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Hot environments — Analytical determination and interpretation of thermal stress using calculation of required sweat rate

Ambiances thermiques chaudes — Détermination analytique et interprétation de la contrainte thermique fondées sur le calcul de la sudation requise

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Contents

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council. They are approved in accordance with ISO procedures requiring at least 75 % approval by the member bodies voting.

International Standard ISO 7933 was prepared by Technical Committee ISO/TC 159, *Ergonomics.*

Annexes A, B, C and D of this International Standard are for information only.

Introduction

This International Standard is one of a series intended for use in the estimation of thermal stress in a hot environment.

The method of analytical estimation and interpretation of thermal stress allows the prediction of the physiological effects of work in the heat and the rational determination of actions to be taken to prevent or limit these effects. This method is recommended to be applied either directly to carry out a detailed analysis of hot working conditions, or as a complement to the method based on the WBGT-index (see ISO 7243) when the reference values for this index are exceeded.

For cases where thermal stress is very high, as detected by the method described in this International Standard, direct and individual observation of the exposed workers is necessary: the types of physiological measurements which are to be used will be described in a future standard.

Hot environments — Analytical determination and interpretation of thermal stress using calculation of required sweat rate

1 Scope

This International Standard specifies a method of analytical evaluation and interpretation of the thermal stress experienced by a subject in a hot environment. It describes a method of calculating the heat balance as well as the sweat rate that the human body should produce to maintain this balance in equilibrium: this sweat rate is called the "required sweat rate".

The various terms used in the determination of the required sweat rate show the influence of the different physical parameters of the environment on the thermal stress experienced by the subject. In this way, this International Standard makes it possible to determine which parameter or group of parameters should be modified, and to what extent, in order to reduce the risk of physiological strains.

The main objectives of this International Standard are

a) the evaluation of the thermal stress in conditions likely to lead to excessive core temperature increase or water loss for the standard subject;

b) the determination of the modifications to be brought to the work situation in order to reduce or exclude these effects;

c) the determination of the maximum allowable exposure times required to limit physiological strain to an acceptable value.

This International Standard does not predict the physiological response of individual subjects, but only considers standard subjects in good health and fit for the work they perform.

The method of computation and interpretation of thermal balance is based on the latest scientific information. Future improvements concerning the calculation of the different terms of the heat balance equation, or its interpretation, will be taken into account when they become available. In its present form, this method of assessment is not applicable to cases where special protective clothing is worn.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this International Standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this International Standard are encouraged to investigate the possibility of applying the most recent editions of the standards listed below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 7243 : 1989, *Hot environments — Estimation of the heat stress on working man, based on the* WBGT-*index (wet bulb globe temperature).*

ISO 7726 : 1985, *Thermal environments — Instruments and methods for measuring physical quantities.*

3 Principles of the method of evaluation

The method of evaluation and interpretation calculates the thermal balance of the body from

a) the typical parameters of the thermal environment:

- air temperature, t_a (in degrees Celsius);
- mean radiant temperature, $\bar{t}_r$ (in degrees Celsius);
- partial vapour pressure, p_a (in kilopascals);
- air velocity, v_a (in metres per second).

(These parameters are measured according to the specifications of ISO 7726.)

b) the mean characteristics of the subjects exposed to this working situation:

- metabolic heat production, M (in watts per square metre);
- clothing thermal insulation, I_{cl} (in square metres kelvins per watt).

Clause 4 describes the principles of the calculation of the different heat exchanges occurring in the thermal balance equation, as well as those of the sweat loss necessary for the maintenance of the thermal equilibrium of the body. The mathematical expressions for these calculations are shown in annex A.

Clause 5 describes the method of interpretation which leads to the determination of the predicted sweat rate and the maximum allowable exposure times and work-rest regimens to achieve the predicted sweat rate. This determination is based on two criteria: maximum body core temperature increase and maximum body water loss. Limit values for these criteria are shown in annex C.

The precision with which the predicted sweat rate and the exposure times are estimated is a function of the model (i.e. of the expressions proposed in annex A) and the limit values which are adopted. It is also a function of the accuracy of measurement of the physical parameters and of the precision with which the metabolic rate and the thermal insulation of the clothing are estimated.

