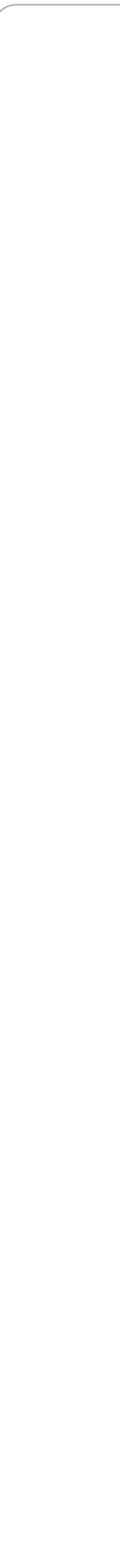


Fine Wire Ropes

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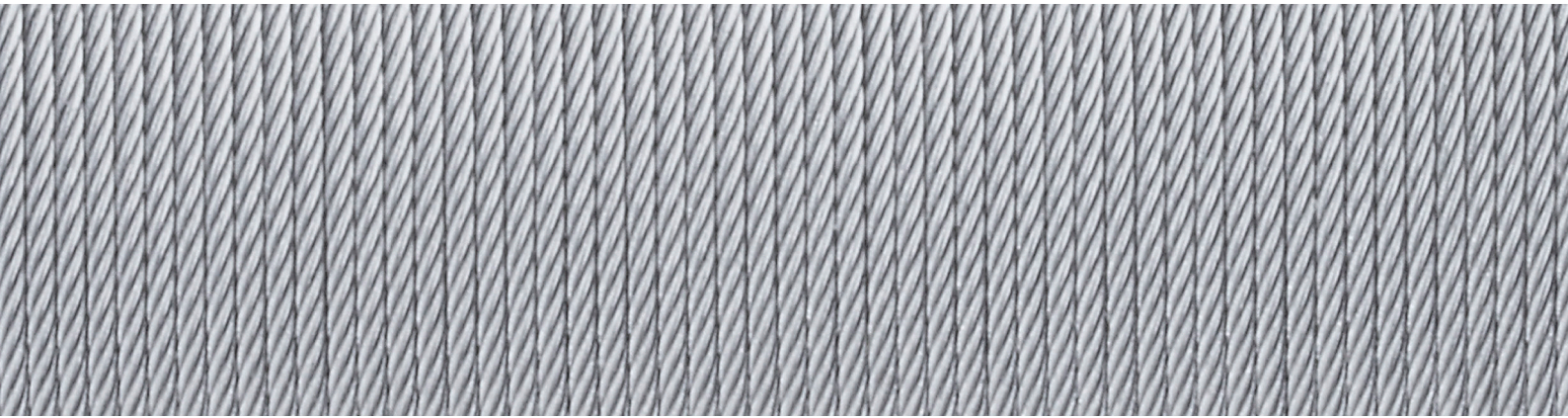


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We have been in the rope profession for over 130 years

- | | | | |
|----------------|--|------|--|
| 1875 | Alfred Engelmann founded the hemp rope company. | 1997 | Certification |
| 1920 –
1930 | In the 1920s production was expanded to steel wire ropes in accordance with technological developments. What was originally intended as a supplement to the existing offer grew into a core business with the increasing demand in the industry for wire ropes. The production of fibre ropes declined to the same extent. | 2003 | Introduction of ultrasonic surface-cleaning technique. |
| 1932 | Wilhelm vom Hofe Drahtwerke took over all business interests from the founding family. The production programme remained largely unchanged until the early 80s. | 2004 | Founding member of INMETALL, the Lower Saxony Industrial Association of Metal and Electrical Companies (Employer's Organisation). |
| 1950 –
1960 | Market leader in Lower Saxony for rope and lifting technology in heavy industry, shipyards, ore mining, paper and energy industries. | 2005 | Start of series production of hybrid products. |
| 1982 | Increasing imports and an accompanying decrease in market prices required new considerations in order to secure the Hanover site for the long term: The conversion to the production of fine wire ropes began. ENGELMANN very quickly made a name for themselves in this market segment with high-quality products. | 2007 | Introduction of mobile on-site inspection service for lifting accessories, load-carrying devices and lifting equipment. |
| 1984 | Start of fine wire rope production with continuous expansion of production capacities. | 2008 | ENGELMANN has been the chair of the Wire Rope Association from 2008 until the present day. |
| | | 2010 | Authorised service partner of COLUMBUS McKINNON Industrial Products GmbH with the Yale/Pfaff silberblau brands – specialised dealer in lifting technology. |
| | | 2011 | Technical and human resources expansion of the mobile on-site inspection service. |



130 years of well-founded experience in rope manufacture – innovation based on tradition



Added value for our clients: we strive to find the best solution – good products at fair prices

Innovative fine wire ropes-system solutions

We are a traditional company that, with its modern production lines, is one of Europe's leading rope companies today. As a systems supplier for rope and lifting technology, we benefit from many years of experience in the industrial manufacture of ropes and convince through high quality based on conscientious and precise craftsmanship.

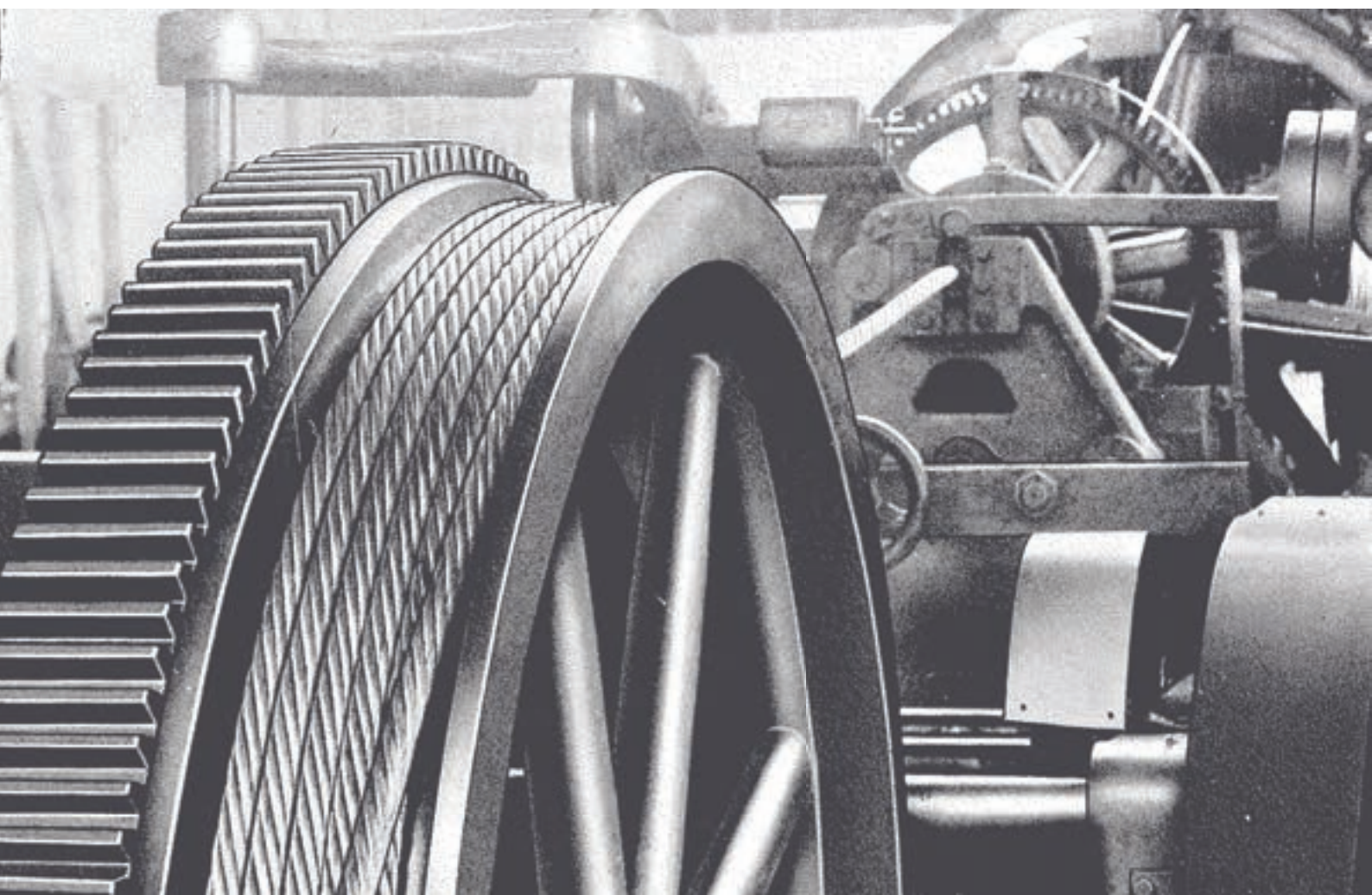
Our fine wire ropes solutions are widely used for metal weavings, mechanical engineering, electrical engineering, medical technology, the jewellery industry and solar technology.

