



Date: 21 Nov 07

## EAGOSH Recommendation No 9

### Operations in extreme temperatures

This recommendation shall provide guidance to EAGOSH members regarding the issue of operations in extreme temperatures. It reflects EAGOSH's co-ordinated opinion on this matter.

#### 1. Policy.

Certain atmospheric circumstances pose a danger to human beings that have to perform work at their workplace or are occupied outside a building. This concerns cases of extreme heat as well as cases of extreme cold. In order to prevent health problems, for safely planning and conducting work activities and ultimately for ensuring safe operations, it is important that personnel are protected from such circumstances.

#### 2. Definitions.

a. Acclimatization is the human body's adaptation to changes in climatic factors (namely temperature and humidity). Acclimatization is a slow physiological process taking weeks to months; its determination will always require competent medical confirmation. Note that the human body cannot adapt to extremely cold temperatures.

b. Ambient Temperature is the temperature of the air measured in the shade using a thermometer, without regard to the effects of humidity or the radiant heat of the sun.

c. Apparent Temperature (AT) is an adjustment to the ambient temperature based on relative humidity and wind-speed as per reference A. It is used as a reference temperature for determining the combined physiological effects of ambient temperature, relative humidity and wind-speed on the human body both for low and high temperatures.

(1). An algorithm for calculating the AT from the commonly available meteorological parameters ambient temperature, relative humidity and wind-speed is detailed by reference B.

(2). An estimation of the AT is given at Annexes A and B.

d. Cold Stress is a medical condition in which, as a result of exposure to cold, chilblain, immersion foot, frost nip, frostbites of the extremities and/or hypothermia (i.e. a drop of the human body's core temperature to below 35°C) occurs. See Annex F for symptoms and first aid measures.

e. Heat Stress is a medical condition in which, as a result of a high net heat load on the body, and dehydration coupled with loss of body electrolytes, heat cramps, heat exhaustion, and/or heat stroke occurs. See Annex E for symptoms and first aid measures. See Annex E for symptoms and first aid measures.

f. Net Heat Load on the body results from the combined contributions of metabolic heat production and external environmental factors, which include ambient temperature and humidity, radiant heat exchange, and air movement, as these are affected by clothing.

g. Danger Zones for Heat and Cold Stress are defined using the Apparent Temperature Index (ATI) as follows:

| Danger zones           | Apparent Temperature (AT) [°C] |
|------------------------|--------------------------------|
| <b>EXTREME DANGER</b>  | <b>&gt;54</b>                  |
| <b>DANGER</b>          | <b>41 to 54</b>                |
| <b>EXTREME CAUTION</b> | <b>32 to 41</b>                |
| <b>CAUTION</b>         | <b>27 to 32</b>                |
| <b>SAFE</b>            | <b>-7 to 27</b>                |
| <b>CAUTION</b>         | <b>-7 to -15</b>               |
| <b>EXTREME CAUTION</b> | <b>-15 to -25</b>              |
| <b>DANGER</b>          | <b>-25 to -48</b>              |
| <b>EXTREME DANGER</b>  | <b>&lt;-48</b>                 |

Note: The temperature given in this table are Apparent Temperatures; they shall not be confused with ambient temperatures typically measured with merely a thermometer.

### 3. Procedures.

EAGSOH members are encouraged to implement company-specific policy on works in extreme temperatures as follows:

- establishing specific rest cycles;
- providing for sufficient supplies of cold or warm beverages (minimum requirement: cold or hot drinking water);
- instructing the adjustment of work clothing to suit the ambient conditions of the workplace; and/or
- re-scheduling in particular heavy work to times of the day with lower expected heat/cold stress as per Annexes C and D.

|                |  |            |
|----------------|--|------------|
| <b>Annex A</b> | <b>Apparent temperature index for heat .....</b>   | <b>A-1</b> |
| <b>Annex B</b> | <b>Apparent temperature index for cold .....</b>   | <b>B-1</b> |
| <b>Annex C</b> | <b>Heat stress guidelines for average unacclimatized staff member<br/>wearing climate-adjusted work clothing .....</b> | <b>C-1</b> |
| <b>Annex D</b> | <b>Cold stress guidelines for average staff member wearing<br/>climate-adjusted work clothing .....</b>                | <b>D-1</b> |
| <b>Annex E</b> | <b>Symptoms and first aid measures for heat stress .....</b>   | <b>E-1</b> |
| <b>Annex F</b> | <b>Symptoms and first aid measures for cold stress .....</b>   | <b>F-1</b> |

## References:

- A. International Labour Office (ILO), Encyclopaedia of Occupational Health and Safety, 4th edition, ISBN 92-2-109203-8 [www.ilo.int](http://www.ilo.int)
- B. Robert G. Steadman, 1984: A Universal Scale of Apparent Temperature, Journal of Applied Meteorology, Vol. 23, No. 12, pp. 1674

