Handling Steel Wire Rope

Unreeling and Uncouling Wire Rope When removing wire rope from the reel on which it was received, or from the coil if it is a coil shipment, it is imperative that the reel or coil rotates as the rope unwinds. Attempts to unwind rope from stationary coils or reels will result in kinking the rope, and once a kink is formed the rope at that point is ruined beyond repair.

Unreeling If the rope is to be unwound from a reel, there are three correct methods of unreeling. 1) The reel may be mounted on a shaft supported by two jacks. The rope is then pulled from the reel by operators holding the end of the rope and walking away from the reel which rotates as the rope unwinds. This is the common approved method of unreeling wire rope. Care should be taken to avoid over-running. 2) The reel may be mounted on a turntable. It is then unwound in the same manner as described above. Care must be exercised to keep the rope from dropping below the lower reel head. Again avoid over-running. 3) The end of the rope may be held and the reel rolled along the ground.

Uncouling If the rope is to be removed from a coil, there is only one correct method of uncoiling. The end of the rope should be held and the coil rolled on the ground like a hoop.

Terminations Wire Rope terminations should be suitable for their purpose and should have a strength of not less than 80% of the minimum breaking load of the rope. Any free end of the rope should be seized to prevent unlaying. The ends of any wire rope other than that on a lifting device, hoist or winch should be fixed to the suspension point with a thimble-eye splice or ferrule-secured eye termination or bulldog-grip fixing ([to DIN 1142]) or other rope coupling device giving a strength of not less than 80% of the breaking load of the wire rope. The ends of any wire rope feeding onto a reeling winch should be fastened onto the winch drum in the manner specified by the manufacturer and in addition should preferably have at least three turns left on the drum when the suspended item is at its lowest level, and in no circumstances less than two turns.

This information is reproduced with permission from the ABTT Code of Practice for Flying, 2000. See also The Lifting Engineers Handbook [page 353].
**Wire Rope Terminology**

The general purpose wire ropes used in the theatre are normally 6 x 19 fibre core or 7 x 19 steel core. The first number refers to the number of “Strands” in the “Wire Rope”. The second number refers to the number of “Wires” in the “Strand”. A 6 x 19 construction wire rope will be slightly more flexible than a 7 x 19 rope. However, 7 x 19 ropes are slightly stronger and are better able to resist crushing and heat. They are less liable to deform when running over sheaves.

Ropes with a construction of 1 x 19 are very stiff and are used for yachts’ standing rigging, architectural rigging or handrailing applications. They must be terminated with roll swagged fittings as the wire cannot be formed into loops. The advantage of this construction is that it uses thicker wires which are better able to resist chafe and they present a smoother surface. We only stock them as stainless steel.

All the wires that we hold in stock are “R.H.R.L.” which stands for Right Hand Regular Lay. Nearly all ropes are “Right Hand Lay” but rarely a rope may need to be left hand lay for a special purpose such as drilling rigs. The “Regular Lay” means that the small “Wires” in each “Strand” are left hand lay to oppose the right hand lay of the rope. Some special purpose wire ropes are made with the wires laid in the same direction as the strands. This lay is called “Lang’s Lay”. These ropes are not suitable for making slings or drifts as they tend to unwind under load.

All our wire ropes are “Pre-formed”. Pre-formed ropes do not tend to spring apart when being cut and are much preferred for general use. Wire ropes are made from various grades of steel. There are only two general grades used for Galvanised Steel Wire Ropes and these are 1,770 N/mm² and 1,960 N/mm². A rope made to 1,770 is manufactured from wire with tensile strengths between 1,570 and 1,960 N/mm². A rope made to 1,960 will have a minimum strength of 1,770 and a maximum of 2,160 N/mm². Stainless steel ropes are slightly weaker than galvanised steel ropes.

The Working Load Limit of a wire rope is based on a safety factor of 5:1 of the Minimum Breaking Load. This is industry general practice but higher safety factors may be specified for your specific application.

Flints supplies full certification for all the wires we supply above 1 mm in diameter.

Flints is a full member of the Lifting Equipment Engineers Association and is approved to ISO 9001 by British Standards Institute.

We are proud of the fact that our staff attend regular training courses and symposiums regarding lifting and working at height.

