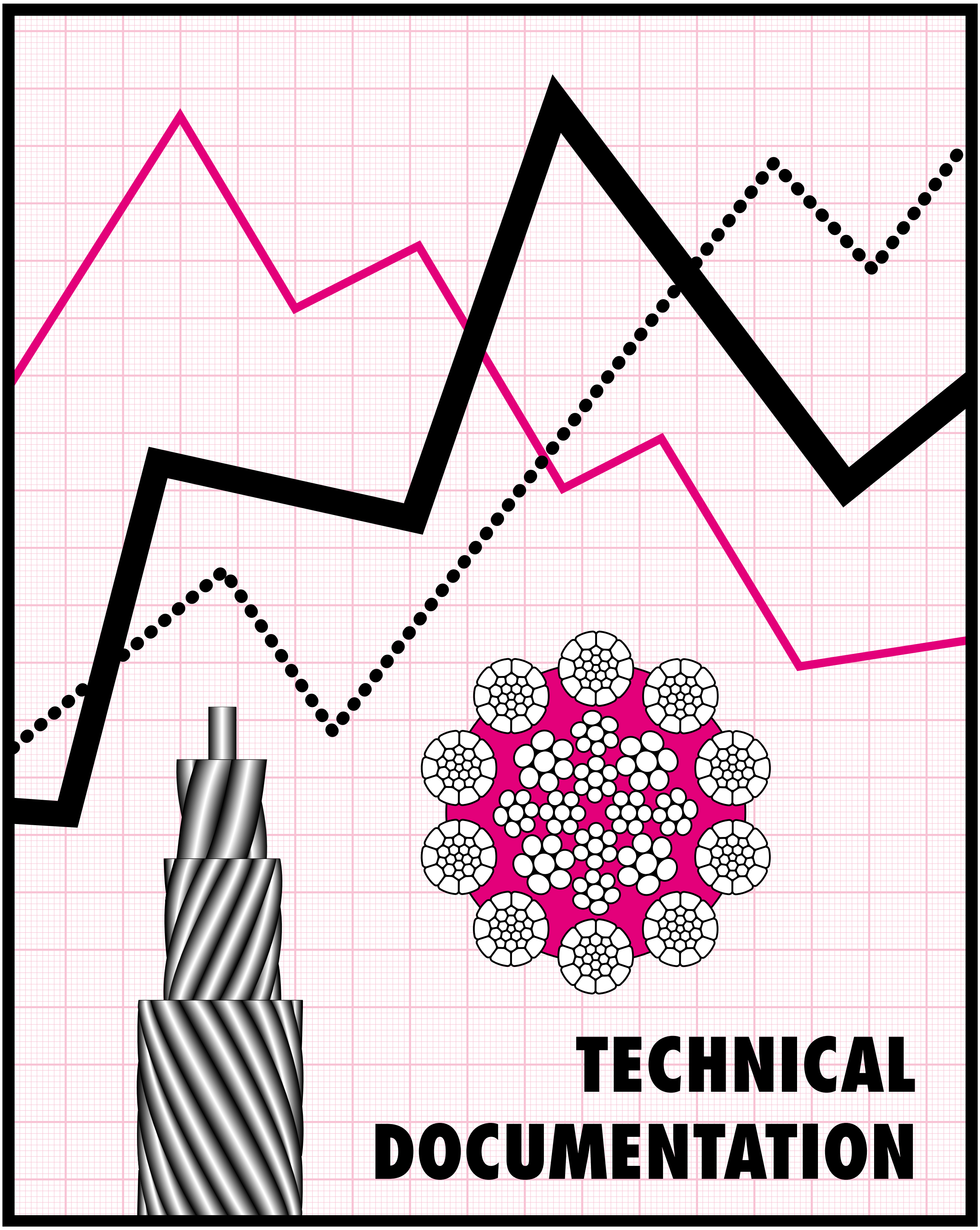
CASAR®

SPECIAL WIRE ROPES



TECHNICAL DOCUMENTATION

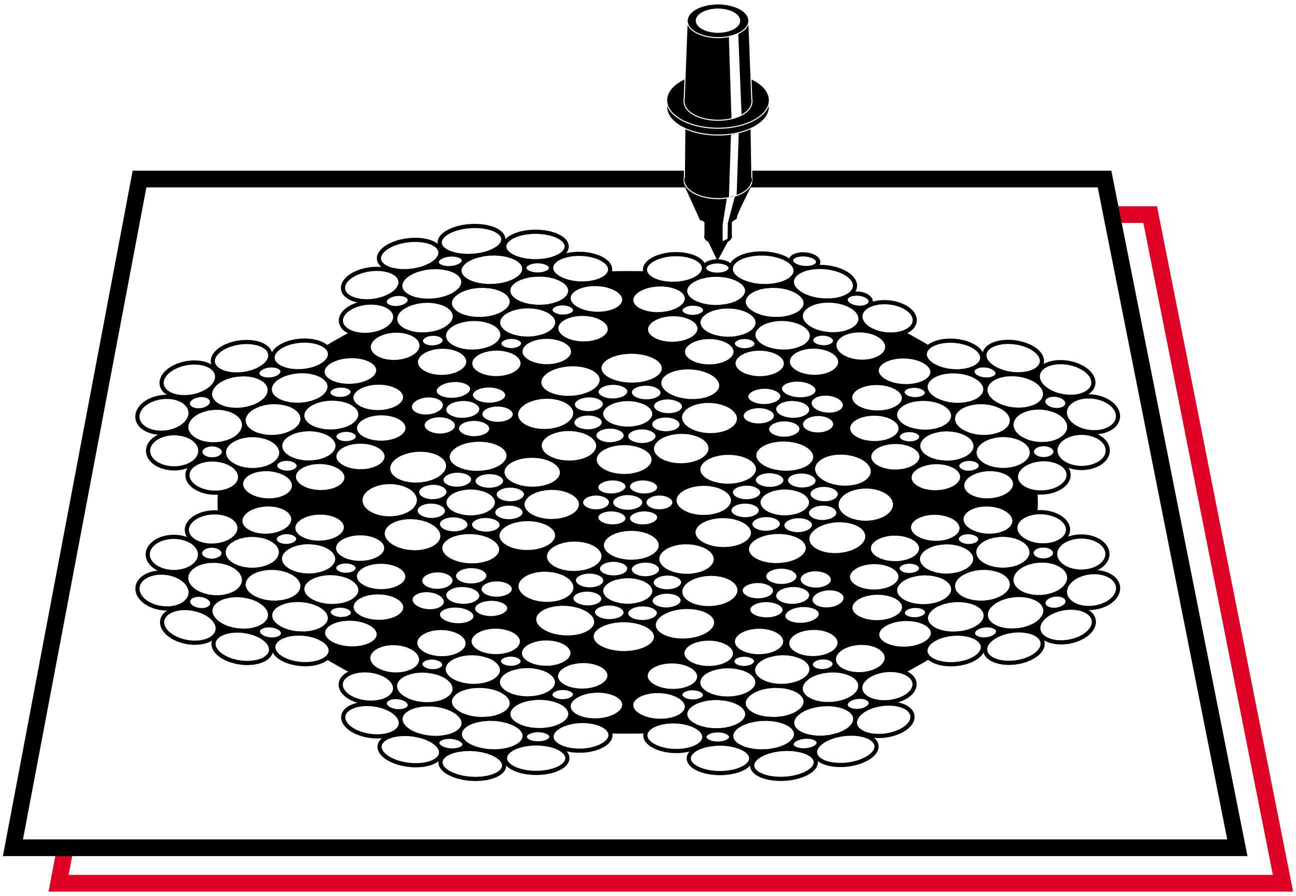
INTRODUCTION AND TABLE OF CONTENTS

This manual about the technical properties of Casar Special Wire Ropes is intended

- *to help the user of the ropes to find the best rope for his specific application,*
- *to help the designer to find the data he needs to build a safe, economic and good machine, and*
- *to help the distributor of the ropes to give his customers even better assistance.*

If you have a question which is not answered by this brochure, please do not hesitate to contact us. We will do our best to help you.

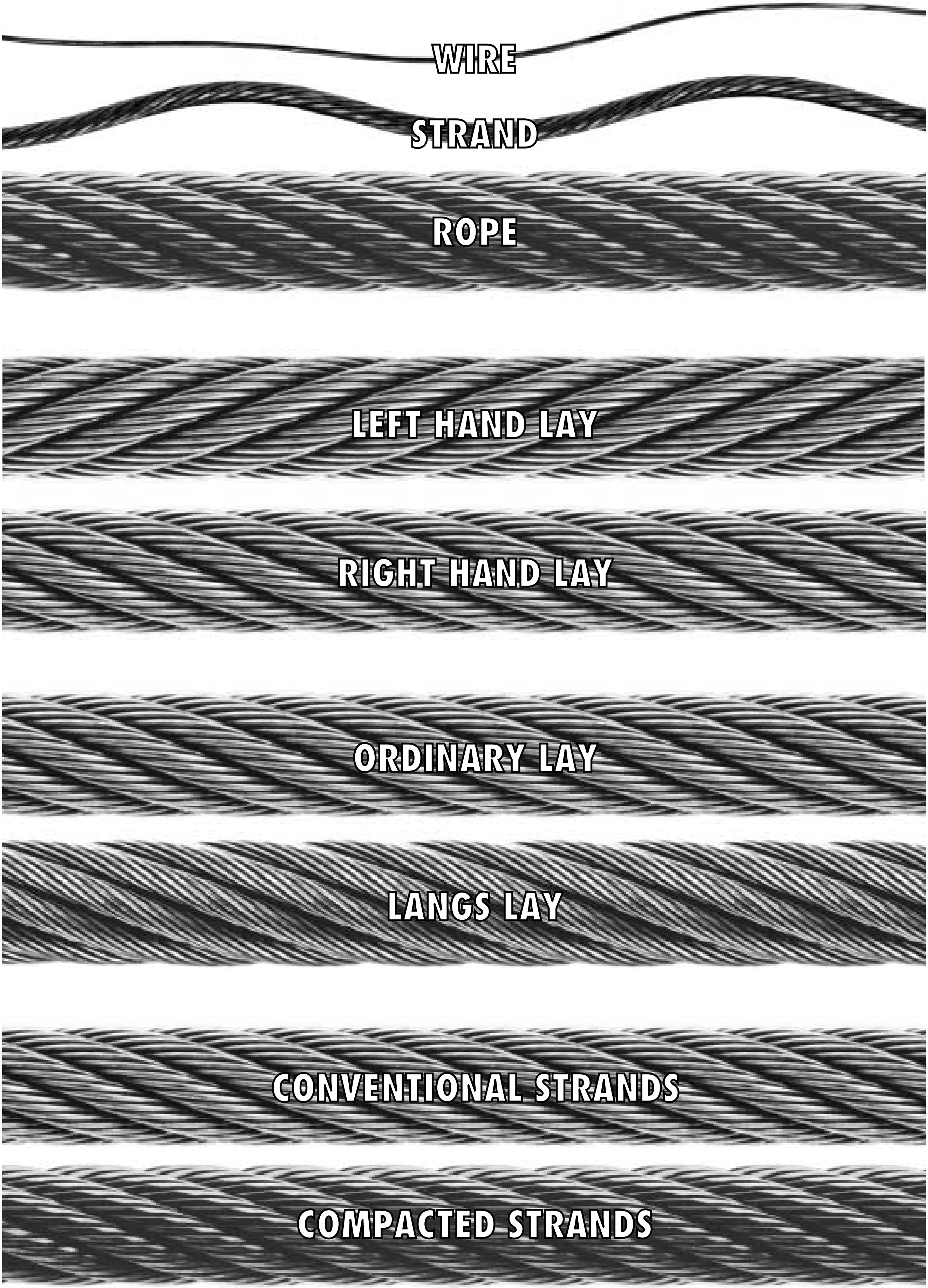
COMPUTER AIDED ROPE DESIGN



A steel wire rope is a complex machine part and consists of a great number of wires and strands of different dimensions. It is subjected to a wide spectrum of mechanical stresses.

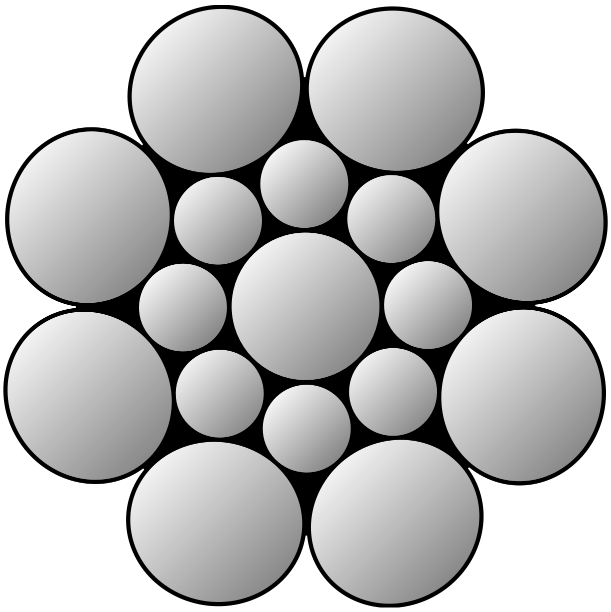
Based on a wide range of empirical data and test results, Casar Special Wire Ropes are adapted to the technical requirements and optimized with the help of a computer.

WHAT IS ...?

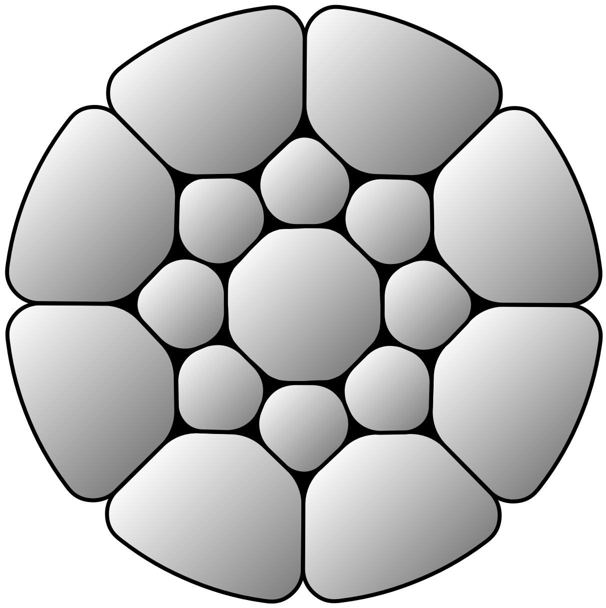

WIRE
STRAND
ROPE
LEFT HAND LAY
RIGHT HAND LAY
ORDINARY LAY
LANGS LAY
CONVENTIONAL STRANDS
COMPACTED STRANDS

WHAT IS A COMPACTED STRAND?

