



Thermal Stress Tactics, Techniques, and Procedures (TTP)



Force Readiness Command
(FORCECOM)

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COAST GUARD TACTICS, TECHNIQUES, AND PROCEDURES 4-11.9

Subj: THERMAL STRESS

- Ref:
- (a) Safety and Environmental Health Manual, COMDTINST M5100.47 (series).
 - (b) Coast Guard Medical Manual, COMDTINST M6000.1 (series).
 - (c) American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, (current edition). ISBN: 978-1-607260-72-1.
 - (d) National Oceanic and Atmospheric Administration (NOAA) Heat Stress and Wind-chill Charts, NOAA.gov.
 - (e) Rescue and Survival Systems, COMDTINST M104701.10 (series).

1. PURPOSE. To provide and assist the Commanding Officer/ Officer in Charge (CO/OIC) along with Assistant Safety Officer/Manager in developing, and maintaining a Thermal Stress Program with Coast Guard tactics, techniques, and procedures (CGTTP) on management of the Thermal Stress Program.
2. ACTION. This CGTTP publication applies to assistant safety officer or managers. Internet release is authorized.
3. DIRECTIVES/TTP AFFECTED. None.
4. DISCUSSION. Thermal stress covers both heat and cold stress. All hands are responsible for recognizing the signs and symptoms of both heat and cold stress, and ensuring prompt medical attention is provided for affected persons.
5. DISCLAIMER. This guidance is not a substitute for applicable legal requirements, nor is itself a rule. It provides guidance for Coast Guard personnel and does not impose legally-binding requirements on any party outside the Coast Guard.
6. ENVIRONMENTAL ASPECT AND IMPACT CONSIDERATIONS. While developing this publication, Integrated Process Team (IPT) members examined environmental considerations under the National Environmental Policy Act (NEPA) and determined they are not applicable.

7. DISTRIBUTION. FORCECOM TTP Division posts an electronic version of this TTP publication to the CGTTP Library on CGPortal. In CGPortal, navigate to the CGTTP Library by selecting **References > Tactics, Techniques, and Procedures (TTP)**. FORCECOM TTP Division does not provide paper distribution of this publication.
8. RECORDS MANAGEMENT CONSIDERATIONS. Integrated Process Team (IPT) members thoroughly reviewed this publication during the TTP coordinated approval process and determined there are no further records scheduling requirements per Federal Records Act, 44 U.S.C. Chapter 31 § 3101 et seq., National Archives and Records Administration (NARA) requirements, and Information and Life Cycle Management Manual, COMDTINST M5212.12 (series). This publication does not have any significant or substantial change to existing records management requirements.
9. FORMS/REPORTS. None.
10. REQUEST FOR CHANGES. Submit recommendations for TTP improvements or corrections via email to FORCECOM-PI@uscg.mil or through the TTP Request form on CGPortal. In CGPortal, navigate to the TTP Request form by selecting **References > Tactics, Techniques, and Procedures (TTP) > TTP Request**.

Send lessons learned applicable to this TTP publication via command email to FORCECOM TTP Division at CMD-SMB-CG-FORCECOM.

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By Direction of Commander,
Force Readiness Command

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Chapter 1: Introduction

Introduction This chapter overviews the contents of this TTP publication. It also defines the use of notes, cautions, and warnings in TTP publications.

In This Chapter This chapter contains the following sections:

Section	Title	Page
A	Introduction	1-2
B	Notes, Cautions, and Warnings	1-3

Section A: Introduction

A.1. Introduction

Coast Guard operations frequently expose personnel to hot and cold climates. Thermal stressors can have physical and physiological effects on personnel. Units need to understand the work environment, be aware of the signs and symptoms of thermal stress, and if necessary, initiate appropriate medical attention. A Thermal Stress Program (TSP) can assess thermal conditions and reduce exposure risks.

Contact the Health, Safety, and Work-Life Service Center's Safety and Environmental Health Division (HSWL SC (se)) if the unit is unsure about the guidelines in this TTP.

A.2. Scope

This TTP assists the commanding officer, officer in charge (CO/OIC), and/or assistant safety officer or manager (ASO/M) in developing, implementing, and maintaining a Thermal Stress Program (TSP).

Section B: Notes, Cautions, and Warnings

B.1. Overview The following definitions apply to notes, cautions, and warnings found in TTP publications.

NOTE: **An emphasized statement, procedure, or technique.**

CAUTION: **A procedure, technique, or action that, if not followed, carries the risk of equipment damage.**

WARNING: *A procedure, technique, or action that, if not followed, carries the risk of personnel injury or death.*

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Chapter 2: Thermal Stress Program

Introduction

This chapter discusses how to develop a Thermal Stress Program and identifies the key components required for implementation.

In This Chapter

This chapter contains the following sections:

Section	Title	Page
A	Developing and Implementing a Thermal Stress Program	2-2
B	Evaluate Thermal Stress Program	2-3

Section A: Developing and Implementing a Thermal Stress Program

A.1. Elements of Thermal Stress Program

Follow the program elements below to manage the unit Thermal Stress Program:

- Identify thermal stress areas in manned spaces and operational environments.
- Measure thermal stress conditions.
- Use controls to reduce severity and duration of exposures.
- Report and document thermal stress casualties.
- Develop thermal stress training.

