Socket Lock

PRODUCT FEATURES & ADVANTAGES

- Formulated to be stronger & tougher.
- Packaged in environmentally protected pouches to ensure product freshness.
- Plastic pails are rust-free and serve as mixing vessel.
- Disposable pouring funnel included with each kit eliminates spills.
- Bright green resin and white hardener makes mixing easy to verify.
- Flows easier to help penetrate bottom of socket better.
- No dry powders that become airborne health hazards.
- Homogeneous formula ensures consistent physical properties from top to bottom of cone.

EASY TO USE

Bright green resin & white hardener makes mixing easy to verify.

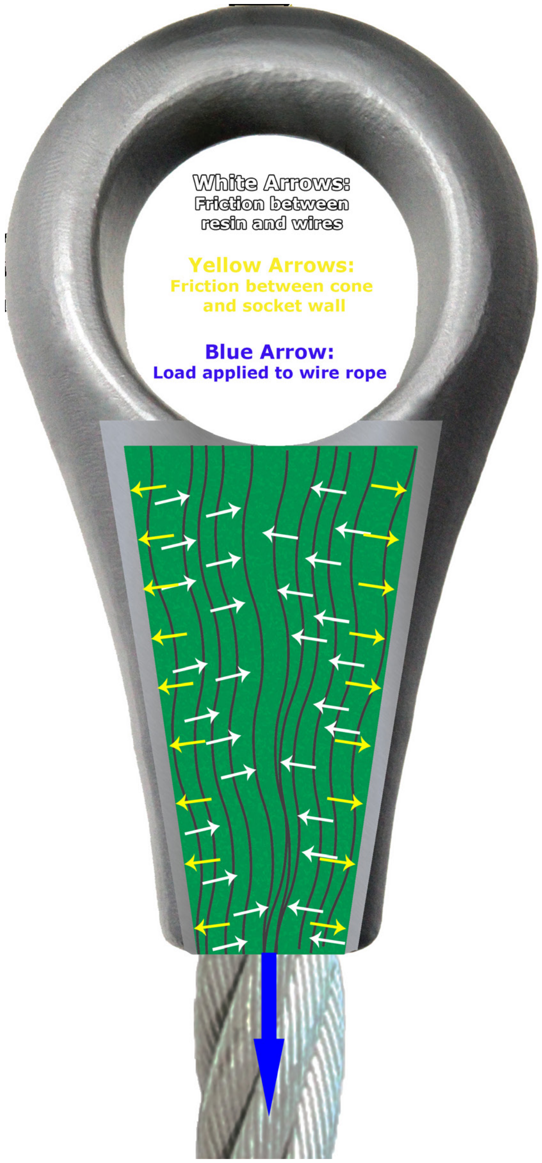
Use the "Fast Funnel" for Less Mess

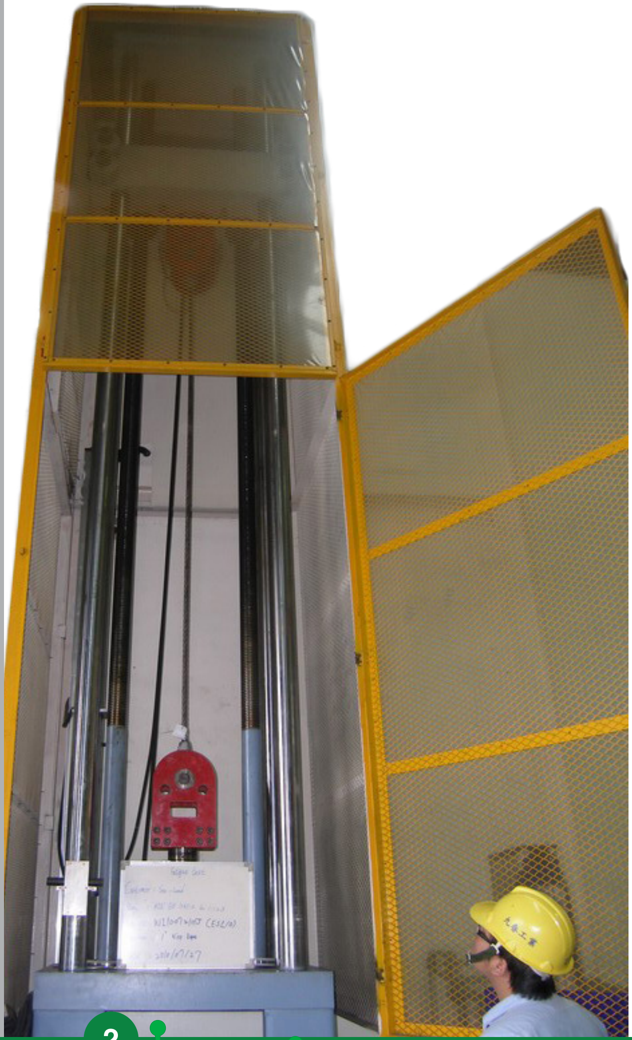
HOW IT WORKS

As the resin hardens and cures, shrinkage occurs that creates a frictional bond to the wires. Silica is blended into the resin mixture to add frictional grip properties. The silica also serves to absorb heat caused by the chemical reaction that results when hardening agent is added to the resin.