Some of the Casar Special Wire Ropes are made out of conventional strands, some are made out of compacted strands.



conventional strand



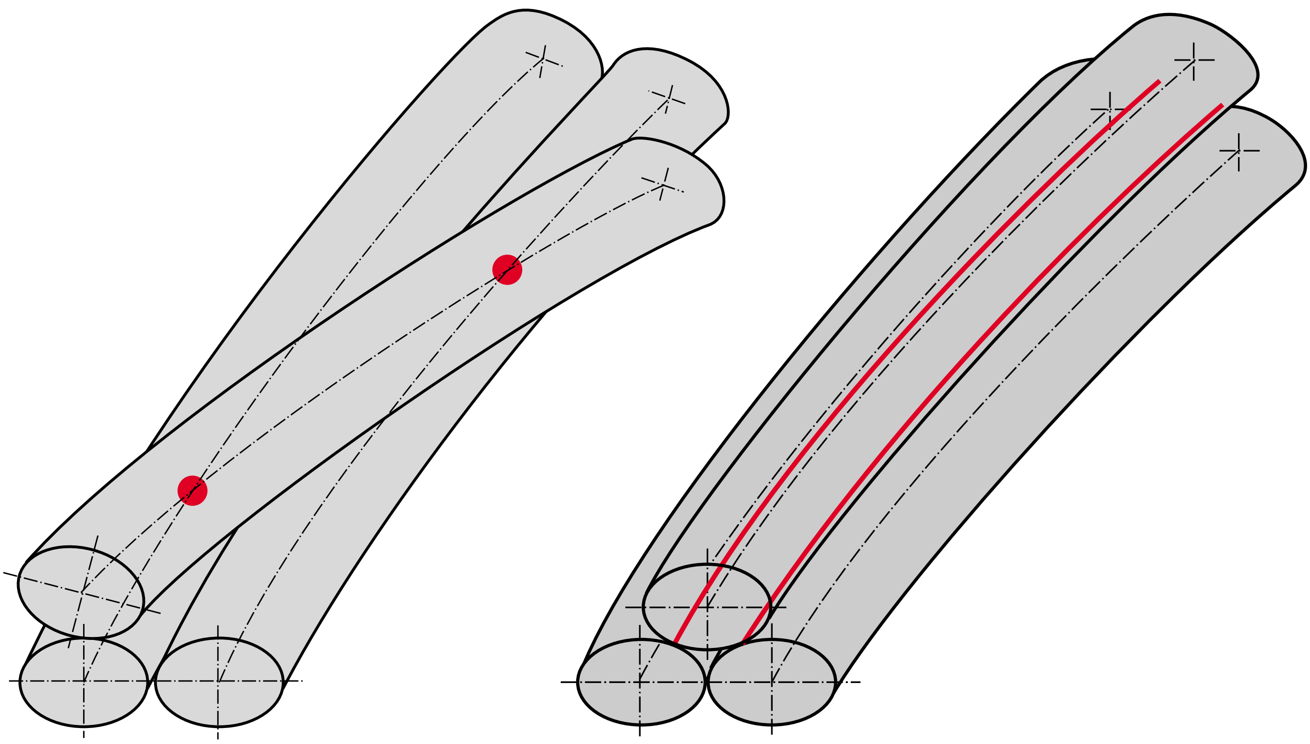
compacted strand

In order to produce a compacted strand, a conventional strand made out of round wires is drawn through a compacting tool. During this procedure, the wires are plastically deformed, the strand diameter is reduced and the surface is made smooth. The contact conditions between the individual wires and the strand-to-strand contacts improve.

Ropes made out of compacted strands have a higher breaking load, a greater flexibility and better rope- to- sheave contact conditions than comparable ropes made out of conventional strands. Because of the larger outer wires and the smaller exposed area they are more resistant to abrasion and corrosion.

WHAT IS A PARALLEL LAY ROPE?

*In a cross (non-parallel) lay strand all wires have **different** lay lengths, and in a cross (non-parallel) lay rope all strands have **different** lay lengths. The high **stress concentration** at the crossover points leads to an early internal failure.*



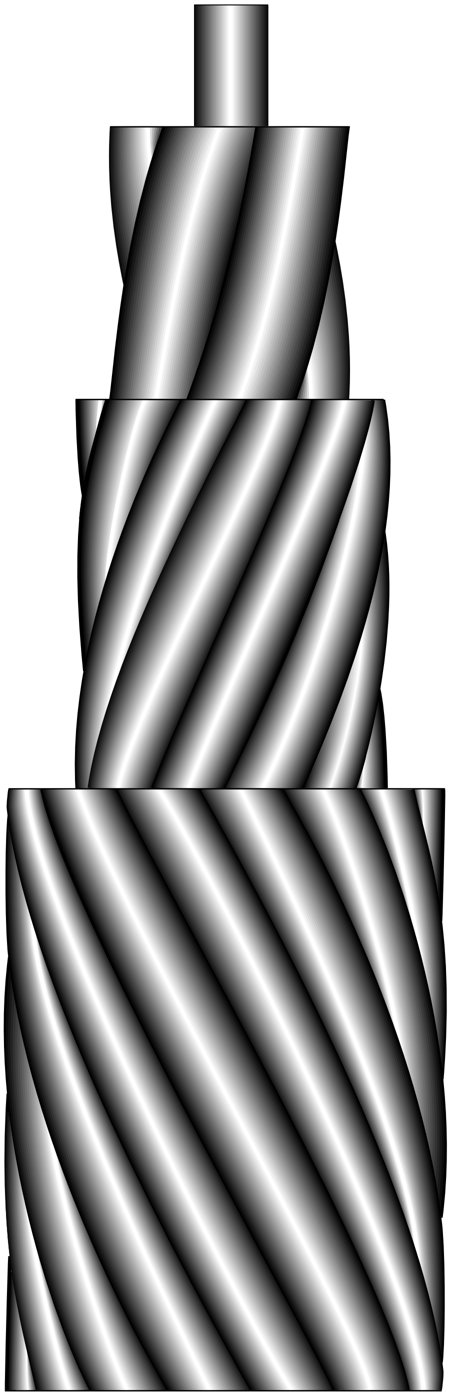
cross (non-parallel) lay
stress concentration

parallel lay
stress distribution

*In a parallel lay strand all wires have the **same** lay length, and in a parallel lay rope all strands have the **same** lay length. The linear contact leads to an optimal **stress distribution**.*

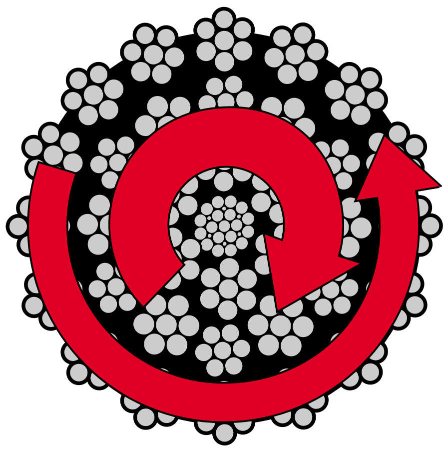
WHAT IS A ROTATION-RESISTANT ROPE?

In a conventional rope, an external load creates a moment which tries to untwist the rope and to rotate the load.



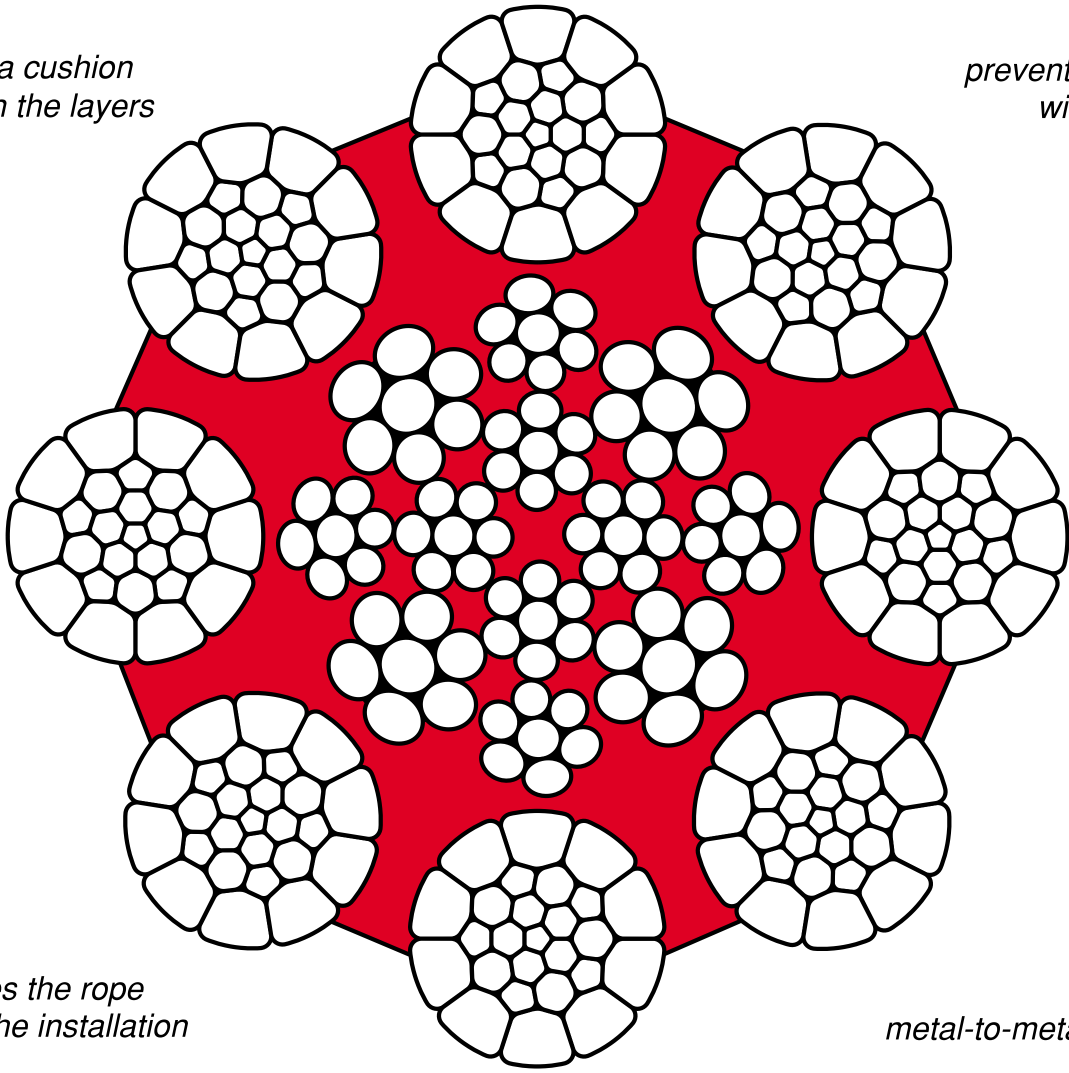
A rotation- resistant Casar Special Wire Rope has a steel core which is an independent rope, closed in the opposite direction to the outer strands. Under load, the core tries to twist the rope in the one direction, the outer strands try to twist it in the opposite direction.

The geometrical design of a rotation-resistant Casar Special Wire Rope is such that the moments in the core and the outer strands compensate each other over a wide load-spectrum, so that even with great lifting heights no rope twist occurs.



WHAT IS THE EFFECT OF THE PLASTIC LAYER?

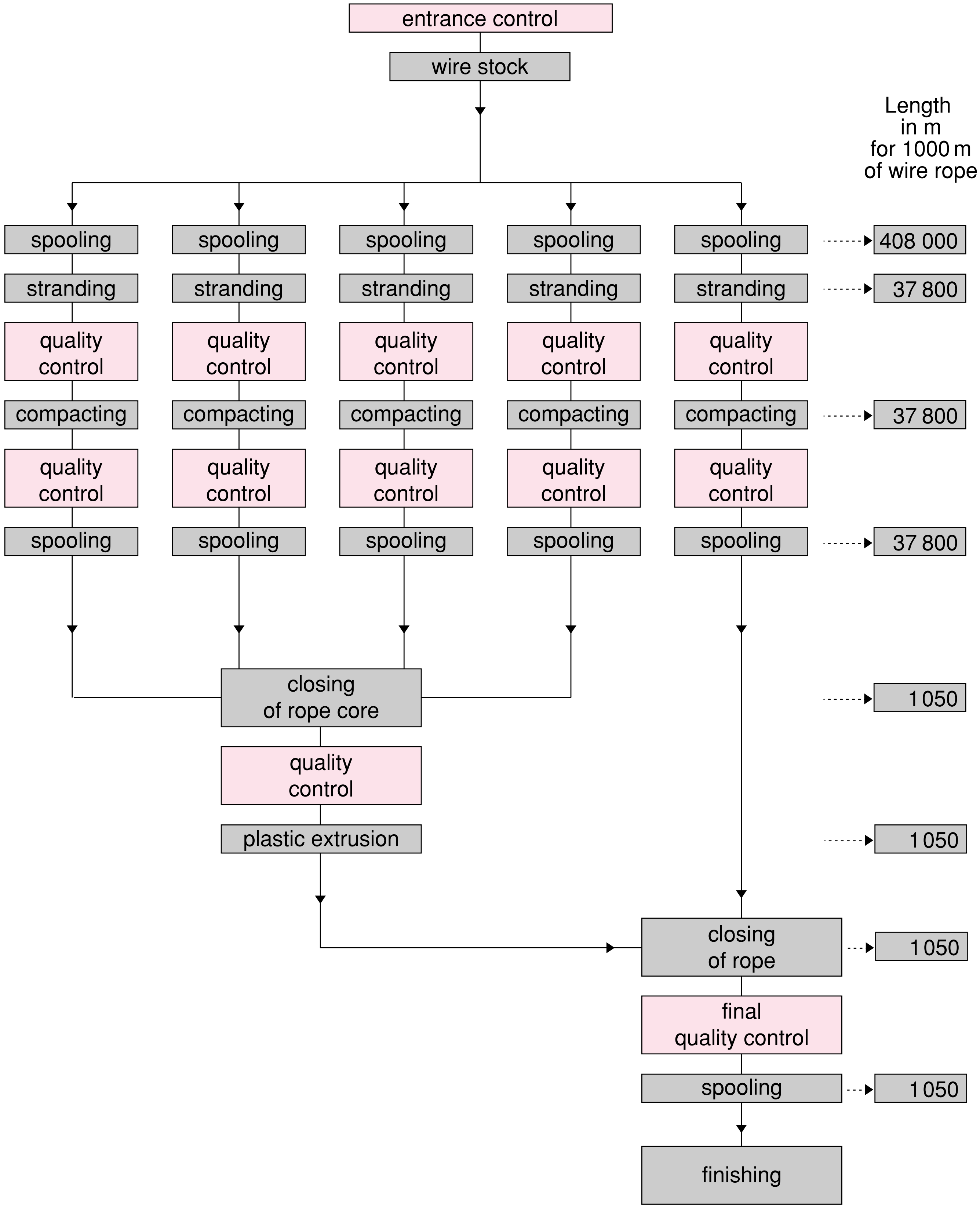
The plastic layer ...