A.2. Develop Thermal Stress Program

Refer to the Thermal Stress Program unit instruction in [Appendix B](#) of this manual. To access a word document for editing, go to link <http://go.usa.gov/cx2CY>.

Required material and equipment are:

- Framework: The program template provides a framework to assist the safety officer in developing the unit Thermal Stress Program. Use instructions in red in the Thermal Stress Program template at <http://go.usa.gov/cx2CY> to fill out all the unit specific information.
- Equipment: QUESTemp Heat Stress Monitor (wet bulb globe temperature [WGBT] Meter). 3M Oconomowoc: 1060 Corporate Center Dr, Oconomowoc, WI 53066 – (262) 567- 9151. See [Appendix C](#).
- Attachments:
 - See [Appendix D](#) for sample Heat/Cold Stress Data Log.
 - See [Appendix E](#) for applicable Heat/Cold Stress Charts.

A.3. Implement Thermal Stress Program

The Thermal Stress Program goes into effect with the commanding officer's signature. Keep the unit program in a designated location. Place dry bulb thermometers in areas specified by the Thermal Stress Program.

Section B: Evaluate Thermal Stress Program

B.1. Evaluate and Review Thermal Stress Program

Review and update the unit Thermal Stress Program annually and make changes as necessary.

B.2. Annual Self-Evaluation of the Thermal Stress Program

Use the following steps to evaluate your unit's level of thermal stress:

1. Ensure annual calibration of the wet bulb global temperature (WGBT) meter.
 2. Complete the thermal stress self-evaluation checklist using the unit safety assessment tool (USAT) for thermal stress at the following link: <https://hswl.uscg.mil/kseUSAT/#>.
 3. Ensure personnel receive training to comply with the Thermal Stress Program initially and annually.
 4. Correct any existing problems with the unit Thermal Stress Program.
 5. If making corrections, have the CO/OIC sign the corrected unit Thermal Stress Program.
-

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Chapter 3: Thermal Stress Training

Introduction This chapter discusses the Thermal Stress Training Program.

In This Chapter This chapter contains the following section:

Section	Title	Page
A	Thermal Stress Training Program	3-2

Section A: Thermal Stress Training Program

A.1. Thermal Stress Training

All unit personnel who might be exposed to thermal stress must receive training initially and annually. Use the Thermal Stress Training PowerPoint template: <http://go.usa.gov/362sT> to guide training. Cover the following topics during training:

1. Environmental factors and conditions that lead to thermal stress.
 2. Recognition of thermal injuries.
 3. Procedures for thermal stress monitoring.
 4. Prevention of thermal injuries.
 5. Components of the unit Thermal Stress Program.
-

A.2. Equipment Training

Ensure all personnel performing thermal stress (heat and cold) monitoring receive training on using the equipment based on the manufacturer's guidelines. See [Appendix C](#) for a link to the manufacturer's guidelines.

A.3. Supervisors

Before supervising personnel working in thermal areas, supervisors must have the following additional training:

1. Implementing the applicable provisions of this section.
 2. Recognizing employees with signs or symptoms of possible thermal injury.
 3. Responding to an emergency.
-

Appendix A: Glossary and Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists.
APECS	All Purpose Environmental Clothing System.
ASO/M	Assistant Safety Officer/Manager.
Calibration	To determine, check, or rectify the graduation of any instrument giving quantitative measurements. Determining an instrument's accuracy, usually by measuring its variation from standard, to ascertain necessary correction factors.
CO	Commanding officer.
DB	Dry-bulb.
Dry bulb temperature (DBT)	The dry-bulb temperature (DBT) is the air temperature measured by a standard thermometer freely exposed to the air but shielded from radiation and moisture.
GT	Global temperature. The temperature inside a blackened, hollow, thin copper globe.
HSWL	Health Safety and Work-Life.
IDHS	Independent duty health service technician.
NOAA	National Oceanic and Atmospheric Administration.
Physiological	The basic processes underlying a species' or class of organism's function, or any of its parts or processes.
ODU	Operational dress uniform.
OEL	Occupational exposure limit.
OIC	Officer in charge.

ORM	Operational risk management.
QUESTemp	A type of manufacturer brand name.
Scullery space	A small room or section of a pantry in which dirty dishes, pots, and pans are lined up to be cleaned.
SE	Safety and environmental.
Stay times	The recommended amount of time employee can safely work in a moderate to high heat stress environment, based on environmental conditions such as type of clothing worn, individual health, and metabolism.
Thermal stress	Defines all heat and cold stress conditions and related areas.
TSP	Thermal Stress Program.
USAT	Unit safety assessment tool.
VB	Vapor barrier.
WB	Wet-bulb.
Wet-bulb global temperature meter (WBGT)	Meter used to measure heat stress conditions and to determine ACGIH occupational exposure limit (OEL).
W/R	Work/rest.

Appendix B: Thermal Stress Program Template

U.S. Department of
Homeland Security

United States
Coast Guard



Commanding Officer
(Insert unit specific information here)

(Unit specific information goes
here)

(UNITABREV)INST####
DATE DD MONTH YY

(FULL UNIT NAME SPELLED OUT) INSTRUCTION ####

Subj: THERMAL STRESS PROGRAM

- Ref:
- (a) Safety and Environmental Health Manual, COMDTINST M5100.47 (series).
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 - (d) National Oceanic and Atmospheric Administration (NOAA) Heat Stress and Wind-chill Charts, NOAA.gov.
 - (e) Rescue and Survival Systems, COMDTINST M104701.10 (series).
 - (f) Thermal Stress Tactics, Techniques, and Procedures, CGTTP 4-11.9.

