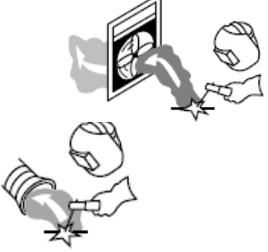


IMPORTANT. This Guide contains important safety and health information – **READ Both Sides.** Before thermal spraying, please read and understand the **Warnings and Instructions on the Product Container and the Safety Data Sheet (SDS), previously MSDS, for the product you are using.** See your Safety Director or Supervisor to obtain a copy of the SDS. You may also obtain a copy of the SDS and sign up to receive update alerts at www.lincolnelectric.com/sds or from your Lincoln Electric Distributor.

THERMAL SPRAY SAFETY

! WARNING

HAZARD	SAFETY PRACTICES
<p><u>Electric shock can kill</u></p> 	<ul style="list-style-type: none"> Wear dry gloves free of holes or split seams. Change as necessary to keep gloves dry. Do not touch electrically “hot” parts or thermal spray gun with bare skin or wet clothing. Keep the thermal spray gun and cable insulation in good condition. Do not use if insulation is damaged/missing.
<p><u>Fumes and gases can be dangerous</u></p>  <p style="text-align: right; margin-right: 20px;">See Health Hazards Page 2</p>	<ul style="list-style-type: none"> Read the warnings and instructions on the consumable label and Safety Data Sheet (SDS) available in the workplace (ask your supervisor). Provide additional ventilation and exhaust where special ventilation is needed or if thermal spraying in a confined area. Know what the base metal is, and determine if there is any paint, plating, or coating that could expose you to toxic fumes and/or gases. Remove it from the metal being surfaced, if possible. Position your head away from the thermal spray fume plume to keep the amount of fume you breathe as low as possible.
<p><u>Use adequate ventilation and/or exhaust</u></p> 	<ul style="list-style-type: none"> Use adequate ventilation and/or exhaust to keep the air you breathe clear and comfortable. Your work area should have enough ventilation and/or local exhaust to control your exposure to the thermal spray fumes and gases so the applicable exposure limits are not exceeded. If you have any concern about ventilation or your exposure level, ask your employer to confirm that exposures do not exceed those limits by obtaining and analyzing a representative sample of air in the breathing zone. If you start to feel uncomfortable, dizzy or nauseous, you may be overexposed to fumes and gases, or suffering from oxygen deficiency. Stop thermal spraying and get some fresh air immediately. Notify your supervisor and co-workers so the situation can be corrected and other workers can avoid the hazard. Be sure you are following these safe practices, the consumable labeling and SDS and improve the ventilation in your area. Do not resume thermal spray operations until the situation has been corrected. Use a respirator if exposure to thermal spray fume cannot be controlled or if spraying outside and natural air movement is not enough to keep thermal spray fume out of your breathing zone.
<p><u>Molten metal and sparks can cause fire or explosion</u></p> 	<ul style="list-style-type: none"> Do not apply thermal spray on containers which have held combustible materials unless procedures for the safe welding and cutting of containers are carefully followed (see AWS F4.1). Remove flammable materials from thermal spray work area or shield from hot metal & heat. Keep a fire watch in area during and after thermal spraying. Keep a fire extinguisher in the thermal spray work area. Wear flame resistant clothing and headgear that is free of frayed edges. Handle all compressed gas cylinders in accordance with sound safety practice: store cylinders upright and secure them using an approved lock-down device. Always use the correct pressure regulator for the specific gas. Separate fuel gas and oxidizers when not in use.
<p><u>Arc rays, sparks & molten metal can burn eyes and skin</u></p> 	<ul style="list-style-type: none"> Select a proper filter lens which provides adequate protection for your eyes and is comfortable for you while thermal spraying. Always use a helmet and/or appropriate head, face and eye protection during thermal spray surfacing application. Process generates UV radiation. Wear flame resistant clothing which provides full coverage for your skin. Use earplugs when thermal spraying to keep noise, sparks and molten metal from damaging your ears. Use non-flammable welding/hot work screens to protect others

THERMAL SPRAY FUME

Thermal spray fume produced from this type of surfacing process may contain particles from the consumables, base metal and base metal coating. These complex particles contain one or more of the constituents listed below. Gases produced when thermal spraying may include carbon monoxide, carbon dioxide, fluorine, nitrogen oxides and ozone, which may be produced from ultraviolet radiation from the arc. An approved respirator should be used unless exposure assessments are below applicable exposure limits.

HEALTH HAZARDS

The International Agency for Research on Cancer (IARC) has determined that welding fumes and ultraviolet radiation from welding are carcinogenic to humans. According to IARC, welding fumes cause cancer of the lung and positive associations have been observed with cancer of the kidney. Also according to IARC, ultraviolet radiation from welding causes ocular melanoma. IARC identifies gouging, brazing, carbon arc or plasma arc cutting, and soldering as processes closely related to welding. The most immediate effects of exposure to thermal spray surfacing fumes and gases depend on the amount and length of exposure. They are temporary, and include symptoms of burning eyes and skin, dizziness, nausea, and fever. Long-term exposure can lead to siderosis (iron deposits in the lungs) and may affect breathing. Bronchitis and some lung fibrosis have been reported.

Thermal spray fumes may contain compounds which are reported to have the following health effects of overexposure. Listed below are materials with significant potential health effects that are commonly found in the fume. This list is not specific to any particular thermal spray consumable or process.

- **Chromium and its compounds** are on the IARC and NTP lists as posing a cancer risk to humans. Some forms of chromium are known or suspected to cause lung cancer, and asthma has been reported.
- **Cobalt** may cause respiratory irritation, lung damage, asthma, and chronic bronchitis. Skin contact may cause dermatitis.
- **Manganese** overexposure may affect the brain and central nervous system, resulting in poor coordination, difficulty speaking, and arm or leg tremor. This condition can be irreversible.
- **Nickel** and its compounds are on the IARC and NTP lists as posing respiratory cancer risk, and are skin sensitizers with symptoms ranging from slight itch to severe dermatitis.
- **Vanadium Pentoxide** is a respiratory irritant and acute overexposures have resulted in shortness of breath and pulmonary edema. The IARC listing for vanadium pentoxide is 2B, possibly carcinogenic to humans.

Materials used in base metal coatings may include cadmium, lead, zinc and various organic materials which have health effects. Refer to the SDS for the coating being used.

DISPOSAL INFORMATION

Refer to the product's SDS and contact your Supervisor or Environmental Manager to determine your company's approved waste disposal or recycling procedures for welding products and by-products according to Federal, State and Local regulations.

REFERENCES

For additional information on welding safety, please refer to www.lincolnelectric.com/safety which contains links to the following, most of which are available free of charge:

- **Safety Data Sheet (SDS)**
- **Lincoln Interactive Welding Safety DVD**
- **Lincoln Safety Publication E205**
- **OSHA Publication 2206** (29CFR1910)
- **ANSI Z49.1** "Safety in Welding, Cutting and Allied Processes"
- **AWS F4.1** "Recommended Safe Practices for the Preparation for Welding and Cutting of Containers and Piping"
- **Compressed Gas Association pamphlets C-6-1968 and C-8-1962** and in the Hazardous Materials Regulations of the Department of Transportation (49 CFR parts 171-179 and 14 CFR part 103)