As load is applied to the rope, the resin cone is pulled downward in the bowl of the socket. As this is happening, the cone shape forces compression of the hardened resin cone against the individual wires and the socket walls. This compression then generates a tremendous frictional grip between the wires and resin resulting in a strength that exceeds the breaking strength of the rope.

Note: *Some sockets have grooves that may prevent the cured resin cone from seating properly as loading occurs. Filling the grooves with putty is an acceptable method to correct this situation. Seating of the cone is necessary to generate compression and frictional forces required to achieve 100% termination efficiency of the assembly..*





EFFORTS TO DEVELOP THE PRODUCT

DYNAMICALLY TESTED

Socket Lock's new and improved formula has been dynamically tested to EN 13411.3 standards, in which socket assemblies were cycled 75,000 times at 30% of the breaking strength of the rope. Following the dynamic testing, assemblies were then break load tested.

SHOCK LOAD TESTED

Large weights were attached to socket assemblies then dropped to prove resin would hold and rope would break.

STATIC BREAK LOAD TESTED

Assemblies up to 3.5 inches were destructive tested to verify **Socket Lock's** performance on high-strength mooring lines.

PACKAGING & KIT SIZES

Kit Part Number	Kit Size or Socket Size	Kits Per Carton	Booster Pack Part Number (Sold Individually)*
10801160	250cc	12	10840250
10801170	500cc	12	10840500
10801180	1000cc	6	10841000
10801190	2000cc	4	10842000
10801200	2” - 2.1/8”	4	10842200
10801225	2.1/4” - 2.3/8”	4	10842225
10801250	2.1/2” - 2.5/8”	4	10842250
10801275	2.3/4” - 2.7/8”	-	10842275
10801300	3” - 3.1/8”	-	10842300
10801325	3.1/4” - 3.3/8”	-	10842325
10801350	3.1/2” - 3.5/8”	-	10842350
10801375	3.3/4” - 4”	-	10842375

**Booster Packs are only required when ambient temperatures are below 60°F (16°C).*

APPROVALS

SOCKET LOCK
MEETS OR EXCEEDS THE REQUIREMENTS OF THE WORLD'S TOP STANDARDS ORGANIZATIONS.

ABS TYPE APPROVED PRODUCT

DNV TYPE APPROVED

TECHNICAL SPECIFICATIONS

Physical Properties	Standard	Value
Viscosity	ASTM D2196	7,00 - 12,000 centipoise
Density	ASTM D792	1.6 g/cc (.0925 oz/in^3)
Linear Curing Shrinkage	ASTM D2566	1.40%
Compressive Strength	ASTM D695	>20,000 psi (138 MPa)
Compressive Modulus	ASTM D695	>1.03 M psi (7,102 MPa)
Compressive Strain	ASTM D695	9.3% at failure
Retention of Compressive Strength After Immersion	ASTM D695	99%+
Barcol Hardness	ASTM D2583	45 - 60
Heat Deflection Temperature	ASTM D648	206°F (97°C)
Flexural Strength	ASTM D790	>10,000 psi (69 MPa)
Flexural Modulus	ASTM D790	>1.04 M psi (7,171 MPa)
Flexural Strain	ASTM D790	1.26%
Tensile Strength	ASTM D638	>6,000 psi (41 MPa)
Tensile Modulus	ASTM D638	>1.15 M psi (7,929 MPa)

SOCKETS & RESIN VOLUME REQUIREMENTS

Socket Size		Resin Volume
Inches	Millimeters	CCs
1/4”	6 - 7	9
5/16” - 3/8”	8 - 10	17
7/16” - 1/2”	11 - 13	35
9/16” - 5/8”	14 - 16	52
3/4”	19	86
7/8”	22	131
1”	26	164
1.1/8”	29	210
1.1/4” - 1.3/8”	32 - 35	361
1.1/2”	37	426
1.5/8”	42	495
1.3/4” - 1.7/8”	43 - 48	737
2” - 2.1/8”	51 - 54	1,265
2.1/4” - 2 3/8”	55 - 60	1,475
2 1/2” - 2.5/8”	61 - 68	1,966
2.3/4” - 2.7/8”	69 - 75	2,294
3” - 3.1/8”	76 - 80	3,277
3.1/4” - 3.3/8”	81 - 87	3,933
3.1/2” - 3.5/8”	88 - 93	4,920
3.3/4” - 4”	94 - 103	7,784

Socket volumes noted above are approximate and may vary according to the manufacturer.