... solves rope problems !

FROM WIRE TO WIRE ROPE

using Casar Powerplast as an example



How do Casar Special Wire Ropes achieve their high breaking loads?

Conventional steel wire rope constructions can meet a requirement for higher breaking loads only by increasing the tensile strength of the individual wires.

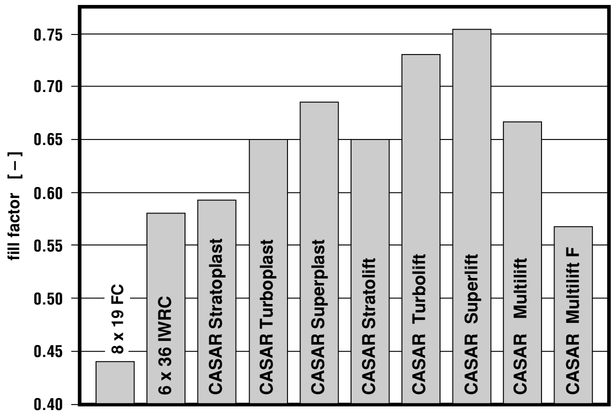
Casar Special Wire Ropes are already designed for the highest breaking loads by a combination of various technologies:

- *A large number of strands increases the metallic area of the rope.*
- *Parallel lay leads to a more compact rope construction.*
- *A plastic layer reduces internal stresses.*
- *Compacting of the strands increases the fill factor of the rope elements.*
- *The tensile strength of the wires is chosen according to the requirements.*

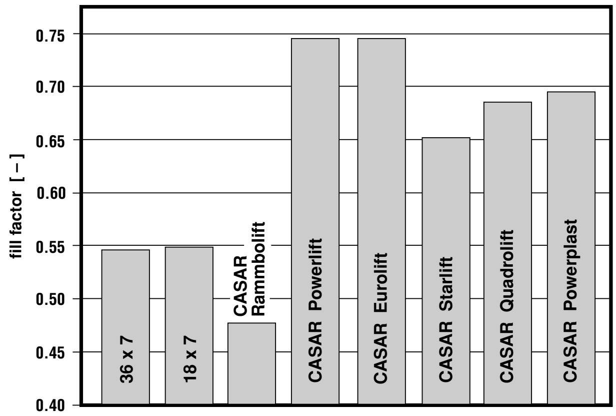
The high breaking loads of Casar Special Wire Ropes offer the user the following advantages:

- *Design advantages by reducing the sheave and drum diameters and the size of motor and gearbox.*
- *Longer service life due to lower specific stress on the rope.*
- *Increased safety.*

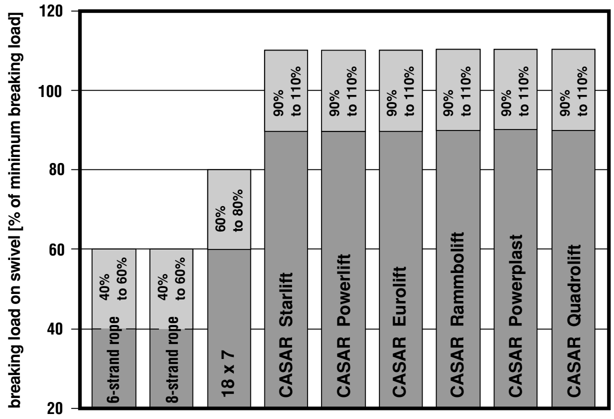
DIAGRAMS: BREAKING LOAD



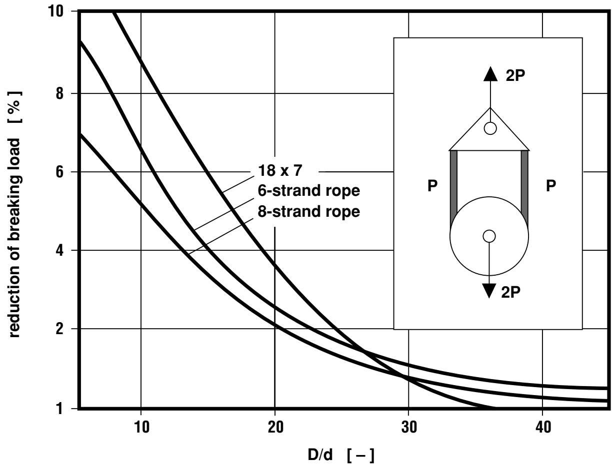
BREAKING LOAD 1: Comparison of the fill factors of non rotation-resistant ropes. The fill factors of Casar Special Wire Ropes are considerably higher than the fill factors of conventional ropes.



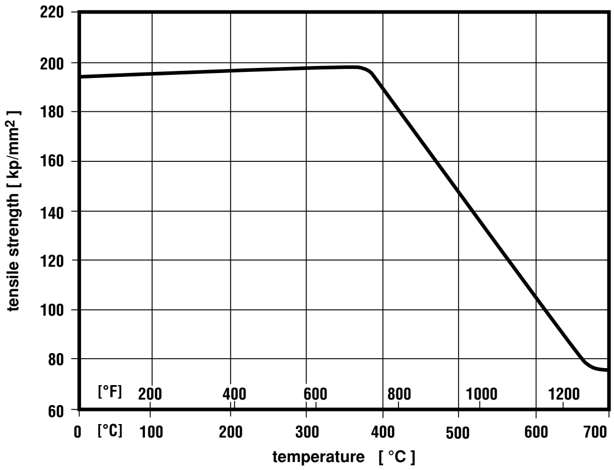
BREAKING LOAD 2: Comparison of the fill factors of rotation-resistant ropes. The fill factors of Casar Special Wire Ropes are in general considerably higher than the fill factors of conventional ropes.



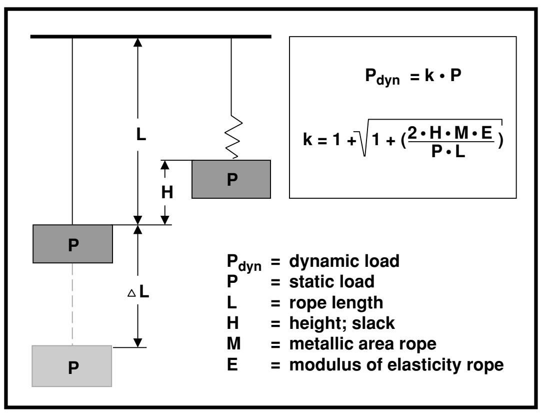
BREAKING LOAD 3: Breaking loads of steel wire ropes tested with a swivel. The breaking loads of 6-strand and 8-strand ropes decrease considerably, whereas the rotation-resistant Casar Special Wire Ropes achieve values in the range of their minimum breaking loads.



BREAKING LOAD 4: Breaking loads of steel wire ropes when tested on sheaves, depending on the ratio sheave diameter/rope diameter. The factors of safety cover the reduction of the breaking loads.



BREAKING LOAD 5: Tensile strength of steel wires as a function of temperature (exposure time 10 min., cooled in air). Temperatures up to 300°C (~600°F) reduce residual stresses, higher temperatures reduce the tensile strength drastically.



BREAKING LOAD 6: Formula to determine the dynamic load caused by a falling weight. Dynamic loads are not covered by the safety factor and should be avoided at all costs.

FILL, WEIGHT AND SPIN FACTORS

	rotation resistant	compacted strands	plastic layer	average fill factor	average weight factor	average spin factor*
STARLIFT	●			0,653	0,90	0,77
EUROLIFT	●	●		0,748	0,86	0,79
POWERPLAST	●	●	●	0,710	0,91	0,84
STRATOPLAST			●	0,608	0,92	0,87
TURBOPLAST		●	●	0,661	0,87	0,86
SUPERPLAST		●	●	0,688	0,86	0,84
STRATOLIFT				0,660	0,89	0,86
TURBOLIFT		●		0,730	0,85	0,84
SUPERLIFT		●		0,755	0,85	0,84
ALPHALIFT				0,650	0,89	0,86
BETALIFT		●		0,755	0,85	0,84
UNILIFT				0,660	0,90	0,88
MEGALIFT				0,655	0,90	0,90
TECHNOLIFT				0,627	0,90	0,82
MULTILIFT		●		0,663	0,85	0,83
MULTILIFT F		●		0,566	0,90	0,86
RAMMBOLIFT	●			0,477	0,94	0,85
QUADROLIFT	○	●		0,684	0,86	0,84

* rope diameters up to 40 mm, 1770 N/mm^2

BENDING FATIGUE

Why do Casar Special Wire Ropes attain the longest service lives?

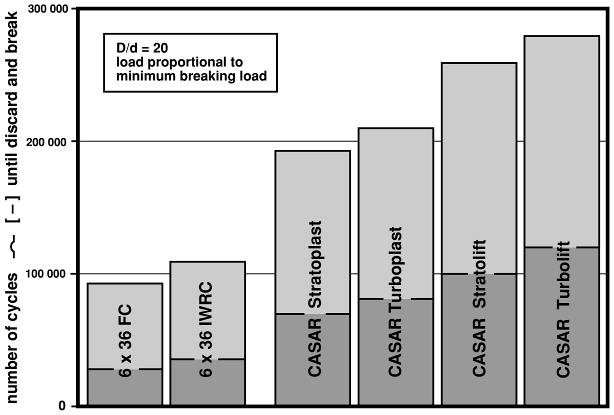
Conventional rope designs often do not meet the requirements of modern reeving systems. Shorter service lives result. Casar Special Wire Ropes offer various design advantages which lead to longer service lives.

- *A larger number of strands increases the number of contact areas within the rope and on sheaves and drums.*
- *Parallel lay prevents the crossover of strands and improves the contact conditions within the rope.*
- *A plastic layer reduces the danger of structural damage and internal wire breaks.*
- *Compaction of the strands improves the contact conditions within the rope and on sheaves and drums.*
- *A large number of strands with smooth surfaces increases the flexibility of the rope.*

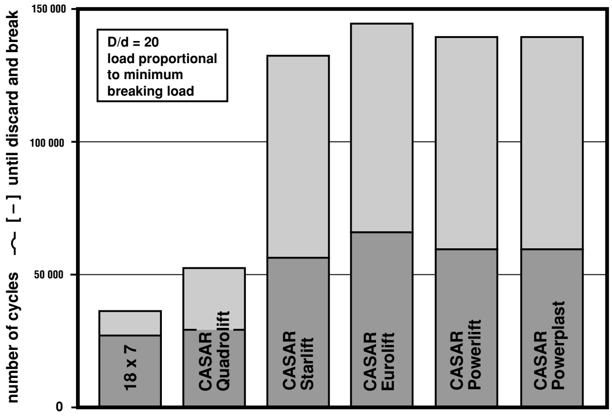
The long service lives of Casar Special Wire Ropes offer the user the following practical advantages:

- *Reduced downtime due to fewer rope changes.*
- *Reduced costs for rope changes.*
- *Minimised rope costs.*
- *Optimum price/performance ratio.*

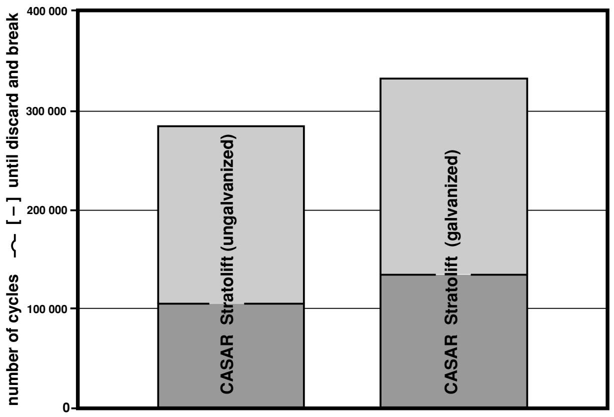
DIAGRAMS: BENDING FATIGUE



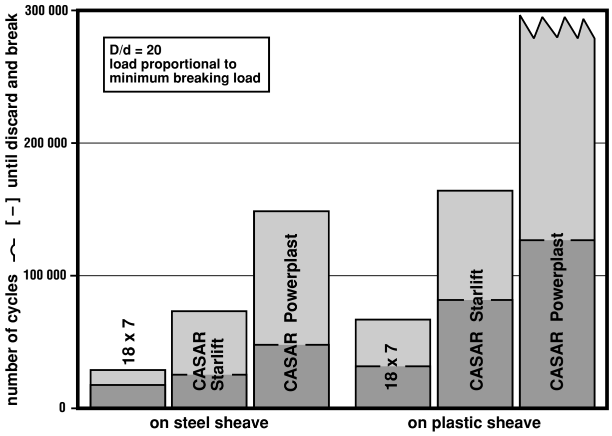
BENDING FATIGUE 1: Comparison of numbers of cycles until discard and break for non rotation-resistant ropes. Under the same test conditions, Casar Special Wire Ropes achieve much higher numbers of cycles than conventional ropes.



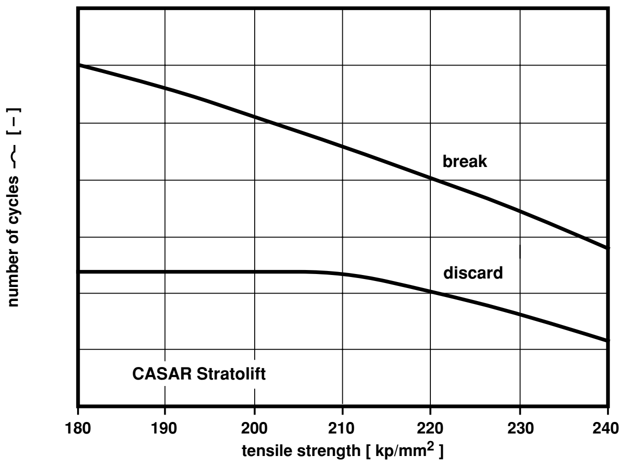
BENDING FATIGUE 2: Comparison of numbers of cycles for rotation-resistant ropes. Under the same test conditions, Casar Special Wire Ropes achieve much higher numbers of cycles than conventional ropes.