Accurate, reliable and economical

We are known on the market for a consistently high product quality based on modern and efficient production. With flexibility, promptness, adherence to delivery reliability dates and products at fair market prices, we ensure a reliable business partnership with our clients.

Certified quality "Made in Germany"

The ENGELMANN Certification according to DIN EN ISO 9001:2008 ensures a continuous quality assurance and improvement process at all stages of development and production. The result: innovative fine wire rope system solutions that make application sustainably more efficient with maximum service life.



Economic Made-in-Germany-production in connection with the Vom Hofe Group

Your advantage: our Vom Hofe network competence

Strong teams provide the necessary competitive advantage in the network: as a member of the Vom Hofe Group - consisting of seven leading German companies in the fields of wire drawing, rope production as well as rope and lifting technology, our company is part of a quality leading industrial network with access to a unique pool of knowledge and experts for different fields of application.

Bundled systems knowledge and expertise

Together with over 130 years' experience in rope and lifting technology, we offer our clients two decisive advantages for individual problem solving with the highest efficiency:

Bundled systems knowledge :

Based on the continuous innovations of the seven individual enterprises during more than 140 years' experience.

Expertise:

Together with the client, our sales, technology and production experts develop practical products and innovations for every problem quickly and application-oriented. Scientific institutions and internationally renowned experts from the fields of material technology, machine construction, as well as rope and lifting technology provide us with support.



ENGELMANN
DRAHTSEILFABRIK
G.M.B.H.

We are working on getting you to recommend us!

Customer satisfaction is at the core of our corporate philosophy. We therefore maintain a cooperative partnership with our clients and are a reliable and trustworthy business partner.

We support our clients with our know-how throughout the entire life-cycle of our products. Clients benefit from our comprehensive services: professional consulting, training or our inspection and repair service.

Do you require further information? Do you have additional questions?

We would be pleased to hear from you!

ENGELMANN DRAHTSEILFABRIK GmbH
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Phone: +49 511 63983-0
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www.engelmann-feinseile.de
info@engelmann-feinseile.de

Product overview

Today the production and processing of fine wire ropes require a high level of experience, procedural knowledge and innovation. The development and production of sophisticated fine wire rope system solutions is our core competence. From the product idea to the procedurally secure series production, the fulfilment of customer requirements with regard to applications, materials and surface quality is the focus of our process steps; besides the economical efficiency is always a key aspect.

Founded in 1875, ENGELMANN DRAHTSEILFABRIK is one of today's leading addresses for excellent fine wire rope system solutions, applied for metal meshes, electrical engineering, machine construction, medical technology, jewellery and design. Use the innovative strength of ENGELMANN DRAHTSEILFABRIK. Meet the challenges of the future with our products and solutions.

We manufacture fine wire ropes of all strandable materials

The focus here lies on stainless steel, non-ferrous metals and a range of special materials. We manufacture fine wire ropes according to your specifications. We are known for our competence and our high-level expert advice. You too can benefit from this service!

As diverse as the fields of application may be, their production procedures are equally varied. As diverse as the fields of application are the manufacturing processes of our products. However, the following applies to all: our company products meet our client's high demands in every respect.

Our tables list the customary standard and rope constructions that we have in stock. Our competence lies in the production of special designs of stainless steel, special alloys, non-ferrous metals, precious metals and mixed constructions of different materials.

Our strengths are special constructions with regard to strands or rope construction as well as intermediate dimensions for which we are known as a market leader. Contact us!

Fine wire ropes

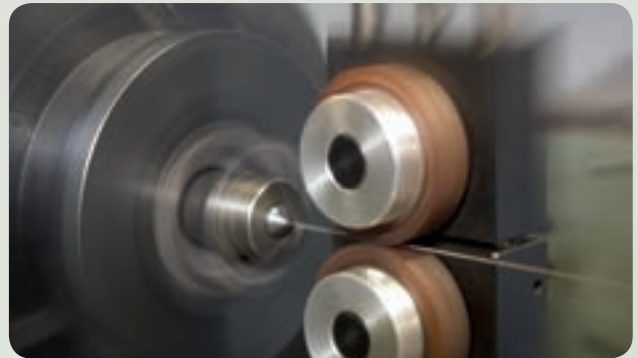
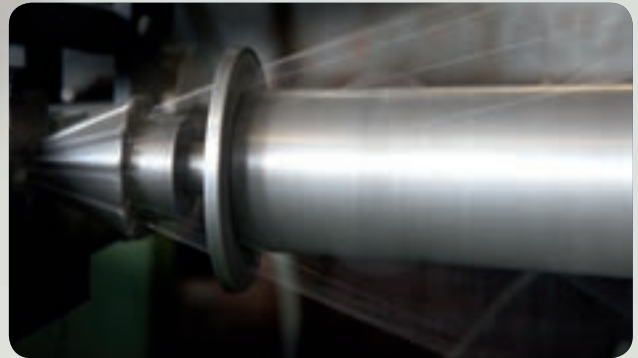
- Spiral and stranded ropes of 0.09 mm to 3.5 mm

Materials:

- Stainless steel
- Special alloys
- Carbon steel
- Non-ferrous metals
- Precious metals
- Synthetic materials
- All spiral and stranded ropes also sheathed or coated

Lifting Technology

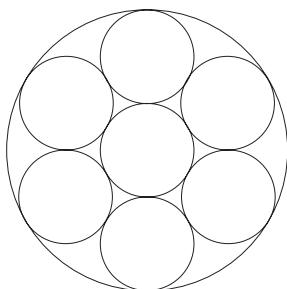
- Special wire ropes
- Standard ropes
- Ready-made ropes
- Lifting chains
- Lifting accessories
- Textile lifting belts, round slings and lashings
- Cable tracks
- Mobile on - site inspection service



Products

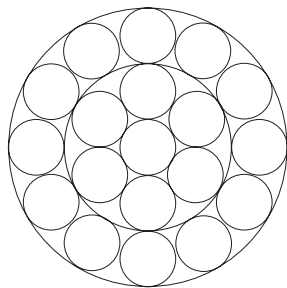
Spiral ropes

- Material 1.4401
- Nominal tensile strength 1770 MPa



1x7

Direction of lay	Diameter (mm)	Minimum breaking load N	Weight per 1.000 m in kg
S	0.09	8	0.045
	0.12	15	0.078
	0.15	23	0.119
	0.18	33	0.170
	0.21	45	0.230
	0.24	58	0.299
	0.27	73	0.383
	0.30	90	0.471
	0.33	109	0.558
	0.36	130	0.664
	0.39	151	0.777
	0.45	205	1.050
	0.48	233	1.200
	0.51	262	1.350
	0.54	293	1.510
	0.60	361	1.850
	0.75	561	2.870
0.84	660	3.380	
0.90	812	4.170	
1.00	972	4.900	