GEL & CURE TIMES

Ambient Temperature		Booster Packs Required	Approximate Gel Time (Working Time)*	Approximate Cure Time (Ready For Service)
°F	°C	Packs	Minutes	Minutes
110	43	None	3 - 4	20
105	41	None	4 - 6	20
100	38	None	5 - 6	25
95	35	None	6 - 8	25
90	32	None	6 - 8	30
85	29	None	7 - 8	40
80	27	None	8 - 9	45
75	24	None	9 - 10	60
70	21	None	10 - 11	60
65	18	None	11 - 13	60
60	16	1	11 - 13	60
55	13	1	12 -14	60
50	10	1	10 - 12	60
45	7	1	12 - 15	60
40	4	1	20 - 22	90
35	2	1	25 - 35	90 - 120
30	-1	1	35 - 45	120

*Note: Times are approximate. The temperature of the resin, socket, and wire rope can affect these times. The times above are based on the resin being at conditioned room temperature of 70°F (21°C), and the socket and wire rope being at the ambient temperature indicated.

STORAGE & EXPIRATION DATES

Chemically speaking, polyester resin wants to slowly harden on its own — without a hardener. To counter this fact, inhibitors are added to the resin to give it a longer shelf life. In warmer temperatures, the molecules in the resin become more active and the inhibitors are less effective. Conversely, in cooler temperatures, the molecules in the resin become less active and the inhibitors are more effective.

The expiration date marked on the carton and on the individual kits is 18 months from the package date. However, the 18 months is based on the product being stored at 70°F (21°C).

If the product is stored in temperatures higher than 70°F (21°C), the shelf life of the resin will be reduced. An indication of expired resin is extremely quick curing after mixing in the hardener. Expired resin cures too quickly and cannot completely penetrate the wire broom and socket bowl. Incomplete penetration will not result in 100% termination efficiency and the wire could pull out of the socket prematurely causing damage or loss of life.

Storing in a cool, dry place helps guarantee **Socket Lock's** intended shelf life. Storing at temperatures cooler than 70°F (21°C) guarantees the shelf life and freshness of the product.

PREPARATION OF SOCKET

To correctly prepare the wire rope and socket for making a good termination, refer to procedures provided by the Wire Rope Technical Board or EN-13411

For a thorough, detailed presentation of the socketing procedure, see the video at:

SocketLock.com

MIXING

The two components of **Socket Lock** are polyester resin and a compound that triggers the resin to harden—referred to as a hardener or catalyst. Mixing is very important because it is necessary for the hardener to come into contact with all of the resin. To ensure this, we require that the preparer stir the two components for at least 60 seconds.

Thorough mixing allows for the resin mixture to gel and harden in the prescribed times. Not mixing thoroughly may cause the resin to have sections of the resin that take longer to harden. Without a hardened mixture, the desired strength of the termination may not be reached and the wire could pull out of the socket prematurely causing damage or loss of life.
It is very important to note that when preparing the kits for the larger, individually sized sockets, there is more than one packet of resin and an equal number of packets of hardener. Be sure to open and pour ALL of the resin into the pail first—THEN squeeze the hardener into the resin. DO NOT mix a resin pack, then a hardener, then a resin pack, then a hardener…. This may cause the resin to start to gel before all of the packs have been added.

POURING

There is actually a recommended technique for pouring the resin into the socket and the reason for this is to help ensure that the resin reaches the bottom of the interior of the socket and doesn't leave any voids in the socket bowl.

When pouring, pour slowly down the side wall of the socket. Doing so will help ensure that no air becomes trapped in the bottom of the socket. A resin poured socket relies on compression and friction between the hardened cone and the individual wires, having a trapped air pocket or void may compromise the strength of the termination or could possibly cause a "pull out" type failure.

COLD WEATHER CONSIDERATIONS

Cold weather presents certain challenges to the preparer of the assembly since the gel and cure times of polyester resin are lengthened at lower temperatures. The temperature of the wire rope, socket, and resin are factors.

Ideally, the wire rope, socket, and resin should be kept at room temperature by some method. However, it is recognized that this is not always possible. The objective is to have the resin gel and cure in as timely a manner as possible and still ensure complete resin penetration and 100% termination efficiency. At the very least, try to keep the resin kit at room temperature just prior to mixing. Cold resin means longer gel and cure times.