## Contact points:

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ANNEX A

APPARENT TEMPERATURE (AT) INDICES FOR HEAT

1. Estimation of AT as a Function of Relative Humidity and Ambient Temperature at a Wind Speed of ≤ 1 kts

|                                      |     | Ambient Temperature T[°C] |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |
|--------------------------------------|-----|---------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|--|--|--|
| Relative Humidity R <sub>H</sub> [%] |     | 20                        | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |  |  |  |  |
|                                      | 0   | 16                        | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 |  |  |  |  |
|                                      | 5   | 16                        | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 47 | 48 |  |  |  |  |
|                                      | 10  | 16                        | 17 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 43 | 44 | 45 | 46 | 47 | 48 | 50 |  |  |  |  |
|                                      | 15  | 17                        | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 35 | 36 | 37 | 38 | 39 | 40 | 42 | 43 | 44 | 45 | 47 | 48 | 49 | 50 | 52 |  |  |  |  |
|                                      | 20  | 17                        | 18 | 19 | 20 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 | 31 | 32 | 33 | 34 | 36 | 37 | 38 | 39 | 40 | 42 | 43 | 44 | 46 | 47 | 48 | 50 | 51 | 52 | 54 |  |  |  |  |
|                                      | 25  | 18                        | 19 | 20 | 21 | 22 | 23 | 24 | 26 | 27 | 28 | 29 | 30 | 32 | 33 | 34 | 35 | 37 | 38 | 39 | 40 | 42 | 43 | 44 | 46 | 47 | 49 | 50 | 51 | 53 | 54 | 56 |  |  |  |  |
|                                      | 30  | 18                        | 19 | 20 | 21 | 23 | 24 | 25 | 26 | 27 | 29 | 30 | 31 | 32 | 34 | 35 | 36 | 37 | 39 | 40 | 42 | 43 | 44 | 46 | 47 | 49 | 50 | 52 | 53 | 55 | 56 | 58 |  |  |  |  |
|                                      | 35  | 18                        | 20 | 21 | 22 | 23 | 24 | 26 | 27 | 28 | 29 | 31 | 32 | 33 | 34 | 36 | 37 | 38 | 40 | 41 | 43 | 44 | 46 | 47 | 49 | 50 | 52 | 53 | 55 | 56 | 58 | 60 |  |  |  |  |
|                                      | 40  | 19                        | 20 | 21 | 22 | 24 | 25 | 26 | 27 | 29 | 30 | 31 | 33 | 34 | 35 | 37 | 38 | 39 | 41 | 42 | 44 | 45 | 47 | 48 | 50 | 52 | 53 | 55 | 57 | 58 | 60 | 62 |  |  |  |  |
|                                      | 45  | 19                        | 20 | 22 | 23 | 24 | 25 | 27 | 28 | 29 | 31 | 32 | 33 | 35 | 36 | 38 | 39 | 40 | 42 | 43 | 45 | 47 | 48 | 50 | 51 | 53 | 55 | 57 | 58 | 60 | 62 | 64 |  |  |  |  |
|                                      | 50  | 19                        | 21 | 22 | 23 | 25 | 26 | 27 | 29 | 30 | 31 | 33 | 34 | 35 | 37 | 38 | 40 | 41 | 43 | 45 | 46 | 48 | 49 | 51 | 53 | 55 | 56 | 58 | 60 | 62 | 64 | 66 |  |  |  |  |
|                                      | 55  | 20                        | 21 | 22 | 24 | 25 | 26 | 28 | 29 | 30 | 32 | 33 | 35 | 36 | 38 | 39 | 41 | 42 | 44 | 46 | 47 | 49 | 51 | 52 | 54 | 56 | 58 | 60 | 62 | 64 | 66 | 68 |  |  |  |  |
|                                      | 60  | 20                        | 22 | 23 | 24 | 26 | 27 | 28 | 30 | 31 | 33 | 34 | 36 | 37 | 39 | 40 | 42 | 43 | 45 | 47 | 48 | 50 | 52 | 54 | 56 | 58 | 60 | 62 | 64 | 66 | 68 | 70 |  |  |  |  |
|                                      | 65  | 21                        | 22 | 23 | 25 | 26 | 27 | 29 | 30 | 32 | 33 | 35 | 36 | 38 | 39 | 41 | 43 | 44 | 46 | 48 | 50 | 51 | 53 | 55 | 57 | 59 | 61 | 63 | 65 | 67 | 70 | 72 |  |  |  |  |
|                                      | 70  | 21                        | 22 | 24 | 25 | 27 | 28 | 29 | 31 | 32 | 34 | 35 | 37 | 39 | 40 | 42 | 44 | 45 | 47 | 49 | 51 | 53 | 55 | 56 | 59 | 61 | 63 | 65 | 67 | 69 | 72 | 74 |  |  |  |  |
|                                      | 75  | 21                        | 23 | 24 | 26 | 27 | 28 | 30 | 31 | 33 | 35 | 36 | 38 | 39 | 41 | 43 | 45 | 46 | 48 | 50 | 52 | 54 | 56 | 58 | 60 | 62 | 64 | 66 | 69 | 71 | 74 | 76 |  |  |  |  |
|                                      | 80  | 22                        | 23 | 25 | 26 | 27 | 29 | 30 | 32 | 34 | 35 | 37 | 38 | 40 | 42 | 44 | 45 | 47 | 49 | 51 | 53 | 55 | 57 | 59 | 61 | 64 | 66 | 68 | 71 | 73 | 75 | 78 |  |  |  |  |
|                                      | 85  | 22                        | 24 | 25 | 26 | 28 | 29 | 31 | 33 | 34 | 36 | 38 | 39 | 41 | 43 | 45 | 46 | 48 | 50 | 52 | 54 | 56 | 58 | 61 | 63 | 65 | 67 | 70 | 72 | 75 | 77 | 80 |  |  |  |  |
|                                      | 90  | 23                        | 24 | 25 | 27 | 28 | 30 | 32 | 33 | 35 | 36 | 38 | 40 | 42 | 44 | 45 | 47 | 49 | 51 | 53 | 55 | 57 | 60 | 62 | 64 | 67 | 69 | 71 | 74 | 77 | 79 | 82 |  |  |  |  |
|                                      | 95  | 23                        | 24 | 26 | 27 | 29 | 31 | 32 | 34 | 35 | 37 | 39 | 41 | 42 | 44 | 46 | 48 | 50 | 52 | 54 | 56 | 59 | 61 | 63 | 66 | 68 | 71 | 73 | 76 | 78 | 81 | 84 |  |  |  |  |
|                                      | 100 | 23                        | 25 | 26 | 28 | 29 | 31 | 33 | 34 | 36 | 38 | 40 | 41 | 43 | 45 | 47 | 49 | 51 | 53 | 55 | 58 | 60 | 62 | 65 | 67 | 70 | 72 | 75 | 78 | 80 | 83 | 86 |  |  |  |  |

