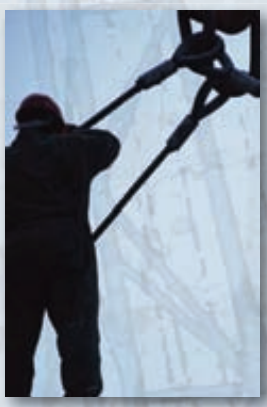
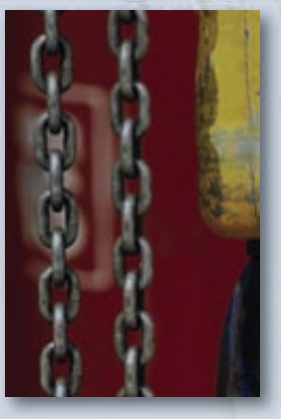
Lifting, Securing, Transporting...

SELDIS polysteen

...for a secure hold.



Textile Ropes
Steel Ropes
Chains
Textile Slings
Lifting Gear and
Lashing Equipment



2011-08

Lifting Securing Transporting
SELDIS polysteen
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Whilst every care is taken to ensure that data and information contained in this brochure is accurate, no liability is assumed for consequences resulting from any errors in these.

Contents of this publication are subject to alteration.

Important

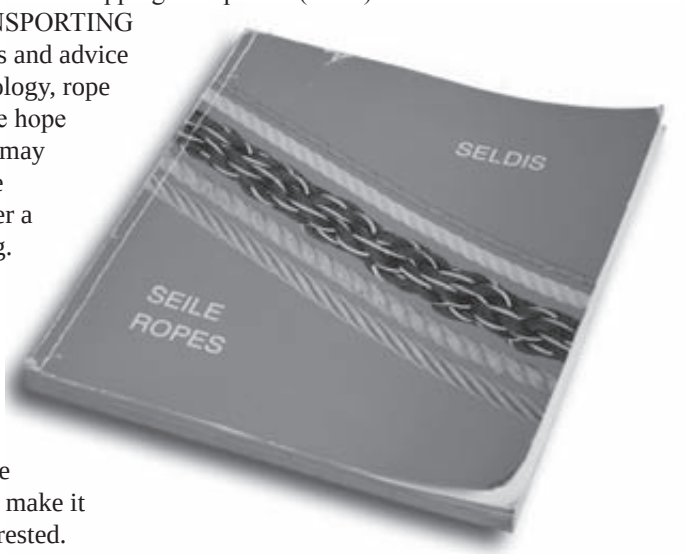
Please observe that numerical presentation appearing in tables may differ from that in text by following the practice common in Germany and other European countries with decimal point as comma and thousand comma as point.

Foreword
Or: What we have in mind …

By the end of the previous century it was already evident that developments in information technology, in the regional and global economies, and above all in the tools for self presentation were having a fundamental impact on our perceived view of the world. These perceptions, however, often neglected the actual substance that was left behind.

In our case, faced with the necessary – and long overdue – update of our company presentation, we place a deliberate focus on substance both in content and the tangible qualities of a booklet made of paper. For good reason too. We know how useful it is and what the user really sees in it. But that should not exclude us having a suitable online presence as well.

Call it a manual or a catalogue, a collection of data or reference work, here it is – the new brochure and successor to the last one dated 1978, which, incidentally, back then was official training material for the Association of German Shipping Companies (VDR). Our motto at the time: LIFTING, SECURING, TRANSPORTING to summarise the extensive range of products, services and advice we offer on connection engineering, and safety technology, rope traditionally being the first thing to spring to mind. We hope all this will be helpful for business partners, who still may not know everything about us, and interesting to those who presently know nothing about us. Indeed, we offer a brochure that covers a lot, but by no means everything. Nevertheless, sufficiently informative and adequately stimulating to prompt enquiry and seek further advice, which we have in abundance and are more than pleased to offer.

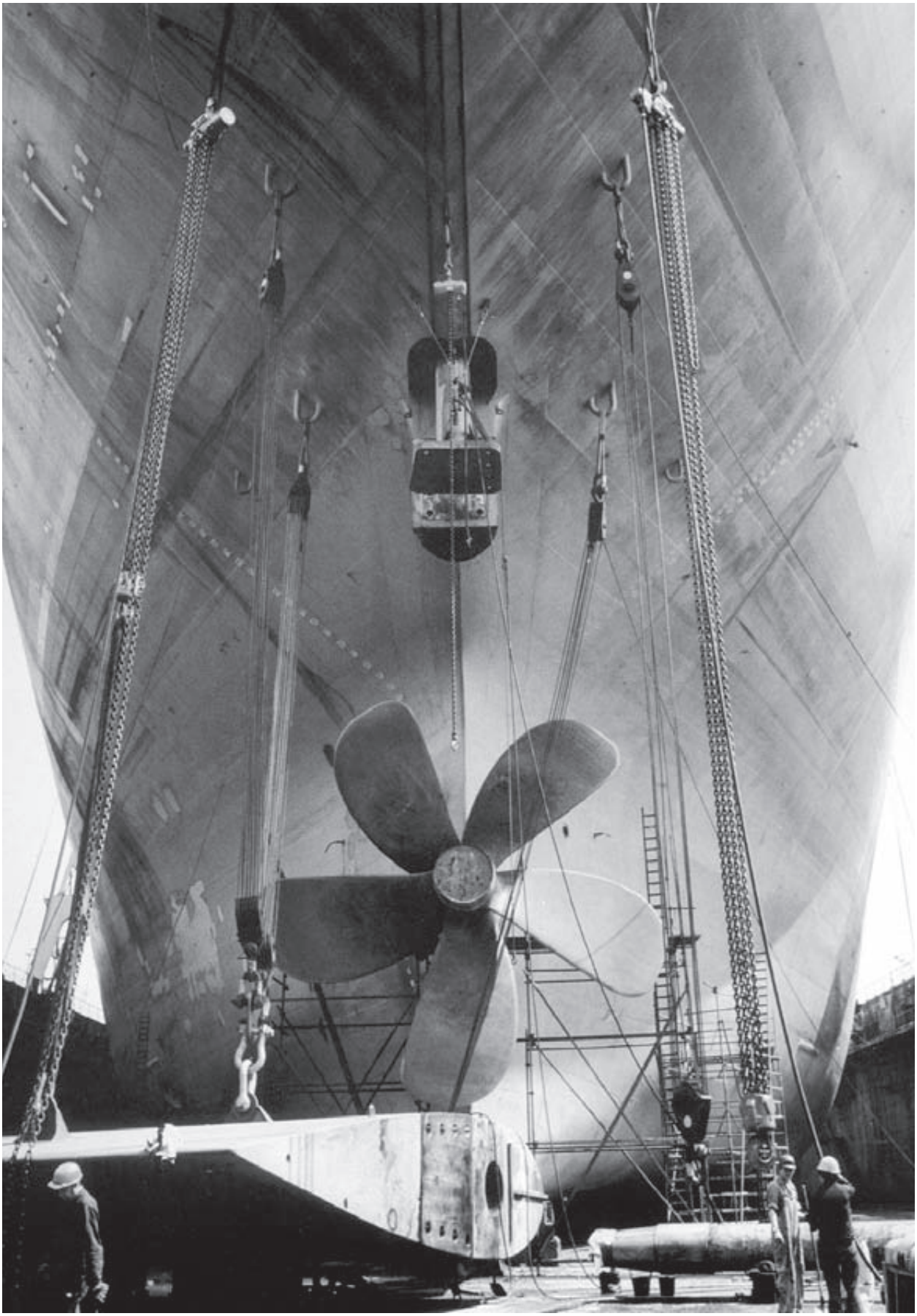


As a means to provide solutions to problems and meet continually growing safety requirements we have decided to update this brochure on a regular basis and make it available as part of our service to all who may be interested.

Should a by-product of this just happen to be an increase in awareness for our company, then this is welcomed. In the age of aggressive communication we think a little more publicity will do us no harm.

Incidentally: Due to our location shipping is obviously the traditional focus of our orientation in service and products. And this publication is no different. Perhaps one-sided at first glance, but on closer inspection it represents a profile, most popular among any user ashore. For what ships order from us must punctually find its way on board and work first time. Because ships do not wait and at sea there are no second chances. This principle is something we adhere to, also where no ships are involved. After all, we know no different.

Eckart Weise



Beginnings:
Worth knowing

History
Notes on the history of rope

'Rope making is an ancient craft that dates back to prehistoric times. The earliest ropes consisted of plant fibres twisted together by hand. By 3500 BC the first special tools to fashion rope from papyrus fibres and leather strips were developed and the use of hemp can be traced to Asia as early as 2800 BC. In Europe this rope material was not adopted until around 200 BC and it remained the principal material for making ropes until the 19th century, when it was replaced by other materials such as coconut and sisal fibres or Manila fibre, which is derived from a plant in the Philippines unrelated to hemp. The introduction of chemical fibres in the 1950s gradually displaced natural fibres as materials for making ropes and most ropes today are manufactured from synthetic materials or metals.

Originally fibres used in the manufacture of rope were carded or teased (combed), then spun in a similar manner used to make wool or cotton yarn. In rope making, the yarns are twisted into strands, which are then laid into rope. In the middle of the 19th century machines to automatically tease the fibres, twist the strands and lay the rope were developed. Even today rope is still found to be made by a traditional method known as the rope 'walk' in which a device equipped with hooks, called a traveller, moves slowly on rails, twisting the fibres into strands as it proceeds, whilst in a second stage these are laid into rope.'

So much for this synopsis taken from an encyclopaedia. Now, as our topic is 'Lifting, Securing, and Transporting', and this brochure shows a collection of products which on the bottom line are concerned with the 'transmission of physical forces', you may ask yourself what the point of that excursion into history was. The answer is quite simple: Ropes or rope-like structures given by nature or fabricated by man, provide the oldest and most fascinating examples of physical force transmission. In addition, they are of special significance to SELDIS and POLYSTEEN as blueprints that enabled us to start and build a successful business.

Rope carts in Ninive 9th Century BC

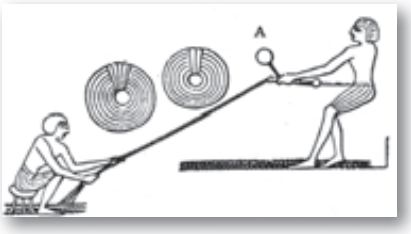
History begins when mankind started to make records. Archaeological discoveries of texts, pictures and material remains give us at least a fragmentary impression of what people did with rope and other devices they made for moving or securing heavy loads.

Nevertheless, what brief descriptions of this kind fail to express is how different things would have been if rope had not been invented at all. How would architecture, power generation, shipping and other activities in the history of mankind have evolved? That surely is something to think about, even if completely theoretical. Moreover, there was never a chance of a world without rope because nature provided scores of examples long before we humans came on the scene. Admittedly, evolution is not history and therefore has no place here; yet what of the threads a spider spins for its web? Surely the spider's web represents the ideal combination of tensile strength, lightness, flexibility and elasticity – characteristics we strive to achieve in the products we manufacture, though will never get anywhere near to achieving. However, we shall refrain from considering the possibilities of modern physics or build spider farms for the production of thread (although already a focus of research for the manufacture of bullet-proof vests). We just find it interesting to point out the origin of all that is industrially fabricated in so many variations today, and where the benchmarks for scientific research lie.

Back to history. Archaeological discoveries prove that woven rope structures made from leaves, bast fibres, branches, rushes or strips of leather

were the first prehistoric examples. These were followed by structures made from bundles of fibre or leather strips, twisted and woven into durable forms. Jute rope in ancient India (400 BC), ropes made from silk worm threads to pull the Chinese Emperor's catafalque in the Han Dynasty (200 BC – 200 AD), traction rope to heave blocks of stone on wooden sleds in Egypt in the fourth dynasty (3500 BC) or rope manufacture from palm leaves or rushes as a handicraft (Egypt 2500 BC). The Greeks and Romans imported rushes, papyrus or palm leaves for the then widespread craft of making rope products, flax also being used in the manufacture of cord, nets and fishing line, hemp for rope, hawsers and nets, esparto for ropes and hawsers.

Egyptian grave finds provide clues on rope dimensions: a 6 mm thick rope from esparto, a 10 mm thick flax rope (3000 BC), a 20mm thick rope made from camel hair (2000 BC). Extremely precise properties for rope were specified as early as Herodot for construction of a pontoon bridge built by the Persian king Xerxes in 400 BC consisting of two lengths of white flax and four of papyrus, metre weight 52 kg, diameter approx. 14 inches, total length more than 2000 m. Even if some measurements may be doubted, such reports are not pure fantasy, for how else could we explain all the famous building and transportation achievements at the time?



Ropemakers in Egypt

In contrast to the ancient world, documentation from the first millennium AD in Europe is extremely rare. It can be assumed that production methods and materials in this era were based on those succeeding the ancient cultures, and it was not until the middle ages before we find reference to the craft of ropemaking and the trade of ropemaker. A handicraft trade indeed it was, since it relied on the simplest hand tools to spin yarn, twist into strands and lay into rope. It took until the latter half of the second millennium for the advent of mechanical rope production in the form of spinning wheels, rope wheels and rope lathes. Rope spinners and layers emerged. With the Enlightenment in the 18th Century technology became a driving force in social advancement and the importance of product quality and production methods was recognised. The path to industrial manufacture of rope, including faster and continual quality improvements was paved. Many pioneers at the time, but one of the most significant, Captain Joseph Huddart from Allonby, Cumberland, England, brought the preindustrial history of rope to a close.

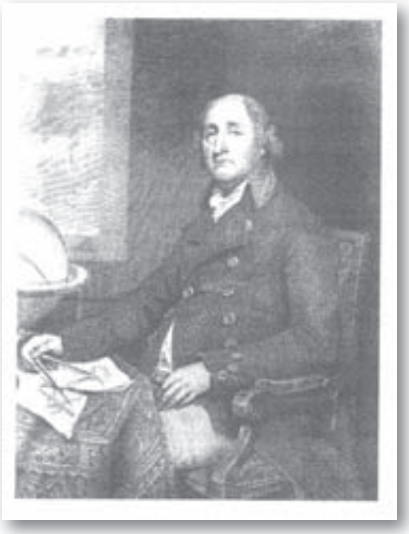
Ropemaker's treadmill around 1595

History

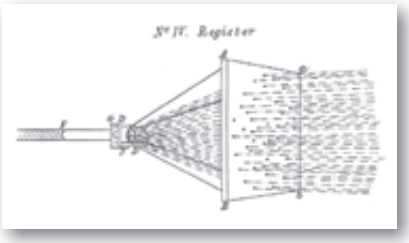
We recall ... Joseph Huddart 1741-1816 (Extracts from an article by Wolfgang Weber, Deutsche Seiler-Zeitung 1996 No. 3)

Captain Joseph Huddart, pioneer in mechanical ropemaking, died 180 years ago.

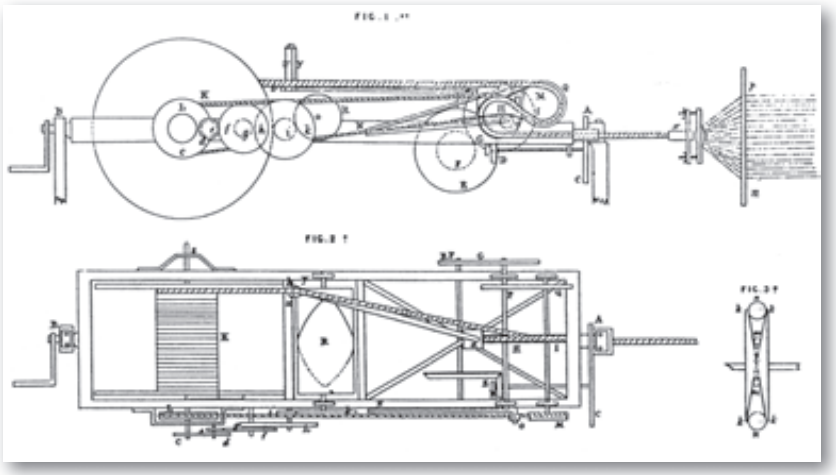
In many publications at the end of the 18th Century much is reported about the problem of ropemaking, especially the issue of rope strength. All agree that the process of twisting yarns to strands, then these to rope, would not equal the strength of the sum of each yarn therein. Research undertaken by Reaumur, Tredgold and others empirically support this supposition. In 1739 the Swede Nils Valerius Erichson published a book on the 'strength of the combined forces of rope and hawser, if twisted in customary fashion' in which he proposed not to twist in customary fashion but to lay strands upon one another and wrap in a thin thread. He freely admitted that this would be technically impossible to accomplish. In 1795 the court counsellor to Württemberg, Wolfgang Mögling, constructed a weaving machine for tube-like ropes. This invention he left to the brothers Landauer in Stuttgart, though nothing came of it. Both Erichson and Mögling could not have known at the time that this method would become possible many years later, albeit with some minor adjustments: The strands are not wrapped in a thin thread (à la Erichson) but an endless strand is manufactured into a jacket or tube. The round sling used everywhere today, therefore, is a further development of the idea proposed by Erichson and Mögling's tube machine. Back to Joseph Huddart and a glance at English patent records in which we find the following entry: 'In 1793 Joseph Huddart of Islington, Patent No.1952: A new Mode or Art of Making Great Cables and other Cordage, so as to attain a greater Degree of Strength therein, by a more Equal Distribution of the Strain upon the Yarns.'

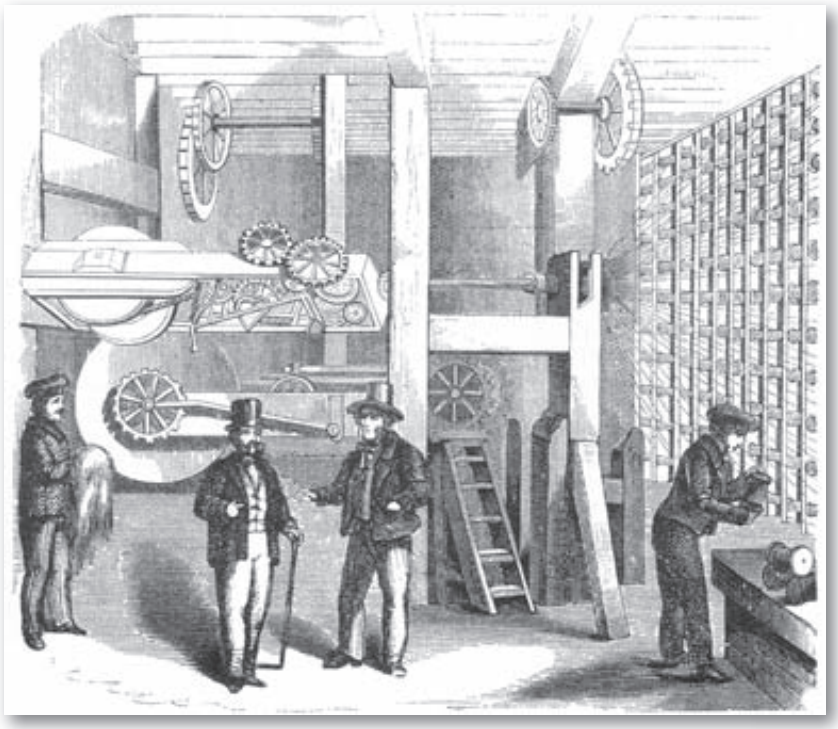


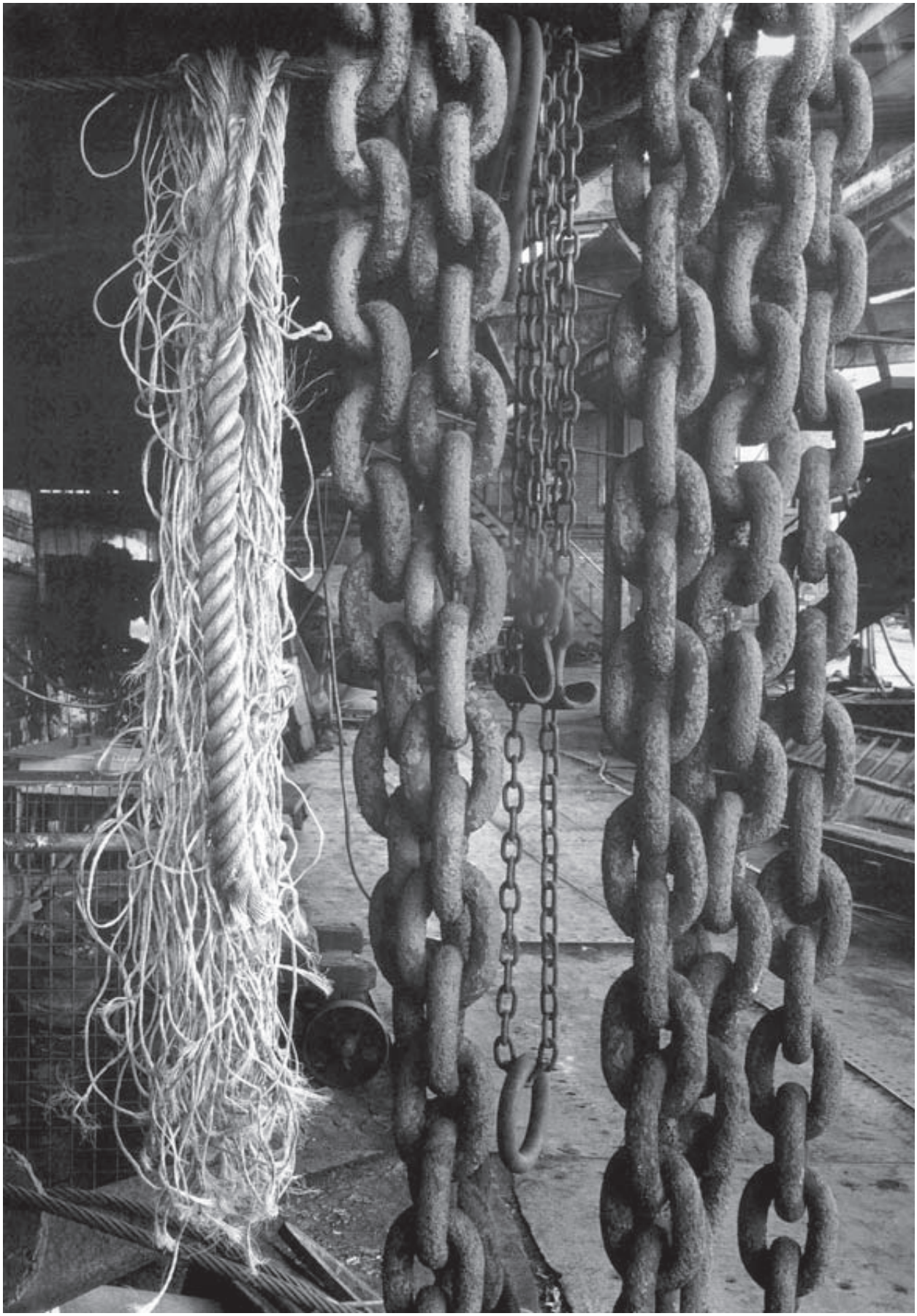
Who actually was this Huddart and how did he arrive at his invention? Joseph Huddart was born on 11th January 1740, the only son of a farmer and shoemaker in Allonby, Cumberland. A technical mind in early years and seafaring experience later, which he acquired in the family fishing business and taking charge of a cutter, laid the basis for his research into rope. Later, in merchant shipping on the routes to India and China through the Straits of Sudan and many times laying at anchor, he made several striking observations. Noticing, for example, that the exterior strands on the anchor rope were torn, he took a piece of rope apart and examined its construction. All yarns were of the same length, but in the manufacturing process, those on the outside of the strands were shortened, whilst those on the inside had formed kinks and lay loose, therefore contributing little to the strength of the rope. Moreover, the greater the angle the strands were laid at, i.e. the shorter they became, the lower the rope strength due to excessive strain on the exterior yarns. The solution he recognised in the need to lay the yarns in different lengths proportional to their position in the rope strands. Back in England he developed a rope making machine employing a so-called register plate and compression sleeve. Its registration as a patent (see above) was successful, the only setbacks being resistance from existing ropemakers and failure to convince the British Admiralty of the benefits offered by the new manufacturing method. It took a certain Admiral Gambier to recognise Huddart's invention as a true technical advancement, which led to Huddart opening a factory in 1800 in the London district of Limehouse backed by influential financiers. Continual optimisation led to the construction



of machines able to produce long lengths of uniformly twisted rope. The principle of the ropewalk and cart on wheels was born (incidentally first employed outside England in Wolgast on the river Peene in Germany). Only a short while later Huddart developed the first stationary machine with identical possibilities, using a sun-wheel and planetary gearing mechanism to enable extraction of different lengths of yarn from the compression sleeve directly to a spool. A model of Huddart's ropemaking machine is on display today in the Science Museum in London. Rope made according to Huddard's technique had twice the strength of conventional rope with the same diameter and post 1810 quickly became established under the term 'patent rope' by which it was called and listed in brochures into the 1930s.







History
Our company then and now


Ergebene Anzeige.

Den Herren Guts-, Gruben- und Fabrikbesitzern die ergebene Anzeige, daß ich am hiesigen Platze eine

Drahtseil-Fabrik

errichtet habe, und empfehle solche der geneigten Beachtung.

Gleichzeitig mache ich die Herren Brennereibesitzer auf mein Lager von geköperten

Maschinen- und Elevatorgurten

aufmerksam. Um geneigten Zuspruch bittet

die Seilerei

von **Gustav Schröder,**

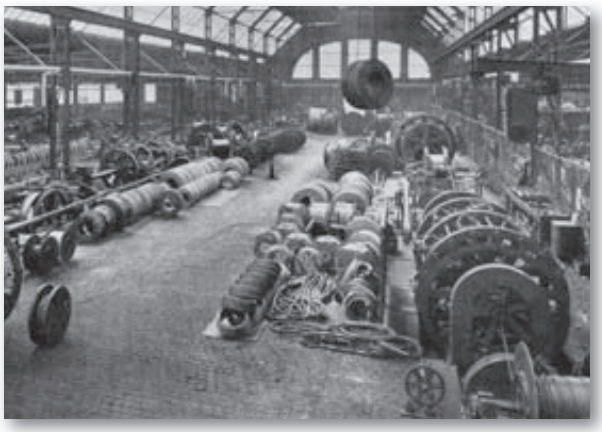
Bollwerk No. 1

Landsberg a. W., den 8. October 1868.

Companies like ours exist in the present and always have their eyes on the future. That is how we survive. Nevertheless, certain circumstances, like the publication of this brochure, open the opportunity for a moment of reflection and a brief glance back at the past. We too are a piece of history. Admittedly, perhaps only a very insignificant one …

Before SELDIS, as representative of the steel side, and POLYSTEEN, as producer of textile ropes, came together in 1983, the two firms had cooperated but grown quite separately. They represent two histories with many parallels.

The first history begins almost 200 years before appearance of the adjacent advertisement in the 'Neumärkisches Wochenblatt' with a family by the name of Schröder that can be traced back to 1644, who practised the craft of ropemaking in Landsberg/Warthe (at the time using textile fibres, as we know). The advertisement from the year 1868 announces the intended establishment of the 'Mechanische Netzfabrik Schröder & Mögelin' – a mechanical factory for making nets; a neighbouring factory providing the drive for the ropewalk via an underground transmission shaft. Machines to manufacture wire rope were later imported from England, following completion of a new factory building in 1888, with a 20HP gas engine, now under the name 'Kabelfabrik Landsberg'. At the beginning of the 20th Century the company lists a wire rope factory, hemp rope factory, twine and cord factory and net factory with plants in Danzig, Berlin, Breslau, Dortmund, Dresden and Hamburg, employing up to 1500 workers in the 1930s and – not necessarily common in those days - a self-managed trust for workers and staff with company health insurance. Manager of the Hamburg representation in the 1930s happened to be a young man by the name of Rudolf Seldis.



The second story has two names and two beginnings. Wiedenbrück in Westphalia was already a famous centre of the ropemaking trade in the 17th Century and birthplace of a family named Baumhüter. Generations later, in the year 1863, Peter Baumhüter started a ropemaking trade and laid the foundation stone for a family enterprise that continued for 150 years. From roots as a handicraft it turned into an industrial player with the advent of the twentieth century, advancing mechanisation and in 1908 first to operate the new spinning machine. What began with binding twine and driving cords developed into a wide spectrum of textile products. Expansion of the company brought regional diversification, amongst others a base in Tanzania in 1965 giving it access to raw fibres, or Hamburg in 1952 and access to the production of ship's rope through a stake in the company Steen & Co, which itself had

started up in 1896 as a manufacturer of binding twines and rope yarns made from hard fibre. With the port of Hamburg as an ideal market on the doorstep, soon a production facility for ship's rope was set up in Hamburg-Bahrenfeld. Until the end of WW2 it processed the natural fibres manila, sisal and hemp. Merger with Baumhüter gave access to a group of companies engaged in production of a wide range of products, and important participation in the development of synthetic fibres, their use becoming increasingly popular in the manufacture of textiles post WW2. Steen & Co. is located in Hamburg-Lokstedt, where it produces binding twines, packing cord and ropes, primarily ship's rope. Rapid advances in the development of synthetic fibres as well as the range of products made by Steen led to further diversification and plants in Schwarzenbek near Hamburg for by now the expanded production of staple fibre products (coarse and fine fibres) for the automobile industry, carpet industry, for road, dam and dyke construction, and materials for sanitary and hygiene products. Textile rope manufacture (primarily maritime) was separated, whilst the two companies POLYSTEEN and SELDIS merged.

SELDIS as a company, therefore, indirectly looks back on well over one hundred years of ropemaking tradition, initially as Hamburg branch of the Landsberg cable factory, then after the war at 'zero hour' and Germany's return to the international community as an independent company founded by RUDOLF SELDIS. A new dawn then, an old dawn now, more than half a century later.

Prominent from the onset Heinz Weise, then Hans Vieth; like Rudolf Seldis long deceased, guiding the company into a successful future, examples for all who followed them and follow them now.

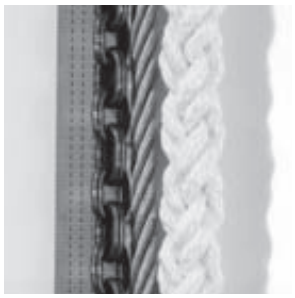
Wire cables and cordage, steel and textile ropes, and a wide range of complementary products parallel to ropes or at their end. This is the business of SELDIS and POLYSTEEN, based in Hamburg, with activities and partners in Germany, Europe and worldwide, forever on the path of tradition progressing into the future.


HHLA

A brief overview, ... or what we offer

Here you find an outline of what we can do (for complete details see contents page or index). Basically it's all about things that make a connection, lift, pull, spread loads, secure and safeguard.

The products ...



Ropes.
Chains.
Textile slings.
End fittings for these.
Rope and cable guides, pulleys, rope blocks.
End fittings for ropes, chains and textile slings.
Canvas covers, fenders, nets.
Material care, gauges and tools.

Service to us is important. We know that the mere act of exchanging money for a good is not everything. Those who place an order with us can expect more.

Used in ...

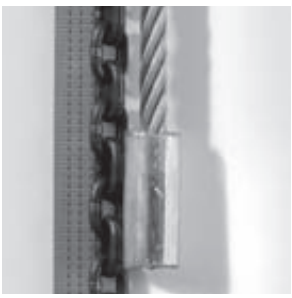
Lifting gear.
Load restraint equipment.
Mooring and towing (tug operating).
Signal and rescue equipment.
Person and material protection.
Anchoring and supporting guy equipment.
Conveyor and elevator systems.
Decoration.

We assist with ...

Assembly and installation.
Test and inspection.
Usage and care.

We advise on ...

Decisions on selection and suitability.
Application of safety regulations and legislation.



Required for ...

Construction industry.
Energy industry.
Shipping.
Road and rail transport.
Industrial production.
Cargo handling.
Stage and studio.
Research and environmental protection.
Leisure and sport.

and...
Hamburg is our home; seaport from where it's second nature to think and act international. We've done so for a long time. We export from here. We have warehouse facilities outside Europe worldwide.

Safety
Laws, regulations, standards ...

The products we manufacture and trade make safety and quality particularly relevant to us: Quality with regard to optimisation of handling and suitability; safety with regard to accident prevention and protection of people, machines and environment. Whilst the subject of product quality is covered elsewhere, here we make a few general comments on safety.

Our products and services have to satisfy high safety requirements. In view of the diversity and number of all the standards, recommendations, guidelines, implementation rules, controlling and supervisory bodies, we see it as our special duty, in the interest of safety for all customers, to provide some explanation.

To begin with: The basis for product delivery and service fulfilment are contract and prevailing law. Even verbal placement and acceptance of an order constitutes a contract. A delivery note with only a brief description of a product is sufficient to establish the buyer's entitlement to quality and safety, and all associated warranties. For most of our products and services this entails consideration of all applicable national, European and international law, plus any derived regulations and standards concerning product liability, industrial safety, accident prevention and equipment safety. There is regulation for product specifications and features, their monitoring and inspection, quality and material controls, documentation and labelling.

What we wish to clarify is that even a casual procedure for placing and accepting orders bears with it the guarantee of absolute product safety, and that we are thoroughly conscious of the stringent regulations applicable in our field of work.

Moreover, we are always available to consult in matters of safety should help beyond the guides outlined in this catalogue be necessary. These are, of course, aligned to law in the European Union, though outside this area serve as a good recommendation.

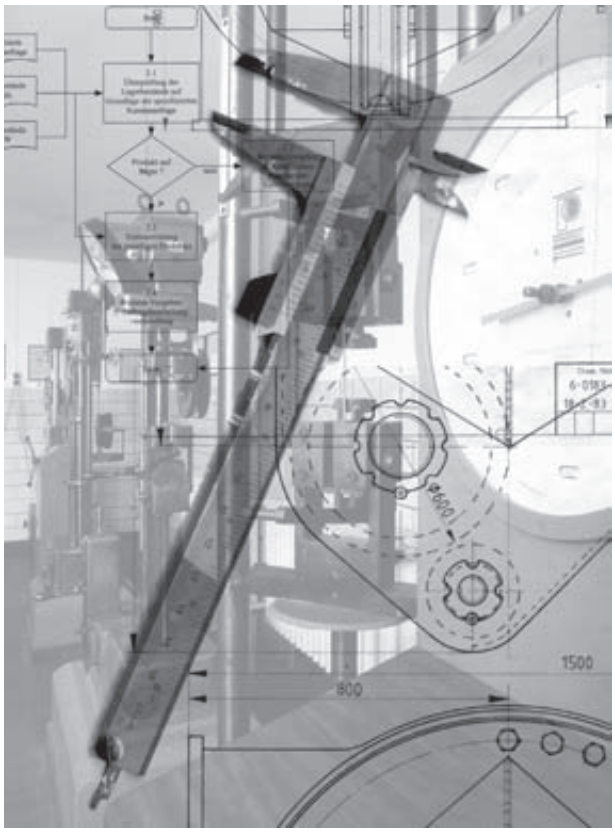
Quality management meant something to us before implementation of ISO 9000 and increased product liability. Here we list a few extracts from our QM manual ...

Objectives of Quality Management (Purpose and scope of application)

One reason for the successful development of our company in past decades was the existence of an efficient quality management system long before introduction of any ISO standard. Still, a higher awareness of quality and legal matters, national or international, requires uniform standards as an instrument to authenticate product safety and competence of manufacturers and suppliers. For us, certification of our quality management in accordance with ISO 9000 ff. is an instrument to confirm and communicate our qualification and competence, as well as guarantee absolute product function and service integrity.

Certification is conditional on:

- All business processes being as standardised as possible, transparent and described clearly, therefore retraceable. Control mechanisms guaranteeing error elimination in all process phases.
- Definition of responsibilities, authorities and procedural methods in all fields of activity being distinct enough to exclude malfunction and interruption in company operations.
- Documentation of activities and instructions being restricted to essentials in order to ensure focus on the principal work. Implementation of regular internal audits to check functioning of the QM system and eliminate sources of error. At the same time training measures to raise employee decision making capabilities within the scope of their authority and reduce regulation.



Resulting in:

- Deliveries and service fulfilment in accordance with order.
- Optimal qualification and competence of all employees.
- Efficiency optimisation in the company.

The QM documentation serves as a binding company agreement, effective from the confirmed time of recognition by the employees in question.

Certification of our company according to ISO 9000 ff. represents the transition of an existing policy of quality assurance to a working quality management system. On the external side it demonstrates and provides proof of our qualification; internally it represents a commitment in the form of a binding agreement between the company and its employees.

QM Elements

The QM manual documents the company organisation (operating divisions, departments, fields of activity, tasks and subtasks), the responsibilities and authorities of management, as well as the competences of the departments and employees implementing tasks and subtasks. It refers to procedures and all other applicable and relevant documentation for quality management and assurance, under special and explicit reference to the following elements and determinations:

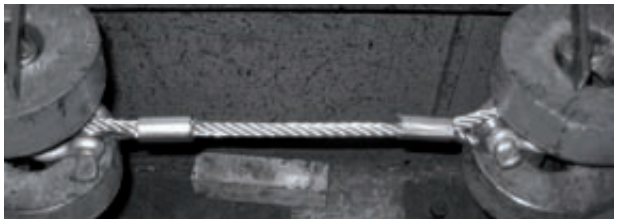
- Management responsibility
  Management is responsible to the company for all business procedures, at the same time authorised by them to act on their behalf and to represent them within the framework of company statutes. Within the framework of their allocated fields of duty high ranking employees are responsible to the company management and the quality manager for the correct implementation of duties assigned to them. Simultaneously they are authorised by management to give instruction to employees assigned tasks and represent the company within the framework of these duties externally. Representation extends to all actions undertaken within the framework of existing provisions and conclusion of business up to an order value of EUR 30,000; activities exceeding this sum require authorisation by or approval from the management.
- Company organisation
  documents and makes the interaction of all operating units in Chapter III evident.
- Contract review
  is component of procedural instructions and ensures that operational business is conducted according to contract.
- Control of documents
  responsibility of the quality manager, regulates the transfer of all information relevant to quality, documented and verifiable as per procedural instructions.
- Purchase and receipt verification
  of materials (any type of product) is a supply element to guarantee that quality of material used complies with contract, thus falls under purchasing, warehouse and despatch.
- Control of consigned products
  supplements purchase in the processing of third party manufactured items ordered by the customer: Usability and suitability must be ensured, and procedure documented in the framework of work preparation.

- Traceability
  of processes allows proof of origin and product features, as well as test results. Obligation to produce supporting evidence is legislated, verification requires identifiably of products, hence relevant labelling of these and documentation in files. Stipulations for this purpose are made within the framework of order processing, warehouse management and sales.
- Outgoing inspection
  of material and control of faulty products includes intermediate and final examination, is an important instrument to guarantee that faulty products are not dispatched and for fault minimisation in manufacturing and storage.

- Testing equipment
  as instruments to examine materials to help avoid incorrect measurement results and wrong decisions, if in flawless condition. QM manager is responsible for regular ongoing examinations.
- Corrective and preventive measures
  refer to implementation of fault identification in fault avoidance as a consequence of all examination methods employed in the operational process. This affects all company areas. Measures of fault avoidance are taken as a consequence of fault identification within the framework of internal QM audits or in stipulations included in operating instructions.
- Handling, storage, packaging and despatch
  determine whether the quality of a product is not impaired or lost before its deployment. Equally indispensible is extreme diligence in the conduct of these duties in the areas of storage and despatch, assured by the qualification of personnel and quality of resources and tools.
- Quality records
  are responsibility of the QM manager in the form of certification and inspection records, compiled by neutral surveyors, suppliers or own personnel, managed according to the relevant procedural instruction. Quality records serve provision of proof of quality for materials either procured, existing, produced or sold.

- Internal quality audits
  are regular examinations carried out at the workplace with simultaneous employee training. Their purpose is to check the functional capability of the quality management and so to minimise errors, reduce costs and to maintain and further develop human resource qualifications.
- Product safety
  is assured when manufacturing methods, standards, statutory provisions and safety requirements are observed at all times and continually updated. Regulations pertaining to this affect procedural requirements in the areas administration and work preparation.

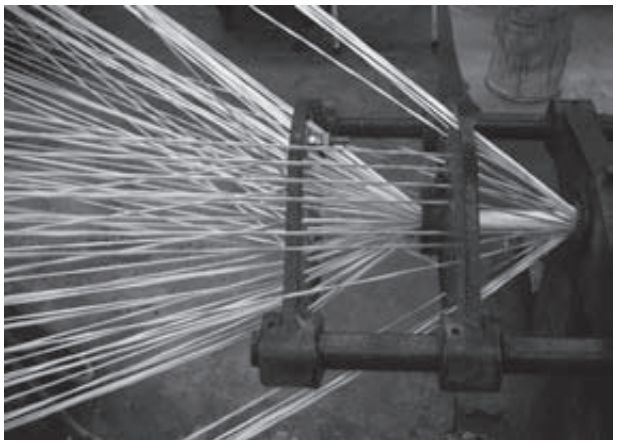
All described elements deserve special attention in company operations because they also represent an instrument to increase efficiency, i.e. to improve economic performance (minimise total costs).



Textile Ropes

Fundamentals...

Rope, a flexible continuous, structure of twisted strands with high tensile strength. Made from natural fibres such as cotton, hemp, jute, flax, manila hemp or sisal, or from synthetic fibres such as nylon, polyester or glass fibre, or from metal wire.



Such might be a dictionary definition of rope. Meanwhile the question on whether fibre or wire rope is the more suitable has become more or less obsolete: There are braided ropes made of steel and wire ropes made of synthetics.
Nevertheless, here we distinguish between textile ropes and steel ropes; between ropes made from non-metallic and metallic materials, depending on how the raw materials are processed and the mechanical properties they possess.
We begin with what used to be called ropes, lines or cordage made not from metal, hence summarised as 'textile ropes' (lat. 'texere': to join together), starting with some useful things to know about terminology, materials, measurements, inspection criteria, properties, selection and usage.

Terminology

Fibre rope
Linear textile fabrication made from twisted or braided rope yarns.

Rope yarn
Yarn or twine made from textile fibres, natural fibres or chemical fibres.

Strand (primary)
Semi finished product made by closing rope yarns.

Strand (secondary)
Semi finished product made by closing rope strands for further processing to a cable-laid fibre rope.

Rope centre
Bundle of closed or braided rope yarns in the middle of the rope to support strands in twisted ropes or to fill hollows in braided ropes.

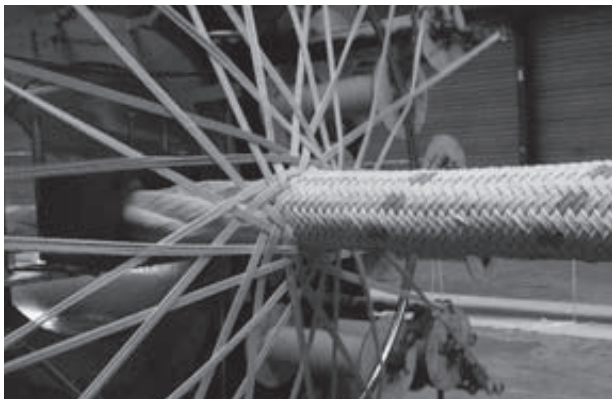
Rope core
Bundle twisted, braided or parallel laid rope yarns as the prime load bearing element on the inside of a braided fibre rope, e.g. kernmantle rope.

Rope sheath
Sleeve, mostly braided, as component of a fibre rope, e.g. kernmantle braid rope.

Closing
Helical twisting technique for rope yarns and primary or secondary strands.

Braiding
Collective term for specific weaving techniques (e.g. crossing, interlacing) in rope yarns or strands.

Braid
Rope element comprising one or several rope yarns, also one or several rope strands, for the manufacture of braided fibre ropes.



Nominal rope diameter
Numerical value for the diameter of the circle tracing the rope cross section in mm.

Nominal rope size
Denomination without unit for the description of ropes. It is identical to the numerical value for the nominal diameter in mm.

Nominal rope circumference
Nominal value for the circumference of the circle tracing the rope cross section in inches. (Indication of the nominal rope circumference is common practice, but is no longer used in the standards for fibre rope). Multiplying this nominal value by 8 gives the nominal rope diameter in mm.

Lay length

- Twisted rope strands: length of one complete turn of a yarn in the rope strand in mm.
- Twisted ropes: length of one complete turn of a rope strand in a cross laid rope or one complete turn of a secondary rope strand in cable laid rope in mm.

Braid pitch
Distance between corresponding points on the turn of a braid in a braided rope in mm.

Direction of twist
The helical direction of rotation

- of the fibres in the rope yarn or the yarns in the twine of rope yarn
- of the rope yarns in a rope strand
- of the rope strands in a cross laid rope or secondary strand
- of the secondary strands in a cable laid rope

Braid length
Number of braids on the circumference of circular braided rope, kernmantle rope or spiral braided rope.

Rope constructions

Twisted fibre rope
Collective term for fibre rope produced by closing yarn to strands (primary closing stage), strands to rope (secondary closing stage); or yarns to strands (primary closing stage), strands to secondary strands (secondary closing stage) and these to rope (tertiary closing stage).

Cross lay
Closing of (primary) rope strands to form a twisted rope.

Cable lay
Closing of secondary strands to form a twisted rope.

Braided fibre rope
Collective term for fibre rope produced by braiding rope or forming a braided sleeve around a rope core or centre with rope yarns or strands.

Circular braid
Rope braid produced by crossing rope yarns or strands to form a hose-shaped rope with or without centre.

Spiral braid
Rope braid produced by interlacing rope yarns or strands to form a hose-shaped rope.

Kernmantle braid
Rope core as primary load bearing element protected by flexible sheath of braided rope yarn or strands.

Square plait
Braided pairs of normally eight strands formed to a rope.

Materials

Hemp was the primary raw material for rope until end of the 19th century, then manila, sisal and coir, prior to introduction of chemical materials, initially polyamide (nylon, perlon), then polyester, later polyolefine (polypropylene, polyethylene). New developments such as aramid or high molecular polyethylene are currently being tested and partly already in use.

Natural fibres
Natural fibres (and ropes made from them), in relation to chemical fibres, have low elongation and elasticity, high wear resistance, low rot resistance, low tensile strength and even lower dry strength.

Hemp (Ha)
(Canabis sativa) Soft fibre, good gripping properties, low rot resistance.

Manila (Ma)
(Abaca, Musa textilis) Hard fibre, low rot resistance.

Sisal (Si)
(Agave sisalana) Hard fibre, low rot resistance.

Other Natural fibres
Henequen (agave), coconut, flax, jute, bast play an insignificant role in rope manufacture.

Chemical fibres
Extruded from polymer mass, then drawn out into long threads, possess diverse mechanical properties, generally rot-resistant, lighter and more elastic than natural fibres, but with lower wear resistance.

Polypropylene (PP)
Derived from thermally splitting hydrocarbons, has low density, good UV-resistance, manufactured as cut sheet, monofilament, staple fibre and multifilament.

Polyethylene (PE)
Low density, low creep resistance.

Polyamide (PA)
Polymers, popularly known as nylon (polyamide 6.6) or perlon (polyamide 6): very high dry strength, reduced wet strength, high dynamic load resistance with high elasticity, reduced UV stability.

Polyester (PES)
Similar to polyamide; high strength, lower elasticity, uncompromised wet strength, insensitive to UV rays and dampness, optimal in combination with other chemical fibres.

Aramid (LCP)
Liquid Crystal Polymer, aromatic polyamide (commercially also known as Kevlar) or polyester (commercially also known as Vectran), with tensile strength close to steel wire, extremely low elongation (only 2-3x more than steel wire), limited dynamic load resistance, low UV resistance, very low transverse strength.

High modular polyethylene (HMPE)
Commercially also known as Dyneema, high tensile strength (somewhat less than aramid), very low elongation, low creep behaviour, higher transverse strength than aramid.

The aforementioned are base materials added (as composites) to the manufacture of twine, yarn or rope strands to significantly improve rope properties. The addition of special protective impregnations to twines and yarns may have a similar effect.

Operands and parameters

Linear mass (ktex)
Formerly rope weight. Mass (g) of a metre length of rope measured pretensioned (without pretension only in exceptional cases).

Delivery length (m)
Rope length measured pretensioned (without pretension only in exceptional cases).

Minimum breaking force (kN)
Minimum force applied by straight tension at which the rope during manufacture has been found by testing to rupture. Minimum breaking forces are determined according to current ISO standard. (Test result meets the requirement if break either occurs at 100% of the relevant value when linear, or at minimum 90% when at splice).

Actual breaking force (kN)
Maximum force applied by straight tension to a rope causing rupture.

Calculated breaking force (kN)
Breaking force calculated from sum of the breaking forces of all yarns in a rope in consideration of the realisation factor (k).

Aggregate calculated breaking force (kN)
Breaking strength determined by multiplying the sum of yarn breaking forces of the rope by the relevant realisation factor.

Spinning loss (%)
Reduction of actual breaking force in relation to the measured breaking force.

Realisation factor
Multiplied by measured breaking force gives the calculated breaking force.

Tenacity (daN/tex)
Formerly breaking length. Rope length (m) at which the vertically hanging rope breaks as a consequence of its own weight.

Rope elongation (%)
Change in rope length under tensile stress, static and elastic, normally shown on a graph.

Design factor
Factor by which the breaking force is reduced to determine the working load limit (WLL), or permissible load capacity (PLC) of a rope. Dependent on intended usage and rope construction.

Rope pretension force (daN)
On a rope sample to determine length-dependent rope parameters, such as delivery length, linear rope mass (rope weight) etc. Ropes shorten when reeled and moved without pretension.

Examination

The nature and scope of rope examination is generally dependent on the rope's usage, its required properties and statutory provisions.

Possible focus of rope examination (and/or)

- rope structure
- rope breaking force
- length-related rope mass
- delivery length
- elongation
- number of falls
- bending cycles
- UV resistance
- dynamic load resistance

Properties

Breaking force, elongation, energy absorption
Fibre ropes have a far lower breaking strength than steel ropes with the same diameter, but significantly more elasticity and energy absorption. However, elasticity in ropes with a steel component, in synthetic wire ropes, aramid ropes and HMPE ropes, is far lower than in normal fibre ropes. Both breaking force and elasticity in chemical fibre ropes made of polypropylene, polyamide and polyester are considerably higher than natural fibre ropes. Even greater is the difference in energy absorption.

Breaking length
Rope length at which rupture occurs under its own weight (see Minimum/Actual breaking force) when freely supported. Relative portrayal of breaking force. Shortens slightly as diameter increases.

Ropes over edges
Edge radius and edge surface reduce breaking force and energy absorption of ropes. Size of edge radius in relation to rope diameter, nature of the edge surface, tensile stress exerted on the rope, condition of the rope (idle or moving, speed of movement), rope material and construction type influence breaking force loss, the permanence of which increases in relation to the duration of exposure to these. Reasons for this are destruction of rope structure and rope material due to friction and wear. Hence, widest possible bending radii and smooth rope edge surfaces provide protection.

Rope connections
A rope normally breaks at the place of attachment or at transition to open rope with breaking force reduced normally by 10%. If the piece of rope is joined by splice or fastened to bollards breakage can also occur on the open length. Fastening by knots lowers the effective rope breaking force by around half.

Running over rope pulleys and winches
Flexural fatigue of textile rope passing through a pulley rises with increasing pulley diameter and falling traction force. The flexural fatigue of twisted rope is far higher than that of braided rope. Advantageous in this respect are four-strand twisted ropes and synthetic wire ropes (e.g. ATLAS) in six-strand cross lay construction as conventional steel ropes.

Dynamic loads
If the load on a rope fluctuates the risk of breakage increases in relation to the stress load and number of stress occasions. The dynamic load resistance of rope is described as fatigue strength or endurance strength. Endurance strength is the greatest stress component to a mean stress load tolerated on a continuing basis without breakage. Hence fatigue strength is understood as the stress amplitude of a fluctuating load tolerated without breakage for a specific number of stress cycles. Fatigue and endurance strength, and hence the rope life, are dependent on numerous factors:

- raw material components
- rope diameter
- static dry strength of the rope
- static wet strength of the rope
- rope connections
- working temperature

Life of the rope is influenced by:

- maximum load
- minimum load
- internal rope friction (dependent on type of fibres)
- rope treatment (impregnation)

Aging, climate, effects of chemical substances
The following factors are of critical importance when using fibre rope outdoors:

- exposure to sunlight
- oxygen content of the air
- ozone content of the air
- humidity of the air
- salt content of the air
- salt content of the water
- sulphur dioxide content of the air
- dust and other impurities

Duration and intensity of exposure affect material-specific properties such as strength, elongation and work capacity. Adding the appropriate UV absorbers can significantly increase the life of fibre ropes, especially PP ropes.

Selection and measurement of ropes

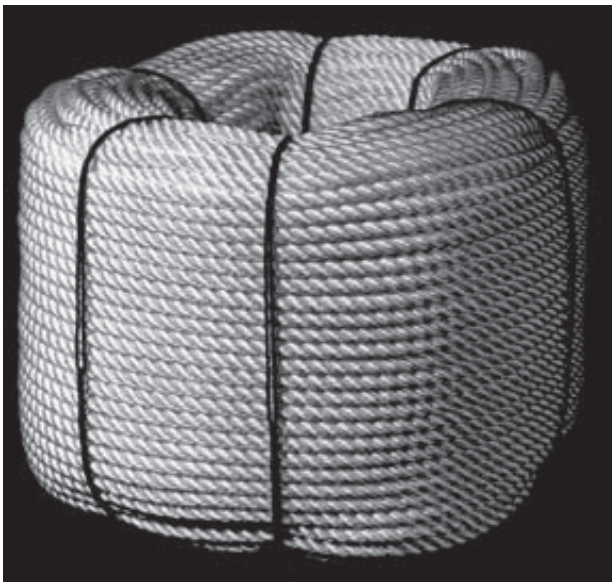
Principle advantages of textile ropes

- better grip when handled
- better general ergonomy
- good flexibility
- less destructive to cargo
- good elasticity
- high breaking length
- low weight

Fibre ropes are flexible and possess favourable handling properties. Their specific weight of 0.9 to 1.6 kg/dm³ makes them suitable for a wide variety of applications. Fibre ropes made from certain raw materials and of a certain construction absorb a high degree of kinetic energy and are suitable for dynamic loads. Natural fibre ropes have a lower elasticity than ropes made from chemical fibres. Under load twisted ropes tend to rotate around their axis and form kinks if the load is suddenly released. This does not happen with braided rope. The properties of textile rope can be optimised by combining different raw materials, fibre yarns or combining synthetic wires with fibre yarns.

Selection criteria

- Load influences (constant, fluctuating, jerky, static, dynamic, straight traction, roller deflection, edge deflection)
- Environment (temperature, dry environment, wet operation, contact with chemicals, frictional influences, rotation resistance)
- Elongation (none, large, insignificant?)
- Dynamic load resistance (low, great, insignificant?)
- End fitting (none, splice, other?) Usage (bracing, holding, anchoring, lashing, mooring, towing, personal safety, mountaineering, lifting?)



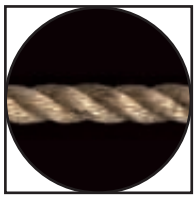
Hemp rope

4-strand twisted

Nominal Rope-Size	Rope Weight	Minimum Breaking Force	
mm	~ kg/m	kN	kgf
6	0,027	2,60	265
8	0,047	4,50	460
10	0,074	7,00	715
12	0,111	10,8	1100
14	0,141	13,8	1400
16	0,185	18,3	1870
18	0,230	22,5	2300
20	0,285	27,8	2840
22	0,345	32,4	3310
24	0,410	39,8	4060
26	0,485	46,0	4690
28	0,560	54,1	5520
30	0,640	61,8	6310
40	1,15	99,8	10200

Material: Hemp
Specific Gravity: ~1,50
Melting Point: burns
Operating Temperature: 40°C (max./continuous use)

Natural...
Chafe resistant,
low elongation,
high wet strength.
But:
low rot resistancy,
reduced dry strength.

