

Function in functional clothing

Breathability and wear comfort

Silke Off & Martin Harnisch | Hohenstein Institute

Sports Performance Days | Annecy & Munich 2011



Hohenstein Institute – at a glance

- Private institute for research, testing, consulting and inspections
- Non-profit research institute
- Technical academy offering vocational and advanced training
- 320 employees at the headquarters in Boennigheim and a global network of branch offices in 23 different countries
- Family operated in third generation

Aerial view of the Hohenstein Institute



Serving textile business worldwide

Europe

- Bulgaria
- Hungary
- Romania
- Russia
- Belarus

The Americas

- USA
- Mexico
- Peru
- Brazil
- Dominican Republic
- Guatemala
- El Salvador
- Colombia (2x)

Asia

- Turkey
- Syria
- Pakistan
- India (4x)
- Sri Lanka
- Bangladesh
- Thailand
- Cambodia
- Vietnam
- China (2x)



Operating ranges & areas of competence



Clothing Technology: Testing of fit and workmanship



Consumer Tests: Comparative product testing



Hygiene & Biotechnology: Attestation of efficiency and safety checks



Textile Testing: Material testing, quality control & inspection service



Function and Care:

- Assessment/optimization of the wear comfort of textiles & clothing
- Development/testing of functionalized textiles and care methods
- Test centre for personal protective equipment

Function and Care – Fields of activity

Clothing Physiology



PPE – Test Centre and Certified Body



Textile UV Protection / Colorimetry / Whiteness Assessment



Functional Textiles



Optimization of textile reprocessing



Contract Research and Consultation



Advanced Training and Education



Function in functional clothing - physiological comfort

- Is wear comfort important for sportswear?
- Demands on running shoes:
 - Performance
 - Injury prevention
 - Comfort

Source: Löffler



Why is wear comfort important?

- Support of physical and mental fitness by a good heat and moisture management
- Protection against external influences

➔ **Wear comfort is no luxury!**



What do we feel while wearing clothing?

Thermophysiological discomfort



Freezing



Heavy sweating

Skin sensorial discomfort



Scratching, clinging, etc.



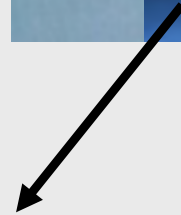
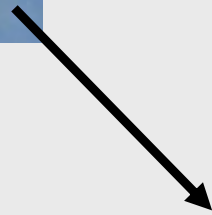
No wear comfort

Aspects of wear comfort

Thermophysiological comfort



Skin sensorial comfort



Wear comfort

Processes of heat and sweat production

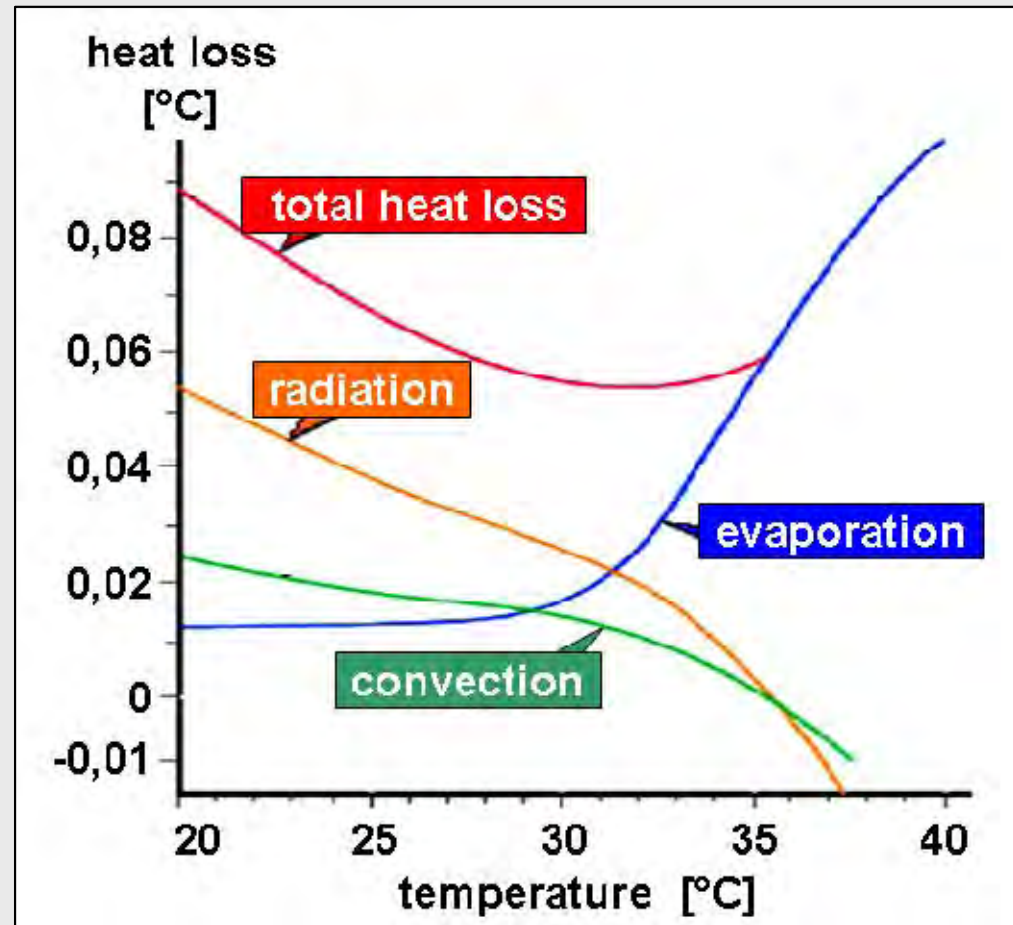
Aim: Balanced relation between heat loss to heat production