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**Galvanised Wire Rope [BS EN 12385:2002]**

**6 x 19 [Fibre Core] 1,960 N/mm²**

This rope is the most flexible wire rope construction that we stock. It is a right-hand regular lay wire rope consisting of 6 strands of 19 wires around a fibre core. The wires are pre-formed so the wire will not spring apart when being cut. Choose it as a general purpose wire for making drifts or slings. If you are replacing a damaged wire in a set of wires, all the wires in the set should be replaced at the same time. The Working Load Limit specified is based on a 5:1 safety factor which must not be exceeded. Sometimes, in the theatre industry, higher safety factors of times eight or ten are required. The tensile strength of these wires is 1,960 N/mm². Supplied complete with certification.

The minimum breaking load shown on the certificate may vary slightly from those given below due to fluctuations in batches.

### Galvanised Wire Rope [BS EN 12385:2002]

<table>
<thead>
<tr>
<th>Wire Ø</th>
<th>Min BL 5:1</th>
<th>per metre</th>
<th>per drum</th>
<th>per drum</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 mm</td>
<td>522 kg</td>
<td>110 kg</td>
<td>WIR012</td>
<td>£0.44</td>
</tr>
<tr>
<td>4 mm</td>
<td>981 kg</td>
<td>196 kg</td>
<td>WIR014</td>
<td>£0.56</td>
</tr>
<tr>
<td>5 mm</td>
<td>1,533 kg</td>
<td>306 kg</td>
<td>WIR016</td>
<td>£0.69</td>
</tr>
<tr>
<td>6 mm</td>
<td>2,208 kg</td>
<td>441 kg</td>
<td>WIR018</td>
<td>£0.79</td>
</tr>
<tr>
<td>8 mm</td>
<td>3,926 kg</td>
<td>785 kg</td>
<td>WIR020</td>
<td>£0.99</td>
</tr>
</tbody>
</table>

A wide variety of other ropes are available to order. Please phone for a quote if you require special cables.

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**Low Rotation Wire Rope** These ropes are specially wound in contrary directions to reduce rotation to a minimum. Used mainly for single-point hanging of chandeliers etc. If using these wires with wedge sockets ensure the tail exceeds 20 times the diameter of the rope. Available to order only. Please phone our Rigging Department for details.
STAINLESS STEEL WIRE ROPES

Flexible Stainless Steel Wire Rope [BS EN 12385-2002] [Steel Core] 1,570 N/mm²

These flexible cables are made from 316 marine-grade stainless steel. They are suitable for running over sheaves or for forming thimble eyes. Ideal when high resistance to corrosion is needed or when the cables are being used for display purposes. The cables over 3 mm Ø are suitable for use with Sta-Lok terminations [page 158]. Unlike galvanised wire, stainless wire will show no telltale signs of wear such as rust streaks, but as no cables last for ever it is a wise precaution to enforce a schedule of replacement depending on the wire's application.

Non-Flexible Stainless Steel Wire Rope [BS EN 12385-2002] [Steel Core] 1,570 N/mm²

These wire ropes are most typically used for standing rigging on yachts and for architectural and handrail applications. They have a smoother appearance and are relatively stiff. Because the wires are thicker they are much less susceptible to surface wear which could cause sharp stray strands. They are NOT suitable for running over sheaves or for forming thimble eyes. Terminations are normally made by roll swaging, which we can undertake [page 158], or by using Sta-Lok type terminations [page 158] which can be fitted on-site. It is much easier fitting Sta-Loks to these cables [with fewer individual wires] than to the flexible cables [with multiple wires]. Flexible cables require a special castellated insert and can be a bit fiddly! 316-grade wire. These wire ropes will be supplied with full certification although being “Non Flexible” they are not suited for general lifting purposes.

