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**Aerospace Medicine**

**PREVENTION, TREATMENT, AND CONTROL  
OF HEAT AND COLD INJURIES**

**COMPLIANCE WITH THIS PUBLICATION IS MANDATORY**

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This instruction establishes responsibilities and procedures for determining conditions conducive to heat and cold stress illness and injuries. This instruction also provides guidance to commanders and supervisors for determining appropriate preventive measures to be taken in extreme thermal conditions.

**SUMMARY OF REVISIONS**

This publication updates the references list and the 375th Aerospace Medicine Squadron's responsibilities.

**1. References:**

- 1.1. American Conference of Governmental Industrial Hygienists, Threshold Limit Values for Chemical Substances, and Physical Agents and Biological Exposure Indices, latest edition.
- 1.2. AFMAN 15-125, *Weather Station Operations*.
- 1.3. SAFBI 15-101, *Weather Support*.
- 1.4. OSHA Fact Sheet 98-55, *Protecting Workers in Cold Environments*.

**2. Definitions:**

- 2.1. Thermal Stress. This is stress on an individual caused by either extreme heat or cold that could result in injury or illness.
- 2.2. Wet Bulb Globe Temperature (WBGT). The WBGT is the measurement of environmental factors which nearly correlate with deep body temperature and other physiological responses to heat. The determination of WBGT requires the use of a black-globe thermometer, a natural (static) wet-bulb thermometer, and a dry-bulb thermometer.

2.3. Equivalent Chill Temperature (ECT). For the ECT, wind chill cooling rate and the cooling power of air are critical factors. Cooling rate is defined as heat loss from a body due to the air temperature and wind velocity upon the exposed body. Higher wind speeds and lower temperatures in the work area require a greater insulation value of protective clothing.

### 3. Responsibilities:

#### 3.1. Unit Commanders will:

3.1.1. Ensure the WBGT Index and ECT Index advisories are relayed to supervisors as received from the Scott Command Post.

3.1.2. Ensure strenuous physical activities are curtailed according to work/rest cycles at [Attachment 1](#) during extreme heat stress conditions.

3.1.3. Ensure adequate protective clothing is worn and exposures are limited during extreme cold conditions.

3.1.4. When mission requires continuation of duties, ensure workers are closely observed for signs and symptoms of heat and cold stresses ([Attachment 1](#) and [Attachment 2](#)).

#### 3.2. Supervisors will:

3.2.1. Brief personnel on hazards and warning signs of thermal stress using WBGT and ECT advisories.

3.2.2. Ensure sufficient water is available for personnel. Encourage frequent drinking of small amounts of water. If possible, adjust workloads for thermal conditions. For instance, in extreme hot weather, perform heavy workloads early in the morning or after sunset. For extreme cold weather, perform outside work during the warmest part of the day.

3.2.3. Ensure work/rest cycles are per the guidelines in [Attachment 1](#) and [Attachment 2](#) as appropriate. Identify shaded or air-conditioned areas for personnel rest periods during conditions conducive to heat stress. Identify heated areas for personnel rest periods during conditions conducive to cold injuries.

3.2.4. Ensure personnel seek medical attention, if necessary.

#### 3.3. The 375th Aerospace Medicine Squadron, Bioenvironmental Engineering Flight (375 AMDS/SGPB) will:

3.3.1. Provide training to personnel on potential thermal stress hazards and avoidance/prevention measures.

3.3.2. Determine heat stress conditions hourly, 0800-1600, Mon-Fri, utilizing the WBGT Index and relay it to the Scott Command Post.

3.3.3. Determine cold stress conditions utilizing the ECT Index and relay it to the Scott Command Post when the 375th Weather Squadron cannot provide the index.

#### 3.4. The Scott Command Post will:

3.4.1. Accomplish secondary dissemination of weather watches, warnings, and advisories, in accordance with SAFBI 15-101, *Weather Support*, Attachment 2, Table A2.1.

3.4.2. Relay WBGT and ECT advisories to all squadrons on Scott AFB as received from 375 AMDS/SGPB.

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**Attachment 1****GUIDELINES FOR HEAT STRESS****A1.1. Types of Heat Stress, Symptoms, and First Aid Measures:**

A1.1.1. Sunburn: Caused from overexposure to sunlight or ultraviolet lamps.

A1.1.1.1. Symptoms: Red, painful skin.