Since a very cold socket can make the resin cold and therefore, slow down the gel and cure times, wrap the socket in a heat blanket if possible prior to pouring the resin mixture.

If heating the wire rope and socket is not an option, a booster packet may be required. See the table in this brochure for temperatures and number(s) of booster packets recommended. The booster packets are basically more hardener (catalyst). The additional hardener will help accelerate the gelling and curing times.

Please note that it is NOT recommended to heat the socket with a torch to the point where the socket is red hot or cannot be touched. If the resin is poured into a hot socket, it may cause the resin to harden before reaching the base of the socket bowl, harden unevenly, and/or reduce the termination strength.

HOT WEATHER CONSIDERATIONS

Though it is not quite the challenge as cold weather, hot ambient temperatures can be cause for concern if the preparer is not aware of the nuances of hot weather socketing.

Going back to the main principle of how a resin termination works, it is compression and friction that produce enough holding power to create 100% efficient wire rope termination — in other words, the rope will break before the rope comes out of the socket. The resin must be able to flow properly since it is absolutely critical that resin reach the bottom of the socket and harden to allow for the compression and friction.

When cold, polyester resin will take longer to gel and cure. When polyester resin is warm, it will take a shorter time to gel and cure. So, when it is 90°F (32°C) outside and the resin has been sitting outside for a while and allowed to reach those temperatures, the resin will gel in approximately 6—8 minutes. If the temperatures are 105°F (41°C), the resin will gel in only 4—6 minutes. The preparer must be aware of this as they need to move more quickly to prevent the mixture from prematurely gelling. If the resin gels too quickly, it may not reach the bottom of the socket or may trap air. Also, it is not recommended to pour part of the socket with one kit, have it start gelling or hardening and then fill the rest with another kit.

A recommendation in hot temperatures is to keep the resin kit in a cool place just prior to mixing to slow the gel time and ensure that the preparer has enough time to pour the socket properly.

POURING SMALL SOCKETS

The concern when pouring small sockets (3/4" and below) is ensuring that the resin penetrates to the bottom of the socket. In larger sockets, there is typically more space between the wires, therefore, the resin can flow easier to the bottom. A good practice in smaller sockets would be to poke a small wire down into the wire rope broom in order to move some of the wires around. This is to make sure that the resin can flow to the bottom and that no air will become trapped. Do not disturb the wires or resin once the resin begins to gel.

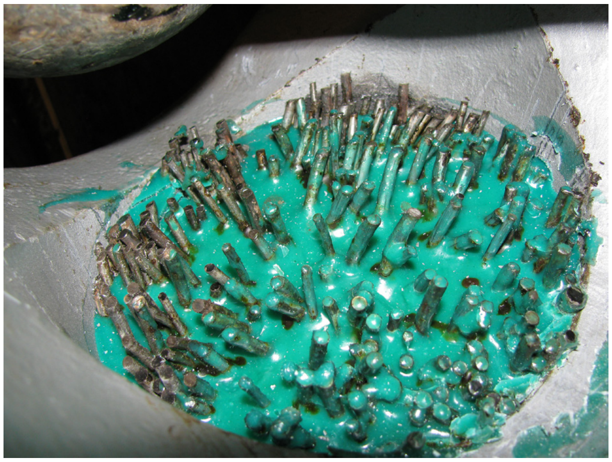
HIGH PERFORMANCE CRANE ROPES

High performance crane ropes can be as much as 14% more dense than general purpose ropes. This extra density can challenge the ability of the resin to reach the bottom of the socket/button. To help ensure complete penetration, use a wire to poke down into the wire rope broom. It is also helpful to use a marlin spike or screw driver to slightly move some of the wires around to promote the flow of resin to the bottom of the socket/button, and to the walls of the socket bowl.

As an added measure, tap the side of the socket with a hammer after the resin has been poured into the socket/button to help make sure that no air is trapped. Do not disturb the wires or resin once the resin begins to gel.

SURFACE CRACKING

Surface cracks occur due to slight imperfections, bumps, and/or protrusions in the socket bowl that prevent the resin cone from wedging down smoothly during seating. If you fill the resin in the socket above the upper tips of the wires, then the assembly is proof tested, there is a good chance surface cracks will develop. The more the resin is poured above the tips of the wires, the more likely this will occur. Hardened polyester resin is very strong in a compressive state—much like concrete, but it lacks tensile strength and flexural strength without reinforcement. The wire broom acts similar to re-bar to reinforce the resin cone and stop crack propagation if it does occur. If the top of the cone does crack on the surface, the cracks typically only go down as far as the top area of the wires. And since the critical area of compression and frictional grip take place in the bottom 60% of the socket cone, the visible cracks on the surface are very unlikely to affect the efficiency of the termination. However, the natural reaction to see a crack is understandably one of concern.