4 Main steps of the calculation

4.1 General heat balance equation

The thermal balance equation of the body may be written as

$$M - W = C_{res} + E_{res} + K + C + R + K + S \qquad \ldots(1)$$

This equation expresses that the internal heat production of the body, which corresponds to the metabolic power (M) minus the effective mechanical power (W) is balanced by the heat exchanges in the respiratory tract by convection (C_{res}) and evaporation (E_{res}), as well as by the heat exchanges on the skin by conduction (K), convection (C), radiation (R), and evaporation (E), and by the eventual balance, heat storage (S), accumulating in the body. The different terms of this equation are successively reviewed in terms of the principles of calculation (detailed expressions are shown in annex A).

4.1.1 Metabolic power (M, in watts per square metre)

M is the metabolic power. Its estimation or measurement will be described in a future International Standard.

4.1.2 Effective mechanical power (W, in watts per square metre)

W is the effective mechanical power. In most industrial situations this is small and can be neglected.

4.1.3 Heat flow by respiratory convection (C_{res}, in watts per square metre)

The heat flow by respiratory evaporation may be expressed, in principle, by the relation

$$C_{res} = c_p \dot{V} (t_{ex} - t_a)/A_{Du} \qquad \ldots(2)$$

where

c_p is the specific heat of dry air at constant pressure, in joules per kilogram of dry air;

$\dot{V}$ is the respiratory ventilation rate, in kilograms of air per second;

t_{ex} is the expired air temperature, in degrees Celsius;

t_a is the air temperature, in degrees Celsius;

A_{Du} is the body surface, in square metres.

4.1.4 Heat flow by respiratory evaporation (E_{res}, in watts per square metre)

The heat flow by respiratory evaporation may be expressed, in principle, by the relation

$$E_{res} = c_e \dot{V} (W_{ex} - W_a)/A_{Du} \qquad \ldots(3)$$

where

c_e is the water evaporation latent heat, in joules per kilogram;

W_{ex} is the humidity ratio for the expired air, in kilograms of water per kilogram of dry air;

W_a is the humidity ratio for the inhaled air, in kilograms of water per kilogram of dry air;

$\dot{V}$ and A_{Du} are as defined in equation (2).

4.1.5 Heat flow by conduction (K, in watts per square metre)

In practice, the heat flow by thermal conduction through the body surfaces in contact with solid objects may be quantitatively assimilated into the heat losses by convection and radiation which would occur if these surfaces were not in contact with any solid body. In this way, the heat flow by conduction is not directly taken into account.

4.1.6 Heat flow by convection at the skin surface (C, in watts per square metre)

The heat flow by convection at the skin surface may be expressed by the equation

$$C = h_c \cdot F_{cl} (\bar{t}_{sk} - t_a) \qquad \ldots(4)$$

where

h_c is the convective heat transfer coefficient, in watts per square metre kelvin;

F_{cl} is the reduction factor for sensible heat exchange due to the wearing of clothes (dimensionless);

$\bar{t}_{sk}$ is the mean skin temperature, in degrees Celsius;

t_a is as defined in equation (2).

4.1.7 Heat flow by radiation at the surface of the skin (R, in watts per square metre)

The heat flow by radiation is a function of the skin characteristics, the clothing, the posture, the mean skin temperature, ($\bar{t}_{sk}$), and the mean radiant temperature of the environment, ($\bar{t}_r$).

This heat flow may be given by the equation

$$R = h_r F_{cl} (\bar{t}_{sk} - \bar{t}_r) \qquad \ldots(5)$$

where

h_r is the radiative heat transfer coefficient, in watts per square metre kelvin;

F_{cl} and $\bar{t}_{sk}$ are as defined in equation (4);

$\bar{t}_r$ is the mean radiant temperature, in degrees Celsius.

4.1.8 Heat flow by evaporation at the skin surface (E, in watts per square metre)

The maximum evaporation rate (E_{max}, in watts per square metre) is that which can be achieved in the hypothetical case of the skin being completely wetted. In these conditions

$$E_{max} = (p_{sk,s} - p_a)/R_T \qquad \ldots(6)$$

where

$p_{sk,s}$ is the saturated vapour pressure at the skin temperature, in kilopascals;

p_a is the partial water vapour pressure in the working environment, in kilopascals;

R_T is the total evaporative resistance of the limiting layer of air and clothing, in square metres kilopascals per watt.

