Electrical Pipe Connections and Designs

There are two basic types of impedance heating electrical connections. These are the end-point and mid-point connections. Simplified drawings illustrating these two connections for a pipe and cable design are shown in Figures 2 and 3.

End-Point Connection

The end-point electrical connection is best suited for complex piping systems where multiple branches or ”tees” are installed. There is no need to electrically balance the system, as with a mid-point connection, which makes installation much easier.

Mid-Point Connection

Electrical isolation is not required at the pipe ends for this connection. Twice the length of pipe can be heated over an end-point system at the same secondary voltage, because the pipe is divided at the mid-point. This connection is best suited for straight or simple pipe runs where the electrical mid-point can be easily determined.

Figure 2 - Pipe and Cable Design with End-Point Electrical Connection

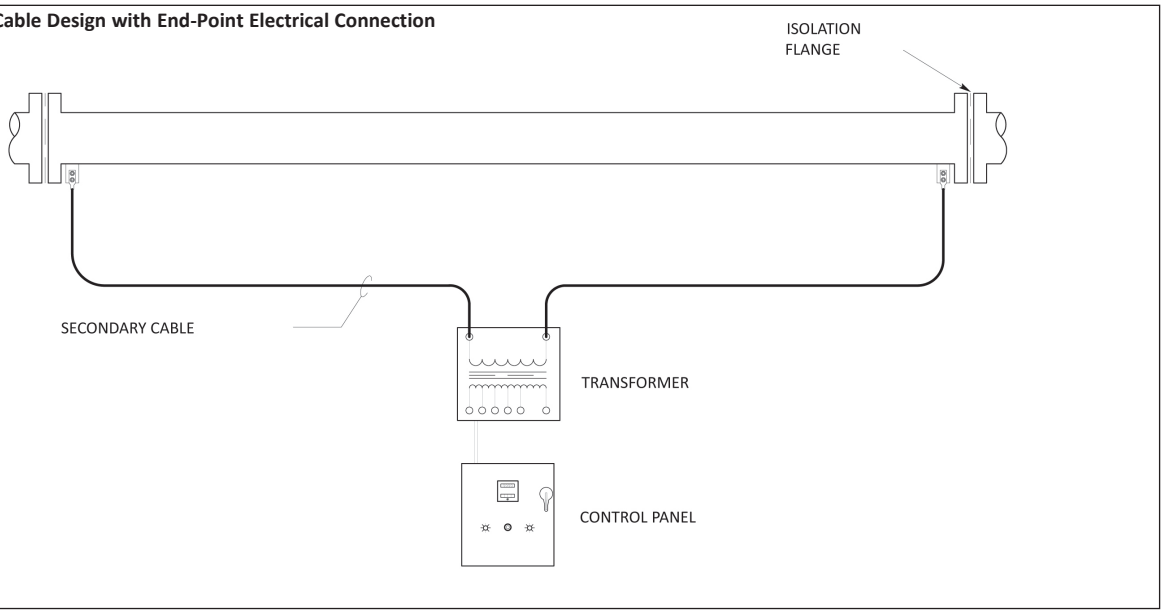
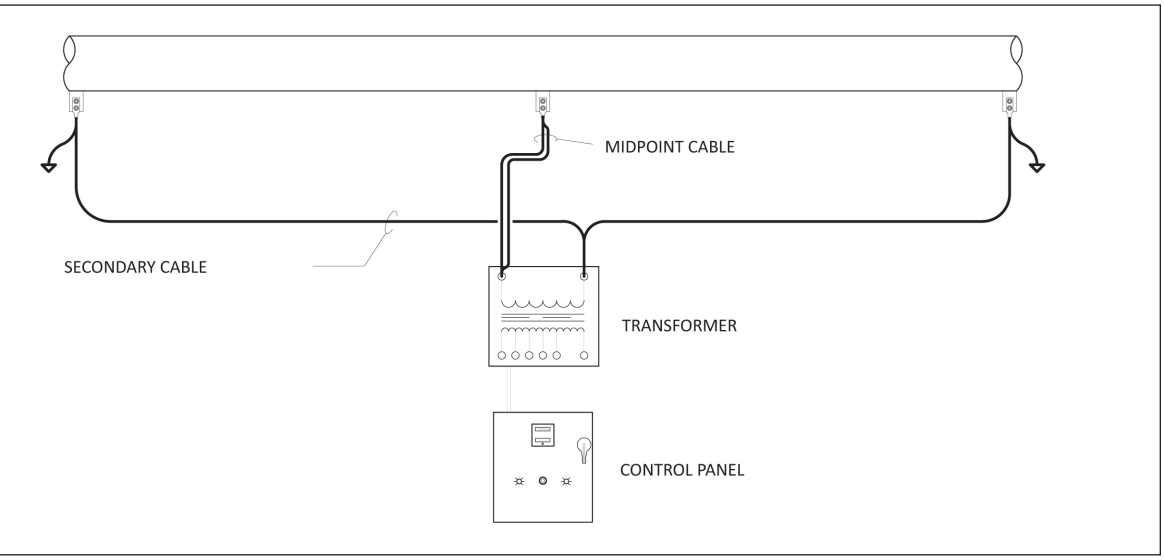


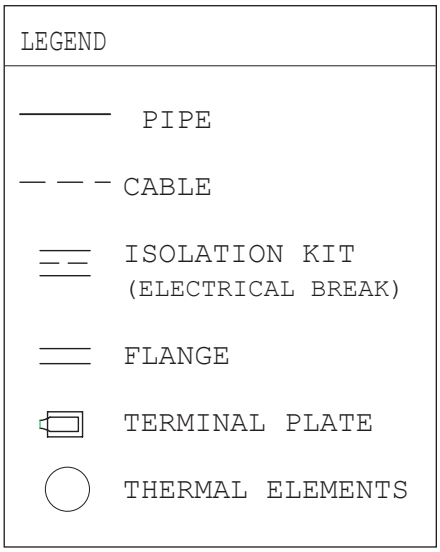
Figure 3 - Pipe and Cable Design with Mid-Point Electrical Connection



Piping Circuitry Drawings

A customer supplied isometric piping layout drawing will enable HEATREX to show recommended isolation points, electrical connections and cable runs.