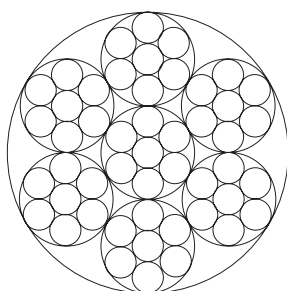
1x19

Direction of lay	Diameter (mm)	Minimum breaking load N	Weight per 1.000 m in kg
S	0.15	22	0.116
	0.20	38	0.202
	0.25	59	0.315
	0.30	85	0.452
	0.35	116	0.614
	0.40	150	0.801
	0.45	191	1.010
	0.50	238	1.260
	0.55	287	1.520
	0.60	341	1.810
	0.65	400	2.120
	0.75	527	2.810
	0.80	604	3.200
	0.90	744	4.050
	1.00	942	4.990
1.25	1.470	7.790	

Products

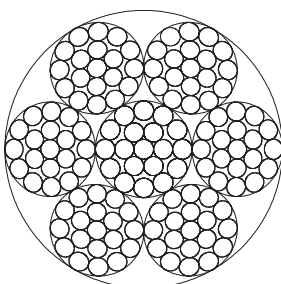
Round strand ropes

- Material 1.4401
- Nominal tensile strength 1770 MPa



7x7

Direction of lay	Diameter (mm)	Minimum breaking load N	Weight per 1.000 m in kg
sZ	0.27	57	0.328
	0.36	99	0.566
	0.45	152	0.869
	0.54	216	1.240
	0.63	292	1.670
	0.72	379	2.170
	0.81	478	2.740
	0.90	588	3.370
	1.00	728	4.180
	1.10	863	4.810
	1.20	1.060	6.050
	1.35	1.330	7.670
	1.50	1.580	9.070
1.80	2.350	13.470	



7x19

Direction of lay	Diameter (mm)	Minimum breaking load N	Weight per 1.000 m in kg
sZ	0.45	148	0.898
	0.60	256	1.550
	0.75	393	2.380
	0.90	560	3.390
	1.05	757	4.610
	1.20	1.000	6.020
	1.35	1.240	7.500
	1.50	1.550	9.360
	1.80	2.190	13.260



Special products

– Medical technology

- Material 1.4310
- Nominal tensile strength 2160 MPa
- Our special sizes for medical applications prove themselves through high spring force and tensile strength

Constructions	Direction of lay	Diameter (mm)	Minimum breaking load N	Weight per 1.000 m in kg
1x3	S	0.39	119	0.734
		0.55	250	1.375
		0.86	665	3.048
1x7	S	0.24	67	0.295
		0.31	90	0.518
		0.39	138	0.722
		0.41	155	0.857
		0.50	284	1.180
1x12	S	0.50	249	1.120
		0.61	389	1.750
1x19	S	0.50	290	1.250
		0.60	355	1.850
		0.90	933	4.010
7x7	sZ	0.68	371	1.720
		0.72	463	2.150
		0.90	717	3.330
		1.00	888	4.140

Further dimensions and constructions on request.



Special products

– Medical technology

Surgical saw strands

- Material 1.4310
- Nominal tensile strength 1960 MPa



Constructions	Direction of lay	Diameter (mm)	Minimum breaking load N	Weight per 1.000 m in kg
2x2	sZ	0.40	38	0.372
		0.60	77	0.750
		0.80	136	1.320
		1.00	204	2.020
		1.20	285	3.080
		1.60	500	5.000
		1.80	525	5.760
3x2	sZ	1.40	471	4.190

This is only a small part of our extensive product range for medical technology. In addition to the special products mentioned here, we have developed special products in collaboration with leading manufacturers, for example ropes from implant materials, TITANIUM etc.



Products

– Spiral and round strand ropes with coatings

The use of sheathed coated spiral and stranded ropes is necessary in many areas. Our spiral and stranded ropes are polyamid coated as standard. For special usage applications,

e.g. medical engineering, other coating materials are required. The table below shows a selection of the usual coating materials.

Common sheath materials

Material	Usage Temperature °C	Water absorption % bei 20 °C	Weather resistance	Inflammability	General chemical consistency
PVC-Polyvinylchloride	-20 to +70	0,40	good	s.e.	limited
PA-Polyamide	-60 to +105	1,00	good	if.	limited
PE-Polyethylene LDPE	-50 to +70	0,10	good	if.	limited good
PE-Polyethylene HDPE	-50 to +100	0,10	satisfactory	if.	limited good
PP-Polypropylene	-10 to +100	0,10	good limited	if.	limited good
FEP-Teflon®	-100 to +205	0,01	very good	n.if.	very good
PFA-Teflon®	-190 to +260	0,01	very good	n.if.	very good

s.e.: self-extinguishing | if.: inflammable | n.if.: not inflammable
Additional coating materials on request.