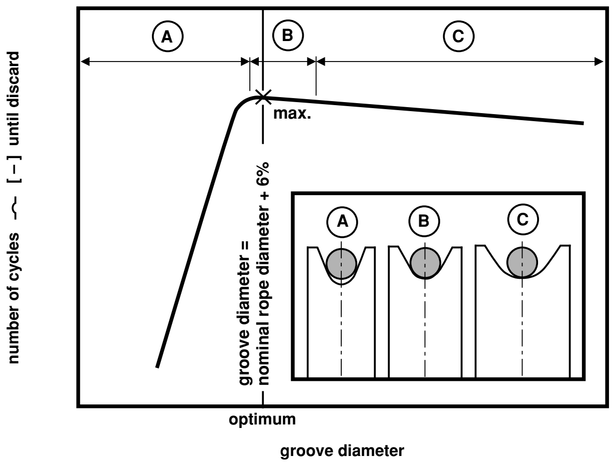
BENDING FATIGUE 3: Comparison of numbers of cycles until discard and break for ungalvanized and galvanized ropes, in both cases lubricated. Under the same test conditions, the galvanized rope achieves higher numbers of cycles.



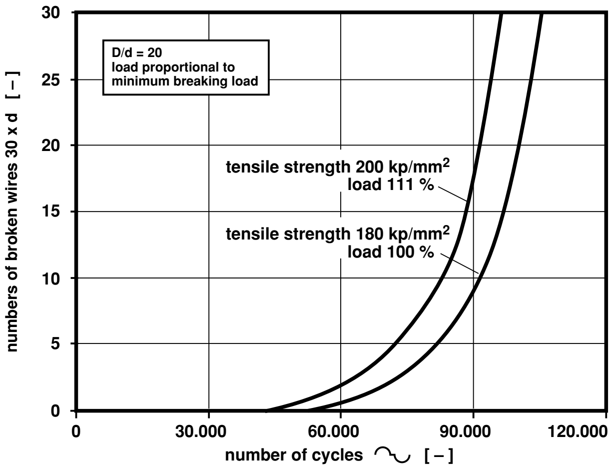
BENDING FATIGUE 4: Comparison of numbers of cycles until discard and break on steel sheaves and on plastic sheaves. On plastic sheaves, the fatigue life is higher, but the residual life (%) between discard and break is lower.



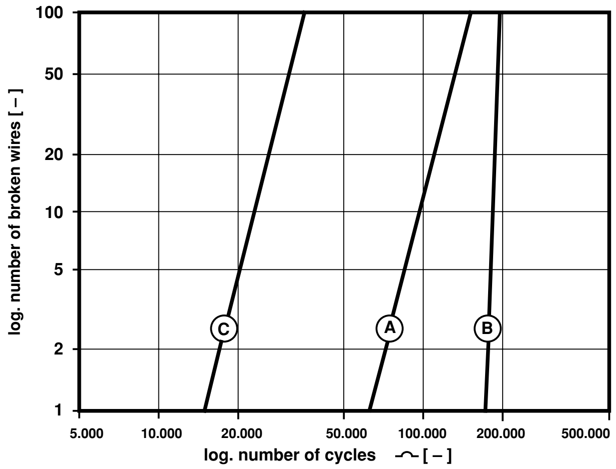
BENDING FATIGUE 5: Comparison of numbers of cycles until discard and break for ropes of different tensile strength under constant load.



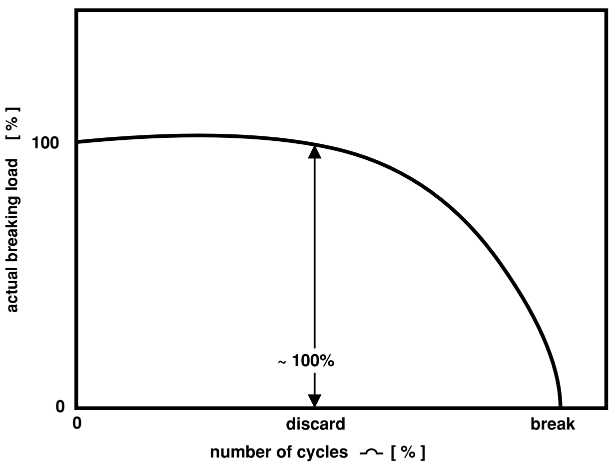
BENDING FATIGUE 6: Rope life as a function of the groove diameter of the sheaves. The optimal groove diameter is nominal rope diameter plus 6% (B). For larger groove diameters, the service life decreases steadily (C), for smaller groove diameters it decreases rapidly (A).



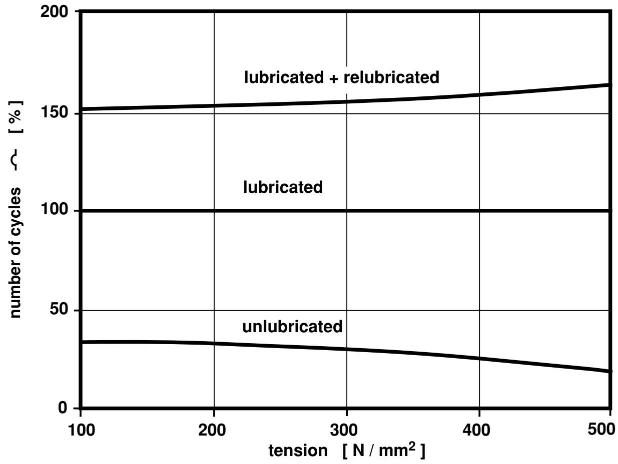
BENDING FATIGUE 7: Number of visible broken wires depending on the number of cycles in a bending fatigue test. The number of wire ropes breaks increases steadily according to a power-function.



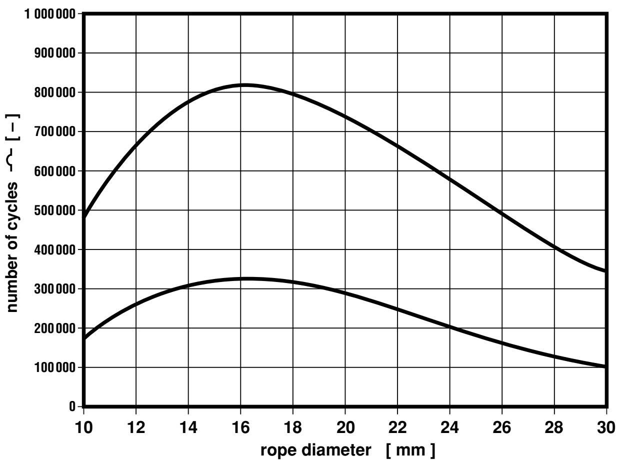
BENDING FATIGUE 8: Number of broken wires depending on the number of cycles. Rope A: Casar Stratolift. Rope C: (competition) fatigues too early. Rope B: (test rope) is dangerous, because the discard criterion is reached shortly after the first wire is broken.



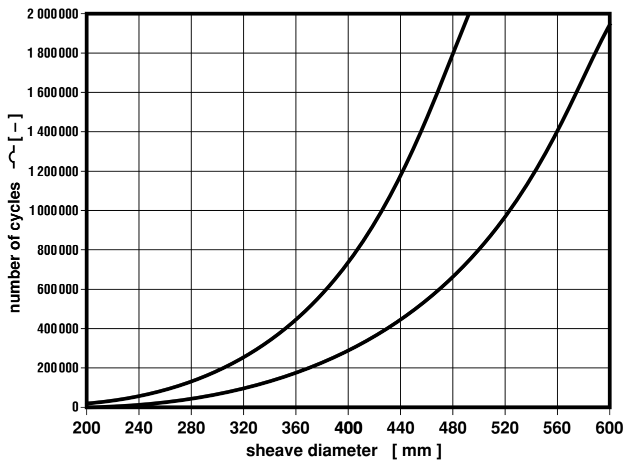
BENDING FATIGUE 9: Breaking load of running steel wire ropes depending on the number of cycles. Normally, the actual breaking load increases during the first half of the service life. When the discard criterion is reached, the rope can still achieve its minimum breaking load.



BENDING FATIGUE 10: Number of cycles until discard for unlubricated, lubricated (= 100%) and relubricated steel wire ropes. Relubrication during service life considerably, increases, lack of lubrication reduces the service life drastically.

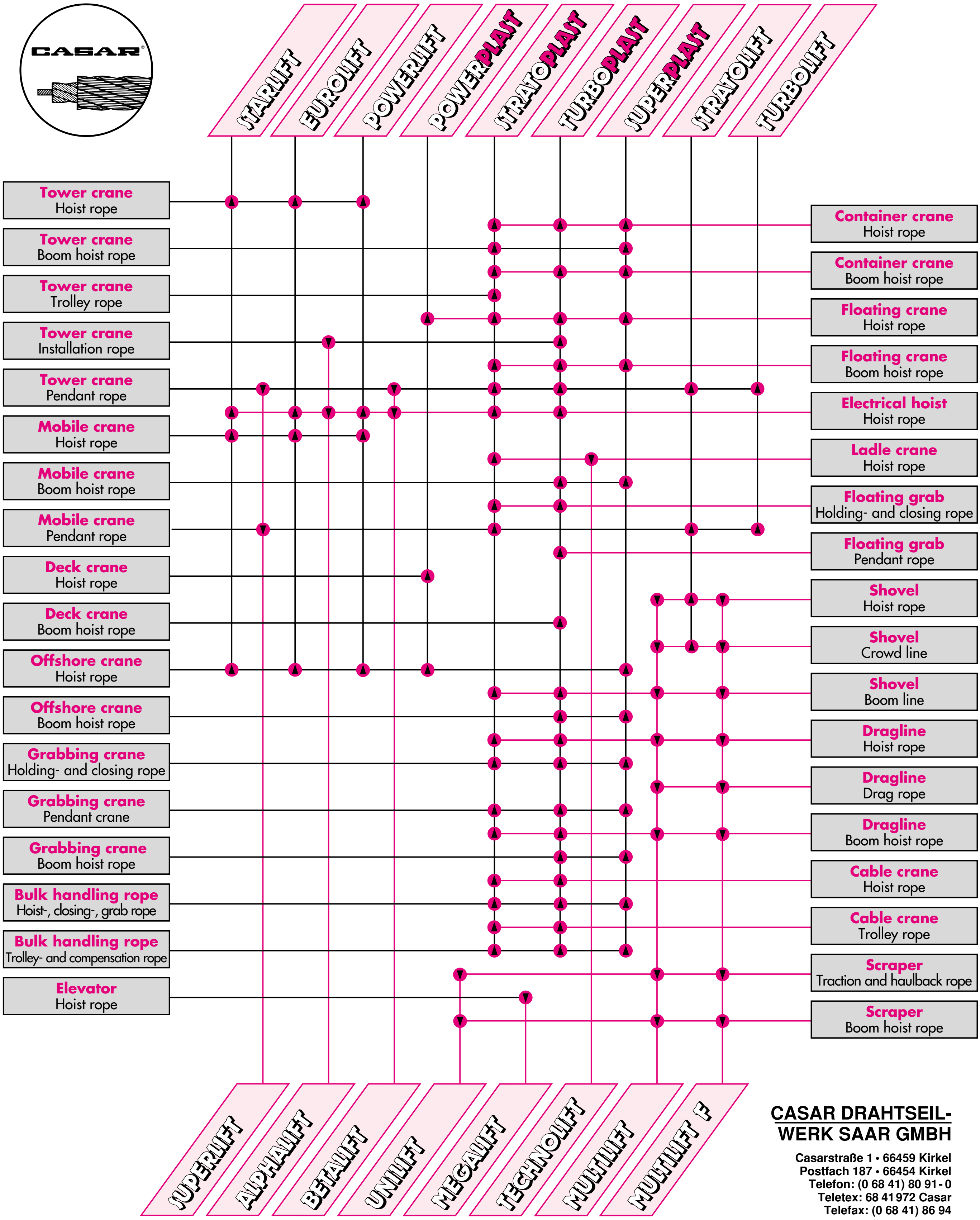


BENDING FATIGUE 11: Number of cycles until discard (lower curve) and break (upper curve) depending on the nominal rope diameter. For every combination of sheave diameter and line pull there is an optimum rope diameter.



BENDING FATIGUE 12: Number of cycles until discard (lower curve) and break (upper curve) depending on the sheave diameter. The service life of a wire rope increases with increasing sheave diameter.

WHICH ROPE FOR WHICH APPLICATION?



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Why are Casar Special Wire Ropes so rotation-resistant?

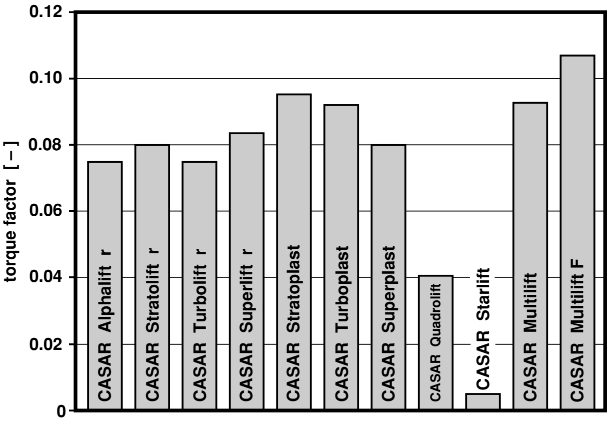
Conventional wire ropes try to untwist under load. Stability can often only be achieved by overloading the core of the ropes.

Rotation-resistant Casar Special Wire Ropes are stabilized against rotation by various technologies.

