



## Heat Stress Prevention for Welding and Hot Work

### INTRODUCTION

Welding and its allied processes generate heat and may and often take place in hot workplace environments. Hot work activities often require wearing layers of clothing to protect against sparks, spatter and heat. Hot work may also involve strenuous physical activity. Since hot work tends to add to the thermal load of the worker performing hot work, the worker can be at an elevated risk of heat-related illnesses.

Steps can be taken to proactively reduce the potential for heat-related illness. Efforts such as providing access to drinking water, adequate work/rest cycles and other special control measures can be effective. In addition, training and education also help workers and their supervisors to recognize the signs and symptoms of heat overexposure, in order to respond effectively and better protect the health of the workforce.

### TYPES AND TREATMENT OF HEAT RELATED ILLNESSES

The body is always generating heat and losing heat to the environment. When conditions exist where the amount of heat being generated begins to far exceed the flow of heat being lost to the environment, the risk of thermal overload or heat stress begins to occur. The higher the level of

physical exertion demanded by the work activity, the higher the risk of heat related illness. The risk also increases due to higher ambient temperature, humidity and radiant heat from the work environment. Protective clothing designed to shield the skin from radiant heat, sparks and spatter can also prevent the loss of internally generated heat, and this adds to the body's heat load.

Over time, humans adapt to working in hot conditions. Individuals generally become adapted after 4 – 6 days working under hot conditions. Time should be given to allow workers to adapt before executing strenuous work – or work in conditions of extreme heat.

Heat illness can take varying forms, depending on the amount of heat exposure and the individual's conditioning and response to heat.

#### Heat Rash

Heat rash appears as many tiny raised red blister-like bumps on the skin, with pricking sensations during heat exposure. It is caused by plugging of sweat gland ducts, with retention of sweat and an inflammatory reaction. It is treated by use of mild drying lotions and keeping the skin clean to prevent infection.

## Heat Cramps

Heat cramps are painful spasms of muscles during work, such as arm, leg or abdominal muscles. Onset can occur during or after work hours. It is caused by loss of body salt in sweat. The treatment is to loosen clothing, drink water and fruit juices or lemonade to replace minerals. Excessive water intake may dilute the electrolytes in the body, and water enters the muscles, causing the spasms.

## Heat Syncope

Heat syncope is fainting while standing up without moving in the heat. It is caused by pooling of blood in dilated vessels of the skin and lower parts of the body. The treatment is moving to a cooler area, and recovery is usually quick and complete.

## Heat Exhaustion

The symptoms of heat exhaustion are fatigue, nausea, headache, giddiness, and clammy/moist skin. There may be mild dizziness, with normal or elevated temperature and rapid pulse (>150 beats per minute). It is caused by dehydration from lack of water and/or salt intake. The treatment for heat exhaustion is to move to a cooler environment and replace fluids and minerals.

## Heat Stroke - A MEDICAL EMERGENCY

Symptoms of heat stroke are hot dry skin, flushed face, high body temperature, and rapid pulse. Brain disorders, such as headache, delirium, and unconsciousness, may also be present. It is caused by failure to sweat, also known as thermoregulatory failure, which then leads to an uncontrolled, accelerating rise in

body temperature. Treatment is to begin immediate and rapid cooling of the body, by immersion in chilled water or by wrapping in wet sheets with vigorous fanning.

## **PREVENTING AND CONTROLLING HEAT STRESS**

### Basic Preventative Measures

- Where possible, try to schedule strenuous jobs early in the morning or in the evening. The sun is at its most direct and hottest point between 10:00 am and 2:00 pm. Give your body a chance to cool off. Short breaks are more effective than long breaks
- Drink water every 15 to 20 minutes - don't wait until you are thirsty. Your body can lose up to three gallons a day during hot weather. Don't take salt tablets, since the average American diet already provides more than enough salt. Instead, eat plenty of fruits and vegetables. This will help maintain a healthy electrolyte balance in your body.
- Prescription drugs can interfere with the body's ability to cool itself. Check with your employer's medical personnel or your physician if you have any questions.
- Eat light, nutritious meals, preferably cold. Fatty foods are harder foods to digest in hot weather.
- Physical training can improve heat tolerance, and exercise does not have to be done in a hot environment to get this benefit.

## PERSONAL PROTECTIVE EQUIPMENT (PPE) AND ENGINEERING CONTROLS

There are some control equipment and wearable options that can be used to help prevent heat overexposure.

- Powered Air Purifying Respirators (PAPR) or Supplied-Air Respirators (SAR) welding helmet respirators with (or without) vortex cooler. These devices can be used to achieve cooling. The hood's bib can be placed under employee clothing to distribute the cool air. (Note: Breathing air quality must comply with occupational safety and health requirements for Grade D Breathing Air.)
- Ice pack vests: The cooling offered by ice pack vests lasts 1-2 hours at moderate heat loads, making periodic replacement necessary. Still, this option can be reasonably effective for many work situations.
- Recirculating cooling vest and cooling clothing options: these systems use an ice filled cooler/chiller to cool water that is pumped and recirculated through the specialized clothing to provide effective cooling. These are most applicable to fixed work situations.
- Personal cooling fans can be used in work areas as long as they do not interfere with the welder's ventilation or shielding gas.
- Misting tents, evaporative coolers, or air-conditioned breakrooms for use

during rest periods can supply the cooling workers need.

## OCCUPATIONAL EXPOSURE LIMITS

The American Conference of Governmental Industrial Hygienists (ACGIH) and the National Institute of Occupational Safety and Health (NIOSH) provide the heat related exposure guidelines that may be used for assessing health exposure in the workplace. In general, limits are determined according to a combination of the Wet Bulb Globe Temperature (WBGT) and a categorization of the level of physical activity required.

## HOW ARE EXPOSURES MEASURED?

A qualified person such as an industrial hygienist can conduct heat related measurements in the workplace. Typically, they would use a WBGT test device to determine the ambient heat load. The device measures the ambient temperature, humidity, and radiant heat load. From these factors the WBGT value is determined. Once the nature of the physical activity is characterized and combined with the WBGT, determinations can be made to compare with the recommended workplace heat exposure limits.

## SUMMARY

It is important to understand that heat can be a risk to the welder when it's difficult to cool the worker, given warmer ambient conditions and more strenuous levels of activity. While workers do acclimate to working in conditions of higher heat load, simple steps can be taken to recognize the

symptoms and avoid the troubles that come with heat stress.

Where basic steps such as supplying enough drinking water, wearing the right clothing, being in good physical condition and eating right are not enough, additional measures such as using air-supplied welding helmets or respirators, cooling vests/clothing and other devices such as misting cooling fans can be utilized. What works best to prevent heat loss needs to be assessed for each unique work situation.

## INFORMATION SOURCES

ACGIH, *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices*, American Conference of Governmental Industrial Hygienists, <[www.acgih.org](http://www.acgih.org)>.

ANSI Z49.1, *Safety in Welding, Cutting, and Allied Processes*, American National Standards Institute, <[www.aws.org](http://www.aws.org)>.

AWS Safety and Health Fact Sheets, American Welding Society, <[www.aws.org](http://www.aws.org)>.

OSHA, Title 29, 1910, *Occupational Safety and Health Standards*, Occupational Safety and Health Administration, Code of Federal Regulations, <[www.osha.gov](http://www.osha.gov)>.

OSHA, Title 29, 1926, *Safety and Health Regulations for Construction*, Occupational Safety and Health Administration, Code of Federal Regulations, <[www.osha.gov](http://www.osha.gov)>.