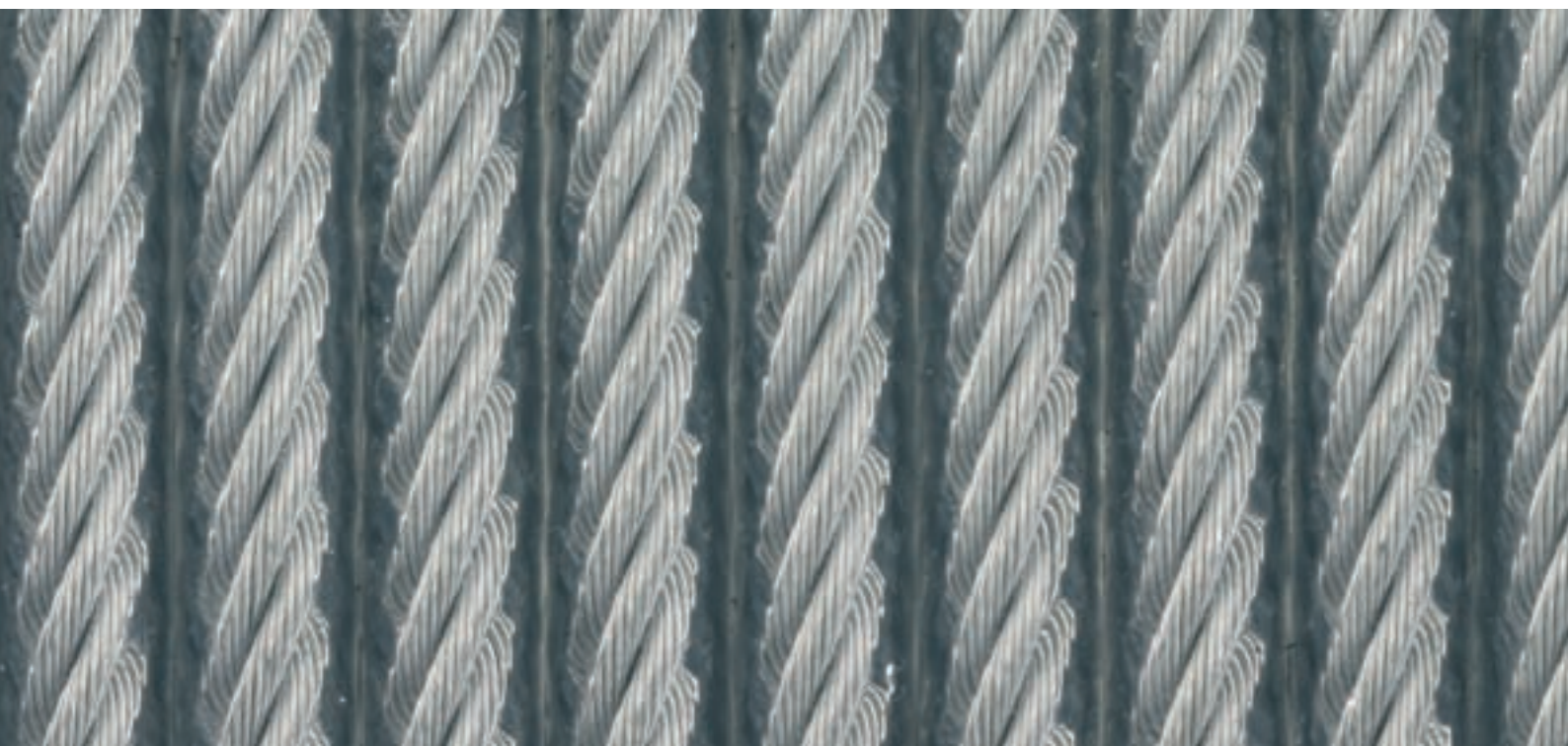


Products

– Spiral and stranded ropes with coatings materials

- Material 1.4401
- Nominal tensile strength 1170 MPa
- PA 12 transparent coated

Constructions	Direction of lay	Rope-Ø mm	Outer-Ø mm	Minimum breaking load N
1x7	S	0.30	0.50	90
		0.39	0.60	151
1x19	S	0.45	0.60	191
		0.50	0.75	238
		0.75	1.00	527
7x7	sZ	0.27	0.36	57
		0.36	0.45	99
		0.45	0.60	152
		0.54	0.70	216
		0.72	0.90	379
		0.81	1.00	478
		0.90	1.20	588
1.00	1.60	728		
7x19	sZ	0.60	0.82	256
		1.00	1.20	757

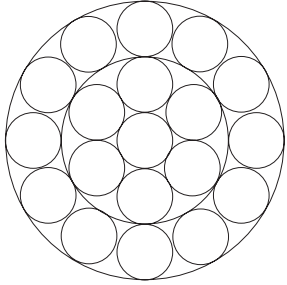
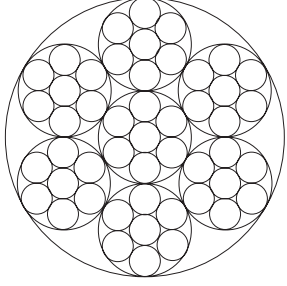
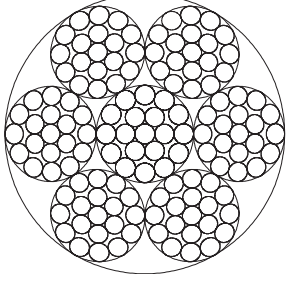


Products

– Standard ropes STAINLESS STEEL programme

- Material 1.4401
- Nominal tensile strength 1570/1770 MPa

- We deliver spiral and stranded ropes in the standard range of up to 16 mm in diameter

	1x19			
	Direction of lay	Diameter (mm)	Minimum breaking load kN	Weight per 100 m in kg
	Z	1.00	0.942	0.498
		1.10	1.290	0.597
		1.25	1.470	0.802
		1.50	1.890	1.200
		2.00	3.340	2.000
		2.50	5.270	3.100
		3.00	7.560	4.500
		4.00	13.370	8.000
5.00		20.830	12.510	
6.00	30.090	17.850		
8.00	53.300	31.700		
	7x7			
	Direction of lay	Diameter (mm)	Minimum breaking load kN	Weight per 100 m in kg
	sZ	2.00	2.920	1.700
		2.50	4.360	2.500
		3.00	5.340	3.540
		4.00	9.930	6.300
5.00		15.050	9.850	
6.00	22.400	14.200		
	7x19			
	Direction of lay	Diameter (mm)	Minimum breaking load kN	Weight per 100 m in kg
	sZ	2.00	2.680	1.600
		2.50	4.100	2.400
		3.00	5.700	3.420
		3.50	7.720	4.700
		4.00	8.910	6.090
		5.00	13.690	9.520
		6.00	19.630	13.800
8.00		35.650	24.400	
10.00	55.940	38.100		

Stronger dimensions on request!

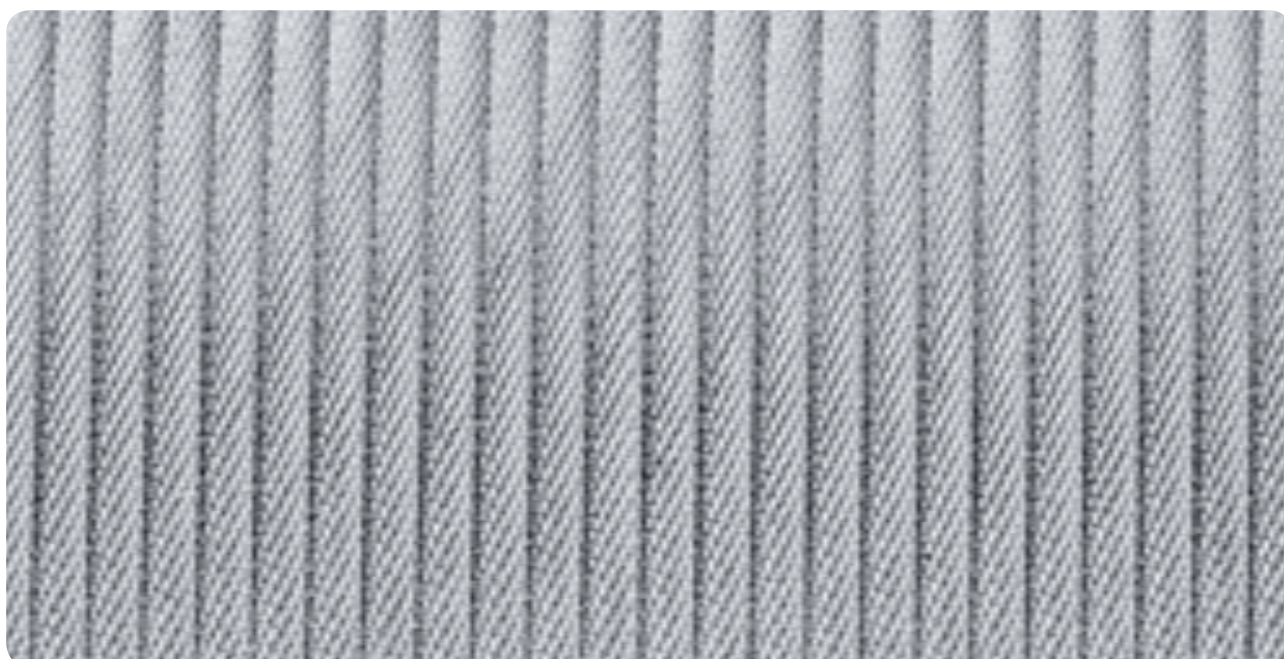
Products

– Rotation-resistant STAINLESS STEEL ROPES

- Material 1.4401
- Nominal strength 1570/1770 MPa
- We have developed rotation-resistant ropes in the lower diameter range of \varnothing 0.45 – 2.50 mm for special applications, for example, in process technology
- For lifting equipment and cranes, where ropes are to be used in areas exposed to danger of corrosion, we also offer our stainless steel ropes with low rotating performance from 3,00 mm diameter upwards.

18x7			
Direction of lay	Diameter (mm)	Minimum breaking load kN	Weight per 100 m in kg
sZ	0.45	0.136	0.088
	0.60	0.238	0.153
	0.75	0.299	0.193
	0.90	0.524	0.338
	1.05	0.709	0.457
	1.20	0.811	0.524
	1.50	1.330	0.858
	2.00	2.260	1.470
	2.50	3.910	2.530
	3.00	5.820	3.600
	4.00	9.060	6.430
	5.00	13.280	10.000
	6.00	19.210	14.500
	8.00	34.170	25.700

Stronger dimensions on request!