In the case of a partially wetted skin, the evaporation rate, E, in watts per square metre, is given by

$$E = w E_{max} \qquad \ldots(7)$$

where

w is the skin wettedness defined as the equivalent fraction of the skin surface which can be considered as fully wetted;

E_{max} is as defined in equation (6).

4.1.9 Heat storage (S, in watts per square metre)

The heat storage of the body is given by the algebraic sum of the heat flows defined previously.

4.2 Calculation of the required evaporation rate, the required skin wettedness and the required sweat rate

Taking into account the hypotheses made concerning the heat flow by conduction, the general heat balance equation (1) can be written

$$E + S = M - W - C_{res} - E_{res} - C - R \qquad \ldots(8)$$

The required evaporation rate (E_{req}, in watts per square metre) defined as the evaporation rate required for the maintenance of the thermal equilibrium of the body and, therefore, for a heat storage equal to zero, is given by

$$E_{req} = M - W - C_{res} - E_{res} - C - R \qquad \ldots(9)$$

The required skin wettedness (w_{req}, dimensionless) is defined as the ratio between the required evaporation rate, E_{req}, and the maximal evaporation rate, E_{max}

$$w_{req} = E_{req}/E_{max} \qquad \ldots(10)$$

The calculation of the required sweat rate shall be made on the basis of the required evaporation rate but shall also take account of the fraction of sweat which, eventually, trickles away because of the large variations in local skin wettednesses.

The required sweat rate (SW_{req}, in watts per square metre), is given by

$$SW_{req} = E_{req}/r_{req} \qquad \ldots(11)$$

where

r_{req} is the evaporative efficiency of sweating (dimensionless), which corresponds to the required skin wettedness;

E_{req} is as defined in equation (9).

NOTE — The sweat rate in watts per square metre represents the equivalent in heat of the sweat rate expressed in grams of sweat per square metre of skin surface and per hour. 1 W/m^2 corresponds to a flow of 1,47 $g/(m^2 \cdot h)$ [for a standard subject (1,8 m^2 of body surface), a flow of 2,6 g/h].

5 Interpretation of required sweat rate

5.1 Basis of the method of interpretation

The interpretation of the values calculated by the recommended analytical method is based on two criteria of stress:

a) the maximum skin wettedness (w_{max});

b) the maximum sweat rate (SW_{max});

and on two limits of strain

a) the maximum heat storage (Q_{max}, in watt hours per square metre);

b) the maximum water loss (D_{max}, in grams).

The required sweat rate, SW_{req}, cannot exceed the maximum sweat rate, SW_{max}, achievable by the subject. The required skin wettedness, w_{req}, cannot exceed the maximum skin wettedness, w_{max}, achievable by the subject. These two maximum values are a function of the acclimatization of the subject.

In the case of non-equilibrium of the thermal balance, the heat storage, S, must be limited by a maximum value (Q_{max}) such that the resulting increase in body core temperature, Δt_{co} (in degrees Celsius), does not induce any pathological effect.

Finally, whatever the thermal balance, the water loss should be restricted to a value, D_{max}, compatible with the maintenance of the hydromineral equilibrium of the body.

Annex C includes reference values for the stress criteria (w_{max} and SW_{max}) and the strain criteria (Q_{max} and D_{max}). Different values are presented for acclimatized and non-acclimatized subjects, and according to the degree of protection which is desired (warning and danger levels).

5.2 Analysis of the work situation

The analysis of the work situation consists of determining the predicted values of skin wettedness, evaporation rate and sweat rate (w_p, E_p, SW_p), taking account of the required values (w_{req}, E_{req}, SW_{req}) and the limit values (w_{max}, SW_{max}).

When the required skin wettedness is lower than the maximum wettedness and the sweat loss lower than the maximum sweat loss, the body is in thermal equilibrium and the predicted values are

$$w_p = w_{req} \quad \text{...(12)}$$

$$E_p = E_{req} \quad \text{...(13)}$$

$$SW_p = SW_{req} \quad \text{...(14)}$$

When, on the contrary, the required skin wettedness exceeds the maximum wettedness

$$w_p = w_{max} \quad \text{...(15)}$$

and therefore

$$E_p = w_p E_{max} \quad \text{...(16)}$$

$$SW_p = E_p / r_p \quad \text{...(17)}$$

where r_p is the evaporative efficiency of sweating corresponding to w_p.

