DELTA Safety Training welcomes you for the training

SOCKET TERMINATION
BY WIRELOCK RESIN
Wirelock is a unique socketing compound for steel wire ropes.

Wirelock has been used in the Offshore, Construction and mining industry for over 30 years.

Wirelock is the only socketing system that meets the requirements of D.N.V’s certification standard, D.N.V. – OS – E304. Certification of: “Mooring Steel Wire Ropes”

Wirelock has both Lloyds and ABS Type Approval.
Course Content:

Part 1: Components
- Spelter Sockets
- Steel Wire Rope
- Wirelock Resin

Part 2: Termination Method
- Theory & Practical

Part 3: Exam
- Test Paper
Socket Termination by Wirelock Resin

Spelter Sockets

Steel Wire Rope

Wirelock Resin
SPELTHER SOCKETS

Sockets are the strongest steel wire rope fittings available. When they are fitted correctly they meet or exceed the breaking load of the steel wire rope.

Sockets are manufactured to various International standards:
- BS: 463
- DIN: 50049
- American Federal Specification RR-S-550

Test certificates including M.P.I reports are always recommend to be provided from the supplier.
SOCKET TERMINATION
BY WIREFLOCK RESIN

SOCKET DIMENSIONS

R = Rope diameter,  S = Strand diameter

W = Outer Wire diameter

THEN IDEALLY:

H/R > 3
or
H/S > 5
or
H/W > 50

CIRCULAR GROOVES

Are generally thought to do more harm than good
SOCKETS TERMINATION EFFICIENCY

% Against the Minimum Breaking Load of the steel wire rope

- Wire rope bulldog grip  80 / 90 %
- Mechanical spliced eye  85 / 95 %
- Wedge socket  80 %
- Swaged socket  100 %
- Spelter socket  100 %
SOCKETS ARE USED IN THE FOLLOWING APPLICATIONS:

- Anchor Lines
- Marine Mooring Lines
- Winch Tow Wires
- Suspension Bridges
- Dredging Wires
- Crane Pennants & Hoist Ropes

**USAGE TEMPERATURE SOCKETS:**
MIN. -53°C / MAX. +115°C
STEEL WIRE ROPE

All types of steel wire rope can be terminated with spelter sockets

Wire Rope (6 X 36 IWRC RHOL)
STEEL WIRE ROPE CONSTRUCTION

Left Hand | Right Hand | Right Hand | Left Hand
Ordinary Lay | Lang Lay
Prior to use ALWAYS check:

- The Suppliers Name
- Batch Number
- Shelf Life Date (This should not exceed 18 months)
Socket Termination
By Wirelock Resin

Wire Lock Resin: CAUTION

Material Safety Data Sheet

CAUTION

- Wirelock® resin, in liquid state, is flammable.
- Chemicals used in this product can give off toxic fumes and can burn eyes and skin.
- Use only in well-ventilated work areas.
- Never breathe fumes directly or for extended time.
- Always wear safety glasses to protect eyes.
- Always wear gloves to protect hands.
- Avoid direct contact with skin anywhere.

1. Identification of the Substance/Preparation and Company
   - Product Name: Wirelock/Paralock Rope Capping Kit
   - Company: Millfield Enterprises (Manufacturing) Limited
   - Address: 16 Shelley Road, Newburn Industrial Estate, Newburn, Newcastle upon Tyne, NE15 9RT, United Kingdom
   - Emergency Contact No: Tel: +44 (0) 191 264 8541
     Fax: +44 (0) 191 696 692

2. Composition/Information of Ingredients
   - Product Description: Unsaturated polyester resin, dissolved in styrene containing low levels of inhibitors to prevent premature polymerisation. The solid portion of the kit contains less than 1% of Benzoyl Peroxide and does not have any significant health hazards apart from the fact that as a powder it may be irritating to the eyes and respiratory system.
   - Ingredients:
     - Styrene: CAS No. 100-42-5
     - Risk Phases: R10, R20, R36/37/38
     - EINECS: 202-851-5
     - Safety Phases: S23, S24/25, S26, S36/37/39
     - Classification/Symbol: Harmful Xn

3. Hazards Identification
   - Flammable. Harmful by inhalation. Irritating to eyes and skin. This product may present a possible environmental hazard.