Products

– Special ropes

Spiral and round strand ropes

We produce a range of special constructions of non-ferrous metals, for example copper, brass, tombac, phosphor bronze, etc.

Let us develop your special product!



Compacted strands and ropes

On request we also offer our strands and ropes in the diameter range of 0.27 – 1.20 mm in a compacted version!



Hybrid strands and ropes

On request we produce strands and ropes from combinations of different materials. We are known for combinations of metal wires with natural or synthetic fibres. We develop your special product together with you!



Products

– Ready-made fine wire ropes

On request we also deliver our fine ropes ready made. The suitable components always ensure the correct connection, whether made of stainless steel, brass, copper steel or aluminium.

Accessories

For optimum use of our ropes we offer a comprehensive range of accessories: end fittings (terminals), tensioning devices (turnbuckles, etc.), connecting systems (carbine hook, chain coupler), ferrules, thimbles, cable grip, rope pulleys, tools for rope processing (hand pressing tools, wire rope cutters).

Just ask us!



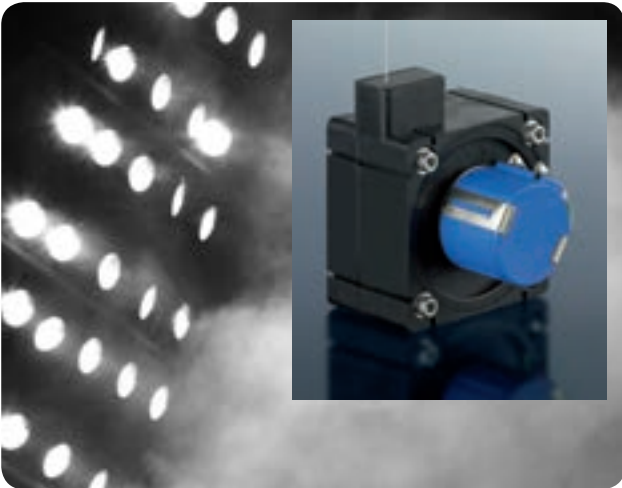
Fine wire rope-system solutions for highest demands



Metal mesh

Our strands and ropes offer extensive application possibilities when processed in metal mesh. Examples in the industry include conveyor belts, mesh plates for the production of chip boards, short-cycle presses for the production of laminate, to name just a few of the ranges of application.

In the field of architecture they set standards in terms of indoor and outdoor design and functionality. There are almost no limits to the creative ideas of the architects.



Electrical engineering

Our products fulfil a variety of tasks as a key element in electrical cables, connectors for high-quality nickel alloy lamps, as mixed conductors for special cables or heat conductors and resistance cables for tubular heating elements.

Fine wire ropes also offer extensive applications in measuring and control systems: as level indicators, control in precision engineering, robots for mechanical three-dimensional moving sequences and in many other fields of operation.



Machine construction

Our fine wire ropes are also applied in machine construction for power transmission in control cables. Stainless steel strands and ropes for transmission belts serve as machine elements for transferring tension loads.

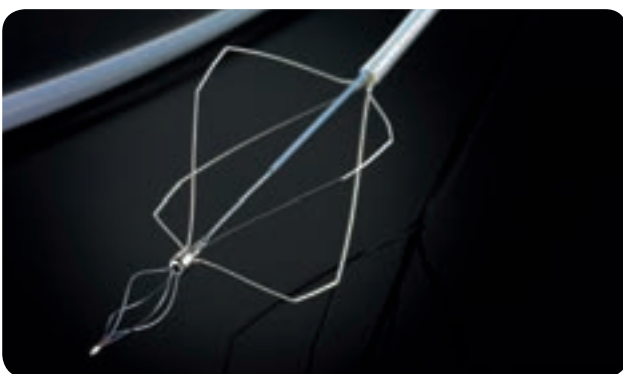


Jewellery and design

Super-fine wire ropes and strands made of precious materials are extremely popular with jewellery designers and offer countless new and surprising design opportunities. They appear puristic and valuable at the same time, and if combined with stones and pearls, they can be processed into beautiful pieces of jewellery.



We produce the finest stainless steel ropes and, if desired, made of all precious metals such as gold, silver and platinum, both in the solid metal or coated state.



Medical technology

Many modern operating methods today are inconceivable without the use of fine wire ropes. They support the most complicated applications in endoscopy, whose importance is constantly growing. Our special developments contribute to opening applicabilities and develop new healing methods.

Our products can be found in pulse generators for pacemakers, surgical bone saws, as well as implants for accident medicine and orthopaedics, to name just a few applications.

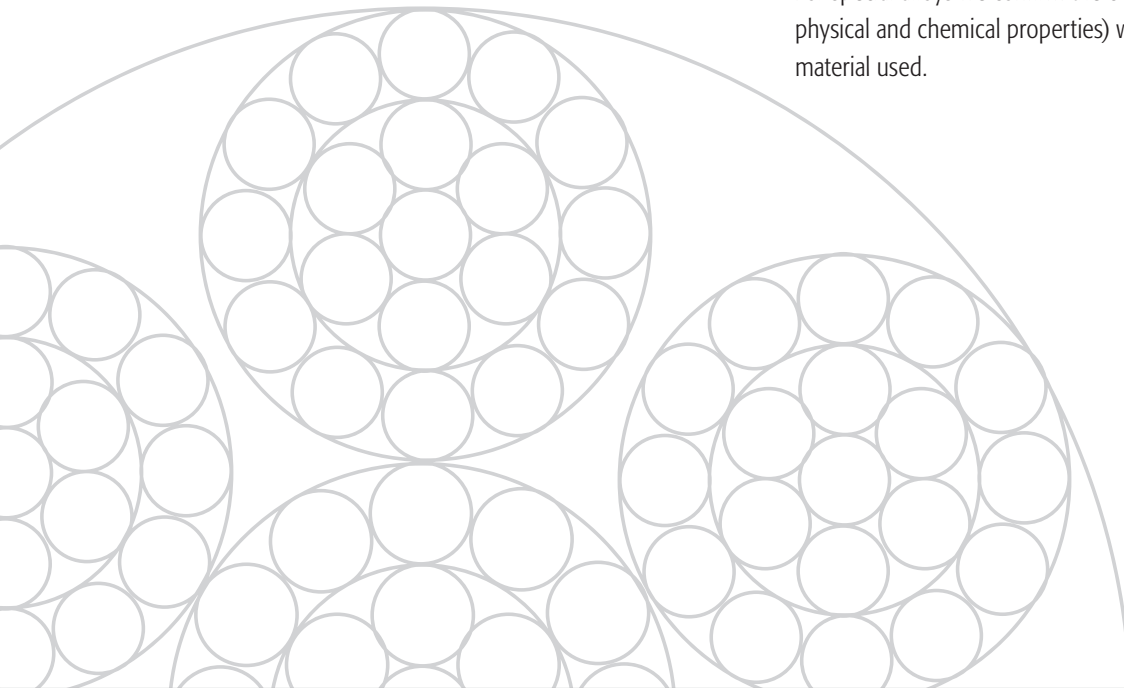


Outline information on wire ropes

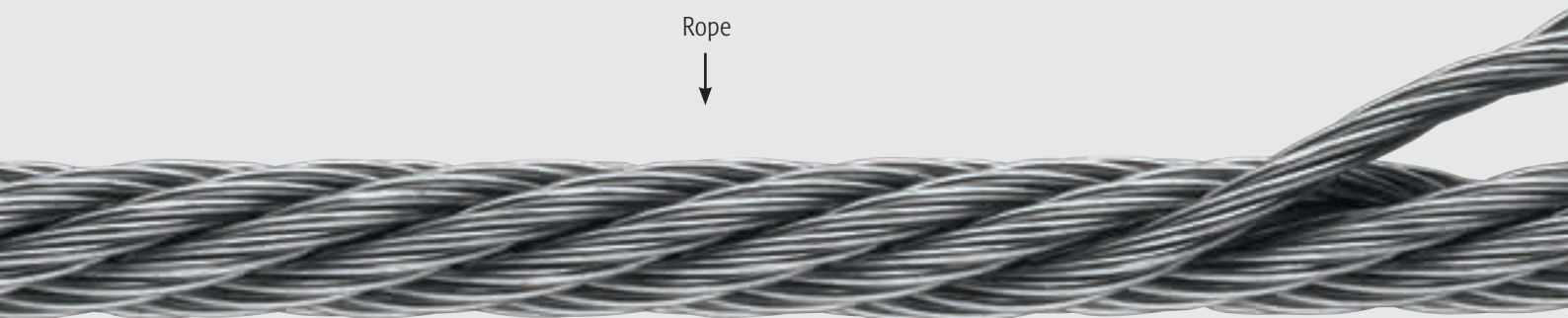
The production of fine wire ropes requires a high degree of precision and differs significantly from the manufacture of normal steel ropes. The different physical characteristics of the materials being processed also demand special attention.

