ALL YOUR HEAT TRACING NEEDS
ELECTRIC HEAT TRACING  HEATED TUBING BUNDLES  STEAM TRACING

THERMON  The Heat Tracing Specialists®
Reliable Sustainable Multifunctional

Thermon’s “state of the art” Electronic Heat Trace Control Module

Offices Worldwide
Unites States • Canada • Mexico • The Netherlands • United Kingdom • France • Spain
Germany • Russia • Australia • Malaysia • China • India • Japan • South Korea • Bahrain
Since 1954, Thermon has concentrated its efforts exclusively on heat tracing; the external application of heat to pipes, tanks and instrumentation. With global design, manufacturing and warehouse facilities, Thermon is capable of supplying heat tracing system design and products to meet the needs of customers around the world. This booklet contains a collection of some of our applications from the past 55 years of heat tracing experience.

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THERMON The Heat Tracing Specialists®
Application
Heat tracing is used in numerous applications, each requiring specific knowledge and experience. One of the fields is heat tracing for freeze protection of gas lines and glycol lines in underground gas storage facilities. Typical examples are the Dutch UGS’s in Zuidwending (owner Gasunie), Norg/Langelo (owner Shell EP) and PGI Alkmaar (owner TAQA).

All heat tracing for these plants has been designed and supplied by Thermon. The main function of these UGS’s is providing a buffer supply of gas when under extreme conditions the normal supply of gas becomes insufficient.

UGS Norg
One of the main sources of gas supply in Western Europe is the Dutch Groningen main gas field and a number of surrounding smaller fields. If at a certain ambient temperature the demand exceeds the supply from the Groningen field, the largest UGS will start producing. With decreasing temperature the demand will increase and the UGS will increase its production.

At some stage however transmission capacities are insufficient and force a regional storage facility (like PGI Alkmaar) into operation before the larger UGS has been used to its full extent. The send-out of gas from a UGS will not be completely limited to the actual moments it is really needed. In order to be prepared for send-out the UGS has to be in stand-by mode first. In this stand-by mode gas will be produced at a minimum flow level.
UGS Zuidwending

The end user is of this UGS is Zuidwending VOF in which Gasunie and Nuon are both participating for 50%.

After Thermon successfully completed the UGS plant in Norg/Langelo, owned by Shell EP, it was a logical choice to involve our company again for the Zuidwending project. However this project is different as far as the underground part is concerned.

Underneath the Zuidwending site a huge salt dome is located; an underground salt mountain. For many years already Akzo Nobel has been extracting salt. This resulted in hollow spaces, called caverns. In the area there are 10 caverns of which 4 caverns, each having a capacity of 530,000 m², will be used for the project. The top of the cavern is 1000m below grade and the bottom 1350m. So the whole Eiffel tower could fit in. The caverns are be filled with gas from the nearby Slochteren field or from other foreign suppliers.

The main function of this UGS is providing a buffer supply of gas when under extreme conditions the demand exceeds the normal supply from the Groningen gas field, the UGS will start producing. The gas to and from the caverns is controlled by a plant consisting of 5 large compressors, main building, generator building, metering station and a process plant. It will be clear that the heat tracing plays a vital role. Heat tracing is among others required for freeze protection of gas lines and glycol lines.

The reliability of the gas supply at all times is eminent considering the economic consequences. It will be clear that the heat tracing plays a vital role. The Thermon self-regulating heating cables supplied for above project are BSX™ and HTSX™.
Application
Heat Tracing is used in numerous applications, each requiring specific knowledge and experience. A typical application is heat tracing for oil fields and in this particular case the redevelopment of an oil field; the SRT Project. The end user of the project is NAM, nowadays called Shell EP, and the EPC was Jacobs Engineering. SRT is the redevelopment of the Schoonebeek oil field in The Netherlands.

