Resin Poured Socket Terminations

This type of termination has traditionally been the method for determining the rope's actual breaking strength. All other types of end terminations have been compared to poured sockets. Their efficiency is therefore established to be 100% for all grades and constructions of rope.

Rope assemblies with poured attachments are generally used as a straight tension member where the rope body does not contact the load and is otherwise kept free from distortion or physical abuse. In such cases the minimum recommended design factor is 3.0. If the assembly is used as a sling then a design factor of 5.0 should be used to calculate the rated capacity. Rated capacities for these slings used in basket hitches are the same as mechanical spliced slings and use the same D/d ratio factors.

Length tolerances for poured attachments can be somewhat more stringent than other types of slings. The manufacturer should be contacted and agreement reached before the order is placed. Tolerance as small as plus or minus 1/8" is not out of the ordinary for this type of assembly. Specifications such as type of fitting, pin orientation, and type of application should also be supplied to the manufacturer when ordering these types of assemblies. Those inexperienced in the socketing process should not try to fabricate assemblies without first getting expert training. It is far better to leave fabrication of this type of assembly to the experts. The following socketing method is general in nature and has withstood the test of time. Slight variations to this method will produce equal results. It is highly recommended that all resin poured sockets be proof loaded.
Thermo-Set Resin Socketing

Before proceeding with a thermo-set resin socketing procedure, check the resin manufacturer's instructions carefully. Each resin system has specific procedures and steps which must be followed in the order specified for the system to give the desired results. Since any thermo-set resin system depends upon a chemical reaction, the procedure becomes critically important. Give particular attention to selecting sockets designed for resin socketing. The following steps give a general outline to follow for resin socketing, they should not be used as a substitute for detailed instructions supplied by the resin manufacturer.

1. Measure the Rope Ends to be Socketed

The rope end should be of sufficient length so the ends of the unlaid wires (from the strands) will be at the top of the socket basket. (Fig. 8)

2. Apply Serving at Base of Socket

Apply a tight wire serving band, at the point where the socket base will be, for a length of two rope diameters. (Figs. 9 & 10)

3. Broom Out Strand Wires

Unlay and straighten the individual rope strands and spread them evenly so that they form an included angle of approximately 60 degrees. Unlay the wires of each individual strand for the full length of the rope end—being careful not to disturb or change the lay of the wires and strands under the serving band. Unlay the wires of the independent wire rope core (IWRC) in the same manner. A fiber core should be cut out and removed as close to the serving band as possible. (Fig. 9)

4. Clean the Broomed-Out Ends

A suggested cleaning solvent for this step is SC-5 Methyl Chloroform or equivalent solvent. It is also known under the names Chlorothane VG, 1-1-1 Trichlorethane, Perchlorothane, and Perchloroethylene.

CAUTION: Breathing the vapor of this solvent is harmful; it should only be used in a well-ventilated area. Be sure to follow the solvent manufacturer's instructions, and carefully observe all instructions printed on the label.

Swish the broomed-out rope end in the solvent, then brush vigorously to remove all grease and dirt—making certain that the wires are clean to the very bottom of the broom up to the serving band (Fig. 11). The use of acid to etch the wires before resin socketing is unnecessary and not recommended. Also, the use of flux on the wires before pouring resin should be avoided since this adversely affects resin bonding to the steel wires. Where it is feasible, the best and preferred cleaning method for rope ends prior to socketing is ultrasonic cleaning. After this cleaning step, place the broomed-out end pointing downward allowing it to remain until all
solvent has evaporated and the wires are dry.

Solvent should never be permitted to remain on the rope or on the serving band since it will run down the wires when the rope is turned upright.