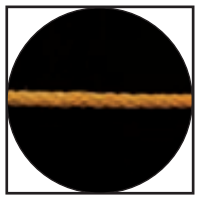


Manila rope

3-strand twisted

Nominal Rope-Size	Rope Weight	Minimum Breaking Force	
mm	~ kg/m	kN	kgf
6	0,025	2,89	295
8	0,044	5,05	515
10	0,069	7,78	794
12	0,100	11,1	1130
14	0,136	14,9	1520
16	0,177	19,3	1970
18	0,225	24,3	2480
20	0,277	29,8	3040
22	0,335	35,9	3660
24	0,399	42,5	4340
26	0,468	49,6	5060
28	0,543	57,2	5830
30	0,624	65,4	6670
32	0,710	74,1	7560
36	0,898	93,1	9500
40	1,11	114	11600
44	1,34	137	14000

Material: Manila
Specific Gravity: ~1,50
Melting Point: burns
Operating Temperature: 40°C (max./continuous use)



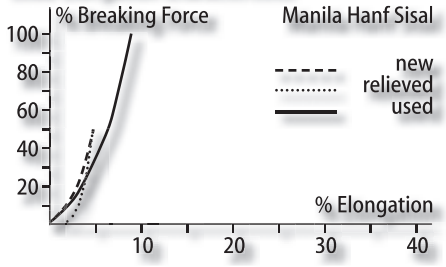
Sisal rope

3-strand twisted

Nominal Rope-Size	Rope Weight	Minimum Breaking Force	
mm	~ kg/m	kN	kgf
6	0,025	2,58	263
8	0,044	4,50	459
10	0,069	6,93	707
12	0,100	9,86	1010
14	0,136	13,3	1360
16	0,177	17,2	1750
18	0,225	21,6	2200
20	0,277	26,5	2700
22	0,335	31,9	3250

Material: Sisal
Specific Gravity: ~1,50
Melting Point: burns
Operating Temperature: 40°C (max./continuous use)

Load-Elongation Characteristics



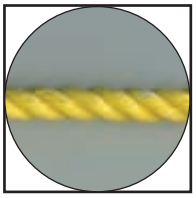
The rope weight is defined as the linear rope mass under pretension. Hemp: 6-14mm +-10%, 16-40mm +-5%. Permissible limit deviation manila and sisal: 6-8mm ±10%, 10-14mm ±8%, above these ±5%. The nominal rope size is the approximate rope diameter in mm. Minimum breaking forces determined according to current ISO standard. (Test result meets requirement if break occurs either at 100% of relevant value when linear (unspliced), or minimum 90% at splice).

PP Multifil rope

3-strand twisted and high tenacity

Nominal Rope-Size	Rope Weight	Minimum Breaking Force	
mm	~ kg/m	kN	kgf
10	0,045	17,5	1790
12	0,065	24,7	2520
14	0,089	32,9	3360
16	0,120	42,1	4290
18	0,150	52,5	5360
20	0,180	64,0	6530
22	0,220	76,4	7790
24	0,260	89,6	9140
28	0,350	119	12100
32	0,460	154	15700

Material: Polypropylene multifil
Specific Gravity: 0,91
Melting Point: 165°C
Operating Temperature: 70°C (max./continuous use)



Simple...
Polypropylene.
Light and easy to handle, floats, balanced elasticity, meets normal requirements.
But: limited wear resistance.

PP rope standard type

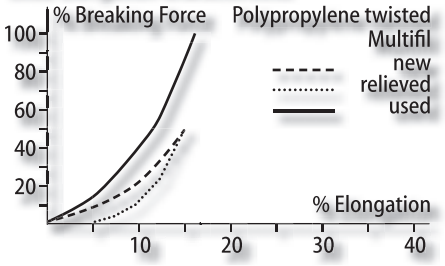
3-strand twisted

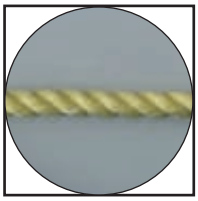
Nominal Rope-Size	Rope Weight	Minimum Breaking Force	
mm	~ kg/m	kN	kgf
6	0,017	5,90	602
8	0,030	10,4	1060
10	0,045	15,3	1560
12	0,065	21,7	2210
14	0,090	29,9	3050
16	0,115	37,0	3770
18	0,148	47,0	4790
20	0,180	56,9	5800
22	0,220	68,2	6960
24	0,260	79,7	8130
26	0,305	92,2	9400
28	0,360	105	10700
30	0,413	120	12200
32	0,463	132	13500
36	0,595	166	16900
40	0,740	202	20600
44	0,890	240	24500
48	1,06	282	28700

Material: Polypropylene
Specific Gravity: 0,91
Melting Point: 165°C
Operating Temperature: 70°C (max./continuous use)

applies to: Splitfilm, Monofil, Multifil

Load-Elongation Characteristics





PP Staple fibre rope

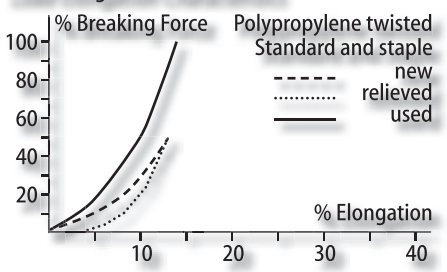
4-strand twisted

Nominal Rope-Size	Rope Weight	Minimum Breaking Force	
mm	~ kg/m	kN	kgf
12	0,063	12,3	1250
14	0,081	15,6	1590
16	0,104	20,0	2040
18	0,130	24,8	2530
20	0,160	30,5	3110
22	0,190	36,5	3720
24	0,230	43,0	4390
26	0,270	49,5	5050
30	0,350	64,0	6530
40	0,630	115	11700

Material: Polypropylene staple fibre
Specific Gravity: 0,91
Melting Point: 165°C
Operating Temperature: 70°C (max./continuous use)

3-strand twisted ropes have 11% higher minimum breaking force.

Load-Elongation Characterisics



PA rope

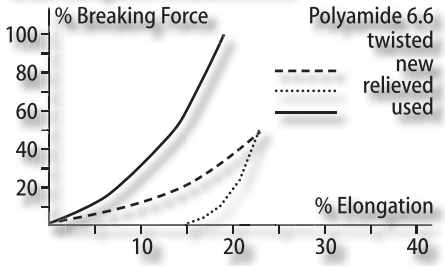
3-strand twisted

Nominal Rope-Size	Rope Weight	Minimum Breaking Force	
mm	~ kg/m	kN	kgf
6	0,023	7,35	750
8	0,040	13,2	1350
10	0,062	20,4	2080
12	0,089	29,4	3000
14	0,122	40,2	4100
16	0,158	52,0	5300
18	0,200	65,7	6700
20	0,245	81,4	8300
22	0,300	98,0	10000
24	0,355	118	12000
26	0,420	137	14000
28	0,485	155	15800
30	0,555	174	17800
32	0,630	196	20000
40	0,976	301	30700

Material: Polyamide
Specific Gravity: 1,14
Melting Point: 250°C
Operating Temperature: 80°C (max./continuous use)

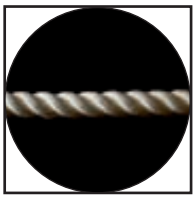
Quality...
Polyester and Polyamide.
Very durable, resistant to wear and tear, flexible, soft feel, balanced (PES) or very high (PA) elasticity.
But: neither rope construction floats.

Load-Elongation Characteristics



Rules and standards...

Even if not specifically indicated: Compliance with standards (ISO, EN, DIN) and rules; state of the art technical product properties.



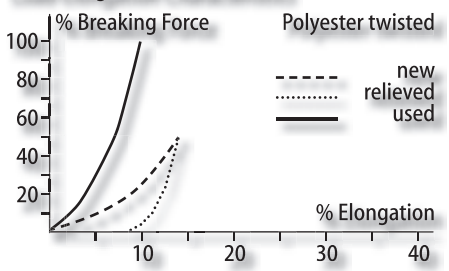
Polyester rope

3-strand twisted

Nominal Rope-Size	Rope Weight	Minimum Breaking Force	
mm	~ kg/m	kN	kgf
6	0,027	5,54	565
8	0,048	10,0	1020
10	0,076	15,6	1590
12	0,110	22,3	2270
14	0,148	31,2	3180
16	0,195	39,8	4060
18	0,245	49,8	5080
20	0,303	62,3	6350
22	0,367	74,7	7620
24	0,437	89,6	9140
28	0,594	120	12200
32	0,778	154	15700

Material: Polyester
Specific Gravity: 1,38
Melting Point: 260°C
Operating Temperature: 100°C (max./continuous use)

Load-Elongation Characteristics



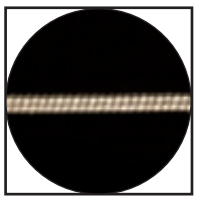
The rope weight is defined as the linear rope mass under pretension. Permissible limit deviation 6-8mm ±10%, 10-14mm ±8%, above these ±5%. The nominal rope size is the approximate rope diameter in mm. Minimum breaking forces determined according to current ISO standard. (Test result meets requirement if break occurs either at 100% of relevant value when linear (unspliced), or minimum 90% at splice).

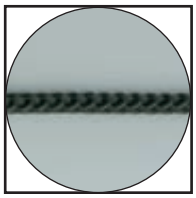
PA rope

Braided

Nominal Rope-Size	Rope Weight	Minimum Breaking Force	
mm	~ kg/m	kN	kgf
1	0,001	0,30	31
2	0,002	0,93	95
3	0,005	1,57	160
4	0,009	2,70	275
5	0,014	4,18	426
6	0,020	6,10	622
8	0,036	10,9	1110
10	0,056	16,7	1700
12	0,081	24,3	2480
14	0,110	32,0	3260
16	0,143	42,6	4350
20	0,225	65,7	6700
24	0,320	94,6	9650

Material: Polyamide
Specific Gravity: 1,14
Melting Point: 250°C
Operating Temperature: 80°C (max./continuous use)



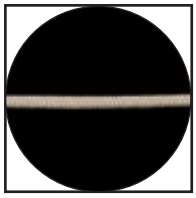


PP multifil rope

Braided

Nominal Rope-Size	Nominal Rope Circ.	Minimum Breaking Force	
mm	~ kg/m	kN	kgf
1	0,001	0,30	31
2	0,002	0,70	71
3	0,004	1,50	153
4	0,007	3,90	398
5	0,010	3,25	332
6	0,016	5,20	530
8	0,026	9,00	918
10	0,040	13,0	1330
12	0,055	18,0	1840
14	0,079	24,0	2450
16	0,102	30,0	3060
20	0,157	47,0	4800
24	0,225	67,0	6830

Material: Polypropylene (PP3)
Specific Gravity: 0,91
Melting Point: 165°C
Operating Temperature: 70°C (max./continuous use)



PES rope

Braided

Nominal Rope-Size	Rope Weight	Minimum Breaking Force	
mm	~ kg/m	kN	kgf
2	0,002	0,75	77
3	0,006	1,50	153
4	0,011	2,60	265
6	0,024	5,90	602
8	0,044	10,3	1050
10	0,068	16,3	1660
12	0,098	22,9	2340
14	0,133	30,3	3090
16	0,174	39	3980
20	0,272	59	6020
24	0,390	82	8370

Material: Polyester
Specific Gravity: 1,38
Melting Point: 260°C
Operating Temperature: 100°C (max./continuous use)

For information on density (specific weight), resistance to UV radiation and rotting/mould, as well as relative wet strength, see technical specifications on twisted rope types on previous pages. Minimum breaking forces for circular braided ropes (form E) in tables on this page. Kernmantle braid (form K) has 25% higher breaking force, spiral braided rope (form H) 20% higher breaking force than circular braided rope of same diameter. Rope weight of all three types is same. Elongation behaviour is dependent on material, type, braid length and yarn quality. Concerning elongation values of twisted ropes (previous pages): Elongation at breaking of circular braided rope is 60-80% of twisted rope made of same material, kernmantel braided rope 20-50%, spiral braided rope 100-130%.

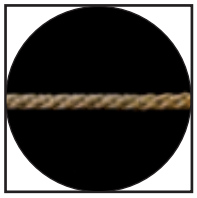
The rope weight is defined as the linear rope mass under pretension. Permissible limit deviation 6-8mm ±10%, 10-14mm ±8%, above these ±5%. The nominal rope size is the approximate rope diameter in mm. Minimum breaking forces determined according to current ISO standard. (Test result meets requirement if break occurs either at 100% of relevant value when linear (unspliced), or minimum 90% at splice).

PP staple fibre rope

Braided

Nominal Rope-Size	Nominal Rope Circ.	Minimum Breaking Force	
mm	~ kg/m	kN	kgf
3	0,004	0,65	66,3
4	0,006	1,35	138
6	0,014	2,95	301
8	0,023	4,70	479
10	0,037	7,40	755
12	0,052	10,4	1060
16	0,090	18,0	1840

Material: Polypropylene (PP1)
Specific Gravity: 0,91
Melting Point: 165°C
Operating Temperature: 70°C (max./continuous use)



Supple...
Common type circular braids.
Light, flexible, twist-free, kink-free.
But: splicing difficult or impossible.
(Applies also to opposite page)

MORE...

Anything missing? Any important information or a similar product, a different size or a solution for your special needs?
Ask us.

dynafil

Braided

Nominal Rope-Size	Nominal Rope Circ.	Minimum Breaking Force	
mm	~ kg/m	kN	kgf
4	0,008	12,3	1260
5	0,014	19,3	1970
6	0,020	27,5	2810
8	0,040	49,1	5010
10	0,066	76,3	7790
12	0,085	109	11100
14	0,105	143	14600
16	0,127	184	18800
18	0,165	230	23500

Material: High Modular Polyethylene
Specific Gravity: ~ 0,97
Melting Point: 145°C
Operating Temperature: 50°C (max./continuous use)

dynafil plus

Braided

Nominal Rope-Size	Nominal Rope Circ.	Minimum Breaking Force	
mm	~ kg/m	kN	kgf
4	0,009	17,7	1810
5	0,016	27,6	2820
6	0,022	39,8	4060
8	0,044	70,9	7240
10	0,075	110	11200
12	0,096	158	16100
14	0,135	216	22000
16	0,153	288	28900

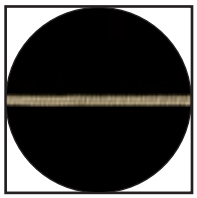
Material: High Modular Polyethylene
Specific Gravity: ~ 0,97
Melting Point: 145°C
Operating Temperature: 50°C (max./continuous use)

aracor

Braided

Nominal Rope-Size	Nominal Rope Circ.	Minimum Breaking Force	
mm	~ kg/m	kN	kgf
4	0,011	14,7	1500
5	0,020	23,0	2350
6	0,028	33,1	3380
8	0,050	58,8	6000
10	0,080	91,9	9380
12	0,012	133	13600

Material: Aromatic Polyamide
Specific Gravity: ~ 1,44
Melting Point: 415°C
Operating Temperature: 130°C (max./continuous use)



Usage guidelines

Storage and maintenance

To avoid negative effects on material properties of natural fibre and synthetic ropes the following should be observed:

- The storage environment should be well ventilated and at normal temperature and humidity.
- Excessive heat, moisture and contact with acids and alkalis or other aggressive substances should be avoided to prevent sudden and significant loss of strength.
- Natural fibre rope having come into contact with aggressive substances must be discarded.
- Synthetic ropes having come into brief contact with aggressive substances can retain their usage properties if rinsed immediately with water. However, the rope must be carefully examined for possible changes and its safety confirmed.
- Soiled ropes should be cleansed (with water) and dried (in fresh air) before being stored.

Inspection

Textile ropes should be inspected before and during service to establish their safe usage condition. Check for:

- Broken yarns
- Broken strands
- Compacted or crushed areas
- Kinks in twisted rope
- Loosening of rope structure
- Condition of end fittings
- Damage caused by aggressive substances
- Evidence of rot in natural fibre ropes (excessive fibre dust)

Removal from service

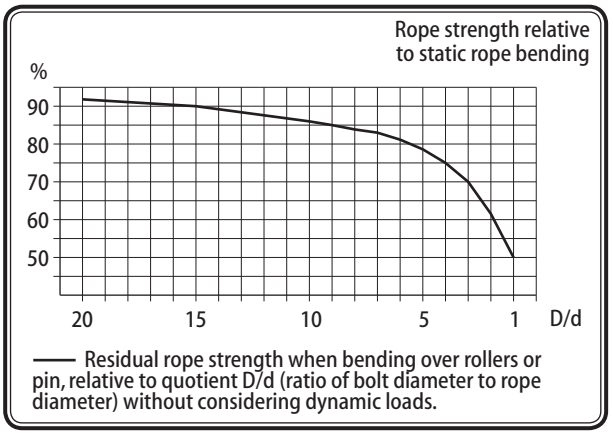
Discard in the event of:

- Broken strands
- Absent or inadequate marking or identification
- More than 10% of all yarns broken or split
- Kink formation
- Heavy mechanical wear (over 10% loss of cross-section), applies to surface as well as inside of rope
- Melt marks in synthetic ropes (over 10% loss of cross-section), applies to surface as well as inside of rope
- Excessive fibre dust in natural fibre ropes
- Deformation due to overload, or shock load (over 10% loss of cross-section)
- Working temperature range exceeds permitted limits, even temporarily (For maximum temperatures at continious operation see 'Characteristics of textile ropes by material')
- Evidence of rotting in natural fibre ropes (discoloration, fungal infection, musty smell, loose rope construction)
- Loose, irreparable splices

Damage and risks

When assessing the condition of textile ropes the following must be taken into consideration:

- Increased wear reduces working load.
- A slightly roughened surface on synthetic ropes (furring) only slightly lowers breaking strength and reduces further surface wear.
- Under normal service conditions the inner frictional resistance in synthetic ropes is high, therefore inner wear low.
- Outer frictional resistance of synthetic materials when in contact with harder materials, however, is low, at least far lower than that of natural fibre materials. The consequence, depending on material, is relatively low wear resistance. Ropes should therefore never be pulled over coarse or dirty surfaces, whether under load or not. This means that any rope pulleys, moving rollers or wheels, stationary bollards or chocks must have clean, corrosion-free and smooth surfaces. If this is not the case, chafe protectors should be used to reduce abrasion.
- Textile ropes are flexible but have low cut resistance. There are, however, limits to pliability: Depending on the bend diameter, static bending reduces breaking strength (for coefficient see approximates in graph) whilst dynamic bending causes material fatigue and destruction (excessive wear through yarn and strands rubbing together). The higher the number and intensity of repeat bends, the greater the wear.



—— Residual rope strength when bending over rollers or pin, relative to quotient D/d (ratio of bolt diameter to rope diameter) without considering dynamic loads.

The bend diameter should, depending on material and construction, be adequately large, certainly no less than 5d for fibre ropes made from polypropylene, polyamide and polyester; 8d for wire ropes made from polyamide (d=nominal rope diameter). In ropes made from high modular polyethylene or aramid the bend radius primarily depends on the rope construction, therefore the manufacturer or supplier should be consulted. Sharp edges must at all times be avoided, if necessary by using edge protection.

- The high elasticity of most synthetic rope materials leads to considerable energy build-up when stretched under load, which may cause a snap back effect if the rope breaks. This can be absolutely lethal to people located near the breakpoint, especially if linear to the rope gradient.
- UV radiation damages chemical fibres, especially polypropylene, less for polyester. UV resistance can be significantly increased by treating with UV stabilisers and is particularly recommended for polypropylene ropes. The resistance of natural fibres and synthetic wire ropes to UV radiation is far higher than that of chemical fibre ropes.
- Textile ropes are generally heat sensitive. Either they burn (natural fibres) or melt (synthetic materials: see also table 'Textile ropes in comparison' elsewhere in this chapter). Textile ropes must therefore be protected from heat and never be dried using fan heaters or other direct heat sources.
- Even without other harmful influences, aging causes a reduction in breaking strength, more so for natural fibres than synthetic materials. It is recommended to test the breaking strength of ropes stored for more than five years.

Handling
Improper winding or unwinding of twisted textile ropes can render them inadequate for service. Winding from a drum or reel should be done tangentially from the inside of rings (coils), i.e. in the winding direction.

Braided ropes are flexible and can be pulled off in both directions. Twisting and untwisting should be avoided to prevent permanent deformation under load and therefore damage, even rendering them unsuitable for service. Kinks in twisted ropes bearing no strain can be removed by turning if one end of the rope can turn freely.

It is best to place ropes on the ground as they fall. In most cases this will be in a figure eight.

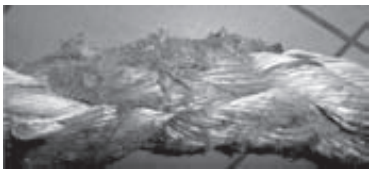
General
These usage guidelines are based on existing European recommendations and standards. Further to these, consideration should also be taken of applicable local, national and international legislation, standards, directives and regulations from official societies (professional organisations, classification bodies, etc.) with regard to equipment safety (personal protection, industrial safety, accident prevention), as well as recommendations and operating instructions from manufacturers and/or operators of the equipment being used (lifting gear, conveyor systems, etc.).

You are advised to consult the manufacturer or supplier if in

Typical
Views of areas with more or less heavy irreparable damages, or areas just slightly affected, thus repairable or without consequences.


Complete strand pulled out.


Used rope. Furry surface. No damage.

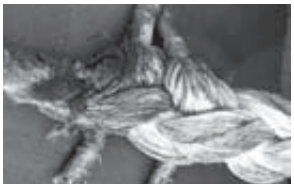

Cut and abraded yarns.

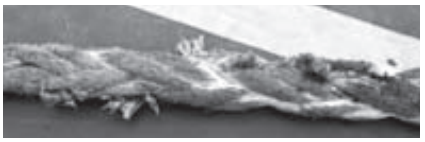

Six-strand laid rope with kinks.


Knotted yarn (inevitable during production of strands). No damage.


Rope compressed upon heavy load on winch drum. No damage.


Damaged braided jacket. Repairable if core undamaged.


Damaged splice. Irreparable without cutting short.

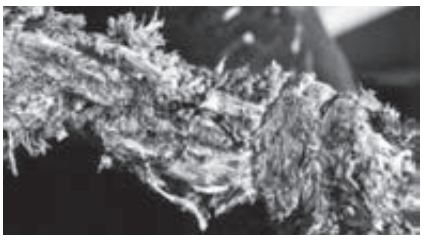

Several yarns cut.


No damage. Single pulled out yarn. Repairable.


Large amount of pulled out yarns.


Six-strand laid rope with birdcages.


More than 50% of all yarns in one strand cut.


Melted areas caused by friction (under load).

Fabrication

Types of fabrication
Fibre ropes can be spliced, knotted, swaged or cast to facilitate terminal fittings, connections for rope extensions or endless splices. Knots, swages or casts cause a more or less significant reduction in the breaking strength at the point of connection. If performed properly, splices are the only safe method of fabrication with normally no more than ten percent breaking strength loss at the splice.

Splices
Splices are manually crafted rope connections, are safe and difficult to undo. They should be performed by trained personnel in accordance with existing standards or rules implemented by rope manufacturers.

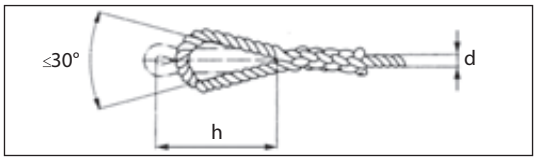
For splicing the ends of the rope strands are undone and re-entered into the rope. Whether a rope can be spliced and what method is appropriate to perform the splice depends extensively on the rope construction.

Splicing methods
shown here are the most important spliced rope connections for twisted and braided rope.

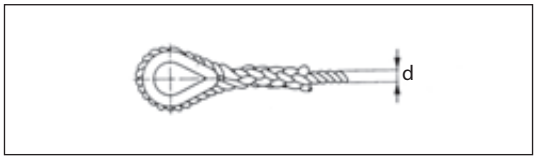
Strengths when spliced
In a static tension test splice connections should achieve at least 90% the minimum rope breaking strength, long splice connections at least 60%.

Kernmantle braid splices
Not shown are connections for kernmantle ropes for which specifications differ depending on manufacturers.

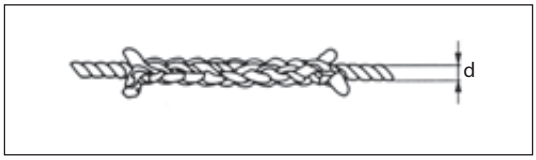
Special requirements
Individual advice should be sought in the event of special requirements.



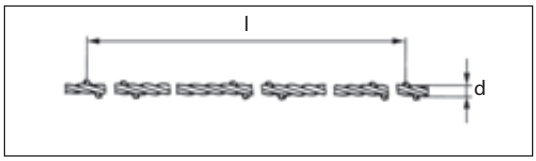
Eye splice
Twisted rope
d = Rope diameter
h = min length of eye 8d



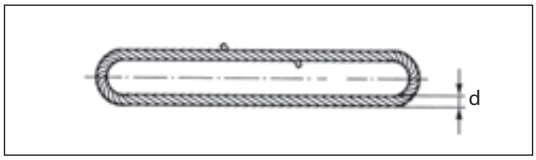
Thimble eye splice
Twisted rope
d = Rope diameter



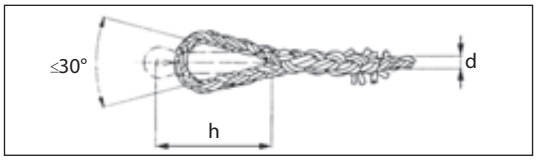
Short splice
Twisted rope
d = Rope diameter



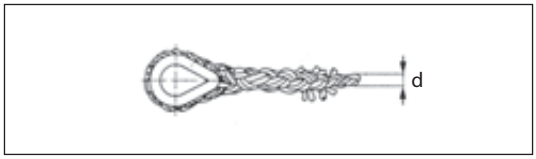
Long splice
Twisted rope
d = Rope diameter
l = min length of splice 100d



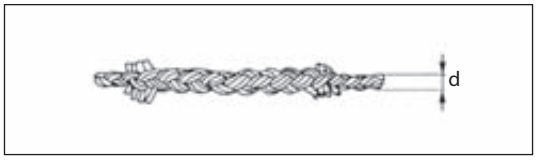
Endless laid grommet
Twisted rope
d = Rope diameter



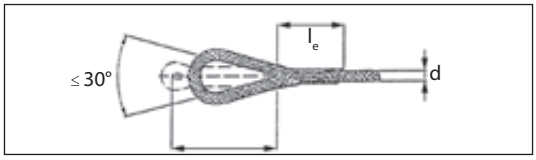
Eye splice
Square plaited rope
d = Rope diameter
h = min length of eye 8d



Thimble eye splice
Square plaited rope
d = Rope diameter



Short splice
Square plaited rope
d = Rope diameter



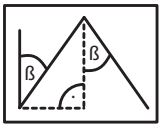
Eye tuck splice
Braided rope
d = Rope diameter
h = min length of eye 8d
l_e = Sufficient length to ensure rope strength maintained

Lifting slings

from natural and synthetic fibre ropes

Nominal Rope Diameter	Material: Hemp	Manila	Polyamide	Polyester	Polyprop Standard and Multifil	Polyprop Staple Fibre
	Working Load Limit (WLL) Single Leg Straight Lift					
(~ mm Ø)	t	t	t	t	t	t
16	0,21	0,25	0,56	0,52	0,48	0,24
18	0,30	0,32	0,85	0,65	0,60	0,33
20	0,32	0,40	0,85	0,80	0,71	0,38
22	0,43	0,47	1,3	1,0	1,0	0,50
24	0,45	0,56	1,3	1,2	1,1	0,55
26	0,60	0,68	1,8	1,4	1,2	0,60
28	0,63	0,78	1,7	1,5	1,3	0,65
32	0,80	1,0	2,1	2,0	1,7	0,85
36	1,1	1,3	2,7	2,5	2,1	1,1
40	1,3	1,5	3,6	3,0	2,5	1,3

1t = 1000kg (t = metric ton).
Length of a lifting sling is the usable length when ready for service. It is measured between the bearing points of sling ends/terminations.



The tilt angle ß is the largest angle between legs and vertical line. To determine working load limit of sling operation: Multiply applicable mode factor (see table <Lift methods> below) with the WLL value (single leg direct) from the above table. Adapt the mode factors as appropriate for asymmetrical loads.

Lift Methods

Single Leg		Double Leg				Endless		
straight	choke	straight ß = 0-45°	choke ß = 0-45°	straight ß = 45-60°	choke ß = 45-60°	choke	double straight	double basket
								
Mode Factors:								
1	**0,8**	**1,4**	**1,12**	**1**	**0,8**	**1,6**	**2 x 2**	**2 x 4**

For really heavy loads …

Rules and standards...

Even if not specifically indicated: Compliance with standards (ISO, EN, DIN) and rules; state of the art technical product properties.

… strong as steel, low elongation, light and ergonomic

Usage guidelines

Service
Fibre rope lifting slings must only be used for lifting loads and only by trained personnel in consideration of existing safety regulations and working conditions.

Working load limit
The working load limit is the weight a lifted object must never exceed. It is derived from the minimum breaking strength of the rope divided by the design factor (safety factor normally = 7), multiplied by the mode factor. The mode factor is dependent, amongst others, on the tilt angle (maximum 60°) for endless or multileg slings. Where the load symmetry (even load distribution, central point of gravity) is not guaranteed for a multileg sling lifting operation, a maximum of two legs as load bearers must be assumed, based on the widest tilt angle, rather than for all legs.

Size
Fibre rope lifting slings with a diameter less than 16mm are not permissible. The length of a sling rope is the distance between the lifting points (incl. fittings). The aperture angle of loops must not exceed 30°. The free rope length between splices must not be less than 20d (d = rope diameter).

Rope connections and fittings
Rope connections must be spliced. Splices must conform to existing standards and be performed by trained personnel. Knots and other methods of connection are not permissible. The bending radius of the rope over hardware fittings must be no less than 0.5d. Thimbles might be needed if end loops are used.

Marking
To the extent that local regulations do not call for additional details, fibre rope lifting slings must be permanently labelled with manufacturer's trademark, dimensions, material, working load limit (WLL), date of manufacture, and tracing code. Material colour codes are as follows: green for polyamide, blue for polyester, brown for polypropylene, and white for all natural fibres.

Storage and maintenance
Before and during storage

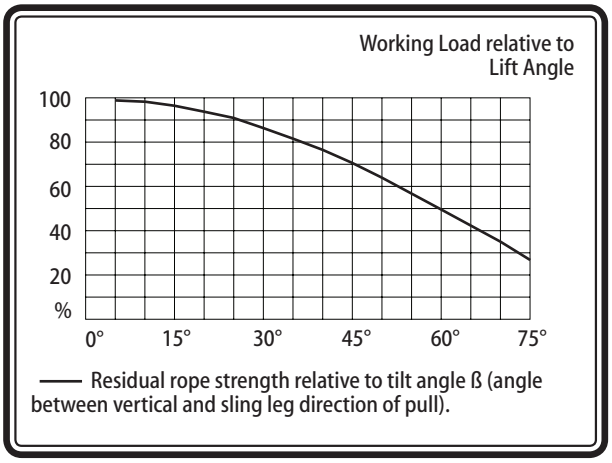
- Examine for damage; do not store damaged slings
- Rinse soiled fibre rope with water; use chemical detergents only after consultation with rope manufacturer or supplier
- Protect stored slings from dirt (e.g. storage on shelves), extreme warmth, dampness, chemicals, corroded surfaces, UV radiation and poor ventilation

Repairs must be performed by trained personnel only.

Inspection
Before first and every subsequent use a visual inspection must be performed to establish suitability for required purpose and absence of damage. Inspection should be conducted regularly, at least once a year by trained personnel. In the event of any damage or deformation of rope material and/or fittings the rope must be removed from service.

Precautions

- Do not use slings with illegible or missing markings
- The load to be lifted must be free to move; avoid swinging, tilting, slipping or dropping through choice of a suitable fastening, trial lift or repositioning of lifting points, use of guide ropes, spreaders or beams, avoid sudden or jerky movements
- Do not knot ropes
- Contact areas must be outside splices or fittings
- Do not pull unprotected ropes over sharp edges (if necessary use edge protectors)
- Do not expose ropes to permanent UV radiation



—— Residual rope strength relative to tilt angle ß (angle between vertical and sling leg direction of pull).

- Working load limit (WLL) is reduced if
  - non-symmetrical (uneven) load
  - choke lift
  - operating temperature outside -40° to +80° for polypropylene or natural fibre ropes, or -40° to +100° for all other ropes
- Do not wind out twisted ropes under strain
- If rope is wound around load several times ensure rope turns are parallel to each other (no crossing)
- Avoid tilt angles (ß) of less than 15° (risk of unstable load suspension)
- Pay attention to rope material sensitivities:
  - polyamide with mineral acids
  - polyester with alkalis
  - polypropylene with some organic solutions, rarely with acids and alkalis; light (if not UV-stabilised)
  - natural fibres with mould (after lengthy rainfall period), acids and alkalis
  - chemical fibres, especially chafing with polypropylene

Repairs must only be performed by trained personnel.

Removal from service
Discard in the event of:

- Broken strand
- Missing or incomplete marking
- Breakage of more than 10% of yarns in the rope cross-section
- Formation of kinks
- Heavy mechanical wear (more than 10% cross section loss)
- Melting signs on chemical fibre ropes (more than 10% cross section loss)
- Inner wear after intensive bending and pulling strain in association with internal outside substance contact (sand, water, ice)
- Shedding of fibre dust in natural fibre ropes
- Destruction of more than 10% of the yarns as a result of chemical influences (split, pulverised)
- Signs of rotting in natural fibre ropes (discoloration, fungus/mould formation, musty smell)
- Loosening of splices, if proper reconstruction no longer possible
- Destroyed, deformed, damaged fitting parts

General
Further information on 'Storage and maintenance' can be found on the pages 'Textile ropes in perspective' and 'Textile ropes in service'.

These usage guidelines are based on existing European recommendations and standards. Further to these, consideration should also be taken of applicable local, national and international legislation, standards, directives and regulations from official societies (professional organisations, classification bodies, etc.) with regard to equipment safety (personal protection, industrial safety, accident prevention), as well as recommendations and operating instructions from manufacturers and/or operators of the equipment being used (lifting gear, conveyor systems, etc.).

You are advised to consult the manufacturer or supplier if in doubt about properties of rope, conditions of usage and safety requirements.

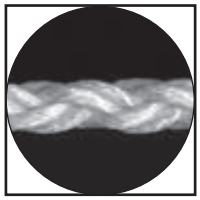
Origins...
Polypropylene for normal mooring, polyester when looking for wear resistance, polyamide for maximum elasticity when towing.
(Applies also to opposite page)

PA rope

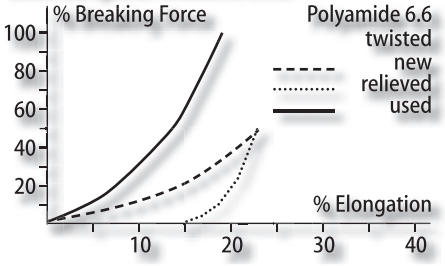
8-strand square plaited

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf
40	5	0,99	294	30000
44	5½	1,20	351	35800
48	6	1,42	412	42000
52	6½	1,66	479	48900
56	7	1,93	549	55600
60	7½	2,21	626	63900
64	8	2,52	706	72000
68	8½	2,84	786	80200
72	9	3,19	882	90000
76	9½	3,55	982	100000
80	10	3,94	1080	110000
88	11	4,77	1280	131000
96	12	5,68	1510	154000
104	13	6,66	1790	183000
112	14	7,72	2060	210000
120	15	8,87	2350	240000
128	16	10,1	2670	272000

Material: Polyamide
Specific Gravity: 1,14
Melting Point: 250°C
Operating Temperature: 80°C (max./continuous use)

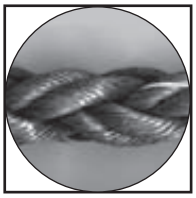


Load-Elongation Characteristics



PP rope standard type

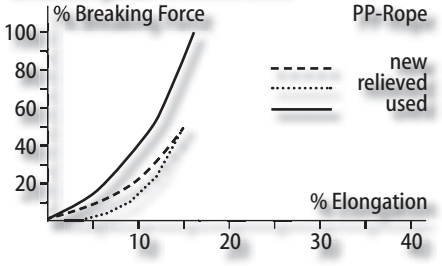
8-strand square plaited (split/monofil)



Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf
40	5	0,72	201	20500
44	5½	0,88	241	24600
48	6	1,04	280	28600
52	6½	1,22	324	33000
56	7	1,42	371	37800
60	7½	1,63	424	43200
64	8	1,85	480	49000
68	8½	2,09	538	54900
72	9	2,34	603	61500
76	9½	2,62	669	68200
80	10	2,90	741	75600
88	11	3,51	889	90700
96	12	4,17	1050	107000

Material: Polypropylene
Specific Gravity: 0,91
Melting Point: 165°C
Operating Temperature: 70°C (max./continuous use)

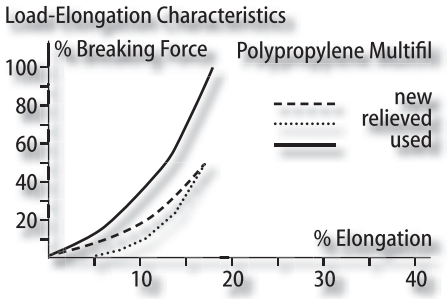
Load-Elongation Characteristics



The rope weight is defined as the linear rope mass under pretension. Permissible limit deviation 6-8mm ±10%, 10-14mm ±8%, above these ±5%. The nominal rope size is the approximate rope diameter in mm, the nominal rope circumference the approximate rope circumference in inches. Due to mode of construction the actual rope diameter of new square braided rope can be up to 25% higher than the nominal diameter. Minimum breaking forces determined according to current ISO standard. (Test result meets requirement if break occurs either at 100% of relevant value when linear (unspliced), or minimum 90% at splice).

Rules and standards...

Even if not specifically indicated: Compliance with standards (ISO, EN, DIN) and rules; state of the art technical product properties.



PP Multifil rope

8-strand square braided - high-strength -

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf
40	5	0,72	233	23800
44	5½	0,88	278	28400
48	6	1,04	327	33400
52	6½	1,22	379	38700
56	7	1,42	436	44500
60	7½	1,63	495	51800
64	8	1,85	558	56900
68	8½	2,08	622	63400
72	9	2,34	692	70600
76	9½	2,61	760	77500
80	10	2,90	850	86700
88	11	3,51	1010	103000
96	12	4,17	1190	121000

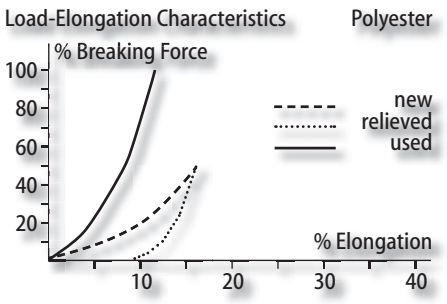
Material: Polypropylene multifil
Specific Gravity: 0,91
Melting Point: 165°C
Operating Temperature: 70°C (max./continuous use)

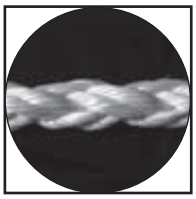
PES rope

8-strand square plaited

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf
40	5	1,21	235	24000
44	5½	1,47	279	28500
48	6	1,75	329	33600
52	6½	2,05	384	39200
56	7	2,38	439	44800
60	7½	2,73	489	49900
64	8	3,10	568	57900
68	8½	3,51	640	65300
72	9	3,93	707	72100
76	9½	4,38	788	80400
80	10	4,85	867	88400
88	11	5,87	1040	106000
96	12	6,99	1230	125000

Material: Polyester
Specific Gravity: 1,38
Melting Point: 260°C
Operating Temperature: 100°C (max./continuous use)





Ships...

Shown here: typical ropes used on board

powerflote

8-strand square plaited

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf
40	5	0,73	289	29500
44	5½	0,88	345	35200
48	6	1,05	408	41600
52	6½	1,23	472	48100
56	7	1,43	541	55200
60	7½	1,64	618	63000
64	8	1,86	699	71300
68	8½	2,10	784	80000
72	9	2,35	879	89700
80	10	2,90	1080	110000
88	11	3,52	1210	123000
96	12	4,19	1430	146000

Material: High Tenacity Polyethylene
Specific Gravity: 0,91
Melting oint: 165°C
Operating Temperature: 70°C (max./continuous use)

High strength...
Light, ergonomic, floats.
Similar to polypropylene.
But: superior wear resistance and significantly stronger.

Ships...

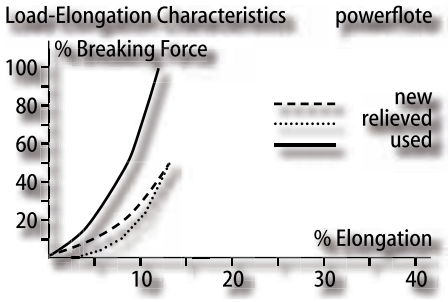
Shown here: typical ropes used on board

powerflote 12

12-strand braided

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf
40	5	0,73	297	30400
44	5½	0,88	353	36000
48	6	1,05	408	41600
52	6½	1,22	482	49200
56	7	1,32	537	54800
60	7½	1,63	630	64300
64	8	1,83	703	71700
68	8½	2,07	793	80900
72	9	2,32	884	90200
80	10	2,89	1090	111000
88	11	3,54	1280	131000
96	12	4,25	1500	153000

Material: High Tenacity Polyethylene
Specific Gravity: 0,91
Melting Point: 165°C
Operating Temperature: 70°C (max./continuous use)



Impregnation .....

...an effective gain for extra life and safety:
AFC emulsions (PE, PFF or PUD-based, depending on rope material) protect rope yarns, therefore
- **optimise load distribution and elongation balance within the strand structure**
- **protect yarns from rubbing against one another and from infiltration of foreign particles**
- **effectively reduce wear inside the rope**

Colours of ropes illustrated subject to change

powerflote cx 12 plus

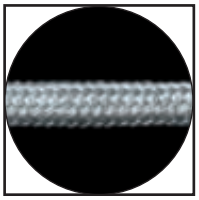
12-strand braided

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf
40	5	0,78	319	32500
44	5½	0,98	385	39300
48	6	1,15	452	46100
52	6½	1,37	533	54300
56	7	1,58	614	62600
60	7½	1,79	696	71000
64	8	2,04	795	81100
68	8½	2,32	896	91400
72	9	2,57	998	102000
80	10	3,21	1220	124000
88	11	3,85	1470	150000
96	12	4,35	1740	177000

Material: High Tenacity Polyester/Polyethylene Composite
Specific Gravity: 0,99
Melting Point: 165°C/260°C
Operating Temperature: 70°C (max./continuous use)

powerflote cx 12 pro

Doublebraid rope, Core: 12-strand braided



Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf
40	5	0,80	296	30200
44	5½	0,96	358	36500
48	6	1,13	422	43000
52	6½	1,36	495	50500
56	7	1,54	569	58000
60	7½	1,81	647	66000
64	8	2,04	736	75000
68	8½	2,31	830	84700
72	9	2,58	930	94900
80	10	3,20	1140	116000
88	11	3,97	1360	139000
96	12	4,62	1620	165000
104	13	4,99	2070	211000
112	14	5,78	2390	244000
120	15	6,64	2720	277000

Material: High Tenacity Polyester/Polyethylene Composite
Specific Gravity: 0,99
Melting Point: 165°C
Operating Temperature: 70°C (max./continuous use)

Impregnation .....

...an effective gain for extra life and safety:
AFC emulsions (PE, PFF or PUD-based, depending on rope material)protect rope yarns, therefore
- **optimise load distribution and elongation balance within the strand structure**
- **protect yarns from rubbing against one another and from infiltration of foreign particles**
- **effectively reduce wear inside the rope**

The rope weight is defined as the linear rope mass under pretension. Permissible limit deviation 6-8mm ±10%, 10-14mm ±8%, above these ±5%. The nominal rope size is the approximate rope diameter in mm, the nominal rope circumference the approximate rope circumference in inches. Due to mode of construction the actual rope diameter of new square braided rope can be up to 25% higher than the nominal diameter. Minimum breaking forces determined according to current ISO standard. (Test result meets requirement if break occurs either at 100% of relevant value when linear (unspliced), or minimum 90% at splice).

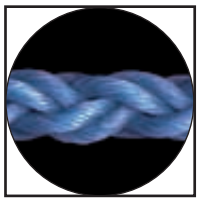
Toughening up...
Polyester reinforced.
High tensile strength at break, increased wear resistance.
But: light, easy to handle and floats.
(Applies also to opposite page).

Ships...

Shown here: typical ropes used on board

powerflote clt

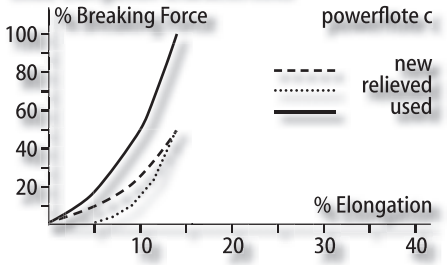
8-strand square braided



Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf
40	5	0,80	326	33300
44	5½	0,97	389	39700
48	6	1,15	462	47100
52	6½	1,35	531	54200
56	7	1,58	610	62200
60	7½	1,81	693	70700
64	8	2,05	788	80400
68	8½	2,32	866	88300
72	9	2,60	973	99200
80	10	3,21	1190	121000
88	11	3,89	1420	145000
96	12	4,63	1680	171000

Material: High Tenacity Polyester/Polyethylene Composite
Specific Gravity: 0,99
Melting Point: 165°C/260°C
Operating Temperature: 70°C (max./continuous use)

Load-Elongation Characteristics



powerflote cx plus

8-strand square plaited

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf
40	5	0,78	319	32500
44	5½	0,98	385	39300
48	6	1,15	452	46100
52	6½	1,37	533	54300
56	7	1,58	614	62600
60	7½	1,79	696	71000
64	8	2,04	795	81100
68	8½	2,32	896	91400
72	9	2,57	998	102000
80	10	3,21	1220	124000
88	11	3,85	1470	150000
96	12	4,53	1740	177000

Material: High Tenacity Polyester/Polyethylene Composite
Specific Gravity: 0,99
Melting Point: 165°C/260°C
Operating Temperature: 70°C (max./continuous use)

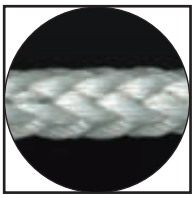
Colours of ropes illustrated subject to change

ti-flex® 12 plus

12-strand braided

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf
40	5	0,98	414	42200
44	5½	1,18	493	50300
48	6	1,40	580	59200
52	6½	1,65	674	68700
56	7	1,92	777	79300
60	7½	2,20	883	90100
64	8	2,50	1000	102000
68	8½	2,82	1120	114000
72	9	3,16	1250	128000
80	10	3,90	1530	156000
88	11	4,73	1840	188000
96	12	5,63	2160	220000
104	13	6,60	2510	256000
112	14	7,65	2870	293000
120	15	8,79	3240	330000

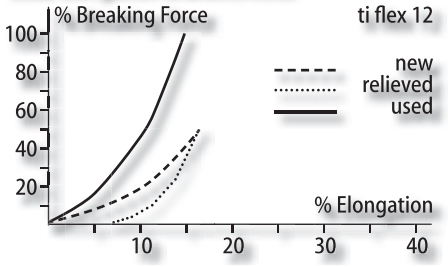
Material: High Tenacity Polyester/Polyethylene Composite
Specific Gravity: 1,14
Melting Point: 165°C/260°C
Operating Temperature: 80°C (max./continuous use)

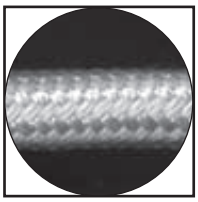


Ships...

Shown here: typical ropes used on board

Load-Elongation Characteristics





ti-flex® 12 pro

Doublebraid rope, Core: 12-strand braided

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf
40	5	1,00	417	42500
44	5½	1,17	482	49200
48	6	1,34	546	55700
52	6½	1,55	630	64300
56	7	1,76	713	72700
60	7½	1,99	795	81100
64	8	2,22	886	90400
68	8½	2,51	1030	105000
72	9	2,81	1110	113000
80	10	3,50	1450	148000
88	11	4,24	1720	175000
96	12	5,05	2010	205000

Material: High Tenacity Polyester/Polyethylene Composite
Specific Gravity: 1,14
Melting Point: 165°C/260°C
Operating Temperature: 80°C (max./continuous use)

Impregnation .....

...an effective gain for extra life and safety:
AFC emulsions (PE, PFF or PUD-based, depending on rope material)protect rope yarns, therefore

- **optimise load distribution and elongation balance within the strand structure**
- **protect yarns from rubbing against one another and from infiltration of foreign particles**
- **effectively reduce wear inside the rope**

The rope weight is defined as the linear rope mass under pretension. Permissible limit deviation 6-8mm ±10%, 10-14mm ±8%, above these ±5%. The nominal rope size is the approximate rope diameter in mm, the nominal rope circumference the approximate rope circumference in inches. Due to mode of construction the actual rope diameter of new square braided rope can be up to 25% higher than the nominal diameter. Minimum breaking forces determined according to current ISO standard. (Test result meets requirement if break occurs either at 100% of relevant value when linear (unspliced), or minimum 90% at splice).

ti-flex® 1300

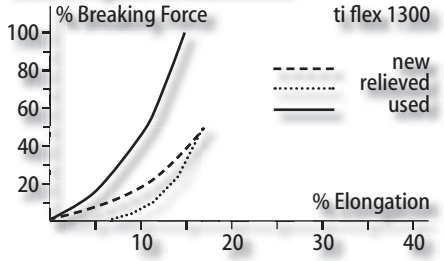
8-strand square plaited

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf
40	5	0,98	414	42200
44	5½	1,18	493	50300
48	6	1,40	580	59200
52	6½	1,65	674	68700
56	7	1,92	777	79300
60	7½	2,20	883	90100
64	8	2,50	1000	102000
68	8½	2,82	1120	114000
72	9	3,16	1250	128000
80	10	3,90	1530	156000
88	11	4,73	1840	188000
96	12	5,63	2160	220000
104	13	6,60	2510	256000
112	14	7,65	2870	293000
120	15	8,79	3240	330000

Material: High Tenacity Polyester/Polyethylene Composite
Specific Gravity: 1,14
Melting Point: 165°C/260°C
Operating Temperature: 80°C (max./continuous use)

Dynamic...
High polyester content, very high wear and dynamic load resistance, high breaking strength, ideal as towing stretcher or as mooring line under heavy duty conditions. But: limited floating capability, floats only if short time in water.

Load-Elongation Characteristics



ti-flex® hp

8-strand square plaited

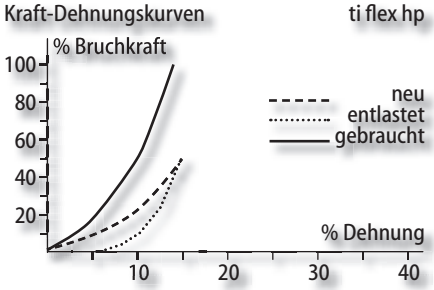
Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf
40	5	0,88	351	35800
44	5½	1,07	418	42600
48	6	1,27	492	50200
52	6½	1,49	571	58200
56	7	1,73	655	66800
60	7½	1,99	745	76000
64	8	2,26	839	85600
68	8½	2,55	945	96400
72	9	2,85	1050	107000
80	10	3,53	1230	125000
88	11	4,27	1540	157000
96	12	5,09	1820	186000
104	13	5,97	2120	216000
112	14	6,92	2430	248000
120	15	7,94	2770	283000

Material: High Tenacity Polyester/Polyethylene Composite
Specific Gravity: 1,14
Melting Point: 165°C/260°C
Operating Temperature: 80°C (max./continuous use)

Tails and stretchers...

Shown here: Rope constructions with good elasticity and high dynamic load resistance, absorb shocks, relieve strain from mooring and tow lines. We help and advise on dimensioning.

Kraft-Dehnungskurven



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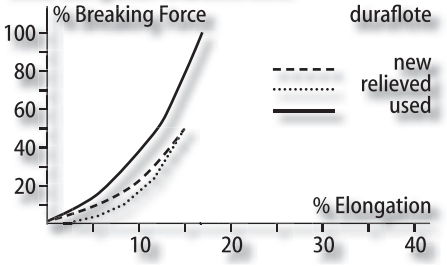
duraflote 6

6-strand cross-lay

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force		Nominal Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf	kN	kgf
40	5	0,99	308	31400	320	32600
44	5½	1,18	367	37400	382	39000
48	6	1,39	432	44100	449	45800
52	6½	1,54	501	51100	521	53100
56	7	1,88	575	58700	598	61000
60	7½	2,03	654	66700	680	69400
62	7¾	2,21	687	70000	715	72900
64	8	2,30	737	75200	766	78100
68	8½	2,63	824	84000	857	87400
70	8¾	2,91	918	93600	955	97400
72	9	3,15	1070	109000	1110	112000
78	9¾	3,42	1120	114000	1160	118000

Material: Polyamide wire over Polyproylene-Multifil
Specific Gravity: 0,99
Melting Point: 165°C/250°C
Operating Temperature: 70°C (max./continuous use)

Load-Elongation Characteristics



Ships...

Shown here: typical ropes used on board

duraflote 8

8-strand cross-lay

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force		Nominal Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf	kN	kgf
46	5¾	1,19	408	41600	424	43200
50	6¼	1,37	470	47900	489	49900
54	6¾	1,66	569	58000	592	60400
60	7½	1,94	664	67700	691	70500
64	8	2,24	767	78200	798	81400
68	8½	2,55	874	89100	909	92700
72	9	2,88	898	91600	934	95300
76	9½	3,23	1110	113000	1150	117000

Material: Polyamide wire over Polyproylene-Multifil
Specific Gravity: 0,99
Melting Point: 165°C/250°C
Operating Temperature: 70°C (max./continuous use)

**Ideal...
on mooring winches,
good wear resistance,
remarkable flexural stability,
high dynamic load resistance,
balanced load elongation, very
good stability. dura winchline
doesn't float, duraflote does.
(Applies also to opposite page)**

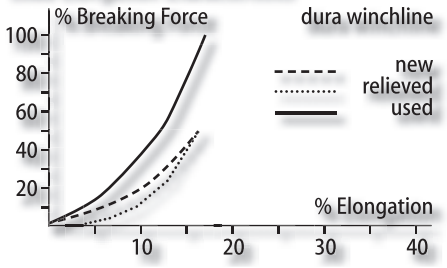
dura winchline

6-strand cross-lay

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force		Nominal Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf	kN	kgf
40	5	1,00	304	31000	319	32500
44	5½	1,25	412	42000	433	44200
48	6	1,48	491	50100	515	52500
52	6½	1,60	530	54100	556	56700
56	7	2,00	652	66500	685	69900
60	7½	2,17	687	70000	721	73500
62	7¾	2,35	775	79100	814	83000
64	8	2,45	795	81100	834	85100
68	8½	2,80	922	94000	968	98700
70	8¾	3,10	1010	103000	1060	108000
72	9	3,35	1060	108000	1110	113000
78	9¾	3,64	1180	120000	1240	126000
84	10½	4,25	1370	140000	1440	147000
90	11¾	5,05	1620	165000	1700	173000
96	12	5,85	1860	190000	1960	200000

Material: Polyamide wire over Polyproylene-Multifil
Specific Gravity: 1,14
Melting Point: 250°C
Operating Temperature: 80°C (max./continuous use)

Load-Elongation Characteristics



The rope weight is defined as the linear rope mass under pretension, approximate limit deviation +2/-0%. The nominal rope size is the approximate rope diameter in mm, the nominal rope circumference the approximate rope circumference in inches. The minimum breaking force is calculated according to EN ISO 2307; the nominal breaking force is the mean of regularly conducted tests. Minimum breaking forces determined according to current ISO standard. (Test result meets requirement if break occurs either at 100% of relevant value when linear (unspliced), or minimum 90% at splice).

