WIRELOCK®

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WIRELOCK® Socketing Compound

WIRELOCK® is a unique socketing compound for use with wire ropes. The product eliminates the hazards of working with a molten metal, and allows socketing to be done on site, when required, in virtually all weather conditions.

WIRELOCK® is generally used in long term applications such as crane ropes, boom pendants, winches, lifting straps, mast stays, suspended roofs, bridges, mining and offshore mooring systems.

Efficiency

When fabricated properly, **WIRELOCK®** wire rope assemblies are 100% efficient based on the minimum breaking force of the wire rope. **WIRELOCK®** is designed to be used with steel wire rope, galvanized wire ropes and stainless steel wire ropes.

Installation Information

Socketing Using WIRELOCK® Resin Material:

Seizing, cleaning, brooming and preparation of wire rope and pouring of **WIRELOCK®** is to be carried out per instructions provided in the **WIRELOCK®** Technical Data Manual located in this manual on Page 73-77, and the **WIRELOCK®** Warnings and Application Instructions located on the **WIRELOCK®** Product or in the Crosby® General Catalog.

Before operation of the wire rope assembly, it is recommended that all poured sockets, whether with zinc or resin, be proof loaded to seat the cone.

Facts about WIRELOCK®

1. **WIRELOCK®** is designed to gel (change from a liquid to a solid), in approximately 20 minutes at 65°F (18°C). To ensure that the kits are not adversely affected by storage, they should be stored in a dry place at a temperature of between 50°F and 75°F (10°C and 24°C) and away from any source of

direct heat. **WIRELOCK®**, like all polyester resins, is temperature sensitive. An increase in temperature of 15°F (10°C) shortens the gel time by approximately 50%. A decrease in temperature of 15°F (10°C) lengthens the gel time by approximately 100%.

2. KIT SIZES

   100 cc
   250 cc
   500 cc
   1000 cc
   2000 cc

   Other sizes available to order.

   The specific gravity of **WIRELOCK®** is 1.73. Therefore, 1000 cc's will weigh 1.73 kilos or 3.81 lbs. 250 cc's will weigh

   $$\frac{1.73 \times 250}{1000} = 0.43 \text{ kilos or } 0.95 \text{ lbs.}$$

3. **WIRELOCK®** Wire Rope Assemblies are 100% efficient when used with steel wire rope, galvanized wire ropes and stainless steel wire ropes. We do not advise the use of stainless steel wire rope in a salt water marine environment without regular inspection. In the presence of an electrolyte, i.e., sea water, electrolytic degradation of the stainless steel wire rope can occur. This phenomenon, known as crevice corrosion, will impair the integrity of the rope in the region near to the neck of the socket. Crevice corrosion also occurs when white metal is used for socketing. (Zinc should not be used to socket stainless steel rope.) However, the onset of crevice corrosion in resin sockets appears to be faster than when white metal is used. Other rope types do not exhibit this behavior.

4. **WIRELOCK®** is approximately 20% the weight of zinc.
5. The strength of **WIRELOCK®**, in its cured state, is not

WIRELOCK® Socketing Compound

Typical example of the swelling of stainless steel rope due to crevice corrosion

adversely affected by cold temperatures.

6. **WIRELOCK®** must be mixed and poured (see 6.3) within the temperature range of 27°F - 95°F (-3°C - 35°C). The kits are not adversely affected by storage at temperatures below 27°F (-3°C). It is recommended the **WIRELOCK®** kit be stored in a cool place.
7. The operating temperature of **WIRELOCK®** is +240°F to -65°F (+115°C to -54°C).
8. When cured, **WIRELOCK®** has a hardness of approximately 55 Barcol. When the resin has set fully (opaque green or mustard color) only a slight scratch mark will be seen when a sharp object, such as a screwdriver blade, is scraped over the surface of the resin. On a small socket, it is quite normal to have a very thin tacky layer on the surface of the resin. The scratch test can be carried out through this layer.
9. Cracks which may appear on the top of the cured cone are surface crazing only, and are the result of heat stresses and shrinkage upon a thin layer of unfilled resin covering the tops of the wires. The crazing does not affect the strength of the termination within the socket.
10. Shrinkage of the **WIRELOCK®** cone may leave a gap between the cone and the socket wall. This is normal, particularly with large sockets and high ambient temperatures. This in no way affects the efficiency of the assembly. Upon loading, the cone will be seated perfectly in the socket. The shrinkage of **WIRELOCK®** is between 1.5 - 2.0%. In high volume **WIRELOCK®**, the shrinkage is about 0.5%.
11. Excessive numbers of horizontal rings in the socket may increase the load required to “seat” and wedge the cone within the socket. They should be avoided whenever possible, and a proof load applied (not exceeding 60% of MBL) if they must be used. Alternatively, they should be filled in with clay prior to placing the socket on the rope.
12. **WIRELOCK®** poured sockets should not be used in environments of strong caustic or acid solutions. **WIRELOCK®** is not affected by oils, or grease or salt water.
13. **WIRELOCK®** is, by design, a compressive resin. Therefore, when removed from the socket a **WIRELOCK®** cone, if hit by a hammer, may shatter. In a socket, even under extreme loads or shockloads, the **WIRELOCK®** cone remains solid and 100% efficient.
14. The shelf life of **WIRELOCK®** is eighteen (18) months (check label before use) from the date of manufacture.

Worldwide Agency Approvals

- ✓ Lloyds Register of Shipping
- ✓ Det Norske Veritas
- ✓ American Bureau of Shipping
- ✓ United States Coast Guard
- ✓ Registro Italiano Navale
- ✓ Germanischer Lloyd

STANDARD CONSIDERATIONS

ASME B30.9

All slings terminated with sockets shall be proof loaded. The proof load shall be a minimum of 2 and a maximum of 2-1/2 times the single leg vertical hitch rated load. The proof load should be that specified by the wire rope or fitting manufacturer’s recommendation provided that it is within the above specified proof load range. When sockets are used in sling assemblies the minimum recommended design factor is 5.

ASME B30.5

Cranes require that boom pendants terminated with sockets be proof tested. When sockets are used in boom pendant lines the minimum recommended design factor is 3.

See OSHA and ASME for full information.

WIRELOCK®

RESIN FOR SPELTER SOCKETS
NOT AVAILABLE IN CANADA
Note: For use on 416, 417, 427 and 517 spelter sockets only.

- 100% termination efficiency.
- Temperature operating range is -65° F to +240° F (-54°C to +116°C).
- Ideal for on site applications.
- No hazardous molten metal.
- Improved fatigue life.
- Pouring temperature without booster pack is 48° F to 110° F (6.67°C to 43.3°C).
- One booster pack if pouring temperature is 35° F to 48° F (1.67°C to 8.89°C).
- Two booster packs if pouring temperature is 27° F to 35° F (-2.78°C to +1.67°C).
- Refer to WIRELOCK® Technical Manual for more information.

SEE APPLICATION AND WARNING INFORMATION
Para Español: www.thecrosbygroup.com *On Pages 94-95*

Approvals:

Lloyds Register of Shipping
Det Norske Veritas (DNV)
United States Coast Guard
United States Navy
American Bureau of Shipping
ISO 17.558
DNV-OS-E304

NATO Numbers:

100 cc	8030-21-902-1823
250 cc	8030-21-902-1824
500 cc	8030-21-902-1825
1000 cc	8030-21-902-1826

Witnessed and tested by American Bureau of Shipping. (ABS)

Approximate U.S. Measurements:
250 cc's Kit 1 Cup

WIRELOCK® W416-7 Socket Compound

W416-7 Kits				Booster Pak Stock No.
Kit Size	Kit Per Case	Stock No.	Weight Each (lbs.)	
100	20	1039602	.62	1039603
250	12	1039604	1.25	1039605
500	12	1039606	2.54	1039607
1000	12	1039608	4.59	1039609
2000	12	1039610	9.00	1039611

Guide to amount of WIRELOCK® Required

Wire Rope Size		WIRELOCK® Required (cc)	Wire Rope Size		WIRELOCK® (cc)
(in.)	(mm)		(in.)	(mm)	
1/4	6-7	9	1-3/4	44	700
5/16	8	17	1-7/8	48	700
3/8	9-10	17	2	51	1265
7/16	11	35	2-1/8	54	1265
1/2	13	35	2-1/4	56	1410
9/16	14	52	2-3/8	60	1410
5/8	16	52	2-1/2	64	1830
3/4	20	86	2-5/8	67	1830
7/8	22	125	2-3/4	70	2250
1	26	160	3	76	3160
1-1/8	28	210	3-1/4	82	3795
1-1/4	32	350	3-1/2	88	4920
1-3/8	36	350	3-3/4	94	5980
1-1/2	40	420	4	102	7730
1-5/8	42	495	—	—	—

Wirelock is a hazardous material regulated by US DOT, ICAO/IATA and IMO for transportation.

DETAILED INSTRUCTIONS FOR THE USE OF WIRELOCK®

With Strand or General Purpose Wire Rope

These instructions explain the proper use of WIRELOCK® for socketing wire rope terminations. When reading and following these instructions, pay close attention to warnings and safety information presented in bold print.

For maximum salety and efficiency, use **WIRELOCK®** only as instructed.

1. Warning on Correct Application of WIRELOCK®

It is very important when deciding upon the use of **WIRELOCK®** to note the following:

⚠ WARNING

- **Incorrect use of WIRELOCK® can result in an unsafe termination which may lead to serious injury, death, or property damage.**
- **Do not use WIRELOCK® with stainless steel rope in salt water environment.**
- **Use only soft annealed iron wire for seizing.**
- **Do not use any other wire (copper, brass, stainless, etc.) for seizing.**
- **Never use an assembly until the WIRELOCK® has gelled and cured.**
- **Remove any non-metallic coating from the broom area.**
- **Non Crosby sockets with large grooves need to have those grooves filled before use with WIRELOCK®.**
- **Read, understand and follow these instructions and those on product containers before using WIRELOCK®.**

2. Safety and Health Precautions for Using WIRELOCK®

It is very important that certain precautions be taken when using **WIRELOCK®** for a wire rope socket termination. When using the product, be sure to read information on product containers and note the following:

⚠ CAUTION

- **WIRELOCK® resin, in liquid state, is flammable.**
- **Chemicals used in this product can give off toxic fumes and can burn eyes and skin.**
- **Never use out-of-date material.**
- **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.**

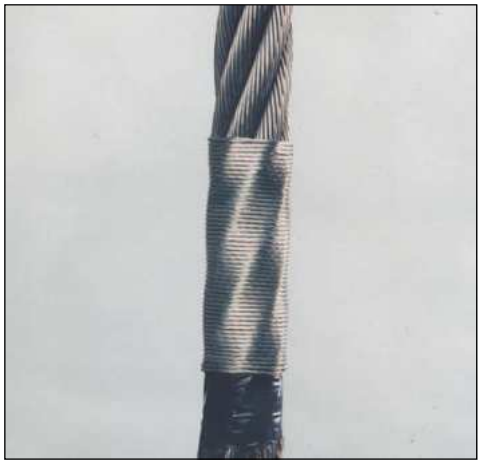
3. Selection of Socket

3.1 WIRELOCK® is recommended for use with sockets that comply with Federal or International (CEN, ISO) Standards.

3.2 WIRELOCK® as with all socketing media, depends upon the wedging action of the cone within the socket basket to develop full efficiency. A rough finish inside the socket may increase the load at which seating will occur. Seating is required to develop the wedging action.

