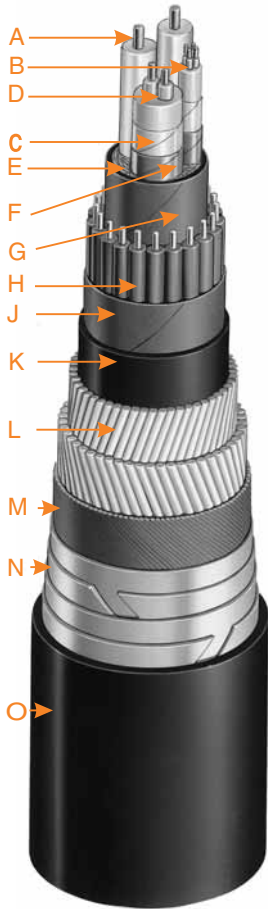




## Low Inductive Interference Cable



- A OKOLENE® Insulated Communications Conductors
- B OKOLENE Insulated Communication Quad
- C Mylar Tape
- D OKOLENE Insulated CTC Code Pair
- E Fillers
- F Copper Shield Tape
- G Binder Tape
- H OKONITE® Vital Circuit Conductors
- J Binder Tape
- K OKOLENE Bedding
- L Non-Magnetic Shielding Conductors
- M Bedding
- N Magnetic Shielding Tapes
- O Outer Covering

This composite cable is representative of one of the many types Okonite can manufacture to meet specific needs.

### Inductive Interference can be a Problem

When railway communications and signal circuits are in the vicinity of high energy power lines, it is essential to investigate and mitigate inductive interference effects. Because of the economic desirability of using existing railway right-of-way for high voltage transmission and the increasing use of solid state circuitry in railroad equipment, the need for precise definition of inductive interference effects becomes most important. The AAR/EEI are recommending as the maximum allowable 60 volts RMS steady state, and 650 volts RMS fault induced voltage. Other limits are required for some special circuits and by some railway systems.

### Induced Circuit and Voltage Effects

Current and voltage in power lines induce electromagnetic and electrostatic effects in communication and signal circuits. In designing these cables, these effects are frequently controlled by means of a shielding system consisting of a concentric conductor and magnetic tapes. The type of concentric conductor and the magnetic tapes are based on calculations of the allowable induced voltage. The space relationship between all metallic circuits in the area, the changing effectiveness of the magnetic cable shield when power currents change, the terminal ground resistance and the resistivity of the earth are all taken into account in these calculations.

### Solutions for Inductive Interference Problems

The Okonite Company has made extensive engineering and laboratory studies of the electromagnetic and electrostatic inductive effects of power lines on communications and signal circuits. These studies, based on computer programs, permit the calculation of impedance, current and voltage parameters which allows us to specify the optimum cable shielding designs.

### Okonite Cables Provide Protection

Okonite designs and manufactures conductors using insulations time-proven in vital railroad signal service. Low loss insulation is used for centralized traffic control (CTC) and communication circuits.

Separate inductively shielded cables for signal, CTC, communications and power circuits can be furnished. Signal, CTC and communication conductors with appropriate isolation shielding can be made up in a composite cable with an overall inductive shielding system such as is illustrated at left.

### Here's how Okonite can help you

Experience. Okonite has a great deal of experience, the most of any cable manufacturer, in solving inductive interference problems. Put this experience to work for you at the earliest stages of your planning — it can save you a lot of time, dollars and frustration.

Since it is recognized that there are no "standard" problems of inductive interference on a system-by-system basis, each one being unique, it follows logically that there is no single standard cable construction to meet universal requirements. However, Okonite experience in working with the criteria of a variety of systems now in service may be able to provide a relatively simple solution, and by combining elements of successful cable designs, give you a quality built — less expensive construction to meet your particular needs.

The technically trained personnel in our sales-service offices are cable professionals to whom the problems of inductive interference are no mystery. Backed by the best engineering and manufacturing facilities in the wire and cable industry, they can make measurable contributions to the solving of your inductive interference problems. Call your local Okonite Office now — have one of our professionals go to work for you.

For each section the information below is needed to make an inductive interference calculation:

- A. First pick a reference point  $x, y = 0$ . Usually this point is chosen to the lower left of all circuits in a given cross section so that all  $x$  and  $y$  measurements are positive.
- B. List  $x$  and  $y$  coordinates of all metallic conductors in the area:
  - (1) All disturbing power phase conductors ( $A_1, B_1, C_1, A_2, B_2, C_2$ , etc.).
  - (2) Cable shield circuit.
  - (3) Any parallel grounded circuits with the same terminal grounds as the cable (such as messengers).
  - (4) All OHG or “static” wires.
  - (5) Catenaries and feed cables for electric railways.
  - (6) Center line coordinates of rails (if rails are electrically bonded and used on electrified rail circuits).
  - (7) Any other metallic circuits paralleling the cable that may be grounded, such as bare ground wires or “neutralizing” wire.
- C. Advise diameters (over metal) and resistance of all items under “B” (above) except (1) and (6).
- D. Advise length of section and whether this section can be isolated (isolated grounds) from other sections.
- E. Earth resistivity (meter-ohms—if no resistivity is given, 100 meter-ohms assumed).
- F. Current flowing in each power conductor under each given circuit condition in complex ( $r_l, j_l$ ) components or polar coordinates ( $I, \alpha$ ). If phases are balanced, it is assumed that the current stated is flowing in phase A at zero degrees. If short circuit current is given, unless otherwise specified it is assumed it is in the phase nearest the cable (usually phase A) and the other power conductors are open circuited.
- G. Terminal ground resistance. Since these terminal grounds are in series with the cable shield circuit, low values are important for low induced voltages from cable core to ground.
- H. If cable under B (2) is already installed, a complete description of the existing cable and shield should be given. If cable is to be designed to meet inductive interference specifications, paragraph “C” can be disregarded *for cable shield only*. The number of the circuits required in this cable, must be given and the cable core and shield will be designed to meet the specifications.