

WBGT Meter

For assessing the risk of Heat Stress

WBGT-301
WBGT-302



WBGT-301

WBGT-302

ISO 7243
Ergonomics of the thermal environment

JIS B 7922
Electronic Wet-bulb globe temperature index meter
- in conformity with Class 1.5

Assessing heat stress risk is quick & easy with the WBGT-300 series meters

What does “WBGT” mean?

WBGT stands for “Wet Bulb Globe Temperature”, an index for predicting heat exchange between the human body and the environment to understand the risk of heat stress. The index is calculated based on the relative humidity, air temperature and radiant temperature of the environment and can be ascertained in both indoor and outdoor settings. The WBGT index is widely applied in heat stress risk assessment, with its standards for measurement being outlined by bodies such as the ISO and JIS.

Calculation of WBGT

WBGT values are calculated automatically by WBGT-300 series instruments according to the following formulae:



Formula for environments exposed to sunlight

$$WBGT = 0.7T_w + 0.2T_g + 0.1T_d$$



Formula for environments not exposed to sunlight

$$WBGT = 0.7T_w + 0.3T_g$$

T_w = wet bulb temperature T_g = globe temperature T_d = dry bulb temperature (ambient air temperature)

Heat Stress Prevention Guidelines For Exercise

WBGT °C		
31	Cancel All Exercise	Outside special circumstances, all exercise and sporting activities should be canceled, especially those involving children.
28	Strong Caution (cease strenuous exercise)	The risk of heat stress is high, so refrain from activities that easily raise body temperature such as strenuous exercise and endurance training. Rest and replenish fluids and electrolytes every 10-20 minutes. Persons with higher sensitivity to the heat ^{*1} are to lighten or cease activities.
25	Moderate Caution (take periodic rests)	Heat stress risk increases in this range, so be assertive in taking periodic rests and replenishing fluids and electrolytes. For strenuous exercise, rest every 30 minutes.
21	Low Caution (proactively replenish fluids)	Death due to heat stress becomes possible from approximately WBGT 21°C. Stay mindful of indicators of heat stroke and replenish fluids and electrolytes.
	Safe Conditions (replenish fluids when needed)	Under normal conditions, the risk of heat stress is low, but make sure to replenish fluids and electrolytes. Heat stress can still occur in participants of non-professional “Public” marathons, so exercise caution.

Adapted from content appearing on the official Japanese Sports Association website

*1 Persons who are obese, have a below-average tolerance of typical outdoor heat, and/or have low physical endurance

Acceptable Physical Work Intensity By WBGT^{*1}

Category	Example Physical Activities By Intensity Level (Categories 0-4)	WBGT °C	
		Heat acclimated ^{*2}	Not heat acclimated
0: At Rest	At rest, sitting in comfort	≤ 33	≤ 32
1: Low Metabolic Rate	Light manual labour (e.g. writing, typing, drawing, sewing, bookkeeping, etc.); labour using arms and hands (e.g. use of small pliers, physical inspection, assembly, sorting light materials, etc.); labour using arms and legs (e.g. operating a vehicle under normal conditions, footswitch and pedal operation, etc.). Drilling small articles while standing; milling machine operation (small articles); coil wrapping (including for small armatures); machine operation requiring light physical force; walking at or below 2.5km/h on level ground.	≤ 30	≤ 29
2: Medium Metabolic Rate	Continuous hand and arm movement (e.g. hammering, filling ground, etc.); arm and leg movement (e.g. driving a truck off-road, operation of a tractor or construction vehicle, etc.), use of arms and torso (e.g. pneumatic hammer operation, tractor assembly, plastering, intermittent moderate lifting work, weeding, harvesting produce, etc.); pushing and pulling a wheelbarrow or other cart type with a light load; smithing/forging; walking between 2.5-5.5km/h on level ground.	≤ 28	≤ 26
3: High Metabolic Rate	Use of arms and torso with high intensity (e.g. carrying heavy objects, using a heavy hammer, shoveling, sawing, planing or chiseling hard wood, mowing, digging, etc.); walking between 5.5-7.0km/h on level ground. Pushing and pulling a wheelbarrow or other cart type with a heavy load, grinding metal, and stacking concrete blocks.	≤ 26	≤ 23
4: Very High Metabolic Rate	Working at a very high intensity (e.g. swinging an axe, shoveling heavy loads/digging hard ground, climbing stairs); running on level ground at 7km/h or faster.	≤ 25	≤ 20

