

## GROUNDING SPECIFICATIONS FOR thermOweld® EXOTHERMIC WELDING SYSTEM

### 1. Purpose

This specification recommends criteria for use of thermOweld® products to provide reliable permanent connections for utility, commercial, industrial, and residential grounding applications. Guidance is provided for the selection of properly formulated welding material, molds and accessories to properly complete these connections. Each application may have specific local code, industry and engineering requirements to assure safe grounding of the customer's installation.

### 2. Product Applications

The thermOweld® exothermic welding system is used in a variety of applications to achieve permanent superior quality electrical connections. Manufacture of thermOweld® products are carefully controlled to assure a safe connection is made every time. thermOweld® products are engineered to provide grounding and continuity solutions in the following applications. Each connection is designed to exceed the life of the system in the harsh direct burial environment.

- a. Industrial Equipment and Power Grounding
- b. Commercial Building Equipment and Power Grounding
- c. Residential Power Systems Grounding
- d. Utility Power and Substation Grounding

Product formulations have been developed for effectively joining a number of materials. Molds are available for joining copper clad ground rods, galvanized ground rod, stainless steel ground rod, signal reference grids, ground mats, AWG and metric wire, lugs, bars, pipes, sheet, rods, a variety of profiles and types. Copper, carbon steel, galvanized steel, stainless steel, cast and ductile iron, brass, bronze, and a variety of custom metal alloys.

Design considerations include rate and heat of reaction necessary to safely provide a superior molecular bond for each material type, size and connection configuration. Connection shall exceed requirements of IEEE 837.

### **3. Materials of Construction**

thermOweld® products are manufactured with raw materials designed to exceed the industry expectations for life and performance. Articles are free of hazardous compounds identified as prohibited in the EU – RoHS requirements.

- a. Weld metals are manufactured with copper, copper oxides, aluminum, and minor constituents for rate control, wetting and deoxidizing molten metals formed during reaction. Formulations will not contain caustic, toxic, or explosive substances including but not limited to magnesium, and phosphorus. thermOweld® weld metals will easily clean out of the crucible after each shot. Cathodic protection and Rail formulations will be free of tin.
- b. Starting powder will contain aluminum, copper oxide, and iron oxide. No phosphorus, magnesium, caustic, toxic or explosive substances will be present in formulation.
- c. Molds for multiple uses will be manufactured from graphite formulated for high temperature applications and designed to provide an average of 50 connections satisfactorily. Molds will be equipped with EZ lite® lid that allows flint ignitor or electronic initiation from top of mold with exhaust gases directed to the side of the mold away from mold handles to extend life of system. One time use products will be manufactured from cordierite ceramic suitable for creating thermOweld® connections.
- d. Remote ignition system products shall be manufactured for use with tubes of weld metal. System shall be designed to allow initiation with battery pack or a flint ignitor without loss of product to change initiation method.
- e. Handle clamps will be offset design to reduce excavation requirements of installer and to achieve quick application of x-type grid connections.

### **4. Quality Control**

Manufacture of thermOweld® exothermic welding system components will be performed in accordance with written work instructions to assure consistent performance for the

end user. Products will have a lot number and/or date recorded on the product during manufacture to provide traceability for quality assurance purposes.

- a. Manufacturers will be ISO9001:2008 certified to assure continuous improvement and consistent performance in service.
- b. Manufacturers will have experience manufacturing exothermic welding systems for at least 25 years.
- c. Destructive testing of test welds will be conducted throughout the manufacturing process to assure quality of connection.
- d. Samples of weld metal and test coupons will be retained for minimum of 2 years.

## 5. Marking

thermOweld® weld metal is packaged with date of manufacture or lot number on each box label to assure customers receive product manufactured in accordance with current specifications and to provide maximum shelf life by allowing FIFO stock rotation.

- a. Weld metal will have cartridge size, formula, and lot number clearly visible on container to aid in identifying intended use. UL marking will be displayed in accordance with requirements for listed products. General safety instructions are provided in each package of weld metal.
- b. Molds made with graphite will have permanent tag attached that clearly identifies mold number, connection type, conductors, weld metal cartridge, and formula of weld metal. One time use ceramic molds will have mold number, connection type, and conductors clearly marked on package. UL marking will be displayed in accordance with requirements for listed products. Application instructions will be provided with each mold detailing general safety procedures, general preparation and welding practice, and information specific to each weld type to assure a quality connection each time.

## 6. Packaging and Shipping

Weld metal produced by thermOweld® is packaged in containers designed to maximize shelf life of product and prevent damage from atmospheric moisture normally encountered during use.

- a. Manufacturer will package tubes of weld metal in shrink wrapped polyethylene boxes to assure maximum shelf life. Package will be designed to prevent damage or spilling during conditions normally encountered during shipping from factory to customer point of use.
- b. Product will be packaged in a manner to prevent mixing of starting powders with weld metal during transportation to assure customer is able to initiate reaction with flint ignitor.

## 7. Training

thermOweld® exothermic connection system is designed to be used with minimum training required. Instructions, catalog details, web based training, and training from a factory representative are available.

- a. Manufacturer will provide exothermic connection system requiring minimal training to produce quality connection designed to last the life of the system.
- b. Manufacturer will provide detailed work instructions with molds and weld metal, catalogs examples; web based video training, and make factory training available upon request.
- c. Manufacturer will respond promptly to customer requests for instruction or guidance for proper use of product or assistance to resolve customer issues. Factory trained personnel will respond to field calls and schedule construction crew training as necessary to assure proper techniques are employed to make exothermic connections.

## 8. Reference Standards

thermOweld® exothermic connections made in accordance with product instructions and the follow standards requirements comply with these requirements.

1. UL 467 “Grounding and Bonding Equipment”
2. UL 96A “Installation Requirements for Lightning Protection Systems”
3. NEC Article 250 “Grounding and Bonding”
4. IEEE 837 “Standard for Qualifying Permanent Connections Used in Substation Grounding”

5. IEEE 1100 “IEEE Recommend Practice for Powering and Grounding Electronic Equipment”
6. IEEE 80 “IEEE Guide for Safety in AC Substation Grounding”
7. BS6651 “Protection of Structures against Lightning”
8. NFPA 780 “Standard for the Installation of Lightning Protection Systems”
9. NFPA 70®”National Electric Code®”
10. ANSI T1.333-2001 “Grounding and Bonding of Telecommunications Equipment”
11. ANSI-J-STD-607-A-2002 “Commercial Building Grounding (Earthing) and Bonding Requirements for Telecommunications”
12. NEC 680 “Equipotential Bonding for Swimming Pools, Spas, and Hot Tubs”
13. USDA “Rural Development Electrification Borrowers”