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HEAT STRESS

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This instruction implements AFD 48-1 and provides local guidance for commanders with information on heat stress and applies to all personnel conducting ground operations while assigned or attached to Incirlik Air Base. This information enables commanders to make decisions on work schedules, uniforms, and water intake for their personnel working outdoors. Ensure that all records created as a result of processes in this supplement are maintained in accordance with AFMAN 37-123, *Management of Records* and dispose of in accordance with the Air Force Records Disposition Schedule (RDS). This supplement requires collection and or maintenance of information protected by the Privacy Act (PA) of 1974. The authorities to collect and or maintain the records prescribed in this supplement are Title 10 United States Code, Section 8013, 37 U.S.C. 301a, Public Law 92-204, P. L. 93-5704, and P. L. 93-294. Forms affected by the PA have an appropriate PA statement. System of records notice F060 AF A applies. Use AF Form 847, **Recommendation for Change of Publication**, through channels when making recommended changes. This publication applies to the Air National Guard (ANG) only upon mobilization. This publication applies to Air Force Reserve Command (AFRC) units.

SUMMARY OF REVISIONS

This document is substantially revised and must be completely reviewed.

This revision changed paragraph **1.8.** to read “Airfield Management Operations.” It also changed paragraph **1.7.** to read “39 ABW/CP.” And it changed paragraph **1.6.** to read, “Weather Flight (39 OS/OSW): The Weather Flight will take heat stress measurements hourly and report the reading and category for dissemination to the Command Post and Base Operations when heat category 1 is reached. The Weather Flight will disseminate subsequent changes in category to include the resumption to normal conditions. Additionally, in local surface weather observations disseminated via the New Tactical Forecast System, the current WBGT reading and category will be provided when the WBGT is 78 degrees Fahrenheit (° F) or higher. NOTE: Heat stress flag colors will not be used with categories at Incirlik AB to prevent confusion with alarm condition colors.”

1. Responsibilities:

1.1. **Unit Commanders** : IAW AFI 91-301, *Air Force Occupational and Environmental Safety, Fire Protection, and Health (AFOSH) Program*, Commanders are ultimately responsible for the health and safety of the members of their unit. Commanders have the authority to modify uniform wear (i.e. unblousing boots, rolling up sleeves, removing battle dress uniform (BDU) tops, etc.) to suit the ambient conditions of the workplace and protect the health of their command. Commanders can also schedule difficult outside work for cooler hours, mandate work/rest cycles, and require acclimatization of new or TDY personnel. Commanders should use this instruction to make decisions affecting their unit to preserve health and safety in hot environments. The commander must balance mission execution with the health and safety risk to unit personnel.

1.2. **Supervisors.** Supervisors are responsible for the implementation of health and safety programs in their workplaces (AFI 91-301). When authorized by commanders, they should take necessary actions to preserve health.

1.3. **Workers.** Workers should follow commanders' and supervisors' directives including water intake rates and work/rest cycles. They should report any heat stress symptoms to their supervisors and watch for heat stress symptoms in their co-workers.

1.4. **Director, Base Medical Services (DBMS):** The DBMS will ensure that heat stress mitigation guidance is available for commanders. The DBMS will also provide for such training of commanders, supervisors, workers, and medics as is required to implement an effective base heat stress management program. DBMS will make determination concerning whether conditions warrant personnel drinking sports beverages to maintain their health and safety. Accordingly, DBMS (or MTF commander) will provide this determination in writing IAW AFI 65-601 (Vol 1), para. 4.45.6.

1.5. **Bioenvironmental Engineering (39 MDS/SGPB):** Bioenvironmental Engineering (BEE) will be the OPR for the heat stress management program. BEE will give heat stress training and recommend actions for commanders and supervisors to maintain worker health and safety. BEE provides logistical support to the Weather Flight by providing the digital Wet Bulb Globe Temperature (WBGT) instrument and distilled water for instrument operation. BEE also maintains and ensures calibration of the instrument, and provides technical guidance.