Some observations on Stainless Steel

Stainless Steel has a lower tensile strength than ordinary steel. As a raw material it is rather weak but higher levels of strength can be obtained by the ability of austenitic stainless steel to be heavily cold worked. The two most common grades of stainless steel are AISI 304 and AISI 316. AISI stands for the American Iron and Steel Institute. They are often referred to as A2 and A4 grade. As a general rule, A2 is used for architectural purposes and A4 is used for marine purposes. A2 [304] is stronger but not so well suited to withstand salt water corrosion. Although A4 [316] is weaker it is virtually always specified for marine use. All our stainless wire ropes are made from A4 [316] grade except for the very small micro cables where the extra strength of 304 grade is essential. N.B. BS EN 13414-1: 2003 + A2: 2008 standard permits rope of both 1,770 N/mm² and 1,960 N/mm² to be used for Lifting. Our stainless steel rope (1,570 N/mm²) falls outside the standard.

Stainless steel resists corrosion by forming an oxide layer on its outer surface. If oxygen is prevented from getting to the steel to form this layer it will corrode rapidly. For this reason stainless steel is not suitable for underwater marine fastenings although it is perfect for standing rigging exposed to both salt water and oxygen. Do not expose stainless steel to hydrochloric acid of any concentration.

When using stainless steel wire ropes a rigorous regime of inspection should by employed as they will tend to look new even when they are old! Care should also be taken with stainless rigging screws which can suffer from cold welding. This is the phenomenon where screw threads can spontaneously weld themselves together without heat. Normally a little Anhydrous Lanolin will prevent this [page 169].

Current Technical Data

We have tried to include as much technical data as we can in this edition of our catalogue.

We will always try to match products as closely as possible to the specifications listed but if you are using a product with very tight tolerances then we would advise that you give us a ring and we will be happy to check the dimensions and load ratings for you.
MICRO CABLES & THEIR TERMINATIONS

Micro Cables
These very fine stainless steel micro cables have many uses. They will form virtually invisible suspension wires which are ideal for display or theatre use. They make excellent small control wires for animatronics and special effects. The wires are made from two grades of stainless steel. The smaller wires are made from the stronger 304 grade. The 1 mm wire is made from the more corrosion-resistant 316 grade. Two of the wires that Flints stocks have a fine transparent nylon coating which is almost invisible but provides a very smooth finish and holds the strands neatly together when the wire is being cut.

The 1 mm 7 x 7 construction wire rope will be supplied with a Certificate of Thorough Examination and complies with BS EN 12385 2002. The smaller cables are not issued with certification. We would recommend that you carry out your own tests to establish a minimum breaking load of the finished assembly and then apply a safety factor of at least five times.

To terminate these micro cables we recommend using the Nicopress® system. Flints has had special ferrules developed by Nicopress® to solve the old problem of making secure terminations in these very small wires [see 1]. We also supply small brass ferrules [not Nicopress®]. When using ferrules any nylon covering should be stripped back and the ferrule should be chosen to suit the actual wire diameter.

Flints’ trials have found a good termination can be made using the Nicopress® tool for Flints to provide an effective means of securing a loop in our micro cables. They are made from solid copper. They can be easily compressed by using the tools above 2. The combination of these economical tools and the micro ferrules solves the old problem concerning the termination of very small cables. Tests show that these terminations exceed the strength of the wire. They are ideal for invisible control and display wires. For the nylon-covered wires use a ferrule to suit the actual wire diameter. The nylon cover should be stripped back before compressing the ferrule. For non-lifting applications it is possible to make a termination with the nylon coating in place. Using ferrule NIC42815VB4 on the 1.05 mm nylon-covered wire with the nylon cover still in place we achieved results of around 20 kg before the wire slid out through the nylon coating. Although less strong with the nylon in place, they do make extremely smooth and neat assemblies which would be suitable for lightweight lanyards.

Nicopress® Tools

department: 9	title: Unit 9 Deptford Trading Estate, Blackhorse Road, London, SE8 5HY	tel: 020 7703 9786	www.flints.co.uk

Brass Ferrules
These ferrules are too small for conventional crimper. A substitute crimper can be made by drilling downwards through the jaws of a pair of pliers and using a vice to apply pressure.

Flints’ trials have found a good termination can be made using the Nicepress® 17BA tool. These brass ferrules are not Nicopress® ferrules. Not suitable for lifting purposes.

Nicopress® Small Wire Tools

Nicopress® Micro Ferrules

Really versatile tools!

Have a look at our Nicopress videos on YouTube under FlintsTheatre channel.