3.3 Measure the rope ends to be socketed. The rope end should be of sufficient length so that the ends of the unlaid wires (from the strands) will be at the top of the socket basket.

3.4 Next, apply the seizing one (1) socket basket length from the end of the rope minus one (1) rope diameter. The length of the seizing must be at least two (2) rope diameters long. Additional information can be secured from your Wire Rope Users Manual or your Wire Rope Manufacturers' Catalogs or National Standard. Seizing wire should be a soft annealed iron wire.



Seizing of Wire Rope

3.5 Plastic coated or plastic filled wire ropes must have all plastic material (non-metallic materials) removed from within the broomed area.

3.6 The socket basket should be examined prior to use and loose scale, dirt or grease removed.

Do not use oversized sockets for Wire Rope.

3.7 When socketing Strand, the time honoured method of one size up when choosing the socket is generally still applicable in the vast majority of cases. However, caution should be exercised as tests have shown that the length of the socket basket should be five (5) times the strand diameter or fifty (50) times the maximum wire diameter, whichever is the greater.

3.8 **Inserting the broom into the socket.**

There are two procedures that can be used to position the broom within the socket. The rope

can be inserted into the socket prior to brooming. Subsequently the socket can be pulled up over the broom. The second method requires that the broom is closed and compacted to enable it to be inserted into the socket without damaging the rope.

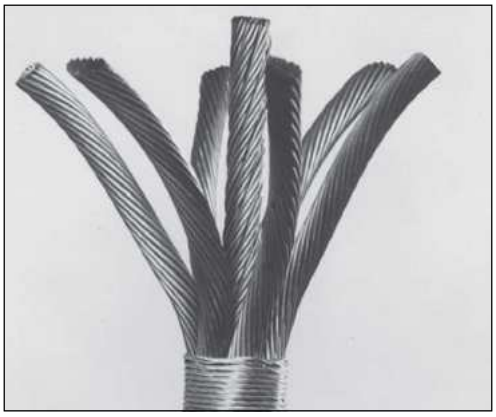
For detailed explanation of Resin Socketing of Steel Wire Rope, see Page 88.

4. Preparation of Broom

4.1 The rope is secured in a vice directly below the seizing to allow the strands to be unlaid to the seizing. They should be bent outwards to an included angle not exceeding 90 degrees. (Fig. 1)

4.2 Internal leakage of resin in ropes 3" (75mm) in diameter and larger can occur because of gaps between strands and the IWRC (Independent Wire Rope Core). These gaps should be sealed (before brooming), by pushing small plugs of the sealing compound down into the served portion.

4.3 If the rope has a fiber core, it should be cut out insuring that the remaining fiber core extends 1/2 rope diameter into the bottom of the socket. In the case of fiber cores, resin is the preferred socketing medium.



Unlay wire rope so that angle does not exceed 90° (Fig. 1)

4.4 If the rope has an IWRC, the IWRC shall be completely unlaid to form part of the broom.

4.5 **All the wires in each strand and in the IWRC must be unlaid completely down to the seizing to form a broom, being careful not to disturb or change the lay of the wires and strands under the seizing band. The wires should not be straightened.**

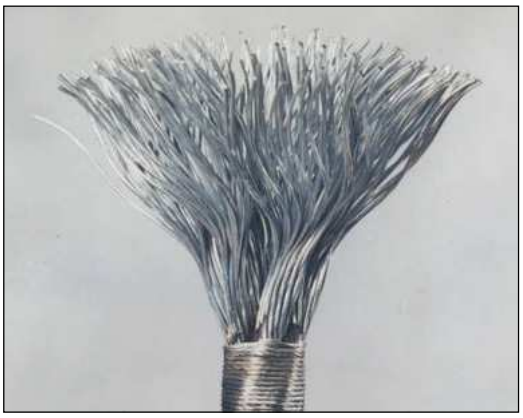
Brooming is one of the most critical parts of any socketing operation.

Note: The wires must be unlaid from the end of the rope to the seizing because a good fill of resin must occur to the bottom (small end) of the socket. (Fig. 2). **Most of the load capacity of the termination is concentrated in the bottom one-third of the socket.**

4.6 Except in the case of wire ropes of coarse construction e.g., 6 x 7, it is not necessary or desirable to hook the wires in the broom. When the rope contains large numbers of wires, hooking the ends causes congestion within the socket and can create penetration problems for the socketing medium, although this is less of a problem with resin than with zinc or white metal.

4.7 The open broom shall be thoroughly cleaned (degreased). **Be sure that the cleaning is confined to the broom and does not extend to the rope beyond.**

Properly Broomed Wire Rope (Fig. 2)



Incorrectly Broomed Wire Rope

4.8 The method of cleaning will depend on the lubricant and/or coating on the wire.

4.9 The methods and materials used for cleaning should comply with the current EPA regulations.

4.10 Consult the Wire Rope Technical Board, your Wire Rope supplier or the Wire Rope Manufacturer for recommended materials and methods.

4.11 **Do not clean the wire rope broom with acid, soda, methol hydrate or acetone. A flux should not be used.**

4.12 The wire rope broom, after cleaning and drying, should be kept in an upright position to prevent any grease, or mixture of grease and cleaner, from

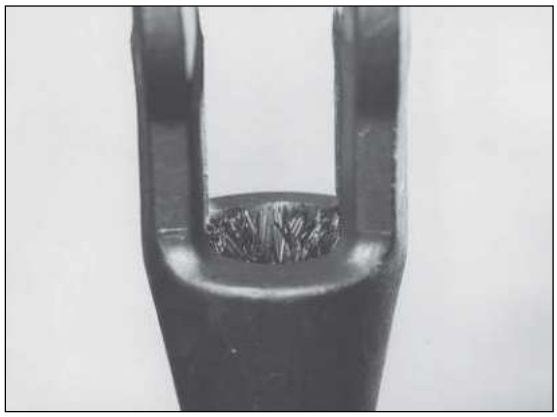
running back down from the main body of the rope and contaminating the clean wires.

5. Positioning of Broom and Alignment of Socket

5.1 The broom should be inserted into the socket using one of the methods described in 3.8. Place rope in a vertical position with the broom end up. It is recommended that there be thirty (30) rope diameters below the socket before any bending occurs in the rope, or twenty (20) rope diameters if securely clamped to a beam.

Make certain the broomed wires are uniformly spaced in the basket, with wire ends at the top edge of the basket, (Fig 3), and that the axes of the rope and the fitting are aligned. A centralizing clamp should be used to assist in the alignment of the axes of the socket and the rope (Fig 4 and Fig 5).

Correct alignment will avoid premature failure of the assembly due to unequal loading of the wires.

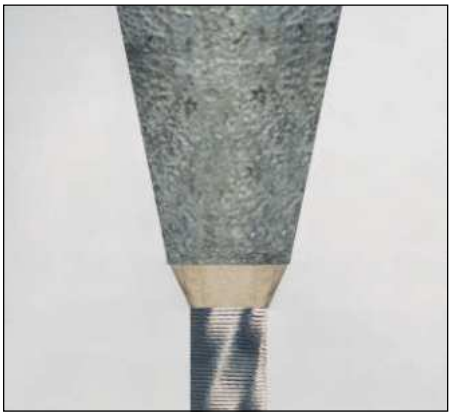


Properly positioned broom with wire rope ends protruding slightly (Fig. 3)

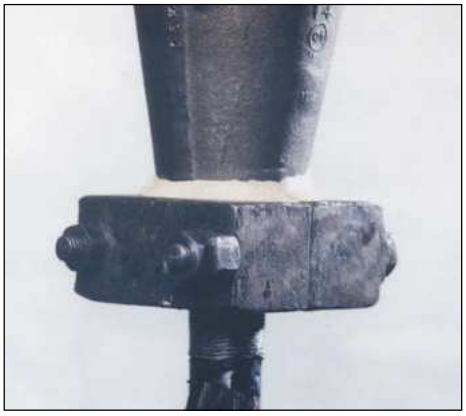
5.2 Plasticine or clay based putty, i.e. window or glazing putty, is required to seal the base of the socket prior to pouring, thus preventing resin leakage which may cause voids. (Fig. 4 and 5)

⚠ CAUTION

- **Wirelock resin, in liquid state, is flammable.**
- **Chemicals used in this product can give off toxic fumes and can burn eyes and skin.**
- **Never use out-of-date material.**
- **Always check expiration date on the cans. Never use out of date material.**
- **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.**



Axes of socket and rope properly aligned and sealed with plasticine (Fig. 4)



Clamp used to align rope and socket before sealling with plasticine (Fig. 5)

6. Materials

6.1 Always check expiration date on the cans. Never use out-of-date material.**WIRELOCK®** should be stored in a cool 50°F - 75°F (10°C - 24°C) dry place.

6.2 **WIRELOCK®** is formulated for mixing and pouring in the ambient temperature range: 27°F – 95°F (-3°C – 35°C). At lower temperatures the gel time will increase. Below 48°F (9°C) the gel time of approximately 20 minutes can be maintained by the use of booster packs.

6.3 At ambient temperatures below 48°F (9°C) and above 35°F (2°C), one (1) booster pack should be used. Below 35°F (2°C) and above 27°F (-3°C), two (2) booster packs should be used. The booster pack compensates chemically for the slower gel time experienced at lower temperatures. In order to comply with all the approvals granted, **WIRELOCK®** should not be mixed and poured at temperatures below 27°F (-3°C). Knowing the ambient temperature is useful – however, it should be remembered **WIRELOCK®** will for some time afterwards tend to cure according to the temperature at which it, the socket and the wire rope were stored. The temperature of the socket

and the rope should conform to the temperature at which the **WIRELOCK®** has been stored for the last 24 hours. When the sockets, rope and **WIRELOCK®** are stored at normal room temperature (65 to 70°F or 18 to 21°C), booster packs must not be used even if the ambient temperature is below 48°F (9°C). If the temperature is above 95°F (35°C) the **WIRELOCK®** kit should be refrigerated for two hours before use.

6.4 It is possible to combine various kit sizes to achieve any required volume, e.g., 2500 cc = 1 x 1000 cc plus 3 x 500 cc, etc. In this case, all of the liquid resin should be placed in the mixing container and then all of the powder added to it (or vice versa) before mixing. **Always mix all of the resin with all of the powder. Never mix less than the total contents of all cans.**

Some kits can be mixed in the original packaging (Fig. 6)

6.5 **Only the 100cc, 250cc & 500cc can be mixed in the original packaging by pouring the resin into the granular materials container. In the case of other kits, a proper mixing vessel should be used (Fig 6).**

Mixing vessels should be clean. They can be of metal, polythene or polypropylene. Polymerization products of styrene, i.e. styrofoam cups and similar products should not be used. A flat wooden or metal paddle, not a spike or screwdriver, should be used as a stirrer.