1.6. **Weather Flight (39 OSS/OSW):** The Weather Flight will take heat stress measurements hourly and report the reading and category for dissemination to the Command Post and Base Operations when heat category 1 is reached. The Weather Flight will disseminate subsequent changes in category to include the resumption to normal conditions. Additionally, in local surface weather observations disseminated via the New Tactical Forecast System, the current WBGT reading and category will be provided when the current surface temperature is 78 degrees Fahrenheit (° F) or higher. **NOTE: Heat stress flag colors will not be used with categories at Incirlik AB to prevent confusion with alarm condition colors.**

1.7. **Command Post (39 ABW/CP):** The Command Post will be notified by the Weather Flight via telephone when changes in heat stress category occur. The Command Post will broadcast the reading and category on the Commander's Net and notify agencies per Controller Checklist QRC-425 to include when normal conditions are resumed.

1.8. **Airfield Management Operations (39 OS/OSAB):** Base Operations will be notified by the Weather Flight via telephone when changes in heat stress category occur. Base Operations will broad-

cast the reading and category via the Secondary Crash phone to include when normal operations are resumed.

1.9. **Notified Agencies.** Agencies notified by 39 ABW/CP and 39 OS/OSAB have the responsibility for disseminating changes in heat stress category to their work areas, implementing the appropriate work/rest cycle, and ensuring proper water intake.

2. Heat Stress Management.

2.1. **Definition.** Heat stress is the thermal exposure to one's body. Incirlik AB experiences conditions of hazardous heat stress on a routine basis from May through October according to historical BEE heat stress records.

2.2. The WBGT is suggested by the American Conference of Governmental Industrial Hygienists (ACGIH) as the best evaluation of the stress of heat upon a body. Therefore, the WBGT is the indicator used to measure heat stress at Incirlik AB.

2.3. **Measurement.** The Weather Flight measures heat stress by the WBGT index. This takes into account the air temperature (dry bulb), relative humidity (wet bulb), and heating by direct rays of the sun (black globe).

2.4. **Reporting.** The Weather Flight will monitor the WBGT index hourly when the temperature reaches 78° F. Initial dissemination will be to 39 ABW/CP and 39 OSS/OSAB. All notified units will develop procedures to disseminate the category appropriately within their work centers.

2.5. **Guidance.** Additional guidance is contained in the attachments to this instruction. **Attachment 2** defines the five Heat Categories and the corresponding Work/Rest Cycles and Water Intake Amounts for the three work categories defined in **Attachment 3** as "Easy", "Moderate," and "Hard" workloads. **Attachment 4** provides guidance for aircrew actions based on the five different Heat Categories. **Attachment 5** provides information to maintain physical performance for acclimated workers.

2.5.1. **Occupational Heat Stress Exposure.** **Attachment 2** provides guidance for acclimated and non-acclimated workers. The chart for acclimated personnel is for workers who routinely perform their jobs while exposed to hot environments. To reduce the effects of heat stress exposure, mandatory rest cycles for both acclimated and non-acclimated workers should be accomplished in shade if possible.

2.5.2. **Acclimatization.** Acclimatized personnel are better able to cope with the hot environment at Incirlik AB. All newly arrived personnel from cooler climates should become acclimated before attempting prolonged strenuous activity or exercise. Newly arriving personnel (including personnel returning from a TDY of two (2) or more weeks in a cooler environment) should be allowed two (2) weeks to become acclimated to the Incirlik AB environment. Acclimatization is required to reduce the risk of heat illness or injury. Acclimatization is a series of physiological adjustments that occur when an individual is exposed to a hot climate. Acclimatization requires personnel to work in the hot environment and perform typically required duties, but at a slower pace with more frequent breaks. Acclimatization is achieved through progressive amounts of heat exposure and physical exertion. Acclimatization to heat begins with the first exposure and is usually developed to 50 percent by the end of the first week. Substantial acclimatization (about 78 percent) should occur by the end of the second week.

