

### 34 Effects of laundering on the thermal insulation of clothing

*H. Makinen and E Tammela*, Institute of Occupational Health, Finland

Most studies on the thermal insulation of clothing have been done with new, unwashed clothing. At the Institute of Occupational Health the effects of wear and laundering on the insulation of cold protective clothing have been studied and how material thickness and garment shrinkage change in relation to insulation has been determined.

The thermal insulation values of clothing were measured on a thermal mannequin. The tests were carried out in two stages. In the first stage the effect of wear and laundering on three different cold protective clothing types was measured:

- a) cotton/nylon outer fabric and quilting
- b) cotton/nylon outer fabric and pile, quilted sleeves
- c) nylon outer fabric with a polyurethane mating on the inside, pile lining

Thermal insulation was measured when the suits were new, after three launderings, and after eight launderings. The suits had been worn in a cold store. In the second stage the tests were carried out for four different cold protective clothing types:

- d) nylon outer fabric with a polyurethane coating on the inside and a lining
- e) outer fabric of 100% polyester, pile lining
- f) same as type c
- g) cotton/nylon outer fabric, special quilted wadding polyester lining

Thermal insulation was measured when the suits were new and after three, five, ten and twenty launderings. After launderings dimensional changes and the changes in fabric thickness were measured.

After wearing and three launderings, there were no significant differences in insulation values when compared to new suits. After wearing and eight launderings, insulation values were 10.15% lower.

When the effects of laundering were tested without wear, the changes in thermal insulation were slight, being 0.2% after three launderings for both pile and special quilting lined suits. The decrease in thermal insulation after suits with regular quilted linings had undergone three launderings was 9%.

The decrease in thermal insulation for all of the suits except the one with the special quilted lining (type g) was near 10% after ten launderings and 10.15% after 20 launderings. The decrease in thermal insulation for the suit with special quilted lining was only 3.5% after 20 launderings.

The dimensional changes of all the suits were under 5%. The suits did not differ in this respect. The changes in material thickness were notably greater, being **6.20%**.

The compression of fabrics while being worn and laundered decreases the thermal insulation of cold protective suits somewhat faster than launderings alone. The decrease was greater for normal quilted linings than for pile linings. The thermal insulation of the suit with the special quilted lining decreased under 5% after 20 launderings, whereas the thermal insulation of the other suits was 10-11% lower. quilted wadding with cotton