When the required sweat rate or the sweat rate predicted at the preceeding step exceeds the maximum sweat rate, it is necessary to determine the predicted wettedness w_p and the evaporative efficiency r_p such that

$$w_p E_{max} = SW_{max} r_p \quad \text{...(18)}$$

taking account of the relationship between w_p and r_p.

Therefore $E_p = w_p E_{max}$ ...(19)

and $SW_p = SW_{max}$ ...(20)

5.3 Determination of allowable exposure time (DLE, min)

The allowable exposure times can be determined as a function of the maximum values for body heat storage (Q_{max}) and water loss (D_{max}).

When $E_p = E_{req}$ ...(21)

and $SW_p < D_{max}/8$ ...(22)

no time limit has to be suggested for the 8 h work shift. In this case, SW_p can be used as a comparison index for the heat stress conditions.

If one or other of these two conditions is not satisfied, it is necessary to calculate an allowable exposure time, DLE.

If the required evaporation rate is not achieved, the difference ($E_{req} - E_p$) represents the heat storage rate which will be responsible for an increase in body core temperature. The exposure time limit (in minutes) can be determined by the expression

$$DLE_1 = 60\, Q_{max} / (E_{req} - E_p) \quad \text{...(23)}$$

When, on the other hand, the predicted sweat rate involves an exaggerated water loss, the exposure time needs to be limited at

$$DLE_2 = 60\, D_{max} / SW_p \quad \text{...(24)}$$

The shortest DLE shall be used for limiting the duration of work.

In work situations for which

— either the maximum evaporation rate, E_{max}, is negative, leading to condensation of water vapour on the skin;

— or the estimated allowable exposure time is less than 30 min, so that the phenomenon of sweating onset plays a major role in the estimation of the evaporation loss of the subject;

special precautionary measures need to be taken and direct and individual physiological surveillance of the workers is particularly necessary. The conditions for carrying out this surveillance and the measuring techniques to be used will be described in a future International Standard.

5.4 Organization of work in the heat

When DLE_2, for excessive water loss is the determining limit, no further exposure should be allowed during the day.

When DLE_1, for excessive core temperature increase is the determining factor, the worker should be allowed a rest period of such a duration that, for the combination of both work and rest sequences, there is no longer any risk of heat stress, when the interpretation is made as indicated hereunder. When the working situation includes different exposure conditions to heat, the methods of analysis and interpretation described in clauses 4 and 5 should be repeated for each sequence or combination of successive sequences of exposure (a sequence being defined as a work period for which the climatic parameters as well as the individual parameters remain approximately constant).

The interpretation of a combination of successive sequences shall be made using the mean values, weighted according to time, of the E_{req} and E_{max} values for each of these sequences.

A computer program in BASIC (see annex D) uses the mathematical expressions shown in annex A as well as the criteria and limit values discussed in annex C. It allows for the calculation of the predicted sweat rate and of the DLE for any sequence or combination of sequences where the metabolic power, the clothing thermal insulation and climatic parameters are known.

Annex A
(informative)

Data necessary for the calculation of thermal balance

The numerical values and the equations given in this annex conform to the present state of knowledge. Some of them are likely to be amended in the light of increased knowledge.

A.1 Determination of the heat flow by respiratory convection, C_{res}, in watts per square metre

The heat flow by respiratory convection can be estimated from the metabolic power M by

$$C_{res} = 0{,}001\,4\,M\,(t_{ex} - t_a) \quad \ldots(A.1)$$

The expired air temperature (t_{ex}) slightly varies with the temperature and the humidity of the inhaled air. In practice, as the heat flow by respiratory convection is small compared to other factors, it is accurate enough to adopt, in hot environments, a constant value of 35 °C, equal to that observed for an ambient air temperature of 35 °C.

A.2 Determination of the heat flow by respiratory evaporation, E_{res}, in watts per square metre

The heat flow by respiratory evaporation can be estimated by

$$E_{res} = 0{,}017\,3\,M\,(p_{ex} - p_a) \quad \ldots(A.2)$$

where the saturated water vapour pressure of the expired air, p_{ex}, is equal to 5,624 kPa for the temperature t_{ex} of 35 °C.