A Speciality
Comments on synthetic wire rope

It was the first time the public was informed about the ideal mooring rope for automatic mooring winches. Before then there were wire ropes made of steel, which provided high dimensional stability, excellent surface pressure resistance and sturdiness. However, they were heavy, stiff, prone to rusting and very inelastic. And there were synthetic fibre ropes, which were flexible, light and elastic. But their dimensional stability was poor, surface pressure resistance low and they were not so robust. Aiming to merge the advantages of both these seemingly irreconcilable material types, Bayer AG Leverkusen, in partnership with SELDIS, began experiments on 'Atlas perlon wire rope'. The result was a rope made from synthetic wires with rope core and strand core of synthetic fibre material, manufactured for dimensional stability and surface pressure resistance, using materials imparting flexibility, optimised elasticity and corrosion resistance, plus excellent elongation and dynamic load resistance. Above all it was ideal for use on automatic winches.

Today, on writing these lines almost fifty years later, there is still nothing to contradict these claims.

Seite 20 - Hamburger Abendblatt

Atlastrosse

Ein Mann kann das jetzt von den Farbenfabriken Bayer A.G. entwickelte Atlastauwerk um den Poller eines Tankriesen belegen. Dieser Perlon-Draht von 220 m Länge hat eine Bruchfestigkeit von etwa 55 t und wiegt nur 350 kg. Die Farbenfabriken Bayer haben zusammen mit der Hamburger Firma Rudolf Seldis und der Esso-Tankschiffs-Reederei GmbH, auf der 47 000 t tragenden „Esso Stuttgart" eine Atlastrosse und eine Flaggenleine ein Jahr lang unter härtesten Bedingungen und guten Ergebnissen getestet.

Newspaper article in the Hamburger Abendblatt from 12th April 1960

Ships...

Shown here: typical ropes used on board

Three good reasons for the original...

Life
The flexural properties of ATLAS ropes are remarkable. The diagramson 'Dynamic Bending' under 'Textile Ropes Compared' at the end of this chapter show the results of tests conducted at the Technical University of Stuttgart according to which ATLAS is best equipped for an extremely long life, assuming proper handling and usage. Rope deflection is recommended over smooth surfaces and bending radii of three to four times the rope diameter (ratio pulley or roller diameter to rope diameter 6:1 to 8:1).

Safety
A tensile test on an ATLAS rope after ten years' service on a container ship showed the rope to have 85% nominal breaking strength of a new rope.

Recommendation
Hardly a case is known where ship management and crew have not explicitly requested ATLAS ropes for winch operations when placing repeat orders.

® Reg Trademark Lanxess Deutschland GmbH (pre. Bayer AG Leverkusen)

atlas®

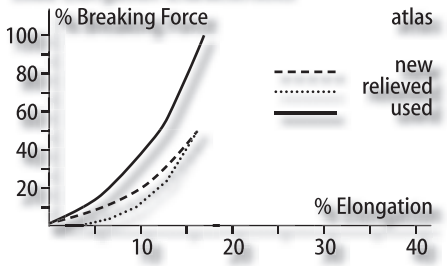
6-strand cross-lay

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force		Nominal Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf	kN	kgf
24	3	0,40	130	13300	146	14900
28	3½	0,52	168	17100	188	19200
32	4	0,65	220	22400	247	25200
36	4½	0,83	260	26500	291	29700
40	5	1,00	310	31600	347	35400
44	5½	1,25	420	42800	471	48000
48	6	1,48	500	51000	560	57100
52	6½	1,60	540	55100	605	61700
56	7	2,00	665	67800	745	76000
60	7½	2,17	700	71400	784	80000
62	7¾	2,35	791	80700	885	90300
64	8	2,45	810	82600	908	92600
68	8½	2,80	941	96000	1050	107000
70	8¾	3,10	1030	105000	1150	117000
72	9	3,35	1080	110000	1200	122000
78	9¾	3,64	1200	122000	1350	138000
84	10½	4,25	1400	143000	1570	160000
90	11¼	5,05	1650	168000	1850	189000
96	12	5,85	1900	194000	2130	217000

Material: Polyamide wire over Polyamide-Multifil
Specific Gravity: 1,14
Melting Point: 250°C
Operating Temperature: 80°C (max./continuous use)

Perfect...
Flexural stability, dynamic strength, wear resistance, all optimised, plus high breaking force, very good dimensional stability and balanced elasticity; there is nothing better on winches. Attention: Choose duraflote when a rope must float. Choose atlas plus when superior resistance to cyclic bending is required.

Load-Elongation Characteristics



atlas® plus

6-strand cross-lay

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force		Nominal Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf	kN	kgf
48	6	1,48	500	51000	568	57900
52	6½	1,60	540	55100	613	62500
56	7	2,00	665	67800	755	77000
60	7½	2,17	700	71400	795	81100
62	7¾	2,35	791	80700	897	91500
64	8	2,45	810	82600	920	93800
68	8½	2,80	941	96000	1070	109000
70	8¾	3,10	1030	105000	1170	119000
72	9	3,35	1080	110000	1230	125000
78	9¾	3,64	1200	122000	1370	140000
84	10½	4,25	1400	143000	1600	163000

Material: Polyamide wire over Polyamide-Multifil
Specific Gravity: 1,14
Melting Point: 250°C
Operating Temperature: 80°C (max./continuous use)

The rope weight is defined as the linear rope mass under pretension, approximate limit deviation +2/-0%. The nominal rope size is the approximate rope diameter in mm, the nominal rope circumference the approximate rope circumference in inches. The minimum breaking force is calculated according to EN ISO 2307; the nominal breaking force is the mean of regularly conducted tests. Minimum breaking forces determined according to current ISO standard. (Test result meets requirement if break occurs either at 100% of relevant value when linear (unspliced), or minimum 90% at splice).

® Reg Trademark Lanxess Deutschland GmbH (pre. Bayer AG Leverkusen)

Mooring ropes in service

Selection

At the time of publication of this brochure few uniform international rules are in force relating to mooring ropes on sea going vessels, despite this field being most sensitive to personal and environmental safety. Aside from guidelines released by classification societies, which cover little more than minimum requirements, on the following pages we take account of recommendations in the OCIMF's 'Mooring Equipment Guidelines' and the international standard ISO 3730 'Mooring Winches' in respect of ropes with special properties making them suitable for mooring operations. The subjects 'mooring' and 'towing' appear in this chapter deliberately, in view of the developments and growing importance of synthetic textiles in this area. Furthermore, we find it appropriate to make comparisons with steel rope in this context, although this is also treated in a separate chapter.

Even prior to vessel construction the design and selection of all deck equipment is closely coordinated with the characteristics and service conditions of rope materials.

Hence the positioning and specifications of winch drums, rollers and chocks must satisfy requirements of mooring ropes in terms of size, flex, dynamic load properties and material. Efficiency and life of ropes depend critically on how rope guiding equipment and winches, in particular automatic winches, are conditioned, controlled and maintained.

In view of the large (almost confusing) variety of synthetic ropes on offer today, it makes sense to break down into categories:

- SWR = Steel Wire Rope
- TWR/HMPE = Textile Wire Rope
- TF1 = Textile Fibre Rope with high wear resistance
- TF2 = Textile Fibre Rope with medium wear resistance
- TF3 = Textile Fibre Rope with low wear resistance

The charts under 'Textile ropes in comparison' (elsewhere in this chapter) and 'Mooring ropes for seagoing ships' (next page) provide assistance in selection of and dimensioning for mooring lines.

The table 'Mooring ropes for seagoing ships' on the following page offers a summary of data that can also be applied to any conventional types of vessel, in consideration of any further factors which may have an influence. Due to the variety of rope constructions, the table lists no rope sizes (diameters) as these are indicated in other rope data tables in this chapter.

Notwithstanding the above, wind, current, tides, swell, and ice each generate forces acting on mooring systems that can hardly be calculated accurately enough to allow the perfect mooring arrangement to be designed. Consequently, when selecting mooring ropes, an adequate safety margin should be taken into account.

Dimensioning

Recommended diameter

Winch drum diameter (first value), bending diameter of rollers and chocks (second value), relative to rope diameter of

- Steel Wire Rope SWR 12-16/10-12
- Textile Wire Rope TWR 6-10/4-6
- Fibre Rope HMPE-type 6-10/4-6
- Fibre Rope PP-type 4-6/4
- Fibre Rope PA-/PET-type 6/4-6

Actual rope force

Recommended maximum force acting on the rope, value relative to minimum breaking force of rope:

- Steel Wire Rope SWR 0,55
- Textile Wire Rope TWR/HMPE 0,55
- Textile Fibre Rope TF1 0,50
- Textile Fibre Rope TF2 0,475
- Textile Fibre Rope TF3 0,45

Drum load

Recommended minimum breaking force of rope, value relative to drum load of mooring winch:

- Steel Wire Rope SWR 3,75
- Textile Wire Rope TWR/HMPE 3,75
- Textile Fibre Rope TF1 4,1
- Textile Fibre Rope TF2 4,3
- Textile Fibre Rope TF3 4,5

Optimum deployment

For an optimum mooring line arrangement, the following rules must be observed:

- Alignment of ropes as symmetrical as possible to mid-ship position
- Smallest possible inclination of all lines to horizontal level of vessel
- Transverse lines positioned as vertical as possible to longitudinal axis of vessel
- Spring lines positioned as parallel as possible to the longitudinal axis of the vessel
- All lines in use should be of same size and material. (Possible exceptions: long bow and stern lines, as well as spring lines in view of their differing longitudinal alignment)
- Long bow and stern lines contribute little to load bearing

The contents of this chapter are meant to serve as a supplement to, not a substitute for, local, national, and international legislation established by appointed bodies such as port authorities, classification societies, etc.

Special considerations

- Use steel ropes (minimum elongation) or elongation-resistant textile fibre ropes (e.g. HMPE, Dyneema) where loading facilities require vessel to remain in fixed position.
- Use textile wire rope or textile fibre rope with high dynamic load resistance in ports with intensive surface or ground swell.
- The breaking force of stretchers used in connection with steel wire ropes to increase elasticity of the complete line should exceed the breaking strength of the steel rope by minimum 37% for polyamides (nylon, perlon) and 25% for all other synthetics.
- Rope-to-rope connections must be properly spliced, not knotted
- No splices between a steel rope and a textile rope.
- Use thimbles, or preferably special links (Fairlead shackles) to connect steel with textile rope.

Mooring ropes for seagoing ships

Summary

Mooring Winch	Mooring Rope							Ship
	Type and Category					Transverse Lines (without Spring, Bow and Stern Lines)		
	SWR Steel Rope	**TWR** atlas dura winchline duraflote	**TF1** hmpe ti-flex	**TF2** Polyamide Polyester powerflote cx powerflote clt	**TF3** Polypropylene powerflote			
Drum Force	Breaking Force					Qty.	Length	Size
kN	kN	kN	kN	kN	kN	pce	m	tdw
50	190	190	210	220	230	6	180	10.000
80	300	300	330	350	360	6	200	15.000
125	470	470	520	540	560	7	200	25.000
160	600	600	660	690	720	8	200	40.000
200	750	750	830	860	900	8	220	75.000
250	950	950	1050	1090	1140	10	220	120.000
315	1180	1180	1300	1360		12	220	150.000
400	1500	1500	1650			14	250	200.000
Breaking Force rel.:	1,0	1,0	1,1	1,15	1,2			

Distinguishing between different rope constructions and classification into categories is useful in helping to compensate lower wear resistance by increasing breaking force, or vice versa, to finally achieve maximum safety. Characteristics like resistance to flexural fatigue, cyclic dynamic loading, friction and wear are factors enabling correlation of breaking forces and stress actually applied to a mooring rope.

General information on handling and maintenance, inspection and discard criteria are covered separately in the chapters 'Textile ropes in service' and 'Steel ropes in service'

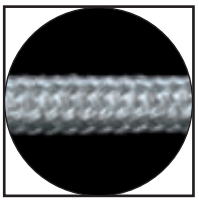
Compact...
Mooring rope, floats, high tensile strength, optimum elasticity, dimensionally stable,
But: low flexibility
(Recommended usage: only on winches).

powerflote winchline

Jacketed 7-strand twisted core

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf
40	5	0,81	303	30900
44	5½	0,98	380	38700
48	6	1,17	465	47400
52	6½	1,32	535	54600
56	7	1,54	636	64800
60	7½	1,77	745	76000
64	8	2,00	815	83100
68	8½	2,26	939	95700
72	9	2,54	1060	108000
80	10	3,19	1300	133000
88	11	3,86	1600	163000
96	12	4,56	1850	186000

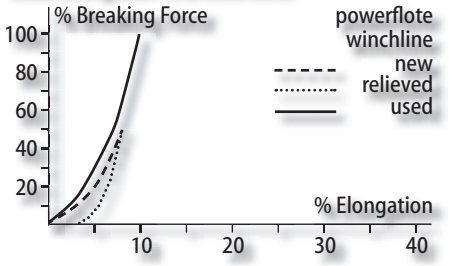
Material:	High Tenacity Polyethylene (Jacket High Tenacity Polyester/Polyethylene)
Specific Gravity:	0,93
Melting Point:	165°C
Operating Temperature:	70°C (max./continuous use)



Variations...

There is no standard for this, hence figures are only typical and may vary depending on application.

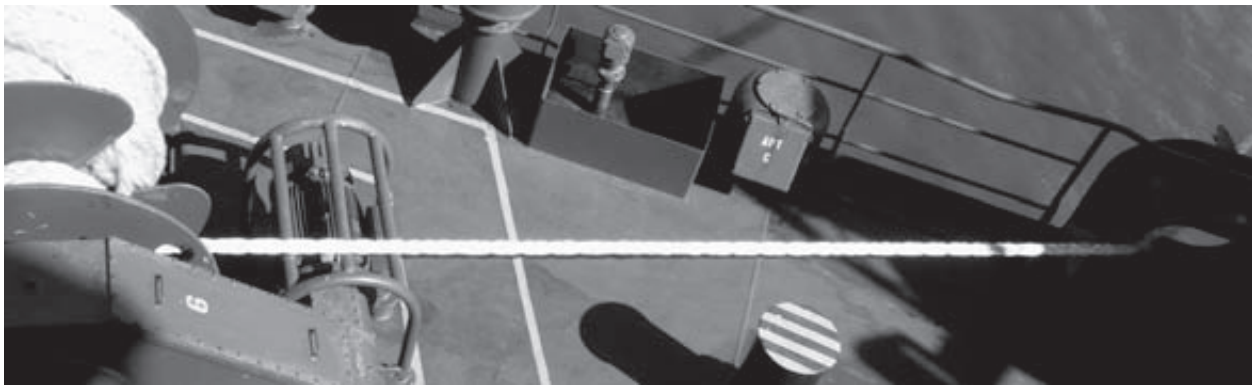
Load-Elongation Characteristics



Impregnation .....

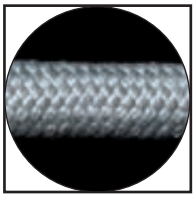
...an effective gain for extra life and safety: AFC emulsions (PE, PFF or PUD-based, depending on rope material) protect rope yarns, therefore

- **optimise load distribution and elongation balance within the strand structure**
- **protect yarns from rubbing against one another and from infiltration of foreign particles**
- **effectively reduce wear inside the rope**



Ships...

Shown here: typical ropes used on board



Resilient...
Hard-wearing, very high tensile strength, very wear-resistant. Extreme dynamic load strength, dimensionally stable. Ideal as tow line. But: low flexibility. (Recommended application: only on winches).

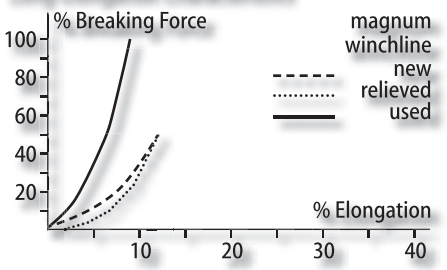
magnum winchline

Jacketed parallel laid twisted strand ropes

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	kgf
40	5	1,12	542	55300
44	5½	1,33	659	67200
48	6	1,61	814	83000
52	6½	1,88	969	98800
56	7	2,22	1170	119000
60	7½	2,49	1310	134000
64	8	2,84	1470	150000
68	8½	3,25	1710	174000
72	9	3,53	1860	190000
76	9½	3,92	2015	205000
80	10	4,33	2250	230000
88	11	5,28	2790	285000
96	12	6,30	3260	333000
104	13	7,38	3790	387000

Material: High Tenacity Polyester
Specific Gravity: 1,38
Melting Point: 260°C
Operating Temperature: 100°C (max./continuous use)

Long-Elongation Characteristics



Variations...

There is no standard for this, hence figures are only typical and may vary depending on application.

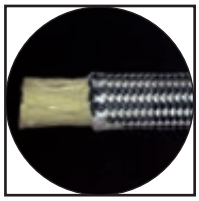
The rope weight is defined as the linear rope mass under pretension, approximate limit deviation ±5%. The nominal rope size is the approximate rope diameter in mm, the nominal rope circumference the approximate rope circumference in inches. Minimum breaking forces determined according to current ISO standard. (Test result meets requirement if break occurs either at 100% of relevant value when linear (unspliced), or minimum 90% at splice).

aracor pro

Kernmantle rope, Core: parallel

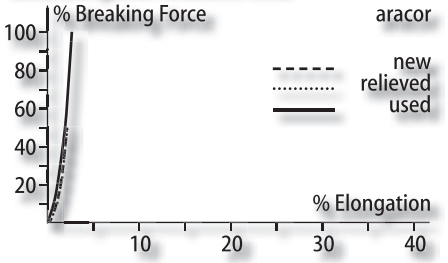
Nominal Rope-Size	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~ kg/m	kN	tf
6	0,028	20	2,04
8	0,043	29	2,97
10	0,065	49	5,01
14	0,143	98	10,0
17	0,206	147	15,0
20	0,279	196	20,0
22	0,341	245	25,0
25	0,435	294	30,1
25	0,472	343	35,1
27	0,542	392	40,8
29	0,609	441	45,1
31	0,678	491	50,1
34	0,830	589	60,2
36	0,944	687	70,2
39	1,08	785	80,2
41	1,23	883	90,2

Material: Aromatic Polyamide
Specific Gravity: ~ 1,44
Melting Point: 415°C
Operating Temperature: 130°C (max./continuous use)



Special case...
ideal for holding and anchoring. Extremely high tensile strength, almost like steel, extremely low elongation, neither static nor elastic. But: low wear resistance, low flexural stability and dynamic load resistance.

Load-Elongation Characteristics

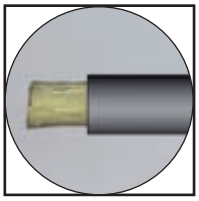


aracor jetline

Core: parallel laid yarns
Cover: polyethylene extruded coating

Nominal Rope-Size	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~ kg/m	kN	tf
4	0,013	5,40	0,55
5	0,018	9,40	0,96
6	0,031	17,8	1,82
8	0,051	29,9	3,06
11	0,082	49,9	5,10
12	0,103	68,7	7,02
13,5	0,141	92,7	9,48
15,5	0,174	120	12,3
17	0,219	156	15,9
19	0,257	189	19,3
23	0,411	260	26,6
27	0,496	312	31,7
30	0,612	379	38,8
31	0,710	468	47,9
35	0,885	580	59,3
39	1,090	714	73,0
43	1,320	892	91,2

Material: Aromatic Polyamide
Specific Gravity: ~ 1,44
Melting Point: 415°C
Operating Temperature: 130°C (max./continuous use)



Variations...

There is no standard for this, hence figures are only typical and may vary depending on application.

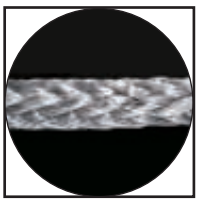
The rope weight is defined as the linear rope mass under pretension, approximate limit deviation ±3%. The nominal rope size is the approximate rope diameter in mm, the nominal rope circumference the approximate rope circumference in inches. Minimum breaking forces determined according to current ISO standard. (Test result meets requirement if break occurs either at 100% of relevant value when linear (unspliced), or minimum 90% at splice).

dynaflex 12

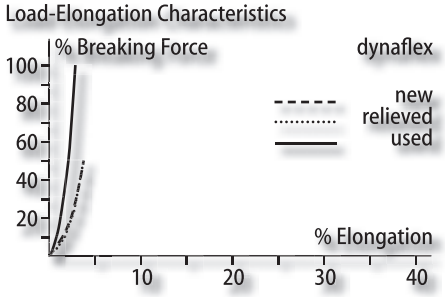
12-strand circlebraid

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	tf
24	3	0,33	595	60,8
28	3 ½	0,42	739	75,6
32	4	0,60	1030	105
36	4 ½	0,74	1210	123
40	5	0,90	1450	148
44	5 ½	1,07	1680	171
48	6	1,26	1950	199
52	6 ½	1,46	2220	226
56	7	1,67	2540	260
60	7 ½	1,90	2830	290
64	8	2,15	3140	321
68	8 ½	2,41	3470	355
72	9	2,68	3810	389
80	10	3,60	4890	500
88	11	4,28	5650	577
96	12	5,02	6330	646
104	13	5,97	7260	732
112	14	6,97	8340	841
120	15	8,07	9320	955
128	16	9,26	10500	1076
136	17	10,5	11600	1209
144	18	11,9	12900	1342

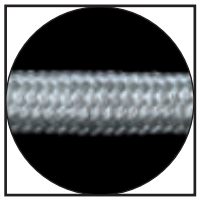
Material: High modulus polyethylene without jacket
Specific Gravity: ~ 0,97
Melting Point: 145°C
Operating Temperature: 70°C (max./continuous use)



Amazing...
Extremely high tensile strength, almost like steel, very flexible, high fatigue bending stability, very low elasticity, floats. But: limited wear resistance, low creep behaviour.



This page shows 12 strand circular braids suitable for use on winches, therefore the recommended rope construction. This rope material is also available with identical weight and breaking force in the traditional construction as 8-strand plait.



dynaflex 12 pro

Jacketed 12-strand circlebraid

Nominal Rope-Size	Nominal Rope Circ.	Rope Weight	Minimum Breaking Force	
(~mm Ø)	~" inch	~ kg/m	kN	tf
24	3	0,34	445	45,4
28	3 ½	0,45	530	54,1
32	4	0,60	740	75,5
36	4 ½	0,75	960	98,0
40	5	0,93	1100	112
44	5 ½	1,11	1400	143
48	6	1,32	1700	173
52	6 ½	1,54	1980	202
56	7	1,79	2350	240
60	7 ½	2,04	2690	275
64	8	2,31	3000	307
68	8 ½	2,59	3380	345
72	9	2,90	3760	384
80	10	3,55	4280	437
88	11	4,31	5180	529
96	12	5,09	5860	598
104	13	5,92	6910	705

Material: High modulus polyethylene with jacket
Specific Gravity: ~ 0,97
Melting Point: 145°C
Operating Temperature: 70°C (max./continuous use)

Variations...

There is no standard for this, hence figures are only typical and may vary depending on application.

Characteristics of textile ropes by material

Type of Rope (Category) Characteristics	Unit	aracor -pro -jetline	dynaflex -8/12 -8/12pro	atlas -original -plus	dura winch	duraflote	polyamide	polyester	ti flex -1300 -12 plus
Material[2]		AR (no jacket)	HMPE (no jacket)	PA wire PA multifil	PA wire PA multifil	PA wire PA multifil	PA	PET	HTPE ±70 HTPET ±30
Construction							figures apply to twisted three-, or four-strand,		
Breaking Strength	rel.	~3,2-4,0	~5,0-7,8	~1,8-1,9	~1,7-1,8	~1,4-1,5	1,47	1,30	2,05
Weight	rel.	~1,4-1,6	~1,2	~1,3-1,4	~1,3-1,4	~1,15-1,2	1,36	1,77	1,35
Specific Gravity	kg/m³	~1,44	~0,97	1,14	1,14	0,99	1,14	1,38	1,14
Wet Strength	%	100	100	100	100	100	85	100	100
Elongation when									
- new at 50% breaking strength	%	2	4	16	16	15	26	16	17
- relieved	%	0	0	4	4	3	17	9	7
- used at break	%	3	3	17	17	16	20	11	15
Creep (plastic elongation)	v	2	4-5	1-2	1-2	1-2	3-4	2	2-3
Water Absorption (yarn)	%	5	0	2	2	2	4-6	<1	<1
Melting Point (yarn-to yarn friction)	°C	415	145	250	250	165/250	216/260	260	145/260
Operating Temperature	°C	130	50	80	80	70	80	100	80
Resistance to									
- dynamic loads (TCLL value)	%		91	73	69	63	64	73	74
- Friction (thermic)									
when dry	v	3	4-5	1-2	2	2-3	3	2	2
when wet	v	5	4-5	1-2	2	2-3	4	2	2
- Abrasion (mechanic)									
when dry	v	4	1-2	2	2	2	2	1-2	2
when wet	v	5	1-2	2	2	2	4	1-2	2
- Cyclic Bending[1]									
at 20% breaking strength	n		~19000	57600	46700	37600	13200	3800	5700
at 40% breaking strength	n		~1300	1910	1430	970	330	410	480
- UV radiation	v	4	2	2	2	2	2	1	2
- Rot/Mildew	v	1	1	1	1	1	1	1	1
- Alkalis	v	5	1	1	1	1	1	2	2
- Acids	v	5	3	5	5	5	5	1	1
- Mineral Oil Substances	v	1	1	2	2	2	2	1	1
- Oxidants	v	5	3	5	5	5	5	3	3
- Solvents	v	3	3	3	3	3	3	3	3

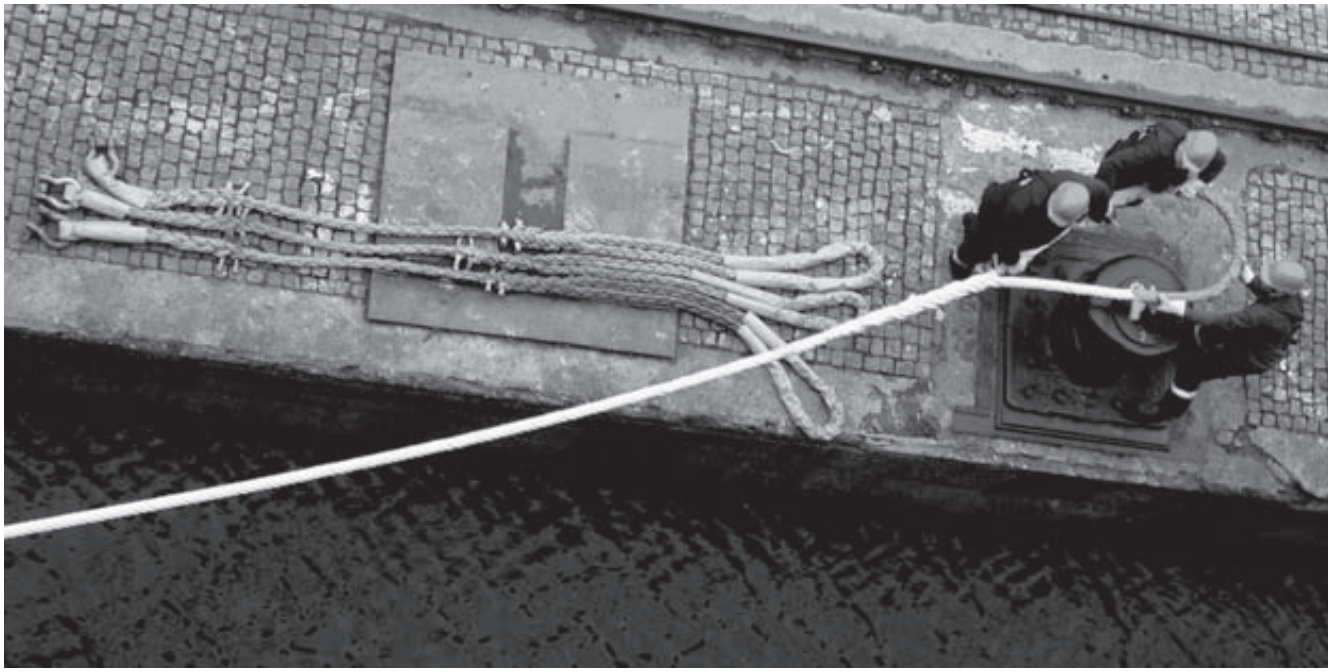
v = valuation: 1 = excellent, 2 = very good, 3 = good, 4 = fair, 5 = poor
n = number/quantity
[1] Number of bending cycles under load of x% of minimum breaking force over pulley D/d=10 (figures apply to braided/plaited fibre ropes, and six-strand synthetic wire ropes at comparable identical breaking force).

[2] Abbreviations: AR = Aramid (Aromatic Polyamide), HMPE = High Modular Polyethylene, HTPEPET = High Tenacity Polyester/Polyethylene Composite, HTPE = High Tenacity Polyethylene, PET = Polyester, HTPES = High Tenacity Polyester, PA = Polyamied, PP = Polypropylene, MA = Manila, SI = Sisal, HA = Hemp

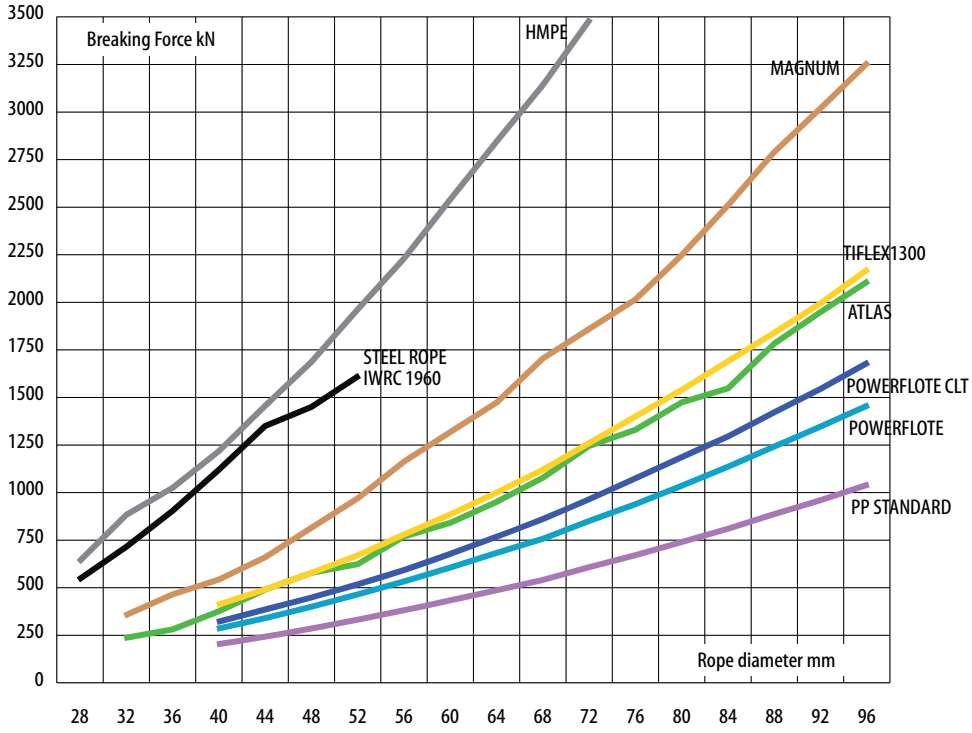
All figures are benchmarks or averages based on existing test results, applicable for constructions shown. Where indications are missing, comparisons are not relevant, or no data available. Pricipally, all data shown of no significance if treated as absolute; they are meant for comparison only.

In addition to all information in this chart, it should be considered that rope resistance properties in relation to dynamic loads, friction, abrasion, and dynamic bending stress can be significantly increased by treating (impregnating) rope yarns with suitable chemical additives.

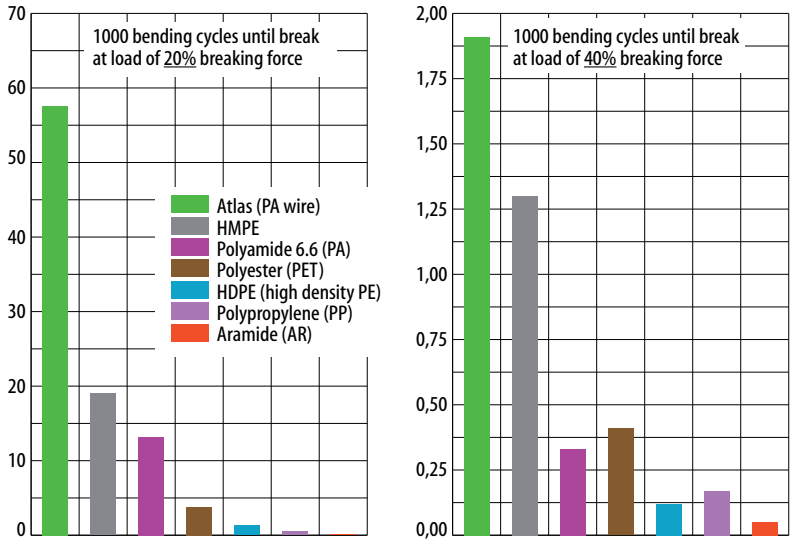
	ti flex -12pro	ti flex -hp	powerflote -clt	powerflote -cx plus -cx 12 plus -cx 12 pro	powerflote -8 -12 -12 pro	polypropylene splitfilm	manila sisal hemp	Notes
	HTPE ±70 HTPET ±30	HTPE ±70 HTPET ±30	HTPE ±80 HTPET ±20	HTPE ±85 HTPET ±15	HTPE	PP	MA/SI/HA	
to squareplaited eight-strand, and braided twelve-strand ropes								
~1,8-2,0	1,75	1,62	~1,65	~1,4-1,5	1,00	0,5-0,6	related to PP of same diameter	
~1,2-1,4	1,22	1,11	~1,10	~1,0-1,1	1,00	1,5-1,6	related to PP of same diameter	
1,14	1,14	0,99	0,99	0,92	0,91	~1,50		
100	100	100	100	100	100	100	related to minimum breaking force	
16	15	14	14	13	15	5	Elongation of circlebraid and doublebraid ropes is lower, of spiralbraid and cablelay twisted ropes is higher than squareplaited and plain laid twisted ropes	
6	6	5	5	3	4	2		
15	14	14	14	12	16	9		
2-3	2-3	3	3	4	4	1		
<1	<1	<1	<1	0	0	100	related to mass (lower, if impregnated)	
145/260	145/260	145/260	145/260	145	165	burns		
80	80	80	70	70	70	40	Maximum at continuous operation. Exceeding these values results in continuously decreasing strength	
74	76	68	59-64	54	50		Residual strength after 1000 load cycles, determined as per OCIMF recommendations	
2	2	3	3	4	5	3	Damage of material due to thermic influence. Rating applies to rope material of impregnated yarns.	
2	2	3	3	4	5	3		
2	2	2-3	2-3	3-4	4-5	3	Damage of material due to mechanic influence. Rating applies to rope material of impregnated yarns.	
2	2	2-3	2-3	3-4	4-5	3		
6600	8100	4100	~2100	~1310	470	12	Not repesentative, as figures partly based on project calculations. Test results available for a limited number of rope diameters only	
~610	720	410	~370	~220	174	2		
2	2	2a	2a	2a	4a	2-3	'2a' if stabilized, otherwise '5'	
1	1	1	1	1	1	3-5		
2	2	2	2	1	1	5		
1	1	1b	1b	1b	1b	5	'1b' applies to all execept nitric acid.	
1	1	1	1	1	1	4		
3	3	3	3	3	3	3		
3	3	3	3	3	3	3		



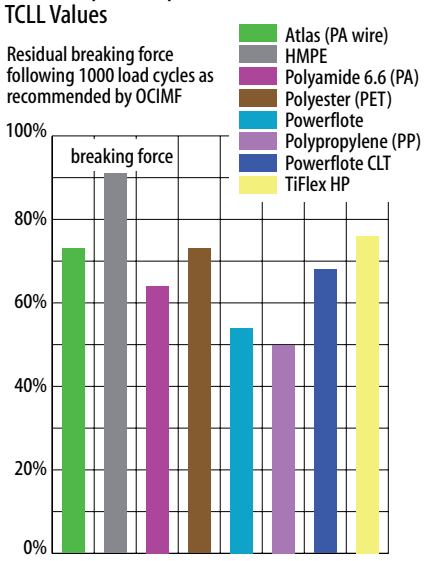
Textile Ropes Compared
Breaking Force / Rope Diameter



Textile Ropes Compared
Dynamic Bending



Textile Ropes Compared
TCLL Values



Steel Ropes

Fundamentals ...

In the beginning there was 'rope' as described in earlier chapters of this brochure. With the technical revolution of the nineteenth century, however, and through this the capability to use metal wires as a material for the industrial production of ropes, new possibilities for the distribution or transmission of loads and forces in material handling were opened. The result was a huge gain in cross-sectional strength and robustness.

It is indeed remarkable how a large number of wires manufactured with high cross sectional strength laid together in a rope construction can suddenly unify the properties of relatively high flexibility, safety and tensile strength. Advantages of this type of load distributor can be summarised as follows: single wires in the rope do not break collectively when fatigued, but rather one by one and in different areas; broken wires provide an effective criterion for determining the time to discard the rope; an evenly spread tensile strength in the rope through individual wires and the repositionability of these wires within the rope construction provides relatively good flexibility; the smooth surface of wire ropes allows high winding speeds at low noise; rope properties are maintained even at low temperatures; the variety of constructions permits adaptation to a wide range of applications.

Incidentally: We could give this product category the heading metal wire or wire rope. Nevertheless, we stay with steel since other metals are insignificant and in the meantime wire rope can be made from synthetic material (see chapter on 'Textile ropes').

Rope service applications

Running ropes
Ropes running over pulleys, traction sheaves, discs and drums, which adapt to the curvature of these and therefore subject to degrees of dynamic strain (hoist ropes, luffing ropes, trolley ropes, elevator ropes, scraper ropes, haulage ropes, mooring and towing ropes).

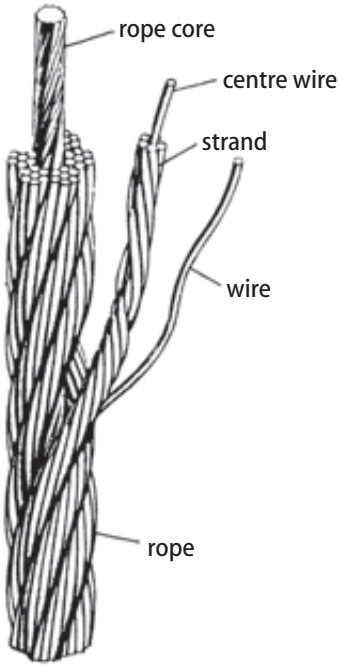
Standing ropes
Ropes virtually stationary in service, therefore subject more to static strain, with their ends attached to fixed points (guy ropes for masts and derricks, guide ropes for elevators, all kinds of anchor rope).

Support ropes
Ropes used as tracks or runs for conveyor wheels, therefore with relatively low bending radius (support rope for cable cars, cable cranes, cable excavators).

Lifting slings
Ropes used to hang, wind or loop around loads.

Rope structure

This illustration shows the most common form of rope structure: a six-strand rope with a fibre core suitable for most applications where no special properties are required.



Wire
Smallest rope component, generally round wire made of steel, diameter dependent on rope diameter and construction type.

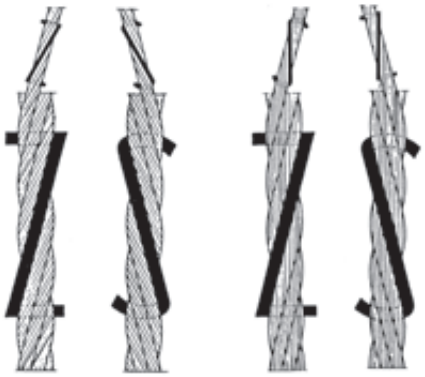
Strand
One or more layers of wires helically wrapped around a core.

Strand core
Central thread in a strand made of metal (one wire or combination of several wires) or yarn, strand or textile rope.

Rope
Construction composed of strands wound helically around rope core.

Rope core
Centre part of a rope, strand or rope made of metal or textile material.

Direction and type of lay
Direction of the helical path of the wire in the strand or the strand in the rope. Service conditions require differentiation between right (sZ) or left hand (zS) cross lay, or right (zZ) or left hand (sS) lang lay.



Length and angle of lay
Pitch of helically wound wires around a strand or strands in a rope, measured as length or angle. Constructional rules exist that vary only for special conditions of service or deployment.

Rotation resistant
Rope property preventing excess rotation around its longitudinal axis when bearing an unguided load.

Non-Rotating
Rope property by which the rope will perform less than one axial rotation when bearing an unguided load (current European standards make no differentiation between non-rotating and rotation resistant).

Tension relieved
Rope in which the elastic recovery of the wires resulting from rope closure has been removed. Wires and strands lie tension free in the rope construction and rope ends and break points do not or only minimally burst open.

Rope materials

Bright wire
Generally made of carbon steel of a certain purity (fixed ratios of Mn, Si, P and S), base material wire rod cold drawn to bright wire with cross sectional strength up to 2200N/mm².

Bright alloy wire (stainless steel)
Austenite steels with large alloy component comprising Cr, Ni, Mo and Ti, particularly corrosion resistant, heat resistant and with low magnetism, but generally with low tensile and flexural strength.

Galvanized wire
End galvanized (galvanized after the drawing process), or drawn galvanized (galvanized before the drawing process) non-alloy wires, common for normal corrosion protection, with minimal reduced tensile strength and flexural fatigue.

Lubricant
Ropes, strands and cores are normally coated with lubricants during manufacture. Common lubricants are oils, vaselines, bitumen and similar materials. Lubrication is one of the more important factors in preventing rope wear.

Construction (rope class)

Description of strand and rope constructions begins with the shape of wires and ends with the systemization of wires, strands and rope diameter. The diversity of combination possibilities for wires and strands within a construction, the opportunity to compact strands and ropes to a variety of rope diameters and diametrical shapes enables product manufacture to very individual specifications for all conditions and requirements. However, for the sake of simplicity and procurement flexibility, today's standards summarise similar constructions into defined rope classifications.

Operands

Nominal rope length mass M
Value derived from the product of the length mass factor and the square of the nominal rope diameter.

$$M = W \cdot d^2$$

Nominal metallic cross sectional area C
Factor derived from fill factor used in calculating the metallic cross sectional area of a rope.

$$C = f \cdot \frac{\pi}{4}$$

Fill factor f
Ratio between the sum of nominal metallic cross sectional areas of all wires in the rope (A) and the circumscribed area (Au) of the rope based on its nominal diameter (d).

$$f = \frac{A}{A_u}$$

Minimum breaking force factor K
Empirical factor to determine the minimum breaking force of a rope obtained from the product of the fill factor (f) for the rope class or construction, spinning loss factor (k) for the rope class or construction and the constants π /4. K factors for common rope classes and constructions are given in EN 12385.

$$K = \frac{\pi f \cdot k}{4}$$

Rope grade R_r
A level of requirement for breaking force indicated by a number (e.g. 1770, 1960). This does not necessarily mean that the actual tensile strengths of individual wires (N/mm²) in the rope correspond to this rope strength class.

Minimum aggregate breaking force $F_{e,min}$
Value (in kN) of the measured aggregate breaking force to be met as minimum requirement in a prescribed test, normally obtained by calculation from the product of the square of the nominal rope diameter (d), the factor for the metallic cross sectional area (C) and rope grade (R_r).

$$F_{e,\min} = \frac{d^2 \cdot C \cdot R_1}{1000}$$

Minimum breaking force F_{min}
Value (in kN) of the measured breaking force (F_m) to be met as minimum requirement in a prescribed test, normally obtained by calculation from the product of the square of the nominal rope diameter (d), the rope grade (R_r) and the breaking force factor (K).

$$F_{\min} = \frac{d^2 \cdot R_1 \cdot K}{1000}$$

Calculated minimum breaking force $F_{e,min}$
Value of minimum breaking force based on nominal wire diameters, nominal tensile strength of wires and the spinning loss factor for the rope class and construction given by the rope manufacturer.

Measured aggregate breaking force $F_{e,m}$
Sum of the measured breaking forces of all wires taken from a rope.

Measured breaking force F_m
The breaking force obtained using a prescribed test method (either tested as a whole or calculated from single wire).

Properties

Rope tension

Wire ropes should be considered as a machine with many components. They serve to accommodate static or oscillatory forces, experience flexural strain through bending, compressional strain through contact with deflection apparatus and end fittings, in addition to torsional strain through rope rotation. These tensional circumstances make wire ropes vulnerable to material fatigue, which becomes apparent in wire ropes through continual degradation in the form of successive wire breakage. However, it takes a large number of wire breakages to render a rope unusable and ready for discarding (see also Removal from service).

Calculation factors
Representative selection of standard types

Rope class	Factor W	Factor C	Factor K
6x7 FC	0,345	0,369	0,332
6x7 IWRC	0,384	0,432	0,359
6x19 FC	0,359	0,384	0,330
6x19 IWRC	0,400	0,449	0,356
8x19 FC	0,340	0,349	0,293
8x19 IWRC	0,407	0,457	0,356
6x36 FC	0,367	0,393	0,330
6x36 IWRC	0,409	0,460	0,356
8x36 FC	0,348	0,357	0,293
8x36 IWRC	0,417	0,468	0,356
6x35N FC	0,352	0,377	0,317
6x35N IWRC	0,392	0,441	0,345
6x19M FC	0,346	0,357	0,307
6x19M IWRC	0,381	0,418	0,332
6x37M FC	0,346	0,357	0,295
6x37M IWRC	0,381	0,418	0,319
18x7	0,401	-	0,328
34(M)x7	0,401	-	0,318

W = Rope length mass factor
C = Metallic cross-sectional area factor
K = Minimum breaking force factor
(See formulars on previous pages)

Rope elongation

The steel rope as a combination of individual wires is subject to permanent elastic elongation, the extent of which depends on the rope construction type, especially the number of wires and amount of metal in relation to the rope's cross-section. The consistent (plastic) elongation rises continually during service and by removal from service is put at one per cent, the elastic elongation, by absolute calculation using the elasticity module (e), relatively at approx. four per cent. These percentage figures are mean values (example for construction 6x19 (FC) for a wide range of constructions. For applications requiring extreme precision in length it is recommended that the rope be pre-stretched (though this procedure is very sophisticated).

Rope life and service life

In research for wire rope the rope life is given as the number of load cycles a wire rope is subject to before it breaks. Obviously, a value derived on this basis can only be applied to one condition of service if comparisons are to be made between different rope types. Designations on life expectancy in absolute figures for a specific rope type under variable service conditions are logically not possible. Service life, on the other hand, is the time between installation and discarding the rope, and also related to a specific deployment. Fatigue bend tests and dynamic tensile tests simulate real service conditions, provide indication of suitable qualities of different types of rope, help in selection of a suitable type of rope and supplement practical experience, but are no substitute for this.

Inspection

Existing standards (DIN, EN, ISO) contain rules for examination of specified wire and rope properties after manufacture and before delivery. These rules comprise methods of testing and limits that must be achieved as proof of fulfilment. Essentially these relate to flexural fatigue resistance, torsion resistance, tensile strength and, where relevant, zinc wire coating, as well as lubrication and breaking force of the rope in a qualitative sense and values of length and weight in a quantitative sense. Depending on service application, further examinations may be sensible and necessary, and can be arranged on request.

Dimensioning

Due to the diversity of parameters and the even greater number of combination possibilities, there are no general and mandatory methods to select rope types and rope diameters. Some technical rules and standards based on experience and research have emerged for a large number and wide variety of service applications and should be considered in the selection process for the appropriate rope size.

This publication can therefore only address fundamental aspects of this complex subject. The subject of dimensioning is based on considerations relating to safety, in other words, the relationship between available rope strength to strain arising from service, in the sense of rope not being subject to excess strain so as to cause failure or accidents. Hence, provisions are aimed at avoiding 'overstrain', i.e. give a value for determining maximum workload in relation to rope breaking force. Technical rules contain such values as the design factor v, by which the known permitted tensile strength of a rope must be raised to calculate the minimum breaking force with a maximum tolerance margin allowed for safety, and this in consideration of any additional strain expected from the service application occurring through bending, compression and torsion. The more precisely the maximum tensile strength of the rope is known, the lower the oscillatory strain, the shorter its deployment and the fewer load cycles per unit of time, the lower the factor v to be chosen. The less precisely the maximum tensile strength is known, the more oscillatory strain, the longer its deployment and the more load changes, the higher the factor v.

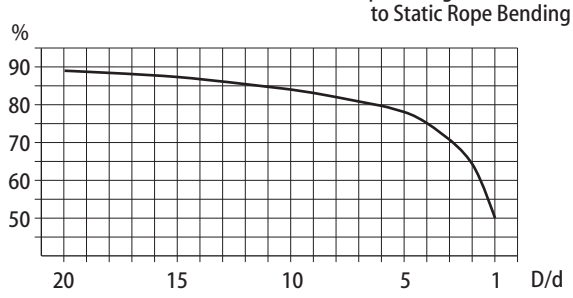
Of all the mentioned strain factors, bending or flexural strain is one that can be influenced most. This is done by choosing adequately large winding and deflection gear. Depending on application, strain and rope type, the diameter of winch drum,

pulley or sheave should be 10 to 32 times that of the nominal rope diameter.

Authoritative here are numerous recommendations and regulations valid for the respective application.

Design factors for selected applications

Application	Factor v from	to
Hydro steel structures	2,5	5
Maritime lifting gear	4	5
Maritime mooring/towing	2,5	4,5
Drilling ropes	3	
Shaft hoisting systems		
- Hoisting ropes	8	10
- Platform ropes	7,5	
- Grab ropes	7,5	
- Guide and stay ropes	4,5	
Elevator ropes		
- Passenger elevators	11,5	
- Freight elevators	6,5	
Funicular railways and cable cars		
- Support ropes	3	
- Traction ropes	4	
- Haul ropes	4,5	
Tow lift systems	4,5	
Cable Cranes		
- Support ropes	3	3,5
- Hoisting ropes	3,5	5
Scraper ropes	5	8
Excavator ropes	3	3,5
Lifting Slings	3	6



—— Residual rope strength when bending over rollers or pins, relative to quotient D/d (ratio of roller/pin diameter to rope diameter) without considering dynamic loads.

Selection criteria

Construction

The diversity of available rope types and products makes it impossible to present a generally valid classification covering all main applications. It is highly recommended to consult the supplier or manufacturer for information of this nature (see also other contents of this chapter). General factors having a highly significant influence on rope properties are: number, shape and size of wires in a rope; number, shape and size of strands; type and size of the core, usage of fibre or polymers to fill interstices between wire layers, lay angle and direction of wires, and strands.

Lay type and direction

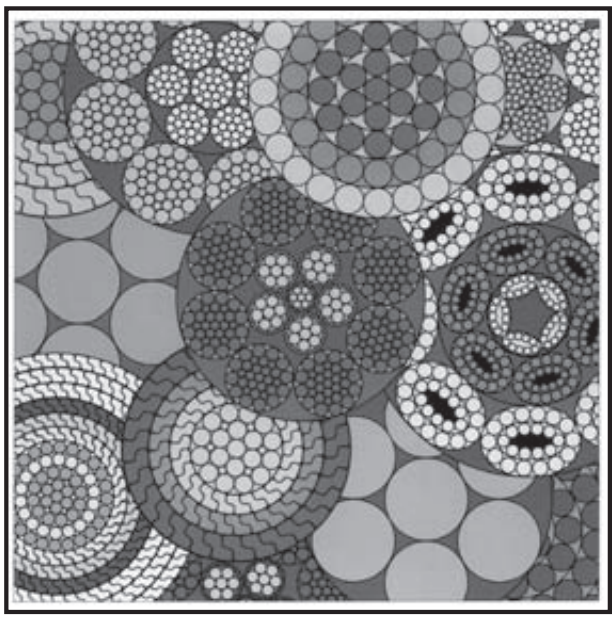
Most common for ropes is a right lay direction, which is suitable for most applications, unless rope course requires adherence to a particular lay direction (right or left), possibly even in combination with rotation resistant or non-rotating constructions to prevent rope untwisting. Cross lay is common as the more robust type of lay, unless rope course and deflectors permit use of more vulnerable but more flexurally resistant lang lay constructions.

Stranding
Preferable are parallel lay stranded ropes consisting of individual wires running parallel (in the same direction) in almost all cases, unless acceptance of overlapping wires for higher flexibility in standard constructions (same lay angle and wire diameter) takes preference over wear resistance.

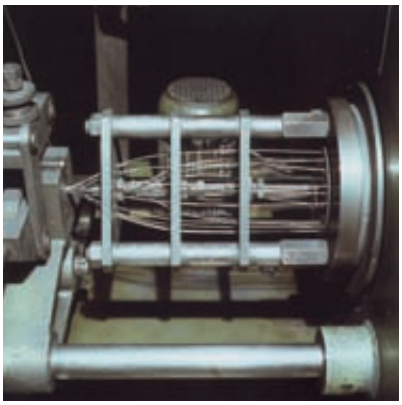
Rope grade (tensile grade) and rope size
The rope diameter is generally determined by the required breaking force based on the rope class most frequently used (construction 6x36 FC, material strength 1770N/mm²). A reduction or minimisation of rope diameter can be achieved by choosing a higher material strength and/or rope construction with higher metallic density.

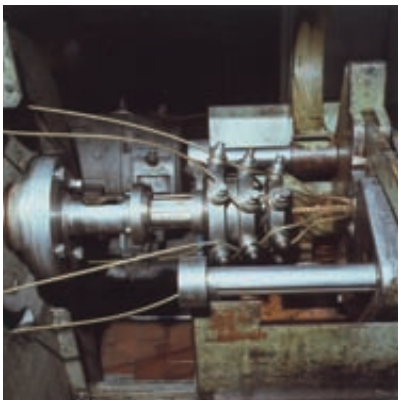
Corrosion protection
Ropes made from standard bright wires are used when no corrosion is expected. If so, zinc galvanized ropes are recommended. Any loss in wire strength and flexural properties can be neglected. Ropes made from stainless steel wire offer extreme corrosion protection, but significantly sacrifice strength and flexural resistance. Irrespective of wire material, rope lubrication (applied during manufacture and periodically reapplied whilst in service) is definitely a condition of effective corrosion protection.

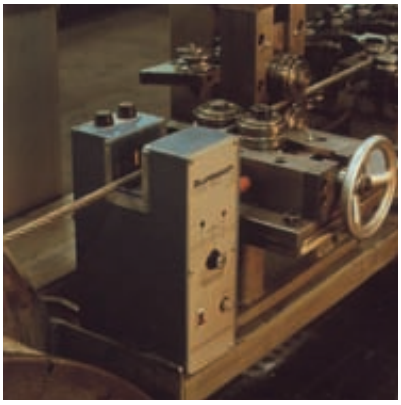
Lubrication
The most important effect of good rope lubrication is reduction in interior and exterior friction, which wires and strands are constantly subject to when under load and bending. Lubrication provides considerable protection against interior and exterior mechanical wear.