A1.1.1.2. First Aid Measures: Remove from sun, drink fluids, take analgesics for pain relief, apply moisturizing creams.

A1.1.2. Fainting: Experienced in unacclimated individuals.

A1.1.2.1. Symptoms: Sweating, weakness, lightheadedness, numbness, blurred vision, ultimately loss of consciousness.

A1.1.2.2. First-Aid Measures: Remove from heat, rest, keep head in low position.

A1.1.3. Cramps: Caused by internal electrolyte imbalance.

A1.1.3.1. Symptoms: Painful spasms of arm and leg muscles and abdomen, often vomiting and fatigue.

A1.1.3.2. First-Aid Measures: Rest, drink electrolyte solutions (sports drinks).

A1.1.4. Heat Exhaustion: Increased body core temperature.

A1.1.4.1. Symptoms: Profuse sweating, pale, moist cool skin, rapid pulse, weakness, fatigue, thirst, giddiness, headache, and confusion.

A1.1.4.2. First-Aid Measures: Cool immediately, sprinkle with water, submerge in cool water or place ice on groin, armpits, and neck.

A1.1.5. Heat Stroke: Internal temperature control mechanism no longer working.

A1.1.5.1. Symptoms: Hot, dry skin, abrupt onset of confusion and irritability, ultimately delirium, convulsions, and death.

A1.1.5.2. First-Aid Measures: Medical Emergency! Cool immediately, transport immediately to medical facility.

**A1.2. Risk Factors:**

A1.2.1. 40 or more years of age.

A1.2.2. Pregnancy.

A1.2.3. Fifteen or more pounds over optimal weight.

A1.2.4. Chronic diseases (heart disease or diabetes).

A1.2.5. Lack of physical conditioning.

A1.2.6. Drugs/medications (e.g., cold meds or antihistamines).

A1.2.7. Alcohol consumption.

A1.2.8. Prior episodes of heat stress.

**A1.3. Prevention:**

A1.3.1. Ensure all personnel are educated on the signs and symptoms of heat stress, the Wet Bulb Globe Temperature, and measures to protect themselves.

A1.3.2. Adjust work schedules, so heavy workloads are done early in the morning or after sunset when temperatures are cooler.

A1.3.3. Encourage early reporting of heat stress symptoms.

A1.3.4. Maintain proper hydration. Drink small amounts of water frequently for best results.

A1.3.5. Do not use salt pills, unless under the direction of a Healthcare provider.

A1.3.6. Wear appropriate clothing. Loose, breathable clothing, such as cotton, is recommended where possible. Personnel should wear sun protection, either light-colored clothing or sunscreen. If personal protective equipment (PPE) must be worn, precautions should be taken to account for the extra heat loading caused by the PPE.

**A1.4.** The WBGT is the temperature index used in hot conditions that combines dry temperature, humidity, and radiant heat to best describe the stressors on human beings. The WBGT is the industry standard for occupational exposures. It's designed to protect the average healthy worker. Protection factors are based on work exertion and consist of work-rest regimens, based on the WBGT temperature and the work exertion or amount of heat produced by the body. The Permissible Heat Exposure Threshold Limit Values (PHETLVs) are listed on the next page.

**WBGT INDEX  
PERMISSIBLE HEAT EXPOSURE THRESHOLD LIMIT VALUES  
(Degrees Fahrenheit)**

<u>Work-Rest Regimen</u>	<u>Workload</u>		
	<u>Light</u>	<u>Moderate</u>	<u>Heavy</u>
Continuous work	86°	80°	77°
75% work each hour	87°	82°	78°
50% work each hour	89°	85°	82°
25% work each hour	90°	88°	86°

Light Work - sitting, standing, some walking, work with hands  
 Moderate Work - walking with some lifting or pushing  
 Heavy - manual labor, pick and shovel work, heavy lifting

**A1.5.** WBGT Correction Factors are as follows: subtract the appropriate correction factor from the WBGT Permissible Heat Exposure Threshold Limit Value in the previous table to determine the corrected work-rest regimen.

<u>Risk Factor</u>	<u>WBGT Correction Factor</u>
Unacclimated personnel	5
Normal summer work clothes	0
Cotton coveralls <sup>2</sup>	
Water barrier, permeable (e.g. Tyvek coveralls)	6

**A1.6.** When wearing Mission-Oriented Protective Posture (MOPP) Gear, subtract 10 from the WBGT PHETLV. Example: Heavy work in coveralls, the WBGT PHETLV becomes 67° F for continuous work.