Adapted from “Table 1-1: Outline of basic measures for preventing heatstroke in the workplace” published by the Ministry of Health, Labour and Welfare (Japan) and “Table of WBGT Heat Stress Index Reference Values” appearing in Appendix A of JIS (Japan Industry Standards) Z 8504, inserting concrete examples of physical activities in place of metabolic rate data.

*1 This table intends to provide a reference for the maximum allowable WBGT for different work intensities to prevent heat stress.

It is not a guarantee of safety, so always consult your physician and workplace health and safety officer to best understand individual risks in your work environment.

*2 “Heat Acclimated” refers to persons that within one week prior to assessment were deemed to be acclimated to working in an equivalent or harsher thermal environment to that used in the test.

Buy from a trusted brand, KEM

In 1993, before “Heat Stress” was a widely known term in Japan, KEM launched its flagship WBGT Meter. Since then, KEM has been constantly developing and refining the WBGT Meter into a feature-rich, compact solution that is lovingly adopted by a large number of customers today.

The WBGT-300 series meters conform to the Japanese national industrial standard “JIS B 7922” (measurement of WBGT with a digital analyser), with the performance of a “Class 1.5” instrument.

The WBGT-301 is endorsed by the Japan Sport Association, a public interest foundation that contributes heat stress prevention advice nationwide, while the WBGT-302 has earned an ongoing sales partnership with the Japan Industrial Safety and Health Association. With a reputation of providing innovative and reliable products acknowledged by numerous research institutions and other organizations, we hope that you consider making the WBGT-300 series meters your new partner in heat stress prevention!

Heat stress can strike in a variety of settings!

While instances of heat stroke are common under the blazing sun or in specific work environments, it can also strike in non-air-conditioned gymnasiums, working kitchens, bathrooms, and even affect infants in strollers. Elderly persons are at particular risk of heat stroke due to a natural decline in their body's water content and a slower and less productive sweating response. Special attention needs to be paid to infants and toddlers when placed on the ground, because their entire bodies bear the brunt of ground-reflected heat causing considerably fast and severe heat transfer leading to heat stress and death.

Helping to prevent heat stress in...



Working Kitchens



Factories



Construction Sites



Schools



Sporting Events



Care Establishments



Concerts &
Other Large Events



Farms



Family Outings

Features

High Performance, Compact Design

Even at a compact size, the WBGT-300 series meters boast JIS Class 1.5 measurement performance, delivering highly reliable WBGT data via high precision sensors.



Outstanding Responsiveness

The globe of the WBGT-300 series is of metallic construction with superb heat conductivity.

Thanks to its industry-leading compact size (30mm), it boasts superior response times.



Water-Resistant, Low-Maintenance Sensor

KEM's WBGT meters have IPX5 water-resistance, for peace of mind in the event of sudden rain. Even if the sensor gets wet, simply wiping or airing it dry will restore its function. Users can easily access the robust sensor for routine performance checking*.



*make sure to follow the user manual's instructions

WBGT Alarm

The instrument has an audible alarm that activates when the WBGT exceeds 28°C.

The WBGT alarm value can be set between 15°C and 40°C.



Designed For Indoor & Outdoor Use

While standard thermometers can measure ambient air temperature, they can't comprehensively analyse radiant heat like the WBGT-300 series meters can. Thanks to their globe, all sources of radiant heat are measurable whether indoors or outdoors. This is important for better assessing heat stress risk, as the intensity of solar radiation, ground-reflected heat and heat generated by machinery and workers, for example, are also determinable.

Memory

The memory function is responsible for recording measurement data over user-set intervals. The interval between each reading can be set to between 1 and 999 minutes, and up to 30,000 readings can be stored on the device. Stored data can be transferred to a personal computer.