6.6 Immediately upon pouring the resin into the granular compound (or vice versa), mix vigorously for two (2) minutes or until a homogenous mixture has been obtained. Make sure that no unmixed granular compound remains on the bottom of the mixing container. For larger sizes, a mechanical mixer is ideal.

Upon mixing, the WIRELOCK® will turn to a greenish / turquoise colour. If the mix remains a pale straw yellow colour, do not use the kit. Always mix all of the resin with all of the powder. Never mix less than the total contents of both cans.

7. Use of Heat

7.1 Do nol apply heat to sockets to accelerate the curing process prior to pouring. The application of external heat may cause the resin to gel before it reaches the bottom of the socket and lead to assembly failure. Used sockets cleaned out by heating (see Appendix D) should be allowed to cool to room temperature before reuse.

Hot sockets must not be used.

8. Pouring

8.1 Once the **WIRELOCK®** is mixed, it should be poured immediately (Fig. 7) into the socket to ensure good penetration, preferably down the side of the socket to allow air to escape.

Upon mixing, the compound should be poured immediately (Fig. 7)

Immediate pouring will ensure that the gelling stage occurs in the socket and not in the mixing container. Sufficient **WIRELOCK®** should be mixed so that the socket can be completely filled at one pouring. **WIRELOCK®** is designed to gel in approximately 15 minutes and to cure within 60 minutes after gel. To provide an adequate safety margin, no load should be applied to the wire rope assembly until a minimum of one (1) hour has elapsed from the time the **WIRELOCK®** gels in the socket. As the **WIRELOCK®** cures, a chemical (exothermic) reaction occurs, causing a considerable rise in temperature.

Temperatures in excess of 212°F (100°C), may be reached in large volume kits in the mixing container. In the socket where the wires of the rope and the socket itself act as a heat sink, the maximum temperature likely to be achieved will be of the order of 160°F - 175°F (70°C - 80°C).

9. Movement

9.1 Movement of resin poured sockets may damage the soft resin and reduce the efficiency of the termination. Resin poured sockets should not be moved for a minimum of ten (10) minutes after the material **in the socket** has gelled.

10. Check on Penetration

10.1 A visual check for penetration of the resin into the socket bottom can be made by removing the centralizing clamp and the plasticine or putty. Seizing on the rope adjacent to the neck of the socket should be removed up to the point where it enters the socket.

11. Re-Lubrication

11.1 After removing the rope from the vice, any degreased area of the rope below the socket should be re-lubricated.

12. Loading

12.1 The rope can be put into service or proof loaded one (1) hour after the material in the socket has gelled.

12.2 Whenever possible, the assembly should be Proof Loaded in accordance with ASME B30.9-2.6.

13. Reuse of Socket

13.1 To remove the resin from the socket:

a. Cut the rope close to the base of the socket (1/2" is about right).

b. Press the rope and cone out of the socket or,

c. Heat the surface of the socket to 350°F (177°C). Leave for 5-10 minutes. Force out the rope and cone with a drift pin and hammer.

13.2 For additional information on reuse of sockets, see Appendix C "Technical Bulletin #1" by The Crosby Group LLC (page 93).

Approvals

Approvals:

✓ Lloyds Register 0f Shipping
✓ Det Norske Veritas
✓ United States Coast Guard
✓ United States Navy
✓ American Bureau of Shipping

NATO Numbers:
100cc 8030-21-902-1823
250cc 8030-21-902-1824
500cc 8030-21-902-1825
1000cc 8030-21-902-1826
Witnessed and tested by American Board of Shipping (ABS)

Manufactured by:
MILLFIELD ENTERPRISES (MANUFACTURING) LIMITED
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Newburn, Newcastle upon Tyne
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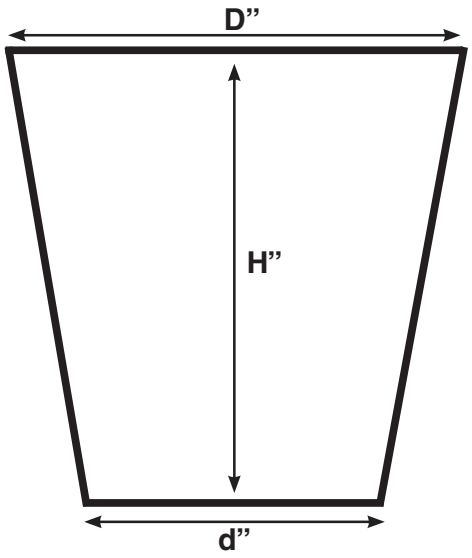
WIRELOCK® Formula for Spelter Sockets

WIRELOCK®
Formula to estimate CC's required to pour standard spelter sockets



$$\left(\frac{D + d}{4}\right)^2 \times H \times 3.142 = cc$$

Note: D, d and H are in centimeters

GUIDE TO AMOUNT OF WIRELOCK® REQUIRED

1/4" (6.5mm)	9cc
5/16" (8mm)	17cc
3/8" (9.5mm)	17cc
7/16" (11mm)	35cc
1/2" (12.5mm)	35cc
9/16" (14mm)	52cc
5/8" (16mm)	52cc
3/4" (19mm)	86cc
7/8" (22mm)	125cc
1" (25mm)	160cc
1-1/8" (28.5mm)	210cc
1-1/4" (32mm)	350cc
1-3/8" (35mm)	350cc
1-1/2" (38mm)	420cc
1-5/8" (41mm)	495cc
1-3/4" (44.5mm)	700cc
1-7/8" (47.5 mm)	700cc
2" (51mm)	1265cc
2-1/8" (54mm)	1265cc
2-1/4" (57mm)	1410cc
2-3/8" (60mm)	1410cc
2-1/2" (63.5mm)	1830cc
2-5/8"(66.5mm)	1830cc
2-3/4" (70mm)	2250cc
3" (76mm)	3160cc
3-1/4" (82.5mm)	3795cc
3-1/2" (89mm)	4920cc
3-3/4" (95mm)	5980cc
4" (101.5mm)	7730cc

Note – Approximate Measurements (U.S.A.)

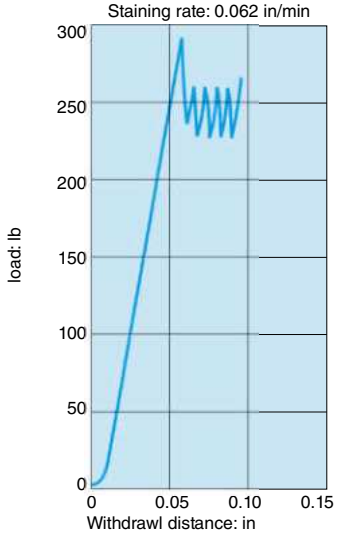
250cc Kit	1 Cup
500cc Kit	1 Pint
1000cc Kit	1 Quart

Properties of WIRELOCK®

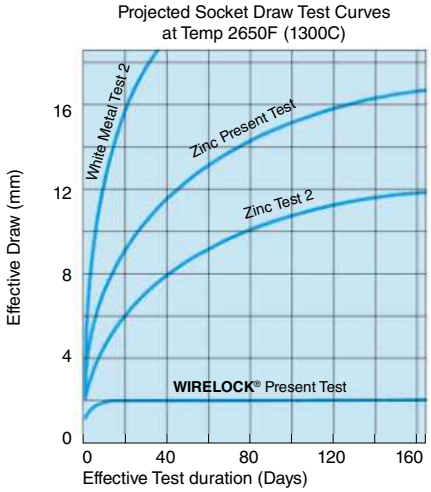
Physical	
Viscosity	3 - 4 Poise
Heat Distortion Point	212° Fahrenheit (100°C) to 240° Fahrenheit (115°C)
Flexural Strength	1500 lb./sq. in.
Flexural Modulus	5.8 x 10^5 lb. sq. in.
Tensile Strength	1.09T/in^2 (16.15N/mm^2)
Flashpoint	89°F (31°C)
Electrical	
Dielectric Strength	230 volts/mm
Arc Resistance	191 S
Volume Restivity Greater than	14.5 $\log_{10}$ ohms/cm
Surface Resistance	14.0 $\log_{10}$ ohms/cm
Insulation Resistance	8.2 x 10^{12} $\log_{10}$ ohms/cm

Flashpoint
Please note that this is not the auto ignition (spontaneous combustion) temperature, but the temperature above which the material will give off a significant amount of vapor.

Graph A



Graph B



The individual wires of the rope are retained by a combination of bonding and frictional forces. The frictional forces are the result of:

- Shrinkage during the curing of the resin.
- Coefficient of friction between the resin and the individual wires.

Additional forces develop due to the wedge action of the socket as the rope is loaded.

As **WIRELOCK®** cures, it shrinks by between 1.5% and 2.5% (High Volume **WIRELOCK®** by less than 0.5%), and with the introduction of a hard inert filler of specific grain size, a high coefficient of friction is obtained.

WIRELOCK® has excellent penetrating qualities and can flow through the most dense wire rope broom, which would impede the flow of zinc.

The **WIRELOCK®** system is designed to have a minimal amount of creep, which ceases once the wedging and frictional forces develop for any given load

WIRELOCK® excels in its ability to resist the action of fatigue – fatigue in a wire rope assembly is normally prevalent in the rope close to the neck of the socket **WIRELOCK®** will minimize such problems.

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Head of Department
Professor B G Clarke

11-Mar-99

Millfield Enterprises
16 Shelley Road
Newcastle upon Tyne 15

Job No 99R007

Test Compressive Strength and Stiffness of Resin

Sample 31436/R1792/T40

The specimens were prepared, cured and sent to us by the client.

Date of test 02/03/99
Ambient conditions during the test 20ºC 60%RH
Testing machine Avery 250kN Compression Testing Machine

Sample	Weight	Height (after grind)	Width	Depth	Density	Compressive Load	Compressive Strength
	g	mm	mm	mm	Mg/m³	kN	MPa
31436/R1792/T40-1	101.3	37.5	39.1	39.6	1.74	180.6	116.7
31436/R1792/T40-3	102.2	37.5	39.1	39.6	1.76	187.8	121.3
31436/R1792/T40-5	102.7	37.5	39.1	39.6	1.77	189.6	122.5
31436/R1792/T40-2	104.0	37.5	39.6	39.6	1.77	203.5	129.8
31436/R1792/T40-4	103.2	37.5	39.6	39.6	1.75	196.7	125.4
31436/R1792/T40-6	103.0	37.5	39.6	39.6	1.75	191.0	121.8
average					1.76		124.1

Sample	Min Stress	Max Stress	Mean Strain	Modulus of Elasticity
	MPa	MPa		N/mm²
31436/R1792/T40-1	0.0	58.3	0.243%	1.20E+04
31436/R1792/T40-3	0.0	60.6	0.263%	1.17E+04
31436/R1792/T40-5	0.0	61.2	0.234%	1.27E+04
average				1.21E+04

Renewed
31.3.99

RECEIVED
15 MAR 1999

B. G. Cl

Professor B G Clarke
Head of Department

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BGC/AEB

21st September 1995

Millfield Enterprises Ltd.
16 Shelley Road
Newcastle upon Tyne
NE15 9RT

Compression Test of Resin Cubes

40mm nominal cubes were supplied. The specimens were cooled by immersing them in a mixture of dry ice and acetone. The temperature was monitored using a similar control specimen containing a thermistor. A specimen was placed between two platens cooled to -18ºC in a refrigerator. The control specimen was also placed between two similarly cooled platens. The specimens were loaded until failure at a rate of 72kN/min.