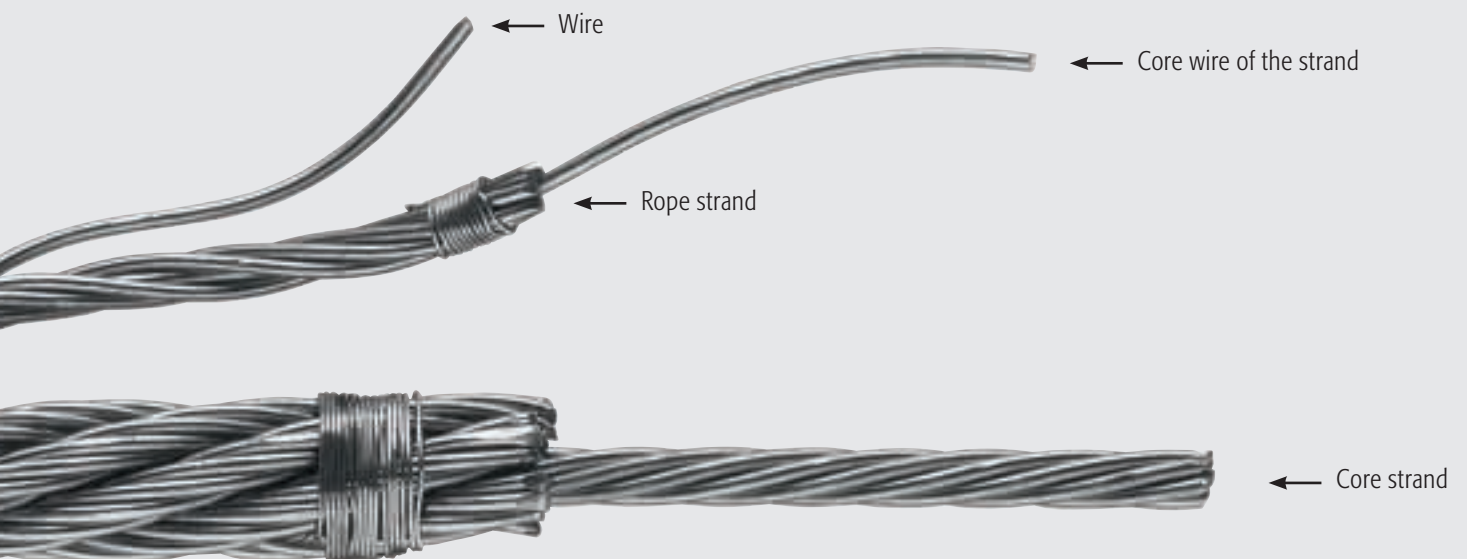
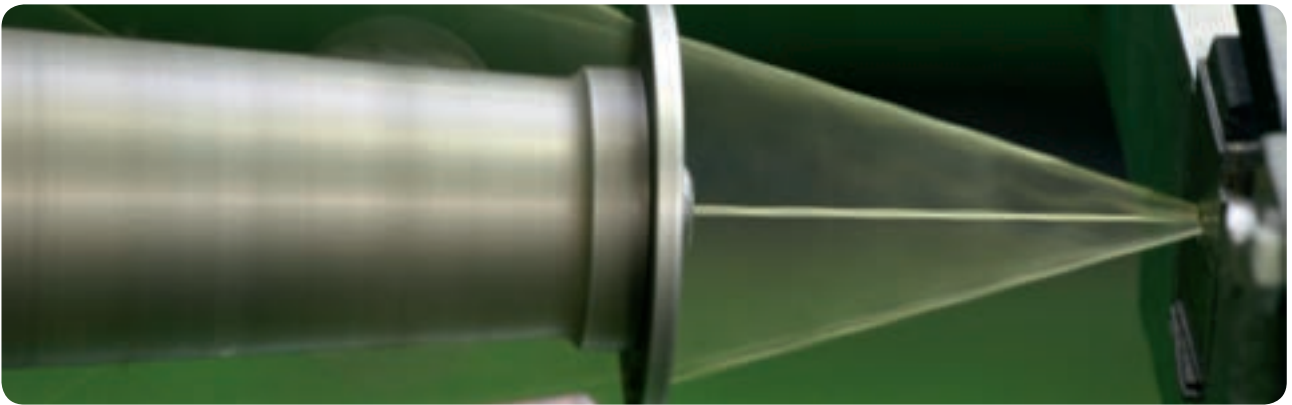
Our products are, without exception, processed according to the very latest engineering practices under continuous quality control. For this the technical delivery conditions for wire ropes are applicable as per EN 12385.

For special alloys we confirm the characteristics (mechanical, physical and chemical properties) which are derived from the material used.



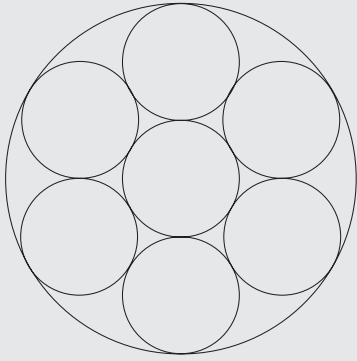
Rope



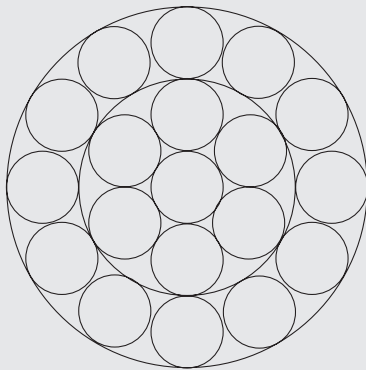


Outline information on wire ropes

Examples of strand constructions

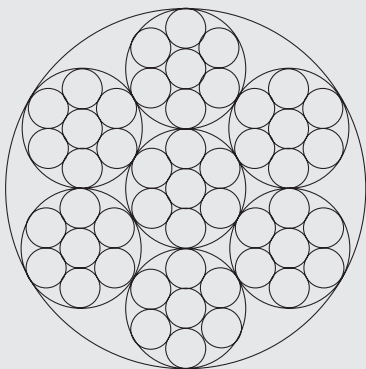


1x7

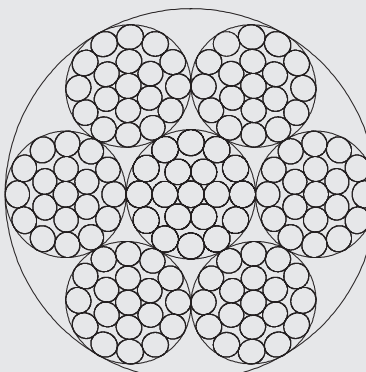


1x19

Examples of rope constructions



7x7



7x19

The primary material, the roping wire, is processed into a strand - stranded - the strands are then worked to become a rope through a further manufacturing process - roping up - to become a rope.