metabolic heat
+
environmental heat

Heat gain

conduction
+
convection
+
evaporation
+
radiation

Heat loss



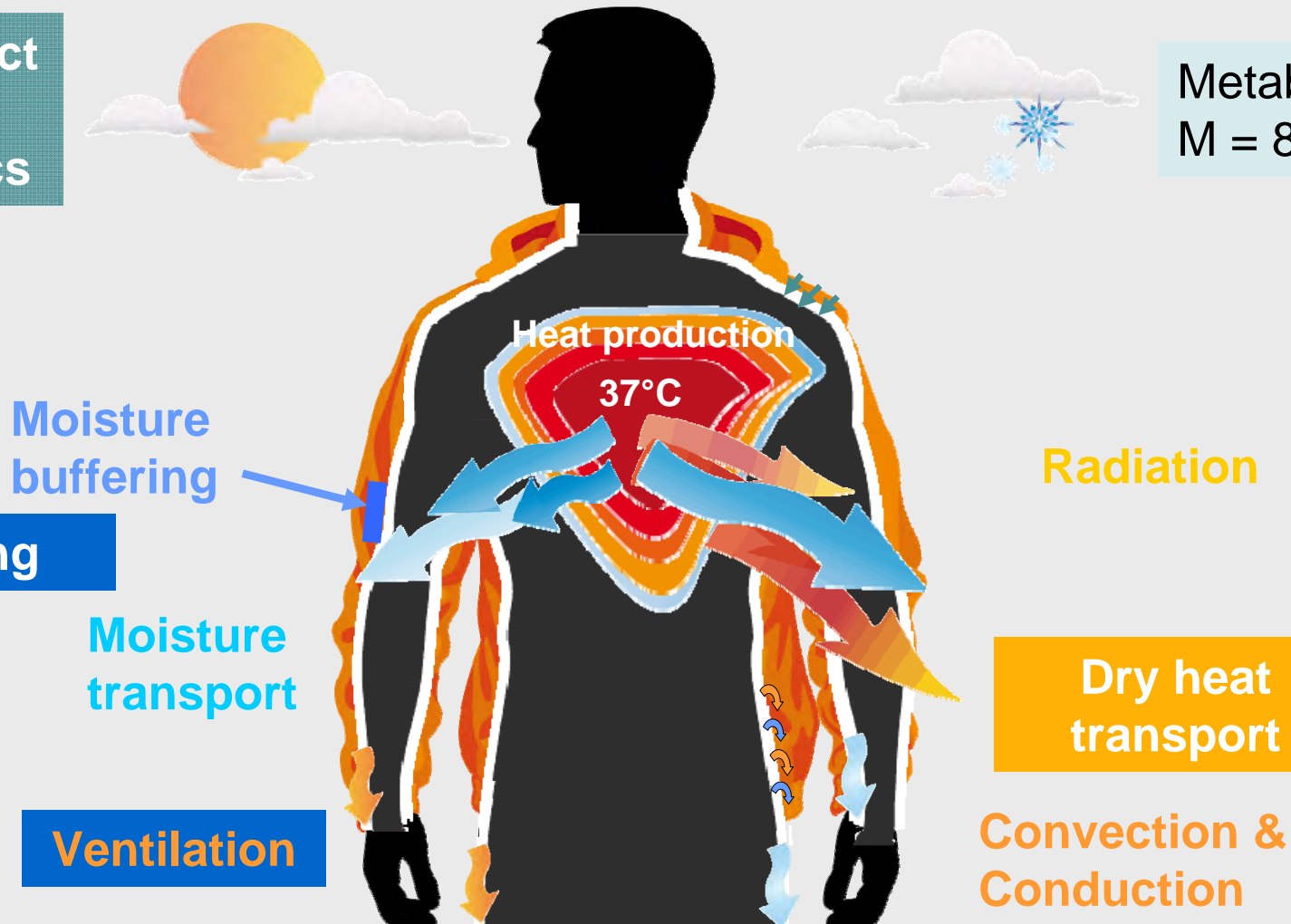
Interaction body – climate – clothing



Interaction body – climate – clothing

Skin contact & Ergonomics

Metabolic rate:
 $M = 80 \text{ W to } 500 \text{ W}$

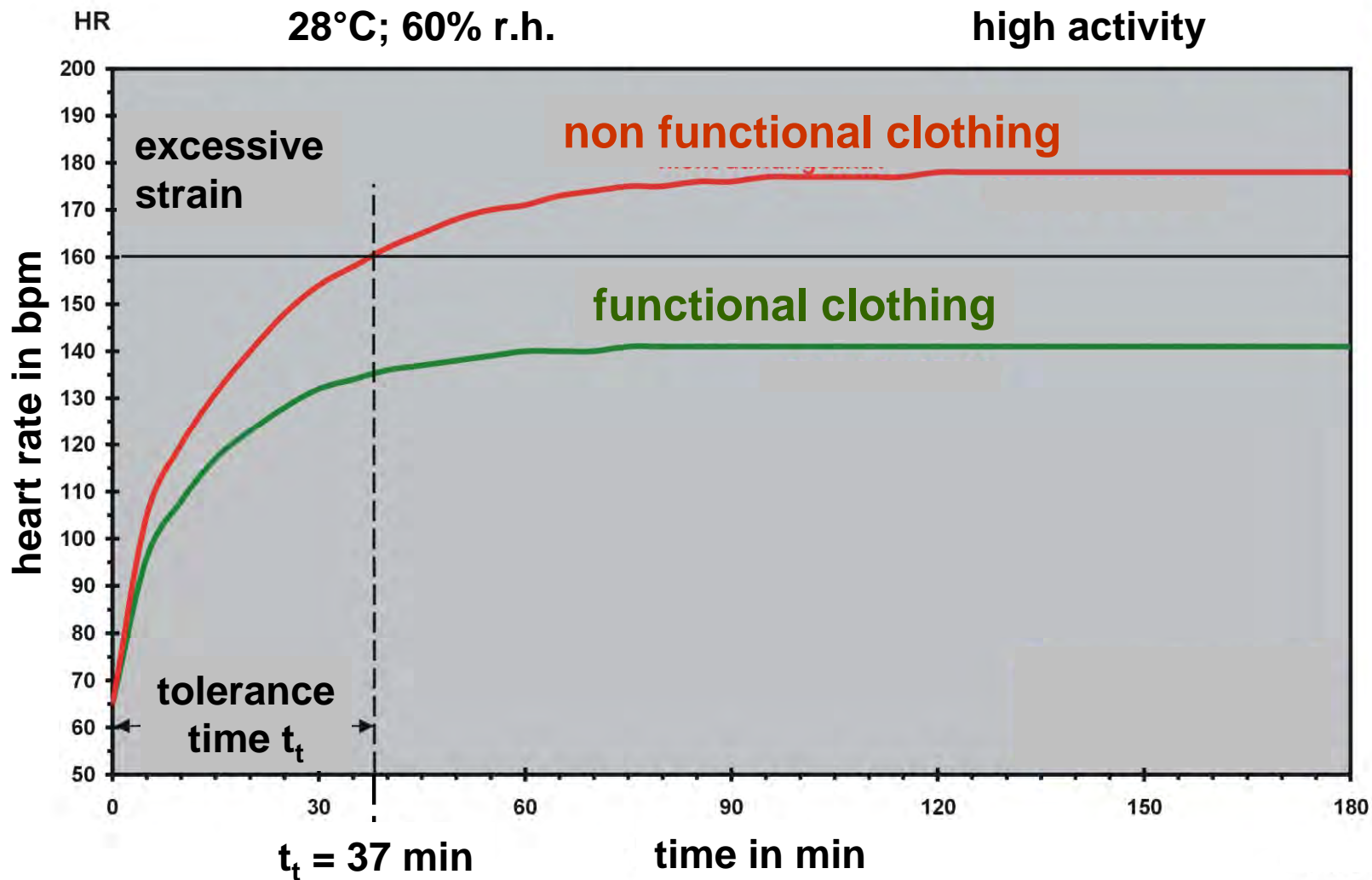


**Heat stress / cold stress
= impairment of attention & performance**

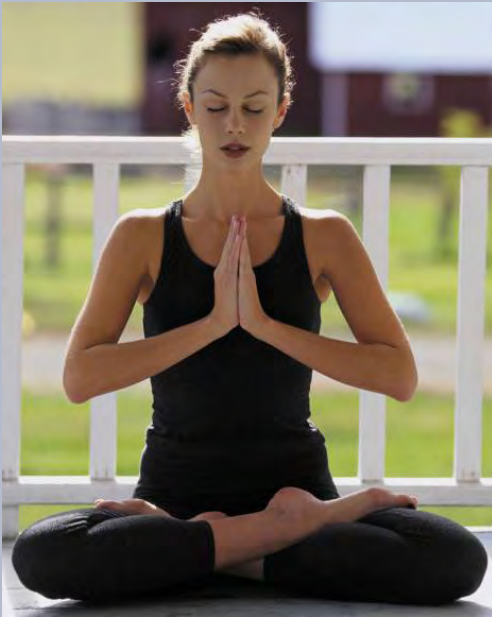
**Thermophysiological comfort
= even energy balance**

