

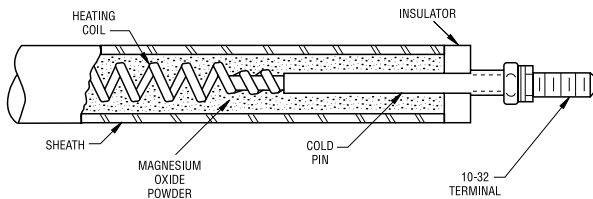
Introduction

INDEECO designs and manufactures commercial and industrial electric heating and control systems that set the industry standard for excellence. The company's heating solutions reflect more than 70 years of innovation, product quality and efficient service.

Our product offering ranges from the tubular heating elements described in this catalog to the most sophisticated, custom designed system. INDEECO's attention to detail and rigorous testing give worldwide customers premium products that they receive quickly and at a fair market price.

Construction

Standard Construction

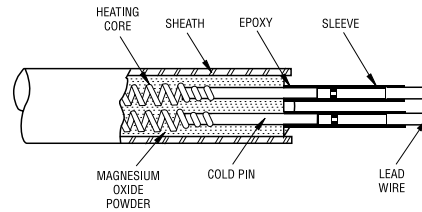


The cutaway view of a typical INDEECO tubular element shows its basic construction. A coil of the highest grade-resistance wire (80% nickel, 20% chromium) is precisely centered in a heavy gauge metal tube while the tube is filled with granular magnesium oxide powder. Terminal pins are welded or silver soldered to the resistance coil at each end to provide an unheated length near the terminals and to secure the coil in the magnesium oxide. Through rolling, the diameter of this assembly is reduced and the magnesium oxide compacted, insuring rapid heat transfer from the coil to the sheath, as well as high dielectric strength.

After compaction, the element is processed in one of three ways:

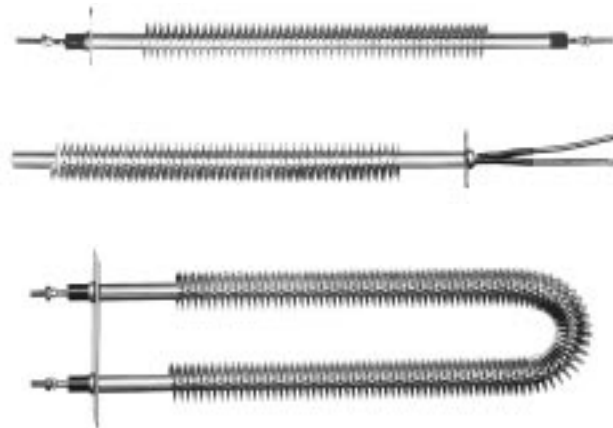
1. **Straight length elements** are sealed and appropriate terminals applied.
2. **Formed elements are annealed** and bent before they are sealed and terminated.
3. **Finned elements** are wound with a helical fin before they are sealed and terminated.

Two-Pass Construction



For applications requiring both terminations at the same end, either a U-bent or a two-pass element may be used. Two-pass elements, as shown in the cutaway view, have a U-bent coil inside the sheath and two leads or terminals at one end. The opposite end is sealed by welding or silver soldering. These elements are available in straight lengths, either finned or unfinned. They can be permanently mounted with a variety of factory-furnished mounting methods (see page 12). By contrast, standard elements in straight lengths must have a flexible electrical connection at one end to allow for thermal expansion.

Finned Construction



Standard Construction: A corrugated 304 stainless steel fin is helically wound on a .475" diameter 304 stainless steel element. To insure a permanent bond, each end of the fin is tack-welded to the element sheath. The entire assembly then goes through a computer controlled atmosphere furnace. This process prepares the element to be bent into a variety of configurations. Standard fin density is five fins per inch, while eight fins per inch can be furnished when specified.

Special Materials: .475" diameter elements can be furnished with monel fins and/or sheath. There are a variety of other exotic materials available that are useful for unique applications. Contact your local sales representative or INDEECO for the appropriate material for your application.

Construction/Quality Control

Construction Techniques

INDEECO construction techniques are designed to insure high quality and long life.

- **Rolling** – All standard diameter elements listed in this catalog are compacted through multi-stage rolls. This process insures uniform compaction of the magnesium oxide, a truly round cross section and a consistent diameter. This is critical if the element is being inserted into a machined hole.
- **Terminal Construction** – A threaded 10-32 stainless steel terminal is welded onto the cold pin for the standard construction. This technique allows the use of a relatively small diameter pin since it is not carrying the element current at its most critical point: connection to field wiring. The smaller pin also results in greater electrical clearances between the pin and the sheath, which is critical at higher voltages.

Stainless steel nuts and washers are furnished for field wiring. This hardware fits up to an integral shoulder with two flat sides on the terminal. Using an end wrench on the flats will prevent the terminal from rotating when connecting field wiring.

The terminal insulator and seal must be suitable for the temperature, voltage and atmospheric conditions of the application. INDEECO offers a wide variety of terminals, insulators and seals to meet virtually any combination of field conditions (see pages 6 and 7).

- **Recompaction** – In the process of bending, hairline cracks can develop in the compacted magnesium oxide. These cracks, in turn, can lead to overheating and coil failure, especially at high temperatures or high watt densities. To prevent such failures, we recompress most bends with a center-to-center diameter of 2" or less, eliminating cracks in the magnesium oxide.

Quality Control

From raw materials through the finished product, INDEECO maintains the highest standards in the industry through a series of Quality Control/Assurance checks.

- **Magnesium Oxide** – INDEECO uses only 96% pure MgO, the highest grade available for electric heating elements. Each batch is checked against two ASTM Standards: ASTM D3347 determines tap density to assure a high insulation density. ASTM D2755 is used for sieve analysis. Samples are sifted through ten progressively coarser sieves to assure a high concentration of larger grains, which have better thermal conductivity and dielectric strength. As a result, INDEECO elements have extremely high MgO density.
- **Certification to Special Standards** – Elements can be certified to Military Standards such as MIL-H-22577C and MIL-H-22594A, and special customer specifications regarding tolerances, hydrostatic testing, etc. Please consult the factory for details.

UL and CSA Recognition

Most of the elements described in this catalog are Recognized by the Underwriters Laboratories under UL Standard 1030. Our File No. is E78533. In addition, epoxy-sealed elements for refrigeration defrost are Recognized under File No. SA3254. Such recognition makes it simpler for manufacturers to incorporate INDEECO elements into equipment that is UL Listed. Tubular and finned tubular elements are also CSA approved under Report No. LR 11895-39. Please consult the factory for details.