### WBGT Reference Guidelines

**Heat Category**
- **1** WHITE
- **2** GREEN
- **3** YELLOW
- **4** RED
- **5** BLACK

<table>
<thead>
<tr>
<th>Heat Category</th>
<th>WBGT Index (°F)</th>
<th>Easy Work (250 W)</th>
<th>Moderate Work (425 W)</th>
<th>Hard Work (600 W)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 WHITE</td>
<td>78-81.9</td>
<td>No limit on work, ½ qt water/hour</td>
<td>No limit on work, ¾ qt water/hour</td>
<td>40/20 Work/Rest ratio, ¾ qt water/hour</td>
</tr>
<tr>
<td>2 GREEN</td>
<td>82-84.9</td>
<td>No limit on work, ½ qt water/hour</td>
<td>50/10 work/rest ratio, ¾ qt water/hour</td>
<td>30/30 min work/rest ratio, 1 qt water/hour</td>
</tr>
<tr>
<td>3 YELLOW</td>
<td>85-87.9</td>
<td>No limit on work, ¾ qt water/hour</td>
<td>40/20 Work/Rest ratio, ¾ qt water/hour</td>
<td>30/30 min work/rest ratio, 1 qt water/hour</td>
</tr>
<tr>
<td>4 RED</td>
<td>88-89.9</td>
<td>No limit on work, ¾ qt water/hour</td>
<td>30/30 work/rest ratio, ¾ qt water/hour</td>
<td>20/40 work/rest ratio, 1 qt water/hour</td>
</tr>
<tr>
<td>5 BLACK</td>
<td>&gt;90</td>
<td>50/10 work/rest ratio, 1 qt water/hour</td>
<td>20/40 work/rest ratio, 1 qt water/hour</td>
<td>10/50 work/rest ratio, 1 qt water/hour</td>
</tr>
</tbody>
</table>

**TB Med 507 Notes**
- The work/rest times and fluid replacement volumes will sustain performance and hydration for at least 4 hours of work in the specified heat category. Fluid needs can vary based on individual differences (±1/4 qt/hr) and exposure to full sun or full shade (±1/4 qt/hr).
- **No limit:** No limit equals no limit to work time per hour (up to 4 continuous hours).
- Rest means minimal physical activity (sitting or standing), accomplished in shade if possible.
- **CAUTION:** Hourly fluid intake should not exceed 1 ½ qt.
- Daily fluid intake should not exceed 12 qts.
- Work/rest and water consumption table applies to average sized, heat-accustomed soldier wearing ACU, hot weather. (See TB MED 507 for further guidance.)
- If wearing body armor, add 5° F to WBGT in humid climates.
- If wearing NBC clothing (mission-oriented protective posture (MOPP 4)), add 10° F to WBGT index for easy work, and 20°F to WBGT for moderate and hard work.

**ACGIH Guidelines**

<table>
<thead>
<tr>
<th>Work Load (WBGT °F)</th>
<th>Light</th>
<th>Moderate</th>
<th>Heavy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Continuous work</td>
<td>86°</td>
<td>80°</td>
<td>77°</td>
</tr>
<tr>
<td>75% work, 25% rest, each hour</td>
<td>87°</td>
<td>82°</td>
<td>78°</td>
</tr>
<tr>
<td>50% work, 50% rest, each hour</td>
<td>89°</td>
<td>85°</td>
<td>82°</td>
</tr>
<tr>
<td>25% work, 75% rest, each hour</td>
<td>90°</td>
<td>88°</td>
<td>86°</td>
</tr>
</tbody>
</table>

**WBGT Correction Factors in °C**

<table>
<thead>
<tr>
<th>Clothing Type</th>
<th>Clo* value</th>
<th>WBGT correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Summer lightweight working clothes</td>
<td>0.6</td>
<td>0</td>
</tr>
<tr>
<td>Cotton coveralls</td>
<td>1.0</td>
<td>-2</td>
</tr>
<tr>
<td>Winter work clothing</td>
<td>1.4</td>
<td>-4</td>
</tr>
<tr>
<td>Water barrier, permeable</td>
<td>1.2</td>
<td>-6</td>
</tr>
</tbody>
</table>

*Clo: insulation value of clothing. One clo = 5.55kcal/m2/hr of heat exchange by radiation and convection for each degree C difference in temp between the skin and the adjusted dry bulb temp. American Conference of Governmental Industrial Hygienists (ACGIH). 1992-1993 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices. Cincinnati: American Conference of Governmental Industrial Hygienists.