Direction of lay: This is the direction in which the wire in the strand is wound around the core wire, and respectively, the way in which the strand of the rope is wound around the core. Thus one distinguishes between left or right hand lay.

Ropes are distinguished between ordinary lay and lang's lay, depending on the direction of lay in the strands and ropes. If the direction of the wires in the strands are opposite to the direction of the strands in the rope one speaks of ordinary lay. If the directions are the same, one speaks of lang's lay.

The abbreviations for both types of rope manufacture are as follows: Ordinary lay right hand sZ, ordinary lay left hand zS Lang's lay left hand sS and lang's lay right hand zZ. Unless otherwise requested, we supply in ordinary lay, right hand sZ.

For the handling of a strand, as with a rope, it is crucial that it only has a moderate twist and low tension.

A rope is then described as low-tension or moderate in twist, when its strands and wires, after cutting, respectively, do not at all or only slightly „fray“ outwards from the rope bundle. A rope which is low in tension is thus „fray resistant“ and is not inclined to develop bending or undulations.

Low rotating, respectively non-rotating rope

A wire rope is low- or non-rotating, if it turns only a little or not at all along its longitudinal axis under the influence of a free hanging load.

This characteristic can only be achieved through special constructions (e.g. multilayered round stranded ropes) and manufacturing processes. The opposing torque in the rope resulting from the load, must be equal, in order to attain the desired low- or non-rotating effect.



sZ



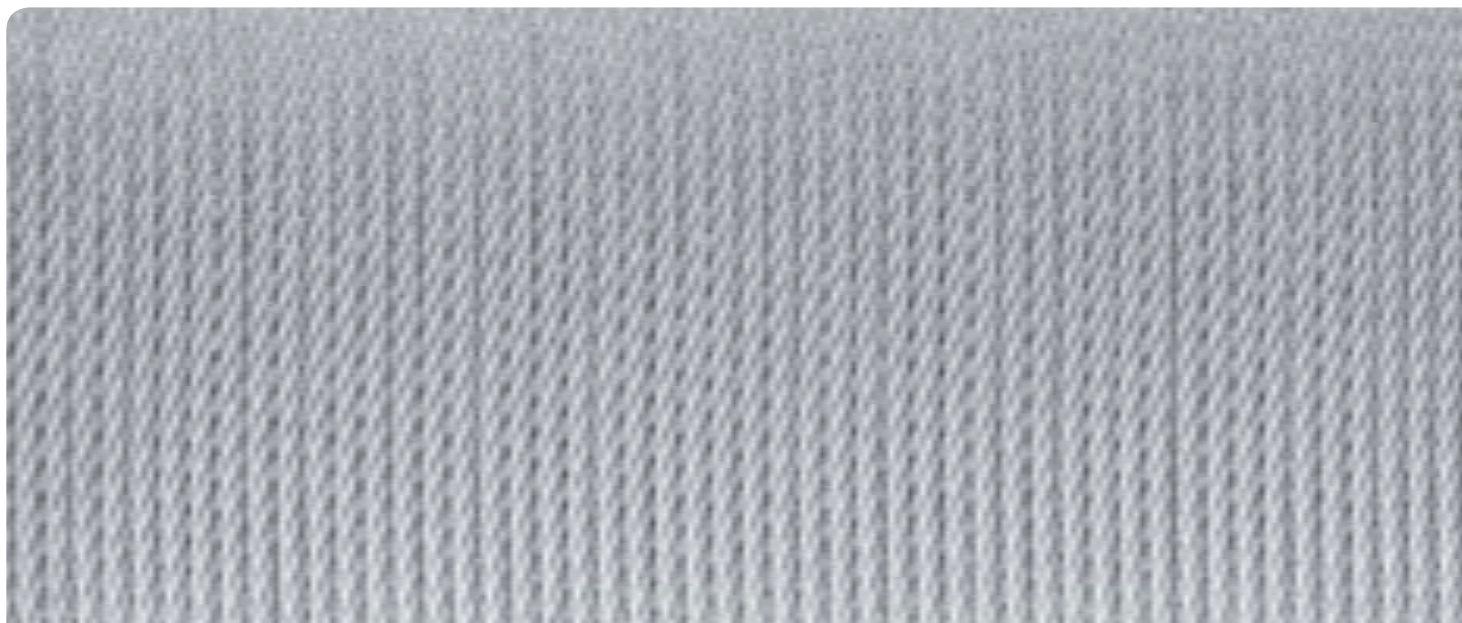
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Outline information on roping materials

We process stainless steel in all the roping grades, and also special materials if these can be delivered in roping wire form, as well as non-ferrous metals, e.g. copper, bronze, brass, etc. and also carbon steel.

Besides the different stainless steel grades, our particular attention is also given to special materials. We are known for the diversity of materials we process and partially have available in stock, and for our extensive application specific consulting.

Numerous special materials have been developed in the last decades that are applied, among other places, in the chemical industry, the nuclear industry, aerospace, marine technology, in industrial furnace construction, medical technology and environmental technology.

Consulting and selection always take place after the latest level of knowledge of metallurgy. Because of the very different conditions to which wire ropes are subjected to in practice, close cooperation is necessary between the user and manufacturer in order to achieve optimal results.

The following list gives a short overview of the most important special materials. For each area of application further alloys can be used, which we select in collaboration with the manufacturers.

We gladly provide you upon request with information about the technical-physical and chemical properties of special materials.

Heat conductor materials

Material No.