The Past
In 1943 a predecessor of the NAM, the Batavian Petroleum Company, discovered the Schoonebeek oil field. After the war the NAM started the exploration of this field which was the biggest onshore oil field in Europe, estimated to be 1 billion barrels. NAM was specially founded for this by Shell and Esso, each owning 50% of the company. Between 1947 and 1996 250 million barrels were extracted by means of sucker rod pumps, which could be seen everywhere in the north east of Holland. In 1996 the exploration stopped because of economical and technical reasons (the oil was very heavy) and all equipment was removed.

The Present
At present, 15 years later, new innovative technologies have been developed and the oil field became interesting again. As a result it was decided to redevelop the oil field again. This redevelopment consisted of steam injection, extraction and treatment of the oil. After that the oil is transported to a refinery in Lingen (Germany). The water that is left over is injected into empty gas fields that have been taken out production.
To generate steam from ultra pure water a new water treatment plant has been built. The residual heat of a cogeneration plant is used to generate the steam. The good old sucker rod pumps did not return. The oil is extracted by means of state of the art high efficiency pumps. As a result over the next 25 years another 100-120 million barrels of oil can be extracted form this old oil field. This means an increase of 50% of the Dutch oil reserves.

Thermon designed and supplied the heat tracing for the following process installations:
- Central Treatment facilities (CTF)
- Combined Heat Power Plant (CHP)
- Well Sites (18 each)
- Water Disposal Facilities (12 each)

The complete design was made by means Thermon’s special VisiTrace 3D design software.
Heat tracing is used in numerous applications, each requiring specific knowledge and experience. One of the fields is heat tracing for hydrate prevention in gas fields. The use of heating cables is essential to warrant the uninterrupted production of gas, even at low temperatures.

A typical example of this is the Groningen Long Term Project (GLT) in The Netherlands:

The Groningen gas field, one of the biggest in the world, was discovered in 1959 and has been in operation since 1963. The operator of this field is NAM, nowadays called Shell EP. Because 60% of the gas has been produced and the free-flow production was expected to cease in 2010, NAM decided to embark on a huge renovation project involving amongst others installation of compressors to boost the pressure.

The total investment would be about 2 billion Euros. The Stork GLT consortium, amongst others consisting of Stork Industry Services responsible for construction and maintenance management and Jacobs taking on the design work, was granted the order to upgrade 29 clusters (production units with 296 wellheads in total). For the execution of the project NAM had a number of specific requirements being e.g.: application of “leading edge but proven” technology, a high degree of standardization and synergy between all participants in the project.

The first wellhead cluster in Tjuchem was equipped with a compressor in 1998. This plant was also the prototype for the upgrading of all production clusters.

The design and supply of all heat tracing systems in all clusters renovated was taken care of by Thermon. More than 130,000m heating cable were installed. For the heating of the X-mas trees a special heating plate was developed together with our customer. About 1,000 heater plates have been installed so far.
Background
The plant consists of three bitumen storage tanks and associated pipework including rail off loading, pumping and gantry tanker loading facilities. The pipework and tanks are to be maintained at between 120°C and 140°C.

The plant had been using a constant wattage cable since a site refurbishment project to change from steam to electrical tracing in the early to mid 90’s.

A PTFE sheathed cut to length constant wattage cable was installed on the pipework, utilising multiple runs. A single core flexible constant wattage cable on the tanks was connected in three sections with three cables per section. Control consists of a main panel with electronic PT-100 controllers, controlling banks of circuits. The tanks are also controlled by PT-100 controllers located in the panel but have the facility to switch between star and delta for heat up capabilities.

Cable Replacement
Since initial commissioning, the plant had experienced a number of tracer failures resulting in the need to remove the insulation to facilitate either a repair or replacement of a section of cable. The cables on the pipework were failing on valves and flanges where close contact to the body of the valve or flange was not guaranteed. This was causing over heating of the cable and the soldered joints to fail.

The cables on the tanks had also failed with the requirement of major insulation removal to replace them. One of the tanks has had the trace heating replaced.
Thermon’s Solution
In 2002 Thermon was asked to provide a long term solution to overcome the problems experienced on site. A review of the site was undertaken with the client representative responsible for the site. This review looked at the current faults and the areas most prone to failure, i.e. pumps.

