

## UNIFRAX ENGINEERED THERMAL COMPONENTS APPLICATION STORY



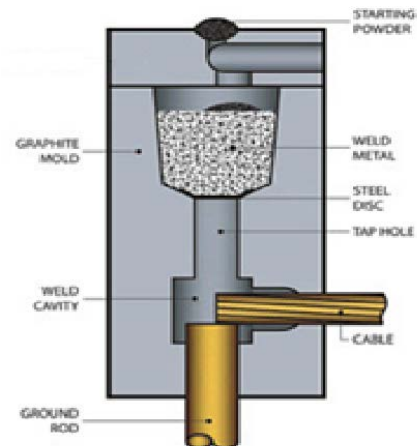
**Product Solution:** Thermfrax™ Vacuum Formed Molds  
**Application:** Exothermic Welding Crucibles  
**Location:** North America

**JANUARY 2018**

### Application Description

Exothermic welding (also known as Thermite Welding) is a fast, low cost process for joining metals together in field conditions where conventional welding equipment is not available or practical. The Thermite Welding process is frequently used to join sections of railroad track, in addition this technique is the preferred method used to join electrical connectors in grounding applications on construction sites.

For welding copper electrical connections together, copper and aluminum powders are mixed together in the mold. A magnesium starter powder is ignited with a spark to initiate the exothermic reaction:



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“ . . . eliminates the fire hazard caused by the cracking and spalling of cordierite molds.”

## Application Description *con't*

Temperatures inside the mold exceed 1400°C and quickly melt the copper. Aluminum, and oxygen freed by the melting of the copper, combines to form an alumina slag that protects the weld. Once the copper melts it flows into the mold cavity joining the ground wires together.

Due to the high reaction temperatures, the single use mold is completely destroyed during the welding process.

*Photo-1*



*Photo-1 Exothermic welds have high mechanical strength and excellent corrosion resistance due to the purity of the metal produced in the process.*

## Competitive Materials

### Single Use Molds:

The large molds used for Thermite welding of steel rails are typically manufactured from a sand resin mix. A pre-fired ceramic shape made from cordierite is used as a mold for thermic welding of electrical connections.

### Multi Use Molds:

One alternative to the consumable mold is a permanent mold machined from graphite. Note that a different permanent mold must be provided for every connector configuration based on wire size and location. On projects where a variety of connections are made in different configurations, single use molds are a more cost effective option.

*Photo-3 The proprietary forming process used to manufacture Thermfrax crucibles assures close dimensional tolerances for proper positioning and support of the weld powder cartridge.*



*Photo-2 Thermfrax thermic welding crucibles are designed for a variety of ground cable sizes and terminal locations.*

## Advantages of Thermfrax™ Vacuum Formed Molds for Thermite Welding

- Thermal shock resistance: molds made from cordierite are prone to thermal shock and fracture due to the high temperatures and fast reaction time in the welding process.
- Fire safety: eliminates the fire hazard caused by the cracking and spalling of cordierite molds.
- Reduced contamination: better weld quality.
- Fewer inclusions.
- Improved insulation of the weld during cooling: improved metal properties.



- Light weight and easy to handle.
- Available with complex geometries and metallic inserts to position ground wires.
- Close dimensional tolerances.



## Manufacturing Capabilities

- Net Shape casting process
- High purity fiber chemistry
- Inorganic “no smoke” formulation
- Assembly of cable ferrules and clips
- Experience: over one million Thermfrax Crucibles produced to date.

## About Unifrax

Unifrax is a global leader in high-performance specialty products used by many industries in a diverse group of industrial applications. Our products provide substantial improvement in thermal performance, save thousands of dollars in energy costs and can help reduce your operations environmental footprint.

## Contact Us

To learn more about Unifrax Engineered Thermal Components, contact your Unifrax sales representative or the Unifrax Application Engineering Group in your region:

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