush well with running water to remove particulate; get medical attention.
- d) Ingestion: In the unlikely event that quantities of rope or any of its components are ingested, get medical attention.

**4.2.3. Safety information – fire or explode hazard**

In the solid state, steel components of the rope present no fire or explosion hazard. The organic elements present, i.e. lubricants, natural and synthetic fibres and other natural or synthetic filling and covering materials are capable of supporting fire.

**4.2.4. Disposal**

Dispose of in accordance with local Regulations.

## CertMax+

The CertMax+ system is a unique leading edge certification management system which is ideal for managing a single asset or large equipment portfolio across multiple sites. Designed by the Lifting Solutions Group, to deliver optimum asset integrity, quality assurance and traceability, the system also improves safety and risk management levels.

# CertMax

## Marking

ROPETEX steel wire ropes are marked with 2 reel labels that identify the reel and the rope. The labels have CE and UKCA marking.



ROPETEX reels are also marked with user instruction pictogram.

## User Manuals

You can always find the valid and updated User Manuals on the web.

The manual is updated continuously and valid only in the latest version.



**NB!** The English version is the Original instruction.

The manual is available as a download under the following link:

[www.powertex-products.com/manuals](http://www.powertex-products.com/manuals)

### Product compliance and conformity



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# ROPETEX



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