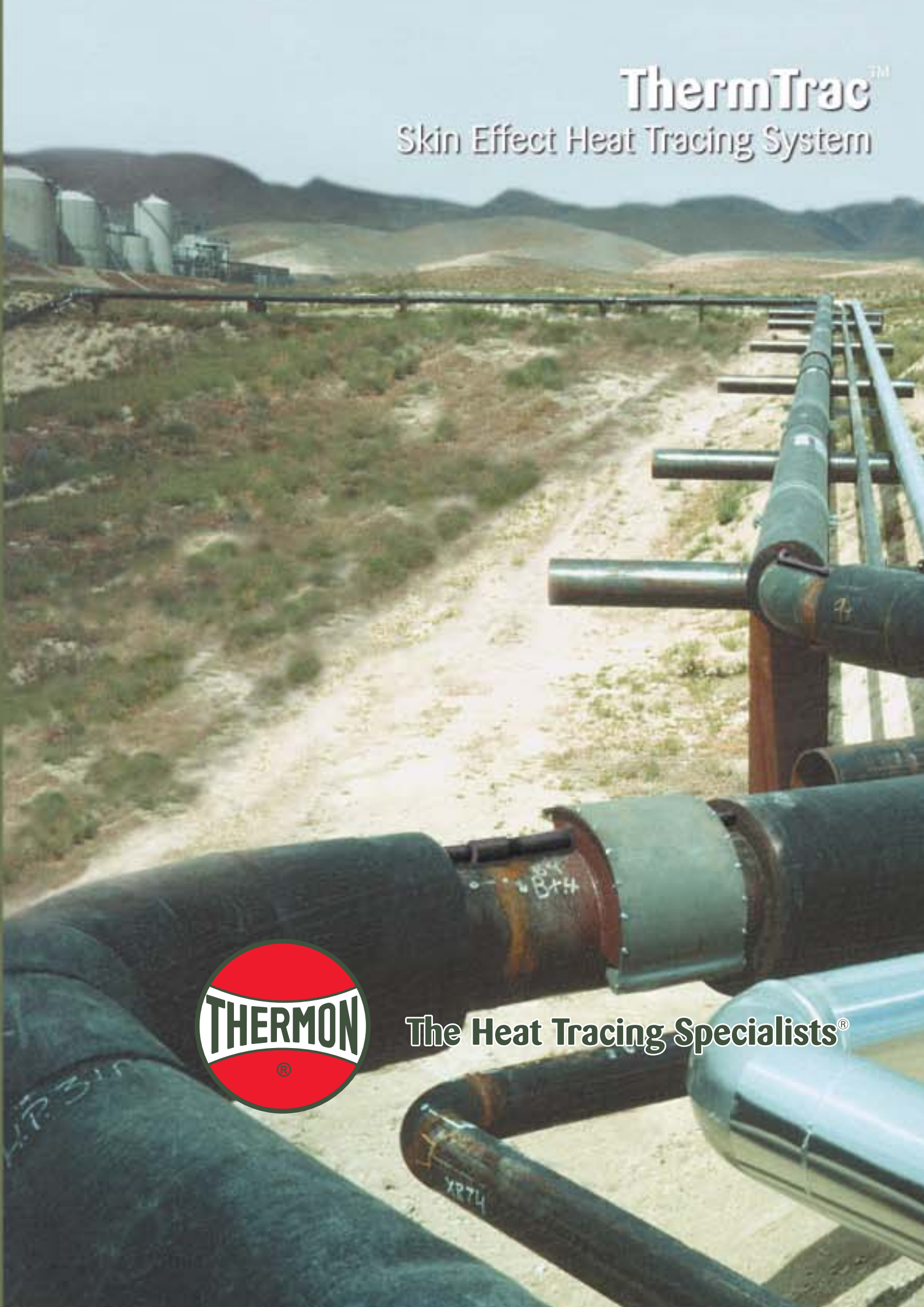
ThermTrac™

Skin Effect Heat Tracing System



THERMON®

The Heat Tracing Specialists®

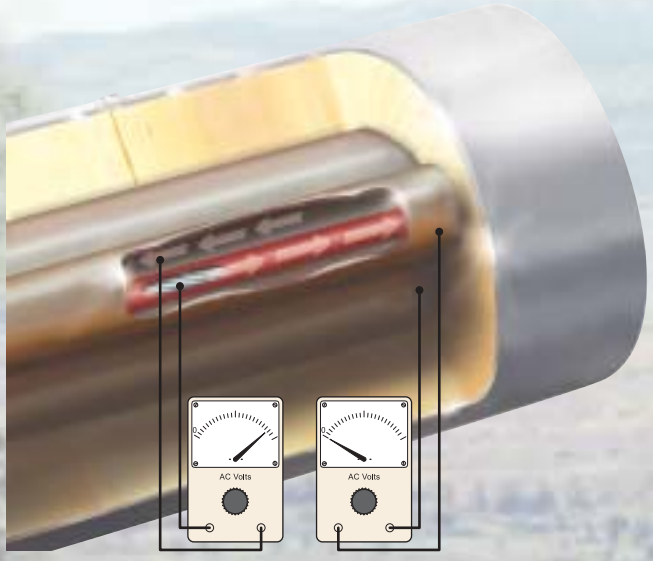
ThermTrac™ Skin Effect Heat Tracing System

The ThermTrac system is ideally suited for long pipeline heating applications involving movement of materials to and from tank farms, process units and loading/unloading facilities. The versatility of the system makes it ideal for temperature maintenance, freeze protection and heat-up applications. Adaptable to varying site conditions both above and below ground, a ThermTrac system can traverse terrains with significant elevation changes.

A ThermTrac system provides a cost-effective alternative to conventional resistance heat tracing on long line piping by eliminating the need for an extensive power distribution system. A pipeline up to 25 kilometers long can be traced from a single power point.

Thermon has a proven track record with skin effect heating systems. ThermTrac installations, dating as far back as the late 1960s, have been installed around the world in a wide variety of industries including:

- Chemical
- Power
- Gas
- Steel
- Refining
- Oil
- Petrochemical
- Pulp/Paper
- Mining



AC voltage will generate a current in the conductor which returns through the inside surface of the heat tube. There is virtually no measurable voltage on the outer surface of the heat tube, allowing the piping system to be grounded.

Heating System Description . . .

The operating principle of a ThermTrac skin effect heating system is based on two phenomena: proximity effect and skin effect. The heating device is a ferromagnetic pipe called a “heat tube” through which a specially designed skin effect conductor has been pulled. The heat tube and insulated conductor are joined together at one end, while at the opposite end the heat tube and the conductor are connected across an AC voltage source (typically 50 or 60 Hz). The impressed AC voltage will generate a current in the conductor which will return through the inside surface of the heat tube. The concentration of the return current on the inside surface of the heat tube is due to the magnetic flux linkages originated by the currents in the insulated conductor and the ferromagnetic pipe. This current penetrates into the heat tube a distance termed the “skin depth.” Due to the phenomena described, there is virtually no measurable voltage on the outer surface of the heat tube, allowing the piping system to be grounded.

The heat generated in a ThermTrac system is the result of the resistance that occurs on the inner skin of the heat tube. (Some unavoidable I^2R heating occurs within the ThermTrac conductor as a result of carrying the supply current to the skin effect end termination box.) While the electrical current is concentrated on the inner surface of the heat tube, the heat generated will dissipate from the tube into the attached carrier pipe to increase the surface temperature of the pipe and its contents to a designed level.

ThermTrac Delivers . . .