**NATA Guidelines**

<table>
<thead>
<tr>
<th>WBGT (°F)</th>
<th>Activity Guidelines and Rest Break Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt;82.0</td>
<td>Normal activities: provide ≥3 separate rest breaks of minimum duration 3 min each during workout.</td>
</tr>
<tr>
<td>82.0-86.9</td>
<td>Use discretion for intense or prolonged exercise. Watch at-risk players carefully. Provide ≥3 separate rest breaks of minimum duration 4 min each.</td>
</tr>
<tr>
<td>87.0-89.9</td>
<td>Maximum practice time = 2 h. For football: players restricted to helmet, shoulder pads, and shorts during practice. All protective equipment must be removed for conditioning activities. For all sports: provide ≥4 separate rest breaks for minimum duration 4 min each.</td>
</tr>
<tr>
<td>90.0-92.0</td>
<td>Maximum length of practice = 1 h. No protective equipment may be worn during practice and there may be no conditioning activities. There must be 20 min of rest breaks provided during the hour of practice.</td>
</tr>
<tr>
<td>&gt;92.1</td>
<td>No outdoor workouts, cancel exercise, delay practices until a cooler WBGT reading occurs.</td>
</tr>
</tbody>
</table>


**HIGH SCHOOL STATE GUIDELINES**

The following states have their own WBGT guidelines for high school athletics:
- Georgia
- North Carolina
- Illinois
- Vermont
- Minnesota

For printed copies, please visit our website www.heatstress.com.
Configuring WBGT settings

1. Scroll to the WBGT Current Measurement Screen and press select
2. Set Type to either Indoor or Outdoor
3. To use the colored WBGT zones (also known as Flag Settings), scroll to Zones and set to On.
4. To access one of the pre-loaded WBGT guidelines, scroll to Zones and press select, then scroll to Guide and press select. Follow the menu options to review the available WBGT guidelines. These guidelines are provided for reference only. Remember, you are responsible for selecting guidelines and thresholds suitable to your activity, environment and participants.
5. To receive light or buzzer alerts, scroll to and select Alerts in the WBGT settings menu.

Tips for taking accurate measurements

» When changing environments (such as moving from an air conditioned room to outdoors), the unit requires between 8-15 minutes to equilibrate to its surroundings before taking readings.

» Take measurements at least 3 feet off the ground and in the same wind or air flow conditions as the people you are monitoring.

» Ensure the Kestrel is oriented into the wind and able to measure the full wind value. A tripod and Kestrel Rotating Vane Mount are ideal for ensuring accurate measurements.

» Differences in the reflectivity of ground surfaces, such as grass or asphalt, will impact measurements.

» Be sure to take measurements in the same solar/radiant heat environment as the people you are monitoring. WBGT is intended to be taken in direct sunlight.

Heat Illness and What to Do

Heat Cramps: Painful, involuntary muscle spasms (usually occurring in the legs) associated with exercise in the heat when athletes have been sweating profusely.

What to do: Stop activity and rest in cool area. Rehydrate.

Heat Exhaustion: Inability to sustain exercise in the heat due to cardiovascular strain. Signs and symptoms include: fatigue, weakness, nausea, light-headedness, headache, heavy sweating, dehydration, decreased muscle coordination, and chills. Improvement is seen usually within 10-15 minutes.

What to do: Stop activity and rest in cool area. Rehydrate. Remove excess clothing and cool the athlete with ice-wet towels. If exertional heat stroke is suspected, take rectal temperature for differential diagnosis.

Exertional Heat Stroke: Occurs when (1) the rectal temperature is ≥104˚F and (2) there are signs/symptoms of central nervous system dysfunction. Signs and symptoms include: high body temperature (≥104˚F), irrational behavior, emotional instability, confusion, nausea, diarrhea, loss of muscle coordination, collapse, dehydration, rapid pulse, low blood pressure, heavy sweating. This is a medical emergency.

What to do: Stop activity and aggressively cool the patient using cold water tub. Activate emergency medical service, but always cool first and transport second. Remove excess clothes. Continuously monitor the rectal temperature until it is cooled down to 102˚F.

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WARNING

To reduce the risk of injury or death to persons, read and follow these guidelines!

Your Kestrel Heat Stress Tracker may provide one or more of these measurements relating to estimation of danger of injury to people or animals from heat or cold: Heat Stress Index, Wind Chill, Wet Bulb Globe Temperature (WBGT), Thermal Work Limit (TWL).

NOTE that guidance tables based on these values are based on typical physiological response. Certain individuals or animals may be more susceptible to harm relating to environmental conditions and require additional precautions.

» Know yourself and the individuals and items you are responsible for
» Where appropriate, seek the guidance of a medical professional
» Know what to do in the event of heat or cold injury and be prepared with supplies
» In the case of heat illness, remember the rule- “Cool first, transport second.”

An inexpensive ice bath can mean the difference between life and death.

YOUR KESTREL HEAT STRESS TRACKER IS NOT A MEDICAL DEVICE. IT IS ONLY ONE SOURCE OF INFORMATION AND MUST BE EMPLOYED WITH CARE AND GOOD JUDGMENT.

Kestrel Heat Stress WBGT Reference Information and Product Recommendations

Kestrel Heat Stress Tracker

Heat Stress Index

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