Large, Easy-To-View Screen

The WBGT is displayed prominently on a large LCD screen alongside humidity & other temperature values, reducing the need to cycle through screens. The display's layout is customizable.

Ta: Ambient Temperature (°C)
Tg: Globe Temperature (°C)



eco Mode

Displayed when eco mode is active. If the instrument is left unoperated for 20 minutes, eco mode will turn it off.

WBGT Reading (°C)



measurement without sunlight



measurement with sunlight

RH: Relative Humidity (%)

USB Connection

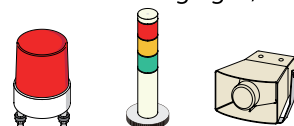
Measurement data can easily be collated and transferred to a PC using the USB port. The instrument can be powered via the USB port, so you don't have to worry about running out of power when using it for a long time.

*Please refrain from powering the instrument via USB during rain.



UART Connections

UART Communication Mode can be set via a switch located in the battery port. Using a USB Type C to RS232 connector & cables allows you to connect to peripherals such as a warning light, LCD display board etc.



*Cables & peripherals not sold by KEM

*Please refrain from powering the instrument via USB during rain.

Part Names and Functions

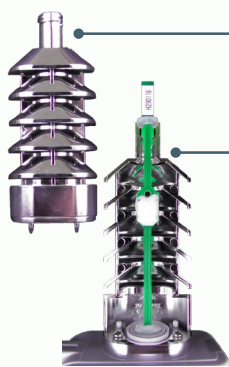
Globe

Measures the globe temperature (Tg)



Sensor Cap B

Can be removed to access the Temperature/Humidity Sensor



Temperature/Humidity Sensor

Measures atmospheric temperature (Ta) and relative humidity (RH)

Strap Attachment Hook

*Note: strap not included



Power ON/OFF Button

Holding down the Power ON-OFF button for 3 seconds turns the device on and automatically starts measurement. Results are updated every second.



Setting Button

Hold down for 2 seconds to access the settings menu

USB Port (Type C)

For connecting to PC or supplying power



Tripod Head Mount Thread

Thread for securing to a tripod head mount and the Wall Mounting Bracket

Lineup

WBGT-301

For

- ▶ Sports
- ▶ Schools
- ▶ Events
- ▶ General Use



WBGT-302

For

- ▶ Work
- ▶ Industrial Hygiene
- ▶ Workplace Health & Safety



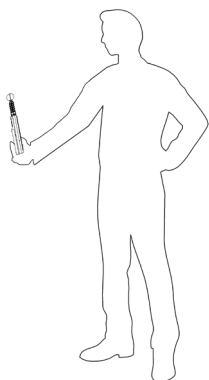
Package contents

- | | |
|---------------------------------|---|
| ■ WBGT instrument x1 | ■ Index sticker x1 |
| ■ Carrying case x1 | ■ Inspection/Certificate x1 |
| ■ Operation manual x1 | ■ China-RoHS declaration of conformity x1 |
| ■ AA size Alkaline batteries x2 | ■ Contact information x1 |



Operation examples

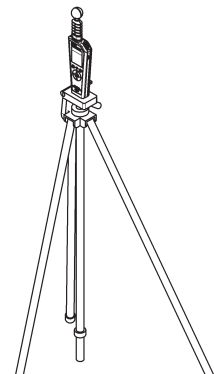
When holding the instrument, stretch your arm out and keep it roughly 1.1m from the ground when standing, or 0.6m when sitting to prevent the moisture and heat generated by your body from interfering with readings.



When measuring in hand, keep it as far away from your body for best accuracy.
Attaching a strap and securing it to your wrist will prevent it dropping to the ground.



The Wall Mounting Bracket (sold separately) is required.
Secure the bracket to the wall with an ordinary screws and fix the device to the bracket with the supplied fixing screw.



A thread on the base of the device allows it to be fixed to the mounting plate of a commercial tripod.