2.5.3. Aerobic Activities and Exercise. During summer months, commanders should schedule outdoor aerobic activity and exercise during morning hours (no later than 0900) or at the end of the day (after 1600). Since the WBGT index frequently exceeds 88° F at mid-day, this scheduling will reduce the potential for undue heat stress. Extreme caution is warranted for any aerobic activities conducted when the WBGT Index exceeds 90° F.

2.5.4. Wear of Personal Protective Equipment. Personnel wearing impervious clothing (such as security forces body armor, rain gear at wash rack(s), fire fighting suits, paint coveralls) or respirators should take special precaution as this equipment adds to the metabolic heat load and hinders the body’s ability to cool itself. Supervisors should use the guidance on the bottom of [Attachment 2](#) when determining work/rest cycles and fluid intake in hot weather.

3. Prevention of Heat Stress Illness/Injury. The following paragraphs discuss actions to prevent heat stress disorders.

3.1. Education. Personnel working and/or training in hot environments should be educated on the causes, symptoms, prevention, and first aid treatment of heat disorders. Personnel should also be educated on the following factors which may contribute to heat illness/injury.

Table 1.

Acute or chronic infection	Vascular disease
Previous heat injury	Lack of sleep or fatigue
Fever	Conditions affecting the ability to sweat
Recent use of alcohol	Overweight
Reaction to immunization	Heat rash, dermatitis, or acute sunburn
Dehydration	Medications or drugs

3.2. Water. To replace water lost through sweating, drink quantities of cool water as recommended in [Attachment 2](#). It is best to drink small amounts of water frequently (one pint every twenty minutes) to replace water than to drink large amounts less frequently. Sudden drinking of large amounts of water stimulates urination, causing the body to lose water more quickly, and may lead to hyponatremia (acute water intoxication) which is a life-threatening condition. **Water intake should not exceed 1.5 quarts of water per hour or 12 quarts per day.** Milk does not replace water loss. Caffeinated drinks, like coffee and many soft drinks, are dehydrating and should be avoided. Carbonated beverages, while containing water, are not as effective as water in keeping the body hydrated because of the tendency to delay gastric emptying. **Alcohol is a dehydrating beverage and should not be consumed for 24 hours prior to working in a hot environment.** Note that workers can check their hydration level by observing the color of their urine. Clear urine indicates adequate hydration. Yellow urine indicates the worker needs more water.

3.3. Sports Drinks. Under normal working conditions cool water alone provides adequate fluid replacement. With prolonged moderate to heavy work in hot and humid environments half strength mixes of electrolyte sports drinks provide additional benefit. [Attachment 6](#) contains guidelines for the use of sports drinks. Per AFI 65-601 (Vol 1), para. 4.45.6, Budget Guidance and Procedures, the local medical treatment facility commander or medically qualified representative must make a written

medical determination that sports drinks are necessary in order to use organizational O&M funds to procure them.

3.4. Salt. Some salt is lost through sweating. North American diets usually contain adequate amounts of salt and extra “salting” or supplements are not necessary. Salt tablets should not be used except under special operating environments when ordered by a physician.

3.5. Clothing. Wear loose fitting clothing, especially at the neck and wrist, to allow air circulation. Wear appropriate headgear. When exposed to the sun’s rays, cover yourself to prevent sunburn. When not exposed to the sun, consideration should be given to wearing the least allowable amount of clothing.

3.6. Work Schedules. Modify work schedules to perform the heaviest work in the coolest parts of the day. When working in hot environments, establish work/rest cycles as discussed in [Attachment 2](#), [Attachment 3](#), and [Attachment 4](#). Take rest breaks in cool, shaded areas.

3.7. Diet. Eat three meals a day, but avoid greasy, fatty, or heavy foods. See [Attachment 5](#).

3.8. Medical. Seek medical attention for illness or skin problems, including rashes. Refer to [Attachment 7](#).

3.9. Fitness. Physical fitness is key to avoiding heat illness. Physical training increases the body’s resistance to stresses such as metabolic and environmental heat. A fit person has better circulation and sweating mechanisms to cool the body. Workers should be encouraged to engage in strenuous physical training regimens IAW AFI 10-248, Fitness Program.