Physiological effect of clothing - function

high activity



Wear situations and appropriate values



Insensible sweating

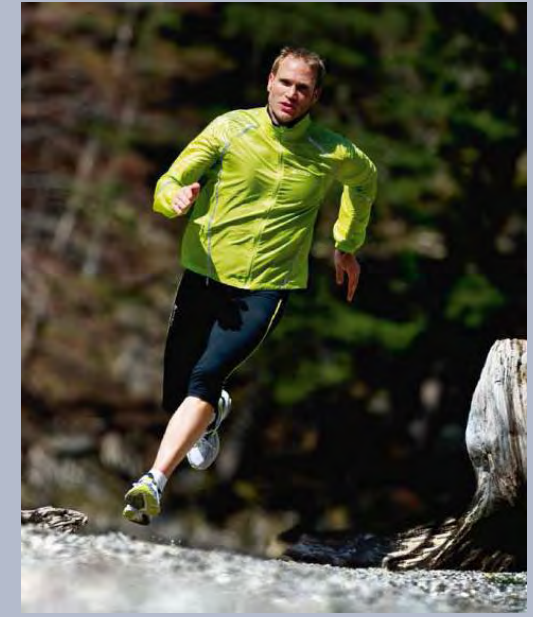
Water vapour resistance
(„breathability“)

