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Departments Affected: Suppliers, 3rd party labs, Development and Sourcing Teams	

Version	Date	Modifications	Page
01	29.01.2019	New test method	All
02	27.06.2019	Requirements updated	All
03	20.11.2019	Deleted Winter RDY Updated requirement Deleted Cold.RDY	All
04	27.01.2025	Added Requirements for Insulation Management Tech Function and Tech Concept CLIMAWARM+ for Women and Kids Size; Added Insulation Management Levels (with Temperature Range) for Kids, Women and Men sizes; Added precise test procedure; New CTQ Format.	All

Remarks:

1 Purpose

This method determines the Thermal Insulation Resistance Value (without Temperature Range) and Tech Function Insulation Management Levels (with Temperature Range) of complete footwear in conjunction with hose, using a moulded test foot in a closed testing environment.

2 Scope

This method is valid for products with assigned Tech Function Insulation Management (with T-Range) and/or Tech concept CLIMAWARM+.

3 Roles & Responsibilities

User Group	Responsibilities	Section	Detail	Link
Suppliers/ 3rd party labs	Test Execution and Evaluation	Entire file	Required Equipment; Sample Preparation and Conditioning; Test Execution; Data Collection, Evaluation and Reporting.	5 ff.
Quality Teams; Material Teams; Operation Teams	Ensure Standard is executed			

4 Reference Documents/Terminology

Reference Documents

- **PHM-FW0002/AG0002** – Material Testing Conditions and Cutting
- **SATRA TM436:2010** – Determination of whole shoe thermal insulation value and cold rating

Terminology

- **Thermal insulation** = Reduction of heat/cold transfer between objects in thermal contact. It can be achieved with specially engineered methods or processes, as well as with suitable object shapes and materials.
- **Temperature Range (T-Range)** = recommended outside temperature range for product use for low-medium activity level.
- **Activity Level LOW-MEDIUM** = represents walking or light work which can be sustained over a significant time[1]

5 Specific Procedure

5.1 Equipment

- Available SATRA thermal insulation test chamber (see Figure 1).

[1] https://www.satra.com/bulletin/article.php?id=1297

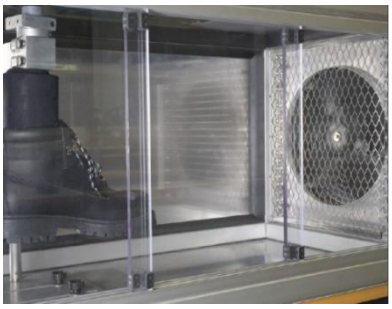

Figure 1: Thermal Insulation Test Chamber with Specimen

- Moulded test foot in different sizes including Adult UK 1, 4, 7, 9; Kids K UK 10, 12 (see Figure 2).

Figure 2: Moulded test foot with sensors

- 2 samples of thin, close fitting standard hose with high moisture wicking properties referred to as the “skin”. Pre-washed 100% synthetic fiber hose (90-95% PA plus elastane) is suitable.
- One sample of absorbent standard hose long enough to cover the top of the foot excluding the leg extension. Pre-washed 85-90% cotton plus synthetic fibre including elastane and plain knit construction.

- One sample of an insulating hose to use when warming up the foot.

5.2 Sample

- A single specimen of test footwear (left side).
- If desired, replicate items of footwear may be used for each cycle of the procedure in which case separate warming up routines are required for each item of footwear.
- If necessary, the shoe can be cut to fit on the test foot. Ensure to close the cut using staples or stitches as good as possible to avoid heat loss.
- Adidas Sample Sizes are not available for the Satra Test Feet, please conduct testing according to sizes given in Table 1.

Note: The Thermal Resistance values are dependent on the sample foot size and fit of the shoe. It is therefore crucial for repetitive and reliable results to use the correct test foot size for each footwear sample.

Table 1: Satra Foot Size and regarding Adidas Sample Sizes that should be used for testing.

Gender	Satra Test Foot Size [UK]	Adidas Sample Size [UK]
Men	9	8.5
Women	4	5.5
Kids	K 10	K 11.5

5.3 Procedure

- Mount the foot in the clamp and position in the chamber.
- Place a skin followed by the insulation hose onto the foot (no conditioning needed).
- Set the temperature controller to 38°C.
- Switch on the temperature controller to commence the warm-up period.
- Allow the equipment to run until the temperature of the foot reaches the required temperature (can take up to 60 mins).
- **The next three steps should be done as quick as possible to ensure minimum heat loss.**
    - After required temperature is reached, remove the insulating hose and skin.

- Place a conditioned skin and a standard hose onto the foot. Ensure there is no excess tensions or slackness.
- Place the test footwear onto the foot and adjust the fastening system as would be done in wear.

- Turn on the timer and allow the equipment to run for at least 30 mins to reestablish the required foot temperature.
- Once finished, switch on the energy recording system and start the timer (180 mins) to let the test run.
- Repeat the test for two further 180 mins on the same sample.

5.4 Data Collection, Evaluation and Reporting

5.4.1 Thermal Resistance

- After the 3 tests are finished, calculate the mean thermal resistance value from the 3 R-values given by the software (see Figure 3).