4. Heat Stress with MOPP Gear.

4.1. Background. Wearing Mission Oriented Protective Postures (MOPP) gear, firefighting gear, or similar restrictive/impermeable clothing increases the workload and metabolic heat production, while dramatically decreasing evaporative cooling.

4.2. Guidance. When wearing MOPP gear, add 10° F to the WBGT value and follow the guidance for corresponding category in [Attachment 2](#). For personnel wearing body armor in addition to their MOPP gear, another 5° F should be added, and the corresponding guidance adhered to. For example, if MOPP gear is being worn with a WBGT of 82° F (Category 2), the conditions would warrant the water intake and work/rest of a WBGT of 10° F higher, thus use the category that corresponds with 92° F (i.e. Category 5). Category 5 is the highest category--the category that requires a determination by the unit commander concerning which tasks are “mission essential”. Remote site measurement of the WBGT should be coordinated, when possible, through the 39 ABW/CP or 39 OS/OSW.

5. Forms. No forms are prescribed or adopted in this publication.

MICHAEL C. GARDINER, Colonel, USAF
Commander

Attachment 1

GLOSSARY OF REFERENCES AND SUPPORTING INFORMATION

References

AFI 91-301, *Air Force Occupational and Environmental*, 1 June 1996

Occupational Exposure to Hot Environments, NIOSH, 1986

AFP AM 48-151, *Thermal Injury*, 18 November 2002

Air Force Medical Operations Agency letter, *Role of Sports Drinks in Prevention of Dehydration and Heat Illness* (3 Jul 01)

AFP 91-216, *USAF Safety Deployment and Contingency Pamphlet*, 9 Aug 2001

AFI 65-601, Vol. 1, *Budget Guidance and Procedures*, 24 Dec 2002

AFI 10-248, *Fitness Program*, 1 Jan 2004

Fighter Index for Thermal Stress (FITS): Guidance for Hot-Weather Aircraft Operations, Aviation, Space, and Environmental Medicine, June 1979

Threshold Limit Values for Chemical substances and Physical Agents and Biological Exposure Indices, American Conference of Governmental Industrial Hygienists (ACGIH), 2003

Technical Note 91-3, *Heat Illness, a Handbook for Medical Officers* (ADA238974, June 91), US Army Research Institute of Environmental Medicine

Abbreviations and Acronyms

ACGIH—American Conference of Governmental Industrial Hygienists

AFI—Air Force Instruction

BEF—Bioenvironmental Engineering Flight

CP—Command Post

DBMS—Director, Base Medical Services

FITS—Fighter Index of Thermal Stress

IAB—Incirlik Air Base

IAW—In accordance with

MAX—Maximum

MOPP—Mission Oriented Protective Posture

OPR—Office of Primary Responsibility

TDY—Temporary Duty

WBGT—Wet Bulb Globe Temperature

Terms

Wet Bulb Globe Temperature (WBGT)—Index that takes into account the dry bulb (air temperature), wet bulb (relative humidity and evaporative effectiveness of the air and wind), and black globe (heating by direct rays of the sun) temperatures. Characterizes thermal stress personnel are exposed to in operational environments.

Fighter Index of Thermal Stress (FITS)—**FITS, developed by the USAF School of Aerospace Medicine, provides guidelines to ensure safe flying operations in hot weather. FITS is primarily designed to provide operational supervisors guidance to predict when cockpit environmental conditions during low-level missions may jeopardize aircrew performance. FITS takes into account relative humidity and temperature, and yields an estimate of cockpit thermal stress.**

