

51 Wearability - the improvement of personal protective equipment
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The design of many types of protective equipment is influenced by the need to comply with standards' specifications. However, most standards confine themselves to the technical specification of materials and construction. Their aim is to ensure that a particular level of protection will be afforded by equipment which complies with the requirements. What many standards tend to ignore is that personal protective equipment has to be worn by people while performing a wide variety of tasks. Such equipment thus needs to be wearable. It is extremely difficult to convince a construction worker, for example, that he should wear a safety helmet if it gives him a headache, falls off or interferes with his job.

Work within the Protective Equipment Section of the Health and Safety Executive's Safety Engineering Laboratory has been directed towards obtaining information about factors which affect the wearability of some personal protective equipment. This information is related to design features of the equipment and can thus be incorporated in revisions of the relevant standards as testable criteria. For example the current British Standard for Industrial Eye Protectors requires the lenses to meet certain precise impact requirements. However, one of the biggest problems encountered in the use of eye protectors is that the lenses mist up. Experimental investigation has determined the criteria needed to alleviate the problem of misting and a test method has been devised to enable eye protectors to be assessed. Prototype goggles designed according to these criteria have been tested in laboratory and field trials. As a result several refinements have been incorporated in pre-production samples.

For some tasks the prevention of foreign bodies passing between the frame and the face is particularly important; this requires a close fitting eye protector. Studies are described in which detailed anthropometric data are used to specify shapes which provide the basis for tests on whether a protector will meet specific criteria for fit. The anthropometric data-base consists of the coordinates for 94 points around the head of each subject; it can be used to investigate shape and size requirements of several types of head mounted personal protective equipment. For example, to ensure adequate fit and comfort of both respirators and goggles the variation in the curvature around the nose area must be accommodated; such information can be obtained from the data. Similarly the curvature of the forehead at any required position can be calculated by interpolating between measured points.

The design of industrial safety helmets is an area where HSE has been sponsoring research to elicit better information on the factors that affect wearability. Findings suggest, for example, that better comfort is achieved with harnesses made from webbing rather than injection moulded plastic. The latest revision of BS5240 incorporates some of these findings in the form of requirements that a comfortable helmet should meet.

If workers are to be required to wear protective equipment then it is very desirable that it is not too uncomfortable. If the current standards can be improved by incorporating criteria that ensure that discomfort is minimized then this is likely to have an effect on product design and to better meet the needs of the user. This in turn should increase the wearing rate at the workplace.

52 A microcomputer model for the thermal comfort prediction in moderate thermal environments

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A simple simulation model of thermal regulation processes in man was presented. This model was based on concepts represented by members of the Thermal Physiology School of the J.B. Pierce Foundation Laboratory and Yale University - mainly by J.A.J. Stolwijk, J.D. Hardy, and A.P. Gagge. A simple CORE-SHELL model represents an "average" human body (the passive subsystem) and a regression function operating on "signals" from the skin and the core represents the thermal controller (the active