This template is an aid for units writing a Thermal Stress Program. Replace red italicized text with unit specific information, or delete it. Units are responsible for ensuring that directives comply with the Coast Guard Directives System COMDTINST M5215.6 (series).

1. PURPOSE. This instruction establishes general procedures, policies, and responsibilities for management of the Thermal Stress Program for *(Unit name)*.
2. ACTION. The assistant safety officer/manager for this program is designated on *(Unit Name)*'s collateral duties list. The assistant safety officer/ manager develops, implements, and maintains the Thermal Stress Program by using references (a) through (e) for policy guidance and reference (f) for procedural guidance.

(Include any additional tasking statements here)
3. DIRECTIVES AFFECTED. None.
4. BACKGROUND. Coast Guard personnel can be exposed to hot and cold climates. It is the policy of *(Unit Name)* to understand the working environment of their personnel, to know the signs and symptoms of thermal stress, to prevent thermal stress, and if necessary, to give appropriate medical attention for themselves or others. These thermal stressors can have physical and physiological effects on personnel exposed to hot and cold climates. The policy of *(Unit Name)* requires reference (a) be followed in its Thermal Stress Program. References (b) through (f) add program guidance from reference (a). When guidance conflicts, the most stringent guidance must be used. This instruction defines unit specific roles and responsibilities and program requirements to address the *(Unit Name)* Thermal Stress Program, and provides the framework to assess the thermal conditions that reduce exposure risks.
5. DISCLAIMER. This guidance is not a substitute for applicable legal requirements, nor is it a rule. It is intended to provide operational guidance for Coast Guard personnel and is not intended to nor does it impose legally-binding requirements on any party outside the Coast Guard.
6. MAJOR CHANGES. *(Include in this paragraph a description of any changes to the unit Thermal Stress Program following annual review. If this is a new Thermal Stress Program, or there are no changes to the Thermal Stress Program, delete this paragraph.)*

7. IMPACT ASSESSMENT. *(This is a required paragraph when assigning new tasking. See section G on page A-5 of The Coast Guard Directives System COMDTINST M5215.6G for guidance on this section. Only develop this section after enclosure 1 is finished in order to have a complete understanding of the scope of the unit Thermal Stress Program.)*
 - a. Personnel Resources Required: *(required sub paragraph)*
 - b. Training Required: *(required sub paragraph)*
 - c. Funding: *(occasionally necessary sub paragraph)*
8. ENVIRONMENTAL ASPECT AND IMPACT CONSIDERATIONS. While developing this publication, Integrated Process Team (IPT) members examined environmental considerations under the National Environmental Policy Act (NEPA) and determined they are not applicable.
9. DISTRIBUTION. No paper distribution will be made of this instruction. An electronic version is on the following *(Unit Name)* Web site. Internet: *(insert hyperlink here, if applicable.)* and CGPortal: *(insert hyperlink here.)*
10. PROCEDURE. The assistant safety officer/manager implements and maintains documentation of the Thermal Stress Program in a file that includes this instruction and all other program documents. *(Name of assistant safety officer/manager)* is the unit assistant safety officer/manager. The assistant safety officer/manager will implement and administer the Thermal Stress Program per reference (a), Safety and Environmental Health Manual, COMDTINST M5100.47 (series), reference (c), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, (current edition). ISBN: 978-1-607260-72-1, and reference (d), National Oceanic and Atmospheric Administration (NOAA) Heat Stress and Wind-chill Charts, NOAA.gov as appropriate.
11. RECORDS MANAGEMENT CONSIDERATIONS. This instruction has been thoroughly reviewed during the directives clearance process, and there are no further records scheduling requirements, per the Federal Records Act, 44 W.S.C 3101 et seq., NARA requirements, and Information and Life Cycle Management Manual, COMDTINST M5212.12 (series). This policy does not have any significant or substantial change to existing records management requirements.
12. FORMS/REPORTS. None.
13. REQUEST FOR CHANGES. *(Inform the reader how to submit recommended changes (provide an organizational email address, FAX number, and/or the complete command mailing address.)*

CO's NAME IN ALL CAPS
CO's Rank, U.S. Coast Guard
Unit Name

Encl: (1) Unit Thermal Stress Program Elements

Enclosure (1) to *(Unit Name)* Thermal Stress Program, INST #####

_____ *(insert name of person responsible)* is responsible for this program. Guidance is in reference (a), Safety and Environmental Health Manual, COMDTINST M5100.47 (series), reference (b), Medical Manual, COMDTINST M6000.1 (series), and reference (c), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, (current edition).

NOTE:

Contact Commandant (CG 1121) within 24 hours for cold weather injuries, or heat illness per reference (b), Coast Guard Medical Manual, COMDTINST M6000.1 (series). Report instances of personnel casualties resulting from excessive heat exposure as prescribed in Chapter 3 of reference (a), Safety and Environmental Health Manual, COMDTINST M5100.47A.