5. Close Rope Ends and Place Socket

Place rope in a vertical position with the broom end up. Close and compact the broom to permit insertion of the broomed end into the base of the socketing. Slip the socket on, removing any temporary banding or seizing as required. Make certain the broomed wires are uniformly spaced in the basket, with the wire ends slightly below the top edge of the basket, and the axis of the rope and the fitting are aligned. Seal the annular space between the base of the socket and the rope to prevent leakage of the resin from the basket. In addition to normal sealing materials, non-hardening butyl rubber-base sealant or latex glazing compounds are satisfactory for this purpose. Make sure the sealant does not enter the base of the socket so the resin will be able to fill the complete depth of the socket basket.

6. Pouring the Resin

Mix and pour the resin in strict accordance with the resin manufacturer's instructions.

7. Lubrication After Socket Attachment

After the resin has cured, re-lubricate the wire rope at the base of the socket to replace any lubricant that may have been removed during the cleaning operation.

8. Acceptable Resin Types

Properties of commercially available resins vary considerably. It is next to impossible to establish general rules to cover all available resins. It is extremely important to refer to the individual resin manufacturer's instructions before using any one type. If the resin manufacturer has no data as to how his resin system performs with wire rope socketing, tests should be conducted before the system is used for field applications.

When properly formulated, most thermoset resins are acceptable for socketing. These formulations, when mixed, form a pourable material which will harden at ambient temperature, or upon the application of moderate heat. No open flame or molten metal hazards exist with resin socketing since heat-curing when necessary requires a relatively low temperature (250-300 degrees F) obtainable by electric resistance heating. Since resin socketing is so much simpler than zinc socketing, care must be taken not to become lax in following the recommended procedures.

Tests have demonstrated that satisfactory wire rope socketing performance can be obtained with resins having characteristics and properties as follows:

The resin shall be a liquid thermoset material that will harden after being mixed with the correct proportion of catalyst or curing agent. (Hardener)
A. Properties of Liquid (Uncured) Material

Resin and catalyst are normally supplied in two separate containers. After thoroughly mixing the two components together, the liquid can be poured into the socket basket. For ease of handling, liquid resins and catalysts should have the following properties:

1) Viscosity of the resin-catalyst mixture should be 30-40,000 CPS at 75 degrees F immediately after mixing. The viscosity will increase at lower ambient temperature and the resin may require warming prior to mixing with the catalyst if ambient temperatures are too low.

2) Flash Point

Both resin and catalyst should have a minimum flash point of 100 degrees F.

3) Shelf Life

Unmixed resin and catalyst should have a maximum shelf life specified by the resin manufacturer.

4) Pot Life and Cure Time

After mixing, the resin-catalyst blend should be pourable for approximately eight minutes and should harden within 30 minutes. Heating the blend in the socket should be permissible to obtain the cure.

B. Properties of the Cured Resin

1) Socket Performance

The resin shall exhibit sufficient bonding to the solvent-washed wires in a wire rope end socket to develop the breaking strength of all types, constructions and grades of wire rope. No slippage of individual wires is permissible when testing resin socketed rope assemblies in tension. After testing, however, some “seating” of the resin cone may be apparent and is acceptable.

The resin/wire bond within the cone or basket must be capable of withstanding tensile-shock loading encountered in normal field usage.

2) Compressive Strength

The minimum allowable compressive strength for fully cured resin is 12000 psi.

3) Shrinkage

Maximum allowable shrinkage is 2%. To control shrinkage, an inert filler may be used in the resin provided that the viscosity requirements are met. This filler material should always be formulated into the resin system by the resin manufacturer, not field mixed by the user.
4) Hardness

The desired hardness of the cured resin system is in the range of Barcol 40-55.

C. Performance of Resin Socketed Assemblies

Resin socketed assemblies may be moved after the resin has hardened. If the resin manufacturer's directions are followed, resin sockets should develop the breaking strength of the rope, and have the capability to withstand shock loading to a degree sufficient to break the rope, without the resin cone cracking or breaking.

One final note: resin technology is changing almost daily. Characteristics of these products vary significantly and each must be handled differently. The resin manufacturer should supply specific data as to fitness of their system for wire rope socketing.