Specimen	Height	Length	Width	Weight	Bulk Density	Cooling Temperature	Temperature of failure	Max Load	Failure Stress
	mm	mm	mm	g	Mg/m^3	ºC	ºC	kN	N/mm^2
1	39.7	39.6	40.0	110.9	1.76	-44	-30	203	128
2	39.3	39.3	39.7	108.7	1.77	-55	-30	215	138
3	39.6	39.5	39.7	107.2	1.73	-60	-30	207	132
4	39.6	39.6	39.6	108.1	1.74	-1	-28	204.5	130
5	39.8	39.6	39.7	109.1	1.74	-73	-36	200	127
6	39.7	39.9	39.7	109.2	1.74	74	-38	207	131

B. G. Cl

B G Clarke

Direct dial - 0191 222 6888
Switchboard - 0191 222 6000
Fax - 0191 222 6613
Telex - 53654 (UNINEW G)

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WIRELOCK ROPE CAPPING KIT (Resin System)

SECTION 1 : IDENTIFICATION OF THE SUBSTANCE OR PREPARATION AND THE COMPANY/UNDERTAKING

1.1	Product Identifier	:	WIRELOCK ROPE CAPPING KIT (RESIN SYSTEM)
1.2	Product use	:	The attachment of Sockets to Wire Rope. The kit consists of: 1. Polyester resin disolved in styrene and other inhibitors. (RESIN) 2. Pure silica granules, Dibenzoyl Peroxide and inert fillers (POWDER)
1.3	Chemical Family	:	Mixture
1.4	Manufacturers name and address	:	Millfield Enterprises (Manufacturing) Limited, 16 Shelley Road, Newburn Industrial Estate, Newburn, Newcastle upon Tyne, NE15 9RT England
1.5	Emergency Telephone		+44 (0) 191 2648541

SECTION 2 HAZARDS IDENTIFICATION

2.1 Classification of Substance or Mixture

Product Definition : Mixture

Classification according to Regulation (EC) No. 1272/2008 (CLP/GHS)

Flam. Liq.	3	H226
Acute Tox.	4	H332
Skin Irrit.	2	H315
Eye Irrit.	2	H319
STOT SE	3	H335
STOT RE	1	H372i

See section 16 for the full text of the H statements declared above

Classification according to Directive 1999/45/EC (DPD)

The product is classified as dangerous according to directive 1999/45/EC and its amemdments

Classification : R10
Xn R20,R48/20
Xi R36/37/38

Physical/chemical hazards Flammable

Human Health Hazards : Harmful by inhalation. Irritating to eyes, respiratory system and skin. Harmful: danger of serious damage to health by prolonged exposure through inhalation.

Environmental Hazards : Based on available data of this product, no hazardous properties are known.

See section 16 for the full text of the R-phrases declared above

2.2 Label Elements

Hazard Pictograms :

Pack 1 RESIN	Pack 2 Powder
	

Signal Word :

Hazard Statements :

H226	Flammable liquid and vapour
H332	Harmful if inhaled
H315	Causes skin irritation
H319	Causes serious eye irritation
H335	May cause respiratory irritation
H372i	Causes damage to organs through prolonged or repeated exposure if inhaled
H400:	Very toxic to aquatic life

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Precautionary statements

Prevention :

: S15 Keep away from heat, sparks,open flames & hot surfaces
: S16 Keep away from sources of ignition - No smoking
: S17 Keep away from combustible material
: S37/39 Wear suitable gloves and eye/face protection
P261: Avoid breathing dust/fume/gas/mist/vapours/spray
P273: Avoid release to the environment
P272: Contaminated work clothing should not be allowed out of the workplace

Response :

: P304+340: IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
: P303+361+353: IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
: P333+313: If skin irritation or a rash occurs: Get medical advice/attention
: P305+351+338: IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do – continue rinsing
: P337+313: If eye irritation persists get medical advice/attention
: P264: Wash hands and contaminated skin thoroughly after handling
: P272: Contaminated work clothing should not be allowed out of the workplace
: P280: Wear protective gloves, protective clothing, eye protection, face protection
: P302+352: IF ON SKIN: Wash with soap and water
: P308+313: IF exposed or concerned: Get medical advice/attention
: P391 : Collect spillage
:

Storage : S3/9/49 Keep only in the original container in a cool, well-ventilated place

Disposal : P501: Dispose of contents & container according to local regulations

Hazardous Ingredients : Styrene

.3 **Other Hazards**

Other Hazards which do not result in classification : Pure silica sand within the powder mixture is not regarded as a health or environmental hazard under current legislation

SECTION 3 COMPOSITION/INFORMATION ON INGREDIENTS

efinition : Mixture

oduct/ Ingredient Name	Identifiers	% Content	Classification 67/548/EEC	Regulation(EC) No. 1272/2008 (CLP)
yrene	REACH #: 01-2119457861-32 EC: 202-851-5 CAS: 100-42-5 Index: 601-026-00-0	35-50	R10 Xn; R20.R48/20, R65 Xi; R36/37/38	Flam Liq. 3. H226 Acute Tox. 4 H332 Skin Irrit. 2. H315 Eye Irrit. 2. H319 STOT SE 3. H335 STOT RE 1 H372i Asp. Tox. 1. H304
4 naphthquinone	EC: 204-617-8 CAS: 123-31-9 Index: 604-005-00-4	<0.1	Carc. Cat. 3; R40 Muta. Cat. 3; R68 Xn: R22 Xi R41 R43 N; R50	Acute Tox. 4; H302 Eye Dam. 1; H318 Skin Sens. 1; H317 Muta. 2; H341 Carc. 2; H351 Aquatic Acute 1; H400
benzoylperoxide, 20% Powder th inert fillers (Stated below)	EC: 202-327 -6 CAS: 000094-36-0	<1%	EN Xi R03,R36,R43, R50/53	Expl. Fire. 2; H241 Skin Sens. 1; H317 Eye Irrit. 2; H319 Aquatic acute. 1; H400
lcium Sulphate % gnesium Carbonate Hydroxide	EC: 231-900-3 CAS: 007778-18-9 EC: 235-192-7, 231-851-8 CAS: 012125-28-9, 007760-50-1		None None	
			See section 16 for the full text of the R-	See section for the full text of the H statements

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There are no additional ingredients present which,within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational Exposure limits, if available, are listed in Section 8.

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SECTION 4: FIRST AID MEASURES

4.1 Description of First aid Measures

Eye contact : Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.

Inhalation : Remove victim to fresh air and keep at rest in a position comfortable for breathing. Maintain an open airway. Loosen tight clothing such as collar, tie, belt or waistband.

Skin Contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before re-use. Clean shoes thoroughly before re-use.

Ingestion : Wash out mouth with water. Remove dentures if fitted.Remove victim to fresh air and keep at rest in a position comfortable for breathing.Stop if the exposed person feels sick, as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs,the head should be kept low so that vomit does not enter the lungs. Get Medical attention following exposure or if feeling unwell. Never give anything by mouth to an unconcious person. If unconcious,place in recovery position and get medical attention immediately. Loosen tight clothing such as collar, tie, belt or waistband.

Protection of First Aiders : No action will be taken involving any personal risk or without suitable training.

4.2 Most important symptoms and effects, both acute and delayed

Potential acute health effects

Eye contact : Causes serious eye irritation

Inhalation : Harmful if inhaled

Skin Contact : Causes skin irritation

Ingestion : Irritating to mouth, throat and stomach

Over-exposure signs / symptoms

Eye contact : Adverse symptoms may include the following:
Pain or irritation
Watering
Redness

Inhalation : Adverse symptoms may include the following:
Respiratory tract irritation
Coughing

Skin Contact : Adverse symptoms may include the following:
Irritation
Redness

Ingestion : No specific Data

4.3 Indication of any immediate medical attention and special treatment needed

Notes to Physician : **Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.**

Specific Treatments : **No specific Treatment**

SECTION 5: FIREFIGHTING MEASURES

5.1 Extinguishing Media

Small fire

Suitable : Use dry chemical powder, CO2 or alcohol resistant foam. Cover with vermiculite or other non combustible material.

Not Suitable : Do not use water jet

Large Fire

Suitable : Alcohol resistant foam

Not Suitable : Do not use water jet

5.2 Special hazards arising from the mixture

Hazards from the mixture : Flammable liquid and /or vapour. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. Runoff to sewer may create fire or explosion hazard.

Hazardous combustion products : In case of fire, may produce hazardous decomposition products such as carbon monoxide, carbon dioxide, dense black smoke, aldehydes,organic acids.

5.3 Advice for firefighters

Special precautions for fire fighters : Fire water contaminated with this material must be prevented from entering waterways, sewers or drains.

Special protective equipment for firefighters : Fire-fighters should wear appropriate protective equipment and self contained breathing apperatus (SCBA) with a full face-piece operated in positive pressure mode. Clothing for fire fighters (including helmets, protective boots and gloves) conforming to European standard EN469 will provide a basic level of protection for chemical incidents.

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SECTION 6: ACCIDENTAL RELEASE MEASURES.

6.1 Personal precautions, protective equipment and emergency procedures (LARGE SPILLS ONLY)

6.2 Environmental precautions : Avoid dispersal of spilt material, run-off and contact with soil, waterways, drains and sewers.

6.3 Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from the spill area. Absorb with an inert dry material and place in an appropriate waste disposal container.
Dispose of using a licensed waste disposal contractor.

6.4 References to other sections : See section 1 for contact information
See section 8 for information on appropriate PPE
See section 13 for additional waste treatment information.

SECTION 7: HANDLING & STORAGE

7.1 Precautions for safe handling

Protective measures : Wear appropriate PPE, (See Section 8). Do not breathe vapour. Do not ingest. Avoid contact with eyes, skin & clothing. Use only with adequate ventilation. Always keep in the original container. Store and use away from heat and ignition sources. Do not reuse the containers.

Advice on General Hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands before eating drinking and smoking. Remove contaminated clothing and PPE before entering eating areas. See Section 8 for additional information on Hygiene measures.

7.2 Conditions for safe storage including incompatibilities : Do not store above 20 degrees C, 68 degrees F. Store in accordance with local regulations. Store in a segregated and approved area. Store the original container protected from direct sunlight in a dry, cool and well ventilated area, away from incompatible materials, food & Drink. Eliminate all ignition sources. Separate from oxidizing materials. Do not store in unlabelled containers. Use appropriate containment to avoid environmental contamination.