I. General Information for Assessing Thermal Stress Conditions

1. Thermal stress includes both heat stress and cold stress. All hands are responsible for recognizing the signs and symptoms of both types of stress, and giving prompt medical attention for affected persons.
2. Heat stress is any combination of elevated air temperature, thermal radiation, high humidity, low air flow, and work load that influences the regulation of body temperature. Heat stress becomes excessive when the body's capability to respond is exceeded, leading to an increase in body temperature. Heat stress can result in fatigue, severe headache, nausea, and poor physical and mental performance. If body temperature continues to increase due to prolonged exposure, heat illnesses may occur (e.g., heat exhaustion or heat stroke, a severe impairment of the body's temperature-regulating ability). These reactions can be life threatening if not immediately and properly treated.
3. Cold stress is a condition that occurs when the body cannot maintain normal body temperature due to exposure to cold climates or submersion in water cooler than normal body temperature. These exposures remove body heat and decrease body temperature. The human body maintains a constant core temperature of 98.6 degrees Fahrenheit (37 degrees Celsius). When the body loses more heat than it gains or can produce, it goes into a state of hypothermia or low body temperature. Excessive cold stress degrades physical performance, significantly impacts morale, and eventually causes cold casualties. Cold stress environments includes exposure to extremely low temperatures (for example, Arctic regions), and cold-wet exposures (for example, rain and immersion) in warmer ambient temperatures. Low air temperature, high humidity/rain/immersion, little thermal radiation, and higher air movement are all causes of environmental cold stress.

II. ACTION The following supportive elements must be implemented:

1. All unit personnel must:
 - (1) Assess the risk of each evolution, operation, or duty period to the risks associated with thermal stress. This should include outdoors and manned indoor spaces that involve mechanical processes that generate excessive heat or cold.
 - (2) Ensure unit incorporates a Thermal Stress Program into Operational Risk Management (ORM) procedures. Use ORM to determine safe working temperatures to prevent hazardous thermal stress work conditions.

- (3) Evaluate thermal work conditions by determining temperature and wind chill for cold work environments, and the humidity and temperature for hot work environments.
- (4) Refer to the charts in Appendix E for guidance on how long employees can work under the thermal conditions in the work areas.
- (5) Employ administrative controls for employee work cycles, for example work-rest periods (25/75, 50/50, or 75/25 rest/work/ratios), especially for work in more extreme temperatures.
- (6) Use reference (e), Rescue and Survival Systems, COMDTINST M104701.10 (series), to determine appropriate cold weather survival garments whenever there is a risk of immersion in water.

2. Assessing Thermal Stress Conditions

a. Use a WBGT meter to monitor thermal stress work conditions for both hot and cold environments.

b. Dry Bulb Temperature

- (1) The dry-bulb temperature (DBT) is the temperature of air measured by a thermometer freely exposed to the air but shielded from radiation and moisture. DBT is the temperature that is usually thought of as air temperature and is measured using a standard thermometer located in a dry shady area.
- (2) At a minimum, all work areas with potential to put thermal stress on personnel should measure dry bulb temperature. Mount thermometers so that the bulb of the thermometer is not next to local heat sources. Mount the thermometers in areas like the main machinery, main engine room, auxiliary machinery, laundry, and scullery.
- (3) Record dry bulb temperatures every 4 hours at a minimum. Record these readings on a locally prepared form or use the form in Appendix D of reference (e), Thermal Stress Tactics, Techniques, and Procedures, CGTTP 4-11.9.
- (4) Measure the dry bulb temperature when these levels are exceeded:
 - Outdoors - if above 80 degrees Fahrenheit or below 50 degrees Fahrenheit.
 - Indoors – if above 100 degrees Fahrenheit or below 50 degrees Fahrenheit.

c. Wet Bulb Globe Temperature (WBGT) index

- (1) The WBGT index is a composite temperature used to estimate the effect of ambient temperature, relative humidity, wind speed (wind chill), and other solar radiation on humans. Use WBGT index to help develop appropriate exposure levels to extreme temperatures.
- (2) Calibrate and operate WBGT meters according to manufacturer's standards.
- (3) WBGT meters are used to determine the stay time, or work/rest ratio. Follow procedures in reference (c), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, (current edition) and Appendix C of reference (e), Thermal Stress Tactics, Techniques, and Procedures, CGTTP 4-11.9.

d. Units without a WBGT meter

- (1) Use general temperature and relative humidity thermometers to determine the heat index in work areas.
- (2) Use temperature and wind speed to determine cold stress outside. See the National Oceanic

and Atmospheric Administration (NOAA) heat/cold stress charts located in Appendix E of reference (f), Thermal Stress Tactics, Techniques, and Procedures, CGTTP 4-11.9.

- (3) Use a thermometer to determine the cold stress conditions inside. See the ACGIH reference (c), American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, (current edition). ISBN: 978-1-607260-72-1.

3. Heat Stress

- (1) Identify manned spaces with a potential for heat stress conditions, i.e., those manned spaces having a dry bulb temperature exceeding 100 degrees Fahrenheit at anytime or when outside temperatures are greater than 80 degrees Fahrenheit. The assistant safety officer/manager will determine which spaces require constant monitoring.
- (2) In those identified areas and spaces, measure heat stress using a WBGT meter (follow manufacturer guidelines), and record measurements on the heat stress data log (see Appendix D).
- (3) Determine personnel exposure durations when required using guidelines in reference (d), ACGIH Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, (current edition).
- (4) Perform necessary controls to reduce heat stress.

