

### 36 Temperature parameters for manned survival suit evaluation

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in 1984, delegates from seafaring nations on the Maritime Safety Committee of the International Maritime Organization (IMO) completed writing the new lifesaving requirements for the Safety of Life at Sea (**SOLAS**) 1974 Convention. These new regulations introduce for the first time requirements for "immersion suits", "exposure suits" or "survival suits" which are just some of the names of the same protective suits. With regards to the thermal qualities of the suits the regulations require that the suit can protect the wearer from a core temperature drop of more than  $1^{\circ}\text{C}$ , and that skin temperatures measured at hand, foot and lumbar region do not drop below  $10^{\circ}\text{C}$  for a test period of 2 or 6 hours depending on the type of suit.

It is clear from the regulations that the tests are to be performed using human subjects. Test results of suits are not only of interest to the approving authorities but naturally also to the manufacturers during a development process. It seems as if the parameters specified have become the essential parameters for the manufacturers' development work. Rectal temperature for the test subjects are in particular used as an "index" for the suit's thermal qualities. Unfortunately the rectal temperature does not always reflect the real properties of the suit, at least not when the test is performed for only a limited time (2 or 6 hours). For instance, test results can show that a 2mm neoprene suit could be equally good or even better than a 5mm suit when based on rectal temperatures over a 2 hour test period. A Ventile fabric suit has shown the same confusing results when tested with or without a thinsulate inner lining as the rectal temperatures indicated no difference.

The explanation for these unexpected results, is the fact that in the colder suits shivering will compensate for the increased heat loss, and will manage to keep the rectal temperature at a reasonably high level for the test period. This is clearly demonstrated when oxygen consumption is included as a parameter. Including oxygen consumption as a part of the test procedure increases the complexity of the test with cost implications as well. Results have shown that the skin temperature at the lower back region can be a better index of the thermal quality of the suits than rectal temperature.

One reason for measuring the skin temperatures on the sites given in the regulations is to avoid cold damages. In that respect the selected sites may not give the temperatures on the coldest part of the body. Subjective comments from participating subjects have indicated that the heels get painfully cold during suit tests in cold water. Heel skin temperatures as low as  $2^{\circ}\text{C}$  have been observed while the skin temperatures as specified in the regulations are still above  $10^{\circ}\text{C}$ . Such observations confirm that from a safety point of view, one should pay more attention to the skin temperatures of these parts of the body during testing.