2. Estimation of AT as a Function of Relative Humidity and Ambient Temperature at a **Wind Speed of 5 kts**

|                                      |     | Ambient Temperature T[°C] |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |
|--------------------------------------|-----|---------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|--|
| Relative Humidity R <sub>H</sub> [%] |     | 20                        | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |  |  |
|                                      | 0   | 14                        | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 |  |  |
|                                      | 5   | 15                        | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 |  |  |
|                                      | 10  | 15                        | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 37 | 38 | 39 | 40 | 41 | 42 | 44 | 45 | 46 | 47 | 48 |  |  |
|                                      | 15  | 15                        | 16 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 37 | 38 | 39 | 40 | 41 | 43 | 44 | 45 | 46 | 48 | 49 | 50 |  |  |
|                                      | 20  | 16                        | 17 | 18 | 19 | 20 | 21 | 22 | 24 | 25 | 26 | 27 | 28 | 29 | 31 | 32 | 33 | 34 | 35 | 37 | 38 | 39 | 40 | 42 | 43 | 44 | 45 | 47 | 48 | 50 | 51 | 52 |  |  |
|                                      | 25  | 16                        | 17 | 18 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 28 | 29 | 30 | 31 | 33 | 34 | 35 | 36 | 38 | 39 | 40 | 42 | 43 | 44 | 46 | 47 | 48 | 50 | 51 | 53 | 54 |  |  |
|                                      | 30  | 17                        | 18 | 19 | 20 | 21 | 22 | 24 | 25 | 26 | 27 | 28 | 30 | 31 | 32 | 33 | 35 | 36 | 37 | 39 | 40 | 41 | 43 | 44 | 46 | 47 | 49 | 50 | 52 | 53 | 55 | 56 |  |  |
|                                      | 35  | 17                        | 18 | 19 | 20 | 22 | 23 | 24 | 25 | 27 | 28 | 29 | 30 | 32 | 33 | 34 | 36 | 37 | 38 | 40 | 41 | 43 | 44 | 46 | 47 | 49 | 50 | 52 | 53 | 55 | 57 | 58 |  |  |
|                                      | 40  | 17                        | 18 | 20 | 21 | 22 | 23 | 25 | 26 | 27 | 28 | 30 | 31 | 32 | 34 | 35 | 37 | 38 | 39 | 41 | 42 | 44 | 45 | 47 | 49 | 50 | 52 | 53 | 55 | 57 | 59 | 60 |  |  |
|                                      | 45  | 18                        | 19 | 20 | 21 | 23 | 24 | 25 | 26 | 28 | 29 | 30 | 32 | 33 | 35 | 36 | 38 | 39 | 40 | 42 | 44 | 45 | 47 | 48 | 50 | 52 | 53 | 55 | 57 | 59 | 61 | 62 |  |  |
|                                      | 50  | 18                        | 19 | 21 | 22 | 23 | 24 | 26 | 27 | 28 | 30 | 31 | 33 | 34 | 35 | 37 | 38 | 40 | 42 | 43 | 45 | 46 | 48 | 50 | 51 | 53 | 55 | 57 | 59 | 61 | 62 | 64 |  |  |
|                                      | 55  | 18                        | 20 | 21 | 22 | 24 | 25 | 26 | 28 | 29 | 30 | 32 | 33 | 35 | 36 | 38 | 39 | 41 | 43 | 44 | 46 | 48 | 49 | 51 | 53 | 55 | 57 | 58 | 60 | 62 | 64 | 66 |  |  |
|                                      | 60  | 19                        | 20 | 21 | 23 | 24 | 25 | 27 | 28 | 30 | 31 | 33 | 34 | 36 | 37 | 39 | 40 | 42 | 44 | 45 | 47 | 49 | 51 | 52 | 54 | 56 | 58 | 60 | 62 | 64 | 66 | 69 |  |  |
|                                      | 65  | 19                        | 21 | 22 | 23 | 25 | 26 | 27 | 29 | 30 | 32 | 33 | 35 | 36 | 38 | 40 | 41 | 43 | 45 | 46 | 48 | 50 | 52 | 54 | 56 | 58 | 60 | 62 | 64 | 66 | 68 | 71 |  |  |
|                                      | 70  | 20                        | 21 | 22 | 24 | 25 | 26 | 28 | 29 | 31 | 32 | 34 | 36 | 37 | 39 | 40 | 42 | 44 | 46 | 47 | 49 | 51 | 53 | 55 | 57 | 59 | 61 | 63 | 66 | 68 | 70 | 73 |  |  |
|                                      | 75  | 20                        | 21 | 23 | 24 | 26 | 27 | 28 | 30 | 32 | 33 | 35 | 36 | 38 | 40 | 41 | 43 | 45 | 47 | 49 | 50 | 52 | 54 | 56 | 58 | 61 | 63 | 65 | 67 | 70 | 72 | 75 |  |  |
|                                      | 80  | 20                        | 22 | 23 | 25 | 26 | 28 | 29 | 31 | 32 | 34 | 35 | 37 | 39 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | 54 | 56 | 58 | 60 | 62 | 64 | 67 | 69 | 72 | 74 | 77 |  |  |
|                                      | 85  | 21                        | 22 | 24 | 25 | 27 | 28 | 30 | 31 | 33 | 34 | 36 | 38 | 39 | 41 | 43 | 45 | 47 | 49 | 51 | 53 | 55 | 57 | 59 | 61 | 64 | 66 | 68 | 71 | 73 | 76 | 79 |  |  |
|                                      | 90  | 21                        | 23 | 24 | 26 | 27 | 29 | 30 | 32 | 33 | 35 | 37 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | 54 | 56 | 58 | 60 | 63 | 65 | 68 | 70 | 73 | 75 | 78 | 81 |  |  |
|                                      | 95  | 22                        | 23 | 24 | 26 | 28 | 29 | 31 | 32 | 34 | 36 | 37 | 39 | 41 | 43 | 45 | 47 | 49 | 51 | 53 | 55 | 57 | 59 | 62 | 64 | 67 | 69 | 72 | 74 | 77 | 80 | 83 |  |  |
|                                      | 100 | 22                        | 23 | 25 | 26 | 28 | 30 | 31 | 33 | 35 | 36 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | 54 | 56 | 58 | 61 | 63 | 66 | 68 | 71 | 73 | 76 | 79 | 82 | 85 |  |  |