Thermal insulation



Heavier sweating

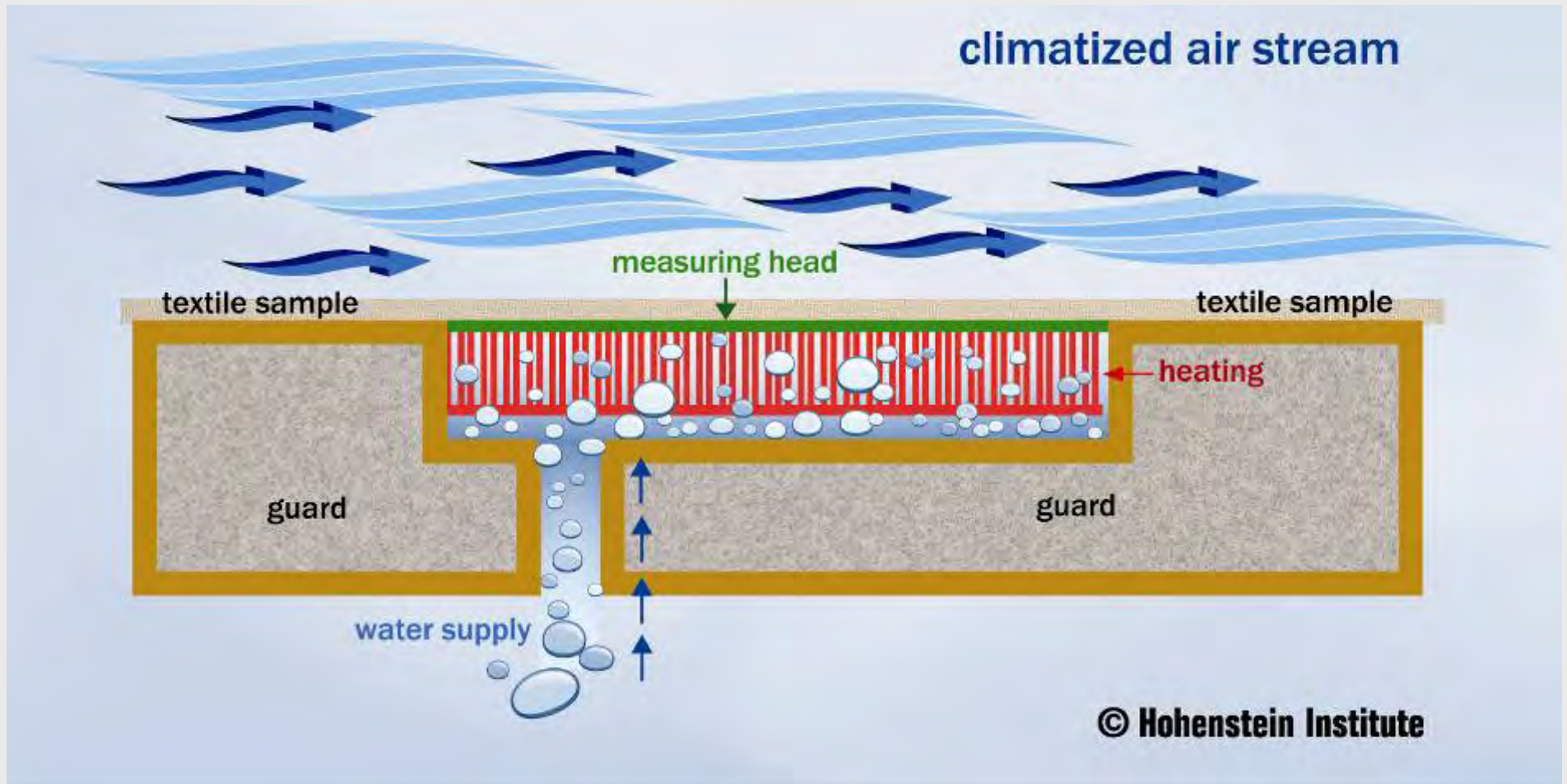
Buffering of sweat



Heavy sweating

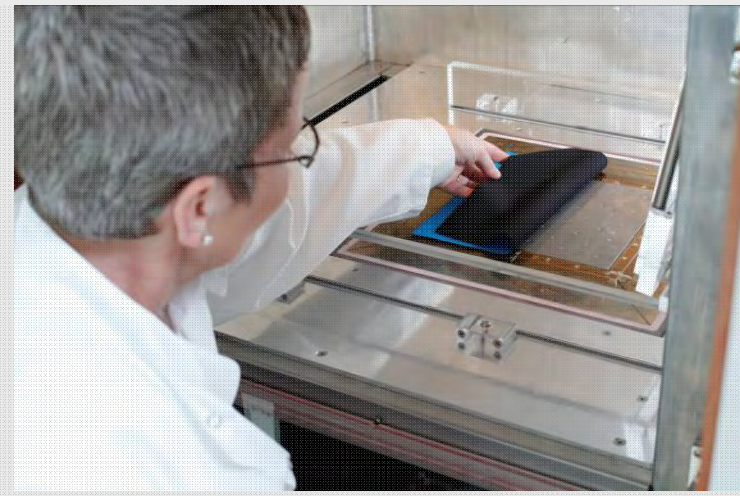
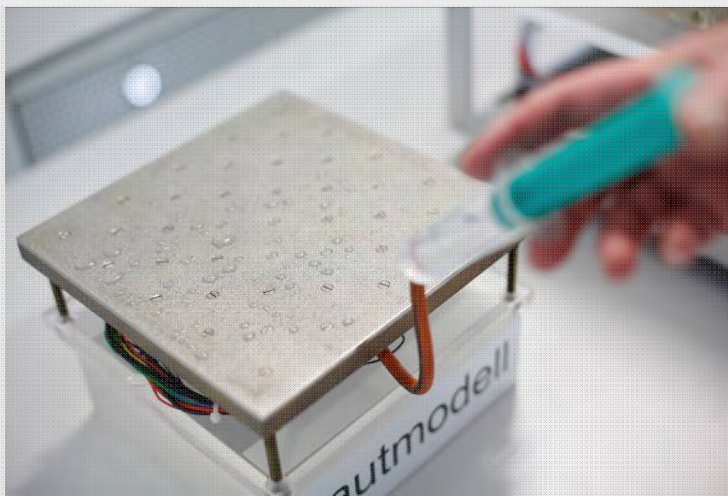