4. First Aid Measures
   - Inhalation: Remove to fresh air, keep patient warm and at rest. If breathing is irregular or has stopped, administer artificial respiration. Give nothing by mouth.
   - Eye Contact: Irrigate copiously with clean, fresh water for at least 10 minutes, holding eyelids apart.
   - Skin Contact: Remove contaminated clothing, wash skin thoroughly with soap and water or use a proprietary skin cleanser. Do not use solvents.
   - Ingestion: If accidentally swallowed, DO NOT INDUCE VOMITING, keep at rest and obtain medical attention.
   - General: In all cases of doubt, or where symptoms persist, seek medical attention.

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**WIRELOCK RESIN:**

Polyester Resin
Thermosetting (Exothermic reaction)
No Heat Required
No Socket Pre-heat

Two Pack System
One Pack Contains Resin + Accelerator
One Pack Contains Filler + Catalyst

**Mix together thoroughly to activate**
HOW A SOCKET WORKS:

- **Socket body**
- **Brush**
- **Socketing Medium**
- **Wire Rope**

SOCKET TERMINATION BY WIRELOCK RESIN
HOW A SOCKET WORKS:

So:

The socketing medium needs to adhere to the wires in order to generate the initial downward force.

And:

The socketing medium needs to be compressible under radial pressure to grip the wires.
SOCKET TERMINATION
BY WIRELOCK RESIN

CALCULATION OF SOCKET VOLUME:

\[
\frac{(D + d)^2}{4} \times H \times 3.142 = cc
\]

(D, d & H are in cm)

\[
\frac{(D + d)^2}{4} \times H \times 3.34 = \text{Socket Volume in cc}
\]

(D, d & H are in inches)

GUIDE TO AMOUNT OF WIRELOCK® REQUIRED

<table>
<thead>
<tr>
<th>Wire Diameter (mm)</th>
<th>Amount (cc)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.5</td>
<td>50</td>
</tr>
<tr>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>9.5</td>
<td>17</td>
</tr>
<tr>
<td>11</td>
<td>35</td>
</tr>
<tr>
<td>12.5</td>
<td>35</td>
</tr>
<tr>
<td>14</td>
<td>52</td>
</tr>
<tr>
<td>16</td>
<td>52</td>
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<tr>
<td>18</td>
<td>35</td>
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<tr>
<td>19</td>
<td>36</td>
</tr>
<tr>
<td>22</td>
<td>125</td>
</tr>
<tr>
<td>25</td>
<td>160</td>
</tr>
<tr>
<td>28.5</td>
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<tr>
<td>32</td>
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<td>54</td>
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<tr>
<td>57</td>
<td>1410</td>
</tr>
<tr>
<td>60</td>
<td>1410</td>
</tr>
<tr>
<td>65</td>
<td>1830</td>
</tr>
<tr>
<td>68.5</td>
<td>1830</td>
</tr>
<tr>
<td>70</td>
<td>2250</td>
</tr>
<tr>
<td>75</td>
<td>3100</td>
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<tr>
<td>82.5</td>
<td>3795</td>
</tr>
<tr>
<td>89</td>
<td>4920</td>
</tr>
<tr>
<td>95</td>
<td>5980</td>
</tr>
<tr>
<td>101.5</td>
<td>7730</td>
</tr>
</tbody>
</table>
COMPARISON OF TERMINATION BY WHITE METAL AND WIRE LOCK RESIN

EFFICIENCY RATING

<table>
<thead>
<tr>
<th>White Metal Method</th>
<th>Wire Lock Resin</th>
</tr>
</thead>
<tbody>
<tr>
<td>125mm (100%)</td>
<td>125mm (100%)</td>
</tr>
<tr>
<td>95mm (94%)</td>
<td></td>
</tr>
<tr>
<td>55mm (44%)</td>
<td>55mm (100%)</td>
</tr>
<tr>
<td></td>
<td>25mm (43%)</td>
</tr>
</tbody>
</table>

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SOCKET TERMINATION
BY WIRELOCK RESIN

Distribution of pressure on the cone within the socket

Load

Pressure

Slip
TECHNICAL REFERENCES:

BS EN 13411-4:2011
Part 4: Metal and Resin Socketing

WIRELOCK
Technical Data Manual
## SAFETY AND RISK ASSESSMENT

<table>
<thead>
<tr>
<th>Safety Considerations</th>
<th>Sockets terminations can be carried out in a workshop facility or on offshore locations. Example: AHV Deck</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Therefore inspection of your work area should be carried out prior to starting the work.</td>
</tr>
<tr>
<td></td>
<td>Ensure you have the appropriate work permit for the work that you are going to carry out.</td>
</tr>
<tr>
<td></td>
<td>Personnel are to wear appropriate personal protective equipment related to the work site.</td>
</tr>
<tr>
<td>Risk Assessment</td>
<td>When conditions or the work site constitute the need for a risk assessment, the following should be used for guidance:</td>
</tr>
<tr>
<td></td>
<td>Look for the hazard. Decide who might be harmed, and how. Evaluate the risk and decide whether existing precautions are adequate.</td>
</tr>
</tbody>
</table>
TOOLS AND EQUIPMENT REQUIRED:

- Steel Wire Rope
- Spelter Socket
- Rags
- Cleaning Fluid
- Abrasive Cutter
- Serving Wire
- Clamps
- T Needle / Spikes
- Opening Tubes
- Pliers / Grippers
- Suitable Stand or Vice
- Containers for Mixing
- Plasticine or fire clay

A Safe Workstation
PREPARATION: SOCKET

Is the socket suitable for the application..? (Do not use oversized sockets)

Check :
Socket Size against rope size.? 
Ensure socket is dry and grease free
Has the socket been inspected ?

ALL CLEAR..?

Proceed .....
Preparation: of Steel Wire Rope to be Terminated

Select wire rope, measure & mark for cutting

Apply temporary serving each side of cut mark

Did we fit the socket..?
Preparation: of Steel Wire Rope to be Terminated

Cut the rope (abrasive wheel preferred)

Select socket

Mark to show start of permanent serving

Secure steel wire rope in holding vice or clamp

Did we fit the socket..?
Preparation: of Steel Wire Rope to be Terminated

Location of Permanent Serving
Preparation: of Steel Wire Rope to be Terminated

Brooming is one of the most critical parts of any socketing operation

Note:
Any Plastic covering or in-fills / fibre cores should be removed
SOCKET TERMINATION
BY WIRELOCK RESIN

SOCKETING CARRIED OUT ON LOCATION OFFSHORE
CLEANING THE BROOM

The broom should be cleaned using:

- Jizer
- Gunk

You must always clean towards the broom
After washing and cleaning keep the broom upright

Keep the broom clean at all times
Course Content:

Part: 1 Components
- Spelter Sockets
- Steel Wire Rope
- Wirelock Resin

Part: 2 Termination Method
- Theory & Practical

Part: 3 Exam
- Test Paper
REFORMING THE BROOM

- The brush should be reformed using **CLEAN** tools

- Reform the broom so that it is approximately the same shape as the inside of the socket

- Avoid lots of wires touching the inside of the socket
POSITIONING OF BROOM AND ALIGNMENT OF SOCKET

- The axis of the socket must be aligned with the axis of the rope.

- The rope must be 30 x the rope dia on the vertical with no bends or curves within the wire.

- The broom location and positioning is vital in which to provide an efficient termination with the load from the wire being uniformly distributed.
Make certain the broomed wires are uniformly spaced in the basket, with wires ends at the top edge of the basket, with a slight protrusion of the single wires by 1 / 2 mm. and that the axes of the rope and the fitting are aligned.

Correct alignment will avoid premature failure of the assembly due to unequal loading of the wires.
Question:
1. Is it necessary to have a flushed surface?

Answer: No.
The customer / inspector/ insurance inspector need to know that a proper broom has been created and not half way.

Corrosion – \( \text{O}_2 + \text{H}_2\text{O} \)

Over years, the protruding wires may disappear due to corrosion.
SEALING OF THE SOCKET PRIOR TO POURING

Plasticine, Putty is required to seal the base of the socket, thus preventing the resin leakage which would result in the socket termination being totally useless.

Extreme care must be taken that the sealing compound is able to hold the volume weight of the wirelock.