3. Estimation of AT as a Function of Relative Humidity and Ambient Temperature at a Wind Speed of 15 kts

|                                      |     | Ambient Temperature T [°C] |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |
|--------------------------------------|-----|----------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|
|                                      |     | 20                         | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |  |
| Relative Humidity R <sub>H</sub> [%] | 0   | 11                         | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 |  |
|                                      | 5   | 11                         | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 42 | 43 |  |
|                                      | 10  | 11                         | 12 | 13 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 38 | 39 | 40 | 41 | 42 | 43 | 45 |  |
|                                      | 15  | 12                         | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 30 | 31 | 32 | 33 | 34 | 35 | 37 | 38 | 39 | 40 | 42 | 43 | 44 | 45 | 47 |  |
|                                      | 20  | 12                         | 13 | 14 | 15 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 25 | 26 | 27 | 28 | 29 | 30 | 32 | 33 | 34 | 35 | 37 | 38 | 39 | 41 | 42 | 43 | 45 | 46 | 47 | 49 |  |
|                                      | 25  | 13                         | 14 | 15 | 16 | 17 | 18 | 19 | 21 | 22 | 23 | 24 | 25 | 26 | 28 | 29 | 30 | 31 | 33 | 34 | 35 | 37 | 38 | 39 | 41 | 42 | 43 | 45 | 46 | 48 | 49 | 51 |  |
|                                      | 30  | 13                         | 14 | 15 | 16 | 18 | 19 | 20 | 21 | 22 | 24 | 25 | 26 | 27 | 29 | 30 | 31 | 32 | 34 | 35 | 36 | 38 | 39 | 41 | 42 | 44 | 45 | 47 | 48 | 50 | 51 | 53 |  |
|                                      | 35  | 13                         | 14 | 16 | 17 | 18 | 19 | 20 | 22 | 23 | 24 | 25 | 27 | 28 | 29 | 31 | 32 | 33 | 35 | 36 | 38 | 39 | 41 | 42 | 44 | 45 | 47 | 48 | 50 | 51 | 53 | 55 |  |
|                                      | 40  | 14                         | 15 | 16 | 17 | 19 | 20 | 21 | 22 | 24 | 25 | 26 | 27 | 29 | 30 | 32 | 33 | 34 | 36 | 37 | 39 | 40 | 42 | 43 | 45 | 47 | 48 | 50 | 52 | 53 | 55 | 57 |  |
|                                      | 45  | 14                         | 15 | 17 | 18 | 19 | 20 | 22 | 23 | 24 | 26 | 27 | 28 | 30 | 31 | 32 | 34 | 35 | 37 | 38 | 40 | 41 | 43 | 45 | 46 | 48 | 50 | 51 | 53 | 55 | 57 | 59 |  |
|                                      | 50  | 14                         | 16 | 17 | 18 | 19 | 21 | 22 | 23 | 25 | 26 | 28 | 29 | 30 | 32 | 33 | 35 | 36 | 38 | 39 | 41 | 43 | 44 | 46 | 48 | 50 | 51 | 53 | 55 | 57 | 59 | 61 |  |
|                                      | 55  | 15                         | 16 | 17 | 19 | 20 | 21 | 23 | 24 | 25 | 27 | 28 | 30 | 31 | 33 | 34 | 36 | 37 | 39 | 41 | 42 | 44 | 46 | 47 | 49 | 51 | 53 | 55 | 57 | 59 | 61 | 63 |  |
|                                      | 60  | 15                         | 16 | 18 | 19 | 20 | 22 | 23 | 25 | 26 | 27 | 29 | 30 | 32 | 34 | 35 | 37 | 38 | 40 | 42 | 43 | 45 | 47 | 49 | 51 | 53 | 54 | 56 | 59 | 61 | 63 | 65 |  |
|                                      | 65  | 16                         | 17 | 18 | 20 | 21 | 22 | 24 | 25 | 27 | 28 | 30 | 31 | 33 | 34 | 36 | 38 | 39 | 41 | 43 | 45 | 46 | 48 | 50 | 52 | 54 | 56 | 58 | 60 | 62 | 65 | 67 |  |
|                                      | 70  | 16                         | 17 | 19 | 20 | 21 | 23 | 24 | 26 | 27 | 29 | 30 | 32 | 34 | 35 | 37 | 39 | 40 | 42 | 44 | 46 | 48 | 49 | 51 | 53 | 56 | 58 | 60 | 62 | 64 | 67 | 69 |  |
|                                      | 75  | 16                         | 18 | 19 | 21 | 22 | 23 | 25 | 26 | 28 | 29 | 31 | 33 | 34 | 36 | 38 | 39 | 41 | 43 | 45 | 47 | 49 | 51 | 53 | 55 | 57 | 59 | 61 | 64 | 66 | 69 | 71 |  |
|                                      | 80  | 17                         | 18 | 20 | 21 | 22 | 24 | 25 | 27 | 29 | 30 | 32 | 33 | 35 | 37 | 39 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | 54 | 56 | 59 | 61 | 63 | 65 | 68 | 70 | 73 |  |
|                                      | 85  | 17                         | 19 | 20 | 21 | 23 | 24 | 26 | 28 | 29 | 31 | 32 | 34 | 36 | 38 | 39 | 41 | 43 | 45 | 47 | 49 | 51 | 53 | 55 | 58 | 60 | 62 | 65 | 67 | 70 | 72 | 75 |  |
|                                      | 90  | 18                         | 19 | 20 | 22 | 23 | 25 | 27 | 28 | 30 | 31 | 33 | 35 | 37 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | 55 | 57 | 59 | 61 | 64 | 66 | 69 | 72 | 74 | 77 |  |
|                                      | 95  | 18                         | 19 | 21 | 22 | 24 | 25 | 27 | 29 | 30 | 32 | 34 | 36 | 37 | 39 | 41 | 43 | 45 | 47 | 49 | 51 | 54 | 56 | 58 | 61 | 63 | 65 | 68 | 71 | 73 | 76 | 79 |  |
|                                      | 100 | 18                         | 20 | 21 | 23 | 24 | 26 | 28 | 29 | 31 | 33 | 35 | 36 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 53 | 55 | 57 | 60 | 62 | 64 | 67 | 70 | 72 | 75 | 78 | 81 |  |