From wire rods to finished rope … The manufacturing process



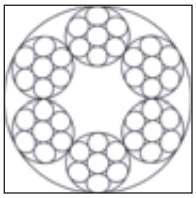




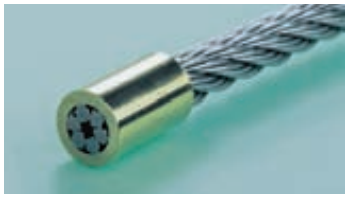
6x7 FC

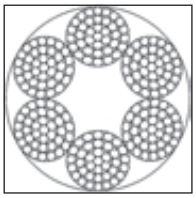
Round strand rope with fibre core

Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade 1770N/mm² (180kp/mm²)	
mm	~ kg/m	kN	kgf
2	0,014	2,35	240
3	0,031	5,29	540
4	0,055	9,40	959
5	0,086	14,7	1500
6	0,124	21,2	2160
7	0,169	28,8	2940
8	0,220	37,6	3840
9	0,279	47,6	4860
10	0,345	58,8	6000



Handy...
Light, flexible, strong, versatile.
Suitable for normal applications where no special properties are required.





6x37M FC

Round strand rope with fibre core

Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade 1770N/mm² (180kp/mm²)	
mm	~ kg/m	kN	kgf
6	0,125	18,8	1920
7	0,170	25,6	2610
8	0,221	33,4	3410
9	0,280	42,3	4310
10	0,346	52,2	5320
11	0,419	63,2	6450
12	0,498	75,2	7670
13	0,585	88,2	9000
14	0,678	102	10400
16	0,886	134	13700
18	1,12	169	17200
20	1,38	209	21300

Regular...

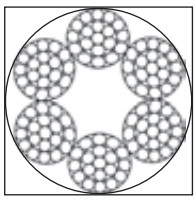
- **Material: Drawn galvanized steel wire**
- **Lubrication: Neutral acid-free inside and outside**
- **Type/direction of lay: Ordinary lay sZ**
- **Tensile grade:1770N/mm²**

Other requirements? By arrangement we can supply: No or special galvanization, different type/direction of lay, special lubrication. Also for higher tensile grades (1960 with 10.7%, and 2160 with 22.0% higher breaking force in relation to 1770).

6x19M FC

Round strand rope with fibre core

Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade 1770N/mm² (180kp/mm²)	
mm	~ kg/m	kN	kgf
3	0,031	4,89	499
4	0,055	8,69	886
5	0,087	13,6	1390
6	0,125	19,6	2000
7	0,170	26,6	2710
8	0,221	34,8	3550
9	0,280	44,0	4490
10	0,346	54,3	5540
11	0,419	65,8	6710
12	0,498	78,2	7980



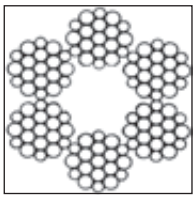
The rope weight is defined as the approximate calculated length mass kg/m (informative). The rope grade is the acronym for the nominal tensile strength of the wires in N/mm². The permitted limit deviation of the rope diameter from nominal diameter is +8-0% for 2 to <4mm, +7-0% for 4 to <6mm, +6-0% for 6 to <8mm and +5-0% for 8mm and more.

6x19 FC

Parallel lay round strand rope with fibre core

Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade			
		1770N/mm² (180kgf/mm²)		1960N/mm² (200kgf/mm²)	
mm	~ kg/m	kN	kgf	kN	kgf
10	0,359	58,4	5960	64,7	6600
11	0,434	70,7	7210	78,3	7990
12	0,517	84,1	8580	93,1	9500
13	0,607	98,7	10100	109	11100
14	0,704	114	11600	127	13000
15	0,808	131	13400	146	14900
16	0,919	150	15300	166	16900
17	1,04	169	17200	187	19100
18	1,16	189	19300	210	21400
19	1,30	211	21500	233	23800
20	1,44	234	23900	259	26400
22	1,74	283	28900	313	31900
24	2,07	336	34300	373	38000
26	2,43	395	40300	437	44600
28	2,81	458	46700	507	51700

Staunch supporter...
Larger wire diameter means:
Better corrosion protection and wear resistance. Long service life for applications with low bending strain. Particularly robust with steel core.



Regular...

- Material: Drawn galvanized steel wire
- Lubrication: Neutral acid-free inside and outside
- Type/direction of lay: Ordinary lay sZ
- Tensile grade:1770N/mm²

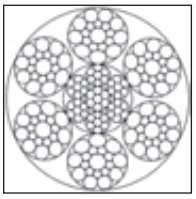
Other requirements? By arrangement we can supply: No or special galvanization, different type/direction of lay, special lubrication. Also for higher tensile grades (1960 with 10.7%, and 2160 with 22.0% higher breaking force in relation to 1770).

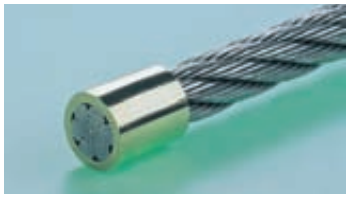
Rules and standards...

Even if not explicitly indicated: Compliance with standards (ISO, EN, DIN) and statutory provisions. Product specifications continually updated to meet requirements

6x19 IWRC

Parallel lay round strand rope with steel core





Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade			
		1770N/mm² (180kgf/mm²)		1960N/mm² (200kgf/mm²)	
mm	~ kg/m	kN	kgf	kN	kgf
12	0,576	90,7	9250	100	10200
13	0,676	106	10800	118	12000
14	0,784	124	12600	137	14000
15	0,900	142	14500	157	16000
16	1,02	161	16400	179	18300
17	1,16	182	18600	202	20600
18	1,30	204	20800	226	23100
19	1,44	227	23200	252	25700
20	1,60	252	25700	279	28500
22	1,94	305	31100	338	34500
24	2,30	363	37000	402	41000
26	2,70	426	43500	472	48100
28	3,14	494	50400	547	55800
32	4,10	645	65800	715	72900
36	5,18	817	83300	904	92200
40	6,40	1010	103000	1120	114000

dynasteel omni

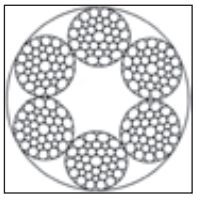
...far more than normal!

- Computer controlled construction
- Optimised interior lubrication
- Increased zinc coating, average 40% over standard
- Increased flexural and torsion properties, average 50% over standard

6x36 FC

Parallel lay round strand rope with fibre core

Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade			
		1770N (180kgf/mm²)		1960N/mm² (200kgf/mm²)	
mm	~ kg/m	kN	kgf	kN	kgf
9	0,297	47,3	4820	52,4	5340
10	0,367	58,4	5960	64,7	6600
11	0,444	70,7	7200	78,3	7990
12	0,528	84,1	8580	93,1	9500
13	0,620	98,7	10100	109	11100
14	0,719	114	11600	127	13000
15	0,825	131	13400	146	14900
16	0,940	150	15300	166	16900
18	1,19	189	19300	210	21400
20	1,47	234	23900	259	26400
22	1,78	283	28900	313	31900
24	2,11	336	34300	373	38000
26	2,48	395	40300	437	44600
28	2,88	458	46700	507	51700
30	3,30	526	53700	582	59400
32	3,76	598	61000	662	67500
34	4,25	675	68900	748	76300
36	4,76	757	77200	838	85500
38	5,30	843	86000	934	95300
40	5,87	935	95400	1030	105000
42	6,77	1030	105000	1140	116000
44	7,11	1130	115000	1250	128000
46	7,77	1240	126000	1370	140000
48	8,46	1350	138000	1490	152000
50	9,18	1460	149000	1620	165000
52	9,92	1580	161000	1750	179000
56	11,5	1830	187000	2030	207000
60	13,2	2100	214000	2330	238000



Regular...

- **Material: Drawn galvanized steel wire**
- **Lubrication: Neutral acid-free inside and outside**
- **Type/direction of lay: Ordinary lay sZ**
- **Tensile grade:1770N/mm²**

Other requirements? By arrangement we can supply: No or special galvanization, different type/direction of lay, special lubrication. Also for higher tensile grades (1960 with 10.7%, and 2160 with 22.0% higher breaking force in relation to 1770).

Rules and standards...

Even if not explicitly indicated: Compliance with standards (ISO, EN, DIN) and statutory provisions. Product specifications continually updated to meet requirements

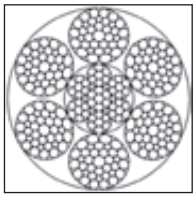
The rope weight is defined as the approximate calculated length mass kg/m (informative). The rope grade is the acronym for the nominal tensile strength of the wires in N/mm². The permitted limit deviation of the rope diameter from nominal diameter is +8-0% for 2 to <4mm, +7-0% for 4 to <6mm, +6-0% for 6 to <8mm and +5-0% for 8mm and more.

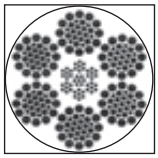
For the case at hand...
Wear resistant through parallel lay and high outer wire diameter, high breaking strength.
Almost universal deployment where no rotation resistance or extreme breaking strength required. Flexible and very robust if with fibre core (FC), or still flexible, but extremely robust if with steel core (IWRC).

6x36 IWRC

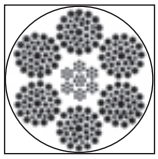
Parallel lay round strand rope with steel core

Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade			
		1770N/mm² (180kgf/mm²)		1960N/mm² (200kgf/mm²)	
mm	~ kg/m	kN	kgf	kN	kgf
9	0,331	51,0	5200	56,5	5770
10	0,409	63,0	6430	69,8	7120
11	0,495	76,2	7770	84,4	8610
12	0,589	90,7	9250	100	10200
13	0,691	106	10800	118	12000
14	0,802	124	12700	137	14000
15	0,920	142	14500	157	16000
16	1,05	161	16400	179	18300
18	1,33	204	20800	226	23100
20	1,64	252	25700	279	28500
22	1,98	305	31100	338	34500
24	2,36	363	37000	402	41000
26	2,76	426	43500	472	48100
28	3,21	494	50400	547	55800
30	3,68	567	57900	628	64100
32	4,19	645	65800	715	72900
34	4,73	728	74400	807	82300
36	5,30	817	83300	904	92200
38	5,91	910	92800	1010	103000
40	6,54	1010	103000	1120	114000
42	7,21	1110	113000	1230	125000
44	7,92	1220	124000	1350	138000
46	8,65	1330	136000	1480	151000
48	9,42	1450	148000	1610	164000
50	10,2	1580	161000	1740	177000
52	11,1	1700	173000	1890	193000
56	12,8	1980	202000	2190	223000
60	14,7	2270	231000	2510	256000
64	16,8	2580	263000	2860	292000
68	19,0	2920	297000	3230	329000
72	21,2	3270	333000	3620	369000

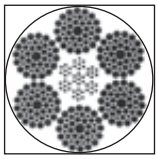




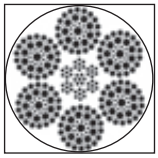
6x31Warrington-Seale



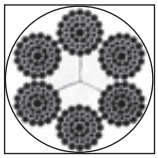
6x36 Warrington-Seale



6x41 Warrington-Seale



6x46 Seale-Filler



6x49 Filler-Seale

All examples of rope construction shown here have identical parameters and features, hence are summarised into one rope grade. 6x36 is not only the description of a rope construction, rope structure or number of strands and wires but also the universal description of a rope grade. Where individual rope constructions hardly differ in their technical application summarisation into one rope grade represents a welcome simplification in the choice of suitable rope for a specific service application.

Regular...

- **Material: Drawn galvanized steel wire**
- **Lubrication: Neutral acid-free inside and outside**
- **Type/direction of lay: Ordinary lay sZ**
- **Tensile grade:1770N/mm²**

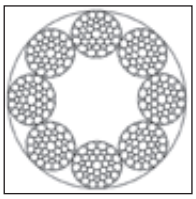
Other requirements? By arrangement we can supply: No or special galvanization, different type/direction of lay, special lubrication. Also for higher tensile grades (1960 with 10.7%, and 2160 with 22.0% higher breaking force in relation to 1770).

Special cases...
Variations for special requirements: high to extreme flexural strength, excellent handling or good surface area contact in sheave and roller grooves. But: compromised breaking force.

8x36 FC

Parallel lay round strand with fibre core

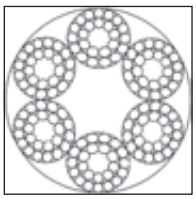
Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade 1770N/mm² (180kgf/mm²)	
mm	~ kg/m	kN	kgf
16	0,891	133	13600
18	1,13	168	17100
20	1,39	207	21100
22	1,68	251	25600
24	2,00	299	30500
26	2,35	351	35800
28	2,73	407	41500
32	3,56	531	54200
36	4,51	672	68500
40	5,57	830	84700



6x24+7FC

Round strand rope with fibre core in centre and fibre cores in each strand

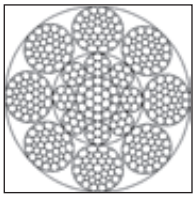
Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade 1770N/mm² (180kgf/mm²)	
mm	~ kg/m	kN	kgf
14	0,624	97,2	9880
16	0,815	127	12900
18	1,03	161	16300
20	1,27	198	20200
22	1,54	240	24400
24	1,83	286	29000
26	2,15	335	34100
28	2,50	389	39500
32	3,26	508	51600



8x36 IWRC

Parallel lay round strand with steel core

Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade 1770N/mm² (180kgf/mm²)	
mm	~ kg/m	kN	kgf
20	1,67	252	25700
22	2,02	305	31100
24	2,40	363	37000
26	2,82	426	43500
28	3,27	494	50400
32	4,27	645	65800
36	5,40	817	83300
40	6,67	1010	103000
44	8,07	1220	124000



Regular...

- Material: Drawn galvanized steel wire
- Lubrication: Neutral acid-free inside and outside
- Type/direction of lay: Ordinary lay sZ
- Tensile grade:1770N/mm²

Other requirements? By arrangement we can supply: No or special galvanization, different type/direction of lay, special lubrication. Also for higher tensile grades (1960 with 10.7%, and 2160 with 22.0% higher breaking force in relation to 1770).

The rope weight is defined as the approximate calculated length mass kg/m (informative). The rope grade is the acronym for the nominal tensile strength of the wires in N/mm². The permitted limit deviation of the rope diameter from nominal diameter is -0/+5% for 8x36, +7%/-0% for 6x24/7FC .

Coated …
Plastic jacket to protect rope from environmental influences (weather, dirt) or to protect damageable surfaces from rope.

6x7FC galvanized PVC coated

Round strand rope with fibre core

Nominal Rope Diameter		Rope Weight	Minimum Breaking Force at tensile grade	
Rope plain	Rope plus coat		1770N/mm² (180kgf/mm²)	
mm	mm	~ kg/m	kN	kgf
1,5	2,5	0,010	1,32	135
2	3	0,020	2,35	240
2,5	3,5	0,030	3,68	375
3	4	0,040	5,29	540
3	5	0,050	5,29	540
4	6	0,080	9,40	959
5	7	0,115	14,7	1500
6	8	0,180	21,2	2160

6x37FC galvanized PVC coated

Round strand rope with fibre core

Nominal Rope Diameter		Rope Weight	Minimum Breaking Force at tensile grade	
Rope plain	Rope plus coat		1770N/mm² (180kgf/mm²)	
mm	mm	~ kg/m	kN	kgf
10	12	0,40	52,2	5320
12	14	0,59	75,2	7670
14	16	0,77	102	10400

6x19FC galvanized PVC coated

Round strand rope with fibre core

Nominal Rope Diameter		Rope Weight	Minimum Breaking Force at tensile grade	
Rope plain	Rope plus coat		1770N/mm² (180kgf/mm²)	
mm	mm	~ kg/m	kN	kgf
4	6	0,075	8,69	886
5	7	0,098	13,6	1390
6	8	0,158	19,6	2000
8	10	0,254	34,8	3550
10	12	0,420	54,3	5540
12	14	0,560	78,2	7980
14	16	0,750	106	10800

Stainless steel plastic coated

Round strand rope, material 1.4401

Nominal Rope Diameter		Rope Construction	Coating Material/Colour	Rope Weight	Minimum Breaking Force at tensile grade	
Rope plain	Rope plus coat				1570N/mm² (160kgf/mm²)	
mm	mm			~ kg/m	kN	kgf
1,25	2	7x7	PVC transparent	0,012	0,87	89
2	3	7x7	PVC transparent	0,030	2,25	229
2,5	3,5	7x7	PVC transparent	0,035	3,52	359
3	4	7x7	PVC transparent	0,040	5,07	517
3	5	7x7	PVC transparent	0,050	5,07	517
3	5	7x7	PVC white	0,050	5,07	517
4	5	7x19	PVC transparent	0,070	8,29	846
4	5	7x7	PVC white	0,070	8,98	916
4	6	7x7	PVC white	0,080	8,98	916
4	6	7x7	PE white	0,080	8,98	916
4	7	7x7	PVC white	0,090	8,98	916
4	8	7x7	PVC white	0,100	8,98	916
5	7	7x19	PVC transparent	0,120	13,0	1320
5	8	7x7	PVC white	0,130	13,0	1320
6	9	7x7	PVC white	0,200	20,3	2070

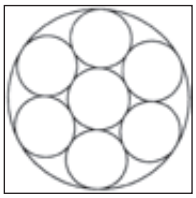
MORE...

PVC coating is standard. For special requirements ropes can be fitted by arrangement with other polymer materials.

1x7

Stainless steel spiral strand rop

Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade 1570N/mm² (160kgf/mm²)	
mm	~ kg/m	kN	kgf
1	0,005	0,855	87,1
1,5	0,011	1,92	196
2	0,020	3,42	349
2,5	0,031	5,34	545
3	0,045	7,69	784
4	0,080	13,7	1400
5	0,126	21,4	2180

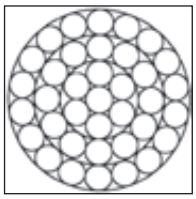


Stability and rust protection... Stiff but highly inelastic, ideal as guy rope, extremely corrosion resistant.

1x37

Stainless steel spiral strand rope

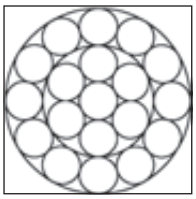
Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade 1570N/mm² (160kgf/mm²)	
mm	~ kg/m	kN	kgf
4	0,078	12,9	1310
5	0,122	20,1	2050
6	0,176	29,0	2950
7	0,240	39,4	4020
8	0,313	51,5	5250
9	0,396	65,2	6640
10	0,489	80,5	8200
12	0,704	116	11800
14	0,958	158	16100



1x19

Stainless steel spiral strand rope

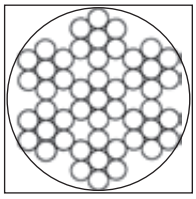
Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade 1570N/mm² (160kgf/mm²)	
mm	~ kg/m	kN	kgf
2	0,020	3,30	337
2,5	0,031	5,15	525
3	0,045	7,42	757
4	0,079	13,2	1350
5	0,124	20,6	2100
6	0,178	29,7	3030
7	0,243	40,4	4120
8	0,317	52,8	5390
9	0,401	66,8	6810



7x7

Stainless steel round strand rope with steel strand core

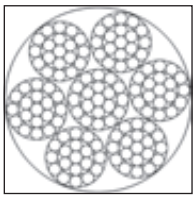
Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade 1570N/mm² (160kgf/mm²)	
mm	~ kg/m	kN	kgf
1,5	0,009	1,37	140
2	0,015	2,43	248
3	0,035	5,48	559
4	0,061	9,75	995
5	0,096	15,2	1550
6	0,138	21,9	2230
7	0,188	29,8	3040



7x19

Stainless steel round strand rope with steel strand core

Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade 1570N/mm² (160kgf/mm²)	
mm	~ kg/m	kN	kgf
3	0,034	4,69	478
4	0,061	8,34	851
5	0,095	13,0	1330
6	0,137	18,8	1920
7	0,187	25,5	2600
8	0,244	33,3	3400
9	0,309	42,2	4300
10	0,381	52,1	5310
11	0,461	63,1	6440
12	0,549	75,0	7650

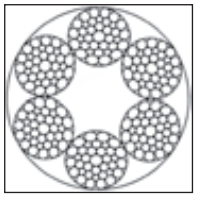


Good runner and rust protection... Flexible, elastic, runs on winches and pulleys, extremely corrosion resistant. But: limited long-term flexural stability.

Regular...

- Material: Bright steel wire 1.4401 (AISI 316)
- Lubrication: none
- Type/direction of lay: Ordinary lay sZ
- Tensile grade: 1570N/mm²

Other requirements? By arrangement we can supply: Different type/direction of lay, or higher tensile grade (1770 instead of 1570 with approx. 12.7% higher breaking force).



6x36 FC

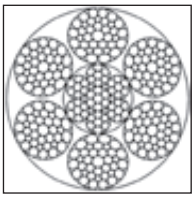
Stainless steel round strand rope with PP fibre core

Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade 1570N/mm² (160kgf/mm²)	
mm	~ kg/m	kN	kgf
8	0,234	33,2	3390
10	0,367	51,8	5280
12	0,528	74,6	7610
14	0,719	102	10400
16	0,940	133	13600
18	1,19	168	17100
20	1,47	207	21100
22	1,78	251	25600
24	2,11	298	30400
26	2,48	350	35700

6x36 IWRC

Stainless steel round strand rope with steel rope core

Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade 1570N/mm² (160kgf/mm²)	
mm	~ kg/m	kN	kgf
8	0,262	35,8	3650
10	0,409	55,9	5700
12	0,590	80,5	8210
14	0,800	110	11200
16	1,05	143	14600
18	1,33	181	18500
20	1,64	224	22800
22	1,98	271	27600
24	2,36	322	32800
26	2,76	378	38600



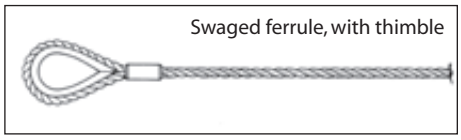
The rope weight is defined as the approximate calculated length mass kg/m (informative). The rope grade is the acronym for the nominal tensile strength of the wires in N/mm². The permitted limit deviation of the rope diameter from nominal diameter is +8-0% for 2 to <4mm, +7-0% for 4 to <6mm, +6-0% for 6 to <8mm and +5-0% for 8mm and more.

Fabrication

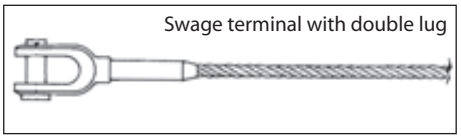
The weakness of ropes is where they end. Where a fitting is attached is also where a weak point emerges. Depending on the type of end fitting, a fall in resistance of the rope material to torsion, bending, oscillations and dynamic forces, as well as corrosion, can be expected. In other words: whether wound, spliced, molded, pressed or clamped, the weakest point of a rope is its termination. The correct choice of end fitting is therefore extremely important.

Typical types of rope end fittings are shown here and their properties summarised in the table opposite.

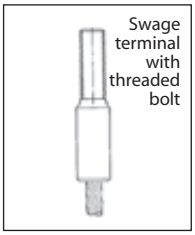
Flemish eye swaged ferrule combination, with thimble

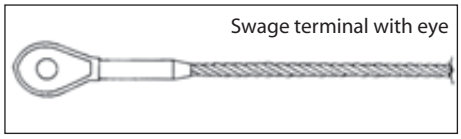


Swage terminations

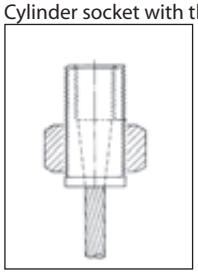


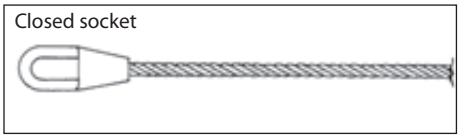
Swage terminals



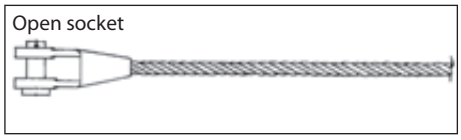


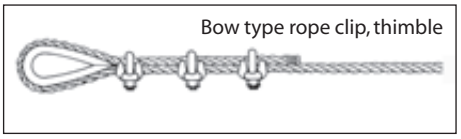
Cylinder socket with threaded coupling



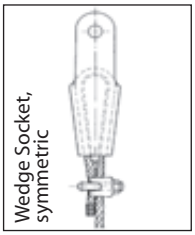


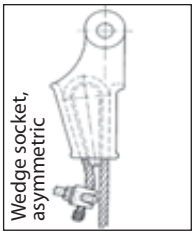
Conical sockets, metal or synthetic resin

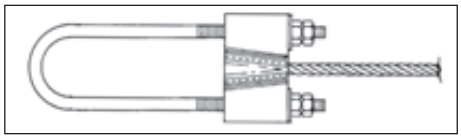




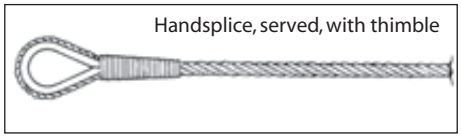
Clamped attachments



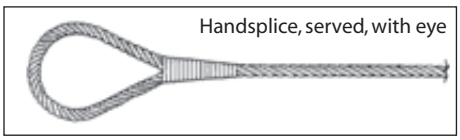




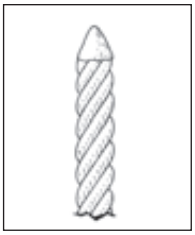
Bridge type clamp socket



Handsplices



Rope end with becket loop



Rope end tapered



The hardest way is the safest … Splicing by hand in the traditional manner.






Efficiency of steel rope end terminations

Type	Breaking force rel. %	Load cycles rel. %	Operating Temperature °C Fibre core	Operating temperature °C Steel core
Cast rope end				
- Metal	100	100	-40/+80	-40/+120
- Synthetic resin	100[3]	[2]	-54/+80	-54/+115[3]
Handsplice	80-90	10-50	-40/+100	-40/+150[1]
Swaged ferrule connection				
- Aluminium ferrule	85-95	25-240	-40/+100	-40/+150
- Copper ferrule	80-90	[2]	-40/+100	-40/+150
- Steel ferrule	85-95	[2]	-40/+100	-60/+150
Flemish eye swage combination				
- Steel ferrule	90-100	60-190	-40/+100	-40/+200[1]
Swaged bolt connection				
- Steel bolt termination	90-100	35-400	-60/+100	-60/+300[1]
Clamped connection				
- Wedge socket, symmetric	80-85	50-130	-60/+100	-60/+300[1]
- Wedge socket, asymmetric	80-90	30-170	-60/+100	-60/+300[1]
- Bow type rope clip	85-95	40-200	-60/+100	-60/+300[1]

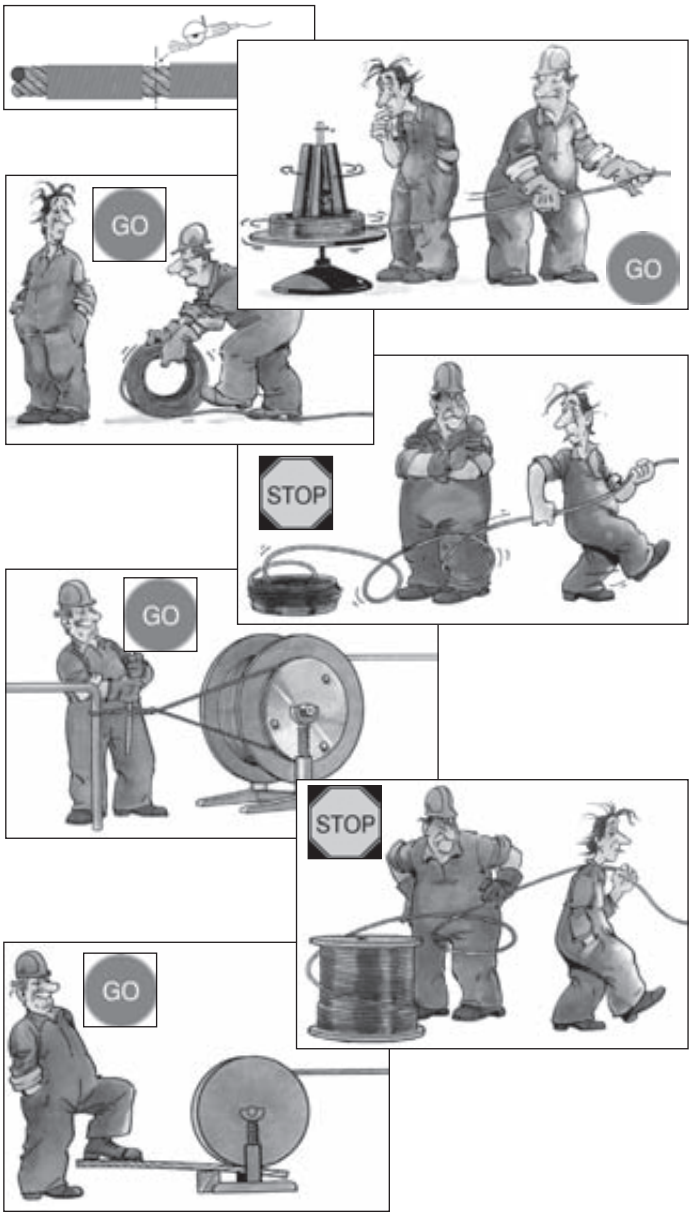
All values indicated are based on existing test results
[1]stepwise reduction in WLL over 150°C: 90%,/200%; 75%/300°;65%/400° (not considering lubricant behaviour)
[2]no test results available
[3]values for 'Wirelok'

Usage guidelines

Handling and installation

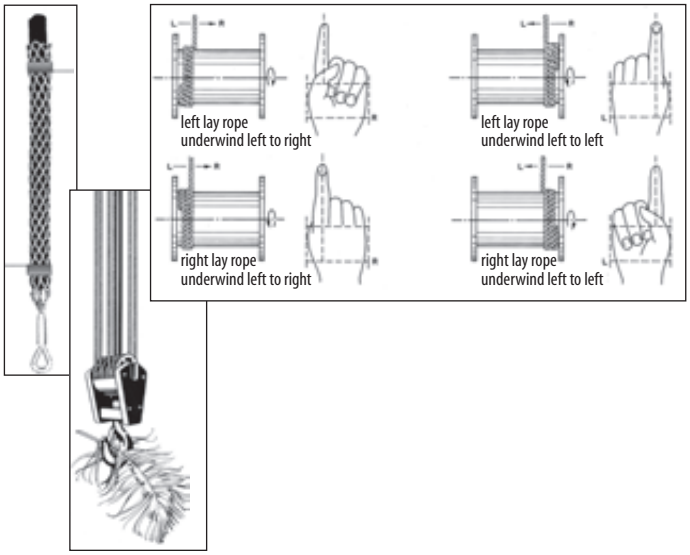
In order to guarantee flawless rope function attention must be paid to the following handling and installation guidelines.

- To prevent structural changes when cutting rope to size seize rope ends with iron wire or strands, or weld ends in front of and behind cut position prior to cutting.
- Unwind from coil either using turntable or roll out on ground. To avoid torsions under no circumstances should the rope be pulled sideways from coil.
- Unwind from reel either using turntable or jacked up. To avoid torsions under no circumstances should the rope be pulled from lying reel.
- Inspect functionality of equipment, especially end switches, overload protection, slack rope compensators, rope drums, rope drives.
- Ensure alignment of rope and rope guides and deflectors. The groove diameter should be 5% to 8% greater than the rope diameter.
- When changing ropes (replacing an old rope by a new one) the grooves may have to be reworked.
- When installing the new or replacement rope ensure correct lay and winding direction. To ensure avoidance of torsions the original bending direction should also be maintained. Avoid twisting/untwisting rope, dirt or pulling over sharp edges.
- Important when winding/unwinding: keep rope fleet angle from sheave as low as possible, (max. 2° for single layer, max 4° for rotation-resistant ropes) as otherwise contact with groove wall edge can damage rope.
- A forerunner rope (thin, rotation-resistant steel rope or three-strand fibre rope) can be useful for pulling in. A discarded rope can also be used as a forerunner. Ensure the rope ends are securely connected, either by pad eyes or cable grip. When using cable grips ensure that the ropes to be joined are wrapped in adhesive tape to prevent a grip slipping on excessively smooth rope surface (e.g. lang lay ropes or ropes with compacted strands).
- To avoid loose layers apply tension to the rope when winding onto drum (brake load).
- Installation offers a good opportunity to inspect rope for damage.
- Always work in a new rope by moving several times under reduced load. Then check end fittings, tighten screws, bolts etc.



Control and inspection

To guarantee operational safety the rope should be subject to thorough inspection by trained personnel with respect to the rope's intended service application. Operators must observe prevailing regulations and usage instructions, if necessary by referring to responsible supervisory boards and their recommendations. Steel ropes should be inspected for type, number, position and frequency of wire breakages, reduction of rope diameter, corrosion, abrasion, loosening of structure, rope deformation and service time.



Why?

During service steel ropes undergo changes such as loss of breaking force (after brief increase at beginning), abrasion, corrosion and wire breakage as continuous wear factors affecting the metal cross section. The purpose of inspection is to ascertain damage, establish cause, rectify cause, change environmental conditions and, if necessary, remove ropes from service.

Intervals
There are no general recommendations for when and how often to inspect ropes. However, regular inspection is advisable for newly installed ropes, ropes lifting extraordinary loads, ropes that have been out of service for a lengthy period, after a relocation of an appliance, and after initial evidence of damage.

Rope areas
Although the entire rope should be visually inspected, particular attention should be paid to the following:

- Excessive bending cycle strain is likely to cause abrasion and strand/wire breakage.
- Lifting points, i.e. areas where the rope contacts rollers or drums when lifting, are subject to heavy strain.
- Rope end fittings adversely affect rope elasticity; at these points even load distribution stops and corrosion risk increases.
- Increased oscillatory strain occurs in the area near to balancing sheaves.
- Rope on winch drums is subject to increased abrasion, strand breakage and structural change caused by continuous deflection, higher surface contact and possible rope crossover on multilayer winding.
- Rope pulleys can be a significant factor causing premature abrasion in the relevant rope area due to impaired running, too narrow or excessively wide grooves, damaged groove surface, lateral deflection from the groove contact area (never more than 4°) or asymmetrical strain on the rope pulley apex.
- Rope segments significantly exposed to aggressive substances or heat quickly lose lubrication and tensile strength, i.e. working load limit is reduced.

Removal from service
A number of criteria determine when steel ropes should be discarded.

- Wire breakage
  A minimum number of wire breakages on a length 6 times rope diameter and 30 times rope diameter, as identification of general wear or limited local damage. The exact limits depend on application, strain the rope is subjected to and prevailing regulations or recommendations (see table)
- Rope diameter
  A 10% or more fall in the nominal diameter of the rope in any area caused by abrasion, corrosion or structural changes
- Rope deformation
  Corkscrew formations exceeding 33% of nominal rope diameter
- Birdcaging effects
- Loop formation
- Loosening of wires
- Knot formation
- Heavy strangling effects
- Curly deformation caused by rope being pulled over edges
- Kinking
- Deformation caused by load release when rope twisted on itself under load
- Buckling
- Heat influence
  Temperature exceeding 300°C at any part of the rope

Max. number of visible broken wires before discard (examples)

on a length of	3d	6d	30d
Lifting slings			
–Stranded rope	4	6	16
–Cable lay rope	10	15	40
Crane ropes			
–6x19 cross lay MB		5	10
–6x19 cross lay HB		10	19
–6x36 cross lay MB		9	18
–6x36 langs lay HB		4	9
–6x36 cross lay MB		18	35
–6x36 langs lay HB		9	18
–8x36 cross lay MB		12	24
–8x36 langs lay HB		6	12
–Casar Powerplast cross lay HB		11	22
–Casar Turboplast cross lay HB		9	18

d = nominal rope diameter, MB = medium strain, HB = high strain.

All limits mentioned are generally recognized recommendations and are based mainly on existing regulations for crane systems. Special service applications may demand different limits.

Storage and maintenance
Appropriate storage and maintenance of steel rope is a condition for its safe usage

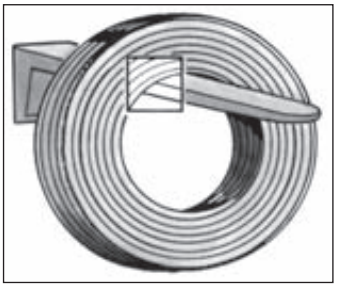
- Protect ropes from damage during loading/unloading. When lifting, do not clamp coils with edged forks, but use soft textile web, round or rope slings. Use axle and jack up rope if rope is put up on reel.
- Before storage inspect for damage. Ropes can incur damage during transport. If necessary, remove damp packaging.
- Store in slightly heated, dry, dust-free areas, protected from mechanical influences and strong sunlight. Avoid ground contact if possible by placing on pallets.
- Mark clearly for the duration of storage to exclude mix-ups and ensure traceability.
- If stored outdoors, use waterproof covers with an intermediate layer of jute cloth to absorb condensation.

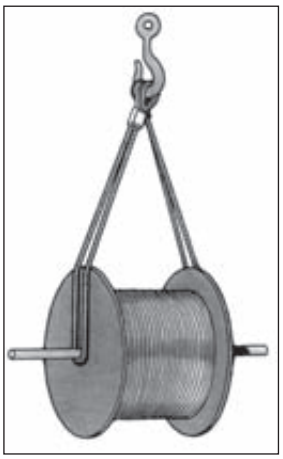
The life and safety of steel ropes can be significantly improved if properly cared for.

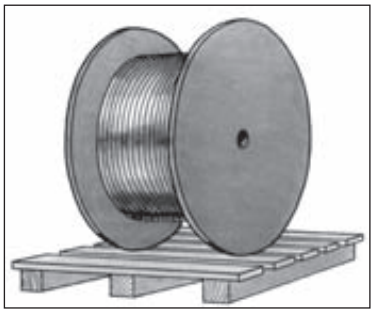
- Regular relubrication is a measure of considerable importance as it reduces corrosion and friction between rope constituents and rope and reel or drum. If application prevents rope from being lubricated regularly, the rope life will be reduced, therefore the need for more intensive periodic rope examination.
- Cleaning is particularly necessary when ropes are used in heavily abrasive environments and after contact with chemical substances. Brushes or other suitable implements available on the market are recommended.
- Broken wire ends (single wires) must be removed, not hidden, not pinched off, but by bending to and fro.
- Ropes may be shortened or reversed for reasons of economy and to prevent excessive strain in certain areas. Shorten rope only if the remaining length is sufficient for the intended purpose.

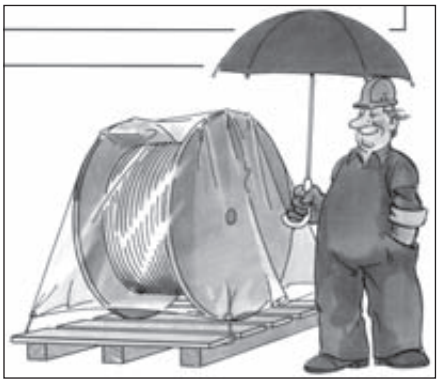
Caution!

Examples of damage to steel ropes are described and shown in detail elsewhere in this chapter (Steel rope in service) under the heading 'Typical rope damage'.









Test equipment
Recommended test equipment

- Rope (calliper) gauge, preferably with flat surface jaws (to measure diameter)
- Measuring tape (to determine sectional lengths)
- Chalk (to mark measuring points)
- Screwdriver (to open rope for view of interior)
- Magnifying glass
- Groove gauge (to measure groove diameter)
- Cleaning rags
- Logbook (with previous logs and space for new logs)

Problem areas
Damage in the rope interior caused by dampness and mechanical friction between the wires, strands and core remains largely invisible. In case of doubt, if careful opening of rope structure is not possible (without mechanical damage to the rope) or provides no definite result, expert advice should be sought or the rope removed from service.

General
Further information on steel ropes can be found in the chapter 'Steel ropes in perspective'.

These usage guidelines are based on existing European recommendations and standards. Further to these, consideration should also be taken of applicable local, national and international legislation, standards, directives and regulations from official societies (professional organisations, classification bodies, etc.) with regard to equipment safety (personal protection, industrial safety, accident prevention), as well as recommendations and operating instructions from manufacturers and/or operators of the equipment being used (lifting gear, conveyor systems, etc.).

In case of doubt about rope properties, suitability or safety requirements consult rope manufacturer or supplier.

Typical rope damage

As soon as abnormalities are identified on the inside or outer surface of the rope it is time to look for the causes. Knowledge of the damage cause is imperative to preventing damage and promoting safety and a long service life of the rope. Here we illustrate a number of common types of rope damage.

Damage caused by twisting

Looseness of strands caused by twisting are often massaged to one point by sheaves, mostly the end point of movement.

Double parallel lay ropes react sensitively to twisting. In this case the inner strands have been stretched and pushed out.

Twisting in the lay direction shortened this rotation-resistant rope on the outside whilst lengthening the steel core.

The two outer wire layers in the strands of this rope loosened when the rope twisted.

Rope twisted in counter lay direction. In unloaded condition rope forms a loop in the lay direction. If rope is now loaded it will be permanently deformed.

Rope twisted in lay direction. In unloaded condition rope forms a loop in the counter lay direction. If rope is now strained it will be permanently deformed.

Birdcage formation on a rotation-resistant rope.

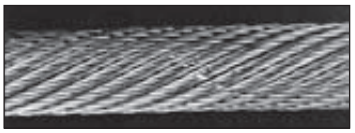
External damage

Rope damage caused by being pulled over a jammed sheave.

Rope badly damaged after being dragged over the rim of a sheave.

After striking a sharp edge this rope can now be discarded (number of wire breaks on 6 x d).

Rope dragged over the rim of a sheave.



On crane turning rope damaged by striking a sharp edge.

Heat damage

The outer wires wave and the lubricant has completely dried out.

Damage from the sheave

Rope operated in too narrow sheave groove.

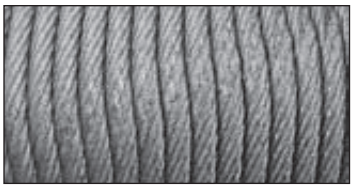
Too wide grooves inadequately support the rope leading to premature wire breakage along the line of contact.

This rope was pulled along a jammed sheave. Note heavy wear on the right, loose wires on the left.

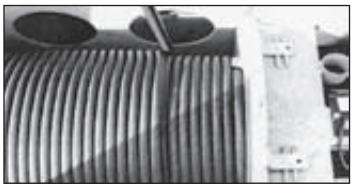
These two broken wires trapped between rope and sheave and were severely flattened.

This rope was operated in a groove far too wide causing premature wire breakage along the line of contact.

Damage from the drum



The wear pattern on multi layer drum is indicative of an unsuitable rope diameter.

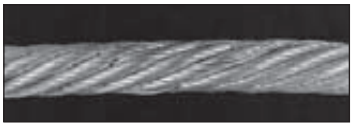


This rope is spooling onto a multi layer drum with special grooving. It is about to cross over one wrap.

This type of rope damage is typical on the cross over zone on multi layer drum.

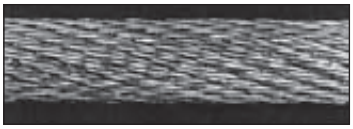
The fleet angle causes segments of the rope being wound onto the drum to rub against the lay on the neighbouring rope causing severe abrasion and twist.

Internal wire breaks



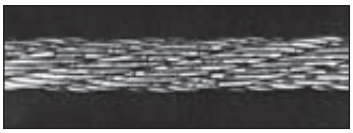
This rope displays signs of internal wire breakage. The broken ends are twice to three times longer than those broken on the crown.

Heavy bending caused the number of internal wire breaks to become visible.



Surface of a rotation-resistant rope. No wire breaks are visible.

The same rope after removing the outer strands. Numerous wire breaks are evident at the cross over points.

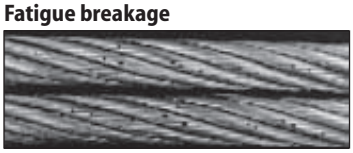


The inner core strands of this rope. Here too very many wire breaks.

Mechanical abrasion

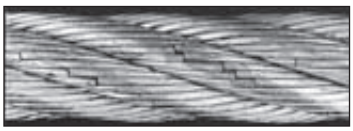
Heavy mechanical abrasion. In spite of high diameter loss (up to 50%) no fatigue breakage. Flattening has increased the contact surface.

Fatigue breakage

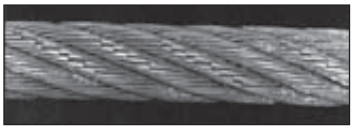


Fatigue breakage generally occurs in rope segments subject to most strain.

Broken wire ends in opposite lateral directions point to rope twisting.

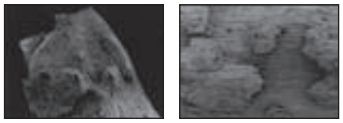


This rope has virtually no visible signs of wear but a large number of fatigue breaks.

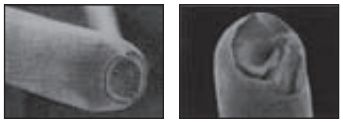


Three neighbouring strands with fatigue breakage followed by one without is an indication of a pulled in strand.

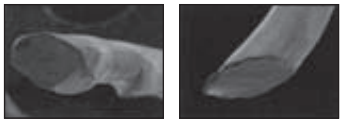
Wires under the microscope



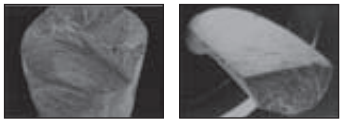
Heavily corroded wires.



Typical breakage caused by overloading (excess tensile strain).



Sheer breakage (simultaneous effects of high tensile and transverse force).



Wire breakage caused by heavy material fatigue.

High demands …

are always made on the functionality of steel rope. These are met in the main by the regular types of rope described earlier in this chapter. Numerous applications, however, demand extreme rope properties in terms of optimised lifespan, dimensional stability, tensile strength and reliability or (conversely) minimised wear, out of service time or wasted space. Product development and production are faced with quite a challenge when we think of all the forces rope is subjected to:
Tensile forces arising from constantly changing loads, tensile forces from accelerated and inconsistent movements, flexural forces on deflection, torsion forces from oblique course of single wires and strands, oscillatory tension, compressional tension from physical touching of rope and sheaves or drums, or between individual wires in the rope.
Our partners have wide experience and competence to ensure that customised fabrications of steel rope resist these influences and hence meet the high demands required of rope for special applications. We present examples of these on the following pages.


WOLFF
Otto Wulff

Selectivity …

Crane ropes of exceptional quality, a tradition by the specialist CASAR. On this and the following pages we review a selection from the extensive CASAR range – a solution for the most demanding service applications.

STARLIFT

Hoist rope for tower cranes, mobile cranes, electrical hoists and other applications, where rotation resistant ropes are required.

PARAPLAIT

Hoist rope for electrical hoists and lifting devices with multiple part reeving, whereas a rotation resistant rope is not needed due to great lifting heights, low number of falls or not guided loads. High breaking load.

ULTRAFIT

Boom hoist rope for mobile crane and grabs, hoist rope for container cranes, floating cranes, portal cranes etc. In multiple part reeving for smaller lifting heights, twin hoist systems with left and right hand ropes for greater lifting heights, where rotation resistant ropes are not required. Highest abrasion resistance. Especially suitable for multiple layer spooling.

EUROLIFT

Hoist rope for mobile cranes, electrical hoists and other applications, where rotation resistant ropes are required. Especially suitable for multiple layer spooling.

STRATOPLAIT

Hoist rope for container cranes, floating cranes, harbour cranes, portal cranes, steel mill cranes etc. In multiple part reeving for smaller lifting heights, twin hoist systems with left and right hand lay ropes for greater lifting heights. Holding and closing rope for grabs, where rotation resistant ropes are not required.

RAMMBOLIFT

Hoist rope for pile drivers, pulling line for electrical power cables.

QUADROLIFT

Rotation-resistant hoist rope for electrical hoists with twin hoist systems and greater lifting height, combined hoist and erection rope for self erecting cranes, where rotation resistant ropes are required.

STRATOLIFT

Pendant rope for tower cranes, mobile cranes, grabs etc.

STARFIT

Hoist rope for deck cranes and offshore cranes and other applications where rotation resistant ropes are required. Especially suitable for multiple layer spooling.

TURBOLIFT

Pendant rope for tower cranes. mobile cranes, grabs, suspended structures etc., when high breaking loads are required.

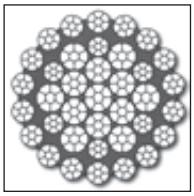
SUPERPLAIT 8

Boom hoist rope for mobile cranes and grabs, hoist rope for container cranes, floating cranes, portal cranes etc. and for various offshore applications. In multiple part reeving for smaller lifting heights, twin hoist systems with left and right hand ropes for greater lifting heights, where rotation resistant ropes are not required.

Special construction non rotating rope
compacted with polymer cushioned centre

CASAR® POWERPLAIT

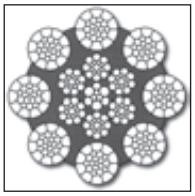
Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade			
		1770N/mm² (180kp/mm²)		1960N/mm² (200kp/mm²)	
mm	~ kg/m	kN	kgf	kN	kgf
22	2,43	399	40700	441	45000
24	2,87	474	48300	524	53500
25	3,15	513	52300	568	57900
26	3,43	555	56600	615	62700
28	3,93	644	65700	713	72700
30	4,53	738	75300	817	83300
32	5,15	843	85700	930	94700
34	5,78	951	97000	1050	107000
36	6,50	1070	109000	1190	121000
38	7,27	1190	121000	1320	135000
40	8,15	1360	139000	1460	149000
42	8,92	1460	149000	1610	164000
44	9,75	1600	163000	1770	181000
46	10,7	1750	179000	1940	198000
48	11,7	1910	195000	2110	214000
50	12,6	2070	211000	2290	234000
52	13,8	2200	224000	2440	249000



An ingenious couple...
Maximum breaking force, highest rotation resistance, complete parallel closure, compacted strands, polymer interior padding, intensive special lubrication.
Caution:
Turboplast non-rotating-resistant.

Special construction round strand rope
compacted with polymer cushioned centre

CASAR® TURBOPLAIT



Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade			
		1770N/mm² (180kp/mm²)		1960N/mm² (200kp/mm²)	
mm	~ kg/m	kN	kgf	kN	kgf
24	2,61	465	47400	514	52400
25	2,82	504	51400	558	56900
26	3,07	549	56000	601	61300
27	3,31	585	59700	648	66100
28	3,53	630	64300	697	71100
29	3,79	679	69300	737	75200
30	4,10	727	74200	789	80500
31	4,37	777	79300	843	86000
32	4,64	828	84500	911	92900
34	5,23	936	95500	1020	104000
36	5,83	1040	106000	1130	115000
38	6,55	1160	118000	1260	129000
40	7,29	1290	132000	1400	143000
42	7,96	1420	145000	1540	157000
44	8,79	1550	158000	1690	172000
46	9,59	1710	174000	1860	190000

Regular...

- **Material: Drawn galvanized steel wire**
- **Lubrication: Special lubrication inside and outside**
- **Type/direction of lay: Ordinary lay sZ**
- **Tensile grade: 1960N/mm²**

Other requirements? By arrangement we can supply: No or special galvanization, different type/direction of lay, special lubrication. Also for higher tensile grades (2160 instead of 1960 with 10,7% higher breaking force).

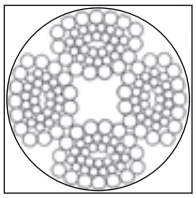
The rope weight is defined as the approximate calculated length mass kg/m (informative). The rope grade is the acronym for the nominal tensile strength of the wires in N/mm². The permitted deviation of the rope diameter from nominal diameter depends on rope type and rope diameter, is normally lower than comparable standard rope.

uni-rope

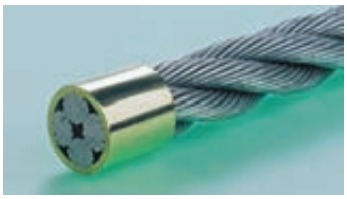
Special four-strand construction non rotating rope compacted, fibre core in centre and in each strand

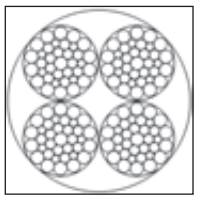
Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade 1920N/mm² (195kgf/mm²)	
mm	~ kg/m	kN	kgf
20	1,61	277	28300
22	1,95	335	34200
22,4	2,02	347	35400
24	2,32	399	40700
25	2,51	433	44200
26	2,72	468	47700
28	3,15	543	55400
30	3,62	623	63500
31,5	3,99	687	70100
32	4,12	709	72300
33,5	4,51	777	79300
34	4,65	800	81600
35,5	5,07	872	88900
36	5,21	897	91500
37,5	5,66	974	99300
38	5,81	1000	102000
40	6,44	1080	110000

Supple...
Rotation-resistant, compacted rope, optimal sheave groove surface contact, very flexible.
But: Breaking force similar to normal solid steel rope.



Cost conscious...
Simple, rotation resistance four strand construction, normal breaking force, limited rotation-resistance, for applications without special requirements.



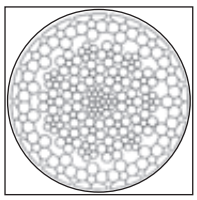


uni-hoist 4x36

Special construction rotation-resistant rope with central fibre core

Nominal Rope Diameter	Rope Weight	Minimum Breaking Force	
mm	~ kg/m	kN	kgf
18	1,25	220	22400
19	1,45	252	25700
20	1,54	270	27500
22	1,89	330	33700
22,4	1,98	344	35100
24	2,25	395	40300
25	2,46	429	43800
26	2,56	450	45900
28	3,05	535	54600
30	3,49	610	62200
32	3,97	695	70900
34	4,36	765	78000
36	5,03	880	89800

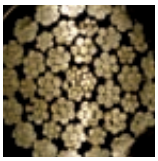
The rope weight is defined as the approximate calculated length mass kg/m (informative). The rope grade is the acronym for the nominal tensile strength of the wires in N/mm². The permitted deviation of the rope diameter from nominal diameter depends on rope type and rope diameter, is normally lower than comparable standard rope. With Unirope it is +7/-0%, with Unihoist it is +5/-0%.

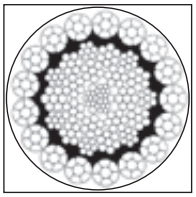


python® lift

(former python 505) special construction non rotating rope

Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade			
		1960N/mm² (200kp/mm²)		2160N/mm² (220kp/mm²)	
mm	~ kg/m	kN	kgf	kN	kgf
12	0,68	139	14200	153	15600
13	0,79	163	16600	179	18300
14	0,92	189	19300	208	21200
15	1,06	217	22100	239	24400
16	1,20	246	25100	272	27700
17	1,36	278	28400	307	31300
18	1,52	312	31800	344	35100
19	1,69	347	35400	383	39100
20	1,88	385	39300	424	43200
22	2,27	466	47500	513	52300
24	2,70	554	56500	611	62300





python® hoist c

(former python 17S24 KL) plastic coated IWRC,
special construction compacted non rotating round strand rope
with polymer cushioned centre

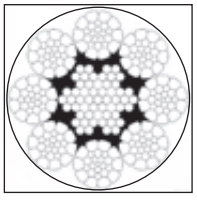
Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade			
		1960N/mm² (200kp/mm²)		2160N/mm² (220kp/mm²)	
mm	~ kg/m	kN	kgf	kN	kgf
26	3,17	633	64600	664	67700
28	3,64	726	74100	761	77600
30	4,15	830	84700	870	88700
32	4,69	937	95600	982	100000
34	5,30	1060	108000	1110	112000
36	6,00	1200	122000	1260	129000
38	6,60	1320	135000	1380	141000
40	7,31	1460	149000	1530	156000
42	8,18	1640	167000	1710	174000
44	8,99	1800	184000	1880	192000
46	9,89	1980	202000	2070	211000

The ideal three. Robust, adequately flexible, extreme structural stability, optimised breaking force, parallel closure, compacted strands, interior plastic padding, intensive lubrication, suitability almost guaranteed
Caution: 'super 8c' non-rotating-resistant.

python® super 8 c

Special construction round strand rope compacted strands

Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade			
		1960N/mm² (200kgf/mm²)		2160N/mm² (220kgf/mm²)	
mm	~ kg/m	kN	kgf	kN	kgf
24	2,51	512	52200	525	53600
26	2,94	600	61200	615	62700
28	3,44	703	71700	720	73400
30	3,92	798	81400	818	83400
32	4,51	921	93900	944	96300
34	5,09	1030	105000	1060	108000
36	5,69	1160	118000	1190	121000
38	6,34	1290	132000	1320	135000



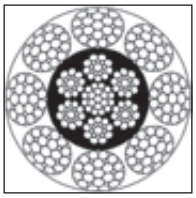
The rope weight is defined as the approximate calculated length mass kg/m (informative). The rope grade is the acronym for the nominal tensile strength of the wires in N/mm². The permitted deviation of the rope diameter from nominal diameter depends on rope type and rope diameter, is normally lower than comparable standard rope.