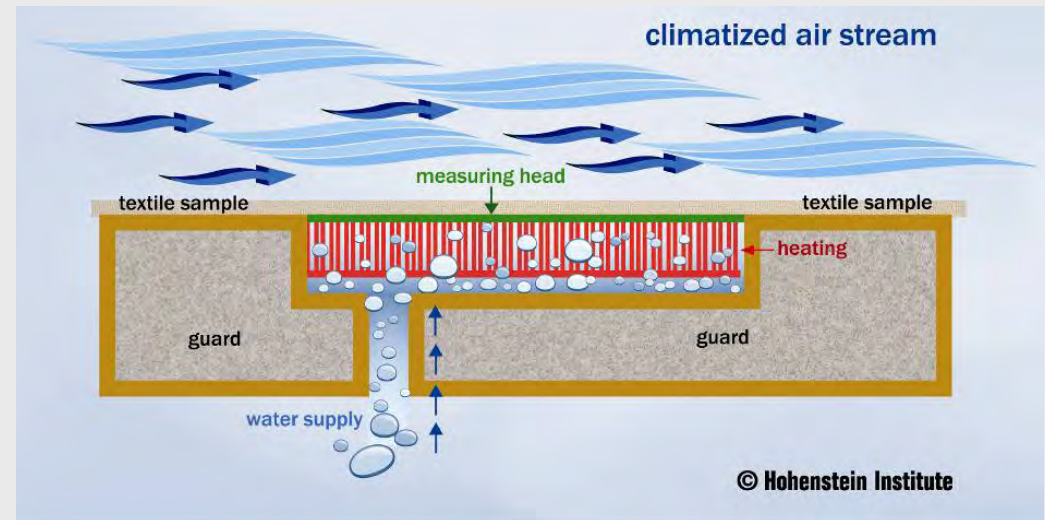
Sweat transport
Sweat absorbency
Drying time

Measurement of wear comfort - Skin Model



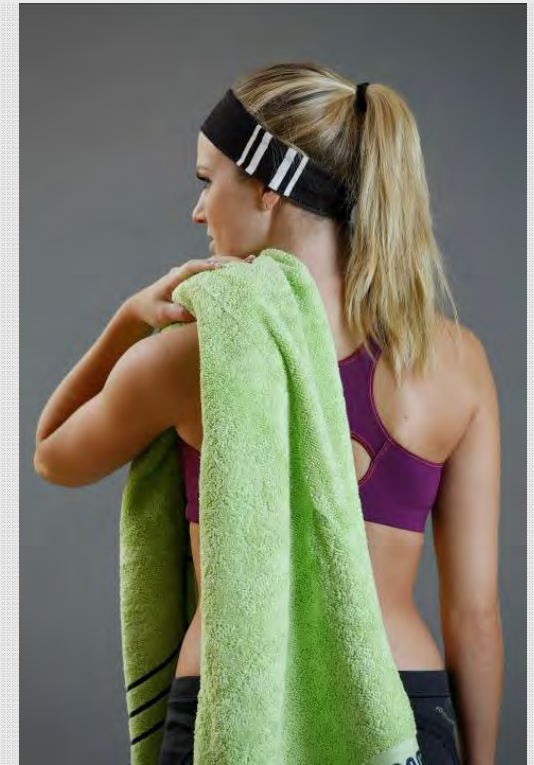
Measurement of wear comfort - Skin Model