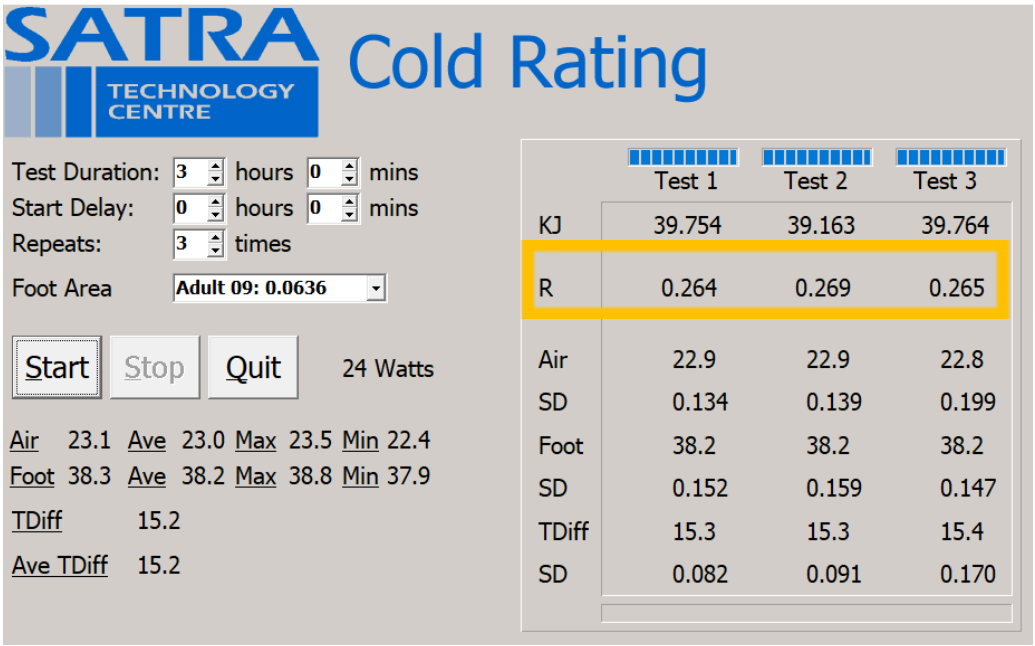

Figure 3: Software with test results (R) for each 3 tests.

- The Thermal Resistance is being calculated according to Formula (1).

$$Ri = \frac{A*(Tfi-Tci)}{Wi} \quad (1)$$

Ri = Thermal Resistance [m² K W⁻¹]
A = surface area of the foot [m^2]
Tfi = mean value of foot surface temperature [°C]
Tci = mean value of chamber atmosphere temperature [°C]
Wi = heat loss [W]
i indicates the period that is 1,2 or 3

- The Thermal Resistance requirements for Thermal Insulation (without T-Range/ Climawarm+) can be found in Table 2. There are different requirements for each foot size since R is dependent on the test foot area A.

Table 2: Thermal Resistance Requirements R for Climawarm+ per shoe size.

	Satra Test Foot Size [UK]	Adidas FTW Sample Size [UK]	A Area of foot [m²]	R Thermal resistance [m² K W⁻¹]
Tech Concept Climawarm+	9	8.5	0.06360	≥0.24
	4	5.5	0.04440	≥0.17
	K 10	K 11.5	0.03016	≥0.12

5.4.2 Insulation Management Levels (with T-Range)

- To callout an Insulation Management Level with Temperature Range, the thermal resistance first needs to be determined according to chapter 5.4.1.

- Minimum Thermal Resistance Values to callout Insulation Management Levels LOW, MID, HIGH or ULTIMATE (with T-Range) can be found in Table 3. Also see the examples below Table 3 as reference.
- The Temperature Ranges are based on the calculation of the Cold Rating C which can be found in the reference document SATRA TMC 436-2010 (chapter 6.18).
- The calculation for the Temperature Ranges is based on a low to medium activity level resulting in a heat loss rate of 8 W (according to SATRA TMC 436-2010). The definition of Activity Levels according to Satra can be found in chapter 4.

Table 3: Minimum Thermal Resistance Values to achieve Insulation Management Level with Temperature Ranges.

Insulation Management Level	Min. Thermal Resistance R [m^2 K W^{-1}]			T-Range [°C]
	8.5 UK	5.5 UK	11.5 K UK	
BASIC	≥0.16	≥0.12	≥0.08	**Up to 0**
MID	≥0.24	≥0.17	≥0.12	**Up to -10**
HIGH	≥0.28	≥0.20	≥0.14	**Up to -15**
ULTIMATE	≥0.32	≥0.23	≥0.16	**Up to -20**

Example 1: Thermal Resistance R = 0.12 for UK 5.5
→ Only Insulation Management Level **LOW** can be assigned! This means you have a product with insulation for temperatures up to 0°C for a low-medium activity level.

Example 2: Thermal Resistance R = 0.26 for UK 8.5
→ Insulation Management Level **LOW or MID** can be assigned. This means you have a product with insulation for temperatures up to -10°C for a low-medium activity level.

6 Additional Information

In all cases, the instruction manual according to the manufacturer including calibration and maintenance must be followed to ensure safety and quality.

7 Appendix

- Thermal Insulation with T-Range

TF Insulation management - with T range.pptx

- Thermal Insulation without T-Range

TF Thermal insulation levels - without T range.pptx