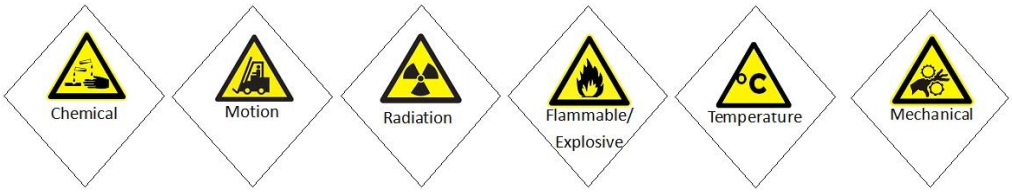
SAFE JOB PROCEDURE **SJP-34**

April 18, 2018 **EXOTHERMIC BONDING**

PURPOSE/APPLICATION

To provide guidance and direction on the safe completion of exothermic bonding **(Cadwelding, or thermite welding)** copper conductor to copper conductor or copper to a steel grounding rod. This is normally done in certain electrical component installations (e.g. grounding), or in pipeline applications where wire is attached to pipe (e.g. cathodic protection).

HAZARD SOURCES



PPE

- CPES minimum requirements (hard hat, safety glasses, safety footwear, appropriate protective clothing)
- Leather welding gloves
- Face shield

TRAINING

- Specific training course in cadwelding or thermite welding
- Mentorship in this procedure by CPES Supervisor
- Review of Manufacturer's instruction manual

TOOLS/EQUIPMENT

- Wire brush
- Exothermic welding kit and mold
- Control unit or flint igniter
- Propane torch

PRIOR ACTIVITIES

1. Assess the task hazards using the HIAC process. Extra care should be given to identifying and isolating/removing any easily ignited material or fuel sources.
2. Verify that any required Hot Work Permits have been obtained.
3. Verify all workers involved are familiar with this procedure and the manufacturer's specifications.
4. Depending on the level of flammable hazards identified in the HIAC, fire watch may be required.
5. Always inspect the mold before and following use and discard it if it has been damaged.
6. Do not inhale the fumes produced during thermite welding.

#	Job Steps	Hazards	Control Measures
1	Clean material to be welded	❖ Flammable - combustible material or hydrocarbons in the area ❖ Flammable - Work being completed in live sites	▪ All contact points must be cleaned to ensure a proper bond ▪ All potentially ignitable material must be relocated from work area ▪ Verify that a fire extinguisher is within

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			easy access of the workers involved ▪ (Where required) Verify gas monitors have been used to test for potentially combustible atmospheres
2	Inspect and set up the mold, insert the handle clamp into the holes	❖ Flammable - Damage to the mold may lead to material leaking out ❖ Motion - Sharp edges or wires from the material being connected ❖ Flammable - Wrong mold for conductor size or welding material	▪ Workers to wear welding gloves ▪ Clamps are only designed for approx. 50 connections and should be replaced if any damage is identified ▪ Check mold for cracks or pitting to the material ▪ Verify mold ID tag matches the welding material as well as the conductor size ▪ Tighten/loosen the handle clamps until the mold seals cleanly
3	Dry out the mold and the conductor using a propane torch	❖ Electrical - The graphite of the mold absorbs moisture which may weaken the bond or produce porous weld ❖ Flammable - Use of an open flame in a live facility ❖ Flammable - Hot surfaces and open flame of torch	▪ Welding gloves to be used with torch ▪ Personal gas monitors to be used during the drying of the materials ▪ Dry the mold on both sides, clean the material with a wire brush to remove dirt or contaminants
4	Position the conductors and/or grounding rod and tighten the clamp	❖ Motion - Pinch points within the clamp ❖ Motion - Sharp edges or the material ❖ Chemical – insulation on wire conductor	▪ Request assistance from other workers in the positioning of the connectors as required ▪ Ensure no wire insulation is in contact with the mold
5	Insert the disk or welding cup, pour in welding material and ignition powder where required	❖ Flammable – Improper or excessive loading of the ignition material	▪ All set up must be done according to manufacturer's specification ▪ **Note: the amounts and set up of the welding material and/or starting material vary between manufacturers. Specifications must be consulted prior to use**
6	Attach the control unit to mold and activate or ignite	❖ Flammable – Ignition of welding material, open	▪ Warn workers in the area prior to initiating the welding process

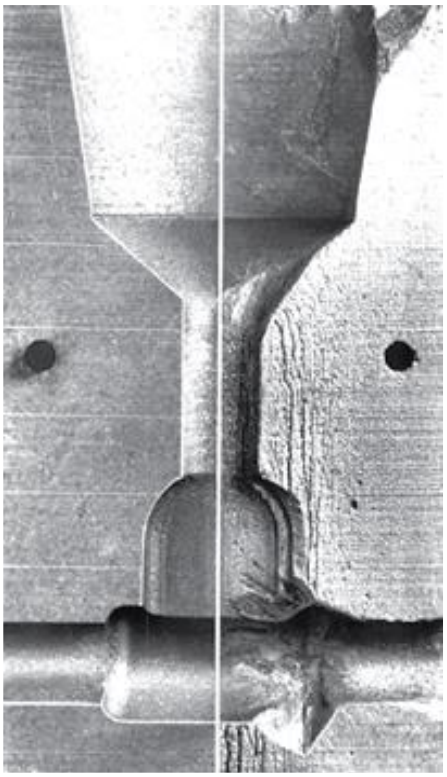
#	Job Steps	Hazards	Control Measures
	powder with flint igniter	flame ❖ Temperature – Very high temperature generated from welding process ❖ Radiation – IR Radiation from welding process	▪ Do not use matches or other ignition source ▪ Allow the mold to cool for a minimum of 30 seconds before handling the mold ▪ Avoid looking directly at the mold during ignition ▪ Safety glasses must be worn by all workers in the area ▪ Do not extinguish the weld. Allow it to burn itself out
7	Remove the mold and inspect the weld	❖ Temperature – The mold or weld may still be hot ❖ Flammable – Smoldering material may fall from the mold and present an ignition or burn risk	▪ Avoid touching the weld when removing the mold ▪ Check the area for smoldering sparks and maintain fire watch as required ▪ Inspect the weld against manufacturer's specifications for acceptance ▪ File down any irregularities to prevent risk associated with future handling
8	Test the weld	❖ Mechanical - Poor or weak connection	▪ Check for burn-through of the wire ▪ Gently tug on wire to check for give or weld failure. If so, condemn this weld, and go back at least 150 mm and repeat the weld procedure.

ADDITIONAL PRECAUTIONS

Inspection of the mold is critical for a safe and effective bond, refer to figure 2 below for an example of mold in need of replacement

Figure 1. – Example of Mold

Figure 2. – Example of a Mold in Good vs Poor Condition



Good Replace

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