Note that resin in particular is very ‘searching’ and the sealing process must be done carefully otherwise you will end up with an empty socket and a resin covered rope!
Identification Plate

Duck Tape
MIXING WIRELOCK RESIN KITS

You must plan safely and carefully the next fitting steps as time is a key factor.

The complete mixing process must be completed within 2 minutes
Min./Max. pouring temperature -3°C / +35°C.
MIXING THE RESIN

Pour the liquid into the powder and mix with a wooden spatula or similar. When combining two or more kits pour all the powder into a suitable clean container followed by all the resin.

Do not split kits into smaller quantities.

Make sure no powder remains at the bottom of the mixing container.

When you are mixing please watch the wirelock resin as it will turn greenish, turquoise in color.

In the event that the color changes to a straw color please do not use.

Always mix the complete kits: Resin & Powder.

Ensure thorough mixing.
MIXING THE RESIN

**Booster Pack**

At ambient temperatures below 9 deg C (48deg F) and above 2 deg C (35 deg F), one (1) Booster Pack should be used.

Below 2 deg C (35 deg F) and above -3 deg C (27 deg F), two (2) Booster Packs should be used.

The Booster Pack compensates chemically for the slower gel time experienced at lower temperatures.

Ensure thorough mixing
POURING THE SOCKET

Ensure the rope, socket is held secure

Once the Wirelock resin has been mixed correctly it should be immediately poured into the basket of the socket.

To ensure that the basket accepts the full volume of resin the pouring should be done slowly and preferably down the side of the socket to allow air to escape

Pour the socketing medium in a continuous flow down the inside face of the socket “puddle” with a wooden or metal rod to remove trapped air
POURING THE SOCKET

The gelling process should start within the basket of the socket and not before.

Always mix sufficient wirelock to complete the pouring in a single event.
Pouring the Socket

The gelling process should start within the basket of the socket and not before. Always mix sufficient wirelock to complete the pouring in a single event.

SOCKET TERMINATION BY WIRELOCK RESIN
Socket should be straight and level prior to pouring the resin
CHECK ON PENETRATION

The top of the cured cone should have the single wires slightly visible by 1 or 2 mm

On removing the stopper material from the socket base it will be visible that the wirelock resin has gone down into the throat of the socket
Topping up of the resin may be done providing the following are observed:

- The socket must be allowed to cool for 1 hour after it has gelled.
- Topping up is complete within 24 hours of the socket pour and
- Only be done with a thin layer for cosmetic / protection reasons!!!
MOVEMENT OF THE WIRE ROPE AND SOCKET
Don’t..!

Do not move the socket from its pouring position until at least 30 minutes after the gelling has been completed.
SURFACE CRACKS

Cracks means good shrinkage
2-3 mm standard
Crack will stop penetrating
INSPECTION

- Allow the socketing medium to fully set and scratch test
- Remove the “permanent” serving
- Check alignment of rope & socket
- Check wire protrusion
- Check complete filling of socket particularly at socket neck
- Re-lubricate the rope at the neck of the socket
LOAD TESTING OF THE SOCKET TERMINATION

Should the socket termination require load testing then this can be carried out 1 hour after the gelling period.

Should the socket be proof load tested we recommend 2 x the safe working load. (Presuming 5:1 Factor Of Safety)
<table>
<thead>
<tr>
<th>SOCKET TERMINATION BY WIRELOCK RESIN</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>FRANKLIN OFFSHORE</strong></td>
</tr>
<tr>
<td>REPORT / RECORD</td>
</tr>
<tr>
<td>OF SOCKET TERMINATION BY WIRE LOCK RESIN</td>
</tr>
<tr>
<td>REPORT TYPE FOS : 009</td>
</tr>
<tr>
<td>FRANKLIN OFFSHORE QUALITY CONTROLLED FITTING PROCEDURE Non. F.O.S SSP-1</td>
</tr>
</tbody>
</table>

**Record of Socket Termination by Wirelock Resin**

<table>
<thead>
<tr>
<th>REPORT NUMBER</th>
<th>NAME OF OWNER</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>DATE</td>
<td>LOCATION</td>
</tr>
<tr>
<td>LOCATION</td>
<td>SERVICE WORK COMPLETED BY</td>
</tr>
<tr>
<td></td>
<td>DESCRIPTION OF WORK</td>
</tr>
</tbody>
</table>