Depending on the line size the original design used either two or three heating cables. It was concluded that lines with two tracers had a higher risk of blockage should a tracer fail. There was one particular line that caused continual problems and this was singled out as an ideal section to trial with Thermon product.

The line was to be replaced with Thermon’s HPT Power Limiting Heating Cable.

HPT-OJ Heating Cables
HPT power limiting heating cables are designed for use with a wide range of trace heating systems from frost protection to high temperature process applications up to 200°C. The cable is ideal for applications where steam cleaning or purging precludes the use of lower temperature heating cables or where very high temperature maintenance is required. The withstand temperatures of up to 260°C de-energised is not restricted by either frequency or duration of exposure.

The power limiting feature of the cable is initiated by the coiled metal alloy resistance heating element which has a positive temperature coefficient. The metal alloy heating element is helically wrapped around a fibre substrate to create a unique composite heating element. The thermal expansion relief created by the fibre, coupled with the impact resistance it provides, makes HPT-OJ a highly durable heating cable.

The cable has a PFA Teflon jacket, followed by a nickel plated copper outer braid, providing a high degree of mechanical protection and corrosion resistance and a PFA Teflon overjacket.

HPT-OJ cables are able to provide significantly higher outputs than conventional cables when used at higher temperatures, which results in the use of less cable and hence reduction in cost. Another feature of the cable is its low start-up current characteristic which ultimately reduces power distribution requirements.

HPT-OJ cables are certified to the ATEX directive for use in Zone 1 and 2 classified areas and have a Temperature Classification of T2 to T6 (dependent on output).
Undertaking the Trial Section

A Thermon installation engineer was employed to install the trial section with the site electrical engineer in attendance to receive training to enable the client to undertake future installation work.

Upon successful completion of the trial section an opportunity then arose to replace the trace heating on the pump section. One of the cables had failed and the remaining tracers were not maintaining the temperature.

This is one of the most demanding areas for heat tracing on site. The pumps are exposed to the elements and form an important part of the plant, performing both rail off loading and tanker loading.

The pump section was stripped and replaced with HPT. Both installations were deemed a total success.

The Way Forward

The client continue the replacement of the constant wattage cables with Thermon’s HPT cable and having installed between 500m – 1000m of cable without subsequent failure, and has experienced the major benefits of using Thermon products.

The client has also employed Thermon to replace the heat tracing on two of the three storage tanks. These were undertaken during shutdown periods and utilised Thermon’s mineral insulated (MI) cables and Thermon site personnel. The installation consisted of over 1100m of MI cable per tank and the design utilised the existing control system and junction boxes so as to reduce of the overall cost of the project. The stripping and replacement of the thermal insulation was also with the Thermon scope, thus providing a full turnkey package.
LNG PRODUCTION & STORAGE FACILITIES

It is estimated that by 2020 gas will supply about 25% of the global energy demand and with the benefit of being a relatively clean fuel this percentage will further increase. As many of the world gas reserves are geographically isolated from the market LNG will play a major role in the efficient delivery of gas to the end user.

The production of LNG by conversion of natural gas to liquid is done in a series of processes that are commonly known as “gas trains”. During these processes the gas is cleaned and dried, liquefied by cooling to -160°C and stored in large LNG storage tanks ready for pumping to LNG Tankers.

Foundation Heating for Refrigerated Storage Tanks
LNG is stored in large insulated atmospheric storage tanks. As the LNG is stored at -160°C the foundation slab requires heating to prevent frost heave and potential foundation buckling due to an ice lens formation, resulting in potential destruction of the tank. Other typical cryogenic products that also require slab heating are Butane and Propane.

Given the critical nature of this application Thermon uses 3D FEA analysis to provide a comprehensive design that includes edge effects. Heater cable is placed in conduit in the foundation slab providing a uniform heat across the tank base and circumferentially in the ring walls as required. Thermon can also advise on the appropriate control and monitoring system. Recommended heat tracing system: FP constant watt heating cable or RSX self regulating heating cable, both with RTD control.

