



INNOVATIVE FUNCTIONAL CLOTHING PREVENTS HEAT STRESS IN THE WORKPLACE

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Heat-free in the workplace?

Optimal climatic conditions are closely related to the health, productivity and employee satisfaction¹.

Significantly elevated temperatures are generally reflected in lower productivity and a reduced ability to concentrate, and can endanger the health and safety of employees. This can also affect the sales and performance of the employers, not only as a result of the employees themselves, but also due to reduced work productivity. According to a study by the Institute for the Global Economy (Institut für Weltwirtschaft, IfW)², the additional number of extremely hot days caused by climate change alone could have a significantly adverse effect on Germany's gross national product in the future. Of course, this finding allows us to draw conclusions regarding the temperatures that already prevail in companies today.

12 % LESS PRODUCTIVITY

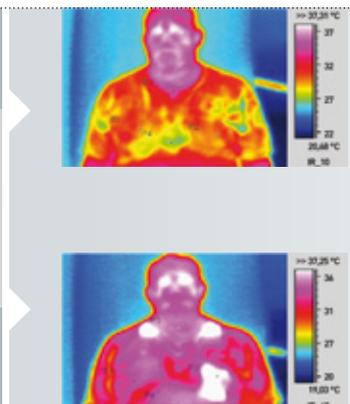
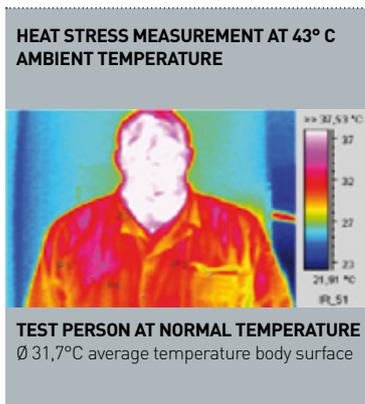
Every extremely hot day costs the national economy money: According to conservative estimates, work productivity declines by up to 12 percent on extremely hot days. This effect has already caused 2.4 billion Euro in economic losses, according to the authors of the IfW study. In Germany close to 25,000 people each year are already being hospitalized for heat-related complaints. The authors of the study expect this number to increase to about 150,000 cases annually in the future. This does not account for the general health-related stress that prevails on extremely hot days in areas that are not air-conditioned (shipping companies, warehouses, construction workers, road workers, etc.). Attention must

also be paid to work in typically hot environments, such as steel mills, foundries, mines, fire departments, etc. In these and other cases, the use of additional, insulating protective clothing can be added to heat stress. In particular, the body temperature and heart rate of the affected individuals is elevated disproportionately as a result of heat stress³. Substantial loss of fluids leads to a significant reduction in performance. Twenty-five percent of accidents among firefighters in the United States are caused by heat stress⁴.

ENVIRONMENTALLY FRIENDLY AND YET PHYSIOLOGICAL

The use of air-conditioning systems is one alternative. However, because of higher fuel consumption

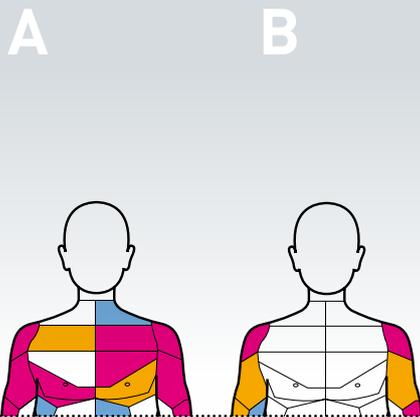
in the vehicle and/or the high level of electricity use in buildings, this only increases CO₂ emissions and thus the number of extremely hot days. This exacerbates climate change and can thus automatically be ruled out as a solution to the heat problem. Besides, the use of air-conditioning is not feasible in most of the cases described. The E.COOLINE cooling system is an environmentally friendly and physiological solution. This innovative product is capable of cooling the human body for hours, depending on the temperature, in a simple and physiological way. Due to the physiological principle of heat-loss caused by evaporation, an optimal cooling effect occurs automatically. The Thermoman Study⁵ performed by the Empa National Research Institute – Materials Science and Technology, in St. Gallen, Switzerland, has confirmed the cooling effect of E.COOLINE. Areas of the body that were protected by E.COOLINE (product: sleeveless vest) exhibited less of a temperature increase than those areas that were not protected with the new high-tech fleece. The temperature conditions on the "Thermoman" surface (skin), at a radiation output of 5 kW/m², were 3,4°C lower on average than without the E.COOLINE vest. At a radiation output of 10 kW/m², the difference measured as much as 6,6°C. According to the test setup, the "Thermoman" was dressed in a T-shirt and the appropriate firefighter's protective



Conclusion: The test person with cooling achieved the same low temperatures at head and upper body as in normal ambient temperatures. With increased temperatures of + 6.6°C the same test person exceeds without cooling vest temperatures which are conducive to health and performance and represent a health risk. On the long run, this may lead to health problems and lack of performance.