4. Estimation of AT as a Function of Relative Humidity and Ambient Temperature at a Wind Speed of 25 kts

|                                      |    | Ambient Temperature T [°C] |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |  |  |  |  |  |  |
|--------------------------------------|----|----------------------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|--|--|--|--|--|--|
|                                      |    | 20                         | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 | 46 | 47 | 48 | 49 | 50 |  |  |  |  |  |  |
| Relative Humidity R <sub>H</sub> [%] | 0  | 7                          | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 33 | 34 | 35 | 36 | 37 |  |  |  |  |  |  |
|                                      | 5  | 7                          | 8  | 9  | 10 | 11 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 | 34 | 35 | 36 | 37 | 38 | 39 |  |  |  |  |  |  |
|                                      | 10 | 8                          | 9  | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 39 | 40 | 41 |  |  |  |  |  |  |
|                                      | 15 | 8                          | 9  | 10 | 11 | 12 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 24 | 25 | 26 | 27 | 28 | 29 | 31 | 32 | 33 | 34 | 35 | 37 | 38 | 39 | 40 | 42 | 43 |  |  |  |  |  |  |
|                                      | 20 | 9                          | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 19 | 20 | 21 | 22 | 23 | 24 | 26 | 27 | 28 | 29 | 31 | 32 | 33 | 34 | 36 | 37 | 38 | 40 | 41 | 42 | 44 | 45 |  |  |  |  |  |  |
|                                      | 25 | 9                          | 10 | 11 | 12 | 13 | 15 | 16 | 17 | 18 | 19 | 20 | 22 | 23 | 24 | 25 | 27 | 28 | 29 | 30 | 32 | 33 | 34 | 36 | 37 | 38 | 40 | 41 | 43 | 44 | 46 | 47 |  |  |  |  |  |  |
|                                      | 30 | 9                          | 10 | 12 | 13 | 14 | 15 | 16 | 17 | 19 | 20 | 21 | 22 | 24 | 25 | 26 | 28 | 29 | 30 | 32 | 33 | 34 | 36 | 37 | 38 | 40 | 41 | 43 | 44 | 46 | 48 | 49 |  |  |  |  |  |  |
|                                      | 35 | 10                         | 11 | 12 | 13 | 14 | 16 | 17 | 18 | 19 | 21 | 22 | 23 | 24 | 26 | 27 | 28 | 30 | 31 | 33 | 34 | 35 | 37 | 38 | 40 | 41 | 43 | 45 | 46 | 48 | 49 | 51 |  |  |  |  |  |  |
|                                      | 40 | 10                         | 11 | 12 | 14 | 15 | 16 | 17 | 19 | 20 | 21 | 23 | 24 | 25 | 27 | 28 | 29 | 31 | 32 | 34 | 35 | 37 | 38 | 40 | 41 | 43 | 45 | 46 | 48 | 50 | 51 | 53 |  |  |  |  |  |  |
|                                      | 45 | 10                         | 12 | 13 | 14 | 15 | 17 | 18 | 19 | 21 | 22 | 23 | 25 | 26 | 27 | 29 | 30 | 32 | 33 | 35 | 36 | 38 | 39 | 41 | 43 | 44 | 46 | 48 | 50 | 51 | 53 | 55 |  |  |  |  |  |  |
|                                      | 50 | 11                         | 12 | 13 | 15 | 16 | 17 | 19 | 20 | 21 | 23 | 24 | 25 | 27 | 28 | 30 | 31 | 33 | 34 | 36 | 37 | 39 | 41 | 42 | 44 | 46 | 48 | 50 | 51 | 53 | 55 | 57 |  |  |  |  |  |  |
|                                      | 55 | 11                         | 12 | 14 | 15 | 16 | 18 | 19 | 20 | 22 | 23 | 25 | 26 | 28 | 29 | 31 | 32 | 34 | 35 | 37 | 39 | 40 | 42 | 44 | 46 | 47 | 49 | 51 | 53 | 55 | 57 | 59 |  |  |  |  |  |  |
|                                      | 60 | 12                         | 13 | 14 | 16 | 17 | 18 | 20 | 21 | 22 | 24 | 25 | 27 | 28 | 30 | 31 | 33 | 35 | 36 | 38 | 40 | 42 | 43 | 45 | 47 | 49 | 51 | 53 | 55 | 57 | 59 | 61 |  |  |  |  |  |  |
|                                      | 65 | 12                         | 13 | 15 | 16 | 17 | 19 | 20 | 22 | 23 | 25 | 26 | 28 | 29 | 31 | 32 | 34 | 36 | 37 | 39 | 41 | 43 | 45 | 46 | 48 | 50 | 52 | 55 | 57 | 59 | 61 | 63 |  |  |  |  |  |  |
|                                      | 70 | 12                         | 14 | 15 | 16 | 18 | 19 | 21 | 22 | 24 | 25 | 27 | 28 | 30 | 32 | 33 | 35 | 37 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | 54 | 56 | 58 | 61 | 63 | 65 |  |  |  |  |  |  |
|                                      | 75 | 13                         | 14 | 16 | 17 | 18 | 20 | 21 | 23 | 24 | 26 | 27 | 29 | 31 | 32 | 34 | 36 | 38 | 39 | 41 | 43 | 45 | 47 | 49 | 51 | 53 | 56 | 58 | 60 | 62 | 65 | 67 |  |  |  |  |  |  |
|                                      | 80 | 13                         | 15 | 16 | 17 | 19 | 20 | 22 | 23 | 25 | 27 | 28 | 30 | 31 | 33 | 35 | 37 | 39 | 40 | 42 | 44 | 46 | 48 | 51 | 53 | 55 | 57 | 59 | 62 | 64 | 67 | 69 |  |  |  |  |  |  |
| 85                                   | 14 | 15                         | 16 | 18 | 19 | 21 | 22 | 24 | 26 | 27 | 29 | 31 | 32 | 34 | 36 | 38 | 40 | 42 | 43 | 46 | 48 | 50 | 52 | 54 | 56 | 59 | 61 | 64 | 66 | 69 | 71 |    |  |  |  |  |  |  |
| 90                                   | 14 | 15                         | 17 | 18 | 20 | 21 | 23 | 25 | 26 | 28 | 30 | 31 | 33 | 35 | 37 | 39 | 41 | 43 | 45 | 47 | 49 | 51 | 53 | 56 | 58 | 60 | 63 | 65 | 68 | 71 | 73 |    |  |  |  |  |  |  |
| 95                                   | 14 | 16                         | 17 | 19 | 20 | 22 | 23 | 25 | 27 | 28 | 30 | 32 | 34 | 36 | 38 | 40 | 42 | 44 | 46 | 48 | 50 | 52 | 55 | 57 | 59 | 62 | 64 | 67 | 70 | 73 | 75 |    |  |  |  |  |  |  |
| 100                                  | 15 | 16                         | 18 | 19 | 21 | 22 | 24 | 26 | 27 | 29 | 31 | 33 | 35 | 37 | 38 | 40 | 43 | 45 | 47 | 49 | 51 | 54 | 56 | 58 | 61 | 63 | 66 | 69 | 72 | 75 | 78 |    |  |  |  |  |  |  |

# ANNEX B

## APPARENT TEMPERATURE (AT) INDEX FOR COLD

Estimation of AT as a Function of Wind Speed and Ambient Temperature at a  
Relative Humidity of 70%

| Ambient Temperature T[°C] |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |     |
|---------------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
|                           | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -19 | -18 | -17 | -16 | -15 | -14 | -13 |     |     |
| Wind Speed V [kts]        | 0   | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -19 | -18 | -16 |     |
|                           | 2   | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -27 | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -19 | -18 | -17 |     |
|                           | 4   | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -19 | -18 |     |
|                           | 6   | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -19 |     |
|                           | 8   | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -19 |
|                           | 10  | -43 | -42 | -41 | -40 | -39 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -19 |
|                           | 12  | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -23 | -22 | -21 | -20 |
|                           | 14  | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -23 | -22 | -21 |
|                           | 16  | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -29 | -28 | -27 | -26 | -25 | -24 | -23 | -22 | -21 |
|                           | 18  | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -23 | -22 |
|                           | 20  | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -23 |
|                           | 22  | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 |
|                           | 24  | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 |
|                           | 26  | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 |
|                           | 28  | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 |
|                           | 30  | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -32 | -31 | -30 | -29 | -28 | -27 | -26 |
|                           | 32  | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 |
|                           | 34  | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 |
|                           | 36  | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -29 | -28 |
|                           | 38  | -53 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 |
|                           | 40  | -53 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 |
|                           | 42  | -54 | -53 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 |
|                           | 44  | -55 | -54 | -53 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -35 | -34 | -33 | -32 | -31 |
|                           | 46  | -56 | -55 | -54 | -53 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 |
|                           | 48  | -56 | -55 | -54 | -53 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 |
| 50                        | -57 | -56 | -55 | -54 | -53 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 |     |
| 52                        | -58 | -57 | -56 | -55 | -54 | -53 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 |     |
| 54                        | -58 | -57 | -56 | -55 | -54 | -53 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 |     |
| 56                        | -59 | -58 | -57 | -56 | -55 | -54 | -53 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 |     |
| 58                        | -60 | -59 | -58 | -57 | -56 | -55 | -54 | -53 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -39 | -38 | -37 | -36 |     |
| 60                        | -61 | -60 | -59 | -58 | -57 | -56 | -55 | -54 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 |     |
| 62                        | -61 | -60 | -59 | -58 | -57 | -56 | -55 | -54 | -53 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 | -38 |     |
| 64                        | -62 | -61 | -60 | -59 | -58 | -57 | -56 | -55 | -54 | -53 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 |     |
| 66                        | -63 | -62 | -61 | -60 | -59 | -58 | -57 | -56 | -55 | -54 | -53 | -52 | -51 | -50 | -49 | -48 | -46 | -45 | -44 | -43 | -42 | -41 | -40 | -39 |     |
| 68                        | -63 | -62 | -61 | -60 | -59 | -58 | -57 | -56 | -55 | -54 | -53 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 | -40 |     |
| 70                        | -64 | -63 | -62 | -61 | -60 | -59 | -58 | -57 | -56 | -55 | -54 | -53 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 | -41 |     |
| 72                        | -65 | -64 | -63 | -62 | -61 | -60 | -59 | -58 | -57 | -56 | -55 | -54 | -53 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -42 | -41 |     |
| 74                        | -66 | -65 | -64 | -63 | -62 | -61 | -60 | -59 | -58 | -57 | -56 | -54 | -53 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 | -42 |     |
| 76                        | -66 | -65 | -64 | -63 | -62 | -61 | -60 | -59 | -58 | -57 | -56 | -55 | -54 | -53 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 | -43 |     |
| 78                        | -67 | -66 | -65 | -64 | -63 | -62 | -61 | -60 | -59 | -58 | -57 | -56 | -55 | -54 | -53 | -52 | -51 | -50 | -49 | -48 | -47 | -46 | -45 | -44 |     |
| 80                        | -68 | -67 | -66 | -65 | -64 | -63 | -62 | -61 | -60 | -59 | -58 | -57 | -56 | -55 | -54 | -53 | -52 | -51 | -49 | -48 | -47 | -46 | -45 | -44 |     |