Gas Sampling and Instrument Impulse Lines
Process and analytical analysers require the sampling tubing to be heated above the process or dew point of the specific gas to ensure the sample reach’s the analyser at the desired elevated temperature. Pre-insulated heated tubing bundles include tube, heater cable, thermal insulation and outer jacket as a combined custom product called TubeTrace®. TubeTrace provides an efficient and cost effective solution to heat trace small OD tubing. Recommended heat tracing system: TubeTrace with customer specified tubing type and BSX or HTSX self regulating heating cable and thermostat control.

Process Temperature Maintenance
Process and dew point maintenance for a variety of products transferred in pipelines within the plant. Typical products requiring electric heat tracing are oxazolidinone, waste vent gas, buffer gas and gas metering. Recommended heat tracing system: HTSX self regulating heating cable or if higher maintain temperatures are required HPT power limiting heater cable or MIQ mineral insulated heater cable.

Electric Heat Tracing Standards and Codes
Thermon heat tracing systems are tested and certified by major approval agencies to international industry standards.

LNG projects completed by Thermon worldwide.

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<tr>
<th>EPC</th>
<th>Owner</th>
<th>Location</th>
<th>Project</th>
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<tr>
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<td>Woodside Petroleum</td>
<td>Australia</td>
<td>Gas Trains 1-2,4</td>
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<tr>
<td>FW</td>
<td>Woodside Petroleum</td>
<td>Australia</td>
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<td>KMSB-SIME MLNG</td>
<td>Malaysia</td>
<td>Gas Train 3</td>
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<tr>
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<td>Sempra Energy</td>
<td>Mexico</td>
<td>LNG Tanks</td>
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<tr>
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<td>USA Shell Hazira</td>
<td>Nigeria</td>
<td>LNG Tanks</td>
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<tr>
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<td>Snamprogetti Ras Laffan</td>
<td>Qatar</td>
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<td>Daelim</td>
<td>Skanska Korean Gas/POSCO</td>
<td>Korea</td>
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THERMON The Heat Tracing Specialists®
Application ...
Reliable and effective hopper heating systems play an important role in the removal of fly-ash from precipitators and baghouse hoppers. The hopper must be designed for preheating the hopper to prevent moisture condensation from collecting in the hopper during startup conditions in addition to maintaining the hopper (and fly-ash) above the fluegas acid dew point during normal operating conditions.

Field experience ...
During the last decades many designs and operating procedures have been tried to minimize or eliminate hopper pluggage caused by compaction, agglomeration and solidification. Many of the earlier designs were based on solving the compaction problem only by means of poke tubes and mechanical vibrators. Hopper heating was recognized as by far the most practical method to prevent agglomeration and solidification.

Earlier designs mostly using MI cable (or sometimes heating panels with resistance wires) proved to be very unreliable. Failure was mostly caused by mechanical damage, vibration and chloride stress corrosion. It was even considered quite an achievement if the heaters survived until the next boiler maintenance was carried out, during which the MI cable was mostly replaced.

Sometimes MI cables failed after such a short time that operators gave up and went back to hammering and using pokes. Thermon, manufacturer of amongst others MI cable, recognized that this specific problem demanded a specific solution. As a result the HT hopper heater module was designed 30 years ago already and it has been the landmark for reliability ever since.
HOPPER & CONVEYOR SOLUTIONS
(cont’d.)

Product ...
Instead of using resistance wires the Thermon HT hopper heater module contains an unconventional high temperature Inconel 600 heating element, providing multiple paths, eliminating series wire burnout which is typical for the conventional heating systems. The HT hopper heater has proven to be the ultimate solution in numerous installations. The heaters do not need to be replaced anymore during a plant stop. They even survive the hoppers!
It is almost common practice that when the hoppers are replaced the heaters are mounted again on the new hoppers.