® Reg Trademark WDI Dortmund

Balanced...
High breaking force, good elasticity, adequate flexibility, well protected against wear and corrosion in the rope core.
But: not rotation-resistant.

multilift hp 825 cp

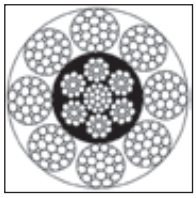
Special construction compacted round strand rope with polymer cushioned centre



Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade 1960N/mm² (200kp/mm²)	
mm	~ kg/m	kN	kgf
8	0,34	61,6	6280
9	0,43	76,0	7750
10	0,52	92,0	9380
11	0,62	109	11100
12	0,73	128	13100
13	0,85	149	15200
14	0,97	171	17400
15	1,11	195	19900
16	1,26	220	22400
17	1,41	246	25100
18	1,57	274	27900
19	1,74	304	31000
20	1,91	368	37500
22	2,29	438	44700
24	2,91	514	52400
26	3,37	596	60800
28	3,87	684	69800
30	4,40	778	79400
32	4,98	879	89700

multilift hp 825 p

Special construction round strand rope with polymer cushioned centre



Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade 1960N/mm² (200kp/mm²)	
mm	~ kg/m	kN	kgf
8	0,27	48,7	5000
9	0,34	61,6	6280
10	0,43	76,0	7750
11	0,52	92,0	9380
12	0,62	109	11100
13	0,73	128	13000
14	0,85	149	15200
15	0,97	171	17400
16	1,11	195	19900
17	1,26	220	22400
18	1,41	246	25100
19	1,57	274	27900
20	1,74	304	31000
22	2,10	368	37500
24	2,50	438	44700
26	2,91	514	52400
28	3,37	596	60800
30	3,87	684	69800
32	4,40	778	79400
34	4,98	879	89700

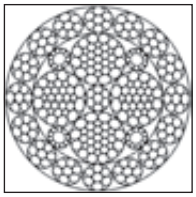
Plastic lining ...

...a technical application well worthwhile:
Plastic lining between rope core and outer strands prevents escape of lubricant, influx of water and dirt, stabilises the rope structure, prevents wire and strands rubbing together, provides elasticity, i.e. cushions when pulled, pressed and bent.
The benefits:
- **Improved stability in rope structure**
- **Excellent corrosion protection in the rope interior**
- **Reduced inner wear**
- **Improved absorption of dynamic forces**
- **Enhanced running performance**
- **Better protection against deformation**

multilift hp35

Special construction non rotating round strand rope

Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade 1960N/mm² (200kp/mm²)	
mm	~ kg/m	kN	kgf
8	0,295	49,2	5020
9	0,373	62,2	6340
10	0,461	76,8	7830
11	0,558	93,0	9490
12	0,664	111	11300
13	0,779	130	13300
14	0,904	151	15400
15	1,04	173	17600
16	1,18	197	20100
17	1,33	222	22600
18	1,49	249	25400
19	1,66	277	28300
20	1,73	307	31300
21	2,03	339	34600
22	2,23	372	37900
23	2,44	406	41400
24	2,66	442	45100
25	2,88	480	49000
26	3,12	519	52900
28	3,61	602	61400
30	4,15	691	70500
32	4,72	787	80300
34	5,33	888	90600



Established...
as standard solution where good breaking properties, rotating resistance and adequate flexibility are called for.

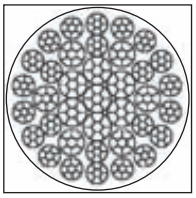
Variations...

multilift hp35 plus:
identical rope structure with higher breaking force
multilift hp35k plus:
enlarged metallic cross section with significantly higher breaking force

Rock solid ...
Universal genius: robust, flexible, good bending cycle properties, high rotation resistance, very high breaking force.

multilift triflex 377

Compacted strands



Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade 1960N/mm² (200kp/mm²)	
mm	~ kg/m	kN	kgf
24	2,87	510	52000
25	3,12	555	56600
26	3,36	598	61000
28	3,88	690	70400
30	4,50	800	81600
32	5,07	902	92000
34	5,79	1030	105000
36	6,50	1160	118000
38	7,16	1270	130000
40	7,89	1400	138000

Regular...

- **Material: Drawn galvanized steel wire**
- **Lubrication: Special lubrication inside and outside**
- **Type/direction of lay: Ordinary lay sZ**
- **Tensile grade:1960N/mm²**

Other requirements? By arrangement we can supply: No or special galvanization, different type/direction of lay, special lubrication. Also for higher tensile grades (2160 instead of 1960 with 10,7% higher breaking force).

The rope weight is defined as the approximate calculated length mass kg/m (informative). The rope grade is the acronym for the nominal tensile strength of the wires in N/mm². The permitted deviation of the rope diameter from nominal diameter depends on rope type and rope diameter, is normally lower than comparable standard rope.

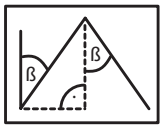
Steel rope lifting slings

Nominal Rope Diameter	Type of rope: **Round strand rope** Fibre core soft eyes hand-spliced	**Round strand rope** Fibre core soft eyes Alum Ferrule mech. spliced	**Round strand rope** IWRC soft eyes Alum Ferrule mech. spliced	**Cable lay rope** Fibre core laid endless Grommet	**Cable lay rope** IWRC laid endless Grommet	**Cable lay rope** IWRC soft eyes hand-spliced
	Working Load Limit (WLL) Straight lift					
	Single leg	Single leg	Single leg	Double leg	Double leg	Single leg
mm	t	t	t	t	t	t
8	0,60	0,70	0,75			
10	0,95	1,00	1,15			
12	1,38	1,50	1,70	2,20	2,30	0,85
14	1,88	2,00	2,25			
16	2,40	2,70	3,00			
18	3,11	3,15	3,70	4,70	5,10	1,90
20	3,85	4,00	4,60			
22	4,60	5,00	5,65			
24	5,50	6,30	6,70	8,25	9,00	3,75
26	6,50	7,00	7,80			
27				10,5	11,5	4,75
28	7,50	8,00	9,00			
30				11,5	14	5,5
32	9,80	11	11,8			
33				14	17	7,50
36	12,4	14	15	16,5	20	9,00
39				19,5	23,5	10,5
40	15,4	17	18,5			
42				22,5	27	12,5
44	18,7	21	22,5			
48	22,2	25	26	30	35,5	16
52	26,0	29	31,5			
54				37,5	45	20,5
56	30,1	33,5	36			
60	34,7	39	42	46	55,5	25

Rules and standards...

Even if not explicitly indicated:Compliance with standards (ISO, EN, DIN) and statutory provisions. Product specifications continually updated to meet requirements.

1t = 1000kg (t = metric ton).
Length of a lifting sling is the usable length when ready for service. It is measured between the bearing points of sling ends/terminations.



The tilt angle ß is the largest angle between legs and vertical line. To determine working load limit of sling operation: Multiply applicable mode factor (see table <Lift methods> below) with the WLL value (single leg direct) from the above table. Adapt the mode factors as appropriate for asymmetrical loads.

Lift Methods

Single Leg		Double Leg				Three- and Fourleg		Endless	
straight	choke	straight	choke	straight	choke	straight	straight	double straight	choke
		ß = 0-45°	ß = 0-45°	ß = 45-60°	ß = 45-60°	ß = 0-45°	ß = 45-60°		
									

Mode Factors:

1	**0,8**	**1,4**	**1,12**	**1**	**0,8**	**2,1**	**1,5**	**4**	**1,6**

Usage guidelines

Usage
Sling ropes must only be used for lifting loads and only under supervision of trained personnel in accordance with operating instructions and existing safety regulations, with due consideration of prevailing operating conditions.

Working load limit
The working load limit is the maximum weight the rope is safe to lift. It is derived from the minimum breaking force of the rope divided by the design factor (safety factor, normally 5, minus a value that considers the influence from the end fitting, or, for cable lay ropes, the realization factor), multiplied by the mode factor, this being dependent, amongst others, on the tilt angle (maximum 60°) for multileg or endless slings. An extremely important aspect to consider is strength loss, i.e. if the value D/d falls short of 2 for single leg sling ropes, or D/d (depending on rope construction) falls short of 4 to 6 for endless slings (D/d = diameter of lift point divided by rope diameter). Where the load symmetry (even load distribution, central point of gravity) is not guaranteed for multileg lifting procedures, two legs maximum must be assumed as load bearing, based on the widest tilt angle, and this applied to all legs.

Dimensioning
Steel rope lifting slings with a diameter of less than 8mm are not permissible. The length of a steel rope lifting sling is the distance between the bearing points, including end fittings. If specific length precision is required for eye or endless slings, the measurements of the end fittings must be considered. The aperture angle of loops must not exceed 50°. The free rope length between ferrules must be a minimum of 20·d, between splices a minimum of 15·d. Permissible deviation of actual rope sling length from nominal length is ±1% or 2·d. In the case of multileg slings the length of the individual ropes must deviate by no more ±1% or 2·d, if spliced or as grommet ±0.5% or 1·d if swaged (d = nominal rope diameter).

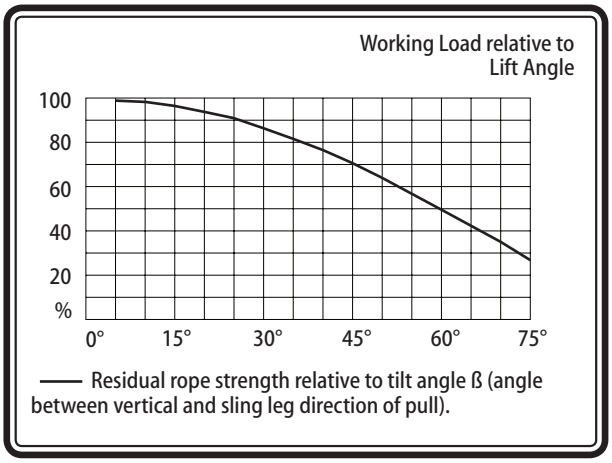
Rope terminations and fittings
The inner length of end loops roughly equals 15·d, the inner width (largely dependent on material) 7.5·d, however at least three times hook width (d = nominal rope diameter). End fittings must be attached with thimbles. Intermediate links must be used to connect suspension link and ropes on three and four leg slings.

Marking
Steel rope lifting slings must be permanently marked at the ferrule (single leg) or by tag (multileg or spliced). The marking should clearly show manufacturer's label of origin, test identification number (reference to certification), working load limit (if appropriate, for tilt angles) and all legal international markings, to the extent that local regulations do not require further details. The contents of the certification document with the rope sling include certification number, test identification number, name and address of supplier, relevant standards, description of rope sling and all individual components, working load limit (if appropriate, for different tilt angles).

Inspection
Before first and every subsequent use steel rope lifting slings should be carefully inspected for visual signs of damage and their safe condition established. Slings should be examined by a trained person every year, at shorter intervals if conditions of service require.

Precautions

- The load to be lifted must be free to move; avoid swinging, tilting or dropping load through choice of suitable fastening, trial lift or repositioning of lifting points, use of guide ropes, spreaders or beams, avoid sudden or jerky movements.
- Do not knot ropes.
- Rope contact area must be outside ferrules or splices, or joints (marked red) in grommet slings.
- Do not pull unprotected ropes over sharp edges.



- The edge radius must be no smaller than the nominal rope diameter (if necessary use edge protectors).
- Lifting capacity is reduced
  - if load is not symmetrical
  - in choke hitch mode
  - operating temperature outside limits in table (see chapter 'Rope terminations')
  - end fittings with diameter less than 2·d in eyes of single leg and 4·d in endless slings (d = nominal rope diameter).
- Do not untwist ropes when under load.
- If rope is multiwound around load ensure rope turns are parallel to each other (no crossing).
- Do not use in acids or alkalis.
- Do not apply load to hook points
- Avoid tilt angles (ß) less than 15° (danger of instable load suspension).
- Master links or eyes and thimbles must move freely in crane hooks.
- Do not join ropes with different lay directions.
- Do not use eight-strand rope with fibre core, or single leg/endless cable lay ropes with a nominal diameter exceeding 60mm made from strand rope with fibre core.
- Repairs must only be performed by trained personnel.

Storage and maintenance

- Steel sling ropes not in service should be hung in a suitable place away from potential causes of damage.
- Do not store on the ground.
- If rope is going to be out of service for a prolonged period, clean, dry and protect rope from corrosion (e.g. apply light coating of oil).

Operating termperature of steel wire rope slings
Efficiencies

Temperature	Efficiency Fibre core	Efficiency Steel core
All ropes:		
-40° bis ≥+100	°100%	100%
+100° bis ≥+200°	not permitted	90%
+200° bis ≥+300°	not permitted	75%
+300° bis ≥+400°	not permitted	65%
über +400°	not permitted	not permitted
Ropes with aluminium swaged ferrules:		
-40° bis ≥+100°	100%	100%
+100° bis ≥+150°	not permitted	90%
über + 150°	not permitted	not permitted

No remaining reduction of working load after cooling down to normal temperature when used within permissible range of temperature. Ropes to be discarded when exposed to higher temperatures.

Temperature = Surface temperature in °C

Removal from service

Discard in the event of:

- Missing or incomplete marking
- Fittings or components damaged (squashed, notched, fractured, stretched)
- Damaged rope end fabrication
- Fitting or its attachment damaged
- Rope is worn (more than 10% reduction of nominal diameter)
- Fittings or components worn (more than 5% reduction of cross section)
- One or more broken strands
- Loosening of external strand layer between rope end fabrications
- Deformation of the rope structure
- Compressions in the exposed rope length
- Compressions in the sling contact area with more than four wire breakages in stranded ropes or 10 in cable lay ropes
- Kink formation
- Scars caused by corrosion
- Overheating of the rope (loss of lubricant, discoloration of wire material)
- Local concentration of wire breakage
- More than maximum number of broken wires as per table

Maximum number of visible broken wires before discard

on a length of	3d	6d	30d
• stranded rope	4	6	16
• cable lay rope	10	15	40

d = Nominal rope diameter

General

Further information on steel ropes can be found in the chapters 'Steel ropes in perspective' and 'Steel ropes in service'.

These usage guidelines are based on existing European recommendations and standards. Further to these, consideration should also be taken of applicable local, national and international legislation, standards, directives and regulations from official societies (professional organisations, classification bodies, etc.) with regard to equipment safety (personal protection, industrial safety, accident prevention), as well as recommendations and operating instructions from manufacturers and/or operators of the equipment being used (lifting gear, conveyor systems, etc.).

In case of doubt about rope properties, suitability or safety requirements consult rope manufacturer or supplier.

dynasteel lift double leg grommet

IWRC rope endless cable lay

Nominal Rope Diameter		Minimum Length (circumference)	Rope Weight	Working Load Limit (WLL) Double Leg Straight Lift
mm	~" inch	m	~ kg/m	t
60	2⅜	2,10	12,5	55,5
66	2⅝	2,30	15,2	69
72	2⅞	2,50	18,1	84
78	3⅛	2,70	21,2	102
84	3⅜	2,90	24,7	121
90	3½	3,10	28,4	144
96	3¾	3,30	32,0	168
102	4	3,50	36,0	196
108	4¼	3,70	41,0	227
114	4½	4,00	45,0	262
120	4¾	4,20	50,0	300
132	5¼	4,70	61,0	392
144	5⅝	5,10	73,0	505
156	6⅛	5,60	85,0	700
168	6⅝	6,00	96,0	800
180	7⅛	6,50	111	900
192	7½	7,10	124	1000
216	8½	7,80	160	1250
240	9½	8,50	197	1500

Rules and standards ...

Even if not explicitly indicated: Compliance with standards (ISO, EN, DIN) and statutory provisions. Product specifications continually updated to meet requirements.

The WLL unit describes a metric ton = 1000kg. The rope weight refers to one metre circumferential length. The diameter of the bolts attached to the ropes influence the rope length beyond terminal distances.

dynasteel lift single leg cable lay rope

IWRC rope both ends with hand-spliced soft eye

Nominal Rope Diameter		Minimum Length (circumference)	Rope Weight		Working Load Limit (WLL) Single Leg Straight Lift
			at minimum length	each additional metre	
mm	~" inch	m	~ kg/ea	~kg/m	t
66	2⅝	6,5	206	15,1	28
72	2⅞	7,5	285	18,1	34
78	3⅛	8,5	378	21,2	41
84	3⅜	9,5	491	24,6	49
90	3½	10	592	28,2	58
96	3¾	11	742	32,1	68
102	4	12	912	36,2	79
108	4¼	12,5	1070	40,7	92
114	4½	13	1240	45,5	106
120	4¾	14	1260	43,0	122
132	5¼	15	1920	60,8	158
144	5⅝	16	2430	72,4	204
156	6⅛	17	3040	85,0	250
168	6⅝	18	3730	98,6	290
180	7⅛	19	4510	113	335
192	7½	20,5	5550	129	410
216	8½	21,5	7310	162	510
240	9½	23	9030	187	610
264	10⅜	25	12800	243	720

MORE...

Anything missing? Some important information or a similar product, a different size or a solution for your special needs? Ask us. We are pleased to advise.

CAUTION!

Working load limit and heavy loads!
The working load limits (WLL) on this and the following page refer to existing standards. They are derived from safety factors (so-called design factor), which determine the ratio between the necessary rope breaking strength and intended load capacity for a direct, straight normal load. The resultant factor between 3 and 5 depends on rope diameter, but must be adapted (raised) for factors influencing the situation, such as tilt angle, length tolerance of legs on multileg slings, dynamic forces (transport speed), load centre of gravity, rope bending radius (over bolts, bolt diameter minimum 2x rope diameter), sling type or type of rope end fittings. If in doubt, consult supplier or an expert.

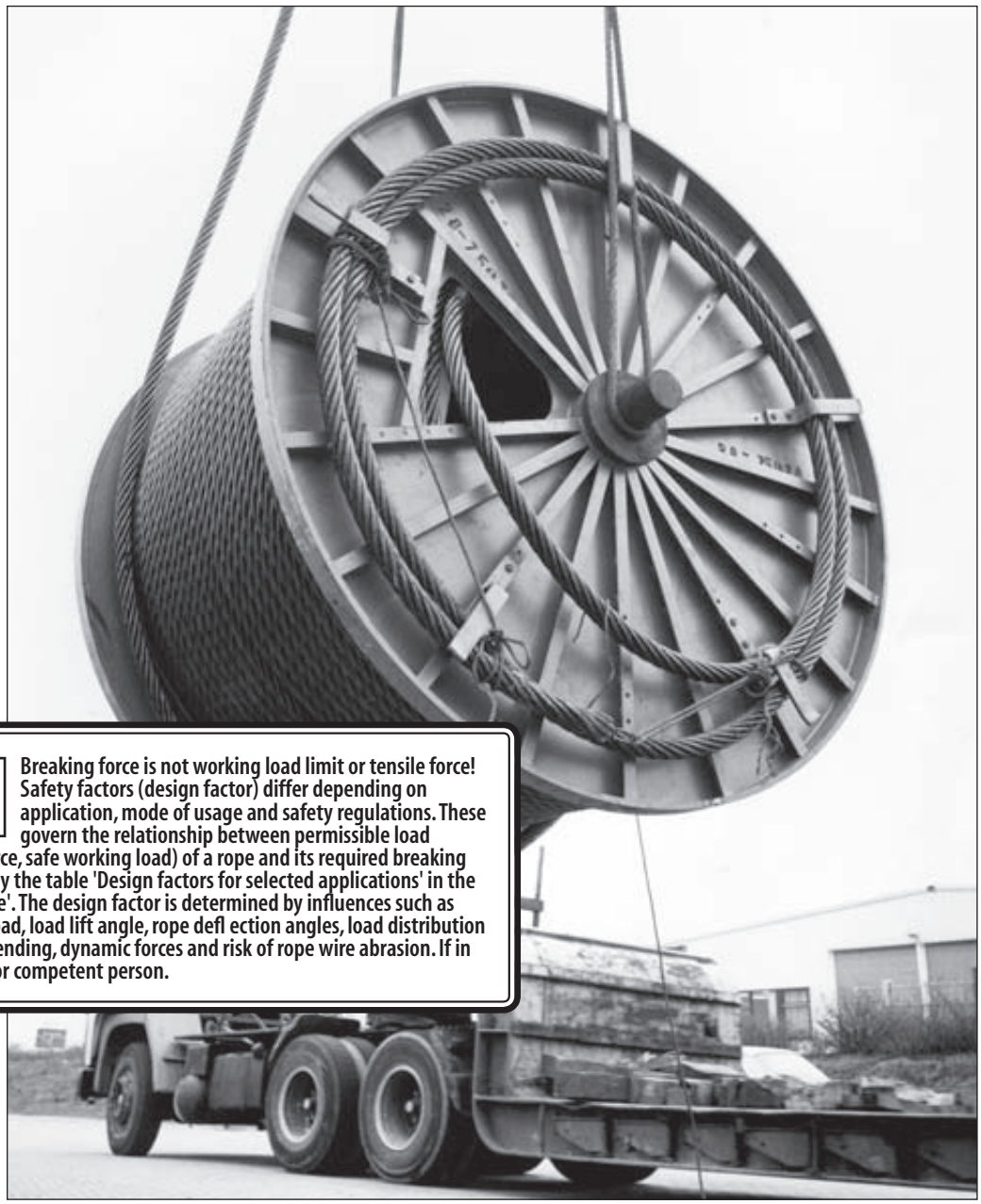
Giants...
among the steel ropes are demanded when mammoth loads need to be lifted, moved or anchored.

dynasteel heavy

Parallel lay round strand rope with steel core

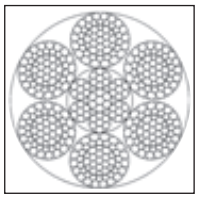
Nominal Rope Diameter		Rope construction	Tensile grade	Rope Weight	Minimum Breaking Force	
mm	"inch		N/mm²	~ kg/m	kN	tf
51	2	6x36 IWRC	2160	10,5	1960	200
57	2¼	6x36 IWRC	2160	13,3	2470	252
64	2½	6x36 IWRC	1960	16,6	2800	286
68	2¾	6x47 IWRC	1960	19,0	3100	316
76	3	6x47 IWRC	1960	23,8	3800	388
84	3¼	8x47 IWRC	1960	28,8	4910	500
92	3½	8x47 IWRC	1960	35,2	5900	600
102	4	8x52 IWRC	1960	45,8	7850	800

The unit "ton" (WLL) signifies one metric ton = 1000 kg.



CAUTION!

Breaking force is not working load limit or tensile force! Safety factors (design factor) differ depending on application, mode of usage and safety regulations. These govern the relationship between permissible load (carrying capacity, tensile force, safe working load) of a rope and its required breaking force. You are advised to study the table 'Design factors for selected applications' in the chapter 'Steel ropes in service'. The design factor is determined by influences such as number of rope legs under load, load lift angle, rope defl ection angles, load distribution using multileg slings, rope bending, dynamic forces and risk of rope wire abrasion. If in doubt consult your supplier or competent person.



6x55 IWRC

Regular...

- Material: Drawn galvanized steel wire
- Lubrication: Neutral acid-free inside and outside
- Type/direction of lay: Ordinary lay sZ
- Tensile grade: 1770N/mm²

Other requirements? By arrangement we can supply: No or special galvanization, different type/direction of lay, special lubrication. Also for higher tensile grades (1960 with 10.7%, and 2160 with 22.0% higher breaking force in relation to 1770).

Strong but flexible... Special inside and outside lubrication, minimised diameter tolerance, optimised lay length and strand structure: Flexible alternative for tugs, easier deflection handling.

dynasteel towline 6x55 IWRC

Parallel lay round strand rope with steel core

Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade			
		1770N/mm² (180kgf/mm²)		1960N/mm² (200kgf/mm²)	
mm	~ kg/m	kN	tf	kN	tf
40	6,25	990	101	1100	112
42	6,89	1090	111	1210	123
44	7,57	1200	122	1330	136
46	8,27	1310	134	1450	148
48	9,00	1430	146	1580	161
50	9,77	1550	158	1710	174
52	10,6	1670	170	1850	189
54	11,4	1800	184	2000	204
56	12,3	1940	198	2150	219
58	13,5	2090	213	2300	235
60	14,1	2230	227	2470	252
64	16,0	2540	259	2810	287
68	18,1	2860	292	3170	323

dynasteel towline 6x47 IWRC

Parallel lay round strand rope with steel core

Nominal Rope Diameter	Rope Weight	Minimum Breaking Force at tensile grade					
		1770N/mm² (180kgf/mm²)		1960N/mm² (200kgf/mm²)		2160N/mm² (220kgf/mm²)	
mm	~ kg/m	kN	tf	kN	tf	kN	tf
64	16,9	2720	277	3010	307	3320	338
68	19,1	3070	313	3400	347	3750	382
72	21,4	3440	351	3810	389	4200	428
76	23,8	3830	391	4250	433	4680	477
80	26,4	4250	433	4700	480	5180	529
84	29,1	4680	478	5190	529	5720	583
88	31,9	5140	524	5690	580	6270	640
92	34,9	5620	573	6220	634	6860	699
96	38,0	6120	624	6770	691	7470	761

The unit "ton" (WLL) signifies one metric ton = 1000 kg.

dynasteel towline 8x47 IWRC

Parallel round strand rope with steel core.

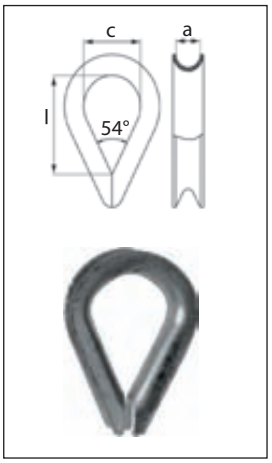
Similar values as 6x47 IWRC:
Weights about 3% higher, Minimum breaking forces about 1,5% lower.

The rope weight is defined as the approximate calculated length mass kg/m (informative). The rope grade is the acronym for the nominal tensile strength of the wires in N/mm². The permitted limit deviation of the rope diameter from nominal diameter is +5/-0%.

Steel ropes in service, a wide range...

Holding, lifting and moving loads and objects. These are the principal tasks for steel ropes. The contents of the previous chapter provide detailed information on the main products in the steel rope range offered by SELDISpolysteen, covering lifting gear and sea transport in the widest sense. Rope types and constructions shown describe such a wide spectrum of rope properties that hardly an application is excluded. If your special application is not mentioned we will be pleased to advise you individually and help find the rope suitable for your requirement – for guying, elevators, construction industry, stage engineering, fishing, forestry, leisure and sport, building architecture, agriculture, machine construction, and road, rail and air transport.

End Fittings

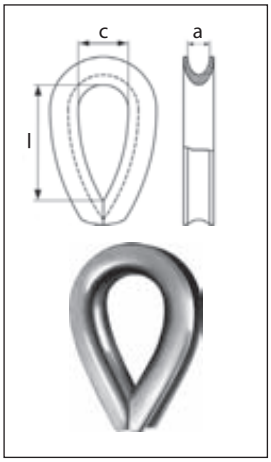


Thimble BF

similar to DIN 6899

Nominal Size = Groove width	Weight	Measurements		
		a	c	l
mm	kg/ea	mm	mm	mm
3	0,01	3	12	19
4	0,01	4	13	21
5	0,01	5	14	23
6	0,02	6	16	25
7	0,02	7	18	28
8	0,03	8	20	32
10	0,05	10	24	38
12	0,07	12	28	45
13	0,08	13	30	48
14	0,10	14	32	51
16	0,15	16	36	58
18	0,20	18	40	64
20	0,29	20	45	72
22	0,32	22	50	80
24	0,47	24	56	90
26	0,59	26	62	99
28	0,80	28	70	112
30	1,1	30	75	120
32	1,2	32	80	128
34	1,6	34	95	152
36	1,8	36	100	160

medium duty, deep groove
Finish: hot dip galvanized

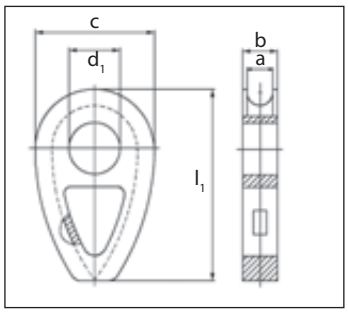


Thimble N type

EN 13411-1

Nominal Size = Rope Diameter	Weight	Measurements		
		a	c	l
mm	kg/ea	mm	mm	mm
4	0,01	5	10	29
6	0,03	7	15	42
8	0,06	9	20	56
10	0,15	11	25	70
12	0,24	13	30	85
14	0,38	16	35	102
16	0,52	18	40	113
18	0,66	20	45	127
20	0,88	22	50	141
22	1,0	24	55	153
24	1,3	26	60	165
26	2,6	29	65	181
28	2,8	31	70	193
32	4,4	35	80	223
36	4,6	40	90	247
40	7,0	44	100	281
44	10	48	110	305
48	12	53	120	329

Material: St 37-2
Finish: hot dip galvanized

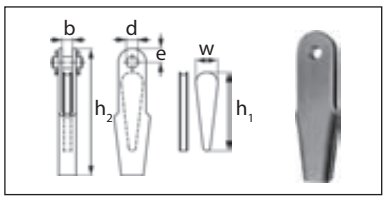


Solid thimble

for wire ropes
DIN 3091

Nominal Size = Rope Diameter	Weight	Measurements						
				Bore d_1				
		a	b	rough size	min.	max.	c	l_1
mm	~ kg/ea	mm	mm	mm	mm	mm	mm	mm
8	0,2	9	15	14	17	20	40	66
10	0,3	11	17,5	18	21	25	50	82
12	0,5	13	20	21	24	30	60	98
14	0,7	16	23,5	25	29	35	70	114
16	0,8	18	26	28	32	40	80	130
18	1,1	20	28,5	31	35	45	90	145
20	1,4	22	31	35	40	50	100	161
22	1,8	24	33,5	38	43	55	110	177
24	2,3	26	36	41	46	60	120	193
26	3,0	29	39,5	44	49	65	130	209
28	3,7	31	42	47	52	70	140	224
32	5,3	35	47	53	58	80	160	256
36	7,5	40	53	59	65	90	180	288
40	10,4	44	58	65	71	100	200	320
44	13,4	48	63	70	76	110	220	352
48	27,8	53	69	76	82	120	240	384
52	23,1	57	74	81	87	130	260	416
56	29	62	80	86	92	140	280	448

Material: GTW 17 or GGG 17
Nominal Size = maximum nominal rope diameter
Usual tolerances apply to measurements

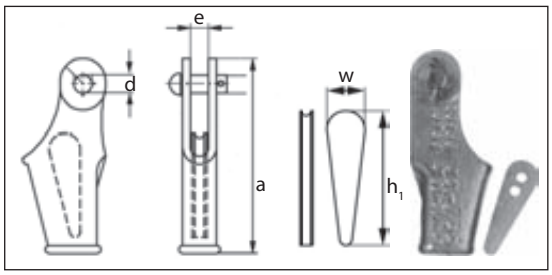


Wedge socket symmetrical

Straight type, for steel rope

Nominal Size	Rope Diameter	Weight	Measurements					
			b	d	e	h_1	h_2	w
	mm	~ kg/ea	mm	mm	mm	mm	mm	mm
5	4-5	0,18	12	10	14	68	110	19
6,5	5-6	0,21	10	10	16	58	100	19
8	6-8	0,45	14	12	20	92	150	25
11	9-11	1,3	17	16	26	117	190	32
14	12-14	2,0	22	18	32	141	230	38
17	15-17	3,5	25	22	36	162	260	46
20	18-20	5,5	27	25	40	186	300	52
25	22-25	6,5	40	42	40	180	285	60
30	26-30	9,5	55	52	55	182	335	62

with wedge and split pin
Finish: electrogalvanized



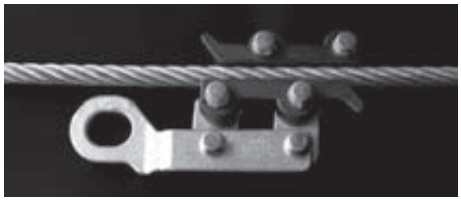
Wedge socket asymmetrical

EN 13411-6

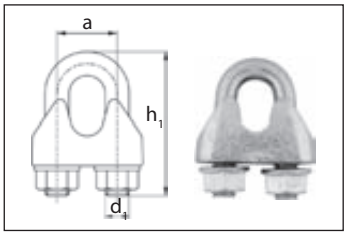
Nominal Size = Rope Diameter	Working Load Limit (WLL)	Weight	Measurements				
			a	d	e	h_1	w
mm	t	~ kg/ea	mm	mm	mm	mm	mm
6-7	1,8	0,9	152	16	14	85	30
8-10	1,8	0,9	152	16	14	81	24
11-12	2,2	1,2	163	17	17	81	24
13-15	5	2,3	218	20	21	112	36
16-17	5,5	6,3	273	25	24	148	56
18	5,5	6,3	273	25	24	136	49
19-20	8	7,5	276	25	29	161	52
21	10	13	370	33,5	30	218	80
22-25	10	13	370	33,5	30	190	78
26-30	12	27	486	48,5	37	212	88

with wedge and split pin
Finish: hot dip galvanized

Working Load Limit = 1/5 Breaking Force



Rope tension grip
for rope dia 1 through 10mm (round eye), and 8 through 28mm (oval eye)



Wire rope clip

EN 13411-5

Nominal Size = Rope Diameter	AZ	A	Weight	Measurements		
				a	d_1	h_1
mm	Nm		~ kg/ea	mm	mm	mm
5	2	3	0,02	12	5	25
6,5	3,5	3	0,04	14	6	32
8	6	4	0,08	18	8	41
10	9	4	0,09	20	8	46
13	33	4	0,28	27	12	64
16	49	4	0,43	32	14	76
19	68	4	0,49	36	14	83
22	107	5	0,68	40	16	96
26	147	5	1,2	46	20	111
30	212	6	1,4	54	20	127
34	296	6	2,1	60	22	141
40	363	6	2,7	68	24	159

Safety type wire rope clip, galvanized/chromatized.
Meets increased safety requirements.
A = Number of clips per rope
AZ = Required torque.

Simplex clip No. 103
Finish: galvanized
Rope dia 2 to 10mm

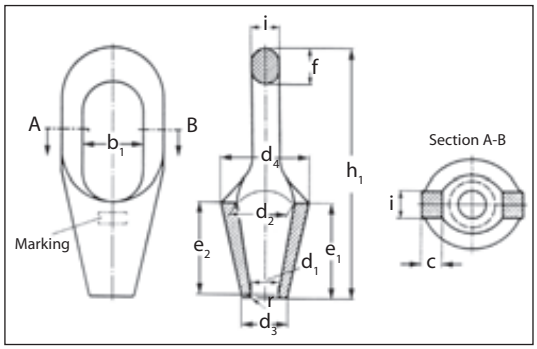
Wire rope clip
Former DIN 741
Light-duty wire rope clips
for end fittings
Finish: galvanized
Nominal size 1/8" to 2"

'Deka' type wire rope clip
Material: Body annealed cast iron,
bolts and nut tempered steel
Finish: galvanized
Nominal size: ¼" to 1"

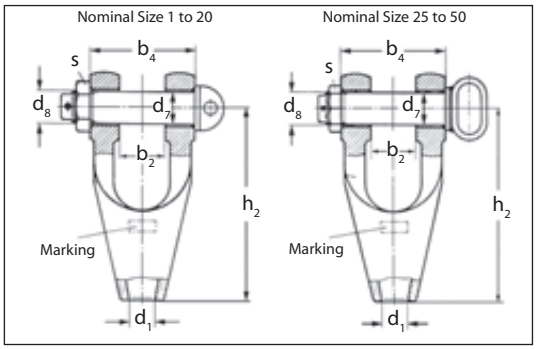
Duplex clip No.104
Finish: galvanized
Rope dia: 2 to 10mm

End Fittings

Closed socket



Open socket



Closed socket A type

DIN 83313

Nominal Size	Working Load Limit (WLL)	Weight	Rope Diameter		Measurements											
			from	to	b_1	c	d_1	d_2	d_3	d_4	e_1	e_2	f	h_1	i	r
	t	~ kg/ea	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
1	1	0,4	10	12	30	8	14	30	26	45	50	48	15	130	12	2
1,6	1,6	0,7	12	14	37	12	17	36	30	55	60	57	19	155	15	3
2,5	2,5	1,2	14	18	45	14	20	42	33	62	69	66	24	182	19	3
3	3,15	1,5	16	20	50	16	22	47	36	69	78	75	26	202	21	3
4	4	2,0	18	22	54	18	24	51	40	76	84	81	30	220	24	3
5	5	3,1	20	24	60	20	27	57	44	85	94	90	34	245	27	4
6	6,3	4,2	22	28	67	23	30	64	49	94	106	102	38	275	30	4
8	8	5,8	26	30	73	26	33	70	54	103	115	111	42	300	33	4
10	10	8,0	28	34	80	29	36	76	60	112	125	120	45	330	36	5
12	12,5	11	32	38	89	32	40	85	67	125	140	135	51	370	41	5
16	16	15	36	44	100	35	45	96	75	140	159	153	56	415	46	6
20	20	20	40	50	110	40	50	106	84	156	174	168	62	460	50	6
25	25	27	44	54	120	43	55	116	93	173	190	183	69	505	55	7
32	31,5	35	50	62	132	48	60	127	104	188	209	201	76	555	61	8
40	40	50	58	72	150	54	68	144	117	212	237	228	85	630	68	9
50	50	67	62	76	165	60	75	159	130	235	262	252	94	695	75	10

Material GS 45.1

Open socket C type

DIN 83313

Nominal Size	Working Load Limit (WLL)	Weight	Rope Diameter		Measurements						
			from	to	b_2	b_4	d_1	d_7	d_8	h_2	s
	t	~ kg/ea	mm	mm	mm	mm	mm	mm	mm	mm	mm
1	1	0,6	10	12	21	47	14	16	M 16	105	22
1,6	1,6	1,1	12	14	27	61	17	20	M 20	125	27
2,5	2,5	1,8	14	18	33	75	20	24	M 24	148	32
3	3,15	2,4	16	20	38	86	22	27	M 27	165	36
4	4	3,2	18	22	42	96	24	30	M 30	180	41
5	5	5,0	20	24	47	107	27	36	M 36	200	46
6	6,3	6,7	22	28	53	121	30	39	M 39	220	50
8	8	9,5	26	30	60	136	33	45	M 45	242	55
10	10	13	28	34	66	150	36	48	M 48	265	60
12	12,5	17	32	38	73	167	40	52	M 52	296	65
16	16	24	36	44	81	185	45	60	M 60	332	75
20	20	31	40	50	90	206	50	68	M 68	365	85
25	25	41	44	54	100	226	55	72	M 72x6	405	90
32	31,5	55	50	62	110	250	60	80	M 80x6	440	100
40	40	80	58	72	125	283	68	90	M 90x6	500	110
50	50	105	62	76	140	316	75	100	M 100x6	550	120

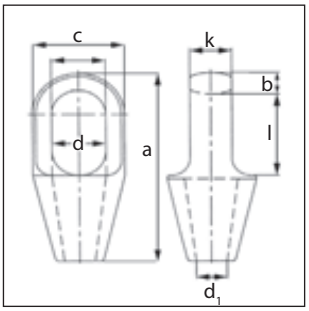
Material GS 45.1

Closed socket HA type

SEL 1301 A

Nominal Size	Minimum Breaking Force	Weight	Rope Diameter		Measurements						
			from	to	a	b	c	d	d_1	k	l
	kN	~ kg/ea	mm	mm	mm	mm	mm	mm	mm	mm	mm
198	196	0,7	11	13	140	17,5	51	30	14	22,5	59
199	245	1,3	14	16	162	21	67	36	17,5	26	65
200	392	2,1	18	19	194	27	76	42	21	32	78
201	539	3,6	20	22	224	33	92	47	24	38	90
204	735	5,3	23	26	253	36	104	57	28	44	103
207	882	7,0	27	30	282	39	114	63	32	51	116
212	1230	9,7	31	36	312	43	127	70	38	57	130
215	1470	13	37	39	358	51	136	79	41	63	155
217	1670	17	40	42	390	54	146	83	44	70	171
219	2210	26	43	48	443	55	171	93	51	76	198
222	2740	38	49	54	502	62	193	100	57	82	224
224	3530	50	55	60	548	73	216	112	63	92	247
226	4170	65	61	68	597	79	241	140	73	102	270
227	4510	94	69	75	644	79	273	159	79	124	286
228	5490	110	76	80	686	83	292	171	86	133	298
229	6130	145	81	86	743	102	311	184	92	146	311
230	7060	168	87	93	788	102	330	197	99	159	330

Material GS 52.3



Load...

**... not to breakage,
but to permissible load limit only!
This is significantly less than breaking force and depends on factors relevant to application (safety factor, design factor, formula). Therefore: Do not confuse breaking force with load capacity (WLL, lashing force, working load, etc.) and calculate in adherence to existing rules (regulations, standards).**

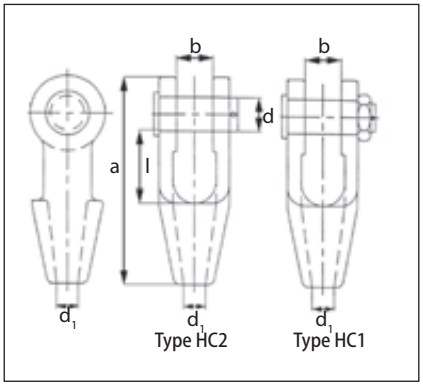
Open socket HC type

SEL 1301 C

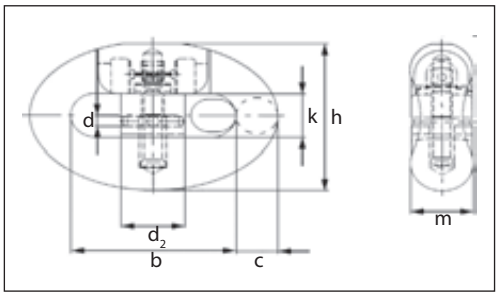
Nominal Size	Minimum Breaking Force	Weight	Rope Diameter		Measurements				
			from	to	a	b	d	d_1	l
	kN	~ kg/St	mm	mm	mm	mm	mm	mm	mm
098	196	1,0	11	13	142	25	25	14	51
099	245	1,8	14	16	171	32	30	17,5	63
100	392	3,2	18	19	205	38	35	21	76
104	539	4,6	20	22	235	44	41	24	89
108	735	8,0	23	26	275	51	51	28	101
111	882	11	27	30	306	57	57	32	114
115	1230	16	31	36	338	63	63	38	127
118	1470	23	37	39	394	76	70	41	162
120	1670	27	40	42	418	76	76	44	165
125	2210	41	43	48	468	89	89	51	178
128	2740	58	49	54	552	101	95	57	228
130	3530	85	55	60	598	113	108	63	250
132	4170	118	61	68	654	127	121	73	273
135	4510	155	69	75	696	133	127	79	279
138	5490	173	76	80	737	146	133	86	286
140	6130	230	81	86	788	159	140	92	298
142	7060	265	87	93	852	171	152	99	318

Material GS 52.3

Type HC1 = with nut and split pin (optional)
Type HC2 = with split pin (standard)



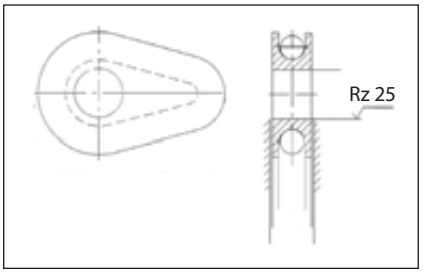
Inside dimension of cone should allow transmission of the minimum rope breaking force. Minimum cone diameter 1.1x rope diameter +4mm.

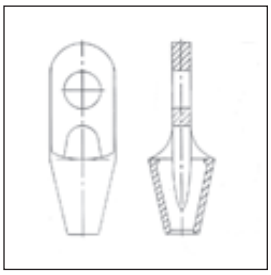


demag type shackle

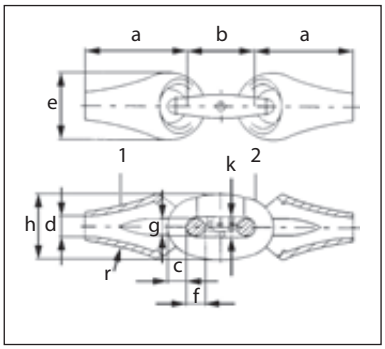
Nominal Size	Rope Diameter	Working Load Limit (WLL)	Breaking Force	Weight	Measurements						
					b	c	d	d_2	h	k	m
	mm	t	kgf	~kg/ea	mm	mm	mm	mm	mm	mm	mm
1	10	1,5	68,7	0,3	48	12	4,2	16	48	14	18
2	11+12	2	98,6	0,4	56	14	4,2	20	57	18	21
3	13+14	2,5	134	0,6	64	16	4,2	20	65	20	24
4	15+16	3	154	0,9	72	18	5,2	25	73	22	27
5	18	4	198	1,4	80	20	5,2	30	81,5	24	30
6	19+20	4,5	222	1,7	88	22	5,2	30	89,5	26	33
7	22+24	6,5	331	2,1	96	24	6,2	36	99,5	30	36
8	26	8	394	3,1	104	26	6,2	38	105,5	32	39
9	28	9	462	3,5	112	28	6,2	38	115,5	34	42
10	32	12,5	615	4,8	120	30	8,2	45	123	36	46
11	35	14	700	6,1	132	33	8,2	50	135	40	50
12	36	16	790	7,2	144	36	8,2	50	147	44	54
13	40	18	887	8,8	156	39	10,2	56	161	48	59
14	44	21,5	1050	11	168	42	10,2	63	173	52	64
15	48	25	1180	13	180	45	10,2	63	183	54	68
17	64	50	2520	28	250	75	12,0	85	270	80	110

Rope thimble
Nominal size 2 to 19
Rope dia. 13 to 45mm





Lig type rope socket
Highly wear-resistant cast steel to DIN 17182
Nom. size 2 to 15
for rope diameters 11 to 48mm



Pear shape rope socket

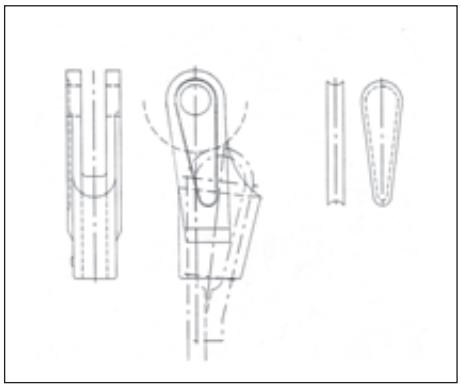
DEMAG standard

Nominal Size	Nominal Rope Diameter	Weight	Measurements									
			a	b	c	d	e	f	g	h	k	r
	mm	~kg/ea	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
1	10	0,3	69	48	12	12	48	12	11,75	48	14	195
2	11+12	0,4	78,5	56	14	15	56	15,5	13,75	57	18	195
3	13+14	0,6	90,5	64	16	18	64	17,5	15,75	65	20	220
4	15+16	1,0	102,5	72	18	20	70	19,5	17,75	73	22	220
5	18	1,3	114	80	20	22	84	21	19,5	81,5	24	245
6	19+20	1,6	129	88	22	24	84	23	21,5	89,5	26	310
7	22+24	2,4	140	96	24	28	100	26	23,5	99,5	30	310
8	26	2,6	158	104	26	31	100	28	25,5	105,5	32	350
9	28	3,6	171	112	28	34	120	31	27,5	115,5	34	350
10	32	4,4	190	120	30	38	120	32	29	123	36	445
11	35	6,0	203	132	33	40	142	36	31	135	40	445
12	36	7,5	225	144	36	42	142	39	35	147	44	495
13	40	9,0	242	165	39	46	166	43	37	161	48	555
14	44	12	265	168	42	51	166	47	41	173	52	595
15	48	13	286	180	45	56	166	49	43	183	54	595
17	64	30	400	250	75	75	250	75	60	270	80	950

Tolerances: Nominal Size 1 to 5 = d+1,5 mm; Nominal Size 6 to 11 = d+2 mm;
Nominal Size 12 to 17 = d+2,5 mm
1 = Pear type rope socket; 2 = Shackle

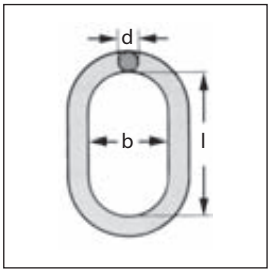
No rough edges ...
Connectors for steel wire rope in crane systems, developed by specialists

Rope socket with wedge
Nominal size 1 to 15
Rope dia. 8 to 45mm



Master link M type

EN 1677-4



Nominal Size	Nominal chain dia.		Working Load Limit (WLL)	Weight	Measurements		
	single leg	double leg			b	d	l
	mm	mm	t	~ kg/ea	mm	mm	mm
6	6	-	1,25	0,2	60	11	100
86	7/8	6	2,5	0,4	70	14	120
108	10	7/8	4	0,7	80	17	140
1310	13	10	7,5	1,5	95	22	160
1613	16	13	10	2,3	110	25	190
2016	18/20	16	17	5,3	140	34	240
2220	22	20	25	7,0	150	38	250
2622	26	22	28	8,0	150	40	250
3226	32	26	43	15	200	50	300
3632	36	32	56	21	200	55	350
4536	40/45	36	70	26	210	60	375

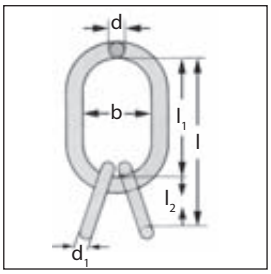
WLL figures shown refer to single leg use. Chain diameters shown refer to use with grade 80 lifting chains.

MORE...

Examples shown here are standard type connecting elements of similar size and load limits. Master links in special sizes or different specifications available on request.

Rules and standards...

Even if not specifically indicated: Compliance with standards (ISO, EN, DIN) and rules; state of the art technical product properties.



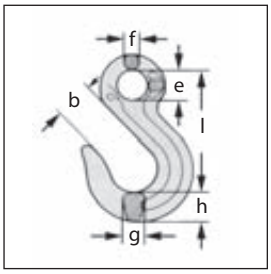
Master link assembly MT type

EN 1677-4

Nominal Size	Nominal chain dia.	Working Load Limit (WLL)	Weight	Measurements					
	3 and 4-leg			b	l	l_1	d	l_2	d_1
	mm	t	~ kg/ea	mm	mm	mm	mm	mm	mm
6	6	3,5	1,8	90	270	150	19	120	14
8	7/8	5,2	3,1	95	300	160	22	140	17
10	10	11,5	6,5	120	360	200	30	160	22
13	13	17	15	150	450	250	40	200	30
16	16	28	23	200	500	300	50	200	32
20	18/20	35	33	200	550	300	55	250	38
22	22	53	46	200	610	350	60	260	45
26	26	70	71	250	730	450	70	280	50
32	32	90	91	260	750	470	80	280	55

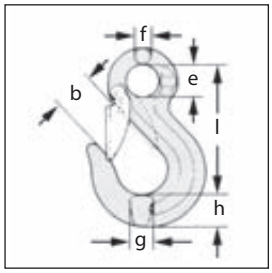
Measurements l_1, b_1, and d_1 refer to sub-links, and apply correspondingly to L, B, and D.
The nominal chain diameter refers to use of hook with grade 80 lifting chain lifting sling.
WLL ß = 0° - 45° (ß = tilt angle).

Hoist hook EK type



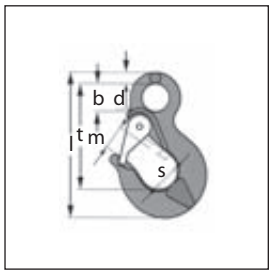
Nominal Size = Nominal chain dia.	Working Load Limit (WLL)	Weight	Measurements					
			b	e	f	g	h	l
mm	t	~ kg/ea	mm	mm	mm	mm	mm	mm
6	1,5	0,3	29	22	10	16	19	94
7/8	2,5	0,5	32	25	11,5	17	22	105
10	3,4	0,9	41	32	13,5	19	29	131
13	6,7	2,2	49	40	17,5	27	36	161
16	11	3,4	60	50	22	34	44	197
18/20	16	5,2	69	60	26	37	52	229
22	15	9,2	82	64	31	42	67	267
26	21,2	12	95	66	32	51	75	301
32	31,5	18	105	76	38	61	80	333

Safety hoist hook EKN type



Nominal Size = Nominal chain dia.	Working Load Limit (WLL)	Weight	Measurements					
			b	e	f	g	h	l
mm	t	~ kg/ea	mm	mm	mm	mm	mm	mm
6	1,5	0,4	24	22	10	16	19	94
7/8	2,5	0,6	28	25	11,5	17	22	105
10	4	1,0	37	32	13,5	19	29	131
13	6,7	2,3	42	40	17,5	27	36	161
16	10	3,8	50	50	22	34	44	197
18/20	16	7,3	60	60	26	37	52	229
22	15	9,4	77	64	31	42	67	267
26	21,2	13	81	66	32	51	75	301
32	31,5	18	93	76	38	61	80	333

Safety hoist hook SIKA type

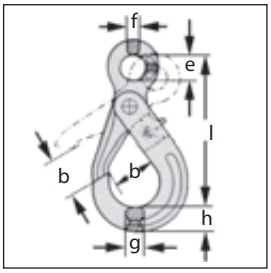


Nominal Size	Working Load Limit (WLL)	Weight	Measurements					
			b	d	l	m	s	t
	t	~ kg/St	mm	mm	mm	mm	mm	mm
0,5	0,5	0,5	25	10	130	20	20	93
0,6	0,63	0,6	26	10	133	22	21	95
1	1	0,8	27	13	147	24	24	105
1,2	1,25	0,9	28	13	149	24	24	109
1,6	1,6	1,0	28	14	160	28	25	115
2	2	1,1	32	14	169	29	28	123
2,5	2,7	1,5	34	16	190	34	29	137
3,2	3,2	1,6	34	17	195	34	30	138
4	4	2,8	40	20	227	40	34	164
5	5	3,6	50	23	255	45	38	188
6,3	6,3	4,5	52	24	288	50	39	213
8	8	5,4	54	26	299	57	39	216
10	10	8,1	60	34	329	61	45	234

Grade 50
Finish: green colour protective coating, galvanized safety latch

Chain diameter based on usage with chain slings grade 80.