- Standardized according to EN 31092/ISO 11092 and ASTM F 1868-02
- Measurement of heat and moisture management of textiles as well as related values



Measurement of wear comfort - skin sensorial comfort

- Skin sensorial properties = perception of a textile on the skin
- Defined by different perceptions
- Development of test apparatus & validation by wearer trials



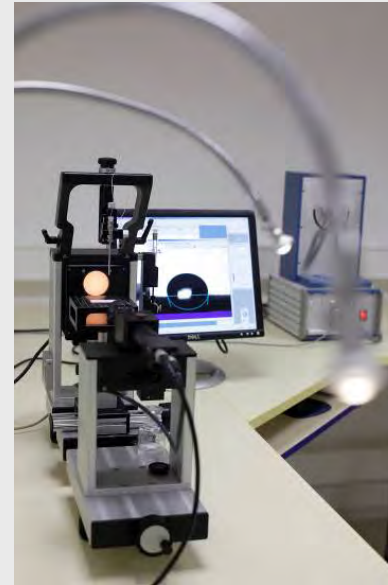
Measurement of wear comfort - skin sensorial values



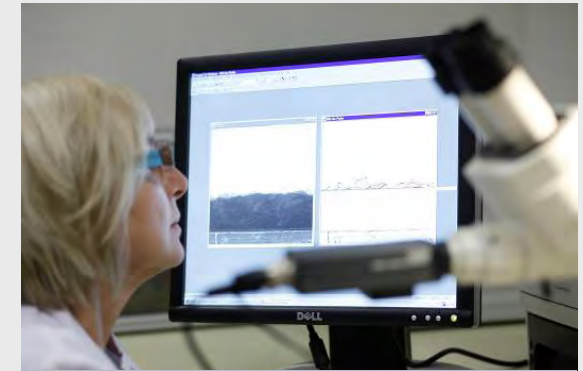
wet cling
index



number of
contact points



sorption
index

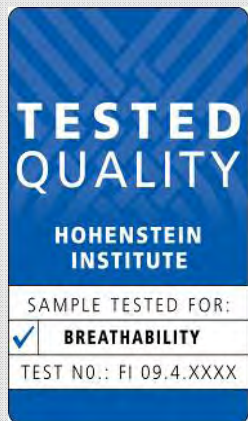
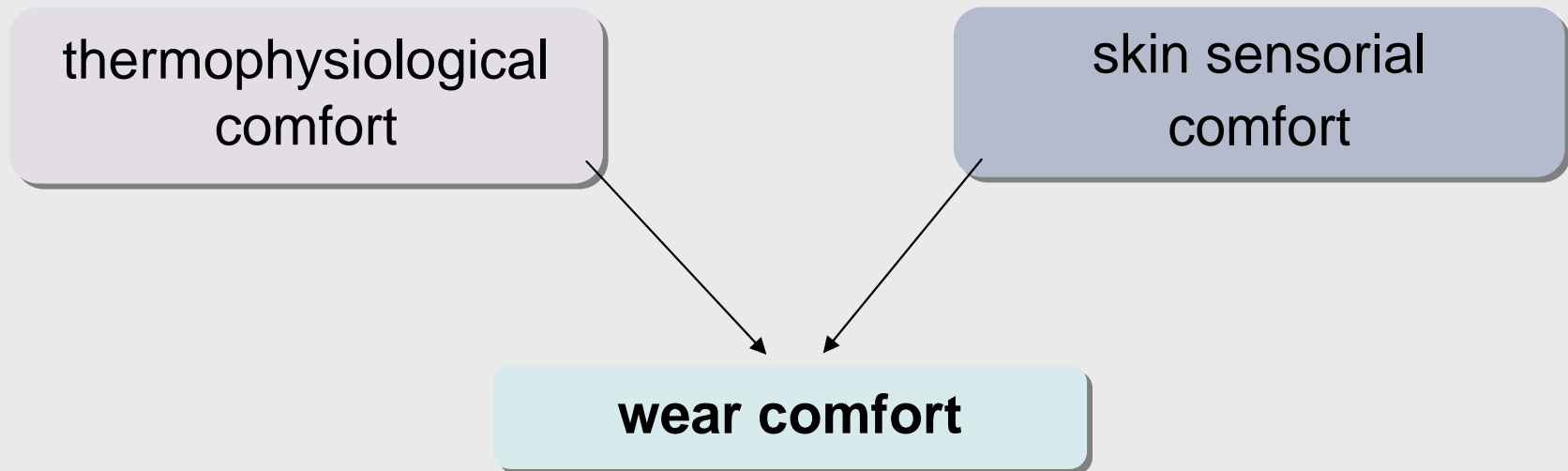