Product Features ...
• Parallel Circuit Heating Elements
• Reliable Connection Design
• Low Watt Density
• Vibration and Shock Resistance
• Rugged Construction
• Ease of Installation

A hopper heater life time of more than 20 years is quite normal!

Visit us today at WWW.THERMON.COM for more info.
Application
Pipelines which transfer product over long distances often require heat tracing to facilitate material flow and prevent freeze-ups. Electric heat tracing is usually the most economical method. Thermon has the products and the application knowledge to offer the best solution.

Heat Tracing Selection
Proper selection of the heating method and materials can easily be shown with the following example. The reduction of the number of power points is the decisive factor.

Length of pipe.................................................. 1000 meter
Insulation polyurethane.......................................... 50 mm
Maintenance temperature......................................... 60°C
Minimum ambient temperature............................... -20°C

With a ThermTrac™ system a pipeline length up to 20,000m can be traced with one single power point!

Operating Characteristics
The heating element of the ThermTrac™ system incorporates a ferromagnetic heating tube and a copper, insulated, heat resistant conductor. These two components are connected to each other at one end of the circuit with the conductor installed inside the heat tube, and connected to an alternating current (AC) power source at the other end.
When the system is energized, current flows through the heat resistant conductor to the connection point, then is concentrated into the inner surface of the heat tube by the skin effect phenomenon and the attendant proximity effect.
This electromagnetic interaction insures that the return current flow travels on the inner surface of the heat tube with virtually no measurable voltage on the outer surface.
Application
Heat tracing is used in numerous applications, each requiring specific knowledge and experience. One of the fields is heat tracing for tanks, pipelines and jetties in tank terminals. The use of a heating tracing system is essential to warrant the quality and the properties of the various products that are unloaded, stored and loaded. A typical example of this is the new Rubis tank terminal in the Botlek area near Rotterdam in The Netherlands.

Rubis Terminal is part of the French Rubis group which is active in LPG distribution and the public storage sector. The terminal in Rotterdam will use existing jetties that have been improved. The new liquid bulk terminal has amongst others 4 stainless steel tanks of 2,500 m³ each and 6 mild steel tanks of 12,500 m³. The site is 77,000 m² large and has an on-site rail connection directly linked to the Betuwe Route, the dedicated freight line with Germany and the European hinterland. At the dock side the maximum depth is 12.65 meters.

Thermon was granted the order for design, supply, installation and insulation of the complete heat tracing system for pipelines, tanks and jetties by Royal Haskoning, the EPC contractor of the project. Thermon finished the project under extreme time pressure to full satisfaction of the customer.
Application

Heat Tracing is used in numerous applications, each Requiring specific knowledge and experience. One of the fields is heat tracing for loading arms.

Loading arms are typically used for loading all kind of chemical and petrochemical products into seagoing tankers, barges, trucks and railcars.

For many products the use of heating cables is essential to warrant uninterrupted flow of product even at low temperatures. However, this application is generally underestimated as far as the complexity of the design is concerned. In general the product transport part of loading equipment is characterized by piping sections and swivel joints. Some parts are insulated some are not. These uninsulated areas represent very substantial heat sinks and hence potential problem areas. Standard calculation methods are insufficient to provide the proper heat tracing solution.

Only extensive experience can protect you against serious problems. Thermon has acquired this experience through numerous installations.

Typical applications are:

- Marine loading arms
- Top and bottom loading arms for truck and rail transportation
- Pharmaceutical and food industry
OFFSHORE OIL AND GAS

Application
Offshore Platform’s, FPSO’s, FSO’s, ships and drilling rigs commonly require the application of electric heat tracing systems for the following reasons.

Freeze Protection
25% of known oil and gas resources are located in extremely cold areas and therefore ships and platforms destined for these regions and other cold locations will require varying levels of freeze protection. Freeze protection of piping, valves, fittings and instrument tubing for fire protection water, potable water, sea and fresh cooling water, drill water and bilge water discharge. Anti-icing (kept ice free) e.g. door seals, ballast tank vents and cargo system valves. De-icing (ice removal in 4-6 hours) e.g. helidecks, gangways, walkways, ladders, antenna, scuppers, railings and freezer room doors.

