

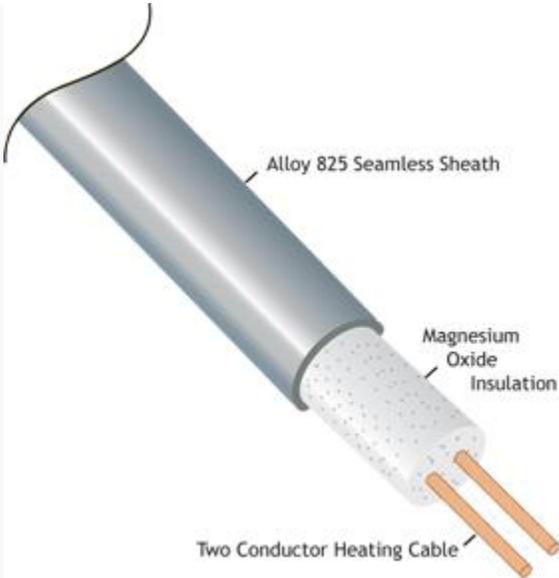
# Mineral Insulated Cables

## Introduction



Figure 1. Typical MI cables

The Mineral Insulated (MI) Cable is the safest choice for power and heating (prevention and protection from fire in industrial and civil applications) as well as for electrical heat tracing (industrial and building processes).



## Construction

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Mineral insulated cable is manufactured from completely inorganic material. The copper sheath and conductors, insulated with magnesium oxide ensure that the cable is able to withstand the effects of fire and is fully usable afterwards. The MI cable system provides a simple solution to many difficult wiring problems and makes for a dependable and permanent installation for virtually all types of electrical circuits. Suitable for 300 and 600 volt applications. Pressure tested to 2000 psi. Mineral insulated cable complies with Articles 330, 500 and 501 and all other applicable provisions of the National Electric Code.

### Production process

Solid copper conductor rods are first inserted into a vertical 2.5" diameter copper tube 30 foot long, kept at the correct spacing with mineral insulated block inserts. The tube is packed with magnesium oxide, which acts as a seal and fireproof insulator. The end of the copper tube is sealed off and a steel draw wire attached. Using special machinery, the filled tube is put through a swaging process which reduces the sheath and conductor diameter proportionately while lengthening the cable. For example, a two conductor cable #16 AWG. has a nominal length of 1221 feet.

Swaging or drawing down locks the conductors into place so the position of the conductors inside the sheath never varies, even when formed or bent. During the swaging process, the cable is put through an annealing or heating process to align the copper molecules and keep the cable flexible.

### Material specifications

Mineral insulated cable is manufactured from high conductivity copper ASTM B4 or B5; insulated with compressed magnesium oxide powder; a seamless phosphorous deoxidized copper sheath; maximum continuous operating temperature of 250°C; a working voltage of 0-300 volts AC/DC and 0-600 volts AC/DC; factory test voltage 1500 volts RMS (300 volt cable) and 2500 volts RMS (600 volt cable); a power factor of 0.1%; dielectric constant (SIC) at 3.7 and dielectric strength 70 volts/ml at 475°C.

## Mineral Insulated Cable Vs. Conduit

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By using mineral insulated cable, you not only eliminate the uncertainty of conduit and wire, but also the cost of additional materials, including pull boxes, unions, grounding wires, conduit seals and other fittings. Pressure tested to 2000 psi, mineral insulated cable delivers superior performance by blocking the passage of vapors, gases, liquids and flames; eliminates pressure piling and confines any exploding gases to their immediate area.

With conduit, seals must be placed within 18" of the arcing device or instrument to be connected to the conduit system. If a conduit seal fails, gas or liquids can migrate freely and it is for this reason that some companies require single or double conduit seals in hazardous areas to be annually x-rayed and inspected.

## Usage

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MICC cable assemblies are ideal for power, control, instrumentation and thermocouple applications in classified areas. The copper outer sheath is approved as a ground conductor and the high current rating can satisfy virtually all power applications. In addition m.i. cable features a low physical profile that allows unlimited bends without pull boxes.

MICC offers four types of cable assemblies:

- copper sheathed cable, copper conductors; UL fire rated for two hours at 1850°F.
- twisted pair and shielded twisted pair with copper conductors, inner shield and outer sheath, UL fire rated for two hours at 1850°F.
- alloy 825 sheath, solid nickel conductors, fire rated for 30 minutes at 2200°F or nickel clad copper conductors, fire rated for 30 minutes at 2000°F.
- stainless steel 316 thermocouple extension cable, all types

All cable assemblies are appropriate for the following conditions:

### **Fire and heat resistant**

The inorganic construction of mineral insulated cable makes it extremely fire and heat resistant. With an operating limit equal to the melting point of copper, 1982°F, 1083°C - it can easily withstand high temperatures and heavy current overloads. It emits no smoke or toxic substances and allows no flame propagation. In contrast, a third party test proved standard conduit and wire failed at 425°F. These fireproof properties make it the best choice for connecting motor operated valves, control stations, plant shutdown systems, instruments and power devices that must remain operational under actual fire conditions.

Mineral insulated cable and cable assemblies are extremely reliable as power and control cables in hospitals, hotels, high rise buildings for emergency generators, fire pumps, smoke and vent exhaust fans, communication circuits, multiplex alarm systems and instrumentation.

Other applications include wiring connections to electric heaters on boilers, tanks and furnace wiring, metal smelters and lumber kilns, where regular pvc insulation hardens and cracks and has to be replaced regularly.

### **Waterproof**

The cable is solid and constructed with an extruded copper sheath that makes it impervious to liquids. Neither water, process liquids or corrosive solutions can migrate into the system. In copper and brass corrosive environments, or for direct burial an extruded outer HDPE jacket may be specified to provide additional protection. PVC boots cover the brass connectors. Epoxy end termination's provide lifetime sealing to moisture ingress.

Industrial applications include light fitting connections in oil tanks that are periodically washed out with kerosene.

M.I cable assemblies are US Coast Guard approved and are currently used to connect warning beacons, fog horns and lanterns on offshore platforms. They also solve many electrical wiring problems on oil tankers and marine vessels that operate under the worst of climatic conditions.

### **Temperature stable**

Mineral insulated cable does not deteriorate at low temperatures and assemblies are unaffected by continuous, even extreme changes in temperature.

Daily temperature changes cause condensation and moisture to accumulate in exposed conduit above the seal packing, causing rust and corrosion to build up and block the conduit drain. In cold temperatures this moisture can freeze, splitting the conduit or seal and possibly damaging the instrument or electrical device, especially if the wiring is top entry.

Because MI cable assemblies are solid and completely moisture resistant, this risk is eliminated. Industrial applications include power wiring to motors in LNG tanks, freezer rooms and instrument connections in harsh climates such as Alaska and Canada.

### **Radiation resistant**

Magnesium oxide, the insulation in mineral insulated cable, provides superior radiation resistance over any other material and for this reason, MICC cable assemblies are an excellent choice for nuclear power plant applications.

Source:

[http://www.openelectrical.org/wiki/index.php?title=Mineral\\_Insulated\\_Cables](http://www.openelectrical.org/wiki/index.php?title=Mineral_Insulated_Cables)