



TN 600-10
TESTING OF SUBSEA
THERMAL INSULATION
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1. Generally speaking, there are two kinds of quality assurance testing: (1) *qualification testing* and (2) *conformance testing*. The latter is systematic testing of production units to ensure that the manufacturing process remains under control. The former is proof testing, often quite lengthy, to verify that the product will work as required under service conditions. Qualification testing is used in the product development process to screen new materials, and it is often applied to candidate materials to prove that they can meet specific project objectives. The purpose of this note is to describe the qualification testing process used in proving the performance of all *C-THERM* products.
2. The basis of all *C-THERM* testing is the concept of good “hot, wet” performance. It may seem obvious that, since subsea insulation must work in the ocean, the service conditions therefore must require contact with sea water. However, some argue that the insulation may be sealed from any contact with water or that the material is “waterproof” so the interior never gets wet. In our experience, there is no way to guarantee the absence of water in any subsea installation. Therefore, all materials systems must be designed to withstand sea water at prevailing pressure and temperature conditions.
3. Every *C-THERM* insulation product undergoes a total of at least 10,000 hours of hot water exposure before finally being accepted as a “qualified” material. The first step in the process is immersion of sample coupons in a succession of hot water baths up to 95° C (203° F) at atmospheric pressure. Coupons are removed from the water, weighed, examined, and returned to the water at weekly intervals. Samples that show minimal weight gain and little or no swelling or shrinkage after prolonged exposure to hot water, up to one year or more, are selected for further evaluation.
4. The next qualification step is to test the candidate materials under a combination of high temperature and hydrostatic pressure. Several disks 2.00” thick and 6.00” diameter (50 x 150mm) are cast and stacked in one of several pressure vessels filled with water capable of being heated up to 302° F (150° C) while being pressurized to 3,000 psig (200 bar). Different test conditions are used in screening different grades of insulation. This intermediate phase of the test program may take from one to several months. Again, the disks are weighed and examined at weekly intervals to determine weight gain and reveal any signs of degradation. Materials that survive exposure up through this level are then accepted for the last step, SST testing.
5. The SST (Simulated Service Vessel) provides the ultimate test for subsea insulation, simulating actual conditions found on the seafloor. The candidate material is cast into a cylinder 3.00” (75mm) thick around an 8” x 66” (203 x 1676mm) steel pipe and placed inside a pressure vessel filled with water chilled to 40° F (4° C). Hot oil up to 302° F (150° C) is circulated through the steel pipe while the chilled water is pressurized to 3,000 psig (200 bar). Data from embedded thermocouples during the 28-day test yield valuable information confirming computer-modeled predictions of *C-THERM* product performance under highly realistic service conditions.