Recommended heat tracing system: BSX or RSX self-regulating heating cable with ambient sensing thermostat control.

Process Temperature Maintenance Oil and Gas products can also require electric heat tracing for process temperature maintenance of pipes, instrumentation and tanks in the following typical situations. High wax content and/ or pour point of crude oil Vapour pipeline’s from product tanks Hydrate prevention on gas pipelines Anti condensation heating on gas pipelines Recommended heat tracing system: KSX or HTSX self regulating heating cable with self regulating control. Personnel Comfort Heating cables installed in the floors of changing rooms Recommended heat tracing system: BSX or RSX self-regulating heating cable with floor sensing thermostat control. Electric Heat Tracing Standards and Codes Thermon heat tracing systems are tested and certified by major approval agencies to international industry and shipping standards.

Offshore Oil and Gas projects completed by Thermon worldwide.

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<td>Australia</td>
<td>Crystal Ocean FPSO</td>
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Exploration
In the 21st century a major increase in demand is changing the global energy market. In order to meet the demand, the international oil and gas industry is exploring the globe in search of new energy resources. Oil and gas exploration companies are being challenged to provide highly technical and environmentally sensitive solutions.

The Arctic region contains a large part of world’s undiscovered oil and gas resources. However, exploration and production in the Arctic, where companies and humans are faced with extreme temperatures down to -60°C, is a difficult undertaking.

Harsh environments
In the high north Arctic and polar regions the extremely low ambient temperatures and high winds create snow and ice conditions that require unique operational considerations.

Thermon provides solutions for winterization, temperature maintenance anti-icing and de-icing systems on Arctic vessels and structures. These systems help provide a safe working environment to ensure the safety of personnel and the operation. With over 60 years in the trace heating industry, Thermon is a proven leader in providing heating solutions for offshore and maritime applications.
Thermon Solutions
In polar and Arctic environments ice formation on exposed surfaces creates serious problems impacting the safety of personnel and operations. The ice formation can be caused by sea spray and/or snow, rain and fog with the low ambient temperature. Thermon has developed anti-icing and de-icing solutions for offshore support and supply vessels, icebreakers, semi-submersible drill ships and platforms.

The trace heating systems are designed to ensure that all pipes, vessels, instruments and equipment are adequately protected for operations in low temperatures with cold sea water and high wind.

Four design philosophies apply:
• Anti-icing: ice and freeze prevention where surfaces will be maintained above freezing under the ‘worst case’ ambient design conditions.
• De-icing: removal of accreted ice in a reasonable and defined period of time.
• Winterization: anti-freeze for piping, valves, instruments and equipment containing fluids.
• Process temperature maintenance: temperature maintenance of piping, valves, instruments and equipment.

Thermon trace heating SOLUTIONS are specifically designed to provide a safe work environment for platforms, escape ways and helidecks. With over 60 years experience in the heat tracing industry, Thermon will evaluate each design and provide a complete heating system.
Typical needs for trace heating on FPSO’s and FSO’s are deck lines for oil, chemical products. Thermon has designed trace heating systems for freeze protection and temperature maintenance of:

- Loading and unloading lines
- Gas/vapour-return lines
- Strip and cleaning lines
- Fuel oil lines
- Storage tanks and vessels
- Deck and tank cleaning lines
- Fire protection lines
- Engine room fuel and drip lines
- Cross-over lines
- Manifolds
- Safety showers

**Engineering & Project Management**

Thermon provides experienced engineering and project management services. Thermon Engineering evaluates heat loss predictions from heat transfer models to establish thermal loads via Finite Element Analysis (FEA) and Computational Fluid Dynamics (CFD) to confirm temperature distribution. Thermon provides an optimized thermal design with a suitable electrical load balance.
ARCTIC OFFSHORE & MARITIME
(cont’d.)