A.3 Determination of the convective heat transfer coefficient, h_c, in watts per square metre kelvin

For a standing subject, this coefficient can be estimated as follows:

a) in natural convection, by

$$h_c = 2{,}38\,|\bar{t}_{sk} - t_a|^{0{,}25} \quad \ldots(A.3)$$

b) in forced convection, by

$$h_c = 3{,}5 + 5{,}2\,v_{ar} \qquad (v_{ar} < 1\ \text{m/s}) \quad \ldots(A.4)$$

$$h_c = 8{,}7\,v_{ar}^{0{,}6} \qquad (v_{ar} \geqslant 1\ \text{m/s}) \quad \ldots(A.5)$$

where v_{ar} is the relative air velocity, in metres per second.

The relative air velocity is the resultant of the air velocity relative to the ground and the speed of the body or parts of the body relative to the ground. In the case of a subject doing muscular work, it can be calculated to a first approximation from

$$v_{ar} = v_a + 0{,}005\,2\,(M - 58) \quad \ldots(A.6)$$

where

v_a is the air velocity with respect to a stationary subject, in metres per second;

M is the metabolic power, in watts per square metre.

It is recommended, however, to restrict the increase in air velocity due to work to a value of 0,7 m/s.

In every case it is recommended that the coefficients of natural and forced convection are calculated, and to consider the highest of the two as determining the heat exchanges by convection.

A.4 Determination of the radiative heat transfer coefficient, h_r, in watts per square metre kelvin

The radiative heat transfer coefficient can be estimated as follows:

$$h_r = \sigma\,\varepsilon_{sk}\,A_r/A_{Du}\left[(\bar{t}_{sk} + 273)^4 - (\bar{t}_r + 273)^4\right]/(\bar{t}_{sk} - \bar{t}_r) \quad \ldots(A.7)$$

where

σ is the Stefan-Boltzman constant, equal to $5{,}67 \times 10^{-8}\ \text{W/(m}^2\cdot\text{K}^4)$;

ε_{sk} is the skin emissivity (0,97);

A_r/A_{Du} is the fraction of skin surface involved in heat exchange by radiation. This fraction is equal to 0,67 for a crouching subject, 0,70 for a seated subject, and 0,77 for a standing subject.

$\bar{t}_{sk}$ is as defined in equation (4);

$\bar{t}_r$ is as defined in equation (5), often, in practice, determined from the globe temperature, t_g, following the specifications in ISO 7726.

A.5 Determination of the reduction factor for sensible heat exchanges

The reduction factor for sensible heat exchanges (F_{cl}) can be determined, in the case of cotton clothing, from

$$F_{cl} = 1/[(h_c + h_r)\,I_{cl} + 1/f_{cl}] \quad \ldots(A.8)$$

where

h_c and h_r are the convective and radiative heat transfer coefficients defined in clause A.3 and clause A.4;

I_{cl} is the thermal insulation of the clothing in square metres kelvins per watt, for which values are presented in annex B. A more complete and precise method will be described in a future International Standard;

f_{cl} is the ratio of the subject's clothed to unclothed surface areas (dimensionless) and is given by

$$f_{cl} = 1 + 1{,}97\, I_{cl} \qquad \ldots\text{(A.9)}$$

A.6 Determination of the evaporative resistance, R_T, in square metres kilopascals per watt

The evaporative resistance can be calculated on the basis of the permeability index of the clothing i_m. The method and some data will be presented in a future International Standard.

In the case of light and porous clothing, however, R_T may be estimated from

$$R_T = 1/(h_e \cdot F_{pcl}) \qquad \ldots\text{(A.10)}$$

where

h_e is the evaporative heat transfer coefficient, in watts per square metre kilopascals, and is given by

$$h_e = 16{,}7\, h_c \qquad \ldots\text{(A.11)}$$

h_c is the convective heat transfer coefficient defined in clause A.3;

F_{pcl} is the reduction factor for latent heat exchanges, which can be calculated by

$$F_{pcl} = 1/[1 + 2{,}22\, h_c (I_{cl} - (1 - 1/f_{cl})/(h_c + h_r))] \qquad \ldots\text{(A.12)}$$

where I_{cl} and f_{cl} are as defined in clause A.5.