4. Acclimatization

- (1) For personnel who are unseasoned climatically or physically to a new location, limit the time and intensity of the activity in physical training programs.
- (2) Acclimatization varies between individuals, some taking longer than others to acclimate.
- (3) Give unseasoned Coast Guard personnel a minimum of seven days to acclimate.
- (4) During this period, progressively increase work area thermal stress conditions exposure and physical activity levels.
- (5) Resting in the heat rather than doing cardiovascular type of work will result in only partial acclimatization.
- (6) Depending upon prior medical conditions (e.g. prescription medications) or pre-dispositions (e.g. prior heat injuries), the acclimatization period may need to be more than seven days. First-line supervisors should be aware of their personnel's ability to acclimate in hot conditions, and adjust the work schedules as appropriate.
- (7) If the mission requires immediate and significant physical work that precludes the minimum seven day acclimatization period, do the following:
 - Schedule the physical work activity during cooler periods of the day (morning, early evening, or night);
 - Establish a work/rest schedule with increasingly longer work periods each day with an alternating rest period; and
 - Continue to enforce minimum drinking water consumption at half a quart per hour.

5. Cold Stress

- (1) Identify work areas that have the potential for cold stress conditions, i.e. areas that have a dry bulb temperature less than 50 degrees Fahrenheit. The assistant safety officer/manager

(ASO/M) should monitor thermal conditions during all evolutions that have a risk of a cold stress injury. List all spaces where constant monitoring is measured:

(ex: Refer) _____

(add more spaces as necessary) _____

- (2) Determine personnel exposure durations when required using guidelines in reference (c), ACGIH Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices, (current edition) or unless operational requirements dictate otherwise.
- (3) Provide warming facilities.

III. TRAINING Thermal stress training is conducted with new personnel, annually, and as needed to ensure personnel understand the symptoms of heat and cold stress, preventive measures, and appropriate actions per reference (c), Thermal Stress Tactics, Techniques, and Procedures, CGTTP 4-11.9. Independent Duty Health Service Technician (IDHS) and supervisors are trained on how to assess the thermal stress risks of each evolution, operation, or duty period. Monitors must have a general understanding of the information contained in this manual and the WBGT meter technical manual. Use Thermal Stress Training PowerPoint template <http://go.usa.gov/362sT>, located in reference (c), and tailor it to your unit's unique missions and needs.

IV. THERMAL STRESS HAZARDOUS EQUIPMENT/AREAS/TASKS.

1. Unit *(insert name here)* has identified the following equipment, areas, and /or tasks as thermal stress hazardous.
 - a. *(Insert equipment/areas/tasks at the unit workplaces that require monitoring).*
2. *The above program elements are required per reference (a), Safety and Environmental Health Manual, COMDTINST M5100.47 (series). They cannot be altered, but units can add to them to meet the needs of the unit specific Thermal Stress Program. Add any unit specific program requirements by continuing the list at number 3. Add additional features to the mandatory program requirements by appending the lists above.*

Appendix C: WBGT Meter Equipment

C.1. WBGT Meter

The basic instrument for assessing heat stress is the wet bulb global temperature (WBGT) meter, which measures the dry-bulb, wet-bulb, and globe temperatures, and integrates these values into the WBGT Index. The WBGT meter is small, lightweight and portable. The user's manual gives instructions on assembly and operation. Present procurement planning for these meters is based on the assignment of one meter per cutter with manned spaces that exceed 100 degrees Fahrenheit dry-bulb temperature. The National Stock Numbers (NSN) for the WBGT meter and replacement parts are:

- RSS-220 Meter - 7H6685-01-055-5298.
- Globe Assemblies - 9G-6685-01-055-5299.
- Standard Nickel-Cadmium Rechargeable AA Batteries - 9G-6140-00-905-1579.

C.2. WBGT Index

The WBGT meter displays the following environmental data:

- Shielded, ventilated dry-bulb (DB) temperature.
- Shielded, ventilated wet-bulb (WB) temperature.
- Globe temperature (GT) - a value that integrates radiant temperature and convective heat loss or gain--that is, the cooling or heating effects of air movement.

C.3. Using the WBGT Meter

Use the WBGT in the American Conference of Governmental Industrial Hygienists (ACGIH) mode. In this mode, the screen displays stay times, and needs no calculations. Use the manufacturer's instructions to ensure you are in the proper mode. The instructions are found here: <http://www.raeco.com/products/heatstress/questemp3x.html>

C.4. Calibration and Repair

Calibrate heat stress meters annually. Follow manufacturer's guideline for calibration and repair.

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Appendix D: Sample Heat/Cold Stress Data Log