SECTION 8: EXPOSURE CONTROLS/ PERSONAL PROTECTION

The information in this section contains generic advice and guidance. The list of identified uses in Section 1 shoud be consulted for any available use specific information provided in the Exposure Scenario.

8.1 Control Parameters

Occupational exposure limits

Styrene	**EH40/2005 WELs (United Kingdom) 8/2007** STEL : 250 ppm @ 15 minutes TWA : 100 ppm @ 8 hours TWA : 430 mg/m3 @ 8 hours STEL : 1080 mg/m3 @ 15 minutes
1.4 naphthquinone	**EH40/2005 WELs (United Kingdom) 8/2007** TWA : 0.5 mg/m3 @ 8 hours
Dibenzoylperoxide,	**EH40/2005 WELs (United Kingdom) 8/2007** TWA : 5 mg/m3 @ 8 hours

Recommended Monitoring procedures : This product contains ingredients with exposure limits, therefore, personal, workplace atmosphere or biological monitoring may be required to determine the effectiveness of the ventilation or other control measures and/or the necessity to use respiritory protective equipment. Reference should be made to European Standard EN 689 for methods for the assessment of exposure by inhalation to chemical agents and national guidance documents for the methods for the the determining of hazardous substances.

Derived effect levels

Product /ingredient name	Type	Exposure	Value	Population
Styrene	DNEL	Short term inhalation	289 mg/m3	Workers
	DNEL	Short term inhalation	306 mg/m3	Workers
	DNEL	Long term inhalation	85 mg/m3	Workers

Predicted effect concentrations

Product /ingredient name	Type	Compartment Detail	Value	Method Detail
Styrene	PNEC	Fresh water	0.028 mg/l	Assessment factors
	PNEC	Marine	0.0028 mg/l	Assessment factors
	PNEC	Fresh water sediment	0.614 mg/kg dwt	-
	PNEC	Marine water sediment	0.0614 mg/kg dwt	-
	PNEC	Sewage treatment plant	5 mg/l	Assessment factors
	PNEC	Soil	0.2 mg/kg dwt	-

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8.2 Exposure Controls

Appropriate Engineering Controls	:	Use only with adequate ventilation.

Individual Protection measures

Hygiene measures	:	Wash hands, forearms and face thoroughly after handling chemical products, before eating smoking and using the lavatory and at the end of each working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reuse. Ensure that eyewash stations are close to the work location.
Eye/face protection	:	Safety glasses with side protection.
Hand protection	:	8 hours breakthrough time : Fluor rubber (Viton) (0.70mm) >1 hour breakthrough time : Chloroprene, Nitrile rubber (0.2mm)
Skin & Body	:	Wear suitable protective clothing
Respiratory protection	:	Wear filter mask, filter type A.

Advice on personal protection is applicable for high exposure levels. Select proper PPE based on a risk assessment of the actual exposure level.

SECTION 9 : PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical & chemical properties (Resin)

Physical State	:	Liquid
Colour	:	Pale Yellow
Odour	:	Characteristic
Odour threshold	:	Not available
pH	:	Not available
Melting point	:	Not available
Initial boiling point and boiling range	:	145 degrees C
Softening range	:	Not available
Flash point	:	31 degrees C
Evaporation rate	:	Not available
Flammability,	:	Not available
Burning time	:	Not available
Burning Rate	:	Not available
Upper/lower flammability or explosive limits	:	Not available
Vapour pressure	:	Not available
Vapour density	:	Not available
Relative density	:	1.09 (water = 1)
Density (g/cm3)	:	1.09 g/cm3 (25 degrees C)
Bulk density	:	Not available
Solubility	:	Insoluble in cold water
Solubility in water	:	Not available
Solubility at room temperature	:	Not available
Partition co-efficient: n-octanol/water	:	Not available
Auto ignition temperature	:	Not available
Decomposition temerature	:	Not available
Viscosity	:	Dynamic : 335 to 455 mPa's (335 to 455 cP)
Explosive properties	:	Not available
Oxidising Properties	:	Not available

9.2 Information on basic physical & chemical properties (Dibenzoyl peroxide)

Appearance	:	Free flowing powder
Colour	:	White
Odour	:	Faint
Boiling Point range	:	Not applicable (Decomposes)

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Melting point range	:	Not Determined
Flash point	:	Not applicable
Flammability	:	Decomposition products may be flammable
Explosive properties	:	None
Oxidising Properties	:	Not Applicable
Vapour pressure	:	Not Applicable
Density (g/cm3)	:	2290 kg/m3 (20 degrees C / 68 degrees F) Specific gravity = 2.29 (20 degrees C / 68 degrees F)
Bulk density	:	588 kg/m3 (20 degrees C / 68 degrees F)
Solubility in water	:	Insoluble
Solubility in other solvents	:	Not Determined
pH	:	Neutral
Partition co-efficient: n-octanol/water	:	Not Determined
Vapour density	:	Not Applicable
Viscosity	:	Not Applicable
Active oxygen content	:	1.32%
Peroxide content	:	20%
Auto ignition temperature	:	Test Method not applicable (see section 10)
SADT	:	70 degrees C (See section 10)
Explosion limits	:	Not Determined
Volatile %	:	Not Determined
	:	

SECTION 10 : STABILITY & REACTIVITY

10.1	Reactivity (RESINS)	:	No specific test data related to reactivity for this product or ingredients
10.2	Reactivity (POWDER)	:	No specific test data related to reactivity for this product or ingredients
10.3	Chemical stability (RESIN)	:	The product is stable
10.4	Chemical stability (POWDER)	:	SADT- (Self accelerating decomposition temperature) is the lowest temerature at which self accelerating decomposition may occur with a substance in the packaging used in transport. A dangerous self-accelerating decomposition reaction, which could result in explosion or fire above 70 degrees C. Contact with oxidisating agents can cause decomposition below 70 degrees C. Containers must be sealed at all times when not in use.
10.5	Possibility of hazardous reactions (RESIN)	:	Under normal storage conditions, hazardous reactions will not occur
10.6	Possibility of hazardous reactions (POWDER)	:	Under normal storage conditions, hazardous reactions will not occur
10.7	Conditions to Avoid (RESIN)	:	Avoid all sources of ignition. Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat sources.
10.8	Conditions to Avoid (POWDER)	:	Avoid shock and friction. A high degree of confinement should be avoided.
10.9	Incompatible materials (POWDER)	:	Avoid contact with rust, iron and copper. Contact with incompatible materials such as acids, alkalis, heavy metals & reducing agents will result in hazardous decomposition. Do not mix with accelerators.
10.1	Hazardous decomposition products (RESIN)	:	No specific data.
10.11	Hazardous decomposition products (POWDER)	:	Benzoic acids, benzene
10.12	Polymerisation (POWDER)	:	Does not occur

SECTION 11 : TOXICOLOGICAL INFORMATION

11.1 Information of Toxicological Effects

Product/Ingredient Name	Result	Species	Dose	Exposure
Styrene	LD50 Dermal	Rat	>2000 mg/kg	-
	LD50 Oral	Rat	5000 mg/kg	-
	LC50 Inhalation Vapour	Rat	12 g/m3	4 hours
1.4 naphthoquinone	LC50 Inhalation dusts and mists	Rat	46 mg/m3	4 hours
	LD50 Dermal	Rat	202 mg/kg	-
	LD50 Oral	Rat	190 mg/kg	-
Dibenzoylperoxide 78%	LD50 Oral	Rat	5000 mg/kg	-
	LC50 Inhalation	Rat	24.3 mg/l	4 hours

Note: No toxicological information on the Dibenzoyl peroxide was available at 20%. The above test was carried out at 78%

Acute Toxicity estimates (RESIN)

Route	ATE Value
Inhalation (Gases)	15397.5 ppm
Inhalation (Vapours)	37.64 mg/l
Inhalation (Dusts and mists)	5.133 mg/l

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	Irritation / corrosion	
Function	Resin	Powder
Skin	Not Available	None at 4 hours exposure time
Eyes	Not Available	Moderate
Respiratory	Not Available	None
Sensitization	Not Available	Possible by skin contact
Genotoxicity	Not Available	Ames test --- None
Carcinogenicity	Not Available	Not available
Teratogenicity	Not Available	Not available

Specific Target organ Toxicity (Single exposure)

Product / Ingredient name	Category	Route of Exposure	Target Organs
Styrene	Category 3	Not Determined	Respiratory tract irritation
1.4 naphthoquinone	Category 3	Not Determined	Respiratory tract irritation

Specific Target organ Toxicity (Repeated exposure)

Product/ingredient name	Category	Route of Exposure	Target Organs
Styrene	Category 1	Inhalation	Ears

Potential acute health effects

Inhalation : Harmful if inhaled. May cause respiratory irritation

Ingestion : Irritating to mouth, throat & stomach

Skin contact : Causes skin irritation

Eye Contact : Causes serious eye irritation

Symptoms related to the physical, chemical and toxicological characteristics

Inhalation : Adverse symptoms may include the following:
Respiratory Tract irritation
coughing

Ingestion : No specific data

Skin contact : Adverse symptoms may include the following:
Irritation
Redness

Eye Contact : Adverse symptoms may include the following:
Pain or irritation
Watering
Redness

General : Causes damage to organs through prolonged or repeated exposure if inhaled.

Carcinogenicity : No known effects or critical hazards

Mutagenicity : No known effects or critical hazards

Teratogenicity : No known effects or critical hazards

Developmental effects : No known effects or critical hazards

Fertility effects : No known effects or critical hazards

Classification

Product / Ingredient name	ACGIH	IARC	EPA	NIOSH	NTP	OSHA
Styrene	A4	2B	-	-	-	-
1.4 naphthoquinone	A3	3	-	-	-	-

SECTION 12: ECOLOGICAL INFORMATION

12.1 Toxicity

Product/ingredient name	Result	Species	Exposure	Effects
Styrene	Acute EC50 4.9 mg/l	Algae	72 hours	-
	Acute LC50 4.02 mg/l	Fish - Fathead minnow	96 hours	-
	Chronic NOEC 1.01 mg/l	Daphnia - Daphnia magna	21 days	-
1.4 naphthoquinone	EC50 0.011mg/l	Algae	72 hours	
Dibenzoylperoxide 78%	Acute EC50 2.91 mg/L Fresh water	Daphnia	48 hours	-
	Acute LC50 2.0 mg/l	Poecilia reticulata	96 hours	-
	Acute EC50 - activated sludge respiration inhibition test 35 mg/l	Bacteria	-	-

12.2 Persistence and degradability

Product / Ingredient name	Aquatic half life	Photolysis	Biodegradability
Styrene	-	-	Readily
Dibenzoylperoxide 78%	-	-	Readily

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12.3 Bioaccumulative potential

Product / Ingredient name	Log P	BCF	Potential
Styrene	2.95		Low
1.4 naphthoquinone	1.71	-	Low
Dibenzoylperoxide 78%	-	-	-

12.4 Mobility in soil

Soil/water partition coefficient (Koc)	:	Not available
Mobility	:	Not available

12.5 Results of PBT and vPvB assessment

PBT : Not applicable

vPvB : Not applicable

12.6 Other adverse effects No known significant effects or critical hazards.

SECTION 13: DISPOSAL CONSIDERATIONS

The information in this section contains generic advice and guidance. The list of identified uses in section 1 should be consulted for any available use-specific information provided in Exposure scenarios.