surface index

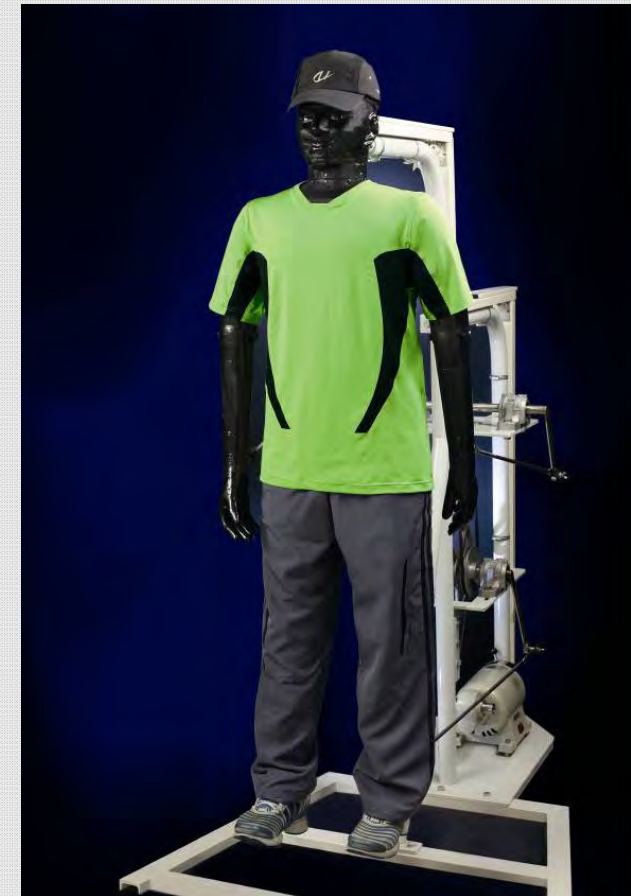


stiffness

Measurement of wear comfort – comfort vote

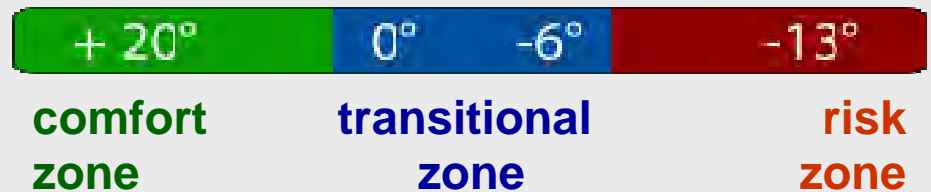


Measurement of wear comfort – Charlie 4th



Measurement of sleep comfort – Charlie 3rd

- Measurement of the thermal insulation of sleeping bags according to EN 13537
- Results lead to a range of utility
- Sleeping bags for EU market have to be labelled according to EN 13537



Measurement of wear comfort – Moveable sweating foot model

- Measurement of thermal insulation and water vapour resistance of “foot clothing” = sock + shoe
- 13 segments, 32 sweat glands
- Simulation of movement



Measurement of wear comfort – wearer trials

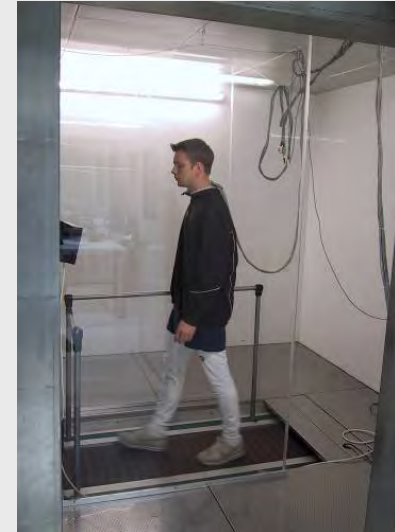


- simulating various weather conditions and activities in a climatic chamber
- measurement of skin temperature and humidity by sensors
- subjective judgment of comfort by the subjects



Benefit for manufacturers / retailers / end-users

- Support during development of new products
- Improvement of physiological properties
- Product safety for the end-user
- Less reclamations
- Officially supported research projects for the textile industry
- Customised test procedures for special issues



Visit us and learn more



Thank you for your kind attention!

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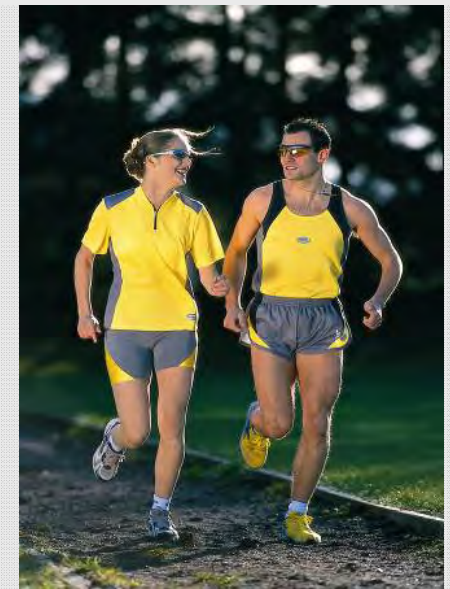
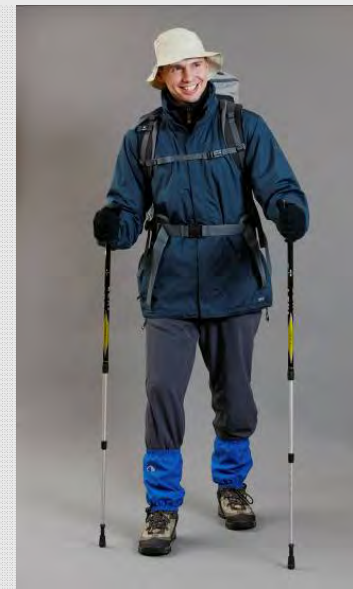
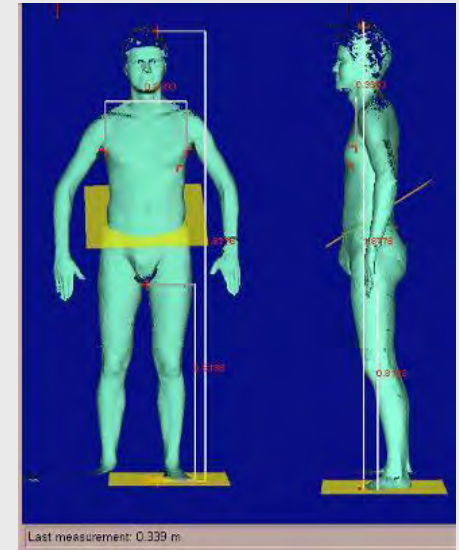
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Further functionalities