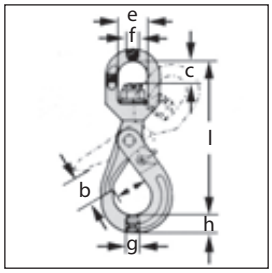
Safety hoist hook BK type



Nominal Size = Nominal chain dia.	Working Load Limit (WLL)	Weight	Measurements					
			b	e	f	g	h	l
mm	t	~ kg/ea	mm	mm	mm	mm	mm	mm
6	1,5	0,5	28	22	10	14	19	109
7/8	2,5	0,9	36	25	11	17	23	137
10	4	1,5	44	32	13	25	29	168
13	6,7	2,8	54	40	16	28	38	208
16	10	5,6	63	50	20	37	49	254
22	15	11	80	70	24	47	62	320
26	21,2	15	100	80	25	50	68	345
28	25	22	120	90	27	67	81	400

Safety hoist hook BKL type

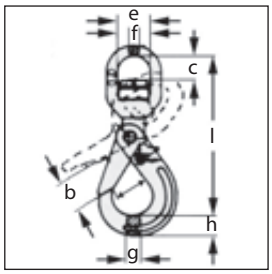
with swivel and bronze slide bearing



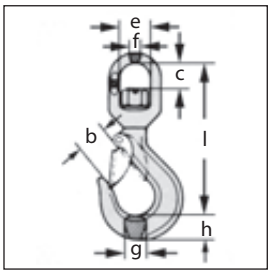
Nominal Size = Nominal chain dia.	Working Load Limit (WLL)	Weight	Measurements						
			b	c	e	f	g	h	l
mm	t	~ kg/ea	mm	mm	mm	mm	mm	mm	mm
6	1,5	0,6	28	23	33	11	15	21	149
7/8	2,5	1,1	37	27	36	12	17	23	183
10	4	2,0	44	36	42	15	21	30	218
13	6,7	3,8	54	47	48	19	30	39	280
16	10	7,1	62	67	61	22	37	49	343

Safety hoist hook BKLK type

with swivel and ball bearing



Nominal Size = Nominal chain dia.	Working Load Limit (WLL)	Weight	Measurements						
			b	c	e	f	g	h	l
mm	t	~ kg/ea	mm	mm	mm	mm	mm	mm	mm
6	1,5	0,7	29	24	33	11	15	21	150
7/8	2,5	1,2	37	27	35	12	17	23	184
10	4	2,1	44	35	42	15	21	30	218
13	6,7	4,1	54	45	48	19	30	39	281
16	10	7,4	62	62	61	22	37	49	339

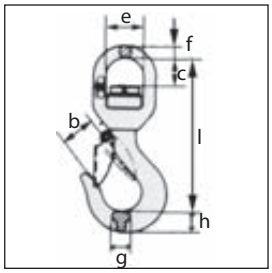


CAUTION!

For applications requiring hook to turn under load only roller bearing swivel hooks are suitable.

Safety hoist hook LKN type

with swivel and safety latch, with bronze slide bearing

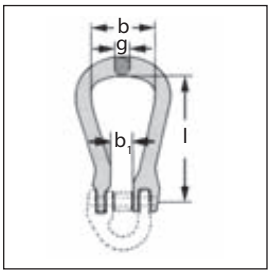


Nominal Size = Nominal chain dia.	Working Load Limit (WLL)	Weight	Measurements						
			b	c	e	f	g	h	l
mm	t	~ kg/ea	mm	mm	mm	mm	mm	mm	mm
7/8	2	0,9	29	28	36	12	18	23,5	155
10	3,15	1,5	36	37	42	15	23	30	192
13	5,3	3,0	40	47	48	19	28	35	238
16	8	5,1	53	62	61	22	33	44	295

Safety hoist hook LKNK type
same as LKN,
but swivel with ball bearing

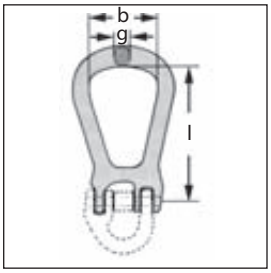
Fluent combinations ...

A team as one. Combines anything with everything: ropes, chains, lashings. Including insulated swivels. The ideal system to connect crane and load.



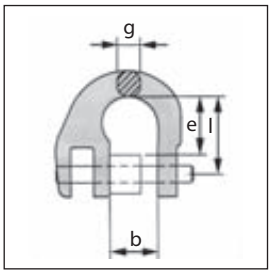
Master link (open) SKO type

Nominal Size = Nominal chain dia.	Working Load Limit (WLL)	Weight	Measurements			
			b	b_1	g	l
mm	t	~ kg/ea	mm	mm	mm	mm
7/8	2	0,3	50	15	14	99
10	3,15	0,6	66	20	18	127
13	5,3	1,0	72	25	22	145
16	8	1,6	82	30	25	175
18/20	12,5	2,6	105	36	30	204



Master link (closed) SKG type

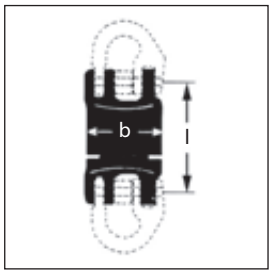
Nominal Size = Nominal chain dia.	Working Load Limit (WLL)	Weight	Measurements		
			b	g	l
mm	t	~ kg/ea	mm	mm	mm
7/8	2	0,3	50	14	99
10	3,15	0,6	66	18	127
13	5,3	1,1	72	22	145
16	8	1,7	82	25	175
18/20	12,5	2,8	105	30	204



Half link SKT type

incl. SKA

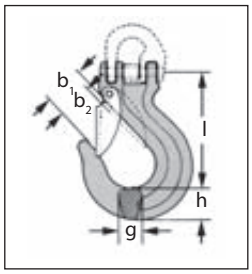
Nominal Size = Nominal chain dia.	Working Load Limit (WLL)	Weight	Measurements			
			b	e	g	l
mm	t	~ kg/ea	mm	mm	mm	mm
7/8	2	0,1	18	22	9	28
10	3,15	0,2	25	26	12	34
13	5,3	0,4	29	33	15	44
16	8	0,7	36	40	19	52
19	12,5	1,1	43	48	22	63
22	15	1,7	49	59	24	75
26	21,2	2,6	58	61	29	80



Roller bearing swivel SKLI type

Nominal Size = Nominal chain dia.	Working Load Limit (WLL)	Weight	Measurements	
			d	l
mm	t	~ kg/ea	mm	mm
7/8	2	0,7	48	75
10	3,15	1,4	59	96
13	5,3	2,9	75	120
16	8	4,9	90	137
18/20	12,5	7,2	104	159

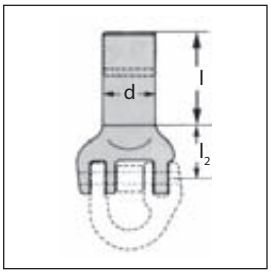
Current leakage max. 1000 V when welding loads suspended from electric crane. Perfect rotation even under maximum load.



Safety hoist hook ESKN type

with latch

Nominal Size = Nominal chain dia.	Working Load Limit (WLL)	Weight	Measurements				
			b_1	b_2	g	h	l
mm	t	~ kg/ea	mm	mm	mm	mm	mm
7/8	2	0,4	32	27	18	21	90
10	3,15	0,9	40	34	23	29	115
13	5,3	1,8	48	42	28	36	141
16	8	3,4	54	62	34	43	181
18/20	12,5	5,0	59	67	41	51	197

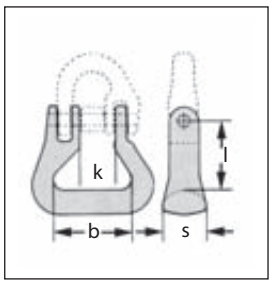


Shank coupling SKS type

Standard configuration with umachined shaft

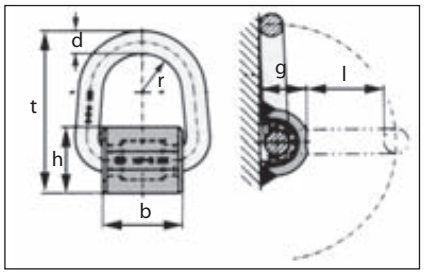
Nominal Size = Nominal chain dia.	Working Load Limit (WLL)	Weight	Measurements			
			d	d_{min}	l	l_2
mm	t	~ kg/ea	mm	mm	mm	mm
7/8	2	0,5	30	13	70	27
10	3,15	0,9	36	16	85	34
13	5,3	1,4	42	20	100	43
16	8	2,5	50	25	112	52
18/20	12,5	4,7	70	30	88	55

When machining the shaft the diameter must not fall below the indicated d_{min} under consideration of the permitted working load limit. The thread length must be no less than than $1{,}5.d_{min}$.



Round sling coupling SKR type

Nominal Size = Nominal chain dia.	Working Load Limit (WLL)	Weight	Measurements			
			b	k	l	s
mm	t	~ kg/ea	mm	mm	mm	mm
7/8	2	0,2	40	18	35	24
10	3,15	0,4	47	24	42	29
13	5,3	0,7	53	29	50	35
16	8	1,2	67	35	62	43
18/20	12,5	1,9	80	43	71	52
22	15	5,0	125	50	110	70
26	21,2	8,5	150	58	130	86



Hold on tight ...

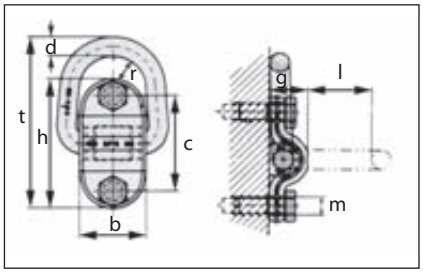
for a firm grip on objects for lifting or transportation.

Lifting point WLP type

Weld-on type

Nominal Size	Working Load Limit (WLL)		Lashing Capacity (LC)	Weight	Measurements						
	vert. 0°	horiz. 90°			b	d	g	h	l	r	t
	t	t	daN	~ kg/ea	mm	mm	mm	mm	mm	mm	mm
1	1	1	2000	0,5	50	14	27	38	55	24	105
3	3	3	6000	0,9	58	17	34	48	57	29	120
5	5	5	10000	1,7	64	22	43	61	74	33	154

Lashing capacity only for load securement. WLL figures for hoisting operation.

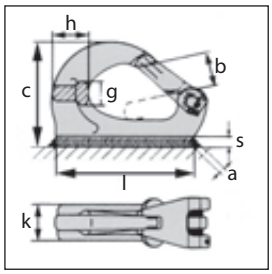


Lifting point SLP type

Bolt-on type

Nominal Size	Working Load Limit (WLL)		Lashing Capacity (LC)	Weight	Measurements								
	vert. 0°	horiz. 90°			b	c	d	g	h	l	m	t	r
	t	t	daN	~ kg/ea	mm	mm	mm	mm	mm	mm	mm	mm	mm
1	1	1	2000	0,9	50	72	14	27	98	55	14	139	24
3	3	3	6000	1,4	58	84	17	33	114	58	16	152	29
5	5	5	10000	2,9	64	116	22	43	160	74	20	203	33

Lashing capacity only for load securement. WLL figures for hoisting operation.



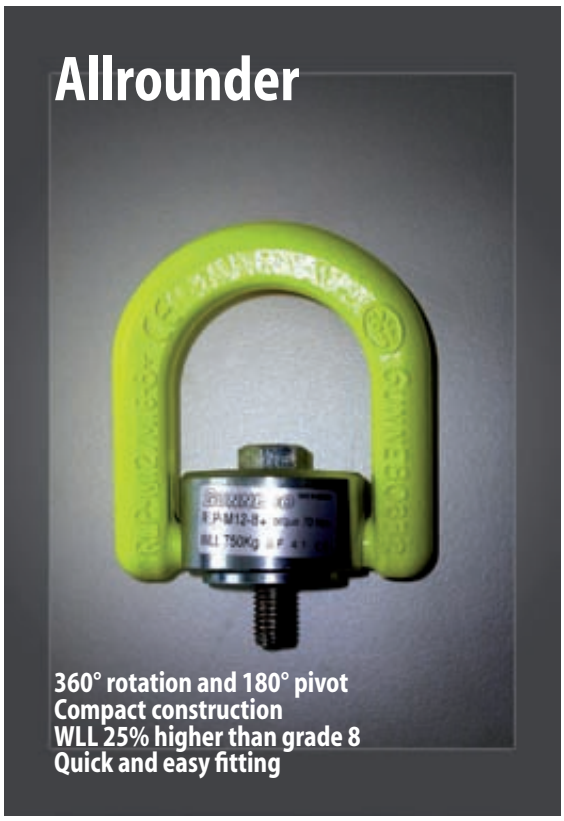
Hook UKN

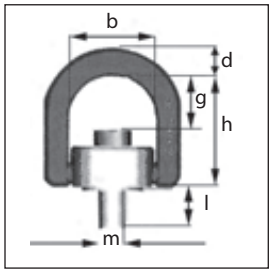
Weld-on type

Nominal Size	Working Load Limit (WLL)	Weight	Measurements							
			a	b	c	g	h	k	l	s
	t	~ kg/ea	mm	mm	mm	mm	mm	mm	mm	mm
0,75	0,95	0,3	3	20	56	13	20	19	82	5
1	1,25	0,6	4	21	72	17	25	25	95	6
2	2,5	1,0	5	26	86	20	30	30	114	8
3	3,75	1,3	6	29	105	23	30	35	132	10
4	5	1,9	7	29	111	29	38	42	140	11
5	6	2,8	8	34	130	30	46	45	165	12
8	10	3,7	9	34	133	39	51	50	172	13
10	12,5	6,3	9	47	168	43	58	55	220	14
15	18,5	9,0	10	53	188	52	67	55	240	16

CAUTION!

Functional safety only guaranteed if properly fitted. Fitting instructions on request.

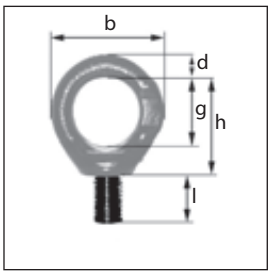




Rotating lifting point RLP type

Grade 10 to screw on

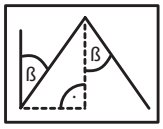
Nominal Size = Thread	Working Load Limit (WLL)		Weight	Measurements				
	vert. 0°	horiz. 90°		b	d	g	h	l
	t	t	~kg	mm	mm	mm	mm	mm
M 8	0,6	0,3	0,3	42	12	35	60	15
M 10	1	0,5	0,3	42	12	34	60	20
M 12	1,5	0,75	0,9	57	19	46,5	85	19
M 16	3	1,5	0,9	57	19	44	85	24
M 20	5	2,5	2,8	83	28	56	111	32
M 24	7	3,5	2,8	83	28	53	111	37



Eye lifting point ELP type

Nominal Size = Thread	Working Load Limit (WLL)		Weight	Measurements				
	vert. 0°	horiz. 90°		b	d	g	h	l
	t	t	~kg	mm	mm	mm	mm	mm
M 16	4	1	0,38	72	16	42	56	24
M 20	6	1,5	0,43	72	16	42	58	30
M 24	8	2	0,85	88	19	48	69	36
M 30	12	3	1,4	106	22	60	84	45
M 36	16	4	2,3	127	26	72	100	54

1t = 1000kg (t = metric ton).
Length of a lifting sling is the usable length when ready for service. It is measured between the bearing points of sling ends/terminations.



The tilt angle ß is the largest angle between legs and vertical line. To determine working load limit of sling operation: Multiply applicable mode factor (see table <Lift methods> below) with the WLL value (single leg direct) from the above table. Adapt the mode factors as appropriate for asymmetrical loads.

Lift methods horizontal:

Single leg	Double leg
straight	straight
90°	90°
	
WLL determination factors:	
1	2

Lift methods vertical:

Single leg	Double leg				Three- and four-leg		
straight	straight	symmetric		asymm.	symmetric		asymm.
0°	0°	0-45°	45-60°		0-45°	45-60°	
							
WLL determination factors:							
1	2	1,4	1	1	2,1	1,5	1

The whole range ...

Loads up to 30t. Variable thread diameter.
Fourfold safety against breakage in all stress directions.

Swivel lifting point TAWSK
weld-on type
red colour
WLL 2 to 15 t
360° turn, 180° pivot

Lifting point TAPG
bolt-on type
red colour
WLL 3 to 8 t

Lifting point TAPSK
weld-on type
edge attachment
red colour
WLL 3,15 to 8 t

Lifting point TAPS
weld-on type
red colour
WLL 1 to 15t

... and start in the future:

Raised working load limit: 25% more for same dimensions.
Hexagonal swivel body: easier fitting and detachment.
Squeeze marks in ring prevent tilting.

THEIPA® Point

Swivel lifting point TAW
bolt-on type
gold colour
WLL 5 to 15 t
single leg direct
360° turn, 180° pivot
and:

Clearly shows
permitted tilt angle.
Jerk-free turning, swivelling
and tilting under load.

Roller bearing wear display
for end of service life
determination
without measuring tools.

Machined support
for better sit.

MORE...

This is just a brief presentation of a whole range of products. Details needed? Ask us. We provide all the information you need.

DIN standard ...

drop-forged,
normalised,
thread to DIN 13,
material C15,
zinc galvanized,
WLL from 0,14t to 38t

Eyebolt
DIN 580

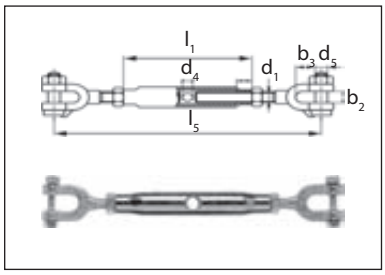
Eyenut
DIN 582

CAUTION!

Functional safety only guaranteed if properly fitted. Fitting instructions on request.

Turnbuckle jaw/jaw

DIN 1478 with counter nuts (rigging screw) closed body type



Nominal Size = Dia of thread	Working Load Limit (WLL)	Adjustable	Weight	Measurements					Jaw Pin
				b_2	b_3	d_4	l_1	l_5	d_5
	~ t	mm	~ kg/ea	mm	mm	mm	mm	mm	
M 8	0,25	85	0,26	8	15	8	110	205	M 6
M 10	0,30	90	0,45	10	21	8	125	250	M 8
M 12	0,60	90	0,66	14	19	10	125	300	M 10
M 16	1,5	125	1,5	20	24	10	170	340	M 16
M 20	3	150	2,9	28	47	12	200	455	M 20
M 24	5,5	180	5,0	33	53	12	255	550	M 24
M 30	8	180	10	44	74	16	255	665	M 30

Finish: galvanized

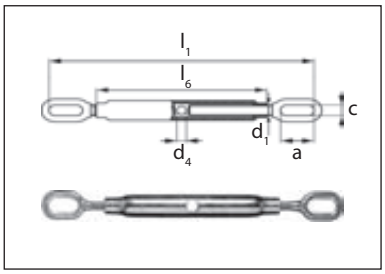
Working Load Limit = 1/5 Breaking Force

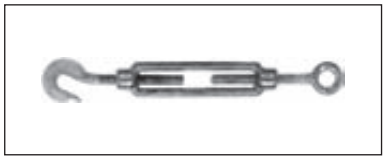
Turnbuckle with oval eyes

DIN 82004 closed body A type

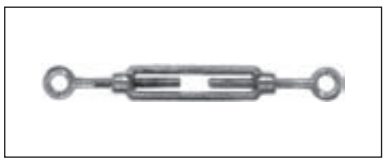
Nominal Size	Working Load Limit (WLL)	Adjustable	Weight	Measurements					
				a	c	d_1	d_4	l_1	l_6
	t	mm	~ kg/ea	mm	mm	mm	mm	mm	mm
0,4	0,4	140	0,75	29	13	M 12	12	305 - 445	180
0,6	0,6	150	1,4	48	21	M 16	12	366 - 516	200
1	1	165	1,7	48	21	M 18	12	385 - 550	220
1,6	1,6	170	2,9	58	26	M 22	14	460 - 630	240
2	2	190	3,6	58	26	M 24	14	470 - 660	260
2,5	2,5	200	5,2	72	32	M 27	14	536 - 736	280
3	3,15	210	6,4	72	32	M 30	18	556 - 766	300
4	4	225	9,0	94	40	M 33	18	631 - 856	320
5	5	235	10	94	40	M 36	18	651 - 886	340
6	6,3	260	13	108	45	M 42	22	724 - 984	380
8	8	295	20	115	49	M 45	22	785 - 1080	420
10	10	315	27	125	54	M 52	22	865 - 1180	460
12	12,5	345	37	144	60	M 56	26	995 - 1340	500
16	16	365	53	144	66	M 64	26	1055 - 1420	540

Finish: galvanized

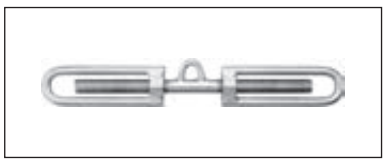




Turnbuckle hook/eye type (optional: hook/hook)
DIN 1480
Material: steel min. 330N/mm² Rm
Finish: electrogalvanized
Thread M6 to M36



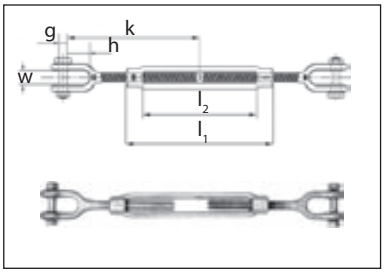
Turnbuckle eye/eye type
DIN 1480
Material: steel min. 330N/mm² Rm
Finish: electrogalvanized
Thread M6 to M36



Deck-lash turnbuckle
Material: mild steel
Finish: untreated
Thread: M30
PLC 5t

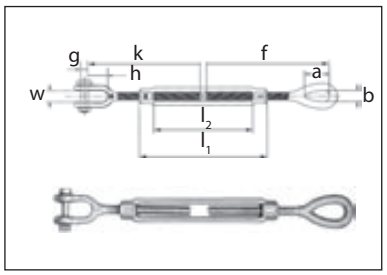
Turnbuckle HT type jaw/jaw

High tensile with enlarged take-up



Nominal Size	Working Load Limit (WLL)	Weight	Measurements					
			g	h	k	l_1	l_2	w
	t	~ kg/ea	mm	mm	mm	mm	mm	mm
⅜x6	0,54	0,37	8	22	137	180	152	13
½x6	1	0,73	9,5	26	147	190	152	16
½x9	1	0,79	9,5	26	187	270	228	16
½x12	1	0,96	9,5	26	222	345	304	16
⅝x6	1,6	1,4	13	33	161	205	152	18
⅝x9	1,6	1,3	13	33	201	280	228	18
⅝x12	1,6	1,5	13	33	236	355	304	18
¾x6	2,4	1,9	15,5	38	173	210	152	23
¾x9	2,4	2,3	15,5	38	213	285	228	23
¾x12	2,4	2,6	15,5	38	248	365	304	23
¾x18	2,4	3,1	15,5	38	328	520	457	23
⅞x12	3,3	3,7	19	44	266	375	304	27
⅞x18	3,3	4,1	19	44	346	530	457	27
1x12	4,5	5,1	22	52	286	385	304	30
1x18	4,5	6,6	22	52	366	540	457	30
1¼x18	6,9	12	29	73	380	540	457	44
1¼x24	6,9	13	29	73	479	690	610	44
1½x18	9,7	14	35	70	430	560	457	52
1½x24	9,7	18	35	70	496	710	610	52
1¾x18	13	25	41	85	440	575	457	59
1¾x24	13	29	41	85	500	725	610	59
2x24	17	45	51	93	540	750	610	64

Finish: hot dip galvanized
Standard: US Fed Spec FF-T-791



Turnbuckle HT type jaw/eye

High tensile with enlarged take-up

Nominal Size	Working Load Limit (WLL)	Weight	Measurements								
			a	b	f	g	h	k	l_1	l_2	w
	t	~ kg/ea	mm	mm	mm	mm	mm	mm	mm	mm	mm
⅜x6	0,54	0,34	28	13	137	8	22	137	180	152	13
½x6	1	0,69	36	18	153	9,5	26	147	190	152	16
½x9	1	0,78	36	18	193	9,5	26	187	266	228	16
½x12	1	0,93	36	18	228	9,5	26	222	342	304	16
⅝x6	1,6	1,1	43	21	177	13	33	161	200	152	18
⅝x9	1,6	1,4	43	21	217	13	33	201	276	228	18
⅝x12	1,6	1,7	43	21	252	13	33	236	352	304	18
¾x6	2,4	1,8	53	25	196	15,5	38	173	210	152	23
¾x9	2,4	2,0	53	25	236	15,5	38	213	287	228	23
¾x12	2,4	2,4	53	25	271	15,5	38	248	362	304	23
¾x18	2,4	3,0	53	25	351	15,5	38	328	515	457	23
⅞x12	3,3	3,5	59	31	287	19	44	266	372	304	27
⅞x18	3,3	4,2	59	31	367	19	44	346	524	457	27
1x12	4,5	5,1	74	36	323	22	52	286	381	304	30
1x18	4,5	6,0	74	36	403	22	52	366	533	457	30
1¼x18	6,9	11	88	45	440	29	73	380	540	457	44
1¼x24	6,9	13	88	45	495	29	73	479	693	610	44
1½x18	9,7	15	105	54	465	35	70	430	550	457	52
1½x24	9,7	18	105	54	540	35	70	496	703	610	52
1¾x18	12,7	22	119	60	475	41	85	440	570	457	59
1¾x18	12,7	28	119	60	577	41	85	500	720	610	59
2x24	16,8	43	146	69	632	41	93	540	735	610	64

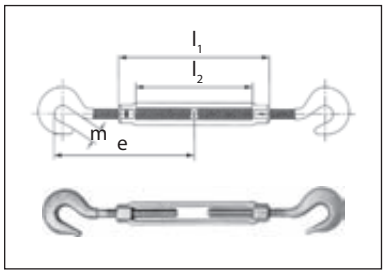
Finish: hot dip galvanized
Standard: US Fed Spec FF-T-791

Working Load Limit = 1/5 Breaking Force

Nominal size = thread dia. x length of body (l_2) in inch

MORE ...

Anything missing? Some important information or a similar product, a different size or a solution for your special needs? Ask us. We are pleased to advise.



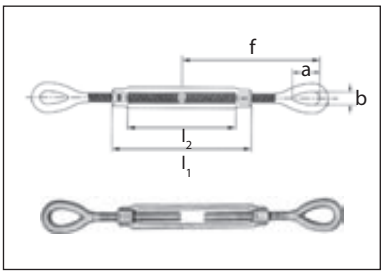
Turnbuckle HT type hook/hook

High tensile with enlarged take-up

Nominal Size	Working Load Limit (WLL)	Weight	Measurements			
			e	l_1	l_2	m
	t	~ kg/ea	mm	mm	mm	mm
⅜x6	0,45	0,39	129	180	152	12
½x6	0,68	0,67	147	190	152	15
½x9	0,68	0,84	187	266	228	15
½x12	0,68	1,0	222	342	304	15
⅝x6	1	1,1	166	200	152	20
⅝x9	1	1,3	206	276	228	20
⅝x12	1	1,6	241	352	304	20
¾x6	1,4	1,8	181	210	152	23
¾x9	1,4	2,1	221	287	228	23
¾x12	1,4	2,4	256	362	304	23
¾x18	1,4	3,1	336	515	457	23
⅞x12	1,8	3,6	273	372	304	26
⅞x18	1,8	4,4	353	524	457	26
1x12	2,3	5,1	286	381	304	29
1x18	2,3	6,3	366	533	457	29

Finish: hot dip galvanized
Standard: US Fed Spec FF-T-791

Working Load Limit = 1/5 Breaking Force



Turnbuckle HT type eye/eye

High tensile with enlarged take-up

Nominal Size	Working Load Limit (WLL)	Weight	Measurements				
			a	b	f	l_1	l_2
	t	~ kg/ea	mm	mm	mm	mm	mm
⅜x6	0,54	0,47	28	13	137	180	152
½x6	1	0,84	36	18	153	190	152
½x9	1	1,1	36	18	193	266	228
½x12	1	1,3	36	18	228	342	304
⅝x6	1,6	1,4	43	21	177	200	152
⅝x9	1,6	1,6	43	21	217	276	228
⅝x12	1,6	1,9	43	21	252	352	304
¾x6	2,4	2,0	53	25	196	210	152
¾x9	2,4	2,5	53	25	236	287	228
¾x12	2,4	2,7	53	25	271	362	304
¾x18	2,4	3,1	53	25	351	515	457
⅞x12	3,3	4,0	59	31	287	372	304
⅞x18	3,3	5,1	59	31	367	524	457
1x12	4,5	5,9	74	36	323	381	304
1x18	4,5	7,2	74	36	403	533	457
1¼x18	6,9	11,3	88	45	440	540	457
1¼x24	6,9	12,1	88	45	495	693	610
1½x18	9,7	16,5	105	54	465	550	457
1½x24	9,7	17,1	105	54	540	703	610
1¾x18	13	23,1	119	60	475	570	457
1¾x24	13	26,3	119	60	577	735	610
2x24	17	40,7	146	69	632	750	610

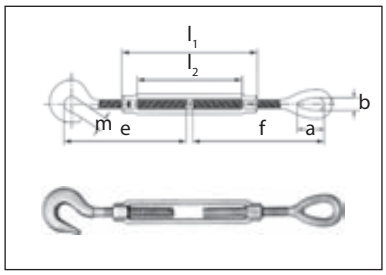
Finish: hot dip galvanized
Standard: US Fed Spec FF-T-791

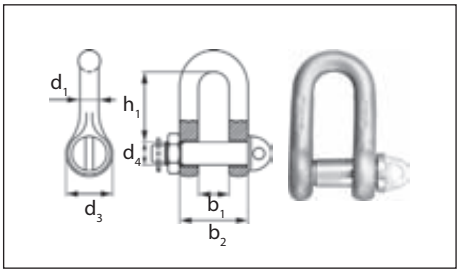
Turnbuckle HT type hook/eye

High tensile with enlarged take-up

Nominal Size	Working Load Limit (WLL)	Weight	Measurements						
			a	b	e	f	l_1	l_2	m
	t	~ kg/ea	mm	mm	mm	mm	mm	mm	mm
⅜x6	0,45	0,39	28	13	129	137	180	152	12
½x6	0,68	0,67	36	18	147	153	190	152	15
½x9	0,68	0,84	36	18	187	193	266	228	15
½x12	0,68	1,0	36	18	222	228	342	304	15
⅝x6	1	1,1	44	22	166	177	200	152	20
⅝x9	1	1,3	44	22	206	217	276	228	20
⅝x12	1	1,6	44	22	241	252	352	304	20
¾x6	1,4	1,8	54	25	181	196	210	152	23
¾x9	1,4	2,1	54	25	221	236	287	228	23
¾x12	1,4	2,4	54	25	256	271	362	304	23
¾x18	1,4	3,1	54	25	336	351	515	457	23
⅞x12	1,8	3,6	60	31	273	287	372	304	26
⅞x18	1,8	4,4	60	31	353	367	524	457	26
1x12	2,3	5,1	76	36	286	323	381	304	29
1x18	2,3	6,3	76	36	366	403	533	457	29

Finish: hot dip galvanized
Standard: US Fed Spec FF-T-791





Shackle A type

Screw pin chain (straight) type similar to DIN 82101

Nominal Size = Working Load Limit (WLL)	Weight	Measurements					
		b_1	b_2	d_1	d_3	d_4	h_1
t	~ kg/ea	mm	mm	mm	mm	mm	mm
0,1	0,01	7	15	4	10	5	15,5
0,16	0,02	8	18	5	12	6	18
0,25	0,04	11	25	7	16	8	24
0,4	0,08	14	30	8	20	10	30
0,6	0,17	17	37	10	24	12	36
1	0,36	21	47	13	32	16	49
1,6	0,75	27	61	17	40	20	61
2	1,0	30	68	19	44	22	67
2,5	1,3	33	75	21	48	24	73
3	1,9	38	86	24	54	27	83,5
4	2,5	42	96	27	60	30	91
5	4,0	47	107	30	72	36	111
6	5,4	53	121	34	78	39	119,5
8	7,9	60	136	38	90	45	139,5
10	10	66	150	42	96	48	147
12	14	73	167	47	104	52	158
16	19	81	185	52	120	60	185
20	28	90	206	58	136	68	211
25	34	100	226	63	144	72	221

Finish: electrogalvanized

Shackle B type

slotted screw pin (straight) type
similar to DIN 8210
Finish: electrogalvanized
Nom. size 0.4 to 25
WLL 0.4 to 25 t
Dimensions as A type

Shackle C type

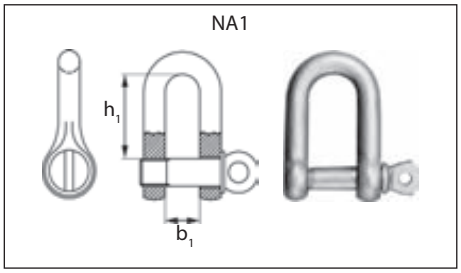
similar to DIN 82101
safety type, with nut and split pin
Finish: electrogalvanized
Nom. size 8 to 40
WLL 8 to 40 t
Dimensions as A type

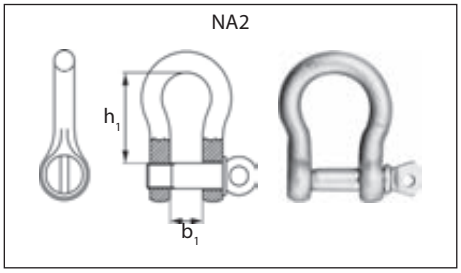
Shackle commercial type

Screw pin type for general use, not permitted with lifting appliances,
NA1 chain (straight) type
NA2 anchor (bow) type

Nominal Size = Diameter	Diameter	Working Load Limit (WLL)	Weight		Measurements	
			chain	anchor	b_1	h_1
~ inch	mm	~ t	~ kg/ea		mm	mm
3/16	5	0,08	0,02	0,02	10	20
1/4	6	0,1	0,03	0,03	12	24
5/16	8	0,2	0,07	0,07	16	32
3/8	10	0,3	0,13	0,14	20	40
7/16	11	0,4	0,18	0,19	22	44
1/2	13	0,5	0,25	0,27	24	48
9/16	14	0,6	0,36	0,38	28	56
5/8	16	0,8	0,53	0,56	32	64
3/4	19	1,1	0,92	1,0	38	74
7/8	22	1,5	1,4	1,5	44	88
1	24	2,0	2,2	2,3	48	96
1 1/8	28	3,0	3,4	3,2	56	112
1 1/4	32	3,5	4,6	4,8	64	128
1 3/8	36	4,0	5,9	6,3	72	144
1 1/2	38	5,0	7,6	8,3	76	152

Finish: electrogalvanized
Diameter relates to pin and bow.

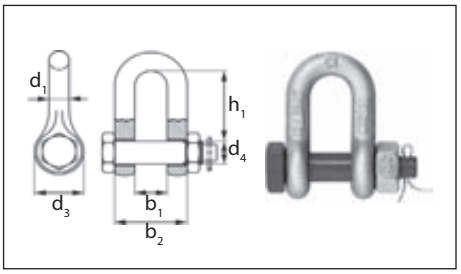




Working Load Limit = 1/5 Breaking Force

CAUTION!

Commercial type shackles must not be used for lifting loads.



Shackle HC1 type

High tensile steel safety pin chain (D) type

Nominal Size = Diameter of Bow	Working Load Limit (WLL)	Weight	Measurements					
			b_1	b_2	d_1	d_3	d_4	h_1
~ inch	t	~ kg/ea	mm	mm	mm	mm	mm	mm
1/4	0,5	0,06	12	26	6	17	8	22
5/16	0,75	0,10	13	29	8	21	10	26
3/8	1	0,15	16	36	10	26	12	31
7/16	1,5	0,22	18	40	11	28	14	36
1/2	2	0,34	21	47	13	30	16	41
5/8	3,25	0,70	27	59	16	42	19	51
3/4	4,75	1,2	32	70	19	48	22	60
7/8	6,5	1,6	36	80	22	57	25	71
1	8,5	2,4	43	93	25	62	28	81
1 1/8	9,5	3,3	46	104	29	69	32	90
1 1/4	12	4,6	52	116	32	78	35	100
1 3/8	13,5	6,0	57	127	35	86	38	113
1 1/2	17	8,3	60	136	38	94	42	124
1 3/4	25	13	73	161	44	112	51	146
2	35	19	83	185	51	127	55	171
2 1/4	42,5	25	95	209	57	139	65	185
2 1/2	55	35	105	231	64	152	70	203
3	85	60	127	279	76	200	82	216
4	150	145	140	348	107	226	107	250

Material: high tensile steel, forged
Finish: hot dip galvanized bow, rust-proof painted pin
Standard: US Fed Spec RR-C-271

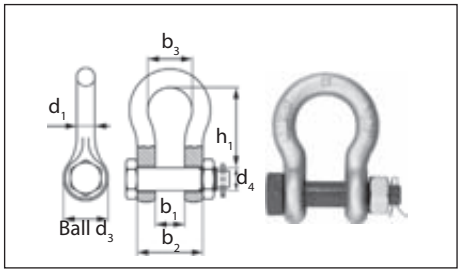
Working Load Limit = 1/6 Breaking Force

Shackle HC2 type

High tensile steel safety pin anchor (bow) type

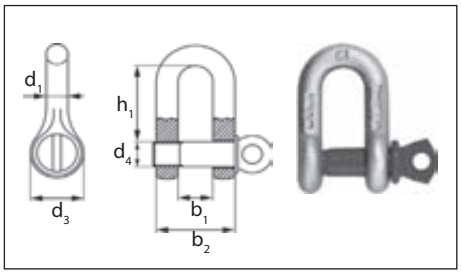
Nominal Size = Diameter of Bow	Working Load Limit (WLL)	Weight	Measurements						
			b_1	b_2	b_3	d_1	d_3	d_4	h_1
~ inch	t	~kg/ea	mm	mm	mm	mm	mm	mm	mm
1/4	0,5	0,07	12	25	19	6	17	8	28
5/16	0,75	0,10	13	29	21	8	21	10	31
3/8	1	0,18	16	36	26	10	26	12	36
7/16	1,5	0,25	18	40	29	11	28	14	42
1/2	2	0,37	21	47	33	13	30	16	48
5/8	3,25	0,71	27	59	43	16	42	20	60
3/4	4,75	1,3	32	70	51	19	48	22	71
7/8	6,5	1,8	36	80	58	22	57	27	84
1	8,5	2,5	43	93	68	25	62	28	95
1 1/8	9,5	3,5	46	104	74	29	69	33	109
1 1/4	12	5,0	52	116	82	32	78	36	119
1 3/8	13,5	6,8	57	127	92	35	86	39	133
1 1/2	17	8,8	60	136	98	38	94	42	146
1 3/4	25	14	73	161	127	44	112	52	178
2	35	21	83	185	146	51	127	57	197
2 1/4	42,5	28	95	209	160	57	139	65	222
2 1/2	55	40	105	231	184	64	152	70	267
3	85	62	127	279	200	76	200	82	330
4	150	130	145	353	250	104	240	108	372

Material: high tensile steel, forged
Finish: hot dip galvanized
Standard: US Fed Spec RR-C-271



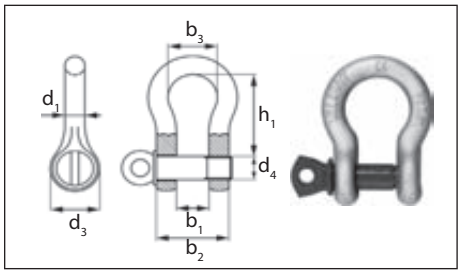
Shackle HA1 type

High tensile steel screw pin chain (D) type



Nominal Size = Diameter of Bow	Working Load Limit (WLL)	Weight	Measurements					
			b_1	b_2	d_1	d_3	d_4	h_1
~ inch	t	~ kg/ea	mm	mm	mm	mm	mm	mm
1/4	0,5	0,05	12	26	6	17	8	22
5/16	0,75	0,08	13	29	8	21	10	26
3/8	1	0,13	16	36	10	26	12	31
7/16	1,5	0,19	18	40	11	28	14	36
1/2	2	0,31	21	47	13	30	16	41
5/8	3,25	0,55	27	59	16	42	20	51
3/4	4,75	0,96	32	70	19	48	22	60
7/8	6,5	1,4	36	80	22	57	27	71
1	8,5	2,0	43	93	25	62	28	81
1 1/8	9,5	3,0	46	104	29	69	33	90
1 1/4	12	4,0	52	116	32	78	36	100
1 3/8	13,5	5,4	57	127	35	86	39	113
1 1/2	17	7,3	60	136	38	94	42	124
1 3/4	25	11	73	161	44	112	52	146
2	35	16	83	185	51	135	57	171
2 1/4	42,5	23	95	209	57	139	60	185
2 1/2	55	33	106	232	63	158	72	203

Material: high tensile steel, forged
Finish: hot dip galvanized ow, rust-proof painted pin
Standard: US Fed Spec RR-C-271



Working Load Limit = 1/6 Breaking Force

Shackle HA2 type

high tensile steel screw pin anchor (bow) type

Nominal Size = Diameter of Bow	Working Load Limit (WLL)	Weight	Measurements						
			b_1	b_2	b_3	d_1	d_3	d_4	h_1
~ inch	t	~ kg/ea	mm	mm	mm	mm	mm	mm	mm
1/4	0,5	0,05	12	25	19	6	17	8	28
5/16	0,75	0,08	13	29	21	8	21	10	31
3/8	1	0,14	16	36	26	10	26	12	36
7/16	1,5	0,22	18	40	29	11	28	14	42
1/2	2	0,33	21	47	33	13	30	16	48
5/8	3,25	0,65	27	59	43	16	42	20	60
3/4	4,75	0,97	32	70	51	19	48	22	71
7/8	6,5	1,5	36	80	58	22	57	27	84
1	8,5	2,4	43	93	68	25	62	28	95
1 1/8	9,5	3,2	46	104	74	29	69	33	103
1 1/4	12	4,3	52	116	82	32	78	36	119
1 3/8	13,5	5,7	57	127	92	35	86	39	133
1 1/2	17	7,8	60	136	98	38	94	42	146
1 3/4	25	13	73	161	127	44	112	52	178
2	35	19	83	185	146	51	135	60	197
2 1/4	42,5	25	95	209	160	57	139	65	222
2 1/2	55	38	106	232	184	63	158	72	267

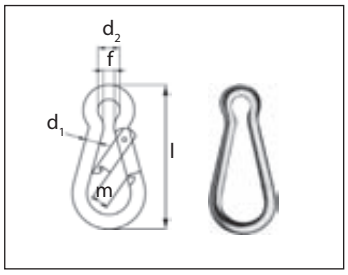
Material: high tensile steel, forgod
Finisch: hot dip galvanized bow, rust-proof painted pin
WLL and size marked, strength/WLL co-efficient = 6

MORE ...

Other sizes, other types, specialities? Ask us. We are pleased to advise.

Hooking up made easy ...

It's not always the heavyweights you need.
For loads less than one ton
making the right connection can be so easy:
with the right fittings.
Here we present some favourites.



Snap hook C type

Similar to DIN 5299

Nominal Size = $l \cdot d_1$	Working Load Limit (WLL)	Weight	Measurements				
			d_1	d_2	f	l	m
mm	t	~ kg/ea	mm	mm	mm	mm	mm
50x5	0,10	0,02	5	8	5	50	7
60x6	0,12	0,03	6	9	6,5	60	8
70x7	0,18	0,04	7	10	8	70	8
80x8	0,23	0,07	8	10	8,5	80	9
90x9	0,25	0,09	9	12	9,5	90	10
100x10	0,35	0,13	10	15	10,5	100	11
120x11	0,45	0,18	11	18	11,5	120	16
140x12	0,51	0,26	12	20	13	140	19
160x13	0,60	0,35	13	22	15	160	25

Material: mild steel
Finish: electrogalvanized

Snap hook A type
DIN 5290
for safety belts to DIN 7470
with screw cap
Material: Aluminium

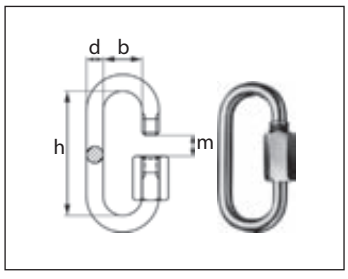
Snap hook B type
similar DIN 5299
Finish: electrogalvanized
Nom. size 60x6 to 120x11
WLL 0.12 to 0.45 t

Snap hook RK type
with thimble eye
Finish: electrogalvanized
Nom. size 60x6 to 120x11
WLL 0.12 to 0.45 t

Snap hook S type
with screw cap
Finish: electrogalvanized
Nom. size 60x6 to140x12
WLL 0,12 to 0,51 t

Snap hook RKS type
with timble eye and cap nut
Finish: electrogalvanized
Nom. size 60x6 to 120x11
WLL 0,12 to 0,45 t

S-Hook M
Material: steel wire
Finish: electrogalvanized
WLL 0,04 to 0,30 t



Quick link

Work standard, approved for use with stage lifting appliances

Nominal Size = d	Working Load Limit (WLL)	Weight	Measurements		
			b	h	m
mm	~ t	~ kg/ea	mm	mm	mm
3,5	0,05	0,01	10	29	5
4	0,09	0,01	11,5	33	6
5	0,14	0,02	13	39	6,5
6	0,20	0,04	14	45	7,5
7	0,28	0,05	16	54	8
8	0,35	0,08	18	60	10
9	0,45	0,10	19	65	11
10	0,55	0,14	20	69	12
12	0,75	0,20	25	82	15

Material: mild steel
Finish: electrogalvanized
Strength: WLL ratio = 10

MORE...

This is just a brief presentation of a whole range of products. Details needed? Ask us. We provide all the information you need.

Dazzlers ...

The shining solution in stainless steel. No chance for rust.
Optimum protection against moisture and chemicals.

Snap hook K type
with thimble eye
Material: AISI 316
Finish: high gloss polished
Nom. size 50x5 to 160x13

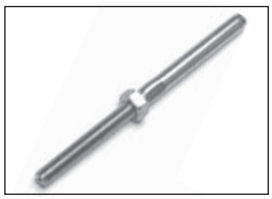
Snap hook SK type
with thimble eye and screw cap
Material: AISI 316
Finish: high gloss polished
Nom. size 60x6 to 120x13

Quick link
Material: AISI 316
Finish: high gloss polished

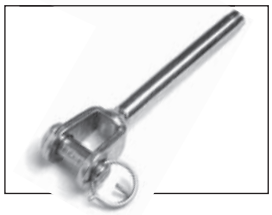
Wire rope clip
similar to DIN 741
Material: AISI 316
Finish: high gloss polished
Rope dia. 2 to 24

Simplex clip
Material: AISI 316
Finish: high gloss polished
Rope dia. 2 to 10

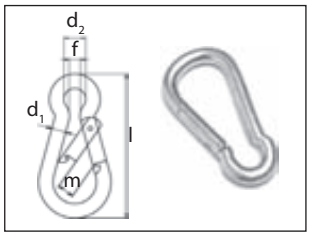
Duplex clip
Material: AISI 316
Finish: high gloss polished
Rope dia. 2 to 10



Screw end swage terminal
with nut
Material: AISI 316
Finish: high gloss polished
Rope dia. 2,5 to 10
Thread M 5 to M 16



Jaw end swage terminal
Material: AISI 316
Finish: high gloss polished
Rope dia. 2,5 to 10



Snap hook NC type

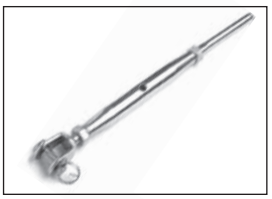
Nominal Size = l · d_1	Working Load Limit (WLL)	Weight	Measurements				
			d_1	d_2	f	l	m
mm	t	~ kg/ea	mm	mm	mm	mm	mm
50x5	0,10	0,02	5	8	5	50	7
60x6	0,12	0,03	6	9	6,5	60	8
70x7	0,18	0,04	7	10	8	70	8
80x8	0,23	0,07	8	10	8,5	80	9
90x9	0,25	0,09	9	12	9,5	90	10
100x10	0,35	0,13	10	15	10,5	100	11
120x11	0,45	0,18	11	18	11,5	120	16
140x12	0,51	0,26	12	20	13	140	19
160x13	0,60	0,35	13	22	15	160	25

Material: AISI 316
Finish: High gloss polished

Thimble N type

Nominal Size = a	Weight	Measurements	
		c	l
mm	~ kg/ea	mm	mm
3	0,003	10	16
4	0,004	11	17
5	0,005	13	20
6	0,009	16	25
7	0,01	18	28
8	0,02	20	32
10	0,03	26	40
12	0,04	28	45
14	0,09	34	56
16	0,13	37	62
18	0,16	42	65
20	0,19	45	78

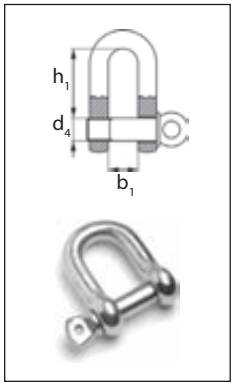
Material: AISI 316
Finish: High gloss polished



Rigging screw
jaw end / swage terminal
Material: AISI 316
Finish: high gloss polished
Rope dia. 2,5 to 10
Thread M5 to M 20

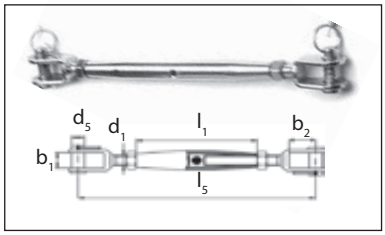
Eye end terminal
Material: AISI 316
Finish: high gloss polished
Rope dia. 2,5 to 10

Shackle short, straight



Working Load Limit (WLL)	Weight	Measurements		
		b_1	d_4	h_1
~ t	~ kg/ea	mm	mm	mm
0,16	0,01	8	M 4	16
0,25	0,02	10	M 5	19
0,40	0,03	12	M 6	24
0,63	0,06	16	M 8	32
1	0,11	20	M 10	40
1,50	0,20	25	M 12	48
2,75	0,47	32	M 16	65
4	0,79	38	M 20	76
5	1,26	44	M 22	88
6	1,86	50	M 24	100

Material: AISI 316
Finish: high gloss polished



Rigging screw

jaw/jaw

Nominal Size = Thread	Working Load Limit (WLL)	Weight	Measurements				
			b_1	b_2	d_5	l_1	l_5
	~ t	~ kg/ea	mm	mm	mm	mm	mm
M 5	0,2	0,05	6	9	5	80	130-190
M 6	0,3	0,10	8	10	6	95	150-220
M 8	0,5	0,17	10	11	8	105	180-255
M 10	0,75	0,30	12	13	9	125	220-300
M 12	1,2	0,51	14	20	12	150	270-385
M 14	1,5	0,60	14	22	12	165	300-425
M 16	2,0	1,1	16	26	16	190	360-500
M 20	3,2	1,7	20	30	19	210	390-560

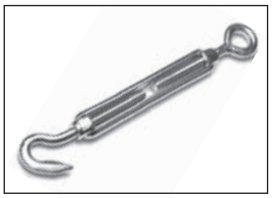
Material: AISI 316
Finish: high gloss polished

Shackle, bow type
Material: AISI 316
Finish: High gloss polished
WLL ~ 0,16 to 5,75 t
Size M 4 to M 24

Shackle, long
Material: AISI 316
Finish: High gloss polished
WLL ~ 0,16 to 1,5 t
Size M 4 to M 12

Eyebolt
similar to DIN 580
Material: AISI 316
Finish: High gloss polished
WLL ~ 0,07 to 3,6 t
Thread M 6 to M 30

Eyenut
similar to DIN 582
Material: AISI 316
Finish: High gloss polished
WLL ~ 0,07 to 3,6 t
Thread M 6 to M 30



Tunbuckle
similar to DIN 1480
Hook/Eye, Hook/Hook,
Eye/Eye,
forged,
Material: AISI 316
Finish: High gloss polished
Thread M 5 to M 16

MORE ...

Anything missing? Some important information or a similar product, a different size or a solution for your special needs? Ask us. We are pleased to advise.

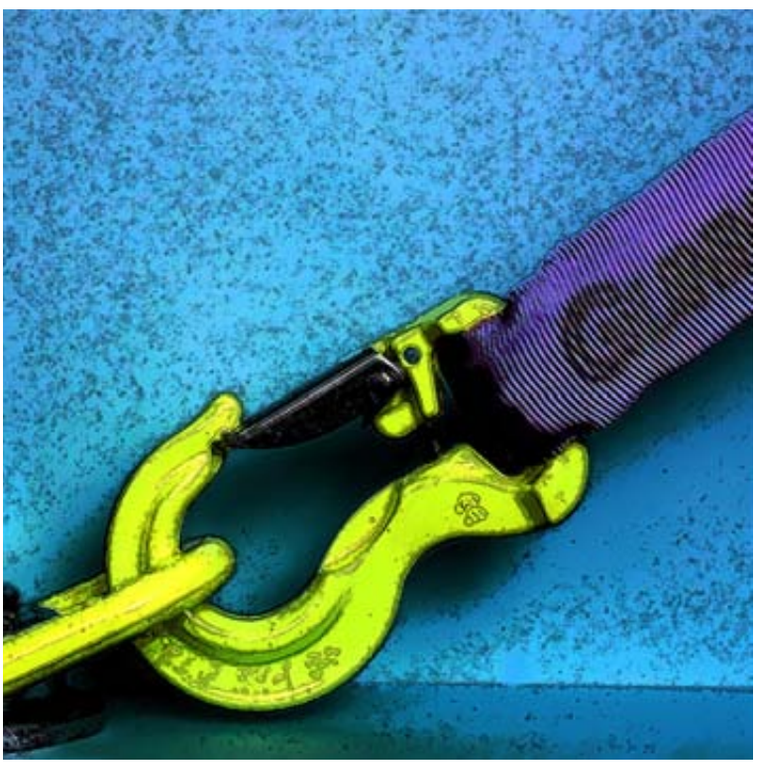
Rost frei

Toggle
Material: AISI 316
Finish: High gloss polished
Pin dia. 5,5 to 16,5mm

Swivel BG type
Eye/Jaw
Material: AISI 316
Finish: High gloss polished
Pin dia. 6 to 16mm

Swivel BB type
Eye/Eye
Material: AISI 316
Finish: High gloss polished
Bow dia. 6 to 16mm

Swivel GG
Jaw/Jaw
Material: AISI 316
Finish: High gloss polished
Pin dia. 6 to 16mm



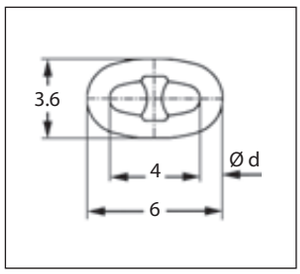
Chains and Slings

Indestructible ...
Heaviest duty anchor chains and tow chains. Resistant to wear and damage.