The isometric drawing shown in Figure 4 represents a typical design for a piping arrangement with end-point connections. The overall length of the pipe in this system is 160 feet. The dotted lines represent return cables.



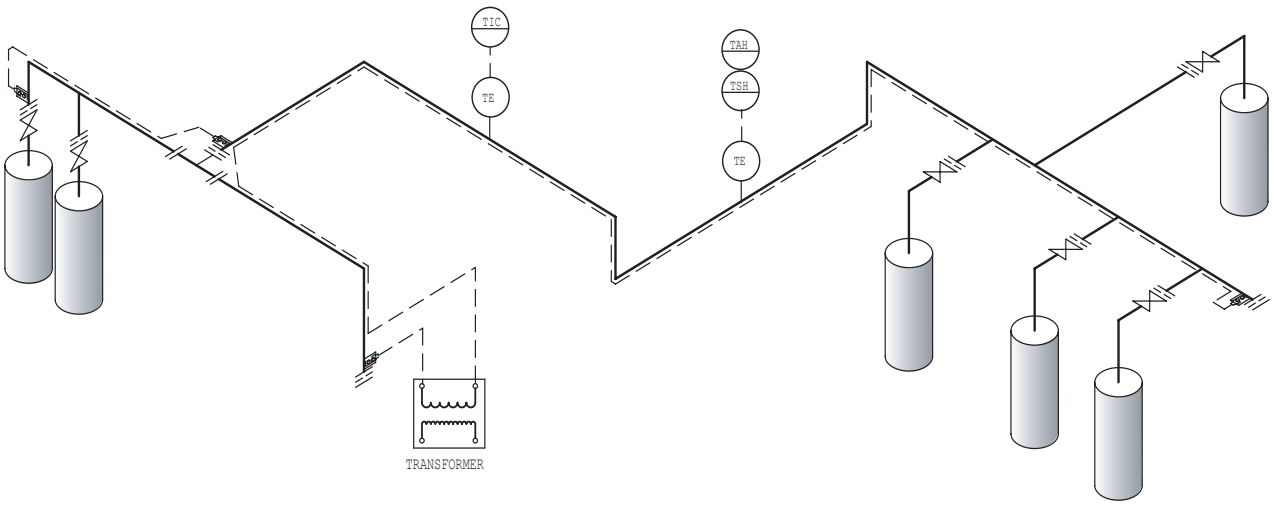


Figure 4 - Isometric Layout Drawing

Impedance heating will maintain or raise the temperature of virtually any gas or liquid in either a flowing or static condition. Since the pipe is actually the heating element, maximum operating temperatures are only limited by the pipe's thermal characteristics.

Although the hardware for an impedance heating system is simple to understand and operate, over 25 interrelated application variables have to be considered during the initial design stage in order to select the appropriate system hardware. To effectively deal with the complex mathematics, HEATREX has developed an exclusive computer design program.

To design each system efficiently, our engineering department needs certain information. Using this information, the design output is generated by the computer program which is then used in the selection of the appropriate hardware.

Customer Input Information

The following information is required for ALL PIPELINE HEATING applications:

Pipe Size: Pipe sizes range from 3/4" to 24" IPS and up to 36" for alloy materials. For carbon steel, we request the IPS pipe size and schedule number. For alloy pipe, we request outside diameter and wall thickness.

Pipe Material: Materials include carbon steel, stainless steel, nickel, Incoloy, Inconel, Monel, Hastelloy and Duranickel. Note: Copper, aluminum and other high electrically conductive materials cannot be used. Non-conductive materials, such as plastic pipe, are also unsuitable.

Pipe Length: This is virtually unlimited; however, short runs of a few feet are usually impractical, and long runs of over several hundred feet may require multiple systems. An accurate system pipe length is very important to the impedance design. Inaccurate measurements or estimated pipe lengths can result in a system that does not perform as designed.

Insulation Type and Thickness: The thermal insulation required on all heated pipes for energy efficiency varies in thickness and insulating properties. This information is needed to accurately determine heat loss and required KVA for the impedance heating system. Heat loss information can be provided by the customer or developed by HEATREX.

Ambient Temperature: The minimum and maximum ambient temperatures to which the pipeline will be exposed.

Maintenance Temperature: This is the temperature at which the pipe is to be maintained and is often the same temperature as the process material in the pipe.

The following information is required for COLD START or TEMPERATURE RISE applications:

Specific Heat, Specific Gravity, Latent Heat of Fusion, and Melting Point: This data is required for the static process material in the pipe at the time of cold start-up.

Heatup Time: This is the desired and/or available amount of time in hours to bring the process material in the pipe up to the maintenance temperature from ambient temperature.

Inlet Temperature: The fluid or gas temperature entering the pipe.

Outlet Temperature: The required fluid or gas temperature at the outlet discharge.

Flow Rate: The fluid or gas mass flow rate in lbs/hr.