

# DIN EN ISO 18640-1:2020-06 (E)

## Protective clothing for firefighters - Physiological impact - Part 1: Measurement of coupled heat and moisture transfer with the sweating torso (ISO 18640-1:2018 + Amd. 1:2019)

<b>Contents</b>		<b>Page</b>
European foreword .....		4
[A <sub>1</sub> ] European foreword to Amendment [A <sub>1</sub> ] .....		5
Foreword .....		6
[A <sub>1</sub> ] Foreword to Amendment [A <sub>1</sub> ] .....		7
Introduction .....		8
<b>1</b>	<b>Scope</b> .....	<b>9</b>
<b>2</b>	<b>Normative references</b> .....	<b>9</b>
<b>3</b>	<b>Terms and definitions</b> .....	<b>9</b>
<b>4</b>	<b>Symbols and abbreviations</b> .....	<b>12</b>
<b>5</b>	<b>Apparatus</b> .....	<b>12</b>
5.1	Sweating torso .....	13
5.1.1	General .....	13
5.1.2	Heated cylinder .....	14
5.1.3	Thermal guard sections .....	14
5.1.4	Heating and temperature control .....	14
5.1.5	Temperature measurement .....	14
5.1.6	Simulation of perspiration .....	14
5.1.7	Wicking layer .....	14
5.1.8	Balance torso weight .....	15
5.2	Computer, control system and data acquisition .....	15
5.2.1	General .....	15
5.2.2	Computer and measurement software .....	15
5.2.3	Control system .....	15
5.2.4	Data acquisition .....	15
5.2.5	Measurement control options .....	15
5.3	Climatic chamber .....	16
5.3.1	General .....	16
5.3.2	Climatic chamber sensors .....	16
5.4	Fan system .....	16
5.5	Sweat water supply .....	16
5.5.1	Gravimetric sweat water control system .....	17
5.6	Simulation of air layers .....	18
<b>6</b>	<b>Sampling and test specimens</b> .....	<b>19</b>
6.1	General .....	19
6.1.1	Size of samples .....	19
6.1.2	Type of test specimen .....	19
6.1.3	Garment/ensemble specification .....	19
6.2	Number of test specimens .....	19
<b>7</b>	<b>Specimen preparation</b> .....	<b>19</b>
7.1	Pre-treatment .....	20
7.2	Conditioning .....	20
<b>8</b>	<b>Measurement procedure</b> .....	<b>20</b>
8.1	Test preparation .....	20
8.1.1	Preparation of climatic chamber .....	20
8.1.2	Wind speed .....	20

8.2	Specimen testing .....	21
8.2.1	General.....	21
8.2.2	Dressing the torso.....	22
8.2.3	Recording specimen identification and test observations.....	22
8.2.4	Starting the test.....	22
8.2.5	Calculated values .....	23
<b>9</b>	<b>Test report.....</b>	<b>26</b>
9.1	General.....	26
9.2	Specimen identification.....	26
9.3	Experiment conditions.....	26
9.4	Calculated results.....	26
<b>10</b>	<b>Maintenance and calibration.....</b>	<b>27</b>
10.1	Maintenance.....	27
10.1.1	Sweat water tank.....	27
10.1.2	Valve checks .....	27
10.2	Calibration .....	27
10.2.1	General.....	27
10.2.2	Correction value for thermal resistance, $R_{ct0}$ (torso).....	27
10.2.3	Wicking layer .....	27
10.2.4	torso temperature sensors.....	28
10.2.5	torso heating power.....	28
10.2.6	torso sweat rate .....	28
10.2.7	Environmental conditions .....	28
10.3	Experiments with a standard fabric (optional) .....	28
<b>Annex A</b>	<b>(A1)(normative)(A1) torso size and materials definition.....</b>	<b>29</b>
<b>Annex B</b>	<b>(A1)(normative)(A1) Calibration.....</b>	<b>33</b>
<b>Annex C</b>	<b>(informative) Example of data evaluation .....</b>	<b>35</b>
<b>Annex D</b>	<b>(informative) Sample check list.....</b>	<b>39</b>
<b>Annex E</b>	<b>(informative) Validation of the measurement device.....</b>	<b>40</b>
<b>Annex F</b>	<b>(informative) Example Matlab code.....</b>	<b>41</b>
<b>Bibliography</b>	<b>.....</b>	<b>45</b>