13.1 Waste Treatment Methods

Product

Methods of disposal : The generation of waste should be avoided or minimised wherever possible. Empty containers may retain some of the product residue. The container must be disposed of in a safe way. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Disposal of the product, solutions and by-products should at all times comply with the requirements of the environmental protection and waste disposal legislation and any regional local authority requirements. Avoid dispersal of spilt material and contact with soil, waterways, drains and sewers.

Hazardous waste : The classification of the product may meet criteria for hazardous waste.

Packaging

Methods of disposal : The generation of waste should be avoided or minimised wherever possible. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible.

Special precautions : This material and its containers must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned and rinsed out. Empty containers may contain product residue. Vapour from the residue may create a highly flammable or explosive atmosphere within the container. Do not cut, weld or grind the container unles they have been cleaned thoroughly. Avoid dispersal of spilt material and contact with soil, waterways, drains and sewers.

SECTION 14: TRANSPORT INFORMATION

14.1 UN Number	UN3269		UN1866	
14.2 UN Proper Shipping name	Polyester Kit		Bulk Resin	
14.3 Transport hazard Class				
14.4 Packing Group	III		III	
14.5 Environmental Hazards	No		No	
14.6 Special precautions for the end user	Not available		Not Available	
Additional Information	Flashpoint 31 degrees C		Flashpoint 31 degrees C	

Millfield

MATERIAL SAFETY DATA SHEET

MSDS Revision date 01/02/2012

SECTION 15: REGULATORY INFORMATION

15.1 Safety,health & environmental regulations/legislation specific for the mixture.

EU Regulation (EC) No. 1907/2006 (REACH)

Annex XIV - List of substances subject to authorisation

Substances of very high concern

None of the components are listed

Annex XVII - Restrictions on the manufacture, placing on the market and use of dangerous substances, mixtures and articles.

Not Applicable

15.2 Chemical safety Assessment : Not applicable

SECTION 16: OTHER INFORMATION

Procedure used to derive the classification according to regulation (EC) No 1272/2008 [CLP/GHS]

Classification	Justification
Flam Liq. 3, H226	On basis of test data
Acute Tox. 4, H332	Calculation methods
Skin Irrit. 2 H315	Calculation methods
Eye Irrit. 2, H319	Calculation methods
STOT SE 3, H335	Calculation methods
STOT RE, H372i	Calculation methods

Full text of abbreviated H Statements	H226	Flammable liquid & vapour
	H302	Harmful if swallowed
	H315	Causes skin irritation
	H317	May cause allergic skin reaction
	H318	Causes serious eye damage
	H319	Causes serious eye irritation
	H332	Harmful if inhaled
	H335	May cause respiratory irritation
	H372i	Causes damage to organs through prolonged or repeated exposure if inhaled.
	H400	Very toxic to aquatic life

Full text of classifications [CLP/GHS]	Acute Tox 4, H302	ACUTE TOXICITY: ORAL - Category 4
	Acute tox 4, H332	ACUTE TOXICITY : INHALATION - Category 4
	Aquatic Acute 1, H400	AQUATIC TOXICITY (ACUTE) Category 1
	Eye Dam. 1, H318	SERIOUS EYE DAMAGE / EYE IRRITATION Category 1
	Eye Irrit. 2, H319	SERIOUS EYE DAMAGE / EYE IRRITATION Category 2
	Flam. Liq. 3, H226	FLAMMABLE LIQUIDS - Category 3
	Skin Irrit. 2, H315	SKIN CORROSION/IRRITATION - Category 2
	Skin Sens. 1, H317	SKIN SENSITIZATION - Category 1

Abreviations and Acronyms	ATE	Acute Toxicity Estimate
	CLP	Classification, Labelling & Packaging Regulation [Regulation (EC) No. 1272/2008]
	DNEL	Derived No Effect Level
	EUH	(Statement) CLP Specific Hazard Statement
	PNEC	Predicted No Effect Concentration
	RRN	REACH Registration Number

Sources of Key data Information derived from investigations and literature from raw material suppliers

Training Advice Handling and preparation of the product to be carried out by competent personnel only.

Notice to Reader

The information contained in the Safety Data Sheet is based on data available at the time of publication. The information is intended to aid the user in controlling the handling risks and is not to be construed as a warranty or specification of the product quality. The information may not be or may not altogether be applicable to combinations of the kit with other substances or to particular applications.
The user is responsible for ensuring that appropriate precautions are taken and for satisfying themselves that the data is suitable and sufficient for the product's intended purpose. In case of any unclarity we advise consulting the supplier or an expert.

Appendix B
Resin Socketing of Steel Wire Rope

J.M. Dodd B.Sc

Millfield Enterprises

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Newcastle upon Tyne, NE15 9RT, England

The concept is not new. The first published data on this topic were produced in the early sixties. In essence, these two papers by Doherty and Campbell, stated that a resin filled socket under either static tension (tensile) or fluctuating tension (fatigue) could offer strengths that were comparable with those of the rope itself.

There is a dearth of information on socketing and the mechanisms by which it works, so it was necessary to establish some basic knowledge before a resin socketing system could be designed.

In theory, the requirements for a successful system are:-
1) High bond strength between resin and wire
2) High modulus of elasticity

To ascertain the bond strength and the magnitude of the predicted frictional grip, tests were done on a single, straight wire cast into a cylindrical block of resin. The embedded length being such, that the wire when loaded would slip rather than break. The cylindrical resin termination was chosen so that there would be no distortion of the figures, due to the mechanical lock, inherent in a conical termination. The results are shown in Figure 1.

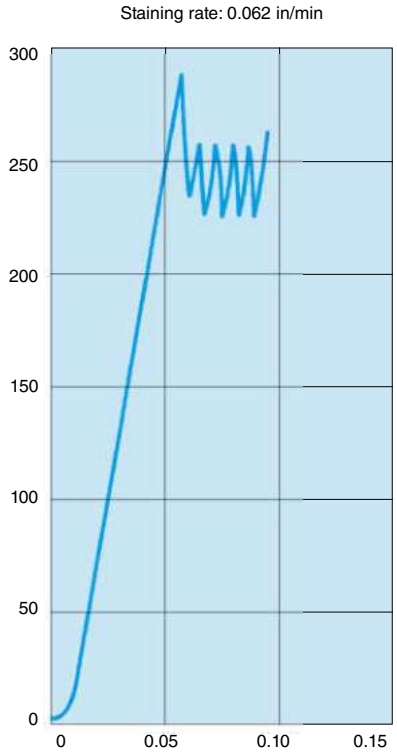


Fig 1
Pull out characteristic for single wire embedded in polyester resin/silica

Resin Socketing of Steel Wire Rope

The graph shows that high bond strengths are achievable between the resin and the wire and that shrinkage of the resin and the inclusion of hard silica in the resin gave a very high frictional grip on the wire. The classic slip/grip peaks and troughs on the right hand side of the loading curve show that the frictional grip is very nearly of the same magnitude as the bond strength.

In practice, it has been found that the wires in the rope broom, which is about to be socketed, are rarely clean enough to achieve anything approaching a good bond strength. Indeed, it will be shown later, when dealing with uncleaned wires, that the frictional grip alone is enough to seat the cone. Either the bond strength of the resin to the wire or the frictional grip of the resin on the wire, is sufficient on their own to seat the cone. Between them they offer a comforting reassurance that the wire will hold and the cone will seat even if the wire has not been cleaned properly.

The modulus of elasticity was measured and found to be 6085 Mpa (BS63 19 Part 6, 1984).

It very soon became apparent, that the bonding action between the socketing medium and the wire was not in itself sufficient to break the rope. Therefore the focus was moved to the shape of the socket, the wedging action it would produce and the mechanism by which this occurred.

The usual total included angle in sockets is between 14/15 degrees and experiments were carried out over the range 9/25 degrees total included angle. It was predicted that the narrower the angle, the lower the load at which movement occurred and the greater that movement would be. In general, this prediction was confirmed, although in the case of the lower angles, the straight line relationship experienced on the wider angles was not found. See Figure II In all cases, the rope ultimately broke, this confirms that the system will cope with a fairly wide deviation from standard socket dimensions.

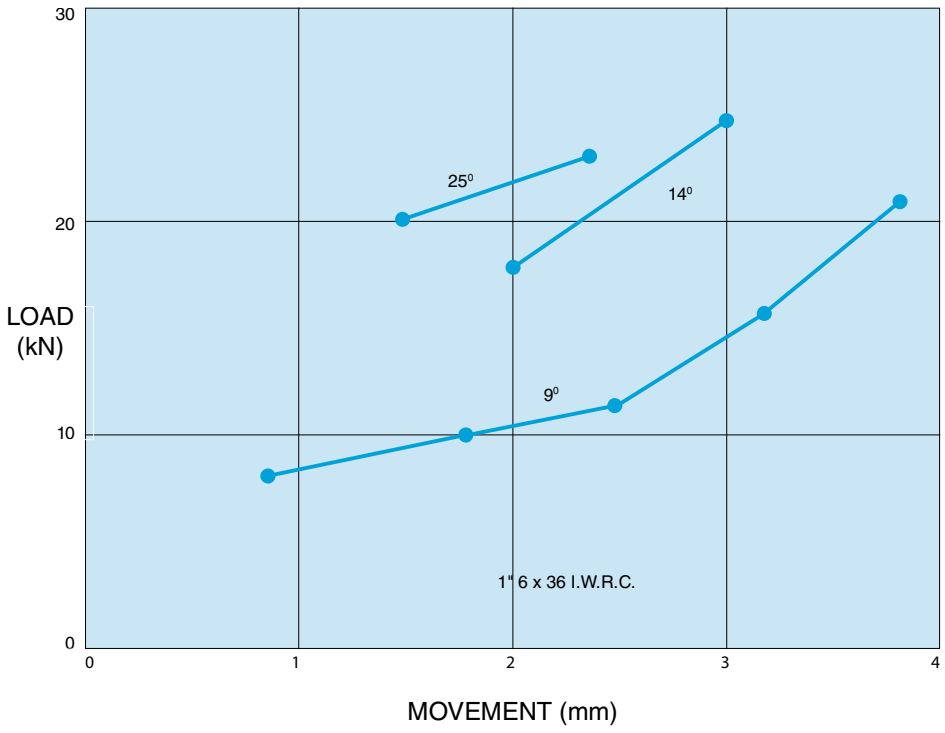
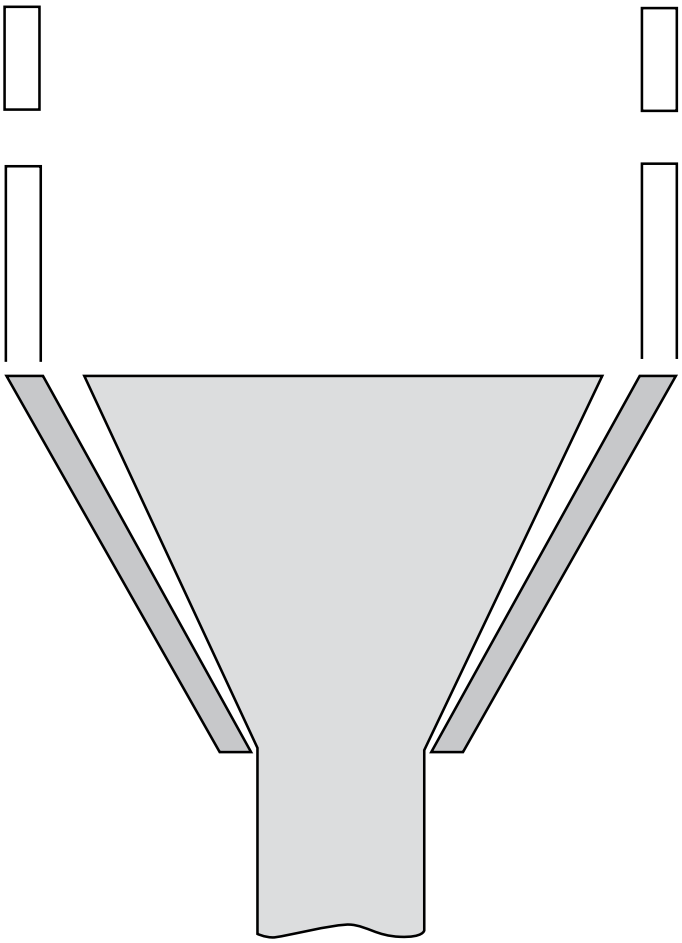


