



SCARLET | TECH

UNDERSTANDING AND
MANAGING WORKPLACE
HEAT STRESS

What Is Thermal Work Limit (TWL)



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Thermal Work Limit (TWL) is a heat stress index that estimates the maximum sustainable work rate a worker can perform without exceeding safe physiological limits.

TWL considers multiple factors:

- Air temperature
- Humidity
- Radiant heat
- Wind speed (critical factor)

Also considers:

- Clothing
- Acclimatization
- Hydration status

TWL is expressed as: Metabolic rate (W/m²). It represents the maximum safe energy output of a worker under specific environmental conditions.

About Thermal Work Limit



Scarlet TWL-1S

- Dry Bulb Temperature (ambient air temperature) (°C)
- Wet Bulb Temperature (determined by the humidity/evaporation) (°C)
- Globe Temperature (determined by the radiant heat) (°C)
- Wind speed (m/s)

Where to Monitor

All hot work areas should be monitored:

- At least once per shift, during the heat of the day
- At any time that workers complain of excessive heat
- Whenever anyone has reported signs of heat illnesses

What Environmental Parameters Must We Measure?

Air Temperature

Dry Bulb (°C)

Ambient air temperature in shade. Less critical alone but part of the full picture.

Wind Speed

Air Movement (m/s)

Higher wind = better sweat evaporation = cooler worker. Use air-movers indoors where possible.

Wet Bulb Temperature

Humidity Proxy (°C)

Most important single parameter. Indicates how effectively sweat can evaporate. High WB = low cooling capacity.

Metabolic Rate

Work Intensity (W/m²)

Harder physical work = more internal heat generated. Must be estimated for each job type.

Radiant Heat

Globe Thermometer (°C)

Heat from sun & hot surfaces measured by a 150mm black hollow copper ball. Critical for outdoor & smelter workers.

Clothing & PPE

Insulation Factor

Overalls, gloves, respirators all trap heat. PPE significantly raises effective heat stress — must be factored in.

TWL Action Levels — What the Numbers Mean

<p>> 220 W/m² GREEN</p>	<p>→ Unrestricted Work</p> <p>Fully acclimatised workers may work without heat-related restrictions. Standard hydration monitoring applies. TWL is HIGH = good conditions.</p>
<p>140–220 W/m² AMBER</p>	<p>→ Acclimatised Workers Only</p> <p>Work restricted to acclimatised workers only. Acclimatisation period = first 7 days back after 14+ days absence. Monitor, hydrate, rest cycles.</p>
<p>115–140 W/m² ORANGE</p>	<p>→ Buffer Zone (Restricted)</p> <p>"Corrective action" zone. Written action requests required. Identify engineering improvements — shade, ventilation, scheduling. Rotation of workers mandatory.</p>
<p>< 115 W/m² RED</p>	<p>→ Withdrawal Limit</p> <p>Even light work is NOT continuously sustainable. Formal permitting system required. Management approval to work. Emergency response on standby.</p>

Reference metabolic rate: ~115 W/m² = light manual work (e.g. slow walking, light lifting)

TWL vs WBGT: Why TWL is Superior for Gulf Conditions

Feature	WBGT	Thermal Work Limit (TWL)
Unit	°C (temperature)	W/m ² (metabolic rate)
Considers wind speed	Partial or None	Yes — critical in Gulf
Accounts for clothing/PPE	No	Yes — full adjustments
Work-rest scheduling	Basic lookup tables	Directly calculable
Individual metabolic rate	No	Yes — job-specific limits
Validation in field	Limited Gulf data	Lab + field validated
Regulatory adoption	UAE/KSA (some)	UAE/Oman/Australia/ADNOC/ARAMCO

Why TWL Works: Scientific & Practical Advantages

Physiologically Grounded

Based on human metabolic rate — not just air temperature. Directly linked to when the body can no longer safely maintain thermal balance.

Actionable Output

Single number in W/m^2 tells supervisors exactly what work intensity is safe. No lookup tables needed.

Wind-Sensitive

Unique among indices: wind speed is a direct input. Critical in Gulf where even a hot breeze provides cooling.

PPE & Clothing Adjustment

Automatically adjusts for overalls, respirators, gloves — reducing misleading green signals.

Self-pacing Compatible

Can predict duration limits and design work-rest cycles for any given thermal environment.



Scarlet Tech specializes in delivering tailor-made, state-of-the-art HSE instruments for accurate measurement and real-time monitoring in demanding environments. Comprehensive range of professional HSE instruments: wireless anemometer, wireless crane camera system, heat stress meter, class 1 & 2 sound level meter.