Performance

A ThermTrac system meets the demanding heat tracing requirements of long line piping:

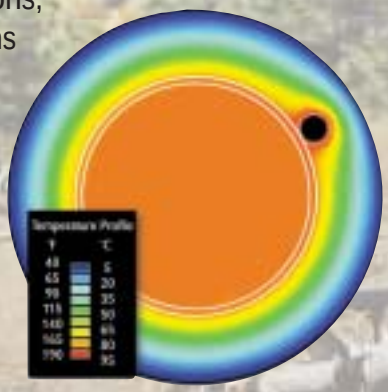
- High temperature
  - Up to 200°C maintenance
  - Up to 260°C exposure
- High Watt density
  - Up to 165 Watts per meter
- Long length
  - Up to 25 kilometers from a single power point

Reliability

Typically, long line piping is located in areas where access is limited. Frequent maintenance and troubleshooting are costly in both time and money. Since one ThermTrac circuit can heat trace over six times the length of pipe that could be protected using conventional resistance heating cables, the power distribution and temperature control requirements are significantly reduced.

Design Solutions

Thermon engineers evaluate the design parameters of each application using CompuTrace™ heat tracing design software and analytical thermal modeling technologies including Finite Element Analysis (FEA) and Computational Fluid Dynamics (CFD). Based on any design requirements or limitations, numerous options are reviewed to establish the best solution for the specific project.



A ThermTrac System Includes . . .

Thermon custom-engineers every ThermTrac system to meet the requirements of each specific application. The Thermon scope of work typically includes:

- Reviewing the application's design parameters and calculating the heating requirements using CompuTrace and thermal modeling as necessary.
- Selecting the heat tube size, ThermTrac conductor and secondary voltage required to feed electrical power to the system.
- Designing and supplying the power/load center and control/monitoring panel(s) including temperature sensor(s).
- Designing and supplying ancillary equipment consisting of field junction boxes, power connection boxes, end termination boxes and pull boxes.
- Providing engineered drawings indicating heat tube routing, box locations, electrical wiring diagrams, field connections, transformer connections and power distribution and control panel connections, plus operation and maintenance manuals for the complete system.
- Supplying specifications for the carbon steel heat tube, couplings and related accessories including specifications for installation, welding and testing.

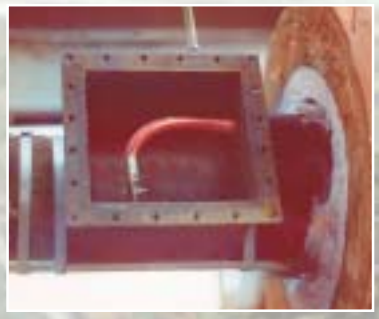
While the engineering package that accompanies each ThermTrac system is complete, many customers elect a Thermon TurnKey installation of the skin effect system. Numerous TurnKey packages are available, ranging from onsite supervision of the ThermTrac system to complete installations that include thermal insulation, power feed wiring, and testing and commissioning of the completed system.

ThermTrac Power Connection, End Termination and Pull/Splice Boxes . . . are integral to the skin effect heating system in that they carry current in the same manner as the heat tube. As such, these boxes are constructed of heavy wall ferromagnetic materials and are welded to the heat tube to ensure the continuity of the skin effect electrical path. The boxes are constructed to conform to the carrier pipe and provide water-resistant protection with gasketed, bolted covers.

Power Connection Box: Located at the power feed end of the ThermTrac circuit, the power connection box permits the connections that supply electrical energy to enter and exit the heat tube. A field junction box located between the power connection box and load center provides an access point to terminate the ThermTrac conductor and the power feed wiring. An external tab on the box permits grounding of the system.

End Termination Box: The design and construction of the end termination box allows the ThermTrac conductor and heat tube to be joined together thereby allowing electrical current to return to the power connection box via the inside surface of the heat tube. An external tab on the box permits grounding of the system.