Guidelines for Average Acclimatized Airmen Wearing BDU, Hot Weather^{1, 2, 4}

Heat Category	Temperature Range WBGT (° F)	EASY WORK		MODERATE WORK		HARD WORK	
		Work Rest	Water Intake	Work Rest	Water Intake	Work Rest	Water Intake
		Cycle	Qt/hr	Cycle	Qt/hr	Cycle	Qt/hr
1	78 - 81.9	No Limit	0.5	No Limit	0.75	40/20 min	0.75
2	82 - 84.9	No Limit	0.5	50/10 min	0.75	30/30 min	1.0
3	85 - 87.9	No Limit	0.75	40/20 min	0.75	30/30 min	1.0
4	88 - 89.9	No Limit	0.75	30/30 min	0.75	20/40 min	1.0
5*	>90	50/10 min	1.0	20/40 min	1.0	10/50	1.0

Guidelines for Average Unacclimatized Airmen Wearing BDU, Hot Weather^{1, 2, 4}

Heat Category / Flag Color ⁷	Temperature Range WBGT (° F)	EASY WORK		MODERATE WORK		HARD WORK	
		Work Rest Cycle	Water Intake Qt/hr ³	Work ⁴ Rest ⁵ Cycle	Water Intake Qt/hr	Work Rest Cycle	Water Intake Qt/hr
1	78 - 81.9	No Limit	0.5	50/10 min	0.75	30/30 min	0.75
2	82 - 84.9	No Limit	0.5	40/20 min	0.75	30/30 min	1.0
3	85 - 87.9	No Limit	0.75	30/30 min	0.75	20/40 min	1.0
4	88 - 89.9	50/10 min	0.75	20/40 min	0.75	10/50 min	1.0
5*	>90	40/20 min	1.0	10/50 min	1.0	Not allowed	Not applicable

¹These values will sustain performance and hydration for at least 4 hours of work in the specified heat categories.

²Wearing body armor adds 5 degrees F to the measured WBGT, thus increasing the heat category by 2 flag conditions.

³For all 3 work rates, individual water requirement may vary by +/- 0.25 qt/hr.

⁴When performing work/exercise with ground crew ensemble, fire-fighting gear or other similar restrictive or impermeable clothing arrangements should be made for remote site measurement of the WBGT and 10 degrees F added to the measurement before using tables 3 or 4. Add 15 degree WBGT if also wearing combat armor

⁵Rest means minimal physical activity, i.e. sitting or standing, accomplished in the shade if possible.

⁶Heat Category and WBGT can be obtained by calling the Command Post at 6-9920 or Base Weather at 6-6878.

⁷Flag colors will not be used at Incirlik Air Base to prevent confusion with alarm condition colors.

* When WBGT is Category 5, non-mission essential tasks should stop. Commanders/Unit Control Centers will decide mission essential tasks.

Reference: AFMOA/CC memo 3 Jul 01

EXAMPLES OF WORKLOAD DETERMINATION

EASY WORK	MODERATE WORK	HARD WORK
<ul style="list-style-type: none"> • Walking on hard surface @ 2.5 mph with \leq 30 lb load • Weapon Maintenance • Manual of Arms • Marksmanship Training • Drill Ceremony • Basic flight line maintenance actions (such as fuel servicing, pre/post flights, repairs, and normal weapons loading) 	<ul style="list-style-type: none"> • Walking on hard surface @ 3.5 mph with <40 lb load • Walking loose sand @ 2.5 mph with no load • Patrolling • Low crawl, high crawl • Defensive position construction • Field Assaults • High tempo flightline maintenance actions (such as red ball repairs, surge operations, combat turns) • Cargo loading / unloading 	<ul style="list-style-type: none"> • Walking on hard surface @ 3.5 mph with \geq 40 lb load • Walking on loose sand @ 2.5 mph with load

Reference: AFMOA/CC memo 3 Jul 01

Attachment 4**AIRCREW ACTIONS****Category 1 and 2** (WBGT 78° to 84.9° F)

- Increase awareness of heat stress indicators and water intake

Category 3 (WBGT 85° to 87.9° F)

- Maximum of two spares (three external preflights)
- Maximum of 90 minutes ground time (cumulative) before recovery period required
- One hour recovery between flights

Category 4 (WBGT 88° to 89.9° F)

