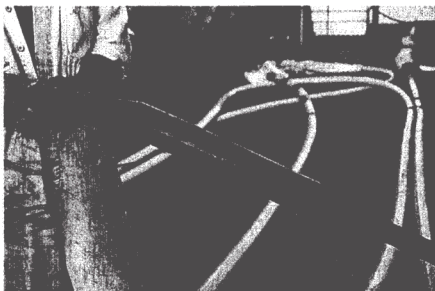


# Flooded Cable/Connector Water Blocking and Reterminating at Sea

By Robert Lindberg, President, RELTEK, LLC

For years the underwater industry has sought ways to water block cable and connector systems. The basic premise is filling the voids in the cable with a moisture repellent compound and pressure compensating the cable in the process. An alternative is now field proven for water blocking cable terminations in an uncompensated cable. This breakthrough technology is proven to water block already flooded cables.

A flooded high voltage power cable on a 1,250 meter deployment for pile driving on a new Shell Oil platform installation by Menck, GmbH of Germany, the number one pile driving



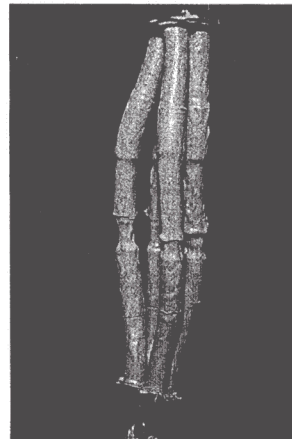
*The "Hammer" on-deck*

company of the world, provided an opportunity to prove cable/connector terminations not only can be water blocked against possible cable flooding, but actually water block and reterminate an already flooded cable. With less than two weeks to go, a 3.5KV motor power cable was found flooded. While operations could continue with the three remaining motors on the pile driver, they would be operating continuously at maximum capacity to handle driving 400 feet of pile into this particular seabed. A failed motor would stop the operations for days at a very high cost.

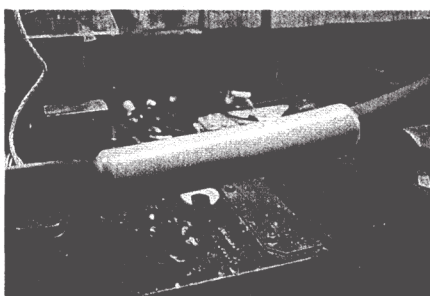
Menck's commitment to on time performance led to contracting with RELEK, LLC, producer of adhesives, sealants and coatings for harsh environments and dissimilar materials, to apply its BONDiT™ technology to solving an emergency operational breakdown onboard *The Balder of Heerema* in the Gulf of Mexico, owned and operated by Heerema.

In October '98, a week to go before driving operations were to begin, RELTK personnel flew to board *The Balder of Heerema* sixty miles off shore in the Gulf of Mexico. With the able support of Menck and Heerema engineering teams, work began immediately. A change in cable diameter was required to accommodate a connector size change. So, the agreed design called for a water blocked cable splice to manage the cable size change and block the water in the already flooded cable. Materials of the assembly included bonding and sealing to polyethylene wire insulation, EPDM cable jacket, urethane and PVC, HDPE high voltage pin insulators, Teflon connector insert, polyolefin shrink tubing, gold, nickel, solder and brass metals. The connector and splice termination and potting were completed at 1 AM the first night, with polyurethane overmolding scheduled for the next afternoon. The next morning insulation resistance reading on the connector was superb but the splice failed miser-

ably. The splice had to be torn down to diagnose what went wrong. Low insulation was measured between the ground lead and one of the hot lines of a three phase system. Investigation showed the multi-motor fresh water, pressure compensated cooling system was under positive pressure at all times. Strangely enough, the ground wire was terminated inside the water cooling system using self-vulcanizing tape for the terminal seal which eventually failed. Water was then forced through the ground wire, into the con-



*Inner assembly of the splice that was successful in blocking water from coming through the ground wire*



*Splice fully potted, without polyurethane overmold, but capable of full immersion*

connector, and back up the entire cable. Water failure was from inside the cable—not outside. We needed to water block water coming from the inside trying to get out.

Only a few days remained, calling for immediate redesign with what ever was available onboard ship to withstand 1,250 meters operating depth outside and positive hydro pressure inside. The new design was successful using BONDiT™ A-3 primer for all the substrates and B-1 potting and adhesive compound for sealing and mechanical stability. The polyurethane overmold was final curing while mounted on the hammer, waiting for deployment in a matter of hours.

The new termination system operated flawlessly while withstanding operations to 1,250 meters, mounted on a pile driver hammering sixteen 405 feet piles into the ocean floor. Menck was able to go online, operate and complete the job on schedule by implementing the BONDiT™ A-3 and B-1 cable termination system.



*Polyurethane overmolded assembly ready for mounting on the "Hammer"*

*Special appreciation is given to the Menck and Heerema teams for their ample contribution of support in the success of this operation. For more information contact Robert Lindberg at (707) 539 0539 or fax (707) 539 0875.*