



INDUCTION HEATING

INTRODUCTION

Induction heating is a process where heat is created electromagnetically in a metallic part. The process is used for preheat, interpass and post-weld heat treatment as opposed to surface heating with an open flame or resistance heating methods. It is a power source–driven metal heating process that quickly and uniformly raises the temperature of a metallic part to a specified level and maintains it. It offers advantages for safety, quality and efficiency not found in other heating methods.

HOW INDUCTION HEATING WORKS

Induction heating systems quickly heat metals by eddy currents induced into the part. Induction does not rely on a heating element or flame to transfer heat. Instead, alternating current passes through the heating device, creating an alternating magnetic field around it. As the alternating magnetic field passes through the workpiece, it creates eddy currents within the part. The resistance of the metal opposes the flow of the eddy currents, generating heat in the part. The part becomes its own heating element, heating from within, which makes induction very efficient since little heat is lost in the process.

Applications that typically require hours for the heating process can often be completed in minutes by utilizing induction heating. Induction heating systems are a flexible option because, based on the size and geometry of the part, various induction heating components can be used to induce the heat.

TYPES OF HAZARDS AND HOW TO AVOID THEM

Electric Shock – Touching live electrical parts can cause fatal shocks or severe burns.

Electrical shock hazards found in induction heating systems are:

Bus bars and coolant fittings that are not insulated or protected from unintentional contact by persons.

- Enclose any connecting bus bars and coolant fittings to prevent unintentional contact.
- Use only nonconductive coolant hoses and coolant to provide isolation.

Other electric shock hazards that can be present during the induction heating process and welding are stated in Safety and Health Fact Sheet No. 5, Electrical Hazards.

Fumes and gases can be hazardous - induction heating of metallic parts that are in contact with certain materials (such as coatings, adhesives, or fluxes) can produce fumes, airborne particulate, and gases (airborne contaminants). Breathing these fumes and gases can be hazardous to your health.

- Keep your head out of the fumes. Do not breathe the fumes.
- If inside, ventilate the area and/or use local forced ventilation to remove airborne contaminants. The recommended way to determine adequate ventilation is to sample for the composition and quantity of fumes and gases to which personnel are exposed.
- If ventilation is poor, wear an approved air-supplied respirator.
- Read and understand the Safety Data Sheets (SDSs) and the manufacturer's instructions for adhesives, coatings, cleaners, consumables, coolants, degreasers, fluxes, metals, etc.
- Work in a confined space only if you are properly trained and the space is well ventilated, or while wearing an air-supplied respirator. Always have a trained watchperson nearby.

Fumes and gases from heating can displace air and lower the oxygen level causing injury or death. Be sure the breathing air is safe.

- Do not heat in locations near degreasing, cleaning, or spraying operations. The heat can react with vapors to form highly toxic and irritating gases.
- Do not heat coated metals, such as galvanized, lead or cadmium-plated steel. When heating a coated metal, remove the coating from the area to be heated, ensure the area is well ventilated and wear an air-supplied respirator. The coatings and any metals containing these elements can give off toxic fumes when heated. See coating SDS for temperature information.

Fire or explosion hazards

- Do not overheat parts.
- Watch for fire; keep extinguisher nearby.
- Keep flammables away from work area.
- Do not operate where the atmosphere contains flammable dust, gas, or liquid vapors (such as gasoline).
- Ensure parts are adequately pre-heated to ensure removal of trapped liquids.

Induction heating of parts can cause burns.

- Do not touch hot parts bare-handed.
- Allow cooling period before handling parts or equipment.
- Do not touch or handle induction head/coil during operation unless the equipment is designed and intended to be used in this manner as specified in the owner's manual.
- Keep metal jewelry and other metal personal items away from head/coil during operation. They also can become heated by the process.

To handle hot parts, use proper tools and/or wear appropriate hand protection and clothing to prevent burns.

Electric and magnetic fields (EMF) can affect implanted medical devices. The induction heating circuit and parts being heated create EMF.

- Wearers of pacemakers and other implanted medical devices should keep away.
- Implanted medical device wearers should consult their doctor and the device manufacturer before going near induction heating operations.
- Observe the EMF data and minimum approach distances provided by the induction heating equipment manufacturer.

SUMMARY

It is important to remember that induction heating is an electromagnetic process that heats parts. Like arc welding, hazards will be present when using this process. These hazards include (but are not limited to) electric shock, fumes and gases, fire or explosion, hot parts and EMF.

Understanding these hazards and how to avoid them will allow you to use induction heating in welding applications to provide more consistent and uniform heating, faster time to temperature and improved operator safety.

INFORMATION SOURCES

American Welding Society (AWS). *Safety and Health Fact Sheets*, published by the American Welding Society, 8669 NW 36 Street #130, Miami, FL 33166; telephone 800-443-9353; web site: www.aws.org.