A.7 Determination of evaporative efficiency of sweating, r (dimensionless)

The evaporative efficiency of sweating, r, can be derived from skin wettedness, w, by the following expression:

$$r = 1 - w^2/2 \qquad \ldots\text{(A.13)}$$

A.8 Determination of operative temperature, t_o, in degrees Celsius

The operative temperature (t_o) is given by

$$t_o = (h_c \cdot t_a + h_r \cdot \overline{t_r})/(h_c + h_r) \qquad \ldots\text{(A.14)}$$

where

h_c is as defined in clause A.3;

t_a is as defined in equation (2);

h_r is as defined in clause A.4;

$\overline{t_r}$ is as defined in equation (5).

Annex B
(informative)

Estimation of thermal insulation of clothing ensembles

The clothing thermal insulation (I_{cl}) can be estimated directly from the data presented in table B.1 for typical combinations of garments, or indirectly, by summation of the partial insulation values for each item of clothing (table B.2).

Table B.1 — Thermal insulation for typical combinations of garments

Work clothing	I_{cl}		Daily wear clothing	I_{cl}	
	clo	$m^2 \cdot K/W$		clo	$m^2 \cdot K/W$
Underpants, boiler suit, socks, shoes	0,70	0,110	Panties, T-shirt, shorts, light socks, sandals	0,30	0,050
Underpants, shirt, trousers, socks, shoes	0,75	0,115	Panties, petticoat, stockings, light dress with sleeves, sandals	0,45	0,070
Underpants, shirt, boiler suit, socks, shoes	0,80	0,125	Underpants, shirt with short sleeves, light trousers, light socks, shoes	0,50	0,80
Underpants, shirt, trousers, jacket, socks, shoes	0,85	0,135	Panties, stockings, shirt with short sleeves, skirt, sandals	0,55	0,085
Underpants, shirt, trousers, smock, socks, shoes	0,90	0,140	Underpants, shirt, light-weight trousers, socks, shoes	0,60	0,095
Underwear with short sleeves and legs, shirt, trousers, jacket, socks, shoes	1,00	0,155	Panties, petticoat, stockings, dress, shoes	0,70	0,105
Underwear with short legs and sleeves, shirt, trousers, boiler suit, socks, shoes	1,10	0,170	Underwear, shirt, trousers, socks, shoes	0,70	0,110
Underwear with long legs and sleeves, thermo-jacket, socks, shoes	1,20	0,185	Underwear, track suit (sweater and trousers), long socks, runners	0,75	0,115
Underwear with short sleeves and legs, shirt, trousers, jacket, thermojacket, socks, shoes	1,25	0,190	Panties, petticoat, shirt, skirt, thick knee-socks, shoes	0,80	0,120
Underwear with short sleeves and legs, boiler suit, thermojacket and trousers, socks, shoes	1,40	0,220	Panties, shirt, skirt, roundneck sweater, thick knee-socks, shoes	0,90	0,140
Underwear with short sleeves and legs, shirt, trousers, jacket, thermojacket and trousers, socks, shoes	1,55	0,225	Underpants, singlet with short sleeves, shirt, trousers, V-neck sweater, socks, shoes	0,95	0,145
Underwear with short sleeves and legs, shirt, trousers, jacket, heavy quilted outer jacket and overalls, socks, shoes	1,85	0,285	Panties, shirt, trousers, jacket, socks, shoes	1,00	0,155
Underwear with short sleeves and legs, shirt, trousers, jacket, heavy quilted outer jacket and overalls, socks, shoes, cap, gloves	2,00	0,310	Panties, stockings, shirt, skirt, vest, jacket	1,00	0,155
Underwear with long sleeves and legs, thermo-jacket and trousers, outer thermojacket and trousers, socks, shoes	2,20	0,340	Panties, stockings, blouse, long skirt, jacket, shoes	1,10	0,170
Underwear with long sleeves and legs, thermo-jacket and trousers, Parka with heavy quilting, overalls with heavy quilting, socks, shoes, cap, gloves	2,55	0,395	Underwear, singlet with short sleeves, shirt, trousers, jacket, socks, shoes	1,10	1,170
			Underwear, singlet with short sleeves, shirt, trousers, vest, jacket, socks, shoes	1,15	0,180
			Underwear with long sleeves and legs, shirt, trousers, V-neck sweater, jacket, socks, shoes	1,30	0,200
			Underwear with short sleeves and legs, shirt, trousers, vest, jacket, coat, socks, shoes	1,50	0,230