To eliminate or minimize the chance of surface cracks occurring, be careful to finish pouring the resin into the socket until it is just below the tips of the wires, and at or slightly below the top of the socket bowl. Over-topping those tips to provide a smooth even surface may look better initially, but the risk of having the assembly rejected by the customer because of their concern at the site of a crack after proof testing may be a situation you would prefer to avoid.

Socket Lock's resin does contain high strength micro fibers to not only make the resin formulation stronger and tougher, it helps minimize the chance of surface cracking.

IMPORTANCE OF ROPE ALIGNMENT

Two years of testing went into the development of **Socket Lock** before we produced it for sale in the market. Many, many tests were conducted with various formulations and testing criteria. All of the those tests were focused on the resin performing when conditions were ideal and in accordance with recommended procedures for preparation of the assemblies.

But at the end of all the testing and we were confident that the product was the best we could make it, we decided to set up a series of tests to see if we could purposefully make the assemblies fail. We felt it was just as important to understand what could make assemblies fail as what makes them perform as needed.

The tests were performed with 1 inch 6x26 IWRC EIPS rope. We performed 3 separate the tests with 20 assemblies per testing criteria:

Test 1: Leave all of the lube on the rope.

Test 2: Very minimally broom the wires.

Test 3: Curve the rope into the bottom of the socket instead of keeping it in vertical alignment.

After each assembly was prepared, we performed a destructive test. And after the testing was completed, it was obvious what socket preparers should be most concerned with. The failure results were:

Test 1: Dirty wire — 25% failure rate
Test 2: Poorly broomed wires — 30% failure rate
Test 3: Poorly aligned rope with socket — 60% failure rate

The reason for the high rate of failure for poorly aligned ropes (FIG. A) with sockets is that when the rope is not in vertical alignment, the resin is poured into the socket and the resin hardens the wires into place. Then, when the rope is straightened and load is applied, half of the wires in the resin cone are in tension and the other half are in compression and this causes an uneven loading on the individual wires. So, as the load becomes greater on the wires that are in tension, they will eventually fail before they should.

We have dedicated this portion of the brochure to this issue because we see this occurrence frequently in rigging shops as we travel around the world. The Wire Rope Technical Board recommends that the wire rope below the socket be in vertical alignment (FIG. B) with the socket for a length of at least 20 times the diameter of the rope.

FIG. A

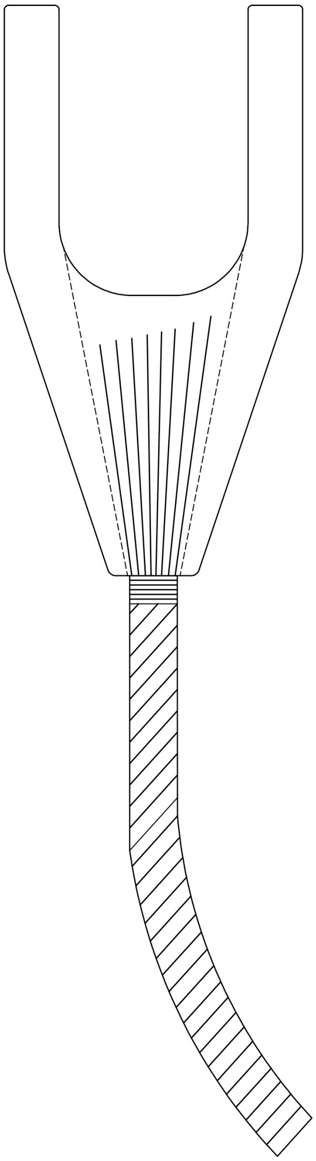
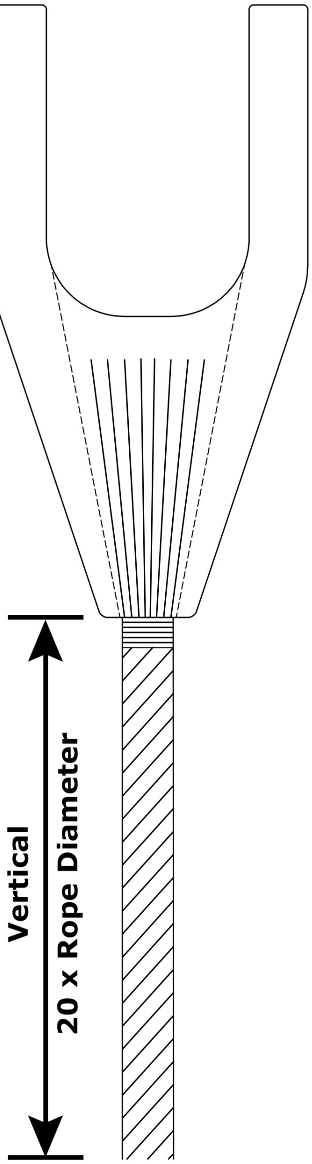


