



What is Wet Bulb Globe Temperature?

Max's Weather Service Newport Beach CA

Excessive heat is the deadliest weather in the United States so creating an accurate way to measure the heat stress on the human body is crucial. One of the best ways to reflect that threat is by measuring Wet Bulb Globe Temperature (WBGT). Wet Bulb Globe Temperature (WBGT) consists of several parts, including Dry Bulb Temperature, Wet Bulb Temperature, and Black Globe Temperature. Note that Wet Bulb Globe Temperature (WBGT) is NOT the same as Natural Wet Bulb Temperature, which is a component in Wet Bulb Globe Temperature (WBGT).

What is Dry Bulb Temperature?

Dry Bulb Temperature is the measure of the air temperature with a thermometer. It is basically the temperature reading that we all know and use.

What is Natural Wet Bulb Temperature?

Measuring Natural Wet Bulb Temperature mimics how the human body cools itself by sweating. To measure Natural Wet Bulb Temperature, wrap a damp cloth around the base of the thermometer. Then, move it outside into direct sun. As cloth heats up, the water on the cloth is evaporated. As it does so, it carries away latent heat on the cloth, cooling the thermometer. The resulting temperature that is read on the thermometer is called the Natural Wet Bulb Temperature, and it is always lower or equal to the dry bulb temperature.

What is Black Globe Temperature?

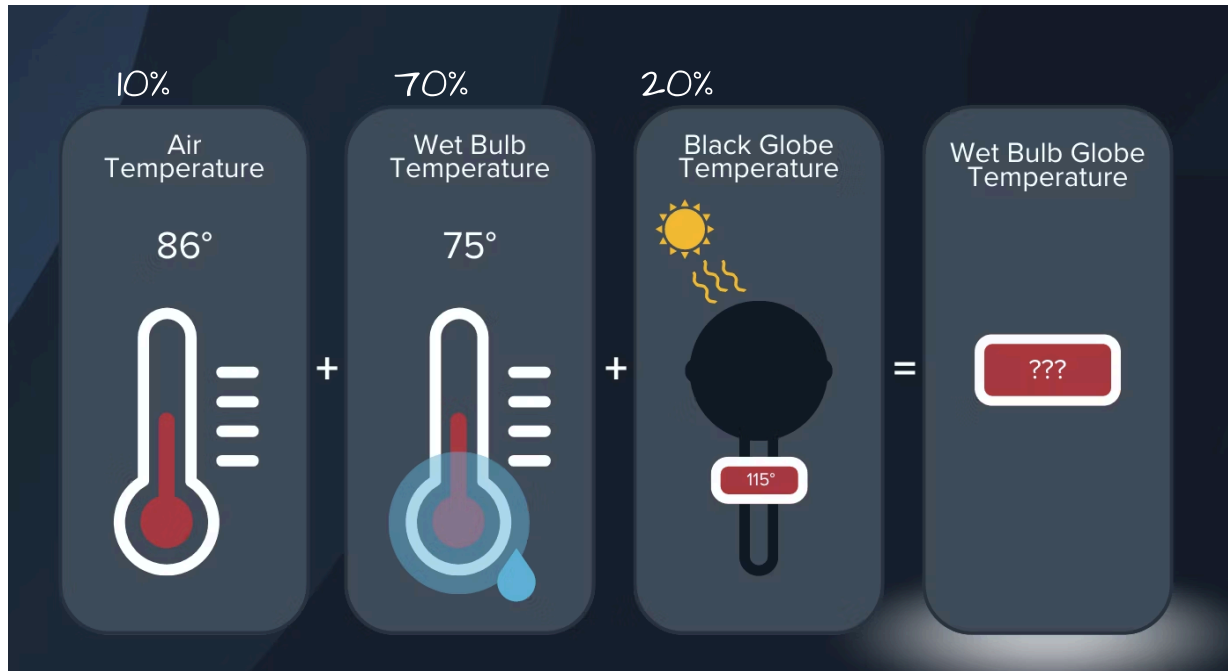
Black globe temperature measures solar radiation, mimicing how the body absorbs heat in direct sunlight. To measure Black Globe Temperature, take a sealed black globe with a thermometer inside of it, but not touching the sides, and put the globe into direct sunlight. Within a few minutes, the outside of the black globe will heat up and warm the inside of the globe, which will be registered on the thermometer. But, wind on the outside of the globe will cool it. The temperature recorded by the thermometer is the Black Globe Temperature.

Calculating Wet Bulb Globe Temperature

After the air temperature, natural wet bulb temperature, and black globe temperature have been found, Wet Bulb Globe Temperature can be calculated.

The formula for Wet Bulb Globe Temperature is

$WBGT = 0.1 \cdot T_d + 0.7 \cdot T_w + 0.2 \cdot T_g$, assuming that T_d is the dry bulb temperature, T_w is the natural wet bulb temperature, and T_g is the black globe temperature.



Wet Bulb Globe Temperature (WBGT) Versus Heat Index

	WBGT	Heat Index
Measured in the sun	✓	✗
Measured in the shade	✗	✓
Uses Temperature	✓	✓
Uses Relative Humidity	✓	✓
Uses Wind	✓	✗
Uses Cloud Cover	✓	✗
Uses Sun Angle	✓	✗

Wet Bulb Globe Temperature (WBGT) is a better measurement of heat stress on the body rather than traditional heat index calculations. As shown in the table above, WBGT takes the sun, wind, and cloud cover into account whereas heat index does not.

Understanding Wet Bulb Globe Temperature Readings

WBGT / RISK	IMPACTS	ACTIONS
<78F / Low	Little to none.	Stay hydrated.
78-84F / Elevated	Body stressed after 45 minutes.	Take at least 15 minutes of breaks each hour if working or exercising in sunlight. Stay hydrated.
84-87F / Moderate	Body stressed after 30 minutes. HEAT CRAMPS likely (dizziness, nausea, vomiting, headache, fainting, disorientation, weakness)	Take at least 30 minutes of breaks each hour if working or exercising in direct sunlight. Drink ½ to 1 quart of water per hour.
87-89F / High	Body stressed after 20 minutes. HEAT EXHAUSTION likely (dizziness, nausea, vomiting, headache, fainting, disorientation, weakness).	Take at least 40 minutes of breaks each hour if working or exercising in direct sunlight. Reduce work, exercise intensity. Drink up to 1 quart of water per hour.
>89F / Extreme	Body stressed after 15 minutes. HEAT STROKE likely (extremely high body temp, confusion, convulsions, unconsciousness, death).	Take at least 45 minutes of breaks each hour if working or exercising in direct sunlight. Suspend all strenuous outdoor activities. Drink at least 1 quart of water per hour. If you see someone with heat stroke symptoms, call 911!

Note: This chart is adapted from the US Army and OSHA guidelines and recommendations.