Fig II
Movement within the socket under load for the two extreme angles and the standard 140 taper

The mechanism of this movement and wedging action were investigated by looking at the distribution of pressure through the socket. This showed that approximately two thirds of the total pressure within the socket was concentrated in the bottom third of the socket. Whilst pressure at the top of the socket was very low indeed.

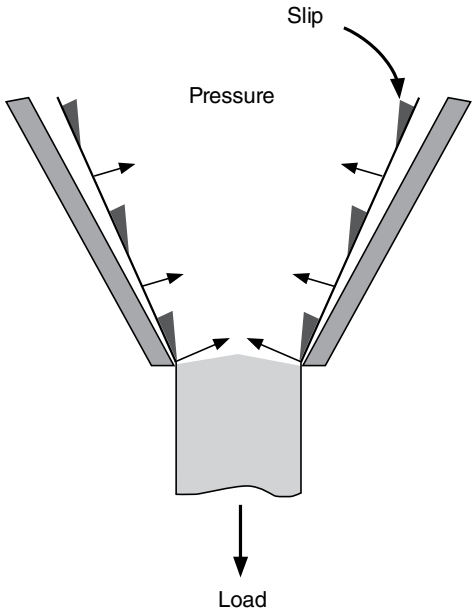
It is necessary to explain why any movement is possible within the socket and to link it with the pressure distribution findings above.

When the resin is first poured into the socket there is a perfect match between the shape of the socket and the resin cone. Once the resin has cured, however, shrinkage occurs and in an exaggerated form the effect is as below. (Fig III)



Exaggerated Relationship between Cone and Socket after the Resin has cured
Figure III

When the load is applied to the rope, any adhesion of the resin to the socket will shear and the cone, which is now slightly smaller, will begin to engage the socket wall at the neck of the socket, thereby generating pressure. Although it still retains a high modulus, the resin in contact with the socket is subject to plastic deformation and some flow is possible, allowing more of the cone to share in the loading process. This participation in load bearing diminishes as we proceed up the cone. See figures IV & V.



Load causes the cone to slip at the socket interface and the pressure generated locks the cone within the socket

Fig IV

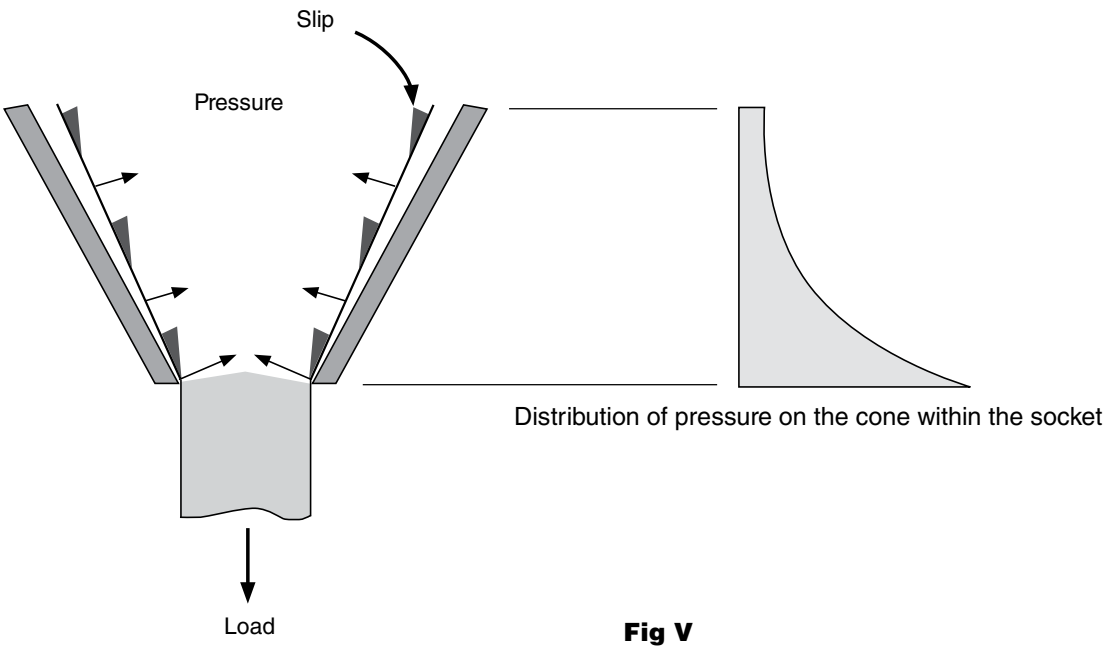


Fig V

If we examine the forces present in Fig IV, we can see that when load is applied, the cone will seat progressively generating forces normal to the socket face. These forces are transmitted through the resin to the wire surface. We are, in effect, creating a wire reinforced composite wedge on the end of the rope, which is capable of withstanding the ultimate strength of the rope.

We now have to consider two different scenarios to establish the key to this mechanism. In the first case, when the load is applied, the wire slips at the resin/wire interface before the cone slips at the cone/socket interface. In the second case upon application of the load the cone slips in the socket/resin interface before the wire slips within the resin.

In the first case, we have a disaster, as the rope will pull out. In the second case we have success, as the rope will break. What is it that determines which will occur?

Assuming that the coefficent of friction between the wire and the resin and the resin and the socket are of the same order, (an over simplification, but it does produce a simple model), the factor that determines which of the above scenarios will occur is the relationship between the surface area of the wire (S1) and the surface area of the inside of the cone (S2). If S1 is greater than S2 then the cone will seat and the rope will break. If S2 is greater than S1 the assembly will fail.

If, for example, we take a 13mm diameter 6 x 19 IWRC rope the relationship between S1 and S2 is of the order of 6:1, for a 36mm diameter 6 x 36 IWRC 9/:1 and for a 52mm diameter 6 x 41 IWRC 10:1. These figures give an indication of the margins of safety involved when resin socketing is employed. It also shows that the degreasing would have to be disastrously bad to reduce the coefficient of friction at the wire/resin interface to a critical level. One factor that has been ignored in this simple model, is that the unstraightened wires in the broom produce deformation forces when any attempt is made to induce slip thus increasing the grip of the resin on the wire and giving a further factor of safety. This wire in the cast cone, also tends to prevent any significant degree of axial extension of the cone during loading and the cone remains almost a constant length.

It would be useful at this point to examine the Federal Specification socket which has grooves or rings internally. It is obvious, that these rings must shear before the “locking” mechanism can operate and as such, are a hindrance to that process. Incidentally, in the case of zinc and white metal, this rupturing of the rings is also required before the rope will break. The only justification for these rings is to stop the cone “backing out” of the socket. In fact, once “seating” of the cone within the socket has occurred, it is not reversible and the cone is then locked into position.

This irreversibility offers the bonus that the stresses created within the socket are fixed and because there is no fluctuation, it follows that the opportunities for fatigue within the socket are reduced.

Let us return to the question of clean and uncleaned wire. A series of tests were carried out by A.I.F. in France, in which two samples of each of a series of rope sizes and constructions were broomed. One sample was degreased with trichlorethane and the other sample was left uncleaned.

Both samples went on to achieve the full breaking strength of the rope and almost identical breaking loads were achieved.

This highlights the fact that the frictional grip on the wires is highly efficient. If we take an overview of the whole situation it becomes apparent that the key operation in the resin socketing process is the brooming of the rope. Indeed this operation is vital for zinc and white metal as well.

Surface area of wire is vital, especially in the highly loaded section at the neck of the socket. From a quality point of view the broom should be opened right down to the seizing. Very often we see brooms which look very pretty and are nicely opened at the top but the strands remain substantially closed near the seizing. This state of affairs does not produce a quality assembly, even though it may break the rope.

One further point on the production of a quality assembly, is that care should should be taken to ensure that the neck of the socket has been sealed with clay or putty. Any leaks could cause voids in the neck area of the socket. These voids are able to form because the resin starts to gel - harden - in the centre of the mass and if resin leaks out at the neck of the socket, the resin above it during gel is no longer liquid and is, therefore, unable to flow down to fill the void.

Resin Socketing of Steel Wire Rope

It is not necessary to hook wires when resin socketing except in the case of coarse construction wire rope such as 6 x 7.

In use, the resin socketed assembly offers a higher achievable tensile strength and a better fatigue performance of the assembly. In general, this can be attributed to two factors; the excellent penetration of resin, ensuring a complete cone and, secondly, the fact that there is no annealing of the wires due to heat from molten metal. A further benefit that is derived from the lack of heat, is that the lubricant in the rope remains intact and is not burned off. It is an easy matter to replace the lubricant on the outside of the rope but very difficult to replace the lubricant in the centre of the rope. It is, as it does not require any heat, acid etching or neutralising, an inherently safe method, for the rigger to use both in the shop and on site. Finally, the quality and reliability of this method is, without question, superior to other methods of socketing. It also avoids the damage caused to ropes by other mechanical methods of attachment of end fittings, which may affect both the tensile and fatigue potential.