FIG. B



WHY IT IS NECESSARY TO FILL THE GROOVES

Detailed in the next section regarding the differences between zinc and resin poured sockets, it is pointed out that zinc poured sockets rely on the bond between the zinc and the wires. Resin poured sockets rely on friction and compression that allow the termination to be 100% efficient.

Today, there are a number of sockets by various manufacturers that are designed with single or multiple grooves in the bowl of the socket. The grooves are designed for zinc and their purpose is to keep the cone from backing out.

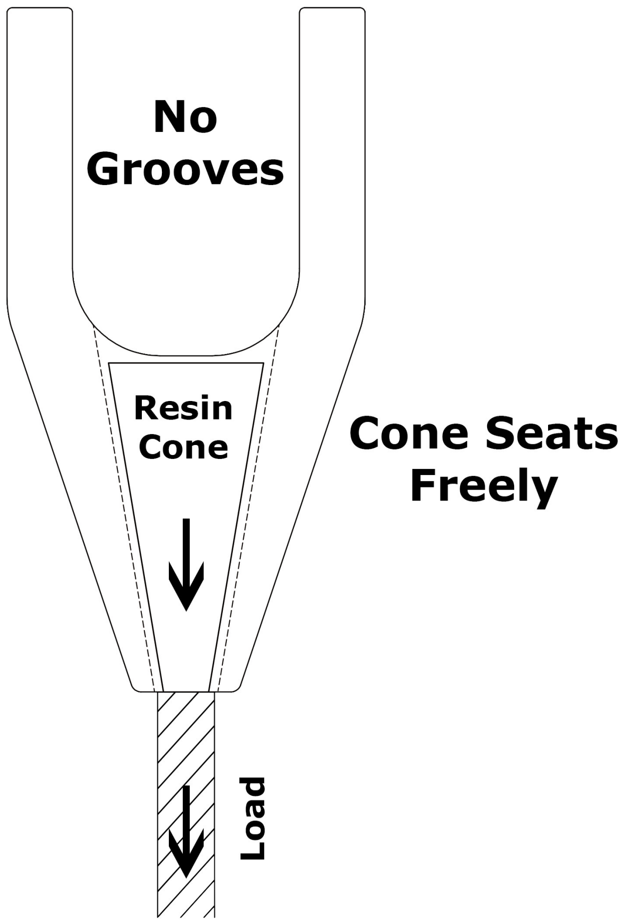
In a resin poured socket, it is necessary for the cone shaped wedge to "seat" down lower in the socket bowl when a load is applied. The wedging effect is what creates tremendous compressive strength. Even though the resin cone is hard, it has the ability to compress, whereas, zinc cannot.

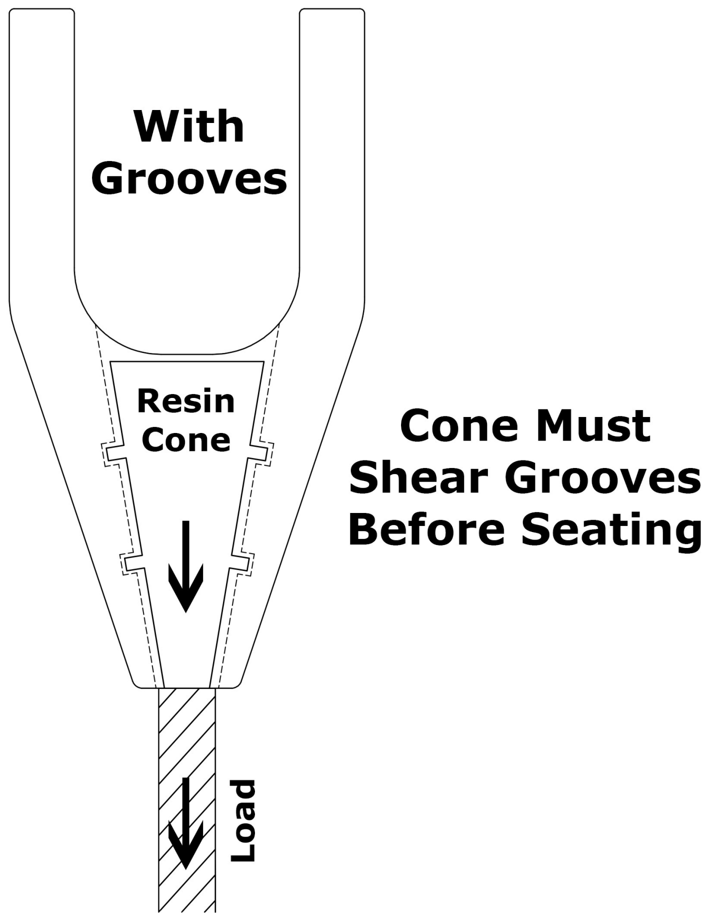
So, if the grooves of a socket are not filled and resin is chosen to make the termination, the resin will fill into the groove(s) and harden. Under light loading conditions, it is most likely that the socket will not seat properly and therefore, no compression will take place. In this condition, the termination strength is relying only on the friction between the resin and the wires.

