

Productivity and Work Area Temperatures in Industrial Facilities

NASA found and reported in a heat stress report CR-1205 (1)

Worker productivity is a key business success factor for industrial facilities. Work area temperature is a primary driver of this productivity seen as (1) worker behaviour change as temperature changes - activity and error rate, and (2) OSHA regulatory requirements vs. temperature. These two factors are discussed below:

Correlation of Productivity change with work area temperature change

A number of studies have been conducted with the objective of correlating productivity loss with changes in temperature. NASA found and reported in a heat stress report CR-1205 (1) that temperatures over 80 F have a marked NEGATIVE effect on both the productivity and accuracy of work. This study and its results are still the authoritative reference used as the foundation for NASA standards and design. The following table is a summary of the relationships identified during NASA tests between temperature, work output and accuracy.

NASA heat stress study CR-1205

Effective Temperature	23.88 °C (75°F)	26.66 °C (80°F)	29.44 °C (85°F)	32.22 °C (90°F)	35 °C (95°F)	37.77 °C (100°F)	40.55 °C (105°F)	
Loss of Work Output		3%	8%	18%	29%	45%	62%	79%
Error Rate Increase		0%	5%	40%	300%			

OSHA Regulations and Work Area Temperatures

OSHA regulations dictate a work/rest regimen as shown in the table below as work area temperatures reach certain levels.

OSHA TABLE III: 4-2 PREMISABLE HEAT EXPOSURE THRESHOLD LIMIT VALUE

Work/rest regimen	Work Load *		
	Light	Moderate	Heavy
Continuous Work	30.0 °C (86°F)	26°C (80°F)	25°C (77°F)
75% Work, 25% rest, each Hour	30.6 °C (87°F)	28°C (82°F)	25.9°C (78°F)
50% Work, 50% rest, each Hour	31.4 °C (89°F)	29.4°C (85°F)	27.9°C (82°F)
25% Work, 75% rest, each Hour	32.2 °C (90°F)	31.1°C (88°F)	30°C (86°F)

*Values are in °C and °FWBGT

These TLV's are based on the assumption that nearly all acclimatized, fully clothed workers with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 38 °C (100.4°F)

They are also based on the assumption that the WBGT of the resting place is the same or very close to that of the workplace. Where the WBGT of the work area is different from that of the rest area, a time-weighted average should be used (consult the ACGIH 1992-1993 Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices (1992).

These TLV's apply to physically fit and acclimatized individuals wearing light summer clothing. If heavier clothing that impedes sweat or has a higher insulation value is required, the permissible heat exposure TLV's in Table III: 4-2 must be reduced by the corrections shown in Table III: 4-3.