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Dodd J.M.	Resin As A Socketing Medium	Wire Industry	- May 1981
Chaplin Dr C.R. Sharman P.C.	Load Transfer Mechanics in Resin Socketing	Wire Industry	- Oct 1984
Cordon Dr C.R.R.	The Use Of Resin For Man Riding In Mine Shafts	IMEMME	- March 1987

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August 2, 1993

TECHNICAL DATA SHEET

REUSE OF CROSBY SPELTER SOCKETS

The following are general guidelines for the reuse of Crosby 416/417 Spelter Sockets. The use and inspection of used spelter sockets is the responsibility of the user.

I. Procedure for Removing Spelter Core

A. Cut the rope close (1/2") to the nose of the socket and press the cone out of the basket.

B. We do not recommend the use of heat to remove the spelter cone for metallurgical, medical and environmental reasons.

1. However, if this is the only means available for removing the zinc cone, care should be taken not to exceed 850°F (450°C) surface temperature. The preferred method would be slow heat in a temperature controlled oven. If a torch (rosebud) is used, the heat spot shall be monitored with a tempil stick or a temperature indicator to prevent localized heating from exceeding the 850°F (450°C) limit.
2. To remove a **WIRELOCK**® cone, heat the surface of the socket to 350°F (do not exceed the 850°F limit for any localized hot spot). Leave for 5-10 minutes, then drive the cone out with a hammer and drift.

II. Selection of Sockets for Reuse

A. Use only sockets that:
- Do not show discoloration from excessive heating.
- Do not show any signs of welding.

B. Select only sockets that have been cleaned and have passed a Magnetic Particle Inspection by a qualified technician (Level II ASNT-SNT-TC-1A-88) per ASTM E709. Acceptance criteria shall be per ASTM E125, Types II-VIII, Degree 1. No cracks are acceptable.

C. Select only sockets that do not show any signs of overloading or wear on the socket or pin, (i.e. elongated pin holes, undersized pins, etc.).

D. Select sockets that are free from nicks, gouges and abrasions. Indications may be repaired by lightly grinding until surfaces are smooth, provided they do not reduce the dimensions by more than 10% of the nominal catalog dimension.

E. Select sockets that are not distorted, bent or deformed.

Note: Sockets having any of the indications as outlined above (A-E) shall not be reused.

III. Procedures for Speltering Sockets

A. The proper procedure for speltering sockets can be found on pages 112-116 of the *Wire Rope Users Manual*, 2nd Edition, and in *American Petroleum Institute (API) Recommended Practice 9B (RP9B)*, 9th Edition, May 30, 1986.

B. Some standards (API, ISO, BSI) recommend preheating of the zinc spelter socket before pouring. This temperature shall not exceed 850°F (450°C).

IV. Proof Testing

A. We recommend the socket assembly be proof tested at two (2) times the Working Load Limit (2 x WLL) assigned to the socketed assembly.

WIRELOCK®

WARNINGS AND APPLICATION INSTRUCTIONS

⚠ WARNING

- **Incorrect use of WIRELOCK® can result in an unsafe termination which may lead to serious injury, death, or property damage.**
- **Do not use WIRELOCK® with stainless steel rope in salt water environment applications.**
- **Use only soft annealed iron wire for seizing.**
- **Do not use any other wire (copper, brass, stainless, etc.) for seizing.**
- **Never use an assembly until the WIRELOCK® has gelled and cured.**
- **Remove any non-metallic coating from the broomed area.**
- **Non Crosby sockets with large grooves need to have those grooves filled before use with WIRELOCK®.**
- **Read, understand, and follow these instructions and those on product containers before using WIRELOCK®.**

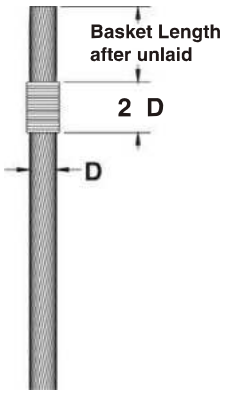
The following simplified, step-by-step instructions should be used only as a guide for experienced, trained users. For full information, consult our document ***WIRELOCK® TECHNICAL DATA MANUAL, API (AMERICAN PETROLEUM INSTITUTE) RECOMMENDED PRACTICE 9B, ISO standards, WIRE ROPE MANUFACTURERS CATALOGS,*** **and** ***WIRE ROPE SLING USERS MANUAL, THIRD EDITION.***

STEP 1 – SOCKET SELECTION

1. **WIRELOCK®** is recommended for use with Crosby 416-417 Spelter Sockets. Structural strand requires a socket with the basket length approximately five (5) times the strand diameter or fifty (50) times the wire diameter, what ever is greater to achieve 100% efficiency. Consult The Crosby catalog for proper selection of Wire Rope or Structural Strand sockets.
2. For use with sockets other than Crosby 416-417, consult the socket manufacturer or Crosby Engineering.
3. Sockets used with **WIRELOCK®** shall comply with Federal or International (CEN, ISO) Standards.
4. **WIRELOCK®**, as with all socketing media, depends upon the wedging action of the cone within the socket basket to develop full efficiency. A rough finish inside the socket may increase the load at which seating will occur. Seating is required to develop the wedging action.

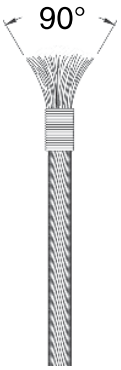
STEP 2 – MEASURE AND SEIZE

The rope ends to be socketed should be of sufficient length so that the end of the unlaid wires (from the strands) will be at the top of the socket basket. Seizing should be placed at a distance from the end equal to the length of the basket of the socket.



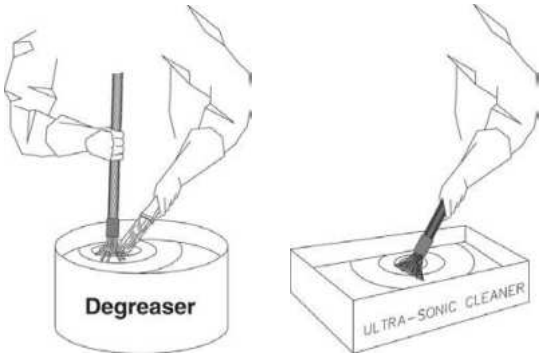
STEP 3 – BROOMING

1. Unlay the individual strands and fully broom out the wires of the wire rope and IWRC as far as the seizing. The wires should be separated but not straightened.
2. Cut out any fiber core.
3. Unlay the individual wires from each strand, including the IWRC, completely down to the seizing.
4. Remove any plastic material from broomed area.



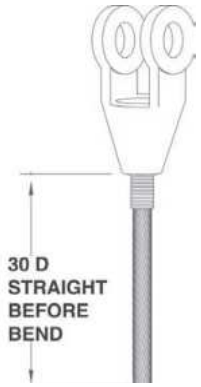
STEP 4 – CLEANING

1. The method of cleaning will depend on the lubricant and/or coating on the wire.
2. The methods and materials used for cleaning should comply with the current EPA regulations.
3. Consult your Wire Rope supplier or Wire Rope manufacturer for recommended material and methods. Follow the solvent supplier's recommendations for cleaning the broomed end.



STEP 5 – POSITIONING OF SOCKET

1. Position socket over the broom until it reaches the seizing on the wire rope. The wires should be LEVEL with the top of the socket basket.
2. Clamp rope and socket vertically ensuring alignment of their axes.
3. **CAUTION: DO NOT USE OVERSIZED SOCKETS FOR WIRE ROPE.**



STEP 6 – SEAL SOCKET

Seal the base of the socket with putty or plasticine to prevent leakage of the **WIRELOCK®**.

STEP 7 – WIRELOCK® KITS

1. **WIRELOCK®** kits are pre-measured and consist of two (2) containers – one (1) with resin and one (1) with granular compound.
2. Use the complete kit – **NEVER MIX LESS THAN THE TOTAL CONTENTS OF BOTH CONTAINERS.**
3. Each kit has a shelf life clearly marked on each container and this must be observed. **NEVER USE OUT OF DATE KITS.**

⚠ CAUTION

- **WIRELOCK® resin, in liquid state, is flammable.**
- **Chemicals used in this product can give off toxic fumes and can burn eyes and skin.**
- **Never use out-of-date material.**
- **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.**

STEP 8 – MIXING AND POURING

1. Mix and pour **WIRELOCK®** within the temperature range of 48 degrees to 95 degrees F. Booster kits are available for reduced temperatures.
2. Wirelock is set up to gel in 20 minutes @ 65°F. For every 18° rise in temperature the gel time will halve. At 83°F the gel time will be 10 minutes and at 101°F it will be 5 minutes. To give extra working time or pot life it is worth considering refrigerating the kits for two hours priot to mixing and pouring. The temperature of the socket will affect the cure time as well. The socket should also be as cool as possible - out of direct sunlight, as an example.
3. Pour all the resin into a container containing all the granular compound and mix thoroughly for two (2) minutes with a flat paddle.
4. The **WIRELOCK®** will turn a green blue color. If it does not turn a green blue color after mixing, DO NOT USE.
5. Immediately after mixing, slowly pour the mixture down one side of the socket until the socket basket is full.
6. Check for leakage at nose of socket, add putty if required.

STEP 9 – CURING

1. **WIRELOCK®** will gel in approximately fifteen (15) minutes, in a temperature range 65 degrees F to 75 degrees F.
2. The socket must remain undisturbed in the vertical position for an additional ten (10) minutes after gel is complete.
3. The socket will be ready for service sixty (60) minutes after gelling.
4. Never heat sockets to accelerate gel or curing.

STEP 10 – RE-LUBRICATION

Re-lubricate wire rope as required.

STEP 11 – PROOF LOADING

Whenever possible, the assembly should be proof loaded in accordance with ASME B30.9-2.6.

ALTERNATE SEIZING AND BROOMING METHOD

Reference the ***WIRELOCK® TECHNICAL DATA MANUAL*** from Crosby for an alternative socketing method.

The Crosby S-423T Super TERMINATOR™ is the first wedge socket designed to take advantage of the performance properties associated with high performance, high strength, compacted strand, rotation resistant wire rope.

The Super TERMINATOR™ offers several advantages over traditional methods of wedge socket terminations:

- The innovative design will significantly increase the termination efficiency over existing wedge sockets available today.
- Terminations on most ropes have a minimum efficiency rating of 80% of the rope's catalog breaking strength.
- Patent pending design eliminates the difficulty of installing high performance, high strength, compacted strand, rotation resistant wire rope into a wedge socket termination.
- Proper application of the Super TERMINATOR™ eliminates the "first load" requirement of conventional wedge socket terminations.

Additional features:

- Wire rope sizes available: 5/8" -1 1/4", 14 mm- 32 mm
- Available as a complete assembly, or as a wedge kit that can be retrofitted onto existing Crosby S-421T TERMINATOR™ wedge sockets.
- Wedge accessories provided with a zinc finish.
- Meets or exceeds all ASME B30.26 requirements including: identification, ductility, design factor, proof load, and temperature requirements. Importantly, they meet other critical performance criteria not addressed by ASME B30.26 including: fatigue life, impact properties and material traceability.
- Available with bolt, nut and cotter (S-423TB)

The Super TERMINATOR™ by Crosby. The first wedge socket termination designed specifically for high performance wire rope.

www.thecrosbygroup.com