**A1.7.** Once a heat condition is briefed to the Scott Command Post, that condition stands until an update is given to them. Heat conditions return to normal after sunset. However, supervisors are encouraged to provide plenty of fluids, breaks when needed, and watch for symptoms of heat stress.

**A1.8.** Consuming sufficient quantities of water is absolutely necessary to keep personnel in good physical and mental condition. [Table A1.1.](#) show the Drinking Water Intake Requirements for various heat conditions.

**Table A1.1. – Drinking Water Intake Requirements**

<b>Heat Condition</b>	<b>Temperature °F (WBGT)</b>	<b>Water Intake (qts/hr)</b>
1	78 – 81.9	
2	82 – 84.9	
3	85 – 87.9	1
4	88 – 89.9	1
5	90 & above	2+

**Attachment 2****GUIDELINES FOR COLD STRESS****A2.1. Types of Cold Stress, Signs and Symptoms, and First-Aid Measures:**

A2.1.1. Trench Foot: Exposure to wet and cold.

A2.1.1.1. Symptoms: Blood vessels contract, feet turn blue, ulcers may form, gangrene.

A2.1.1.2. First-Aid Measures: Remove wet socks, massage or rub feet till warm, keep feet warm and dry.

A2.1.2. Immersion Foot: Due to immersion in cold water.

A2.1.2.1. Symptoms: Same as above.

A2.1.2.2. First-Aid Measures: Same as above.

A2.1.3. Frostbite: Freezing of tissue.

A2.1.3.1. Symptoms: appearance is white to blue/purple, hard, no sensation, and no movement; within 24 hours, swelling and edema, blistering; after 7-10 days the affected tissue turns black and sloughs off.

A2.1.3.2. First Aid Measures: Immediate medical attention, get in warm area, remove wet clothing, thaw affected tissue, give hot drink (no alcohol); thawed skin will be painful, turn red/purple and soft.

A2.1.4. Hypothermia: Low core body temperature.

A2.1.4.1. Symptoms: Shivering until core temp decreases to 86°F; slowed vital signs, confusion, rigid muscles > 80°F, limp muscles < 80°F.

A2.1.4.2. First-Aid Measures: Immediate medical attention if excessive shivering or no longer shivering, remove from cold and wind, remove wet or constrictive clothing, rewarm gently, and do not let exercise, give hot fluids by mouth, no alcohol.

**A2.2. Risk Factors:**

A2.2.1. 40 or more years of age.

A2.2.2. Circulatory disease or poor circulation.

A2.2.3. Drugs/Medication (morphine, barbiturates).

A2.2.4. Alcohol consumption.

A2.2.5. Prior episode of cold stress.

**A2.3. Prevention:**

A2.3.1. Ensure all personnel are educated on the signs and symptoms of cold stress, the Equivalent Chill Temperature Index, and measures to protect themselves.

A2.3.2. Proper eating and drinking habits help the body maintain normal temperature. When exposed to extreme cold, eat high calorie meals and drink lots of fluids.

A2.3.3. Wear appropriate clothing. Loose fitting, layered clothing is the best. Synthetic insulation materials (polypropylene, Gore-Tex) are recommended because they help keep moisture away from the body. Outer layer should be wind and rain resistant. Remove wet clothing.

A2.3.4. Encourage early reporting of symptoms of cold stress.

A2.3.5. If possible, erect wind breaks, provide heating units.

**A2.4.** Equivalent Chill Temperature (ECT) Index. This index takes into account both the temperature and wind speed. The greater the wind speed, the greater the cooling effect on exposed skin. The following guidelines are for individuals working outside for prolonged periods of time:

<u>ECT</u> (degrees Fahrenheit)	<u>Clothing Requirements and Other Recommendations</u>
<40°	Field jacket Leather gloves
<30°	Cover metal tool handles with thermal insulation
<25°	Field jacket Leather gloves Thermal underwear
<10°	Parka Leather gloves with thermal inserts Thermal underwear No prolonged sitting or standing No skin contact with bare metal surfaces Prohibit use of unprotected metal chairs Implement Buddy System

At or below -20°F, the above recommendations apply with work-rest regimens. Rest should take place in a heated area.

-20 to -29°F                      work 45 min, rest 15 min

-30 to -39°F	work 30 min, rest 30 min
-40 to -49°F	work 15 min, rest 45 min
-50°F and less	Restricted