Specifications

Model		WBG-301	WBG-302
Intended use		Sports, schools, events etc.	For use in the workplace
JIS performance classification		Class 1.5 ^{*1}	
IP rating		Equivalent to IP65 ^{*2} (dust proof and water resistant)	
Display		2.8-inch LCD screen (56mm x 42mm)	
Measurement capabilities		WBG, ambient temperature, relative humidity, globe temperature	
Measurement range & (display resolution)	WBG	0.0°C - 50.0°C (displayed to nearest 0.1°C)	
	Ambient Temperature	0.0°C - 50.0°C (displayed to nearest 0.1°C)	
	Relative Humidity	10.0% - 90.0%RH (displayed to nearest 0.1%RH)	
	Globe Temperature	0.0°C - 60.0°C (displayed to nearest 0.1°C)	0.0°C - 80.0°C (displayed to nearest 0.1°C)
Accuracy (Under natural draft) (0.3 to 3 m/sec)	WBG	± 1.5°C (15°C - 40°C)	
	Ambient Temperature	± 0.6°C (20°C - 50°C)	
	Relative Humidity	± 3.0% (30% - 90%RH)	
	Globe Temperature	± 0.6°C (20°C - 60°C)	
Storage temperature		Between 0°C and 50°C (indoors)	
Storage environment		Indoors, free of corrosive and organic gases, low dust, low fluctuations in temperature and humidity	
External interface		USB Type C	
Communication specification ^{*3}		USB connection (USB communication/RS communication) UART connection	
Power source		Two AA alkaline batteries or USB	
Battery life		Approximately 6 months ^{*4}	
Dimensions		69 (W) x 36 (D) x 272 (L) mm 2.7 (W) x 1.4 (D) x 10.7 (L) inches	
Weight		Approximately 230 g/8.1 oz (battery weight included)	

^{*1} Sensor accuracy is based on the JIS B 7922 stipulation (Japanese Industrial Standards).

^{*2} Devices confirmed to have IPX5-equivalent water resistance at time of shipment.
Use as recommended in the user manual. Damage due to liquids is not covered by warranty.

^{*3} Please use the specified cable for connection to the device.

^{*4} Depending on utilized settings, period of active use, usage environments, etc.



Optional Accessories & Parts

— Optional accessories
— Spare parts

12-08175



Wall Mounting Bracket

Used to mount the instrument on a wall. Includes Fixing Plate & Fixing Screw 1/4-20UNC.

20-12864



Fixing Screw 1/4 -20U

Used to secure the WBGT Meter to the Wall Mounting Bracket (12-01875).

64-01783-01



USB 2.0 Cable (A to C) 1.0m

For supplying power and connecting to a PC.

64-01783-02



USB 2.0 Cable (A to C) 2.0m

For supplying power and connecting to a PC.

12-08547



Splash-resistant Cover

Protects the USB port, important when connected to a cable outside and in situations with the risk of splashes. With IPX3-equivalent water resistance, the device is adequately protected in the event of sudden rain.

12-08394



Replacement Globe

Performance is adversely affected if the globe is damaged or dented, so please replace with this part in such events.

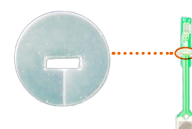
12-08395



Replacement Temperature/Humidity Sensor

In the event that the sensor malfunctions, breaks or if correct readings aren't otherwise obtainable, please replace it with this part.

20-13248



Globe Packing

Packing gasket for the Temperature/Humidity Sensor and Globe. Part 20-13248 includes the packing only.

20-13246



Sensor Cap B

Removable half of the sensor housing located at the rear of the device. Allows access to the sensor.

20-13243



Packing

Protective packing set between the battery compartment & the Battery Cover.

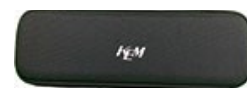
20-13256



Battery Cover

For replacing a broken or lost Battery Cover.

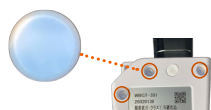
20-13313



Carrying Case

For protection & safekeeping of the device and accessories.

20-05996



Rubber Chip

To cover screw recesses and provide protection.

63-01227



Vent Filter

Replacement for dirty or lost Vent Filters.



WBGT-300 series
introduction movie



<https://www.kem.kyoto/en/movie/>

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