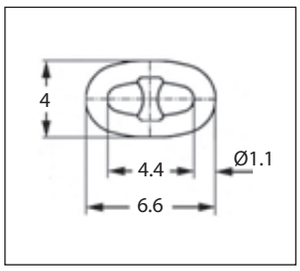
Stud link anchor chain

Nominal chain dia.	Grade K1		Grade K2		Grade K3		Weight
	Proof Force	Breaking Force	Proof Force	Breaking Force	Proof Force	Breaking Force	
mm	kN	kN	kN	kN	kN	kN	kg/m
12,5	46,1	65,7	65,7	92,2	92,2	132	3,5
14	57,9	82,4	82,4	116	116	165	4,4
16	75,5	107	107	150	150	216	5,8
17,5	89,2	127	127	179	179	256	6,9
29	105	150	150	211	211	301	8,1
20,5	123	175	175	244	244	349	9,5
22	140	200	200	280	280	401	10,9
24	167	237	237	323	323	476	13,0
26	194	278	278	389	389	556	15,3
28	225	321	321	449	449	642	17,7
30	257	368	368	514	514	735	20,3
32	291	417	417	583	583	833	23,1
34	328	468	468	655	655	937	26,1
36	366	523	523	732	732	1050	29,3
38	406	581	581	812	812	1160	32,6
40	448	640	640	896	896	1280	36,2
42	492	703	703	981	981	1400	39,9
44	538	769	769	1080	1080	1540	43,8
46	585	837	837	1170	1170	1680	47,8
48	635	908	908	1270	1270	1810	52,1
50	686	981	981	1370	1370	1960	56,5
52	739	1060	1060	1480	1480	2110	61,1
54	794	1140	1140	1590	1590	2270	66,2
56	851	1220	1220	1710	1710	2430	71,2
58	909	1290	1290	1810	1810	2600	76,4
60	969	1380	1380	1940	1940	2770	81,7
62	1030	1470	1470	2060	2060	2940	87,3
64	1100	1560	1560	2190	2190	3130	93,4
66	1160	1660	1660	2310	2310	3300	99,3
68	1230	1750	1750	2450	2450	3500	105,4
70	1290	1840	1840	2580	2580	3690	111,7
73	1390	1990	1990	2790	2790	3990	121,5
76	1500	2150	2150	3010	3010	4300	131,7
78	1580	2260	2260	3160	3160	4500	138,7
81	1690	2410	2410	3380	3380	4820	149,6
84	1800	2580	2580	3610	3610	5160	161,6
87	1920	2750	2750	3850	3850	5500	173,3
90	2050	2920	2920	4090	4090	5840	185,5
92	2130	3040	3040	4260	4260	6080	194,2
95	2260	3230	3230	4510	4510	6440	207,1
97	2340	3340	3340	4680	4680	6690	215,9
100	2470	3530	3530	4940	4940	7060	229,5
102	2560	3660	3660	5120	5120	7320	238,8
105	2700	3850	3850	5390	5390	7700	253,6
107	2790	3980	3980	5570	5570	7960	263,3
111	2970	4250	4250	5940	5940	8480	283,4
114	3110	4440	4440	6230	6230	8890	298,9
117	3260	4650	4650	6510	6510	9300	315,5
120	3400	4850	4850	6810	6810	9720	331,9
122	3500	5000	5000	7000	7000	9990	343,1

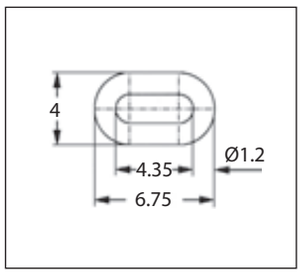
Components



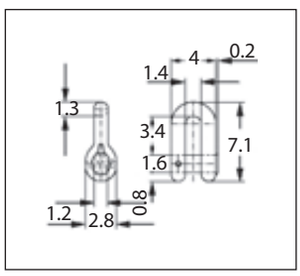
01 Common link



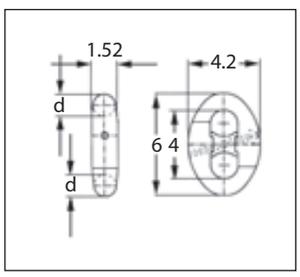
02 Enlarged link



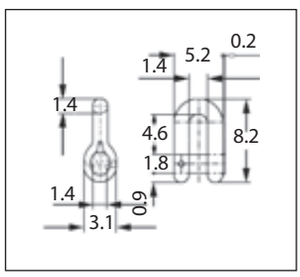
03 Studless end link



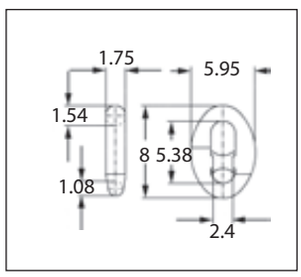
04 'D' type joining shackle



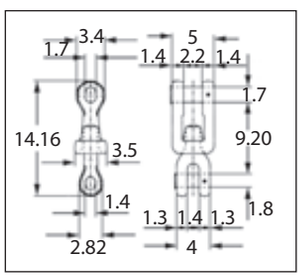
05 'Kenter' type joining shackle



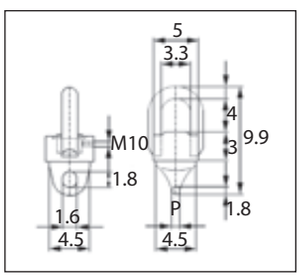
06 'D' type anchor shackle



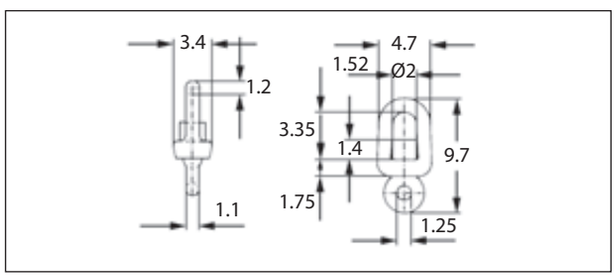
07 'Kenter' type anchor shackle



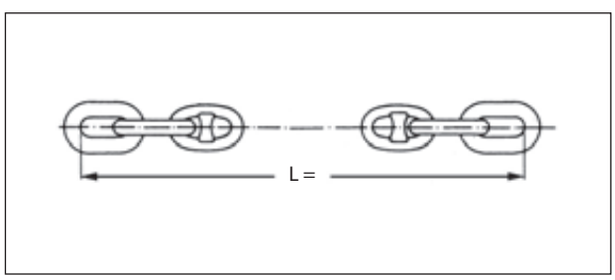
08 Jaw/Jaw swivel



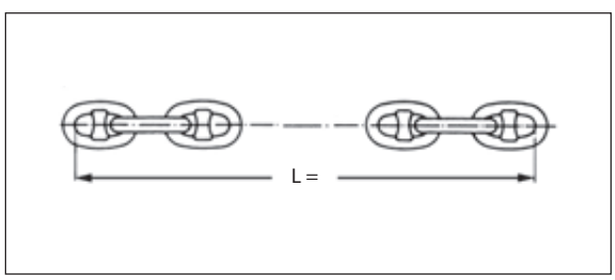
09 Special swivel



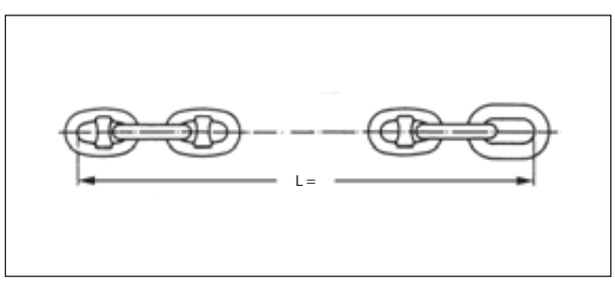
10 Swivel



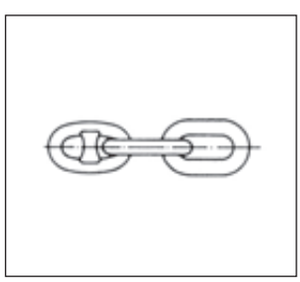
11 Length: Both ends stud link and studless end link



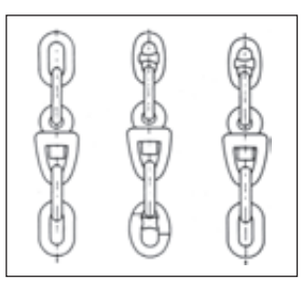
12 Length: Ordinary stud links only



13 Length: One enlarged stud link and studless end link



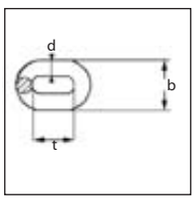
14 Length: Triple link



15 Swivel forerunner

Figures shown indicate ratio to nominal chain diameter. The actual measurement is derived by multiplying ratio with nominal diameter. Normal impregnation: tar-coated.

Established ...
Traditional standard type chains, grade 30 zinc plated, multi-purpose. Not recommended as sling chain for lifting loads, or when high breaking strength required.

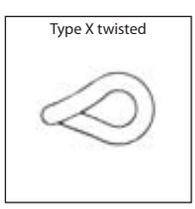


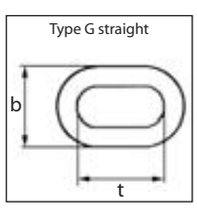
Round link chain

DIN 766 short link grade 30

Nominal chain dia. d	Working Load Limit (WLL)	Proof Force	Minimum Breaking Force	Weight	Measurements	
					b	t
mm	kg	min. kN	kN	~ kg/m	mm	mm
4	200	5	8	0,32	13,6	16
5	320	8	12,5	0,50	17,0	18,5
6	400	10	16	0,80	20,4	18,5
7	630	16	25	1,1	23,8	22
8	800	20	32	1,4	27,2	24
9	1000	25	40	1,8	30,6	27
10	1250	32	50	2,3	36	28
11	1600	40	63	2,7	40	31
13	2000	50	80	3,9	47	36
14	2500	63	100	4,4	50	41
16	3200	80	125	5,8	58	45
18	4000	100	160	7,4	65	50
20	5000	125	200	9,0	72	56
23	6300	160	250	12	83	64
26	8000	200	320	15	94	73
28	10000	250	400	18	101	78
30	11200	280	450	20	108	84
32	12500	320	500	23	115	90
36	16000	400	630	29	130	101
40	20000	500	800	35	144	112
42	22400	560	900	40	151	118

These chain types in similar construction and same grade are available in corrosion-resistant stainless steel (AISA 316) with identical weight, WLL and breaking strengths.

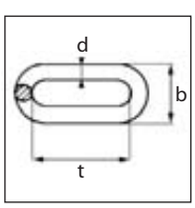




Round link chain

DIN 5685 (no particular safety requirements)

Nominal chain dia.	Breaking Force	Weight	Deformation limit	Measure-ments		Common name of link
				b	t	
mm	~kN	~ kg/m	~kN	mm	mm	
2	1,3	0,07	0,50	8	12	A short
		0,06			22	C long
2,5	2,0	0,11	0,75	10	14	A short
		0,10			24	C long
3	2,8	0,17	1,1	12	16	A short
		0,15			26	C long
3,5	3,9	0,23	1,5	14	18	A short
		0,20			28	C long
4	5,0	0,30	2,0	16	19	A short
		0,27			32	C long
4,5	6,3	0,40	2,5	18	20	A short
		0,35			34	C long
5	7,8	0,50	3,2	20	21	A short
		0,43			35	C long



Round link chain

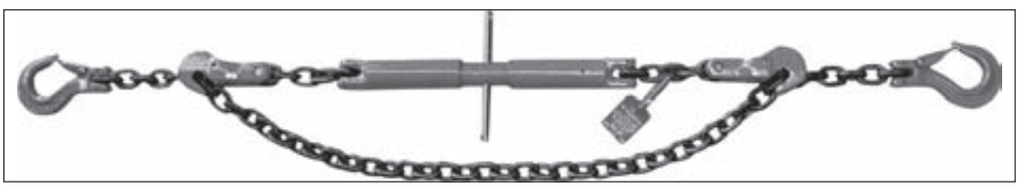
DIN 763 long link grade 30

Nominal chain dia. d	Working Load Limit (WLL)	Proof Force	Mininmum Breaking Force	Weight	Measurements	
					b	t
mm	kg	min. kN	kN	~ kg/m	mm	mm
4	100	2,5	6,3	0,27	16	32
5	160	4	10	0,43	20	35
6	200	5	12,5	0,63	24	42
7	300	7,5	19	0,86	28	49
8	400	10	25	1,1	32	52
10	630	16	40	1,8	40	65
13	1000	25	63	3	52	82
16	1600	40	100	4,5	64	100

These chain types in similar construction and same grade are available in corrosion-resistant stainless steel (AISA 316) with identical weight, WLL and breaking strengths.

Lashing on land ..., robust load restraint on road and rail

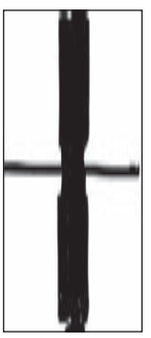
with CLASSIC type G8 combination. High lashing capacity, extremely wear resistant.
Patented shortening claw and ratchet tensioner allow fast length adjustment and securement.
Functional components guarantee absolute safety.



Combinations shown are standard configurations consisting of chain, coupling elements, shortening claws, shaft type tensioner and hooks at both ends.

Chain KL

Coupling link G



Shaft type tensioner GSP

Shortening clutch GKL

Sling hook with latch EGKN, both ends

MORE...

This is the short presentation of a product range. Details needed? Ask us. We provide all the information you need.

Lashing chain CLASSIC

Grade 80, GSP system
Complete with shaft type tensioner GSP with shortener (grab hook) GKL

Nominal Size = Chain dia.	Lashing capacity (LC)		Minimum Breaking Force	Weight		Lengths		
				Standard-length	shorter/longer (+/-)	Standard (finished)	Tensioner shortening	Grab hook shortening
~mm	kN	tf	kN	kg	kg/m	mm	< mm	< mm
6	22	2,2	50	4	0,8	3500	90	2500
8	40	4	80	7,5	1,4	3500	140	2400
10	63	6,3	126	12,5	2,2	3500	240	2300
13	100	10	212	21,7	3,7	3500	270	2100

Alternative configuration:
Ratchet type tensioner instead of shaft type tensioner, clevis shackle or Berglok with oval link instead of hook, or to individual specification.

Clevis shackle GSA

Ratchet type tensioner RLS

Master link MF

CAUTION!

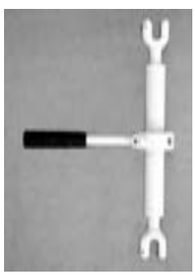
Important for users!
For load restraint within EU legislative area the following must be observed:

- Do not use long link chains
- Do not combine with textile lashing equipment
- All components must be same nominal size
- Protect against sharp edges
- When used as lifting sling WLL only ½ lashing capacity

Where applicable, refer to contents in usage guidelines for lashings and chain lifting slings.

Compact and robust ..., load restraint on road and rail

with G10 lashing chain combination from the GRABIQ range. Maximum lashing capacity combined with all the good features of the CLASSIC variant.



Ratchet type tensioner GSR

Shaft type tensioner GSP

Midgrab shortener MIG CC

Sling hook EGKN with latch

MORE...

This is just a brief presentation of a whole range of products. Details needed? Ask us. We provide all the information you need.

Lashing chain GRABIQ

Grade 10 GSP10 system
Complete with shaft type tensioner GSP with shortener (claw) MIG

Nominal Size = Chain dia.	Lashing capacity (LC)		Minimum Breaking Force	Weight		Lengths		
				Standard length	shorter/longer (+/-)	Standard (finished)	Tensioner shortening	Claw shortening
~mm	kN	tf	kN	kg	kg/m	mm	< mm	< mm
8	50	5	100	4	1,7	3500	120	2600
10	80	8	160	7,5	2,6	3500	220	2500
13	130	13	260	12,5	4,5	3500	270	2400

For 'Lashing chains in service' the same content is generally applicable as in 'Lifting belts in service', supplemented by 'Chain lifting slings in service'.

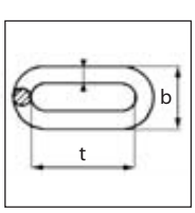
... or lashing on board: Load restraint at sea

Quick and easy to handle. Long link chains grade 8, high tensile strength with standard fittings.

Chain G8 semilong link

Hoist hook E

Hoist hook P



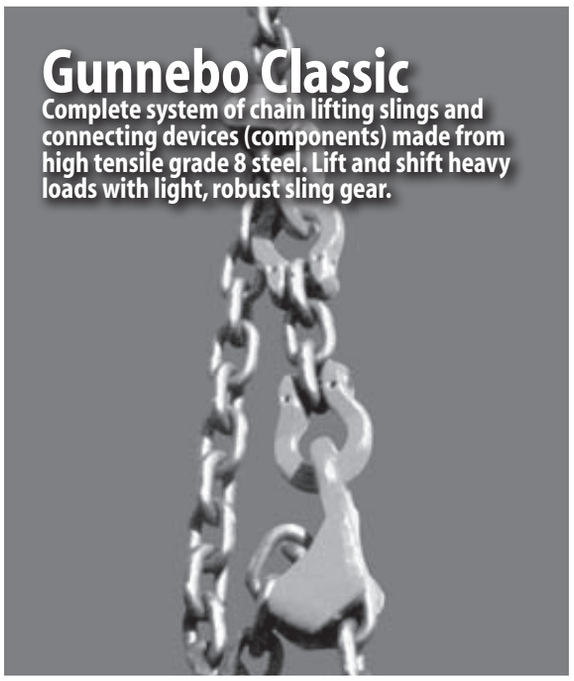
Elephant foot

Tension Lever

Round steel chain HL grade 8

Semilong for cargo lashing

Nominal Size = Chain dia.	Lashing capacity (LC)	Breaking Force	Weight	Measurements	
				b	t
	kN	kN	~ kg/m	mm	mm
6	20	45	0,80	22	35
9	50	102	1,1	33	53
11	75	154	1,4	40	64
13	100	214	2,2	48	80



Easy
Ready-to-assemble chain lifting slings, no problem for user.

Variable
Selection of reliable chain shorteners.

Versatile
Combination possibilities from a wide range of components.

Unmistakable
Categorization of chain and components within each chain diameter, unmistakable identification owing to BERGLOK chain connector.

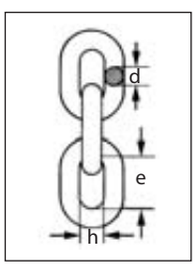
Flexible
Combinable with fibre lifting slings or ropes.

Accident safe
All components proof loaded to 2.5x WLL after manufacture.

Round steel chain KL grade 80

Short link for chain lifting slings CLASSIC

Nominal Size = Nominal chain dia. d	Working Load Limit (WLL)	Proof Force	Minimum Breaking Force	Weight	Measurements e	Measurements h
mm	t	kN	min. kN	~ kg/m	mm	mm
6	1,1	28,3	43,9	0,80	18	7,8
7	1,5	38,5	61,6	1,1	21	9,1
8	2	50,3	80,4	1,4	24	10,4
10	3,2	78,5	126	2,2	30	13,0
13	5,3	133	212	3,7	39	16,9
16	8	201	322	5,6	48	20,8
18	10	254	407	7,3	54	23,4
19	11	284	454	7,8	57	24,7
20	13	314	503	9,0	60	26,0
22	15	380	608	11	66	28,6
26	21	531	849	15	78	33,8
32	32	804	1290	23	96	41,6



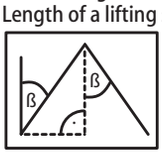
Rules and standards...

Even if not specifically indicated: Compliance with standards (ISO, EN, DIN) and rules; state of the art technical product properties.

MORE...

This is just a brief presentation of a whole range of products. Details needed? Ask us. We provide all the information you need.

1t = 1000kg (t = metric ton).
Length of a lifting sling is the usable length when ready for service. It is measured between the bearing points of sling ends/terminations.



The tilt angle ß is the largest angle between legs and vertical line. To determine working load limit of sling operation: Multiply applicable mode factor (see table <Lift methods> below) with the WLL value (single leg direct) from the above table. Adapt the mode factors as appropriate for asymmetrical loads.

Lift Methods

Single Leg		Double Leg				Three- and Fourleg		Endless	
straight	choke	straight	choke	straight	choke	straight	straight	double straight	choke
		ß = 0-45°	ß = 0-45°	ß = 45-60°	ß = 45-60°	ß = 0-45°	ß = 45-60°		
									
Mode Factors:									
1	**0,8**	**1,4**	**1,12**	**1**	**0,8**	**2,1**	**1,5**	**4**	**1,6**

Unmistakable

Categorisation of chain and fittings within each chain diameter, unmistakable identification owing to BERGLOK chain connector.

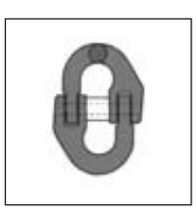
System

Components

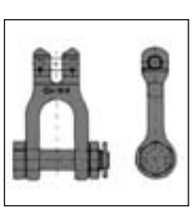
Master link MF
Nominal chain dia.
6 to 22mm (1-leg)
6 to 20mm (2-leg)
WLL 1,25 to 25 t

Master link MTC
Nominal chain dia.
6 to 22mm
(3 and 4-leg)
WLL 2,36 to 31,5 t

Berglok chain coupler BL
Nominal chain dia.
6 to 19mm
WLL 1,12 to 11,2 t

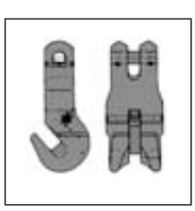


Coupling link G
Nominal chain dia.
6 to 32mm
WLL 1,12 to 31,5 t



Clevis shackle GSA
Nominal chain dia.
7/8 to 16mm
WLL 2 to 8 t

Grab hook GG
Nominal chain dia.
7/8 to 19/20mm
WLL 2 to 12,5 t

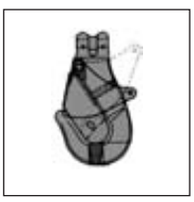


Shortening clutch GKL
Nominal chain dia.
6 to 16mm
WLL 1,12 to 8 t

Swivel latch hook LKN
with swivel
and safety latch
Nominal chain dia.
7/8 to 16mm
WLL 2 to 8 t

Foundry hook OKE
Nominal chain dia.
7/8 to 18/20mm
WLL 2 to 12,5 t

Details on unlabelled components in the chapter 'Rope and chain fittings' or in special catalogue.



Nominal size of components corresponds to nominal diameter of respective chain in mm. Component types shown only a selection.

Previously grade 80...

Lighter
WLL 25% higher than grade 8 allows usage of smaller chains.

Faster
Number of components reduced to minimum. Variable adjustment, easy to shorten and combine.

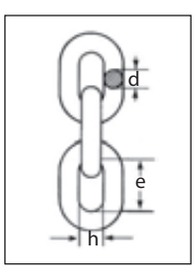
Safer
Extended identification details for more safety.

Now GrabiQ...

...same performance, less effort

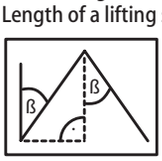
Round steel chain KL grade 10

Short link for chain lifting slings GrabiQ



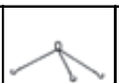
Nominal Size = Nominal chain dia. d	Working Load Limit (WLL)	Proof Force	Minimum Breaking Force	Weight	Measurements	
					e	h
mm	t	kN	kN	~ kg/m	mm	mm
6	1,4	37,5	60	1,0	18	8
8	2,5	62,5	100	1,7	24	11
10	4	100	160	2,6	30	14
13	6,7	168	260	4,5	39	18
16	10	250	400	6,5	48	22
20	16	416	672	9,1	60	29

1t = 1000kg (t = metric ton).
Length of a lifting sling is the usable length when ready for service. It is measured between the bearing points of sling ends/terminations.



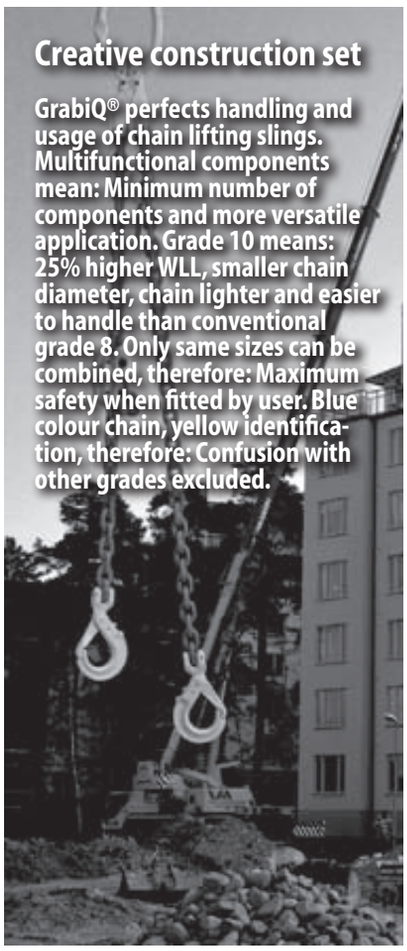
The tilt angle ß is the largest angle between legs and vertical line. To determine working load limit of sling operation: Multiply applicable mode factor (see table <Lift methods> below) with the WLL value (single leg direct) from the above table. Adapt the mode factors as appropriate for asymmetrical loads.

Lift Methods

Single Leg		Double Leg				Three- and Fourleg		Endless	
straight	choke	straight	choke	straight	choke	straight	straight	double straight	choke
		ß = 0-45°	ß = 0-45°	ß = 45-60°	ß = 45-60°	ß = 0-45°	ß = 45-60°		
									

Mode Factors:

1	**0,8**	**1,4**	**1,12**	**1**	**0,8**	**2,1**	**1,5**	**4**	**1,6**



Components

Master link MF
for 1- bis 4-leg
Nomial chain dia.
6 to 16mm
WLL 2,5 to 25 t

Master Grab MG
for 1-leg
chain lifting slings
WLL 1,5 to 10 t

Master Grab Duo MGD
for 2-leg
chain lifting slings
WLL 2,1 to 14 t

Master link assembly TL1
1-leg without
shortening device
Nominal chain dia.
6 to 16mm
WLL 1,5 to 10 t

Master link assembly TL2
2-leg without
shortening device
Nominal chain dia.
6 to 16mm
WLL 2,1 to 14 t

Master link assembly TL3
3-leg without
shortening device
Nominal chain dia.
6 to 16mm
WLL 3,15 to 21 t

Master link assembly TL4
3-leg without
shortening device
Nominal chain dia.
6 to 16mm
WLL 3,15 to 21 t

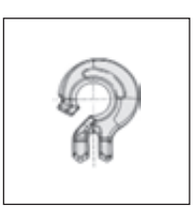
C-Lok Duo CLD
WLL 2,1 to 14 t

Master link TG 1
1-leg with shortening
device
Nominal chain dia.
6 to 20mm
WLL 1,5 to 16 t

Master link TG 2
2-leg with shortening
device
Nominal chain dia.
6 to 20mm
WLL 2,1 to 22,4 t

Master link TG 3
3-leg with shortening
device
Nominal chain dia.
6 to 20mm
WLL 3,1 to 33,6 t

Master link TG 4
4-leg with shortening
device
Nominal chain dia.
6 to 20mm
WLL 3,1 to 33,6 t



C-Grab CG
WLL 1,5 to 10 t

C-Grab Duo CGD
WLL 2,1 to 14 t

Safety hook BKG
WLL 1,5 to 10 t

Safety hook EGKN
WLL 1,5 to 10 t

C-Lok CL
for 2-leg
chain lifting slings
WLL 1,5 to 10 t

MORE...

This is just a brief presentation of a whole range of products. Details needed? Ask us. We provide all the information you need.

Usage guidelines

Chain lifting slings in service

Chain lifting slings may only be used for lifting, transporting and lowering loads. They are a component of the hoisting gear representing the connection between the lifting gear hook and the load to be lifted.

Before using under specific ambient influences (chemicals, weather conditions, etc.) it is recommended to seek advice from the supplier or a competent person.

Working load limit

A chain sling must never be required to lift a load exceeding its indicated permissible working load limit, taking also into consideration the tilt angle. Indicated working load limits are valid without limitation for temperatures from -40° to 200°C. The working load limit drops by 10% in the temperature range between 200° and 300°C and by 25% from 300° to 400°C. Service outside this temperature range is not permissible.

The working load limit is a function of nominal chain diameter, number of legs, tilt angle and type of fitting, assuming symmetry of load. Asymmetrical strain and centre of gravity shifts, i.e. working load limit reduction, can be compensated either by shortening the chain or by increasing nominal chain diameter. Where necessary, the appropriate standards or regulations or a competent person should be consulted.

Marking

Marking must contain manufacturer's identification mark, measurements, material, working load limit (in consideration of tilt angle for multileg lifting procedures), date of manufacture and tracing code, to the extent that local regulations do not require further details.

Storage and maintenance

Before and during storage of chains

- Dry, clean and lightly grease
- Dry environment, normal temperatures (protect from heat and chemical influences)
- Storage on stands (protection from dirt)

Inspection

Before first and every subsequent use chain lifting slings should be carefully inspected for visible signs of damage and imperfections affecting safe usage. User information/instructions must be read and observed. Chain lifting slings in service must be regularly checked and examined by a competent person, at least once every year, more often if used under harsher service conditions. Every three years at most chain lifting slings must be subjected to a crack detection test or proof loading with subsequent visual check. The crack detection test must be conducted by a competent person.

Precautions

- Chain shortening is only permissible using shortening claws or clutches. Chains must not be knotted.
- A sling chain with damaged components must not be used.
- Hoist hooks must not bear the load stress on the sides, at the rear or on the hook tip, but only in the hook hollow. Master links must move freely in the hook. Avoid hook contact with sharp edges.
- Grade 8 chains and sling gear must avoid contact with acids or other aggressive chemicals. In case of doubt consult supplier. Direct service in galvanizing plants is forbidden.
- Persons assembling high strength grade 8 and special class 10 chain lifting slings must be authorised to do so and have the appropriate knowledge. The special assembly and marking instructions must be observed.
- Chains and components of different grades must not be assembled together.
- False assembly or handling of chain lifting slings can lead to material and human damage with lethal consequences.

Removal from service

Discard in the event of:

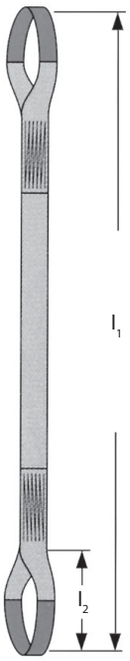
- Mechanical damage such as dented links, cracks or notches in links
- Deformed master links, bent hooks or other damaged components
- If stretched more than 5 %
- More than 10 % reduction of nominal chain diameter
- Damage to safety latches
- Fittings and components:
  Usage prohibited if mechanical damage, i.e. compressed areas, notches or cracks, bends, twists, damage to safety mechanisms, as well as 5% and more cross sectional reduction in eyes, bolts and bows on shackles and hooks

It is forbidden to repair high strength grade 8 components by welding. For repair of chain lifting slings and components only original replacement parts of corresponding measurements may be used.

General

These usage guidelines are based on existing European recommendations and standards. Further to these, consideration should also be taken of applicable local, national and international legislation, standards, directives and regulations from official societies (professional organisations, classification bodies, etc.) with regard to equipment safety (personal protection, industrial safety, accident prevention), as well as recommendations and operating instructions from manufacturers and/or operators of the equipment being used (lifting gear, conveyor systems, etc.).

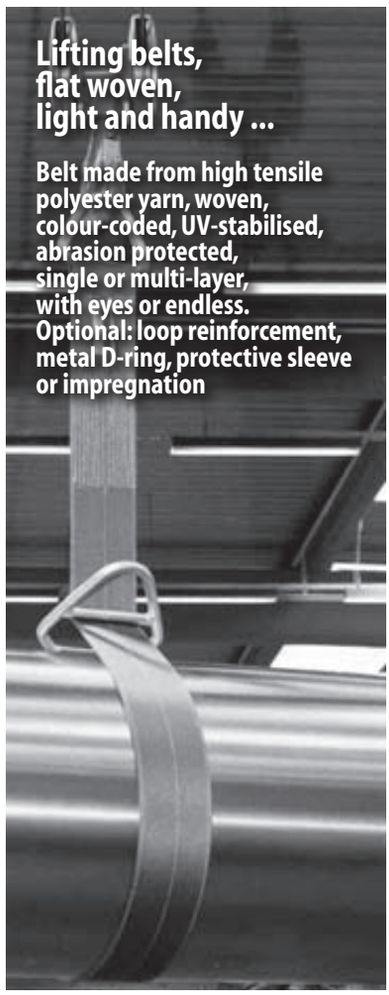
In case of doubt about the technical properties of chains and components, their suitability for the envisaged tasks or safety requirements, consult manufacturer or supplier.



Lifting belt sling SH 2 type

Code SEL-1286, Polyester with loops, Double-belt

Nominal Size	Working Load Limit (WLL)	Weight		Width of belt	Colour	Length of Loop l_2
		Length 2m	+/- add'l Length			
	t	~ kg/ea	~ kg/m	~ mm		~ mm
1000	1	0,4	0,16	30	violet	200
2000	2	0,8	0,38	60	green	200
3000	3	1,5	0,66	90	yellow	300
4000	4	2	0,88	120	grey	400
5000	5	2,2	0,96	150	red	500
6000	6	3,9	1,5	180	brown	600
8000	8	5,4	1,85	240	blue	800

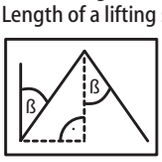


Lifting belt sling SH 1 type

Code SEL-1286, Polyester with loops, Single-belt

Nominal Size	Working Load Limit (WLL)	Weight		Width of belt	Colour	Length of Loop l_2
		Length 2m	+/- add'l Length			
	t	~ kg/ea	~ kg/m	~ mm		~ mm
500	0,5	0,3	0,08	30	violet	200
1000	1	0,6	0,19	60	green	200
1500	1,5	1,1	0,33	90	yellow	300
2000	2	1,6	0,44	120	grey	400
2500	2,5	1,8	0,48	150	red	500
3000	3	3,3	0,75	180	brown	600
4000	4	4,7	0,92	240	blue	800

1t = 1000kg (t = metric ton).
Length of a lifting sling is the usable length when ready for service. It is measured between the bearing points of sling ends/terminations.

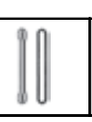
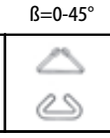
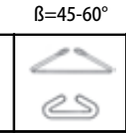
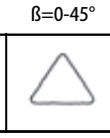
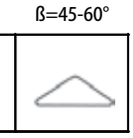


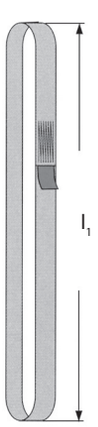
The tilt angle ß is the largest angle between legs and vertical line. To determine working load limit of sling operation: Multiply applicable mode factor (see table <Lift methods> below) with the WLL value (single leg direct) from the above table. Adapt the mode factors as appropriate for asymmetrical loads.

Rules and standards...

Even if not specifically indicated: Compliance with standards (ISO, EN, DIN) and rules; state of the art technical product properties.

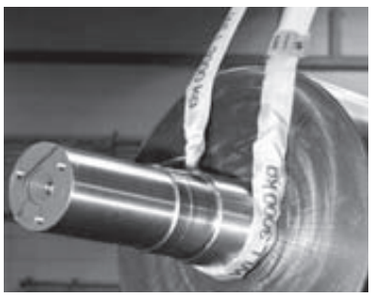
Lift Methods

Single Leg Eyes/Double Leg Endless					Single Leg Endless	
straight	choke	basket	basket ß=0-45°	basket ß=45-60°	basket ß=0-45°	basket ß=45-60°
						
Mode Factors:						
1	0,8	2	1,4	1	0,7	0,5



SB Lifting belt
Lifting belt, endless, Type SB1 single belt or SB2 double belt raises WLL in above tables by factor two. Observe mode factors as appropriate.

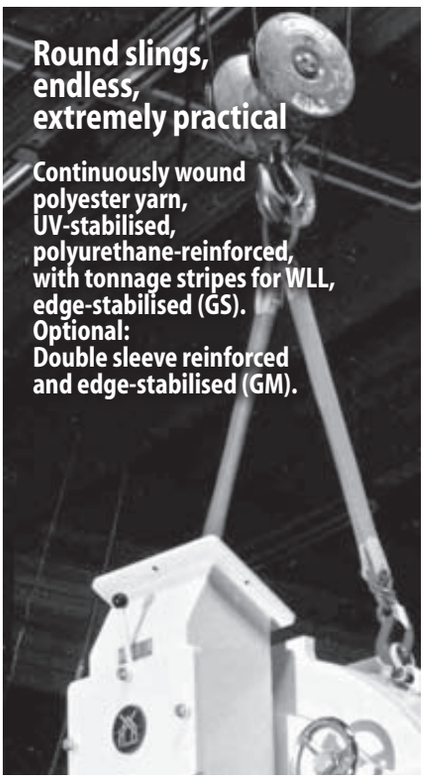
The length of a lifting sling is measured from bearing to bearing of terminations.

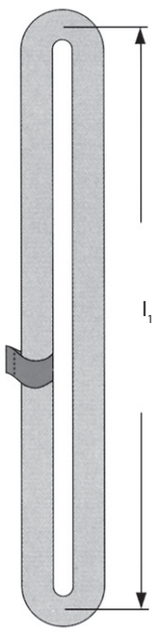


Lifting round sling GM type

Code SEL-1742, Polyester endless

Nominal Size	Working Load Limit (WLL)	Weight	Colour	Width of Surface Contact
	t	~ kg/m		~ mm
1000	1	0,26	violet	40
2000	2	0,47	green	50
3000	3	0,70	yellow	65
4000	4	0,82	grey	70
5000	5	1,1	red	75
6000	6	1,2	brown	80
8000	8	1,7	blue	100
10000	10	2,1	orange	120
15000	15	4,3	orange	155
20000	20	5,7	orange	170
25000	25	7,3	orange	200





Lifting round sling GS type

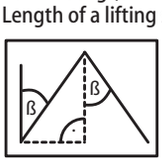
Code SEL-1742, Polyester endless

Nominal Size	Working Load Limit (WLL)	Weight	Colour	Width of Surface Contact
	t	~ kg/m		~ mm
500	0,5		orange	30
1000	1	0,26	violet	35
1500	1,5	0,35	darkgreen	40
2000	2	0,47	green	45
3000	3	0,70	yellow	55
4000	4	0,82	grey	60
5000	5	1,1	red	70
7000	8	1,5	blue	90
9000	9	2,0	darkgrey	115

MORE ...

Anything missing? Some important information or a similar product, a different size or a solution for your special needs? Ask us. We are pleased to advise.

1t = 1000kg (t = metric ton).
Length of a lifting sling is the usable length when ready for service. It is measured between the bearing points of sling ends/terminations.



The tilt angle ß is the largest angle between legs and vertical line. To determine working load limit of sling operation: Multiply applicable mode factor (see table <Lift methods> below) with the WLL value (single leg direct) from the above table. Adapt the mode factors as appropriate for asymmetrical loads.

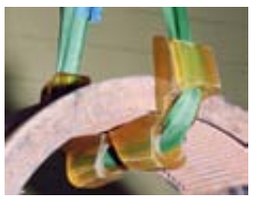
Lift Methods

Single leg endless							Double leg endless	
straight	choke	basket	basket ß=0-45°	basket ß=45-60°	basket ß=0-45°	basket ß=45-60°	straight ß=0-45°	straight ß=45-60°
								
Mode Factors:								
1	**0,8**	**2**	**1,4**	**1**	**0,7**	**0,5**	**1,4**	**1**

The length of a lifting sling is measured from bearing to bearing of terminations.

Protect and connect ...

A selection of how lifting belts and round slings can be protected from damage, stabilised at the ends, connected to lifting gear or combined with chains and ropes.



Edge protector
KW
angle 90°

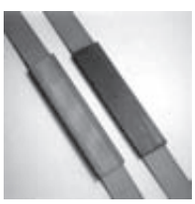
Sling hook RH
Perfect attachment to lifting belts or round slings
Adapted to WLL classes
Optimal surface contact
Optimal abrasion protection on contact area
No intermediate connector required
Perfect combination of textile slings and GRABIQ chain system
Colour-coded WLL marking, therefore unmistakeable

Connector
SKR round sling connector

Belt coating
GPU 1
one side PU-coated
GPU 2
both sides PU-coated

End-fittings
SD 1
plain D-ring
SD 2
choke D-ring

Edge protector/round hose
KP plate
RPES PES woven

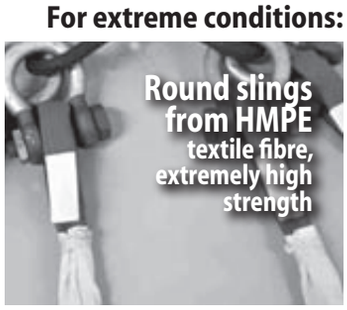


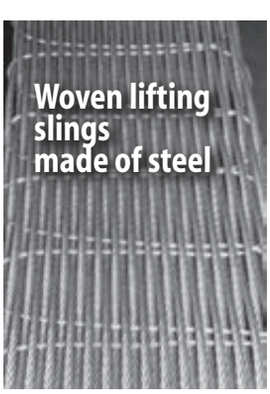
Flat hose PU
FPU 1 one side
FPU 2 both sides

MORE ...

**Anything missing? Some important information or a similar product, a different size or a solution for your special needs?
Ask us. We are pleased to advise.**

For extreme conditions:





Usage guidelines

Service
Lifting slings (lifting belts, round slings) may only be used to lift loads, and only under supervision of a competent person in accordance with established safety regulations and in consideration of prevailing operating conditions. Selection should be made with respect to the intended service application, working environment and type of load.

Working load limit
The working load limit is the maximum weight the lifting sling is safe to lift. It is derived from the minimum breaking load of the sling divided by the design factor (safety factor, normally 7), multiplied by the mode factor, this being dependent, amongst others, on the tilt angle (maximum 60°) for multileg or endless slings. Where the load symmetry (even load distribution, central point of gravity) is not guaranteed for multileg lifting procedures, two legs maximum must be assumed as load bearing, based on the widest tilt angle, and this applied to all legs.

Dimensioning
The length of a lifting sling is the distance between the suspension points including end fittings. The aperture angle of loops must not exceed 20°. Minimum eye length no less than 3.5 times the highest thickness of the hook to be attached.

Marking
Lifting slings must be permanently marked with manufacturer's sign, measurements, material, working load limit, date of manufacture and tracking code, to the extent that local regulations require no further details. Material colour codes are as follows: green for polyamide, blue for polyester, brown for polypropylene and white for all natural fibres.

Storage and maintenance
Before and during storage

- Examine for damage; damaged lifting slings should not be placed in storage.
- Clean soiled lifting slings with water; use chemical detergents only if recommended by manufacturer or supplier.
- Keep lifting slings in storage away from dirt (e.g. by storing on shelves), extreme heat, moisture, chemicals, corrosive surfaces, UV rays and poorly ventilated areas.

Repairs must only be performed by a competent person.

Inspection
Before first and every subsequent use lifting slings should be carefully inspected for visible signs of damage and conformity between marked specifications and properties required. Lifting slings must be examined by a competent person at least once a year. In case of any damage or deformation to sling material or fittings they must be removed from service.

Precautions

- Do not use lifting slings with illegible or absent markings.
- The load to be lifted must be free to move; avoid swinging, tilting or dropping load through choice of suitable fastening, trial lift or repositioning of lifting points, use of guide ropes, spreaders or beams, avoid sudden or jerky movements.
- Do not pull unprotected lifting over sharp edges or rough surfaces.
- If necessary use edge or abrasion protectors.
- Use flat belts in choke mode only with reinforced end loops.
- Avoid bending flat belt along or across seams.
- Avoid sudden and jerky movements.
- Avoid heat contact.
- Working load limit reduction through
  - non-symmetrical (uneven) load distribution
  - use in choke mode
  - outside working temperature -40° to +80° (polypropylene) or -40° to +100° (other materials).
- Pay attention to sensitivities dependent on materials:
  - polyamide and mineral acids
  - polyester and alkalis
  - polypropylene and some organic solvents, acids and alkalis, light (if not UV stabilised)
  - in particular polypropylene and chafing.
- Repair of lifting slings by manufacturer only.

Removal from service
Discard in the event of:

- Chafe marks on the sling surface (caution: bald patches indicate melted yarn).
- Lateral or longitudinal cuts if more than 10% of the flat sling cross section affected.
- Cuts or chafe marks on the web edges, meshes or loops.
- Damaged or deformed fittings.
- Damage caused by chemicals.
- Damaged sheathing on round slings.
- Doubts about the sound condition of the core in round slings.
- Damaged load bearing seams in flat belts.
- After service period of approx. five years as precautionary measure.

General
These usage guidelines are based on existing European recommendations and standards. Further to these, consideration should also be taken of applicable local, national and international legislation, standards, directives and regulations from official societies (professional organisations, classification bodies, etc.) with regard to equipment safety (personal protection, industrial safety, accident prevention), as well as recommendations and operating instructions from manufacturers and/or operators of the equipment being used (lifting gear, conveyor systems, etc.).

In case of doubt about the technical properties of slings and components, their suitability for the envisaged tasks or safety requirements, consult manufacturer or supplier


1 2
Cam buckle


3
Ratchet


4
Ratchet


7 8
Ratchet


10 11
Ratchet

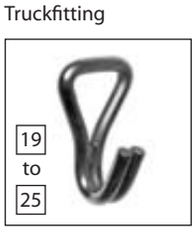

13a
Ratchet


14
Truckfitting

End fittings, tensioning devices, a few examples ..., standard components to attach and tension lashing belts.

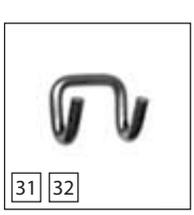

16
Pallet hook


18
Pallet hook

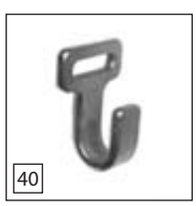

19 to 25
Pallet hook

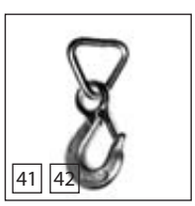

27
Flat hook


29
Ratchet hook

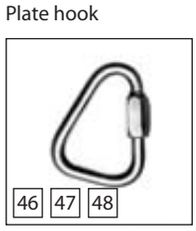

31 32
Claw hook

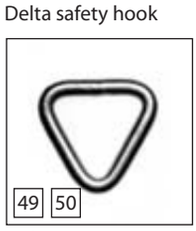

36
Truckfitting


40
Plate hook


41 42
Delta safety hook


43 44
Safety hook

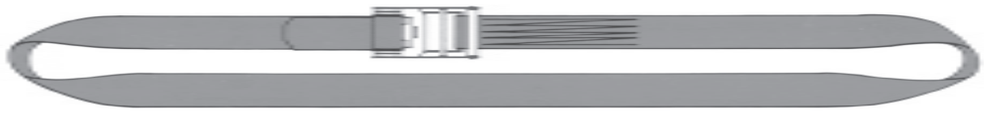

46 47 48
Cap nut triangle


49 50
Delta ring


51 52
Belt connector


53
RS-type coupling


55
Flash mounted lashing eye



Lashing belt single part

With ratchet, Endless strapping,
Orange coloured webbing

Type Size	Lashing Capacity (LC)	Minimum Breaking Force	Width of belt	Application	Fittings
	daN	daN	mm		
SZ 50-1	500	1000	25	Light duty transports	[3]
SZ 101-1	1000	2000	25	Light, large volume cargo	[4]
SZ 201-1	2000	4000	35	Medium duty cargo	[5]
SZ 400-1	4000	8000	50	Heavy duty cargo	[9]
SZ 500-1	5000	10000	50	Heavy duty cargo	[11]
SZS 1000-1A	10000	20000	75	Extra heavy duty cargo	[12]

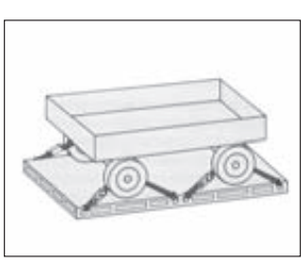
Lashing belt double part

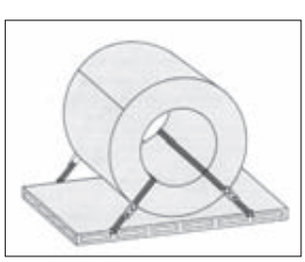
With ratchet and end fittings
Orange coloured webbing

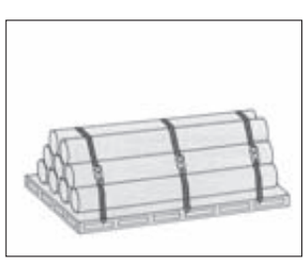
Type Size	Lashing Capacity (LC)	Minimum Breaking Force	Width of belt	Application	Fittings
	daN	daN	mm		
SZ 51-2	500	1000	25	Light, very large volume cargo	[4][22]
SZ 101-2	1000	2000	35	Medium duty cargo	[5][23]
SZ 125-2	1250	2500	50	Medium duty cargo	[8][24]
SZ 200-2	2000	4000	50	Heavy duty cargo	[9][24]
SZ 250-2	2500	5000	50	Heavy duty cargo	[24]
SZ 500-2	5000	10000	75	Extra heavy duty cargo	[25]

Key for lashing belt end fittings on previous page.

CAUTION! Lashing belts must not be used for lifting loads.

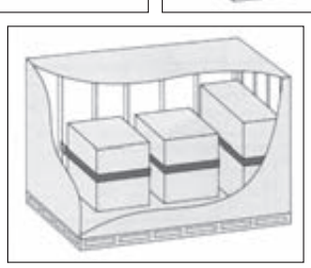


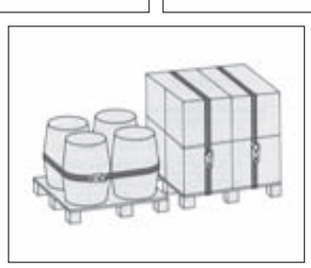




MORE...

**Extreme usage conditions require special solutions: edge protectors, anti-abrasion sleeves or coatings, special end fitting components or special connecting devices, possibly in stainless steel.
We are pleased to advise.**





Usage guidelines

Lashing belts in service

Lashing belts may only be used for securing loads, never for lifting them, and only under supervision of a competent person in accordance with established safety regulations and in consideration of prevailing operating conditions. Selection should be made with respect to the intended application, working environment and type of load, based on established regulations for calculation. For reasons of stability at least two belts are required for lashing down, four for diagonal lashing. The number and size of lashing belts to be used, and the tilt angle, depend on the vehicle (type and size of loading area, number and strength of available lashing points or rails). Stability of the vehicle body, driving speed, acceleration and braking, road curves on route, as well as composition of load items (size, weight, centre of gravity, surface condition of the loading area) form a combination of influencing factors, therefore represent forces to be considered when lashing (mass weight, centrifugal, inertia and friction). Transportation of heavy, large volume loads requires precise calculation of physical forces, and the lashing capacity to cope (securement force, possibly pretensioning force), in association with the necessary lashing method (interlocking diagonal, inclined, horizontal lashing or vertical tiedown lashing). For assistance here refer to existing standards and recommendations published by official safety institutions and the use of further items to support load stability such as boards, scantling and wedges, nets and coverings, slip-proof mats and padding.

Components

Any end fittings used must be adequate for the lashing belt used. Flat hooks must lie flat with the entire hook base width. Pointed hooks must not sit on the tip.

Marking

Lashing belts must be permanently marked with the manufacturer's sign, measurements, material, lashing capacity, year of manufacture, certification number and tracking code, to the extent that local regulations require no further details. Material colour codes are as follows: green for polyamide, blue for polyester, brown for polypropylene and white for all natural fibres.

Inspection

Before first and every subsequent use lashing belts should be carefully inspected for visual signs of damage and conformity between marked specifications and properties required. Any damage or deformation to belt material and/or fittings must lead to their removal from service. Lashing belts should be examined by a competent person at intervals in line with their frequency of usage.

Precautions

- Keep lashing belts away from intense sunlight, excessive heat, dirt, moisture and chemical influences when storing.
- Do not overload lashing belts. Observe lashing and pre-tensioning forces. Rule of thumb: pretensioning force = 50% of permissible lashing capacity for lashing down; ratchet hand tight for diagonal lashing.
- Do not use knotted lashing belts.
- Do not twist lashing belts.
- Connect end fittings correctly (exert no strain on hook tips, hang hooks without safety latch from outside to inside, contact area of flat hooks across total hook width).
- Do not use different lashing materials (e.g. chains with belts) with the same load due to likely differences in stretch behaviour.
- Lashing belts must be protected when used over edges and rough surfaces (use edge protectors and abrasion protection).
- Tensioning devices and end fittings must not rest over edges when under load.
- Lashing belts should only be released when certain that the load is standing securely and there is no danger from the load falling or rolling over. If required, apply lifting gear before releasing lashings.
- Avoid contact with heat
  Pay attention to sensitivity of lashing belt materials:
  - PA (polyamide) and mineral acids
  - PES (polyester) and alkalis
  - PP (polypropylene) and organic solvents, acids and alkalis, light (if not UV stabilised)
  - in particular PP (polypropylene) and chaffing.
- Chafe marks on belt surface (caution: bald patches indicate melted yarn).
- Caution! Lashing capacity reduction through
  - non-symmetrical (uneven) load
  - outside working temperature -40° to +80° (PP), 40° to +100° (PA), -40° to +120° (PES).
- Remove soiled belts immediately from service, rinse with cold water, dry in fresh air at normal temperature.
- Lashing belts must only be repaired by manufacturer and only if markings still visible.

Removal from service

Discard in the event of:

- Missing or incomplete marking
- Identification of tears, cuts, notches and breakages in load-bearing fibres and seams of the belt material
- Deformation caused by heat (frictional and radiant heat)
- Deformation, cracks, strong indication of wear and corrosion in the end fittings and tensioning devices
- Sustained damage after soiled condition in spite of cleaning

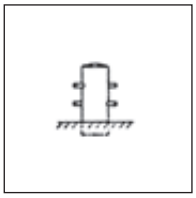
General

These usage guidelines are based on existing European recommendations and standards. Further to these, consideration should also be taken of applicable local, national and international legislation, standards, directives and regulations from official societies (professional organisations, classification bodies, etc.) with regard to equipment safety (personal protection, industrial safety, accident prevention), as well as recommendations and operating instructions from manufacturers and/or operators of the equipment being used (lifting gear, conveyor systems, etc.).

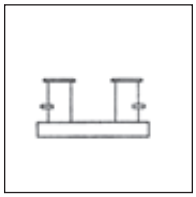
In case of doubt about the technical properties of belt material and components, their suitability for the envisaged tasks or safety requirements, consult manufacturer or supplier.

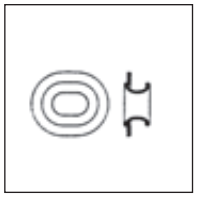
And more ...
All that goes with it

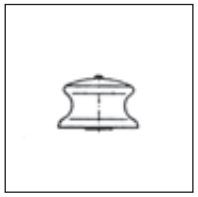
manufactures:
hawses, rollers, bollards,
or equivalent products.
More on the following pages.

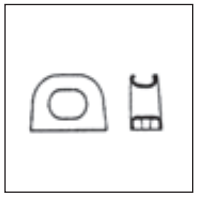


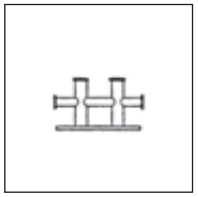
Steadiness ...
is no problem with sturdy deck equipment for mooring and towing ships safely and securely.