**SOCKET DETAILS**

<table>
<thead>
<tr>
<th>SOCKET DETAILS</th>
<th>WIRE LOCK RESIN KIT DETAILS</th>
</tr>
</thead>
<tbody>
<tr>
<td>MANUFACTURER</td>
<td>MANUFACTURER</td>
</tr>
<tr>
<td>TYPE</td>
<td>SUPPLIER</td>
</tr>
<tr>
<td>L.D NUMBER</td>
<td>KIT SIZE</td>
</tr>
<tr>
<td>TO SUIT ROPE SIZE</td>
<td>BATCH NUMBER</td>
</tr>
<tr>
<td>TEST CERTIFICATES</td>
<td>EXPIRY DATE</td>
</tr>
<tr>
<td>MPI REPORT</td>
<td>MIXING METHOD</td>
</tr>
<tr>
<td>SOCKET CONDITION</td>
<td>AMBIENT KIT</td>
</tr>
<tr>
<td>NEW / USED</td>
<td>BOOSTER KIT</td>
</tr>
<tr>
<td>CLEANING METHOD</td>
<td>COLOUR OF MIXED KIT</td>
</tr>
</tbody>
</table>

**STEEL WIRE ROPE DETAILS**

<table>
<thead>
<tr>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIA</td>
</tr>
<tr>
<td>CONSTRUCTION</td>
</tr>
<tr>
<td>FINISH</td>
</tr>
<tr>
<td>LAY</td>
</tr>
<tr>
<td>CLEANING METHOD</td>
</tr>
<tr>
<td>IS THE ROPE FREE FROM INTERNAL CORROSION</td>
</tr>
</tbody>
</table>

**STEEL WIRE ROPE AND SOCKET PROOF LOAD DETAILS**

<table>
<thead>
<tr>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>SWL AND IDENTIFICATION NUMBER</td>
</tr>
<tr>
<td>PROOF LOAD TO BE APPLIED</td>
</tr>
<tr>
<td>METHOD OF TEST</td>
</tr>
<tr>
<td>TYPE OF LOAD MEASURING UNIT</td>
</tr>
<tr>
<td>CALIBRATION REPORT</td>
</tr>
</tbody>
</table>

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RE - USE OF USED SPELTER SOCKETS

The socket should be fully inspected against an inspection criteria

Use only sockets that:

- Do not show any evidence of distortion
- The socket is not Bent, Deformed or Cracked
- The socket is free from nicks and gouges
- The socket should be free from welding
- The socket should not show any signs of discoloration from excessive heating
RE - USE OF USED SPELTTER SOCKETS

Procedure for removing resin cone

The wire should be cut close to the nose end of the socket, and gently pressed out. In some cases the unit can be knocked out by a hammer.

Heating of the socket should be avoided unless you can control the temperature maximum \(95^\circ C\). (200°F by Crosby)

Should the socket be suitable for further service then the socket must be cleaned, including the inside of the basket.
FAILURE OF SOCKET OR SOCKET TERMINATION
The socket alignment with the rope is not straight. This leads to unequal load distribution and termination failure.
SOCKET TERMINATION
BY WIRELOCK RESIN
SOCKET TERMINATION
BY WIRELOCK RESIN

22 mm
MBL: 34.47 ton
WLL: 6.2 ton
FAILURE OF SOCKET OR SOCKET TERMINATION
SOCKET TERMINATION
BY WIRELOCK RESIN
PART 2: PRACTICAL

Safety takes Priority

PPE: Required
PPE

Please use the correct PPE:

- WORK SUIT
- SAFETY GLASSES
- SAFETY GLOVES
- HARD HAT
- SAFETY BOOTS
SOCKET TERMINATION
BY WIRELOCK RESIN

SOCKETING ON SITE…
SOCKET TERMINATION
BY WIRELOCK RESIN

SOCKETING ON SITE…
SOCKET TERMINATION
BY WIRELOCK RESIN

SOCKETING ON SITE…
SOCKET TERMINATION BY WIRELOCK RESIN

SOCKETING ON SITE…
PART 3; EXAM...

The test paper will consist of twenty questions with multiple choice answers

Good Luck
SOCKET TERMINATION
BY WIRELOCK RESIN