Table is continued on next page

# APPARENT TEMPERATURE (AT) INDEX FOR COLD (CONT.)

Ambient Temperature T[°C]

| Wind Speed V [kts] |     | -12 | -11 | -10 | -9  | -8  | -7  | -6  | -5  | -4  | -3  | -2  | -1  | 0   | 1   | 2   | 3   | 4   | 5   | 6   | 7   | 8   | 9   | 10 |
|--------------------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|----|
|                    | 0   | -15 | -14 | -13 | -12 | -11 | -10 | -9  | -8  | -7  | -6  | -5  | -4  | -3  | -1  | 0   | 1   | 2   | 3   | 4   | 5   | 6   | 8   | 9  |
|                    | 2   | -16 | -15 | -14 | -13 | -12 | -11 | -10 | -9  | -8  | -7  | -6  | -4  | -3  | -2  | -1  | 0   | 1   | 2   | 3   | 5   | 6   | 7   | 8  |
|                    | 4   | -17 | -16 | -15 | -14 | -13 | -12 | -11 | -9  | -8  | -7  | -6  | -5  | -4  | -3  | -2  | -1  | 0   | 2   | 3   | 4   | 5   | 6   | 7  |
|                    | 6   | -18 | -17 | -16 | -14 | -13 | -12 | -11 | -10 | -9  | -8  | -7  | -6  | -5  | -4  | -3  | -1  | 0   | 1   | 2   | 3   | 4   | 5   | 7  |
|                    | 8   | -18 | -17 | -16 | -15 | -14 | -13 | -12 | -11 | -10 | -9  | -8  | -7  | -5  | -4  | -3  | -2  | -1  | 0   | 1   | 2   | 4   | 5   | 6  |
|                    | 10  | -19 | -18 | -17 | -16 | -15 | -14 | -13 | -12 | -11 | -9  | -8  | -7  | -6  | -5  | -4  | -3  | -2  | -1  | 1   | 2   | 3   | 4   | 5  |
|                    | 12  | -20 | -19 | -18 | -17 | -16 | -14 | -13 | -12 | -11 | -10 | -9  | -8  | -7  | -6  | -5  | -4  | -2  | -1  | 0   | 1   | 2   | 3   | 5  |
|                    | 14  | -20 | -19 | -18 | -17 | -16 | -15 | -14 | -13 | -12 | -11 | -10 | -9  | -8  | -7  | -5  | -4  | -3  | -2  | -1  | 0   | 1   | 3   | 4  |
|                    | 16  | -21 | -20 | -19 | -18 | -17 | -16 | -15 | -14 | -13 | -12 | -11 | -9  | -8  | -7  | -6  | -5  | -4  | -3  | -2  | 0   | 1   | 2   | 3  |
|                    | 18  | -22 | -21 | -20 | -19 | -18 | -17 | -16 | -15 | -13 | -12 | -11 | -10 | -9  | -8  | -7  | -6  | -5  | -3  | -2  | -1  | 0   | 1   | 2  |
|                    | 20  | -23 | -22 | -21 | -20 | -18 | -17 | -16 | -15 | -14 | -13 | -12 | -11 | -10 | -9  | -8  | -6  | -5  | -4  | -3  | -2  | -1  | 0   | 2  |
|                    | 22  | -23 | -22 | -21 | -20 | -19 | -18 | -17 | -16 | -15 | -14 | -13 | -12 | -11 | -9  | -8  | -7  | -6  | -5  | -4  | -3  | -1  | 0   | 1  |
|                    | 24  | -24 | -23 | -22 | -21 | -20 | -19 | -18 | -17 | -16 | -15 | -13 | -12 | -11 | -10 | -9  | -8  | -7  | -6  | -5  | -3  | -2  | -1  | 0  |
|                    | 26  | -25 | -24 | -23 | -22 | -21 | -20 | -18 | -17 | -16 | -15 | -14 | -13 | -12 | -11 | -10 | -9  | -8  | -6  | -5  | -4  | -3  | -2  | -1 |
|                    | 28  | -26 | -24 | -23 | -22 | -21 | -20 | -19 | -18 | -17 | -16 | -15 | -14 | -13 | -12 | -10 | -9  | -8  | -7  | -6  | -5  | -4  | -2  | -1 |
|                    | 30  | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -19 | -18 | -17 | -16 | -15 | -13 | -12 | -11 | -10 | -9  | -8  | -7  | -6  | -4  | -3  | -2 |
|                    | 32  | -27 | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -18 | -17 | -16 | -15 | -14 | -13 | -12 | -11 | -10 | -9  | -7  | -6  | -5  | -4  | -3 |
|                    | 34  | -28 | -27 | -26 | -25 | -23 | -22 | -21 | -20 | -19 | -18 | -17 | -16 | -15 | -14 | -13 | -12 | -10 | -9  | -8  | -7  | -6  | -5  | -3 |
|                    | 36  | -28 | -27 | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -19 | -18 | -17 | -16 | -14 | -13 | -12 | -11 | -10 | -9  | -8  | -7  | -5  | -4 |
| 38                 | -29 | -28 | -27 | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -18 | -17 | -16 | -15 | -14 | -13 | -12 | -11 | -10 | -8  | -7  | -6  | -5  |    |
| 40                 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -22 | -21 | -20 | -19 | -18 | -17 | -16 | -15 | -14 | -13 | -11 | -10 | -9  | -8  | -7  | -6  |    |
| 42                 | -31 | -30 | -28 | -27 | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -19 | -18 | -17 | -16 | -14 | -13 | -12 | -11 | -10 | -9  | -8  | -6  |    |
| 44                 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -18 | -17 | -16 | -15 | -14 | -13 | -12 | -11 | -9  | -8  | -7  |    |
| 46                 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -22 | -21 | -20 | -19 | -18 | -17 | -16 | -15 | -14 | -12 | -11 | -10 | -9  | -8  |    |
| 48                 | -33 | -32 | -31 | -30 | -29 | -27 | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -19 | -18 | -17 | -15 | -14 | -13 | -12 | -11 | -10 | -8  |    |
| 50                 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -18 | -17 | -16 | -15 | -14 | -13 | -12 | -10 | -9  |    |
| 52                 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -22 | -21 | -20 | -19 | -18 | -17 | -16 | -15 | -13 | -12 | -11 | -10 |    |
| 54                 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -19 | -18 | -16 | -15 | -14 | -13 | -12 | -11 |    |
| 56                 | -36 | -35 | -34 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -23 | -22 | -21 | -19 | -18 | -17 | -16 | -15 | -14 | -13 | -11 |    |
| 58                 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -22 | -21 | -20 | -19 | -18 | -17 | -16 | -14 | -13 | -12 |    |
| 60                 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -19 | -17 | -16 | -15 | -14 | -13 |    |
| 62                 | -38 | -37 | -36 | -35 | -34 | -33 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -23 | -22 | -20 | -19 | -18 | -17 | -16 | -15 | -14 |    |
| 64                 | -39 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -23 | -22 | -21 | -20 | -19 | -18 | -17 | -15 | -14 |    |
| 66                 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -19 | -17 | -16 | -15 |    |
| 68                 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -23 | -22 | -20 | -19 | -18 | -17 | -16 |    |
| 70                 | -41 | -40 | -39 | -38 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -23 | -22 | -21 | -20 | -19 | -18 | -16 |    |
| 72                 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -27 | -26 | -25 | -24 | -23 | -22 | -21 | -20 | -18 | -17 |    |
| 74                 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -23 | -21 | -20 | -19 | -18 |    |
| 76                 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -28 | -27 | -26 | -24 | -23 | -22 | -21 | -20 | -19 |    |
| 78                 | -44 | -43 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -32 | -31 | -30 | -29 | -27 | -26 | -25 | -24 | -23 | -22 | -20 | -19 |    |
| 80                 | -44 | -43 | -42 | -41 | -40 | -39 | -38 | -37 | -36 | -35 | -34 | -33 | -31 | -30 | -29 | -28 | -27 | -26 | -25 | -24 | -22 | -21 | -20 |    |