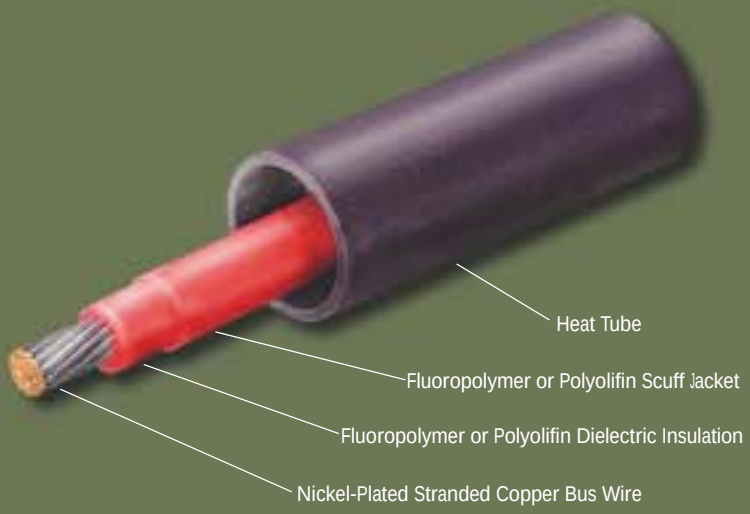
Pull/Splice Box: Located periodically along the heat-traced pipe, this box permits access for installing the ThermTrac conductor. The box is sized to provide for expansion/contraction of the conductor, and versions of the box allow the heat tube to cross over the carrier pipe if necessary at elevation or directional change points.



Power/Load Center and Control/Monitoring Panel(s) . . . are designed to meet the requirements of each specific project based on the available voltage, load requirements, number of circuits and the operating environment.

The power/load center for a ThermTrac system typically consists of a dry-type cast-resin raintight transformer and is equipped with over/under primary taps with additional power adjustment taps on the secondary side. Vacuum contactors, circuit breakers and other protective devices also form a part of the load center. Custom-manufactured, liquid-filled transformers are used based on customer preferences. When multiple skin effect circuits exist (powered from a common location), Scott-tee type transformers may be used to balance a three-phase power supply to feed two ThermTrac circuits.

Control and monitoring panels for a ThermTrac system typically include temperature control and monitoring with high and low temperature alarms, differential current relay safety protection and current/voltage monitoring. The control and monitoring equipment is contained in water-resistant enclosures (for outdoor use) or dust-resistant enclosures (for indoor use).



ThermTrac Ratings/Specifications . . .

The ThermTrac insulated conductor is the heart of Thermon's skin effect heating system. This nickel-plated copper conductor is custom-manufactured by Thermon using a fluoropolymer dielectric insulation and scuff jacket for medium and high temperature applications as well as for critical pipelines. Fluoropolymer-insulated ThermTrac conductors provide superior temperature, flexibility and durability properties necessary for many applications. Where freeze protection and low temperature maintenance applications exist, polyolefin-insulated copper or tinned copper ThermTrac conductors may be utilised.

Available Watt densities	up to 165 W/m
Supply voltages	up to 33 Kv
System operating voltages	up to 5 Kv
Maximum maintenance temperature	200°C
Maximum continuous exposure temperature	
Fluoropolymer-insulated	260°C
Polyolefin-insulated	125°C
Minimum installation temperature	-60°C
Skin effect conductor sizes	8 AWG to 1/0 AWG
Nominal heat tube sizes	1/2" to 1-1/2"
T-rating[1]	T6 to T2

Note . . .

1. Hazardous area temperature classifications are determined for each installation in accordance with the guidelines set forth in IEEE Std 844, *IEEE Recommended Practice for Electrical Impedance, Induction, and Skin Effect Heating of Pipelines and Vessels.*

CENELEC **European Organisation for Electrotechnical Standardisation**
Hazardous (Classified) Locations

CE Ex II 3 G/D T6 to T2 (for G) IP 5X, T .... C (forD) LCIE 00 ATEX 6004X

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