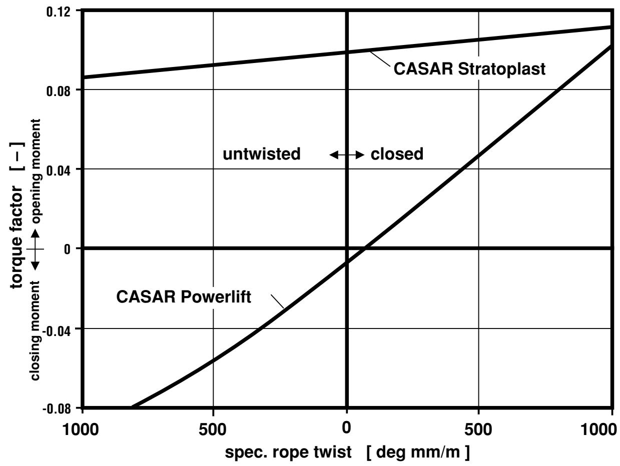
- *A wire rope core, closed in the opposite direction of the outer strands, creates a stabilizing moment.*
- *A compacted core increases the rotational stability.*
- *A favourable ratio of the metallic areas leads to stability without overloading the core.*

The high rotational stability of Casar Special Wire Ropes offers the user the following advantages:

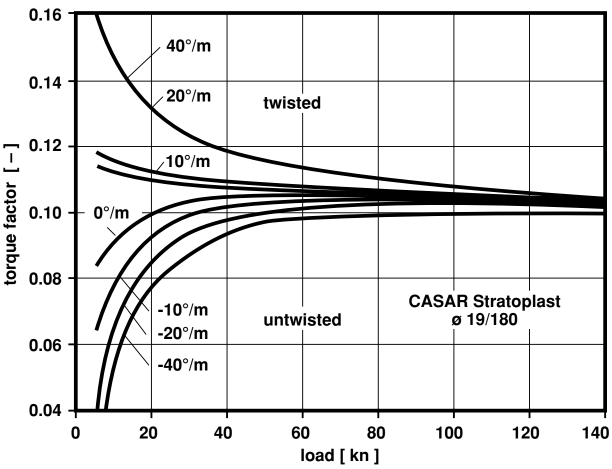
- *No block rotation even with great lifting heights.*
- *Long service life because of an untwisted rope structure.*
- *Great safety in crane operations.*



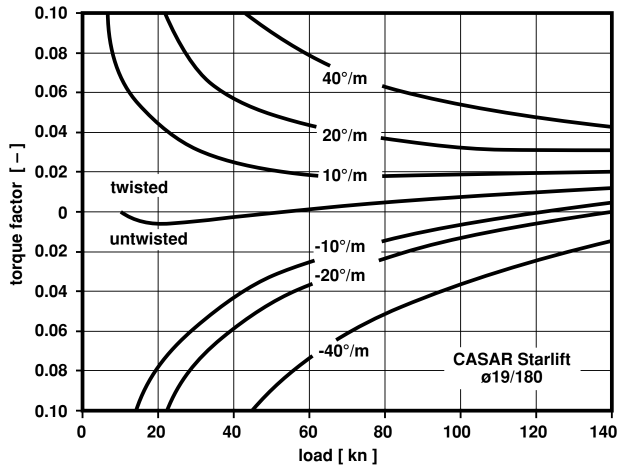
ROTATION 1: Torque factors for different Casar Special Wire Ropes. The torque factor is defined as the moment of the rope under a given load, divided by the load and the rope diameter.



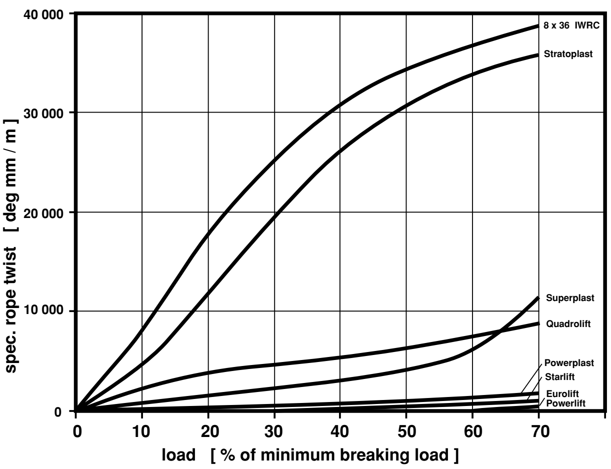
ROTATION 2: Torque factors of Casar Stratoplast and Casar Powerlift against the rope twist (forcible twist). The high torque of Casar Powerlift under forcible twist guarantees a high resistance against rotation of the load.



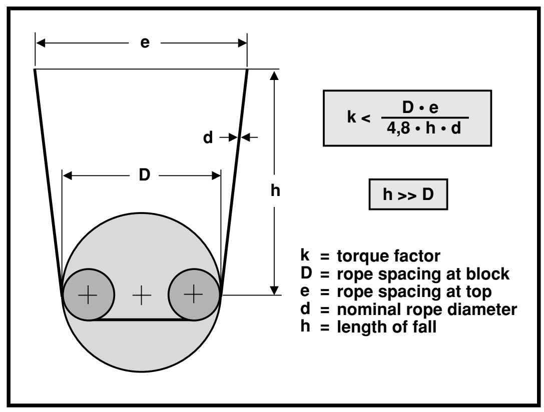
ROTATION 3: Torque factor of Casar Stratoplast depending on the load for different levels of rotation. For higher loads, the forcible twist does not influence the torque factor very much.



ROTATION 4: Torque factor of Casar Starlift as a function of the load for different levels of rotation. The forcible twist influences the torque factor of the rope considerably. Any rotation of the load creates a high moment in the opposite direction, stabilizing the system.



ROTATION 5: Specific rope twist as a function of the load. When tested on a swivel, 6-strand and 8-strand ropes untwisted under very low loads. Casar Powerlift, Casar Starlift and Casar Powerplast only started untwisting at high loads.



ROTATION 6: Formula to determine the stability of a block. If the conditions of the formula are met, the block will be stable (static situation). The formula can also be used to determine the minimum rope spacing or the greatest stable length of fall.

Why are Casar Special Wire Ropes so flexible?

- *Modern machines demand flexible wire ropes.*

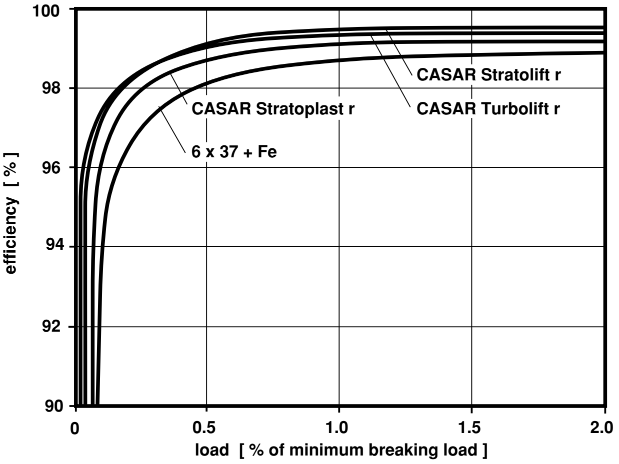
Casar Special Wire Ropes are designed to provide maximum flexibility. The high flexibility is achieved by a combination of different technologies.

- *A larger number of wires and strands allows easier bending.*
- *Intensive lubrication in all stages of production reduces the internal friction.*
- *The smooth surfaces of the compacted strands prevent indentations and allow easier relative motion of the elements.*
- *Cold-resistant lubricants and cold-elastic plastics guarantee good flexibility at low temperatures.*

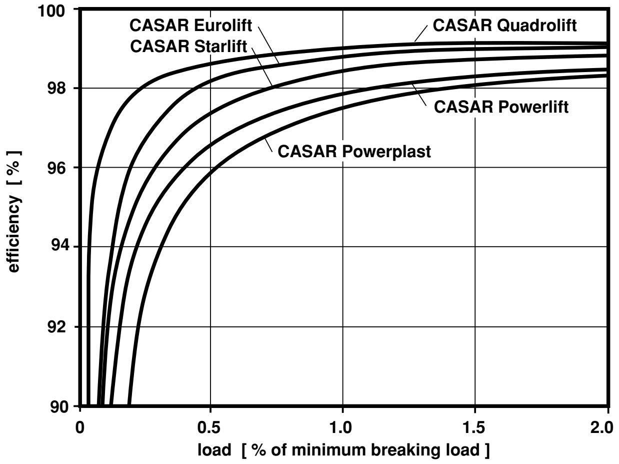
The high flexibility of Casar Special Wire Ropes offers the user the following advantages:

- *Improved running properties due to lower friction losses.*
- *Reduction of motor capacity.*
- *Easy handling during installation.*
- *Excellent spooling on the drum.*

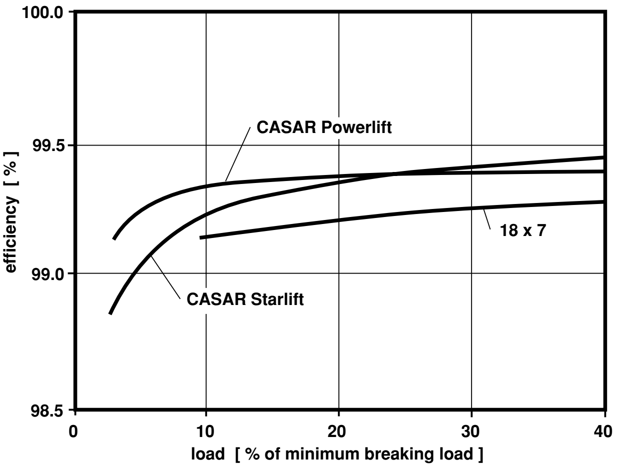
DIAGRAMS: EFFICIENCY



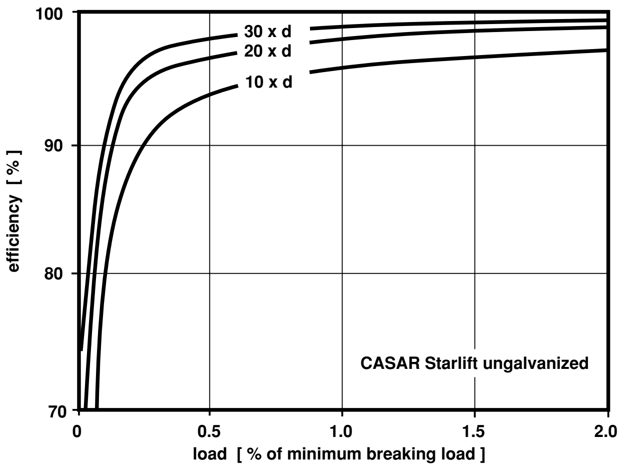
EFFICIENCY 1: Efficiencies of rotation-resistant steel wire ropes on sheaves with roller bearings for low loads. Casar Special Wire Ropes show higher efficiencies than conventional steel wire ropes. D/d = 20



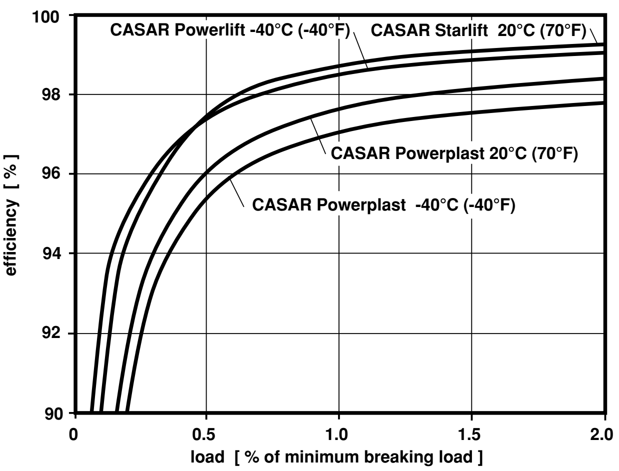
EFFICIENCY 2: Efficiencies of rotation-resistant steel wire ropes on sheaves with roller bearings for low loads. Most rotation-resistant wire ropes show lower efficiencies than non rotation-resistant wire ropes.



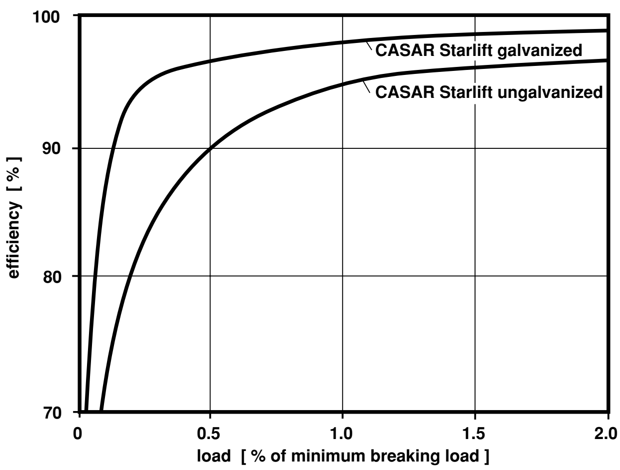
EFFICIENCY 3: Efficiencies of rotation-resistant steel wire ropes on sheaves with roller bearings for high loads. Casar Special Wire Ropes show higher efficiencies than conventional steel wire ropes. D/d = 20



EFFICIENCY 4: Efficiency of a steel wire rope on sheaves with roller bearings against load for different sheave diameters. The efficiency decreases considerably with decreasing sheave diameter.



EFFICIENCY 5: Efficiencies of steel wire ropes on sheaves with roller bearings against load for different temperatures. The influence of low temperatures is minimized by the use of special lubricants and plastics. D/d = 20



EFFICIENCY 6: Efficiencies of galvanized and ungalvanized steel wire ropes on sheaves with roller bearings for low loads. Galvanized ropes show lower efficiencies. D/d = 20

LEFT HAND OR RIGHT HAND LAY ROPE?

The choice of the correct direction of lay is essential for the proper functioning of a reeving system. A wrong direction of lay leads to torque build-up, to spooling problems and to structural damage to the rope.

One layer spooling

For drums with one layer, the direction of lay has to be chosen according to the following rule:

right hand drum - left hand lay rope
left hand drum - right hand lay rope

Multiple layer spooling

With multiple layer spooling, the direction of the spooling changes from layer to layer. So the direction of lay of the rope would also have to be changed from layer to layer. Here the direction of lay should be chosen for the layer which is working the most.

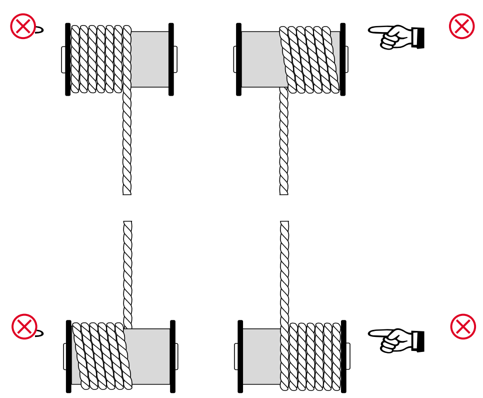
right hand layer - left hand lay rope
left hand layer - right hand lay rope

Multiple-part reeving

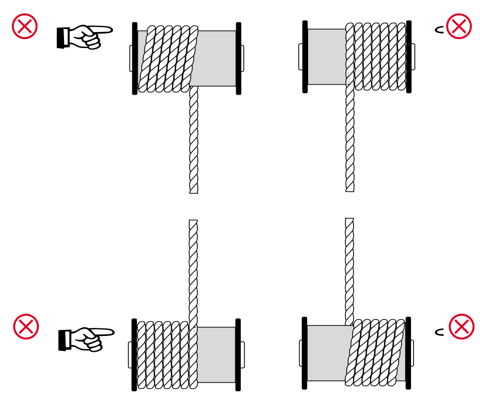
In a multiple part reeving system very often the influence of the fleet angles between the sheaves is greater than the influence of the drum. In this case, the direction of lay of the rope should be chosen depending on the direction of the reeving.

right hand reeving - left hand lay rope
left hand reeving - right hand lay rope

And here is how you determine the direction of the winding of the drum or reeving system: Place yourself at the fix point (⊗) of the rope on the drum (at the reeving system) and follow the turns of the rope with your finger.



right hand drum - left hand lay rope



left hand drum - right hand lay rope

If you move your finger clockwise, the drum (reeving system) is right hand, and needs a left hand lay rope.