1.4828; 1.4841; 1.4860

1.4864; 2.4867; 2.4869

Corrosion-resistant material

SUPERAUSTENIT

Material no.: 1.4539

High corrosion-resistant materials

CARPENTER®

Material no.: 2.4660

HASTELLOY® C4

Material no.: 2.4610

MONEL®

Material no.: 2.4360

NICKEL 200 und 201

Material no.: 2.4066, 2.4068

TANTAL

TITAN

Material no.: 3.7025

Expansion-resistant material

INVAR®

Material no.: 1.3912

High temperature-resistant materials

INCOLOY® 825

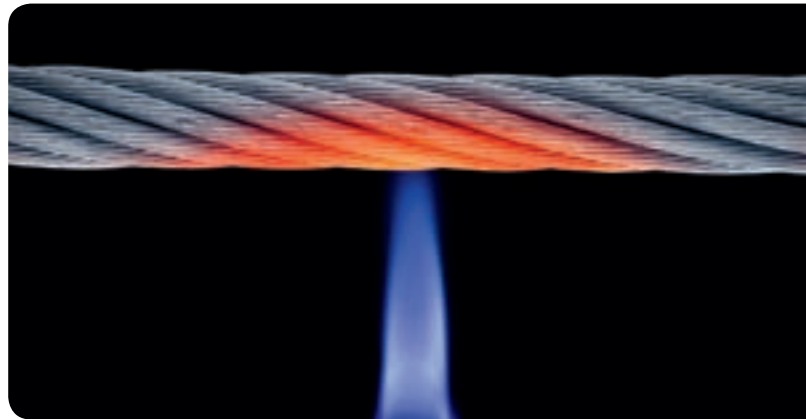
Material no.: 2.4858

INCONEL® 601

Material no.: 2.4851

INCONEL® 625

Material no.: 2.4856



Contact us

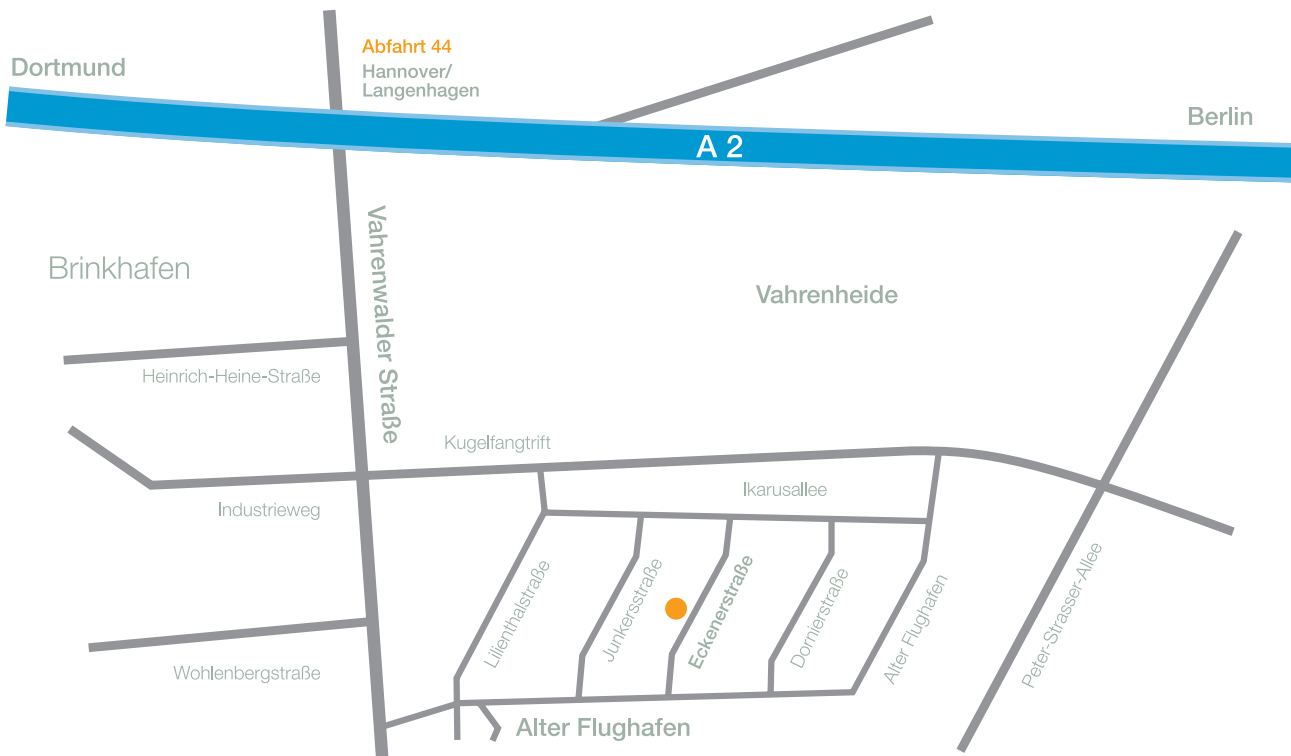
How to find us ...

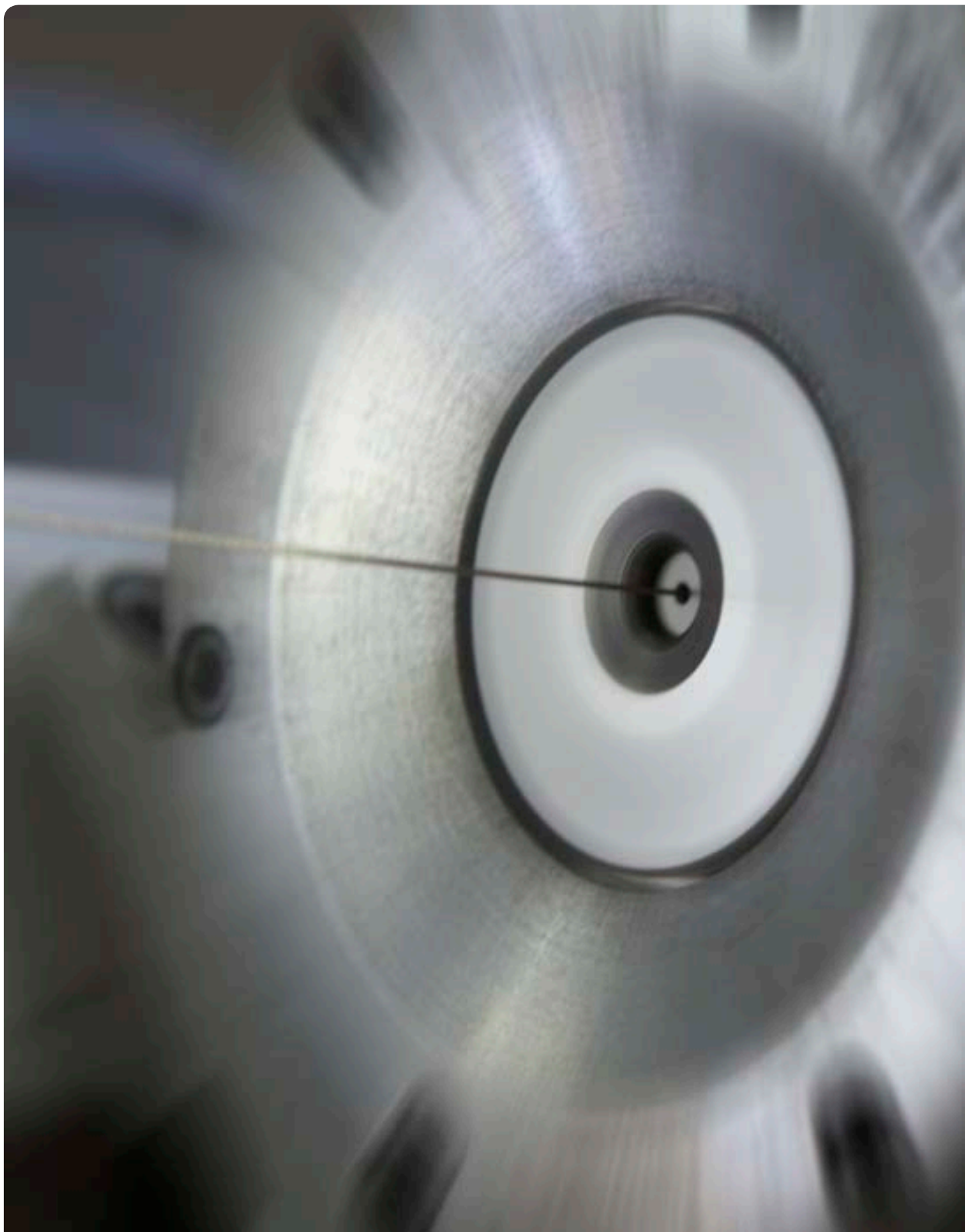
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Phone: +49 511 63983-0
Fax: +49 511 63983-99

www.engelmann-feinseile.de
info@engelmann-feinseile.de

- Highway A2 Berlin - Dortmund
- Take the Langenhagen/Airport/Hanover-North exit and head towards Hanover-North, then continue straight on Vahrenwalder Straße towards Hanover
- After 1.8 km, at the 3rd traffic light near the water tower, take a left onto the "Alter Flughafen" road
- After 600 m take the third road to the left - the Eckenerstrasse
- After 250 m, turn left onto the driveway of the ENGELMANN premises at Eckenerstraße 7





ENGELMANN

Vom Hofe Group

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Subject to technical modifications

The Vom Hofe Group at a glance

DRAHTWERKE
Vom Hofe Group

Spring steel and steel wires

KALTSTAUCHDRAHT
Vom Hofe Group

Cold heading and cold extrusion wires

FRÖNDENBERGER
Vom Hofe Group

Steel wires, rope, spoke
and spring steel wires

ENGELMANN
Vom Hofe Group

Fine wire ropes, rope and
lifting technology

DRAHTSEILWERK
Vom Hofe Group

Ropes for industry, shipping
and fishing, ATLAS® ropes

WADRA
Vom Hofe Group

Crane and traction ropes, lifting
straps, round slings and CableTrac

RSM
Vom Hofe Group

Ribbed expanded metal and
HIGH-RIP® for concrete