- Fit
- Water tightness
- Air permeability
- UV-protection



Practical requirements for clothing according to UV standard 801

new condition

wearing conditions

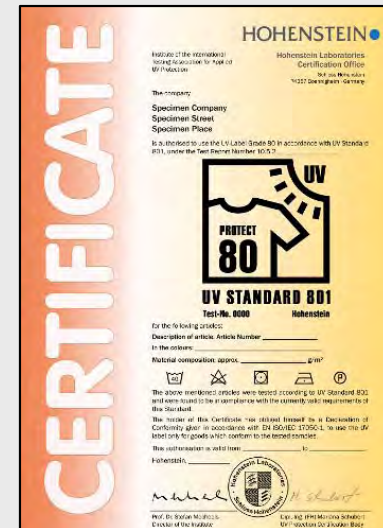
- stretched
- wetted

testing after use

- scouring, abrasion
- stretched and wetted

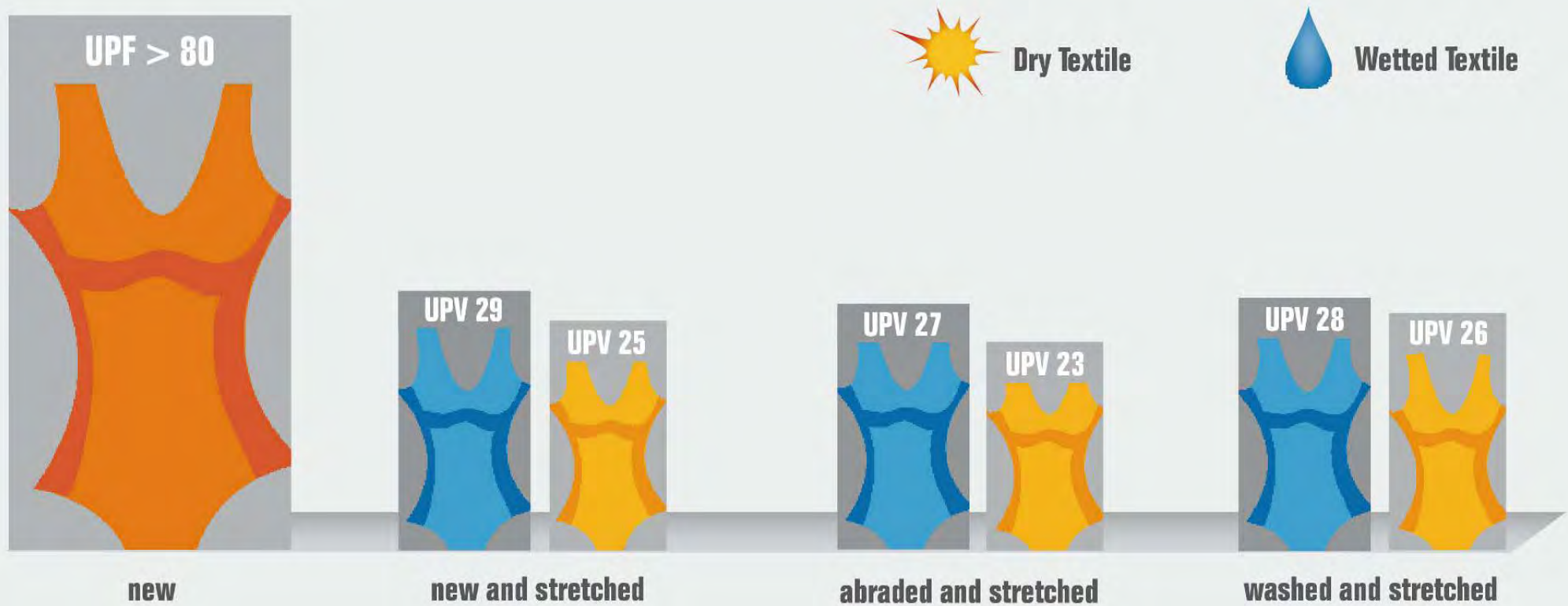
testing after care

- washing and/or dry cleaning
- stretched and wetted



The lowest determined UV protection factor is certified!

UV protection factor according to UV standard 801



UV Protection Factor of swim suit
made of Polyamide/Elasthane applying conditions of use