If you move your finger counterclockwise, the drum (reeving system) is left hand, and needs a right hand lay rope.

ELASTICITY AND ELONGATION

What gives Casar Special Wire Ropes the best stress-strain behaviour?

Conventional steel wire ropes often have insufficient modulus of elasticity and too high permanent elongations.

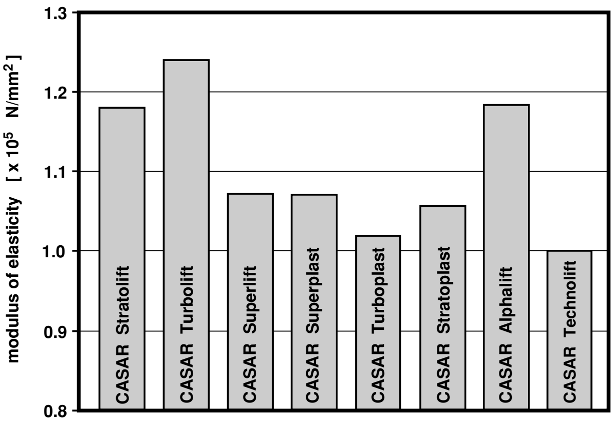
Casar Special Wire Ropes are optimized with regard to their stress-strain properties by various features:

- *The full steel construction provides a high modulus of elasticity.*
- *The compact rope structure guarantees minimal permanent elongations in the working range.*
- *The homogeneous load distribution on all rope elements creates high elongations at break.*
- *The plastic layer absorbs dynamic energy.*

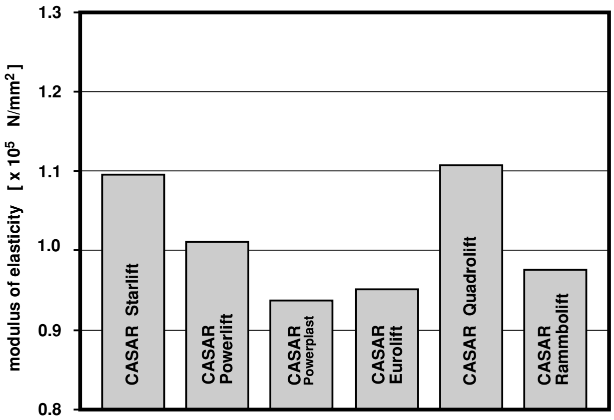
The balanced stress-strain properties of Casar Special Wire Ropes offer the user the following advantages:

- *High rigidity of suspended structures.*
- *Less retentioning for suspended structures and positioning machines.*
- *High safety against dynamic failure.*

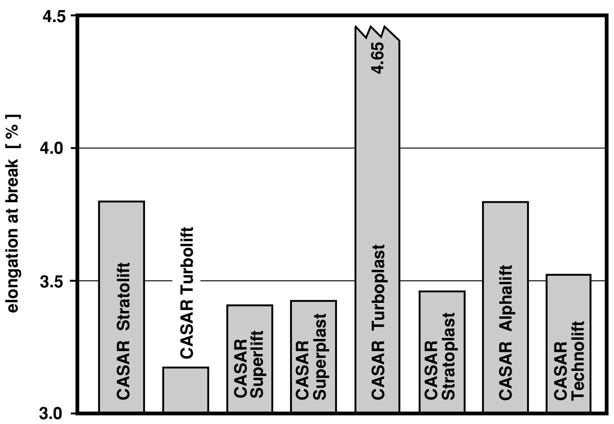
DIAGRAMS: ELASTICITY AND ELONGATION



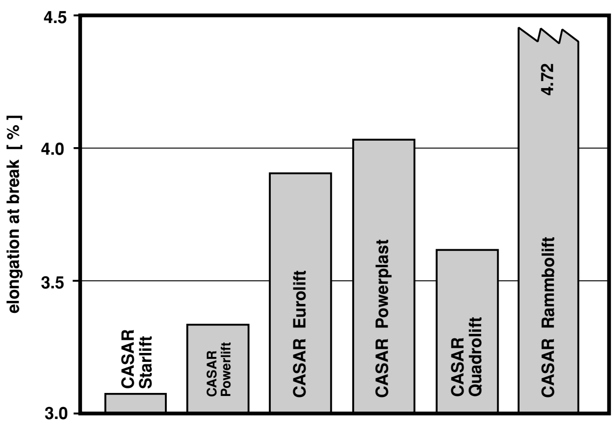
ELASTICITY 1: Moduli of elasticity for non rotation-resistant Casar Special Wire Ropes. The modulus of elasticity of a steel wire rope is about half the modulus of plain steel. (Average values from a great number of tests)



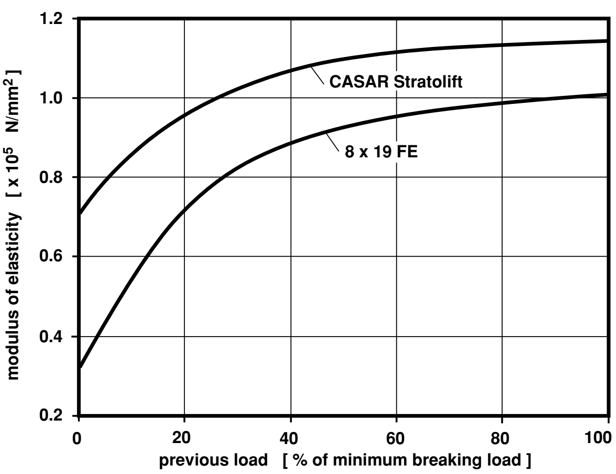
ELASTICITY 2: Moduli of elasticity for rotation-resistant Casar Special Wire Ropes. The modulus of elasticity of a steel wire rope is about half the modulus of plain steel. (Average values from a great number of tests)



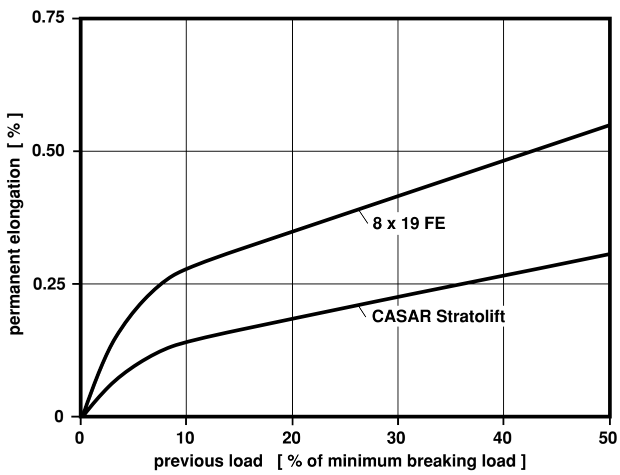
ELASTICITY 3: Elongation at break for non rotation-resistant Casar Special Wire Ropes. The elongations at break range from 3.2 to 4.7 percent. (Average values from a great number of tests)



ELASTICITY 4: Elongation at break for rotation-resistant Casar Special Wire Ropes. The elongations at break range from 3.1 to 4.7 percent. (Average values from a great number of tests)

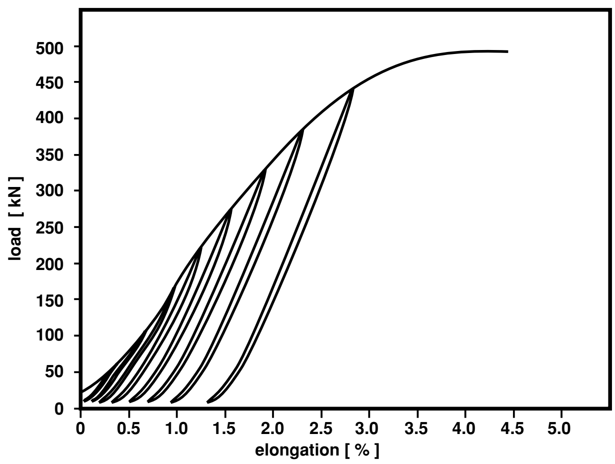


ELASTICITY 5: Modulus of elasticity depending on the previous load for Casar Stratolift and a conventional rope with fibre core. The modulus increases with increasing load. Casar Stratolift shows a much higher modulus.

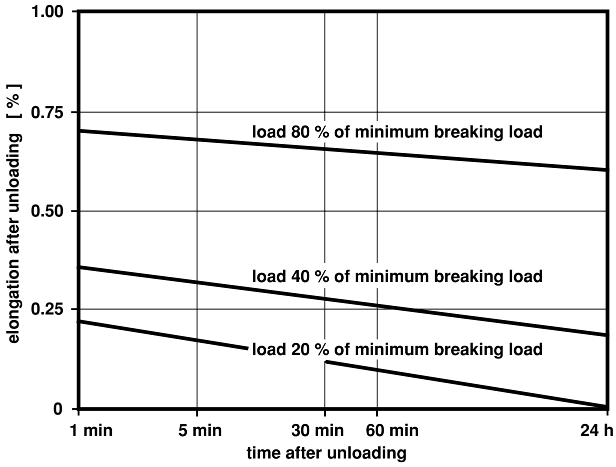


ELASTICITY 6: Permanent elongation depending on the previous load for Casar Stratolift and a conventional rope fibre core. The permanent elongation increases with increasing load. Casar Stratolift shows a much lower elongation.

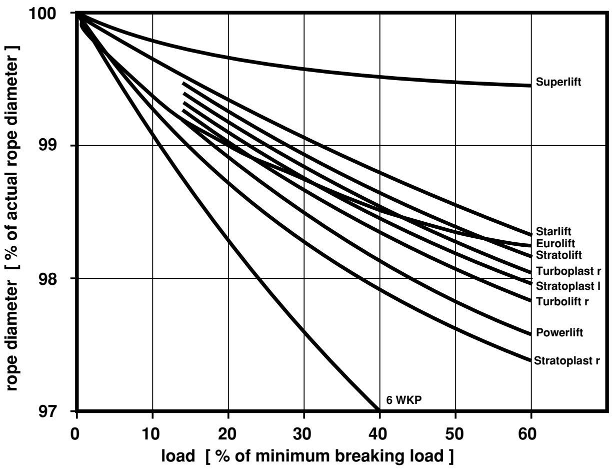
DIAGRAMS: ELASTICITY AND ELONGATION



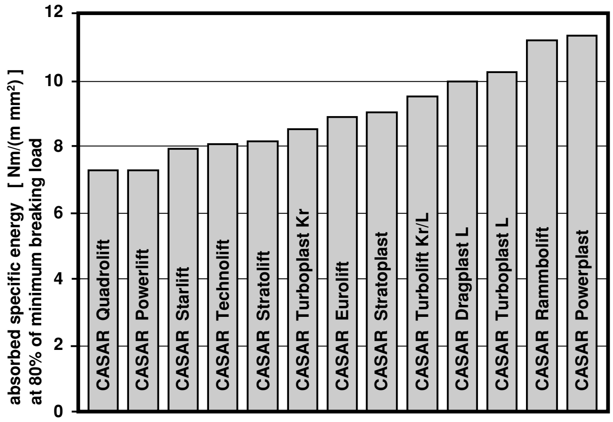
ELASTICITY 7: Load-elongation diagram (Casar Powerplast). During the test, the computer determines the increase of the modulus of elasticity, the total and permanent elongation, the energy absorption, the elongation at break, the diameter change and other required data.



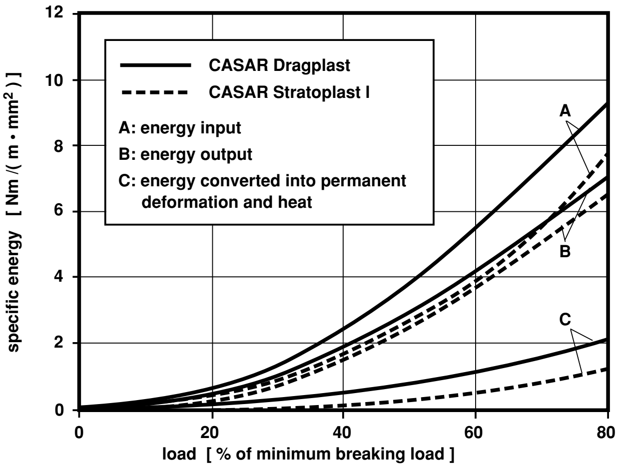
ELASTICITY 8: Permanent elongation after unloading depending on the time. The effect prestressing disappears to a great extend with increasing time. Here 6-strand rope as an example.



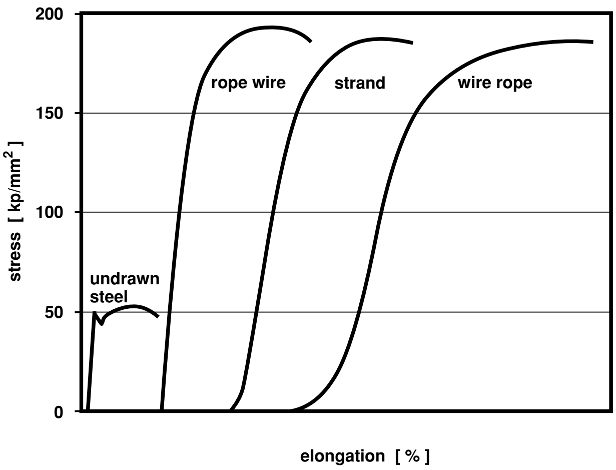
ELASTICITY 9: Rope diameter of a new rope depending on the load in a break test. During service, the rope diameter is of cause reduced by additional factors, e. g., abrasion.



ELASTICITY 10: Absorbed energy at 80% of the minimum breaking load for Casar Special Wire Ropes. Langs lay ropes have a higher energy absorption than regular lay ropes, ropes with an internal plastic layer have a higher energy absorption than full steel ropes.



ELASTICITY 11: Specific energy of Casar Special Wire Ropes.



ELASTICITY 12: Comparison of the stress-elongation- curves of steel, rope wire, strand and wire rope.