- Maximum of one spare (two external preflights)
- Maximum of 90 minutes ground time (cumulative) before recovery period required
- Two hour recovery between flights

Category 5 (WBGT 90° F and above)

- Cease non-mission essential tasks
- No immediate spares
- Maximum of 45 minutes ground time (cumulative) before recovery period required
- One flight per day only

NOTES:

1. Unless otherwise stated, recovery/rest period is defined as a 20 minute period spent in an air conditioned environment while drinking cool water or sports drink.
2. Time spent in a cooled cockpit does not count toward recovery period unless aircraft is inside a shelter.
3. Personnel not acclimated to the area (less than 14 days on station) will take the precautionary measures of the next higher category.

Attachment 5

MAINTAINING PHYSICAL PERFORMANCE IN HOT ENVIRONMENTS

1. DRINK WATER (at rate recommended in [Attachment 2](#)).
2. The body uses water better in small amounts every 15 minutes rather than larger amounts at longer intervals.
3. Avoid dehydrating beverages: coffee, alcohol, and caffeinated soft drinks.
4. **Generally, clear urine indicates good hydration.** Dark yellow urine indicates inadequate hydration.
5. Replace salt by eating 3 balanced meals each day. Do not use salt tablets.
6. Use work/rest cycles (see [Attachment 2](#)). Rest areas should be shaded and in a cool area.
7. Acclimatization is gained by graded, progressively increasing work in the heat. Approximately 50% of acclimatization should occur by the end of the first week of heat exposure, and 78% by the end of the second week.

NOTE: Susceptibility to heat stress is increased by diarrhea, use of alcohol within 24 hours of work, lack of sleep or fatigue, obesity, dehydration, sunburn, poor physical condition, illness, and some medications. Risk is particularly increased by a history of prior heat injuries.

Attachment 6

HEAT EXHAUSTION/ HEAT STROKE SYMPTOMS AND FIRST AID

HEAT EXHAUSTION SYMPTOMS	FIRST AID:
<p>Early: headache, nausea, dizziness, muscle cramps, weakness.</p> <p>Later: profuse sweating, cold body, low thigh temperature, pale or moist face, weak and rapid pulse.</p>	<p>Remove to shaded area, loosen clothing, drink cool water, cool body with water.</p> <p>If symptoms do not resolve quickly, transport to hospital or call ambulance at 6-6666.</p>
<p>Vomiting and/or confusion.</p>	<p><u>IMMEDIATELY</u> remove uniform, spray with water, apply ice packs or cool towels if available, transport to hospital or call ambulance at 6-6666.</p>
HEAT STROKE SYMPTOMS	FIRST AID:
<p>Little or no sweating, hot body, high temperature, flushed and dry face, convulsion and unconsciousness.</p>	<p><u>IMMEDIATELY</u> remove uniform, spray with water, apply ice packs or cool towels if available, transport to hospital or call ambulance at 6-6666.</p>

Attachment 7**GUIDELINES FOR THE USE OF SPORTS DRINKS FOR FLUID REPLACEMENT**

(derived from AFMOA guidance - 3 Jul 01)

1. No particular brand of sports drink is recommended; however, the carbohydrate content should not exceed 15% prior to dilution. **Sports drinks should be diluted to half strength** (1 part water: 1 part beverage or 2 parts water: 1 part beverage powder) for optimal fluid replacement.
2. The half-strength sports drink **should be kept cool** (60-70° F) or shaded if possible. The beverage **must be disposed of after 8 hours if refrigerated, or within 4 hours if allowed to warm.** Sports drinks should not be added directly to canteens or bulk water storage (such as water buffaloes or tanks); they should be added to personal drinking cups or larger washable containers for group access. **Re-usable containers must be washed and sanitized at the end of every work shift**, as the sugar content can provide a good growth medium for bacteria. Unless they are in powdered form, undiluted portions of open sports drink containers should be refrigerated.
3. **Potable cool water must always be available and collocated with the sports drink.**