Figure 1

THERMOKINETIC STUDY



Percentage surface area of pain and burns after 120 seconds

- none
- pain
- 1st degree burns
- 2nd degree burns
- 3rd degree burns
- A. Thermoman test without E.COOLINE
- B. Thermoman test with E.COOLINE

- The "THERMOMAN" study conducted by the Swiss national research institute Empa – Materials Science and Technology in St. Gallen confirmed the effectiveness of E.COOLINE. The parts of the body protected by E.COOLINE showed a lower temperature rise than those not protected by the new high-tech fleece.
- At 5 kW/m², 10 kW/m² and a flash over, the results of the Empa measurements determined additionally that there existed no elevated risk of steam burns despite the water quantities bound in E.COOLINE.

Cf: Empa study report n° 204 959 of 2.2.2006

Figure 2

gear, which also insulates against heat, as can also be the case in other hot workplaces that require protective clothing.

PROVEN IN STUDIES

An in vitro thermokinetics study of the high-tech material performed in the laboratory yielded, at 24°C, a 6°C reduction in surface temperature to 18°C. At an outside temperature of 30°C, the temperature on E.COOLINE was at a cool 16°C, and stayed at this temperature for over 20 hours.

The example of a heat stress measurement carried out in a glass producing company demonstrates the impacts of heat when working in the near surroundings of a melting furnace, for example, with and without cooling textiles. The average ambient temperature lay at 43°C, the relative humidity at 40 %. The radiation of the furnace achieved 304°C. Due to cooling with E.COOLINE, this enormous heat stress could be significantly reduced (Figure 1).

FAST COOLING FOR HOURS

E.COOLINE stands for innovative, functional clothing that mimics and reinforces the body's cooling system. As with perspiration, in which the body is cooled by the principle of evaporation, the mechanism of E.COOLINE is based on the natural evaporation of water. The high-tech fleece is capable of binding several times its own weight

of water, so that the surrounding clothing remains dry. As a result, the water can only escape through evaporation, not through mechanical pressure. This evaporation causes heat-loss, cooling the body. The effect is stronger at higher temperatures and less pronounced at lower temperatures, thus producing a consistently optimal cooling effect.

The cooling effect lasts from hours today, depending on the temperature, and is therefore suitable for most situations of work and use. Depending on the application, E.COOLINE can be manually activated and used once the surface material has dried or, in larger companies, it can be combined with the COOLBOX activation cabinet, which fully automates the activation process with water. And because only a small amount of power consumption is required for each vest, it is also an environmentally friendly alternative that can be used in larger companies, in particular. This cooling functional clothing can be washed and, if properly cared for, will last a long time.

DEMOGRAPHY ASKS FOR COOLING

Demographic change creates new challenges for enterprises. The shortage of young professionals leads to markets where elder personnel work longer and longer. In order to stay competitive and to guarantee future productivity of enterprises, the health of man-

power must be preserved as long as possible. This applies mainly to hot workplaces where not only physical work is required but also resistance to heat. Especially at these workplaces the cardiovascular and metabolic systems are under stress. This results in increasing off times and early retirement. Release with E.COOLINE can be a real advantage for enterprises with regard to competitiveness.

PROVEN TO WORK

Cooling vests and other cooling products are therefore already used by major enterprises. Especially for WBGT* values which lie significantly above the guideline values determined by work laws and regulations, risky workplaces can be made out by heat stress measurements. The use of infrared cameras allows to determine the efficiency of the cooling products on site.

performance international provides a concept of demographic consulting for hot workplaces.

SOURCES

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- ² Costs of Climate Change, Institute of the Global Economy (IfW), Germany, Kiel, 2007
- ³ STATT study, Stress burden of wearers of respiratory protection gear during simulated use in the fire department training building, Germany, 2002
- ⁴ Accident statistics for firefighters in the United States, 1995-2000, National Fire Incident Reporting System, US Fire Administration
- ⁵ Thermoman study with COOLINE, Empa Materials Sciences and Technology, St. Gallen, Switzerland, 2006

* WBGT: world bulb globe temperature



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