**HEAT STRESS: ADVISED ACTIVITY LEVELS AND WATER INTAKE  
FOR AVERAGE UNACCLIMATIZED<sup>1</sup> WORKER WEARING CLIMATE-ADJUSTED WORK CLOTHING**

| Temperature category   | Apparent Temperature <sup>2</sup> (AT)<br><br>[°C] | Easy work <sup>3</sup>                          |                       | Moderate work <sup>4</sup>                      |                       | Hard work <sup>5</sup>                          |                       |
|------------------------|--|---|-----------------------|---|-----------------------|---|-----------------------|
|                        |  | Work/rest cycle<br>Reduce activity level by X % | Water intake<br>[l/h] | Work/rest cycle<br>Reduce activity level by X % | Water intake<br>[l/h] | Work/rest cycle<br>Reduce activity level by X % | Water intake<br>[l/h] |
| <b>EXTREME DANGER</b>  | <b>&gt;54</b>                                      | <b>33%</b>                                      | <b>1.0</b>            | <b>83%</b>                                      | <b>1.0</b>            | <b>Not allowed</b>                              | <b>N/A</b>            |
| <b>DANGER</b>          | <b>41 to 54</b>                                    | <b>16%</b>                                      | <b>0.75</b>           | <b>66%</b>                                      | <b>0.75</b>           | <b>83%</b>                                      | <b>1.0</b>            |
| <b>EXTREME CAUTION</b> | <b>32 to 41</b>                                    | <b>0%</b>                                       | <b>0.75</b>           | <b>50%</b>                                      | <b>0.75</b>           | <b>66%</b>                                      | <b>1.0</b>            |
| <b>CAUTION</b>         | <b>27 to 32</b>                                    | <b>0%</b>                                       | <b>0.5</b>            | <b>33%</b>                                      | <b>0.75</b>           | <b>50%</b>                                      | <b>1.0</b>            |
| <b>SAFE</b>            | <b>-7 to 27</b>                                    | <b>0%</b>                                       | <b>0.5</b>            | <b>16%</b>                                      | <b>0.75</b>           | <b>50%</b>                                      | <b>0.75</b>           |

General procedures for avoiding heat stress:

- Take cooling/rest breaks in the shade or air-conditioned building whenever possible without exposing yourself to cold draft air
- Drink approximately 1 cup of cool water every 15 minutes
- Avoid alcohol and caffeine
- Increase electrolyte intake by salting food or drinking sports drinks
- Watch co-workers for signs and symptoms of heat stress
- Adjust clothing, while taking precautions against sunburns (i.e. early application of UV barrier cream)

**NOTE:** Reduced activity levels can be achieved by adjusting the work tempo and/or introducing recuperation periods preferably in the shade.

<sup>1</sup> For acclimatized workers, the measured AT value can be decreased by 5°C AT

<sup>2</sup> For works involving full-body protective gear (e.g. a/c wash gear, chemical protection coverall) and respiratory protection, the measured AT value will be increased by 25°C AT (also note general working time limits when wearing impermeable protective clothing and/or respirators as detailed by local OSH standards)

<sup>3</sup> e.g. regular office work; sitting with moderate arm and leg movements; standing with light work at machine or bench while using mostly arms; using a table saw; standing with light or moderate work at machine or bench and some walking about

<sup>4</sup> e.g. scrubbing in a standing position; walking about with moderate lifting or pushing; walking on level at 6 km/h while carrying a 3 kg weight load

<sup>5</sup> e.g. intermittent heavy lifting with pushing or pulling (e.g. a/c brake change); works in confined spaces (such as a/c tank entry); carpenter sawing by hand; heavy assembly work on a non-continuous basis