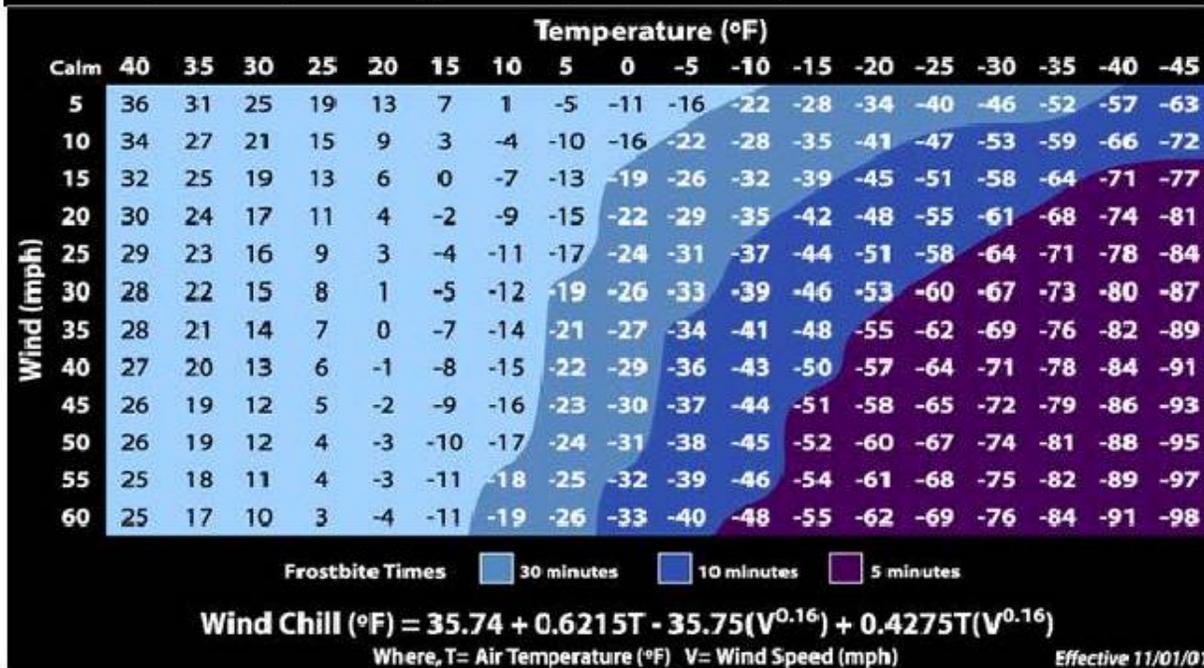
Heat Stress Data Log																
Unit:		_____														
Location:		_____														
Date	Time	Dry Bulb (DB)	Wet Bulb (WB)	Globe (GT)	WBGT	Work/Rest Time										
	0000															
	0200															
	0400															
	0600															
	0800															
	1000															
	1200															
	1400															
	1600															
	1800															
	2000															
	2200															
Manual Calculation: To be done each time the WBGT is used. <table border="1" style="margin: 5px auto; border-collapse: collapse;"> <tr><td>.1 x DB =</td><td> </td></tr> <tr><td>.7 x WB =</td><td> </td></tr> <tr><td>.2 x GT =</td><td> </td></tr> <tr><td>WBGT =</td><td>Sum =</td></tr> </table>									.1 x DB =		.7 x WB =		.2 x GT =		WBGT =	Sum =
.1 x DB =																
.7 x WB =																
.2 x GT =																
WBGT =	Sum =															
Heat Stress Exposure Limits																
WBGT Values (C/F)																
Work Demands	Threshold Limit (Reduce work & demands)				Action Limit (Initiate Controls)											
	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy								
100% Work	31/88	28/82.5	-	-	28/82.5	25/77	-	-								
75% Work, 25% Rest each hour	31/88	29/84.5	27.5/81.5	-	28.5/83.5	26/79	24/75.5	-								
50% Work, 50% Rest each hour	32/90	30/86	29/84.5	28/82.5	29.5/85	27/81	25.5/78	24.5/76								
25% Work, 75% Rest each hour	32.5/90.5	31.5/89	30.5/87	30/86	30/86	29/84.5	28/82.5	27/81								
Source:	ACGIH 2014															
Authorized Official: _____																
Tile, Printed Name, Signature, and Date																

Cold Stress Data Log

Unit: _____

Location: _____

Date	Time	Dry Bulb (F)	Wind Speed (mph)	Equivalent Chill Temperature (F)	Work/Rest Time
	0000				
	0200				
	0400				
	0600				
	0800				
	1000				
	1200				
	1400				
	1600				
	1800				
	2000				
	2200				



Authorized Official: _____

Tile, Printed Name, Signature, and Date

Appendix E: Heat/Cold Stress Charts

NOAA's National Weather Service

Heat Index

Temperature (°F)

	80	82	84	86	88	90	92	94	96	98	100	102	104	106	108	110
40	80	81	83	85	88	91	94	97	101	105	109	114	119	124	130	136
45	80	82	84	87	89	93	96	100	104	109	114	119	124	130	137	
50	81	83	85	88	91	95	99	103	108	113	118	124	131	137		
55	81	84	86	89	93	97	101	106	112	117	124	130	137			
60	82	84	88	91	95	100	105	110	116	123	129	137				
65	82	85	89	93	98	103	108	114	121	128	136					
70	83	86	90	95	100	105	112	119	126	134						
75	84	88	92	97	103	109	116	124	132							
80	84	89	94	100	106	113	121	129								
85	85	90	96	102	110	117	126	135								
90	86	91	98	105	113	122	131									
95	86	93	100	108	117	127										
100	87	95	103	112	121	132										