ELONGATION CURVES

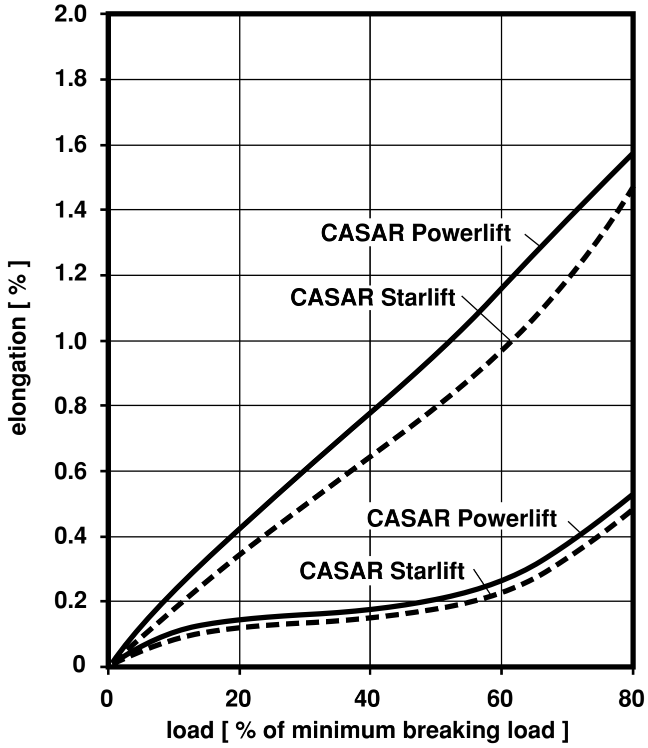
The knowledge of the elongation properties of a steel wire rope can be of great importance to the equipment manufacturer or user. Therefore we present the load-elongation diagrams of the most important Casar Special Wire Ropes, here.

The upper curves show the total elongations depending on the load. The lower curves show the permanent elongations remaining in the rope after unloading depending on the previous load.

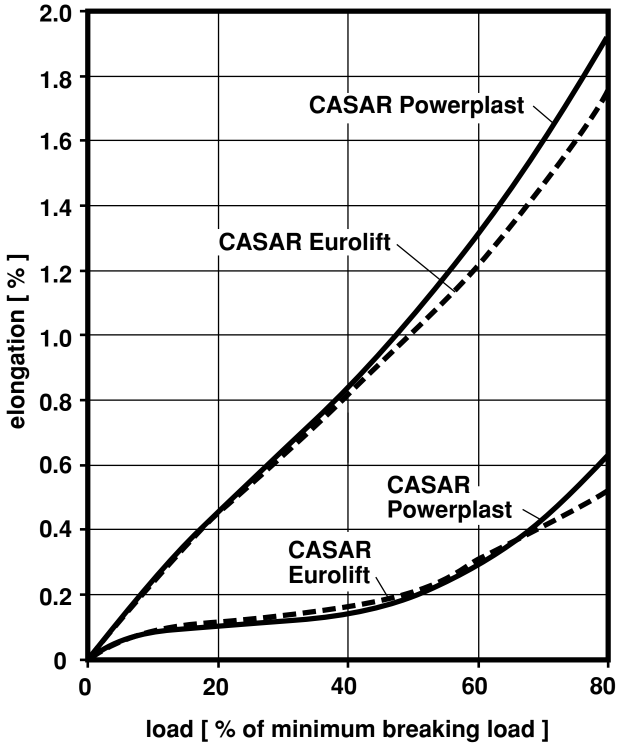
The diagrams show the average values of a great number of cyclical loading and unloading tests performed with ropes of different diameters and tensile strength. The diagrams are independent of the rope diameter. The influence of the tensile strength is negligible.

Please note: setting in the end fitting can cause additional elongation.

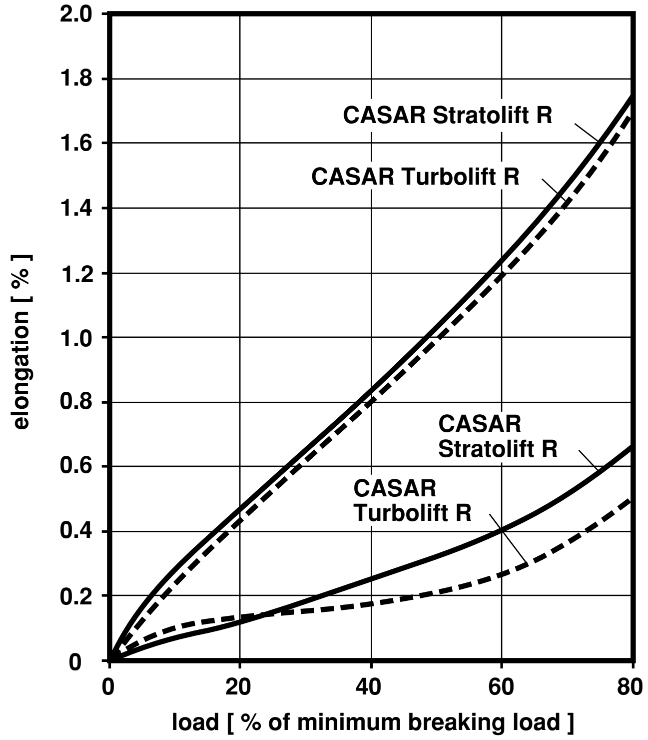
R = Regular Lay; L = Langs Lay



elongation curves 1



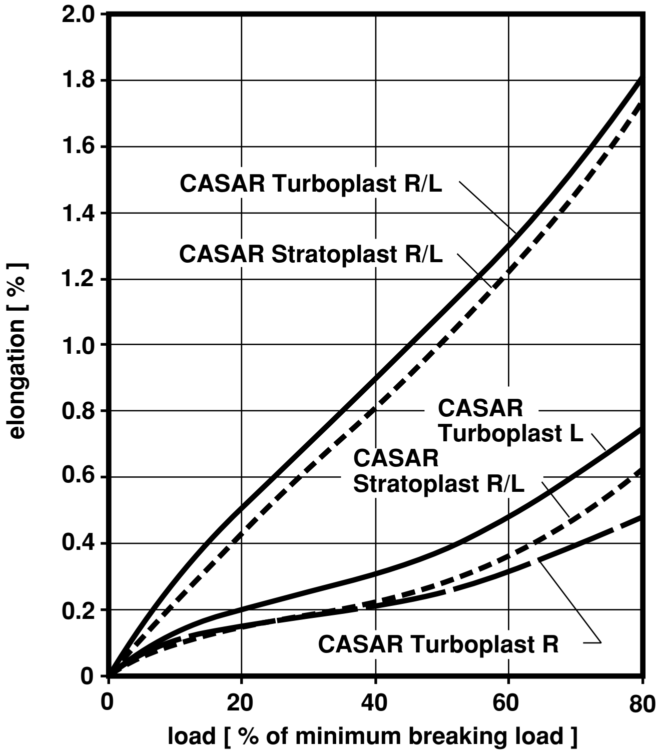
elongation curves 2



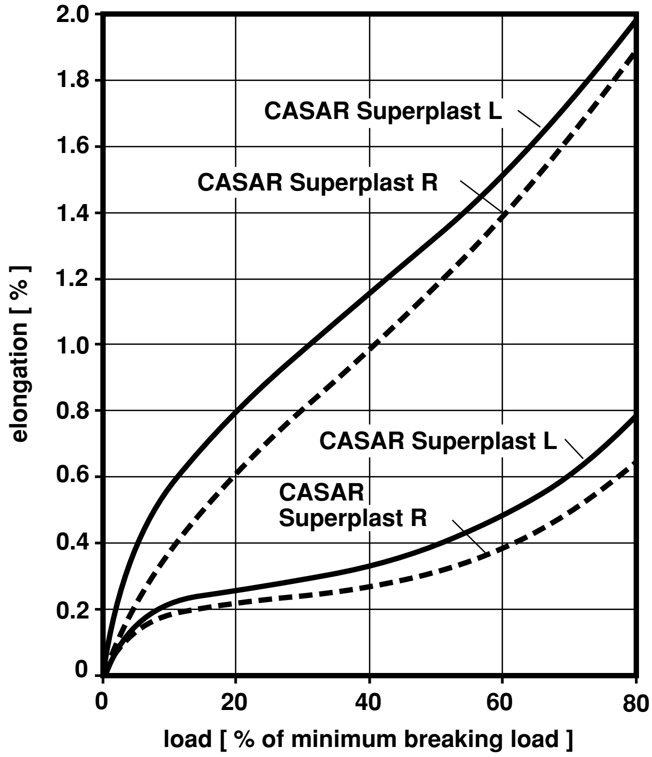
elongation curves 3

R. Verreet, Technical Documentation, 8/1997

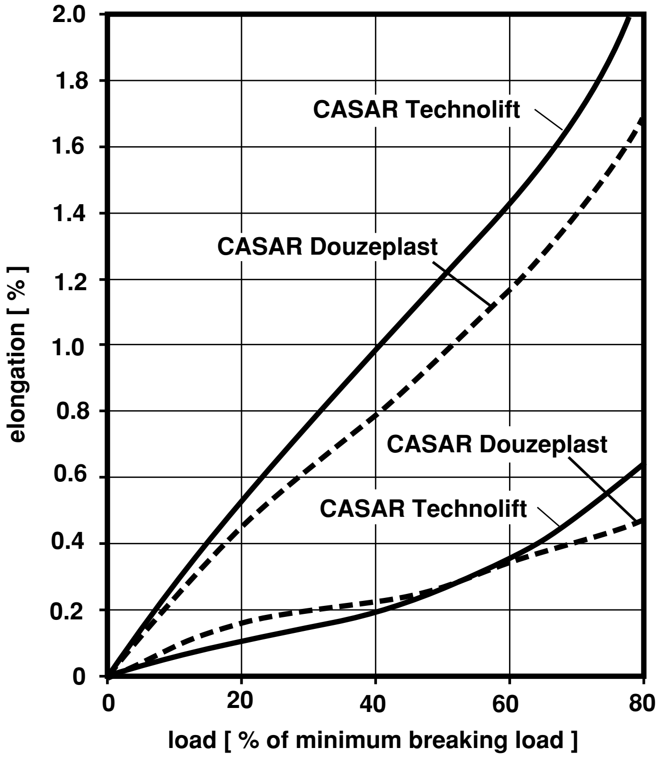
ELONGATION CURVES



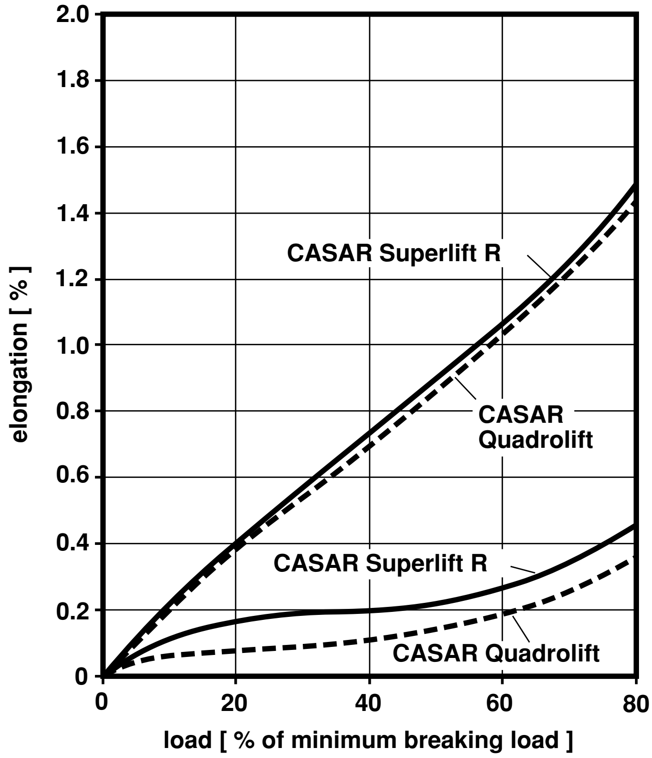
elongation curves 4



elongation curves 5

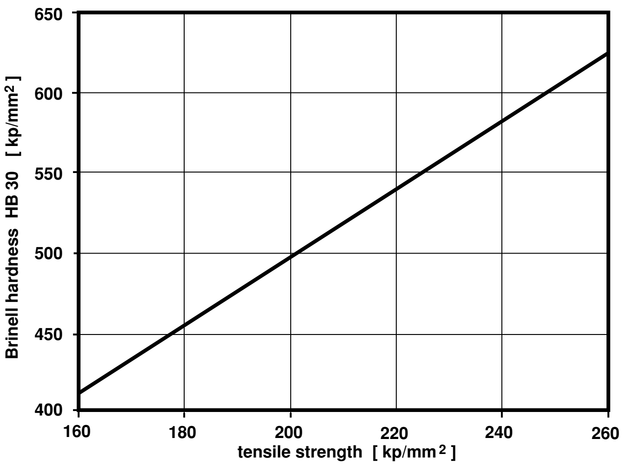


elongation curves 6

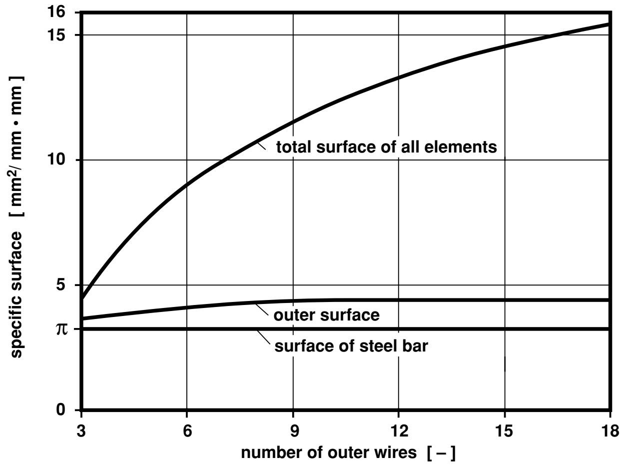


elongation curves 7

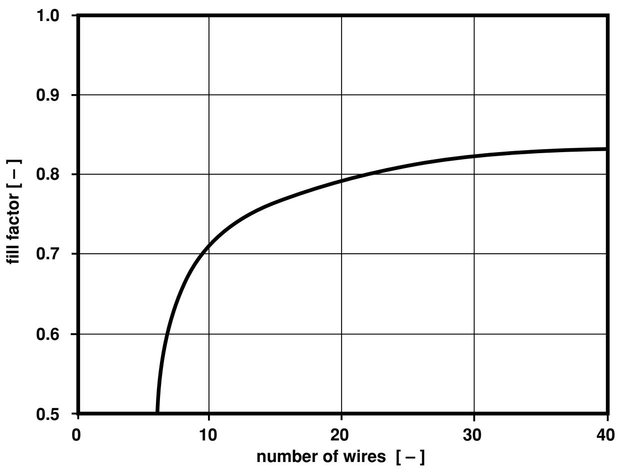
DIAGRAMS: GENERAL



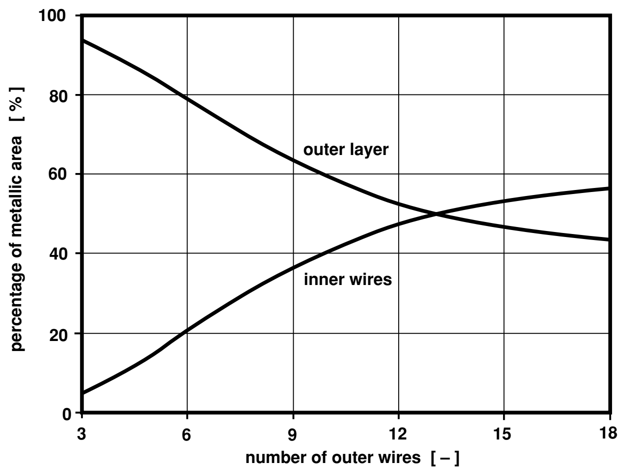
GENERAL 1: Brinell hardness HB 30 of the wire surface depending on the tensile strength of the wire.