## ANNEX D

### COLD STRESS: ADVISED ACTIVITY LEVELS AND PRECAUTIONARY MEASURES FOR AVERAGE WORKERS WEARING CLIMATE-ADJUSTED WORK CLOTHING

| Temperature Category | Apparent Temperature (AT)<br>[°C] | Work/warming <sup>1</sup><br>cycle<br>(in minutes) | Other Precautions   |
|----------------------|-----------------------------------|--|---|
| SAFE                 | 15 to 27                          | No limit   | None  |
|                      | -7 to 15                          |  | <ul style="list-style-type: none"> <li>Wear gloves</li> <li>Do not perform work with bare hands for more than 10 minutes</li> <li>Cover metal handles with thermal insulation</li> </ul>  |
| CAUTION              | -7 to -15                         | 50/10  | All above measures plus <ul style="list-style-type: none"> <li>No outdoor operations with water</li> <li>Wear cold weather protective clothing</li> <li>Avoid heavy sweating</li> <li>Change wet clothes immediately</li> </ul> |
| EXTREME CAUTION      | -15 to -25                        | 40/20  | All above measures plus   |
| DANGER               | -25 to -48                        | 30/30  | <ul style="list-style-type: none"> <li>Wear mittens, not gloves</li> </ul>  |
| EXTREME DANGER       | <-48                              |  | <ul style="list-style-type: none"> <li>Critical tasks only as determined by management</li> </ul>   |

General procedures for avoiding cold stress:

- Avoid wearing cotton garments whenever possible
- Wear thermal socks and glove liners
- Change boot insoles daily or wear cold protective boots
- Be sure to change out of wet clothes as soon as possible
- Increase fluid intake to prevent dehydration.
- Avoid alcohol and caffeine

<sup>1</sup> Warming indoors in a heated environment

## SYMPTOMS AND FIRST AID MEASURES FOR HEAT STRESS

### 1. Heat Cramps

**a. Symptoms.** Usually affect people who sweat a lot during strenuous activity, depleting the body's salt and fluids. The low salt level in the muscles causes painful cramps and spasms - usually in the abdomen, arms, or legs. Heat cramps may also be a symptom of heat exhaustion.

**b. First Aid.** Stop all activity and sit in the coolest available place. Drink clear juice or a sports beverage. Seek medical attention if cramps do not stop in an hour.

### 2. Heat Exhaustion

**a. Symptoms.** The body's response to an excessive loss of water and salt contained in sweat. Symptoms include heavy sweating, paleness, muscle cramps, weakness, dizziness, headache, nausea or vomiting and sometimes fainting. The skin may feel cool and moist, and the pulse rate will be fast but weak. Breathing will be fast and shallow. Untreated heat exhaustion may progress to heat stroke.

**b. First Aid.** Immediately provide cool beverages as tolerated, and cool the body by removing heavy clothing, giving a cool shower/bath, or wetting the clothing, and place in an air conditioned environment. Seek medical attention if the symptoms are severe or last longer than an hour.

### 3. Heat Stroke

**a. Symptoms.** Heat stroke occurs when the body is unable to control its temperature. The body's temperature rises rapidly, the sweating mechanism fails or is ineffective (as when sweat cannot evaporate), and the body is unable to cool down. Heat stroke can cause death or permanent disability if emergency treatment is not given. Warning signs include a high body temperature (above 39.5°C, orally), dry skin which is red and hot, rapid strong pulse, throbbing headache, dizziness, nausea and confusion which may progress to unconsciousness.

**b. First Aid.** First aid is required while immediately transporting to medical care. Start cooling the victim by any method available as described for heat exhaustion, with the addition of vigorous fanning. If uncontrollable muscle twitching or vomiting occur, protect the victim from injury and keep the airway open by turning on his or her side.

## SYMPTOMS AND FIRST AID MEASURES FOR COLD STRESS

### 1. Chilblain

**a. Symptoms.** A non-freezing cold injury, which although painful, causes little or no permanent impairment. It appears as tender, red, swollen skin that is hot to the touch and may itch. This can worsen to an aching, prickly (“pins and needles”) sensation and then numbness. It may develop in only a few hours in skin exposed to cold.

**b. First Aid.** Prevent further cold exposure. Remove wet or constrictive clothing. Gently wash, dry, and elevate the injured part. Cover the injured area with layers of loose warm clothing and allow re-warming. Pain and blisters may develop. Do not pop blisters, do not apply lotions or creams, do not massage, do not expose to extreme heat, and do not allow victim to walk on injury. Seek medical attention.

### 2. Immersion or Trench Foot

**a. Symptoms.** Develop when feet are exposed to moisture and cold for prolonged periods (12 hours or longer). The combination of cold and moisture softens skin, causing tissue loss and, often, infection. Untreated, trench foot can eventually require amputation. Often, the first sign of trench foot is itching, numbness or tingling pain. Later the feet may appear swollen, and the skin faintly red, blue or black. Commonly, trench foot shows a distinct “waterline” coinciding with the water level in the boot.

**b. First Aid.** See 1.b. above.

### 3. Frost Nip

**a. Symptoms.** Involves freezing of water on the skin surface. The skin will become reddened and possibly swollen. Although painful, there is usually no further damage after re-warming. Repeated frost nip can dry the skin, causing it to crack and be sensitive. Frost nip should be taken seriously since it may be the first sign of impending frostbite.

**b. First Aid.** Gradually re-warm the affected area.

### 4. Frostbite

**a. Symptoms.** Involve freezing of deeper layers of tissue. Ice crystal formation and lack of blood flow cause tissue damage. Skin freezes at about -2°C. The skin becomes numb and turns a gray or waxy white color, is cold to the touch and may feel stiff.

**b. First Aid.** Prevent further cold exposure and remove wet or constrictive clothing. Gradually re-warm the injury by direct skin-to-skin contact between injured area and non-injured skin of victim or a buddy. Evacuate for medical treatment. Victims with foot injuries should not walk but should be evacuated by stretcher. Do not thaw frostbite injuries if there is a possibility of refreezing during evacuation.

## 5. Hypothermia

**c. Symptoms.** A life threatening condition in which body temperature falls below 35°C. Generally, body temperature will not fall until after many hours of exposure to cold air or shorter exposure to cold water. Body temperature can fall even when air temperatures are above freezing if conditions are windy, clothing is wet, and/or the person is inactive. The first signs of developing hypothermia include confusion, bizarre behaviour, and withdrawal from group interaction. Victims of hypothermia may be unconscious, with nearly undetectable breathing and pulse.

**d. First Aid.** Prevent further cold exposure and remove wet clothing. Initiate Cardio-Pulmonary Resuscitation (CPR) if required. Re-warm by covering with blankets, sleeping bags or body-to-body contact if necessary. Get the victim off the ground. Handle gently during treatment and evacuation because rough handling (e.g. massage) of hypothermic victims can cause dangerous irregular heartbeats or seizures. Get victim to hospital or other suitable medical facility as soon as possible. Apparently lifeless victims are never pronounced dead, even by physicians, until they are “warm and dead”.