Likelihood of Heat Disorders with Prolonged Exposure or Strenuous Activity

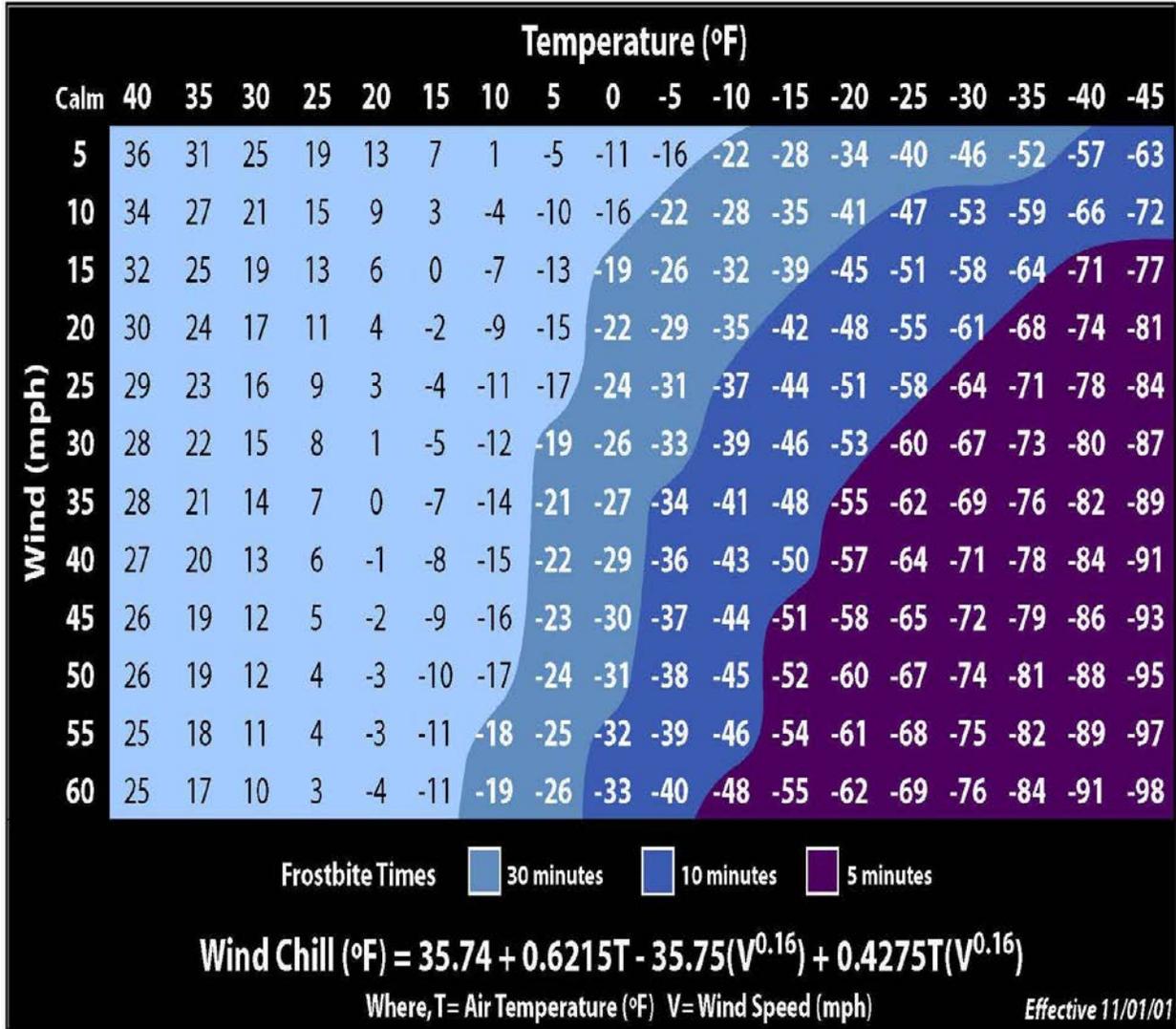
- Caution
 Extreme Caution
 Danger
 Extreme Danger

Heat Injury Prevention Measures Using NOAA Heat Index

	Work/Rest	Water Consumption Requirement
White Conditions	Light Activity: Continuous	Light Activity: ¼ quart(1 cup) per hour
	Moderate Activity: Continuous	Moderate Activity: ¼ quart(1 cup) per hour
	Heavy Activity: Continuous	Heavy Activity: ¼ quart(1 cup) per hour
Yellow Condition (Caution)	Light Activity: 55 min Work/5 min Rest	Light Activity: ¼ quart(1 cup) per hour
	Moderate Activity: 50 min Work/10 min Rest	Moderate Activity: ½ quart(2 cups) per hour
	Heavy Activity: 45 min Work/15 min Rest	Heavy Activity: ¾ quart(3 cups) per hour
Orange Condition (Danger)	Light Activity: 50 min Work/10 min Rest	Light Activity: ½ quart(2 cups) per hour
	Moderate Activity: 45 min Work/15 min Rest	Moderate Activity: ¾ quart(3 cups) per hour
	Heavy Activity: 30 min Work/30 min Rest	Heavy Activity: 1 quart(4 cups) per hour
Red Condition (Extreme Danger)	Light Activity: 45 min Work/15 min Rest	Light Activity: ¾ quart(3 cups) per hour
	Moderate Activity: 30 min Work/30 min Rest	Moderate Activity: 1 quart(4 cups) per hour
	Heavy Activity: 15 min Work/45 min Rest	Heavy Activity: 1-1/2 quarts(4.5 cups) per hour