At a certain point of loading on the socket, the resin filled grooves will shear—thereby allowing the cone to seat properly and allow compressive forces to assure the 100% termination strength desired.

It is required that the grooves be filled, as it is possible for the wires to pull out of the resin cone while the socket assembly is under load if the grooves are not filled and the cone has not yet seated. Socketing putty is recommended for filling grooves.

Proof load testing is recommended as it assures that the resin cone seats properly.





COMPARISON OF POLYESTER RESIN & ZINC POURED SOCKET TERMINATIONS FOR WIRE ROPE

It has been nearly 50 years since the development of polyester resin for use as a socketing medium. Though most of the socket terminations prepared today are done so with resin, zinc is still used to a lesser degree. In the 1960's and 70's, a socketing resin product was developed by Millfield Enterprises in the U.K. and in a separate project, by a collaborative effort between Philadelphia Resins (today, ITW Engineered Polymers) and Bethlehem Wire Rope (today, Wire Rope Works). A great deal of testing was performed then by those companies and by other engineering institutions to compare the differences between the socketing medium types. In short, the following results were produced:

- Both zinc and resin are effective at producing 100% termination efficiency.
- Zinc relies more on bonding grip to the wires and resin relies on frictional grip created by compression.
- Resin provides greater fatigue life for the socket termination than zinc.
- Making socket assemblies with resin is faster than with zinc.
- There are fewer safety hazards when making a socket assembly with resin than with zinc.

LOAD HOLDING EFFICIENCY

Zinc relies on bonding with the individual wires. This occurs when the molten zinc cools and shrinks. Since zinc is a solid metal, the zinc cone does not compress to provide additional friction. It is the bonding with the zinc, along with the helical shape of the individual wires that provides the necessary grip and friction to hold the load. As a result of this, the distribution of the loading on the socket cone is spread out from the top to the bottom of the cone.

In contrast to zinc, resin relies to a lesser degree on the bonding with the individual wires and primarily on the friction between the resin cone and the wires. Unlike zinc, the resin cone will "seat" in the socket and compress. Combined with the friction of the helical shape of the individual wires, the compression created when a load is applied to rope and socket cone will produce a termination strength that exceeds the breaking strength of the rope. As a result, the distribution of the loading on the wires and socket cone is concentrated in the bottom of the socket bowl area.

Advantage: *Neither. Both produce 100% termination efficiency.*

FATIGUE LIFE

The temperature of molten zinc can be in the range of 850°F to 900°F (454°C to 482°C). At those temperatures, pouring it over the wires can have the effect of annealing the individual wires. Annealing may soften or weaken the wires. Testing has shown that the fatigue life of zinc poured sockets is lessened as a result of the weakened wires.

As is the case with resin, the chemical reaction of adding catalyst to the resin will produce heat as a by-product. However, the temperatures from this reaction will not exceed 250°F (121°C) and therefore, have no detrimental effect on the strength of individual wires. Because the wire strength has not been affected, testing has shown that fatigue life on resin poured sockets is greater than that of zinc poured sockets.

Advantage: *Resin*

PREPARATION

Both zinc and resin require the wire rope to be broomed properly. When using zinc on galvanized wire ropes however, the galvanizing must be removed by dipping the broom in acid. Non-galvanized ropes do not require this. Since zinc relies more so on the bonding with the individual wires, it is very important that the wires be as clean as possible.

When using resin on galvanized wires, it is not necessary to remove the galvanizing. And though it is recommended that the grease or lubrication on the wires be cleaned and removed, it is not as critical as it is with zinc. And as with zinc, it is necessary that the wires be broomed properly.