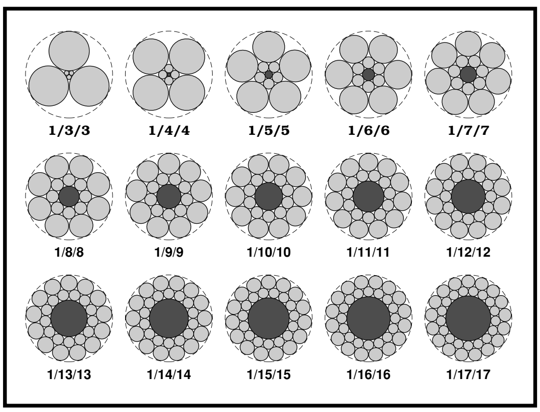
GENERAL 2: Surface of a seale strand, divided by the strand diameter and the strand length, depending on the number of outer wires. The outer (exposed) surface is only slightly larger than the surface of a steel bar, the total surface is much larger.



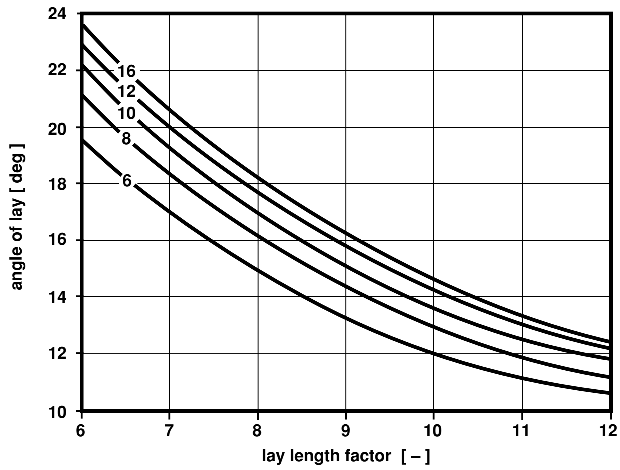
GENERAL 3: Fill factor of a seale strand depending on the total number of wires. The fill factor increases steadily with the number of wires.



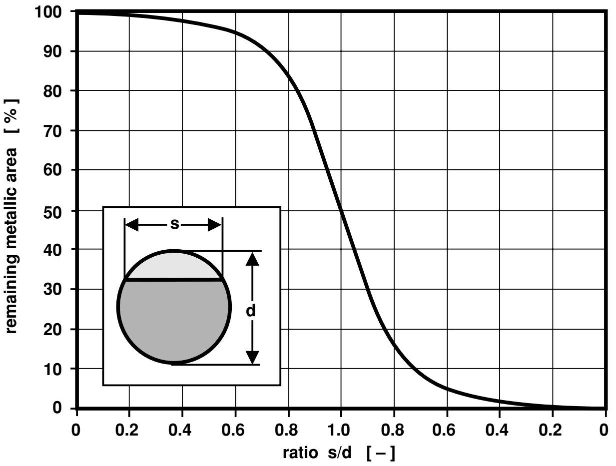
GENERAL 4: Percentage of the total metallic area for the outer and inner wires of a seale strand depending on the number of the core increases steadily, and the percentage of the outer wires decreases steadily with increasing number of outer wires.



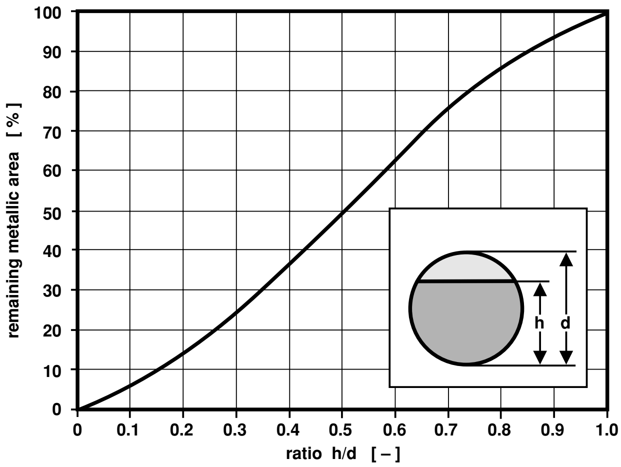
GENERAL 5: Seale strand 1+N+N, for N=3 to N=16. With increasing N, the diameter of the center wire is increasing while the diameter of the outer wires is decreasing.



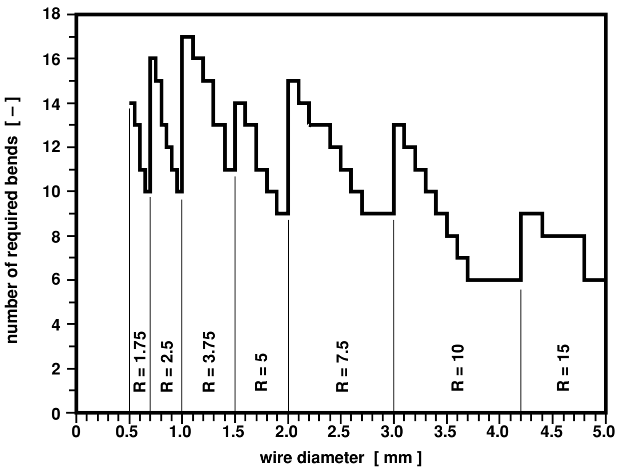
GENERAL 6: Angle of lay depending on the lay length factor for 6-, 10-, 12-, and 16-strand ropes.



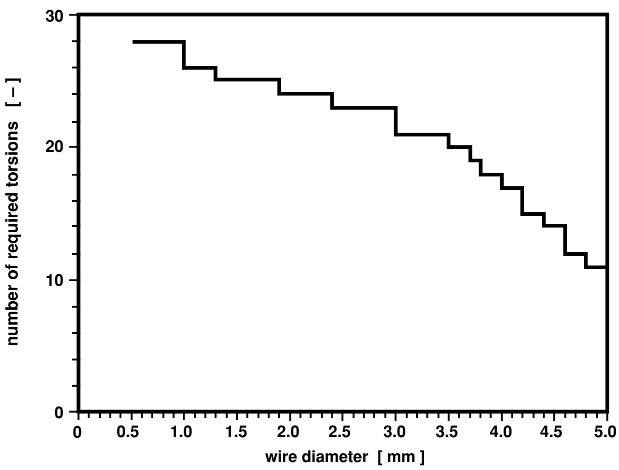
GENERAL 7: Reduction of the metallic area by abrasion. Remaining metallic area of the outer wire depending on the ratio of the width of the abrasion ellipse s vs. the wire diameter d.



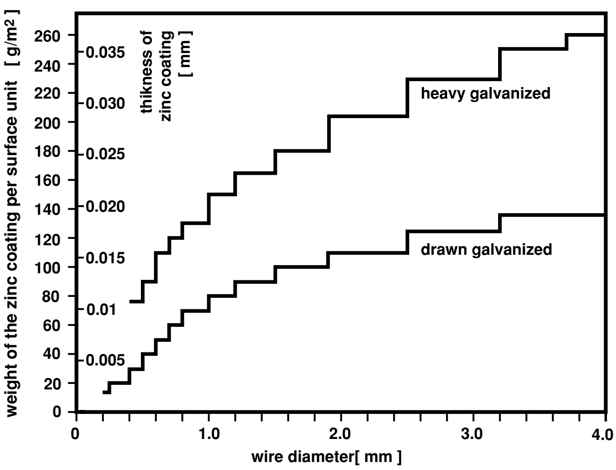
GENERAL 8: Reduction of the metallic area by abrasion. Remaining metallic area of the outer wire depending on the ratio of the remaining height of the wire h vs. the wire diameter d.



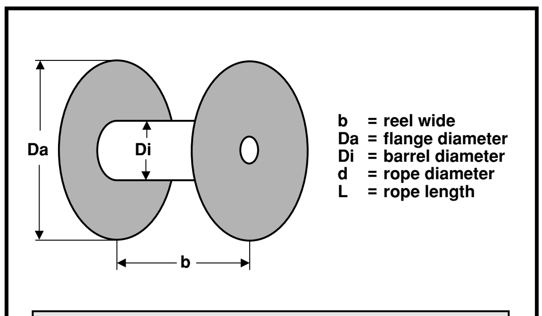
GENERAL 9: Quality control for rope wire according to DIN 2078. Number of required bends in a bending test depending on the wire diameter. R = radius of bend. Tensile strength 1770 N/mm².



GENERAL 10: Quality control for rope wire according to DIN 2078. Number of required torsions in a torsion test depending on the wire diameter. Tensile strength 1770 N/mm².



GENERAL 11: Quality control for rope wire according to DIN 2078. Required weight of the zinc coating per surface unit and thickness of the coating for drawn galvanized and heavy galvanized wires depending on the wire diameter.



$$\frac{\pi \cdot (Da^2 - Di^2) \cdot b}{4 \cdot d^2} < L < \frac{\pi \cdot (Da^2 - Di^2) \cdot b}{4 \cdot d^2} \cdot \sqrt{2}$$

GENERAL 12: Formula to calculate the rope length on a reel.

THE DRUM

The drum is an important element of a hoisting system. We distinguish between grooved and ungrooved drums, and between single and multiple layer drums. In order to guarantee good spooling on the drum, the following rules should be considered:

Single layer drum

- *The direction of layer of the rope has to be chosen opposite to the direction of winding on the drum.*

Multiple layer spooling

- *Wedges should be provided to help the rope to climb into the second and third layer.*

- *The first layers must be installed under tension.*

- *The direction of lay of the rope should be chosen according to the rules (see page 22).*

In the second and higher layers, adjacent wraps are no longer separated by the walls on the drum, so that the wraps can form indentations. In order to avoid premature rope destruction, the following rules should be observed in selecting the correct type of rope:

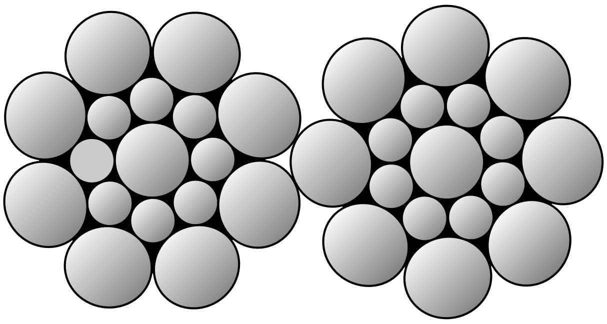
- *In Langs lay rope, indentations between outer wires do not occur. So Langs lay rope should be preferred to regular lay rope.*

- *In rope with compacted outer strands, indentations between outer wires do not occur. So rope with compacted outer strands should be preferred to conventional rope (see page 31).*

- *Eight strand rope should be preferred to six strand rope (see page 31), because it has a more closely circular cross- section.*

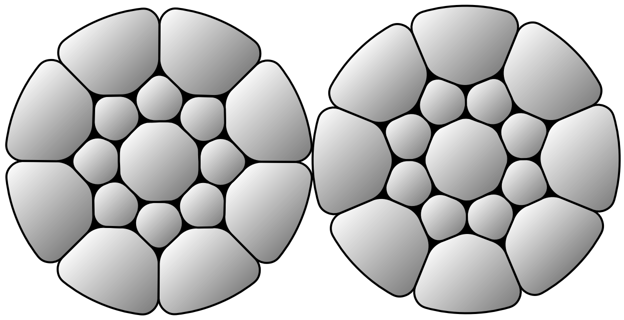
Under the pressure of the overwinding layers, the rope of the lower layers is subject to high radial forces which might cause structural damage.

- *Ropes with an internal plastic layer show excellent results because of their high structural stability.*



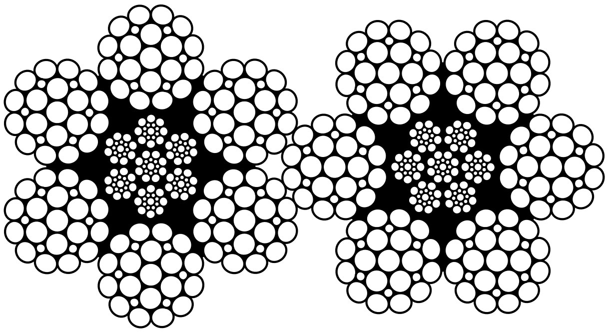
Conventional outer strands:

Between conventional outer strands of adjacent rope wraps, there is danger of mutual indentations of the outer wires. The indentations can lead to severe external damage to the ropes.



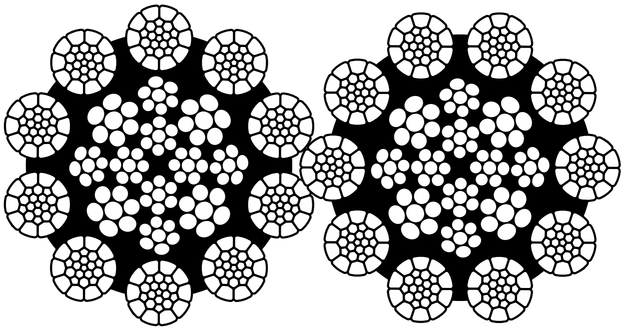
Compacted outer strands:

The outer wires of compacted outer strands cannot form indentations. This is why ropes with compacted outer strands are so suitable for multiple layer spooling.



Six strand ropes:

Six strand ropes can form deep indentations, because they have deep valleys between the outer strands. The indentations can lead to severe external damage to the ropes.



Eight strand and ten strand ropes:

Eight strand and ten strand ropes do not form deep indentations, because their cross- section is very round. This is why eight strand ropes and ten strand ropes are so suitable for multiple layer spooling.

CONVERSION FACTORS

Length	**1 m**	**= 1000 mm**	**= 3,28 ft**	**= 39,37 inch**
Force	**1 kN**	**= 101,97 kp**	**= 0,10197 t metric-f**	**= 224,8 lbs-f**
Tensile Strength	**1 N/mm^2**	**= 0,10197 kp/mm^2**	**= 145,04 p.s.i.**	**= 10 bar**
Cross Section	**1 mm^2**	**= 0,00155 sq.inch**		
Weight	**1 metric t**	**= 1000 kg = 1,102 short t**	**= 0,9842 long t**	**= 2204,6 lbs**
Weight per Length Unit	**1 kg/m**	**= 0,672 lbs/ft.**		

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