Wind Chill Chart



Preventive Measures to decrease frostbite risk	
Frostbite Risk Level	Preventive Measures
Low	<input type="checkbox"/> Recommended W/R cycle: 50 minutes work/10 minutes warming <input type="checkbox"/> Increase surveillance with self and buddy checks. <input type="checkbox"/> Wear appropriate layers and wind protection for the work intensity. <input type="checkbox"/> Cover exposed flesh if possible. <input type="checkbox"/> Wear VB boots below 0 °F. <input type="checkbox"/> Provide warming facilities below 20 °F. <input type="checkbox"/> Avoid sweating.
High (30 Minutes Frostbite Time)	<input type="checkbox"/> Recommended W/R cycle: 40 minutes work/20 minutes warming <input type="checkbox"/> Mandatory buddy checks every 20–30 minutes. <input type="checkbox"/> Wear appropriate layers and APECS. Protect head, face and hands. <input type="checkbox"/> Cover exposed flesh. <input type="checkbox"/> Wear VB boots below 0 °F. <input type="checkbox"/> Provide warming facilities. <input type="checkbox"/> Avoid sweating.
Severe (10 Minutes Frostbite Time)	<input type="checkbox"/> Recommended W/R cycle: 30 minutes work/30 minutes warming <input type="checkbox"/> Mandatory buddy checks every 10 minutes. <input type="checkbox"/> Wear appropriate layers and APECS or cold weather parka. Protect head, face and hands. <input type="checkbox"/> Wear VB boots. <input type="checkbox"/> Provide warming facilities. <input type="checkbox"/> Work groups of no less than two personnel. <input type="checkbox"/> No exposed skin. <input type="checkbox"/> Stay active. <input type="checkbox"/> Avoid sweating.
Extreme (5 Minutes Frostbite Time)	<input type="checkbox"/> Mission critical work only due to extreme risk. (frostbite time = 5 minutes). <input type="checkbox"/> Keep task duration as short as possible. <input type="checkbox"/> Wear appropriate layers, cold weather parka and wind protection. Protect head, face and hands. <input type="checkbox"/> Wear VB boots. <input type="checkbox"/> Provide warming facilities. <input type="checkbox"/> Work groups of no less than two personnel. <input type="checkbox"/> No exposed skin. <input type="checkbox"/> Stay active. <input type="checkbox"/> Avoid sweating.

Notes: Work/Rest (W/R), Vapor Barrier (VB), All Purpose Environmental Clothing System (APECS)

Work/Warm Up Schedule for a 4-hour Shift											
Air Temperature Sunny Sky (Dry Clothes)		No Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
		Max Work Period	No. of Breaks								
Deg C	Deg F	Period	Breaks								
-26 to -28	-15 to -19	(Norm. Breaks) 1		(Norm. Breaks) 1		75 min	2	55 min	3	40 min	4
-29 to -31	-20 to -24	(Norm. Breaks) 1		75 min	2	55 min	3	40 min	4	30 min	5
-32 to -34	-25 to -29	75 min	2	55 min	3	40 min	4	30 min	5		
-35 to -37	-30 to -34	55 min	3	40 min	4	30 min	5				
-38 to -39	-35 to -39	40 min	4	30 min	5						
-40 to -42	-40 to -44	30 min	5					Non emergency work should cease		Non emergency work should cease	
-43 & below	-45 & below	Non emergency work should cease									

*Source: ACGIH, 2014

Recommended Criteria for Heat Stress Exposure (Acclimated)

Heat Cat/Flag Color	WBGT (F)	LIGHT WORK		MODERATE WORK		HEAVY WORK	
		Work Rest Cycle	Water Intake Qt/hr	Work Rest Cycle	Water Intake Qt/hr	Work Rest Cycle	Water Intake 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

- a. For all 3 work rates, individual water requirement may vary by +/- 0.25 qt/hr.
- b. Rest means minimal physical activity, i.e. sitting or standing, accomplished in the shade if possible.
- c. Adjust WBGT based on clothing:

Clothing Type	Addition to WBGT (F)
Working Clothes (long sleeve shirt/pants, ODU, Coveralls)	0
Double-layer woven clothing (Firefighting Gear)	5
Polyolefin Coveralls (Tyvek Suit)	2
Limited-use vapor-barrior coveralls (Hazmat Gear)	20

UNCLASSIFIED//SENSITIVE SECURITY INFORMATION

CGTTP 4-11.9
Thermal Stress TTP

Permissible Heat Exposures and Workload Determination

Heat Stress Exposure Limits

WBGT Values (C/F)

Work Demands	Threshold Limit (Reduce work & demands)				Action Limit (Initiate Controls)			
	Light	Moderate	Heavy	Very Heavy	Light	Moderate	Heavy	Very Heavy
100% Work	31/88	28/82.5	-	-	28/82.5	25/77	-	-
75% Work, 25% Rest each hour	31/88	29/84.5	27.5/81.5	-	28.5/83.5	26/79	24/75.5	-
50% Work, 50% Rest each hour	32/90	30/86	29/84.5	28/82.5	29.5/85	27/81	25.5/78	24.5/76
25% Work, 75% Rest each hour	32.5/90.5	31.5/89	30.5/87	30/86	30/86	29/84.5	28/82.5	27/81

Source: ACGIH 2014

Work Demands Categories:

Examples:

Light	Sitting with light manual work, standing with light arm work, walking
Moderate	Moderate hand, arm, leg work. Light pushing/pulling. Walking with load
Heavy	Intense hand, arm, leg work. Heavy pushing/pulling. Fast pass/increase load
Very Heavy	Very intense activity at fast to max pace

Index

No index entries found.