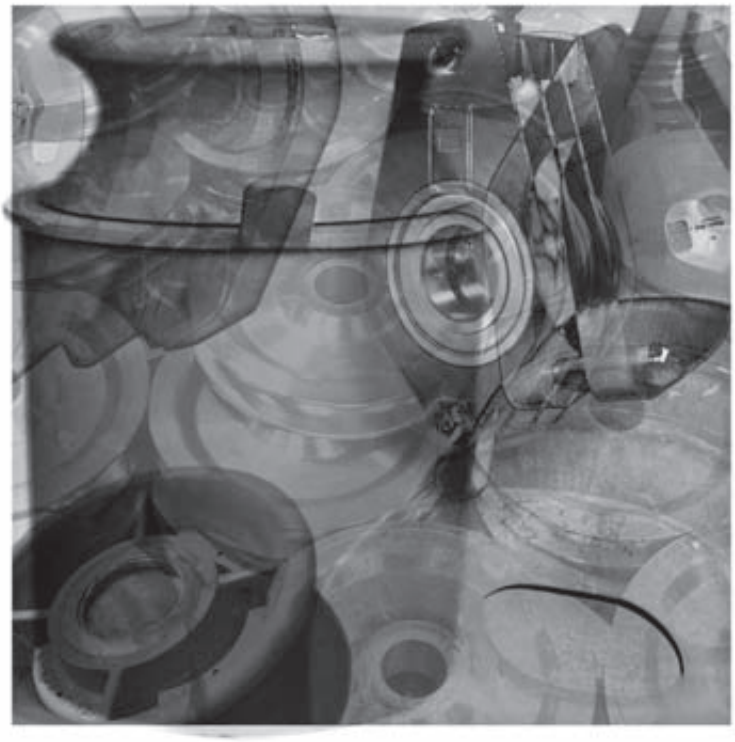




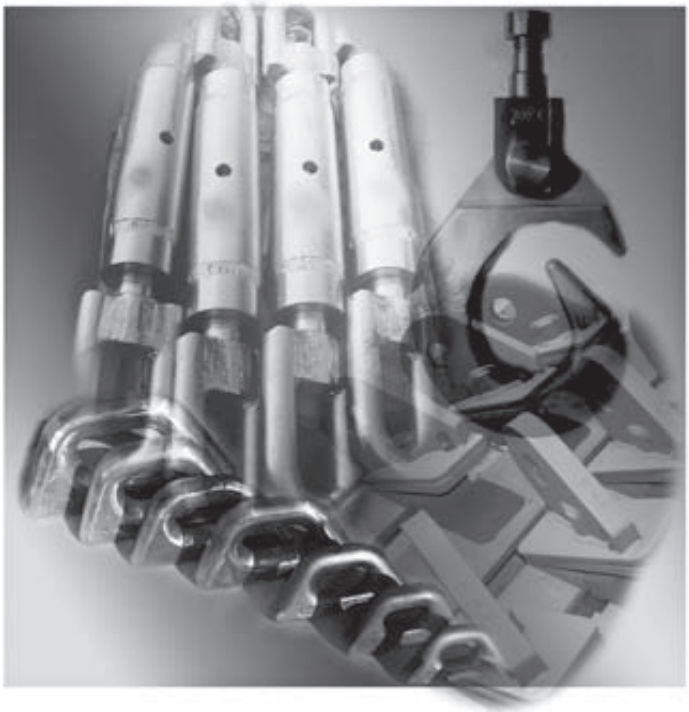
MORE...

This is just a brief presentation of a whole range of products. Details needed? Ask us. We provide all the information you need.

The products presented here are standard industrially produced series products. In certain cases the standard choice may not be suitable. HANSE METALL responds to such needs with fast, flexible solutions: Customised products also in small batches.



Wrong connection? ...
Not likely. HANSE METALL supplies the parts to keep things securely connected.



MORE...

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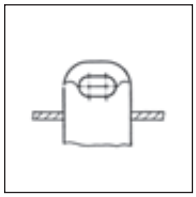
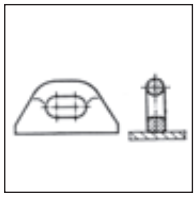
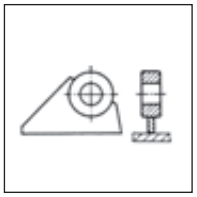
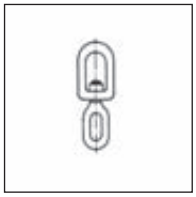
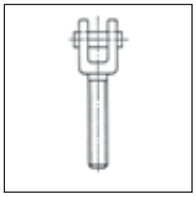
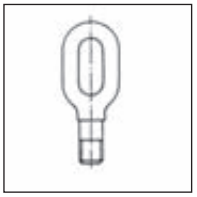


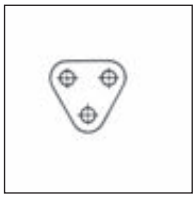


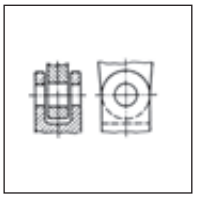
also makes:
eyeplates with stud or oval eyes, cargo hooks, ramshorn hooks, oval eyes, stud eyes or double lugs with shaft, triangular plates and more ...





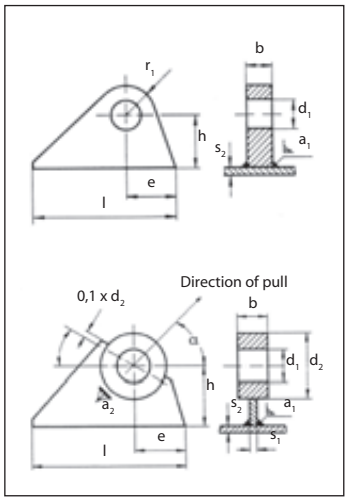


Stud eye plate

DIN 82024

Nom. Size	Perm. Load Capacity (PLC)	Measurements								
		b	d_1	d_2	e	h	l	r_1	s_1	min. s_2
	kN	mm	mm	mm	mm	mm	mm	mm	mm	mm
1	10	16	18	-	28	32	85	17,5	-	4
1,6	16	20	22	-	36	40	110	22,5	-	4
2	20	22	24	-	40	44	120	25	-	6
2,5	25	25	26	55	44	48	130	-	8	4
3	32	28	30	60	48	54	145	-	8	4
4	40	30	33	65	52	60	155	-	8	4
5	50	35	39	75	60	72	180	-	10	5
6	63	40	42	85	68	78	200	-	10	5
8	80	45	48	95	76	90	230	-	12	6
10	100	50	52	110	88	96	260	-	14	7
12	125	55	56	120	96	104	290	-	14	7
16	160	60	66	130	104	120	310	-	16	8
20	200	65	74	140	112	136	340	-	20	10

Material: St 37-2, ISO 630
Other sizes on request
For welding instructions please refer to standard



MORE...

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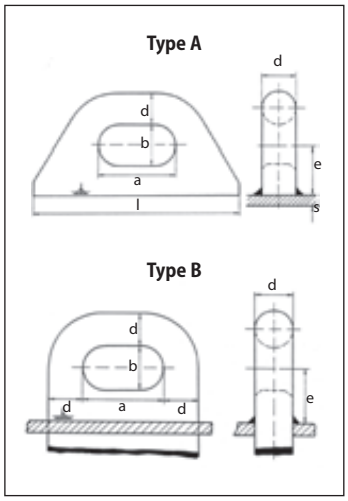
Working Load Limit = 1/4 Breaking Force



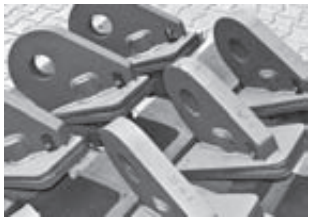
Oval eye plate

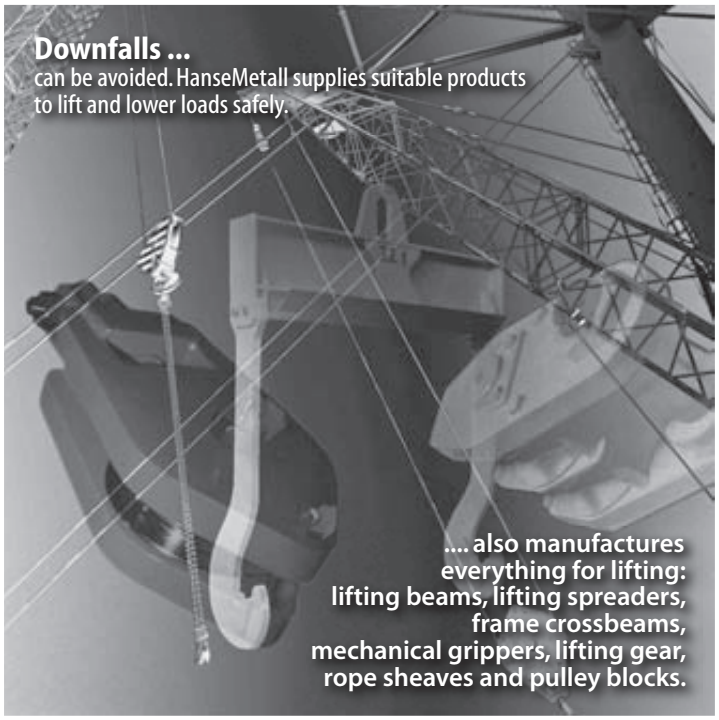
ISO 8146 - 1985

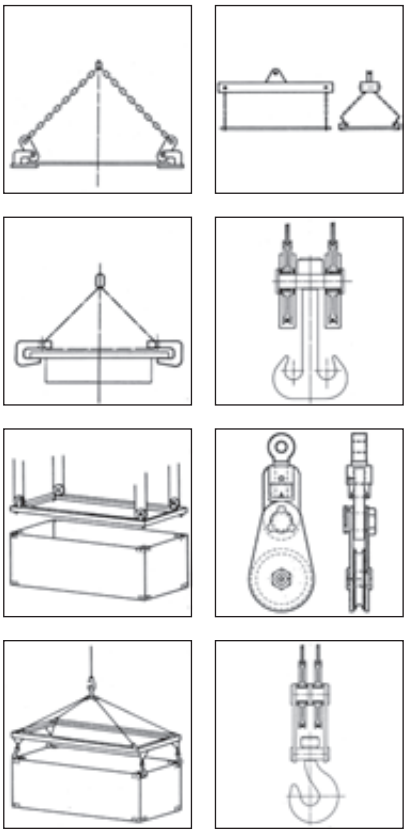
Nom. Size	Perm. Load Capacity (PLC)	Measurements					
		a	b	d	e	l	s
	kN	mm	mm	mm	mm	mm	mm
1	10	35	22	16	25	95	6
1,6	16	42	24	20	33	120	7
2	20	50	27	25	35	132	9
2,5	25	55	29	25	39	140	9
3	32	66	33	30	42	180	10
4	40	77	36	35	48	210	12
5	50	87	41	40	57	225	14
6	63	91	45	40	66	240	14
8	80	101	51	50	73	270	17
10	100	117	56	50	80	300	17
12	125	128	61	60	87	335	20
16	160	145	67	60	95	370	20
20	200	157	73	70	105	420	25

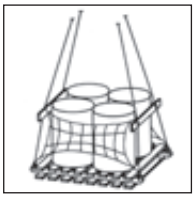
Material:
Other sizes on request
Type A for welding on
Type B for welding in
For welding instructions please refer to standard

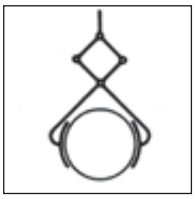
Eye plates, a series product manufactured by our partners HanseMetall, specialists in lifting gear and hoisting equipment, rope guidance and connection technology.

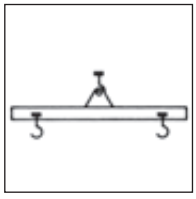


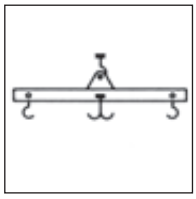


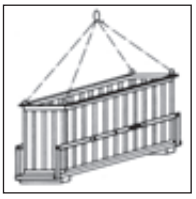


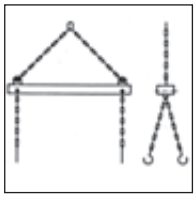












MORE...

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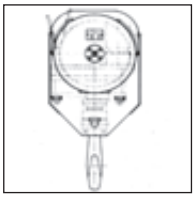
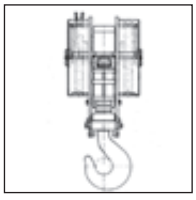





TERSTEEL

Get a grip ...
Clamping and lifting without risk.

TERRIER LIFTING CLAMPS & EQUIPMENT

Some examples...

TS/STS
Vertical lifting and transporting of steel plates and structures.
Lockable clamp position.
WLL: TS from 0,75 t to 30 t. STS from 2 t to 30 t.
Jaw opening: from 0-13mm to 10-90mm, respectively from 17-38mm to 80-150mm

TSMP/STSMP
Vertical lifting. Horizontal when used in pairs.
Lockable clamp position.
Three way articulated linkage arrangement.
WLL from 0,75 t-25 t.
Jaw opening from 0-13 to 80-150mm

TSU-R
Transporting stainless steel plates and structures.
Pivot and cam are made of stainless steel.
WLL 2 t.
Jaw opening from 0-20mm

TSEU-A
For lifting and transporting plates and structures.
Flexible adjustment, versatile positioning.
WLL 3 t.
Jaw opening from 0-100mm

TNMK/TNMKA
Clamping jaws fom synthetic.
Optimum surface protection for transported goods.
Extremely wide clamp range.
WLL 0,5 t to 3 t.
Jaw opening from 1-20 to 1-180mm

THSK
Transporting, lifting and handling of single steel plates and packages when using in pairs.
WLL from 1,5 t/pair to 9 t/pair.
Opening from 3-180mm to 3-420mm

FHX/FHSX
For transporting and lifting steel plates.
Must always be used in pairs.
Torsion resistant.
WLL from 1 t/pair to 15 t/pair.
Opening 0-35mm to 0-150mm

TNMH
For transporting and lifting sensitive plates and constructions.
Must be used in pairs.
Polymer coated clamp areas.
WLL from 1 t/Pair to 6 t/Pair.
Jaw opening from 0-25 to 0-50mm

...and more from a wide product range.


1 Screw clamp FSV


2 Drum clamp TVK


3 Gripping tongue TTL


4 Pipe lifting clamp TPH


5 Drum clamp TVKH


6 Vertical clamp TSHPU


7 Gripping Tongue TBLC


8 Screw clamp TBS

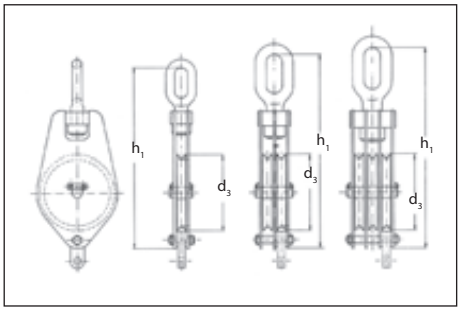
MORE...

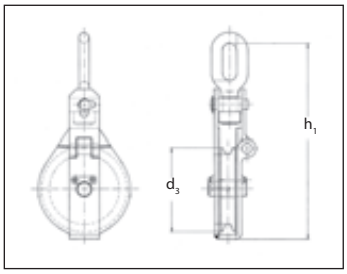
This is just a brief presentation of a whole range of products. Details needed? Ask us. We provide all the information you need.

Tackle block

Metall pulley block for steel rope, for board lifting gear,
With swivel oval eye, with or without becket,
Housing: steel, primed
Pulley: grey cast iron with bronze bushing, Lubrication: oil through groove

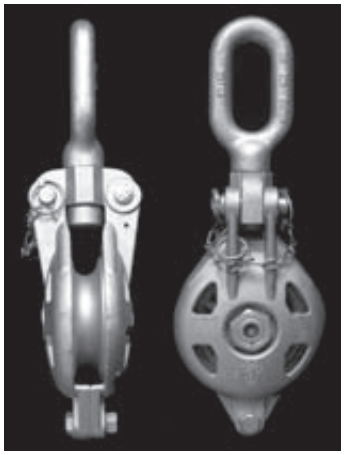
Nom. Size	Working Load Limit (WLL)	Weight	Rope ø	Rope Pull	Rope Sheave d_3	Number		Height h_1
	t	~kg	mm	kN	mm			mm
1	2	8,5	12	10	195	1		430
	3	10				1	S	480
	3,7	16				2		500
	4,5	17				2	S	450
	5,4	26				3		480
	6,1	28				3	S	500
2	4	24	16	20	260	1		605
	6	27				1	S	635
	7,5	30				2		675
	9,1	34				2	S	625
	10,7	55				3		650
	12,2	60				3	S	675
3	6,3	39	20	32	320	1		740
	9,5	43				1	S	790
	11,7	69				2		820
	14	80				2	S	765
	17	98				3		820
	19	104				3	S	850





S = with becket

The configuration described is standard. Optionally available: suspension swivel stud eye, swivel double lug or fixed bow, special coated housing, pulley material cast iron or steel, roller bearing, housing and sheave stainless steel.



Snatch Block COA-150

Metall pulley block for steel rope, single-sheave, compact construction, versatile, for rope dia up to 28mm, WLL 10t, rope pull 50 kN, sheave-dia 150mm, with swivel oval eye (standard),

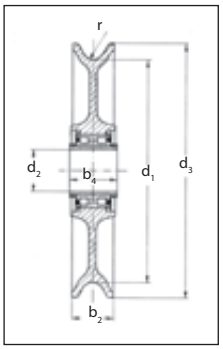
or with swivel hook (optional), see picture on the right

Snatch block

Metal pulley block for steel rope, Single-sheave, with swivel oval eye,
Housing: steel, primed,
Pulley: grey cast iron with bronze bushing,
Lubrication: through centre pin

Nom. Size	Working Load Limit (WLL)	Weight	Rope ø	Rope Pull	Rope Sheave d_3	Height h_1
	t	~ kg	mm	kN	mm	mm
1	2	5	14	10	135	310
2	4	13	18	20	180	430
3,2	6,3	21	22	32	220	520
4	8	28	24	40	260	590
5	10	42	28	50	290	660
6,3	12,5	55	32	63	330	750

The configuration described is standard. Optionally available: suspension swivel stud eye, swivel double lug or fixed bow, special coated housing, pulley material cast iron or steel, roller bearing, housing and sheave stainless steel.



Pulley

No standardised configuration due to multitude of requirements. When ordering please indicate rope diameter (steel or fibre rope), pulley diameter d3, hub width b4, bore d2; if required or known: groove radius r, maximum axial load, bearing (none, bronze bush, roller bearing).

Pulley block (steel rope)

Metal pulley block for steel rope, with swivel oval eye, with becket,
Housing: steel, primed,
Sheave: grey cast iron, with bronze bushing, Lubrication through centre pin

Nominal Size	Working Load Limit (WLL)	Weight	Rope ø	Rope Pull	Rope Sheave d_3	Number of Sheaves	Height h_1
	t	~kg	mm	kN	mm		mm
	0,5	3,3				1	330
100	1	5	7	2,5	100	2	355
	1,6	6,6				3	375
	1	4,6				1	365
125	1,6	7	9	5	125	2	390
	6,1	10				3	405
	2	8				1	430
150	3	12	11	10	150	2	455
	5	20				3	540

Standardised design. Optionally available are swivel hook, swivel stud eye, swivel double lug, or fixed bow eye as head fittings, specially coated housing, rope sheave made from spheroidal iron, or steel, with roller bearing, or housing and sheave made from stainless steel.

Pulley block (fibre rope)

Metal pulley block for fibre rope, with swivel oval eye, with becket
Housing: steel, black varnish

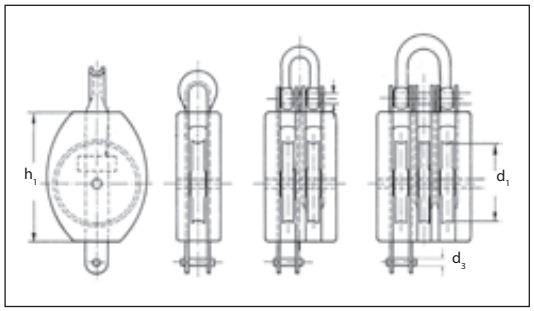
Nominal Size	Working Load Limit (WLL)	Weight	Rope d_1	Rope Sheave d_3	Number	Height h_1
	t	kg	mm	mm		mm
	0,1	0,8			1	210
75	0,15	1,3	10	75	2	230
	0,25	1,8			3	245
	-	-			1 K	-
	0,15	1,5			1	240
90	0,25	2,4	13	90	2	290
	0,5	3,4			3	310
	0,15	1,7			1 K	240
	0,25	2,0			1	285
100	0,5	3,4	16	100	2	350
	1	4,8			3	365
	0,25	2,1			1 K	285
	0,5	3,2			1	335
120	0,75	5,0	19	120	2	370
	1	6,8			3	400
	0,5	3,4			1 K	335

K = Snatch block

Standardised design. Optionally available are swivel hook, specially coated housing, rope sheave made from grey cast iron with bronze bushing, rope sheave made from steel, with roller bearing, or housing and sheave made from stainless steel.

Wooden block

Wooden tackle block for fibre rope, with fixed bow, with becket
Housing: beechwood varnished
Sheave: polyamide or metal



Nominal Size	Working Load Limit (WLL)	Weight	Rope ø	Rope Pull	Rope Sheave d_3	Number	Length of Housing h_1
	t	kg	mm	kN	mm		mm
7	0,66	2	18	2,2	110	1	180
	1,1	3,6				2	480
8	0,78	3	20	2,6	120	1	205
	1,3	5,3				2	205
9	0,9	4	22	3,0	130	1	230
	1,5	6,5				2	230
10	1,1	5	24	3,6	145	1	255
	1,8	7,2				2	255

Specialists for moving moments ...

Wire rope winches, electrical

Wall mounted wire rope winch 'ALPHA'

Pillar jib crane PS

Lifting gear in every variety.
Hoists and conveyors.
Industrial equipment for shifting, lifting, turning.
Some examples ...

Pneumatic hoist ProLine PD

Hand chain pulley block ProLine P 90

Further product fields:
Hydraulic lifting platforms
Wire rope hoist
Electric chain hoists

MORE...

This is just a brief presentation of a whole range of products. Details needed? Ask us. We provide all the information you need.

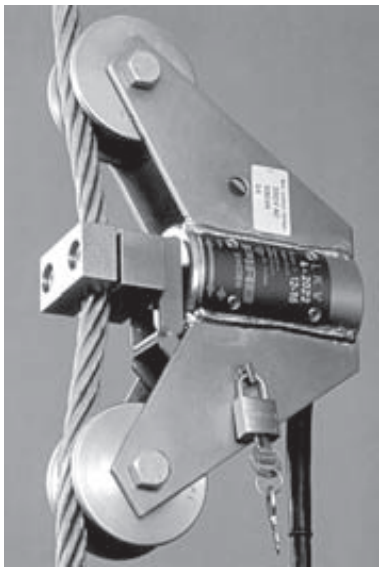
Shows you the limits...

A selection ...

LL Link
with remote display for robust use, measuring range 0-2,000 kg to 0-75,000 kg

Dynamometer
Measuring range 0-250 kg to 0-50,000 kg, optionally with remote display

Digital crane scale
Measuring range 2,000 kg to 10,000 kg



Overload guard LKV
with remote display, maximum switching value1,000 kgf to 16,000 kgf, for line dimension 5-8mm to 40-44mm

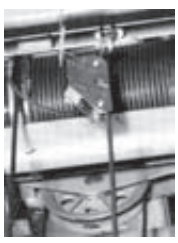
PIAB

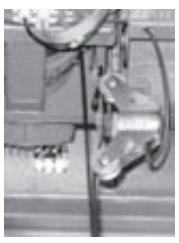
Precision instruments for measurement, control and examination of traction forces, prevent overloading. For use with rope connectors or other force transmitters.

MORE...

This is just a brief presentation of a whole range of products. Details needed? Ask us. We provide all the information you need.

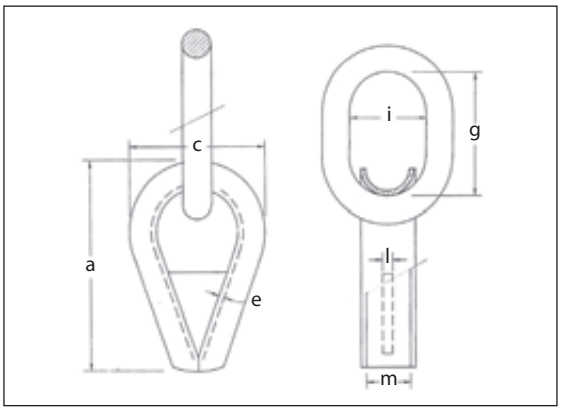
Applications...





Making the link...

...with the right connections.
Everything for heavy ropes, to safely connect them and securely fasten them at the end.



Towing thimble

SEL 1079

Nominal Size = Rope Circ.	Weight	Measurements				
		a	c	e	l	m
~inch	kg/ea	mm	mm	mm	mm	mm
10	20	370	290	15	16	100
12	33	450	330	20	20	115
14	49	520	370	20	20	135
16	56	580	390	20	20	155
17	68	600	440	20	20	170
18	99	600	440	20	20	180

Material: RSt 37-1

Thimble and link size can be freely combined. When choosing and combining consider the bollard pull of the tow connection and guidelines on forces and rope sizes from official tables. We will be pleased to advise.

Towing link

SEL 1079

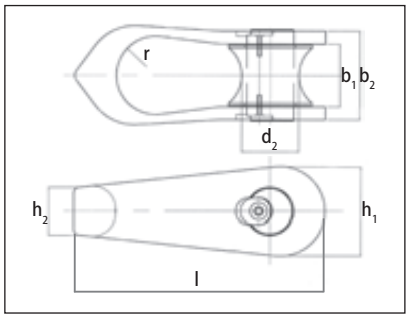
Nominal Size = Material Diameter	Minimum Breaking Force	Weight	Measurements	
			g	i
mm	kN	kg/ea	mm	mm
51	1400	17	350	190
57	1800	24	400	200
63	2400	32	430	230
72	3200	44	440	250
80	4000	57	450	250
90	5000	74	460	300
100	6000	102	500	300

Material: Grade 80 alloy steel

Load...

**... not to breakage,
but to permissible load limit only!
This is significantly less than breaking force and depends on factors relevant to application (safety factor, design factor, formula). Therefore: Do not confuse breaking force with load capacity (WLL, lashing force, working load, etc.) and calculate in adherence to existing rules (regulations, standards).**

Slender connections...
where steel and textile rope immediately feel comfortable. Snug bow, secure pin.



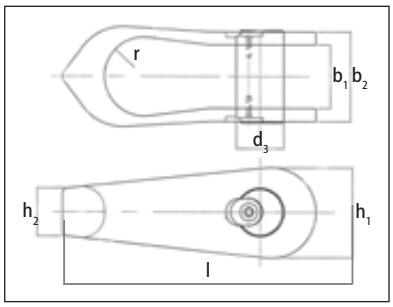
Fairlead shackle M

SEL 1071
With wire rope guard roller

From eye to eye ... ropes, best steel with textile. Keep things slim.

Nominal Size	Minimum Breaking Force	Weight	Measurements						
			b_1	b_2	d_2	h_1	h_2	l	r
	kN	~ kg/ea	mm	mm	mm	mm	mm	mm	mm
90	1030	10	76	110	82	120	71	300	44
120	1370	16	100	140	90	130	90	335	54
185	2450	47	120	170	110	170	90	480	75

Yield force: >800N/mm², tensile strength: 950-1100N/mm², elongation: >10%,
Material: E-GS 34 CrNiMo 6V/GS CrMo 4V bow, 1.4057 (mechanical values according to DIN 17440) Bolt



Fairlead shackle T

SEL 1071

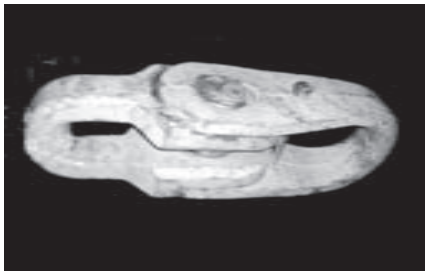
Nominal Size	Minimum Breaking Force	Weight	Measurements						
			b_1	b_2	d_3	h_1	h_2	l	r
	kN	~ kg/ea	mm	mm	mm	mm	mm	mm	mm
90	1030	9	76	110	68	120	71	300	44
120	1370	14	100	140	68	130	90	335	54
185	2450	37	120	170	90	170	90	480	75

Yield Force: >800N/mm², Material Grade: 950-1100N/mm², Elongation: >10%,
Material: E-GS 34 CrNiMo 6V/GS CrMo 4V Bow, 1.4057 (mechanical values according to DIN 17440) Bolt

Load...

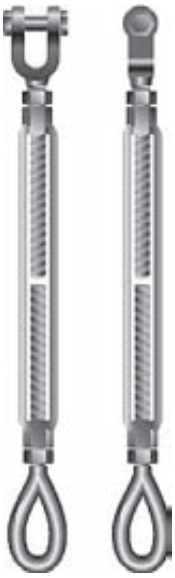
... not to breakage, but to permissible load limit only! This is significantly less than breaking force and depends on factors relevant to application (safety factor, design factor, formula). Therefore: Do not confuse breaking force with load capacity (WLL, lashing force, working load, etc.) and calculate in adherence to existing rules (regulations, standards).

... Or adapted, whatever your needs. Like here, for example, from eye to socket. The perfect match, flush fit. ...



Coupling link BTG
Same parameters as Fairlead shackle. Configuration adapted to each end fitting. Here: Loop of a textile rope stretcher connected with the closed spelter socket of the steel tow rope

...or simply a roller shackle, to connect fibre rope eye with steel rope, rope socket or thimble.

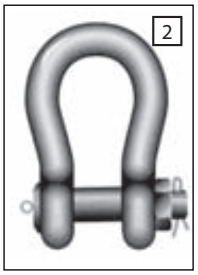


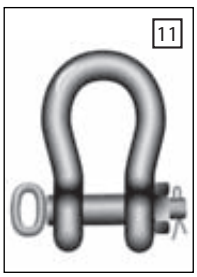
Green Pin®

... means: taking quality to extremes.
Exaggerated quality consciousness is no luxury but the highest level when it comes to preventing accidents and damage.

MORE...

This is just a brief presentation of a whole range of products. Details needed? Ask us. We provide all the information you need.



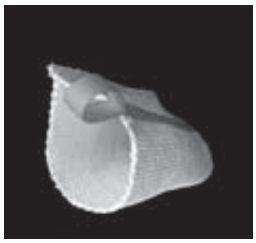


VAN BEEST

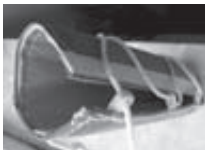
® Reg. Trademark Van Beest Sliedrecht

Worth protecting ...

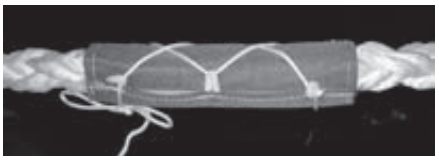
Ropes made from synthetic materials certainly are! Especially when their path takes them over rough or sharp terrain.
For extreme cases we have jackets and sleeves for textile ropes made from wear resistant fabric.



DeltaWeb
Sturdy, abrasion resistant polyester fabric

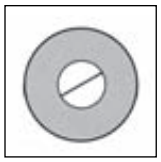


DeltaLace
Cord sleeve for strong and effective wear protection



Good guidance ...

is needed to maximise safety when steel rope is used. Towing sleeves help keep steel rope in check in problem areas on tugs.



Towing sleeve
one piece,
attachment before fabrication
Type Standard d 36 to 64mm
Type Heavy Duty d 48 to 76mm
Type Extra Heavy Duty d 48 to 76mm

Towing shoe
two piece,
attachment after fabrication
Type Standard d 44 to 76mm
Type Extra Heavy Duty Plus d 60 to 90mm

provides effective protection when steel tow ropes start throwing their weight around.

Inflatable, light and handy ...

Fender Type F
Keep your distance. Smart fender protector - prevents too close contact.

d= Diameter
l = Length
h= Height

Polyform® F-Series

Nominal Size	Permissable Load Capacity (PLC)	Weight	Eye Diameter	Measurements	
				d	l
	kg	~ kg	mm	mm	mm
1	8	1,2	18	150	640
2	13	1,4	18	220	640
3	20	1,9	22	220	760
4	35	2,3	22	220	1040
5	45	3,6	24	300	760
6	75	3,6	24	300	1090
7	95	5,2	24	380	1040
8	150	6,2	24	380	1470
10	155	7,0	24	470	1270
11	240	13	27	600	1450
13	600	25	30	800	1950

Polyform® A-Series

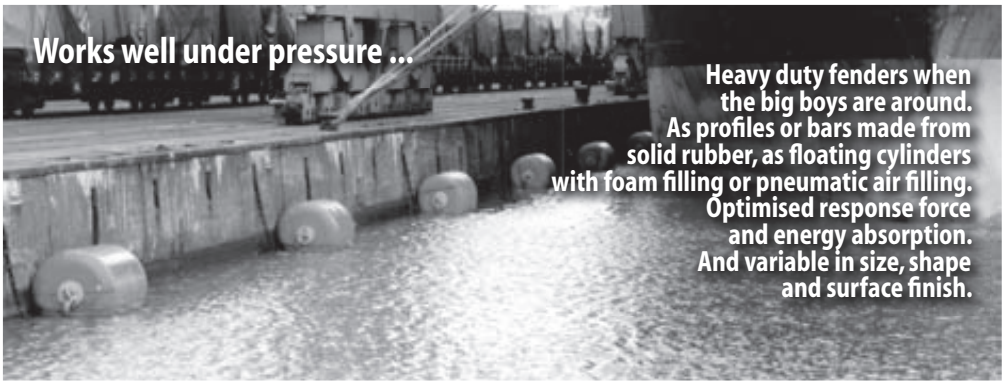
Nominal Size	Permissable Load Capacity (PLC)	Weight	Eye Diameter	Measurements	
				d	h
	kg	~ kg	mm	mm	mm
0	6	0,70	16	230	290
1	13	1,2	25	290	370
2	31	2,2	25	390	490
3	55	3,1	25	470	590
4	85	4,3	25	550	710
5	180	8,5	30	700	920
6	360	15	38	860	1180
7	610	25	50	1050	1380

MORE ...

Information on the complete range on request.

Buoy Type A
No trouble in deep water.
Convenient ground-surface connection.
Mooring and marking.

® Reg. Trademark Polyform U.S. Kent



with foam filling,
PU coated surface,
optionally with chain-tyre net jacket
for extra surface protection

Heavy duty fender
buoyant

pneumatic body
rubberised on both sides
without air, space-saving transportation,
optionally with chain-tyre net jacket
for extra protection

MORE...

This is just a brief presentation of a whole range of products. Details needed? Ask us. We provide all the information you need.

Solid rubber fender
in round-, square-, D- or U-profile

Heavy duty wheel fender
for extra heavy duty

Solid rubbing bars
in all conceivable profiles

Specialities ...

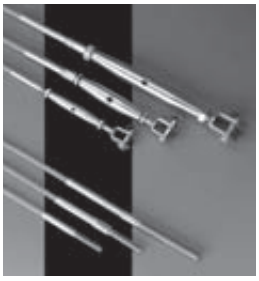
What wonderful things ropes (textile or steel) can be used for. The only limit is the imagination! Have you any ideas? We will help you realise them! Here some food for thought.

Building architecture ...









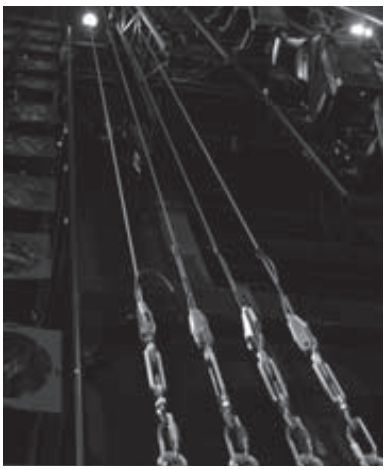



Rope supported constructions as frames for cladding, greening, railing for staircases, paths, balconies.

Stage engineering ...




Example...
Illusions, magic.
Invisible connections
let the fantasy run wild.
Steel rope with dark black
reflection-free surface
for the disappearance
no one should see.



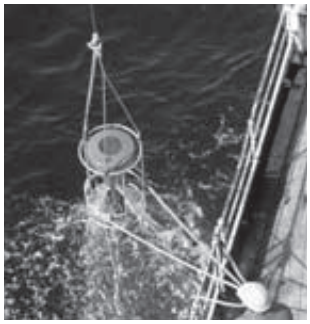
Playground fun ...

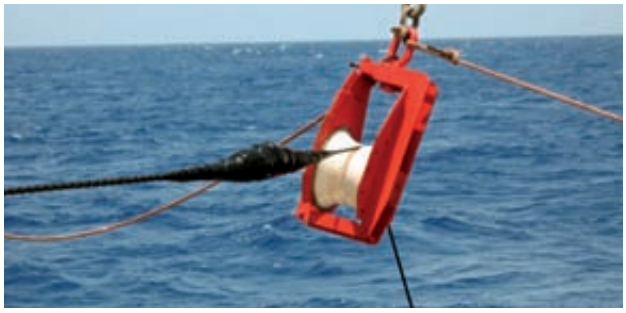



The healthy development of children is a topical issue. Ropes and nets add new dimensions to creative playground planning: for climbing, hanging, swinging. From exercise as a need to exercise as fun.




More specialities ...





Anchoring equipment at depth. Flexible rope connections. Low weight despite great length. Inexpensive? Ultra lightweight? Extra low elongation? For every requirement there is a solution.

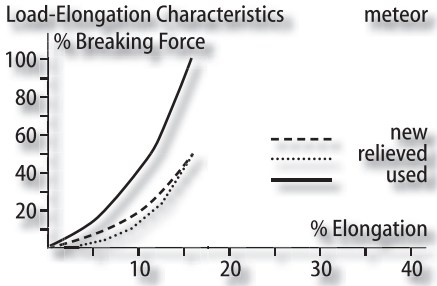
Two examples: Popular rope constructions for anchorages, light and handy. 'Meteor' – low cost, low elongation, for normal requirements; 'Comet' – extremely high tensile strength, extremely low elastic and plastic elongation, for extreme requirements.

meteor

PA/PP Kernmantel braided rope

Nominal Rope Size	Rope Weight	Nominal Minimum Breaking Force	
(~mm Ø)	~ kg/m	daN	kp
11	0,07	2750	2806
14	0,11	4450	4540

Material:	Polyamide (core) Polypropylene (jacket)
Specific Gravity:	1,10 kg/m³
Melting point:	165°/250°C
Operating temperature:	70°C (maximal duration)
Colour:	black (outside)

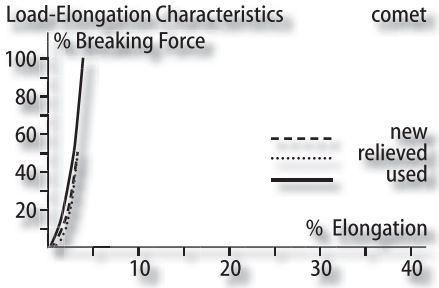


comet

PES/AR Kernmantel braided rope

Nominal Rope Size	Rope Weight	Rope Minimum Breaking Force	
(~mm Ø)	~ kg/m	daN	kp
11	0,09	5600	5700

Material:	Aramide-endless cable (core) Polyester (jacket)
Specific gravity:	1,44 kg/m³
Melting point:	260°/415°C
Operating temperature:	120°C (maximal duration)
Colour:	black (outside)

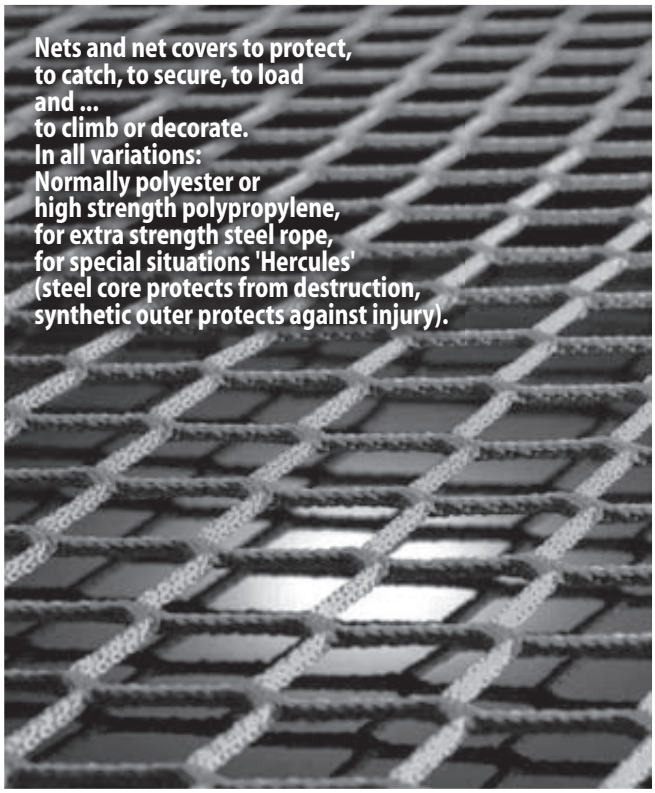


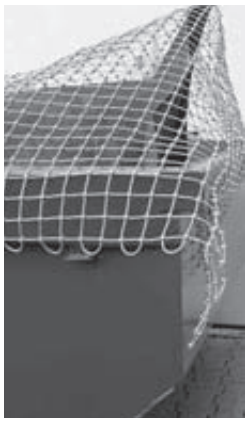
Variations...

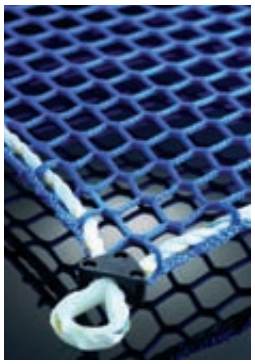
There is no standard for this, hence figures are only typical and may vary depending on application.

Protection of a special nature. Support for diseased trees with flexible connections.

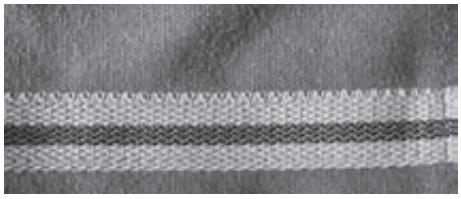
Tree care ...

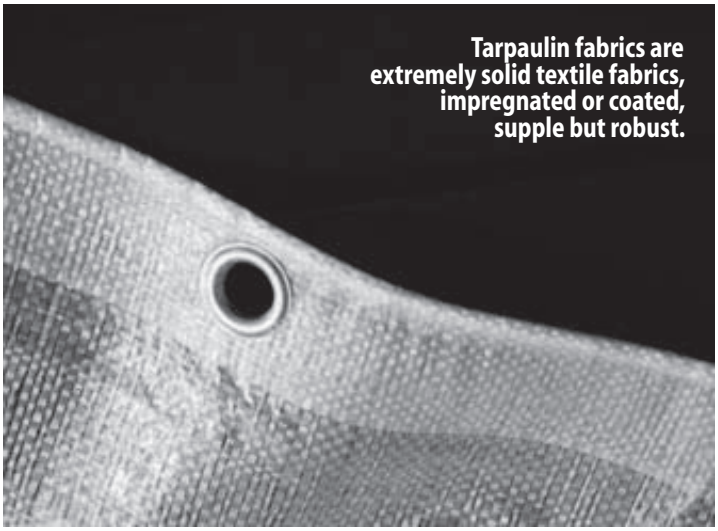

Nets and net covers to protect,
to catch, to secure, to load
and ...
to climb or decorate.
In all variations:
Normally polyester or
high strength polypropylene,
for extra strength steel rope,
for special situations 'Hercules'
(steel core protects from destruction,
synthetic outer protects against injury).





Flexible protection ...
against dirt and dampness.
In every shape and size.





Tarpaulin fabrics are extremely solid textile fabrics, impregnated or coated, supple but robust.

if required, individually processed.

MORE...

This is just a brief presentation of a whole range of products. Details needed? Ask us. We provide all the information you need.

Protective covers, bags, flat tarpaulins, jackets.

Besides, good for a lot more ...

Protection ...
from the free fall. Prevention of worst case.

Safety lines, safety belts, safety harnesses, rope-grab fall protection devices.

Rescue ...
in case of emergency at sea.

PB

Partner for products that we never want to use.

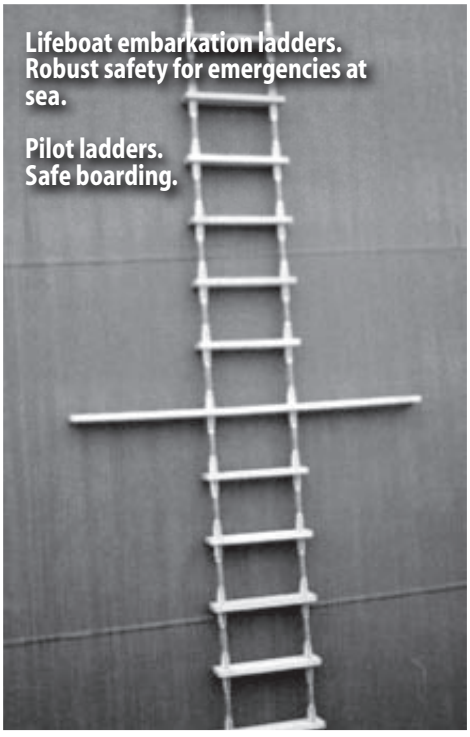
All kinds of Rescue equipment.

MORE...

This is just a brief presentation of a whole range of products. Details needed? Ask us. We provide all the information you need.

Up or down ...
Normal ladders tend to be unwieldy due to their length. The alternative: rope ladders fold or roll up.

**Rescue ladders.
Practical safety for emergencies on land.**



Service...

When expert help is needed.
Even if rare nowadays, riggers and sail-makers are experts in processing and fabricating ropes and canvas structures, in analysing application problems and installation on-site. This type of work you can confidently leave to us. We have skilled, experienced specialists on offer to deal with a wide range of tasks.

Installation and replacement of ropes.
Material tests and safety checks.
Inspection of lifting gear and hoisting equipment.
Advice on product suitability and operation.

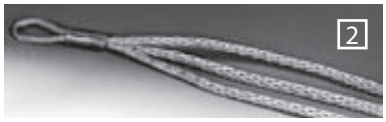
Self help ...

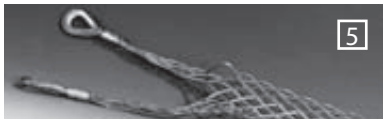
When we are not available to help for emergency repairs, urgent installations or modifications it could be useful to have the appropriate tools for the job to hand.
Such as:

Splicing tools (marlin spike, wooden fid, sewing mallet, splicing clamp) to prepare ropes for or keep them in use. Eyelets, hole punchers and die cutters, needles, special gloves, for keeping protective covers in good order.

Or for example:

Support grips for attaching or holding rope ends when setting up or replacing steel ropes.





Prolong life ...

Care and maintenance, regularly and repeatedly, contribute greatly to damage prevention and functional safety of equipment. One more example:

Steel rope care for essential protection against weather influences. A wide range of preservatives and tools are available for ropes and their environments.

… not forgetting:

The usual supplementary items for ropes and cloths: Cords and lines, iron wire for servicing and packing. Stellings, boat hooks with pole, handy billies and winches. Rope stoppers, cutting tools.

To conclude...
References, conversions, etc.

Conversions

Length

	m	in	ft	yd	fm	sm	nm	
Metre	1	39,37	3,281	1,094	0,5468	0,00062	0,00054	m
Inch	0,0254	1	0,08333	0,02778	0,01389	0,00001	0,00002	in
Foot	0,3048	12	1	0,3333	0,1667	0,00017	0,00017	ft
Yard	0,9144	36	3	1	0,5	0,00057	0,00049	yd
Fathom	1,829	72	6	2	1	0,00114	0,00099	fm
Static mile	1609	63360	5280	1760	880	1	0,8690	sm
Nautic mile	1852	72913	6076	2025	1012	1,151	1	nm

Mass

	kg	oz	lb	sht	lgt	
Kilogram	1	35,27	2,205	0,0011	0,0010	kg
Ounce	0,02835	1	0,0625	0,00031	0,00003	oz
Pound	0,45359	16	1	0,0005	0,00045	lb
Short ton	907,2	32000	2000	1	0,89286	sht
Long ton	1016	35840	2240	1,12	1	lgt

Power

	W (J/s)	PS	hp	
Watt	1	0,00136	0,00134	W (J/s)
Pferdestärke	735,5	1	0,9863	PS
Horsepower	745,7	1,014	1	hp

Area

	m²	in²	ft²	yd²	
Square metre	1	1550	10,76	1,196	m²
Square inch	0,00065	1	0,00694	0,0008	in²
Square foot	0,09	144	1	0,1111	ft²
Square yard	0,8361	1296	9	1	yd²

Plain angle

	rad	°	'	"	
Radian	1	57,296	3437,8	206264	rad
Grad	0,01745	1	60	3600	°
Minute		0,01667	1	60	'
Second		0,00028	0,01667	1	"

Volume

	m³	ft³	yd³	l	qrt	ga	
Cubic metre	1	35,31	1,308	1000	1057	264,2	m³
Cubic foot	0,02832	1	0,03702	28,32	29,93	7,482	ft³
Cubic yard	0,765	27,02	1	764,69	808,0	202,0	yd³
Litre	0,001	0,03531	0,00131	1	1,057	0,2642	l
Quart	0,00095	0,03341	0,00124	0,946	1	0,2500	qrt
Gallon	0,00379	0,1337	0,00495	3,785	4,000	1	ga

Temperature

	K	°C	°F	
Degrees Kelvin	1	- 272,2	- 457,9	K
Degrees Celsius	274,2	1	33,8	°C
Degrees Fahrenheit	255,9	- 17,22	1	°F

Velocity

	m/s	kmh	mph	nmph = Knot	
Metres/second	1	3,6	2,237	1,944	m/s
Kilometres/hour	0,2778	1	0,6214	0,5400	kmh
Miles/hour	0,4470	1,609	1	0,8690	mph
Nautic miles/Hour	0,5144	1,852	1,151	1	nmph = Knot

Force

	N	kN	kp	tf	
Newton	1	0,001	0,1020	0,00010	N
Kilonewton	1000	1	102	0,1020	kN
Kilopond	9,807	0,00981	1	0,001	kp
Ton-force	9806	9,807	1000	1	tf

Pressure

	Pa(N/m²)	bar	kg/cm²	psi	
Pascal	1	0,00001	0,00001	0,00015	Pa(N/m²)
Bar	100000	1	1,020	14,50	bar
	98066	0,9807	1	14,22	kg/cm²
Pounds per sq. in.	6895	0,0690	0,0703	1	psi

Energy

	J (N*m)	kWh	kpm	cal	kcal	ftlbf	
Joule	1	0,0000003	0,1020	0,2388	0,00024	0,7376	J (N*m)
Kilowatt hour	3600000	1	367097	859854	859,8	2655224	kWh
Kilopond metre	9,807	0,000003	1	2,342	0,00234	7,233	kpm
Calorie	4,188	0,000001	0,4269	1	0,001	3,088	cal
Kilocalorie	4188	0,00116	426,9	1000	1	3088	kcal
Foot-pound force	1,356	3,766	0,1383	0,3238	0,00034	1	ftlbf

Conversion table inch/mm

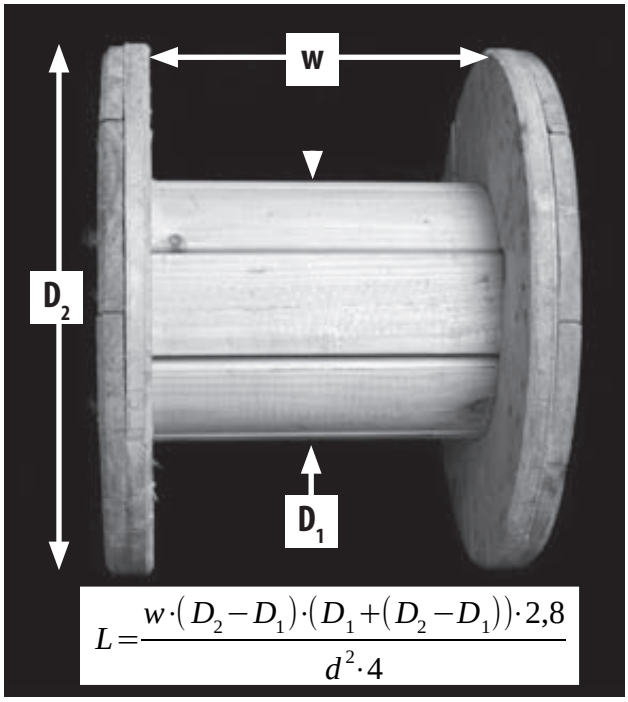
Inches		mm
1/32	0,03125	0,7938
1/16	0,06250	1,588
3/32	0,09375	2,381
1/8	0,1250	3,175
5/32	0,1563	3,969
3/16	0,1875	4,763
7/32	0,2188	5,556
1/4	0,2500	6,350
9/32	0,2813	7,144
5/16	0,3125	7,938
1 1/32	0,3438	8,731
3/8	0,3750	9,525
1 3/32	0,4063	10,32
7/16	0,4375	11,11
1 5/32	0,4688	11,91
1/2	0,5000	12,70
1 7/32	0,5313	13,49
9/16	0,5625	14,29
1 9/32	0,5938	15,08
5/8	0,6250	15,88
2 1/32	0,6563	16,67
1 1/16	0,6875	17,46
2 3/32	0,7188	18,26
3/4	0,7500	19,05
2 5/32	0,7813	19,84
1 3/16	0,8125	20,64
2 7/32	0,8438	21,43
7/8	0,8750	22,23
2 9/32	0,9063	23,02
1 5/16	0,9375	23,81
3 1/32	0,9688	24,61
1	1	25,40

Conversion table mm/inches

mm	Inches	
0,7938	1/32	0,03125
1,588	1/16	0,06250
2,381	3/32	0,09375
3,175	1/8	0,1250
3,969	5/32	0,1563
4,763	3/16	0,1875
5,556	7/32	0,2188
6,350	1/4	0,2500
7,144	9/32	0,2813
7,938	5/16	0,3125
8,731	1 1/32	0,3438
9,525	3/8	0,3750
10,32	1 3/32	0,4063
11,11	7/16	0,4375
11,91	1 5/32	0,4688
12,70	1/2	0,5000
13,49	1 7/32	0,5313
14,29	9/16	0,5625
15,08	1 9/32	0,5938
15,88	5/8	0,6250
16,67	2 1/32	0,6563
17,46	1 1/16	0,6875
18,26	2 3/32	0,7188
19,05	3/4	0,7500
19,84	2 5/32	0,7813
20,64	1 3/16	0,8125
21,43	2 7/32	0,8438
22,23	7/8	0,8750
23,02	2 9/32	0,9063
23,81	1 5/16	0,9375
24,61	3 1/32	0,9688
25,40	1	1

Decimal powers

Notation	Abbreviation	Power
Giga	G	10^9
Mega	M	10^6
Kilo	k	10^3
Hecto	h	10^2
Deca	da	10^1
Deci	d	10^{-1}
Centi	c	10^{-2}
Milli	m	10^{-3}
Micro	µ	10^{-6}
Nano	n	10^{-9}



$$L = \frac{w \cdot (D_2 - D_1) \cdot (D_1 + (D_2 - D_1)) \cdot 2{,}8}{d^2 \cdot 4}$$

International SI-Units

Basic parameter	Notation	Abbreviation (Unit)			
Length	Metre	m	cm	km	
Area	Square metre	m²			
Volume	Cubic metre	m³			
Measures (Weight)	Kilogram	kg	g	mt	
Plane angle	Radian	rad			
Time	Second	s	min	h	d
Temperature	Kelvin	K			
Velocity	Metres/second	m/s			
Acceleration	Metres/second/second	m/s²			
Strength	Newton	N(kg*m/s²)	kN	daN	
Compression	Pascal	Pa(N/m²)			
Force (Work)	Joule	J(N*m)	kJ		
Capacity	Watt	W(J/s)	kW		

Volumetric capacity of rope drums

L = Rope length/quantity m (when reel filled by 85%)
d = Rope diameter in mm
D_1 = Inner diameter in cm (drum)
D_2 = External diameter in cm (flange)
w = Inner width in cm

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