

## TOWARDS A SWEATING THERMAL MANIKIN FOR EVALUATION OF CLOTHING SYSTEMS AND THERMAL ENVIRONMENTS

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Thermal manikins are used in a number of research laboratories to assess the properties of clothing systems and to simulate the thermal interaction between human beings and the environment. These manikins, however, produce only dry heat, and the important influence of evaporative heat loss cannot be properly studied. Within a Nordic cooperation project, the challenge has been taken to build a sweating, movable, sectional, thermal manikin COPPELIA.

The project has advanced in steps and already produced some remarkable results. At TEFO in Gothenburg, Sweden, a sectional, movable dry manikin TORE has been developed, which basically can be produced in short **series**. Two of these manikins are in use in Sweden, one in Netherlands and one in USA. The sweating mechanism, which will be used for COPPELIA, has been applied to a sweating cylinder and a sweating foot, and these are used as test instruments for assessing clothing material and footwear properties, respectively. The local sweating in different situations has been studied in order to define the values within which COPPELIA should be regulated.

COPPELIA is based on the plastic shell and metal skeleton of TORE. The surface is divided into 16 parts with separate thermal control. Water is supplied to the manikin surface in 187 sweating points, each covering a maximal area of 100 cm<sup>2</sup>. The hands, feet and head are not supplied with water. A microcomputer controlled microvalve system allows for individual control of the water supply to the sweat points, and the sweating level can be chosen between 0 and approximately 300 g/m<sup>2</sup>·h. The joints of COPPELIA are based on prothesis technology and the manikin can take different postures and make certain movements by using an external movement mechanism.

Test results from the sweating cylinder indicate that very interesting and important information on clothing properties can be awaited from tests done with COPPELIA.