Advantage: *Resin*

SAFETY

To pour zinc, it must be heated to over 850°F. This means having an open flame in a shop where other flammable items such as solvent may be present. So, care must be taken to eliminate the risk of fire. When the zinc is poured into the socket, there is a risk of splatter to the person pouring the socket and those who may be standing nearby. And if for some reason, there is any moisture in the socket broom or if a drop of water somehow lands in the pot of molten zinc, it also can pop and splatter. In addition to the risks associated with handling molten zinc, preparing galvanized wire rope requires the use of acid to remove the galvanizing.

As for resin, if it gets on the fingers or skin, it needs to be wiped off and cleaned up with soap and water.

Advantage: *Resin*

SOCKETING SUPPLIES

SOCKET DAM
SOCKETING PUTTY— Boxes of 10 x 1 lb. bars.

MIXING STICKS or PADDLES

MARLIN SPIKES

SEIZING WIRE
3-Strand annealed wire in 250 ft. spools. 3/32”, 1/8” & 3/16” diameters.

Sea Lube
Wire Rope Lubricant
Biodegradable

Sea-ZING *Tape*

Developed by the staff at Sea-Land Distributors, Sea-Zing Tape is a fast and effective way of seizing wire rope prior to brooming. For instructions, go to SLDrigging.com under the Sockets & Accessories section.

WIRE ROPE CLEANER
Biodegradable

Pre Socket
BIODEGRADABLE

WARNINGS

- Inspect inside of socket bowl to determine if socket has grooves. If grooves are present, fill grooves with socketing putty.
- Only use soft annealed iron wire for seizing wire.
- **Socket Lock** resin must be gelled and cured before assembly can be used.
- **Socket Lock** is not to be used with stainless steel rope in a salt water environment.
- Never use oversized sockets for wire rope.
- Never use **Socket Lock** beyond the expiration date.
- Never use excessive heat to heat the socket prior to pouring resin in an effort to accelerate the curing of the resin as it may cause the resin to prematurely gel prior to reaching the bottom of the socket bowl. Doing this could cause the assembly to fail.
- **Caution:** Exposure to some strong chemicals may affect the cured polymer (hardened resin mixture) in a way that could weaken the assembly. Please contact Sea-Land Distributors if this has occurred.

SAFETY INFORMATION

- When handling the resin or hardener, goggles and protective clothing are recommended. Impervious gloves are recommended.
- Always work in a ventilated area.
- Avoid skin or eye contact. Wash skin with soap and water and remove contaminated clothing. If contact with eyes, flush with clean water for at least 15 minutes. If irritation persists, seek medical attention.
- Avoid ingestion. If ingestion occurs, DO NOT induce vomiting. Drink milk or water to dilute and call for medical attention.
- Avoid inhaling vapors. If excessive vapors are inhaled, move to a fresh air area. If breathing has stopped or is labored, seek medical attention.
- Never aim an open flame at **Socket Lock**. Keep away from heat. Resin is a flammable liquid.
- Whenever using chemicals, always reference the MSDS sheet for safety and handling guidelines.
- **Socket Lock** MSDS Sheets can be found at: **SocketLock.com**

Socket Lock

Socket Lock is a product jointly developed by both Sea-Land Distributors and ITW Engineered Polymers. Before getting started in 2008, it was decided that the objective was to make **Socket Lock** the best socketing resin product in the world. Testing began in the laboratory and lasted several months before samples were produced for physical testing. In order to learn everything there is to know about this product, we also performed the same tests on the competitors' products. Physical and destructive testing took place over a year and a half with most of the initial testing performed on static load tensile testing machines. Once the basic strength of the product was established, dynamic testing was performed and though there was no standard for it, a shock load test was created to compare the results against competitor products. Today, **Socket Lock** continues to increase its market share in the U.S. and overseas as more distributors are established. **Socket Lock** is made exclusively for Sea-Land Distributors by ITW Engineered Polymers.

Sea-Land Distributors

Established in 2004 in New Orleans, Sea-Land Distributors is not only a wholesale distributor of rigging products, the company has developed and patented other products under the Sea-Fit brand and has several other proprietary brands such as Sea-Lube, Sea-Grease, Sea-Zing Tape and Pre-Socket.

ITW Engineered Polymers

Part of ITW, Illinois Tool Works, ITW Engineered Polymers has a long history of producing world leading products. Most notably, its Chockfast Orange product has long been the world standard and is used as a grouting and leveling compound under engines, gear boxes and rotating machinery in not only the U.S. Navy, but navies and ship companies around the world. And among its many other products, ITW is also the producer of the deck compound used by the U.S. Navy on its aircraft carriers.

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SocketLock.com