Codes and Recommended Practices

You are considering your application of heating a fluid in your process, and electric impedance pipe heating looks like just the right fit. Logic suggests that you should be aware of codes and recommended practices to round out your review and provide additional education. So where to turn to?

Two of the best places to look are the NFPA National Electric Code and IEEE. If you are addressing an application in Canada then the CE Code Handbook would be a good choice.

This article provides you with the relative references and a brief description of what you will find when you review the actual documents.

NEC 2008:
Article 427: Fixed Electric Heating Equipment for Pipelines and Vessels

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The requirements of Article 427 apply to electrically energized heating systems and the installation of these systems used with pipelines, vessels or both.

An Impedance Heating System is a system in which heat is generated in a pipeline or vessel wall by causing current to flow through the pipeline or vessel wall by connection to an ac voltage source from a dual-winding transformer.

Generally, equipment for pipeline and vessel electric heating is identified as being suitable for the chemical, thermal and physical environment and installation in accordance with manufacturer's drawings and instructions.

IEEE
Standard 844-2000

Abstract:
Recommended practices are provided for the design, installation, testing, operation, and maintenance of impedance, induction, and skin-effect heating systems. Thermal insulation and control and monitoring are addressed. General considerations for heating systems are discussed, covering selection criteria, design guidelines and considerations, power systems, receiving and storage, installation, testing, operations, and maintenance. These aspects are then discussed for each of the above types of systems, along with special considerations particular to each. These recommended practices are intended to apply to the use of these heating systems in general industry.

7.1 Introduction
7.2 Selection Criteria
7.3 Design Guidelines and Considerations
7.4 Specifications
7.5 Installation
7.6 Testing
7.7 Operations
7.8 Maintenance
7.9 Special Considerations

The types of heating systems covered by this standard have been used for a number of years. They were recognized in the early 80's in the National Electric Code and have served well through the years.

Impedance heating of pipes and vessels is a growing portion of total heating requirements in a variety of industries because of its advantage in temperature control, minimal maintenance and high reliability.

Since electric heating systems are interrelated with electric power, control and alarm systems, other electrical and local standards should be considered when using this recommended practice.

Heating systems covered in this recommended practice can be divided into five categories:

Solidification prevention
Viscosity Maintenance
Process heating
Condensation Prevention
Remelting Solidified Fluids

Here are general characteristics of impedance heating systems as described in the standard.

Parameters	**Impedance Heating Capability**
Maintain Temperature	High
Practical Heat Density	High
Voltages on Exterior Surface of Pipeline or Vessel	Moderate
System Efficiency	Moderate
Magnetic Path Isolation Required	Yes
Electrical Isolation Required	Yes
Distance between Power Feed Points	Moderate
Uniformity of Longitudinal Heating	Good
Usual Applications	Moderate Length Pipelines

In impedance heating systems, a low ac voltage is applied directly across a length of pipe, which results in a high current flow. This provides I^2R ac heating because of the resistance of the pipe. The return cable (that makes the circuit complete) is run parallel to the pipe and in close proximity to it. A magnetic flux is produced between the cable and the pipe and causes eddy currents and hysteresis, which provides additional heat in the pipe. If the pipe has magnetic properties, these effects will be enhanced. An impedance heating system consists of the secondary of the transformer, the cables, the pipe and insulation.

Canadian Standards Association
CE Code Handbook
Rule 62-402

Pipeline resistance heating is a method used to heat pipe and the substances it encases by using the pipe's resistance to serve as a heating element. Rule 62-402 sets out the electrical installation requirements for pipeline resistance heating. In practice, it is advisable to prepare a drawing of the complete installation and check each requirement against it. Pipeline resistance heating should not be installed without the assistance or direction of people familiar with such systems, and people performing maintenance on these systems should be familiar with their operation.

Further Information

For the full explanation of these standards and practices please click on the following links:

NFPA – User's Guide to the NEC

NFPA 70 - National Electrical Code 2008

IEEE – Standard 844-2000

Canadian Electrical Code, Part I Handbook