Thermon has developed a sustainable and reliable comprehensive range of products for the extreme environmental conditions of offshore support and supply vessels, icebreakers, semi-submersible drill ships and platforms. All products are manufactured by Thermon in compliance with international industry standards and carry approvals for installation and operation in hazardous (classified) areas.

Controls & Monitoring
Critical heat tracing applications warrant increased monitoring and surveillance. Controlling and monitoring the heat tracing system from a central location is particularly important for large scale EHT(electric heat tracing) systems and invites energy management.

Thermon control and monitoring systems are developed specifically for the lowest overall cost of ownership including maintenance and operations.

Classification codes & Standards
Thermon is working with various classification societies to develop solutions that will comply with the upcoming IMO Polar Code.
Thermon Heat Tracing Systems are tested and listed with numerous approvals agencies and shipping comply with IEEE515, IEC60079-30 industrial trace heating standards.
Heat tracing is used in numerous applications for the shipping industry, each requiring specific knowledge and experience. One of the typical fields is heat tracing for deck lines on motor tank ships for oil, chemical products, bitumen and edible oil.

With substantial success Thermon has designed heat tracing systems for freeze protection and temperature maintenance of:

- Loading and unloading lines
- Gas/vapour-return lines
- Strip and cleaning lines
- Fuel oil lines
- Storage tanks and vessels
- Deck and tank cleaning lines
- Fire protection lines
- Engine room fuel and drip lines
- Cross-over lines
- Manifolds
- Safety showers

All Thermon heat tracing cables used for the shipping industry are in compliance with the requirements of Lloyd’s Register

- Maintenance up to 65°C - Heating cable type BSX
- Maintenance up to 121°C - Heating cable type HTSX
- Maintenance up to 149°C - Heating cable type VSX

All above mentioned materials comply with standards IEEE515, CSA 130.03, and IEC 62086-1 and EN 60079-7

The installed heat tracing materials can either be controlled by local thermostats or by means of the Thermon electronic heat tracing controller TC816 often located in the wheel house or engine room. More and more the electronic controller is used for controlling and monitoring the pipeline temperatures from one central point for safety reasons and not at least single man operation.
Heat tracing is applied in numerous applications for the shipping industry, each requiring specific knowledge and experience. One of the typical fields is heat tracing for deck lines of Motor Tank Ships transporting chemical products, bitumen, edible oil and oil.

A nice example of this is Motor Tank Ship Rowinda, built in 2004. This tanker travels under the Dutch flag on the Rhine-route between the big chemical companies and terminals in The Netherlands, Germany and Switzerland. For the Rowinda, 110 meters long and 3,800m3 loading capacity, the complete heating system for all the critical lines was designed and supplied by Thermon. A total length of more than 2000m of heating cable was installed. The heating cables can individually maintain different temperatures within specific tolerances. As a result it is possible to transport different chemicals or other products at the same time. The total load of the heat tracing on the ship about 50 kVA.

The control and monitoring of the heat tracing is done with the modular Thermon TC816 system. Multiple TC816 units can be connected via a RS485 interface. There are different kinds of protocols to communicate with other systems, e.g. MODBus, Profi bus or standard RS485/RS232. For local operation (in the bow of the Rowinda) there is an electronic control unit with an LCD screen, the TCD01. This unit is for displaying and editing set points, measured values, parameters and alarm status of the TC816 units that control the heating cables. In the wheel house, on the other side of the ship, the software program Visual Fecon is installed on a PC, for comfortable management of all data.

All heating data, alarms and system messages are recorded and stored here. These data are always retrievable. The skipper can recall the corresponding set points that are required for the specific products that are transported and download them into the connected TC816 systems. Visual Fecon makes sure and registers that the product temperatures are kept during the transport (quality assurance).

This is just one example of the many projects in which the versatile TC816 control and monitoring system has been applied. With the TC816, the TCD01 and Visual Fecon, Thermon has a sophisticated and future-orientated control and monitoring system suitable for further expansions towards internet development, wireless and SMS operation.
Application

Heat tracing is used in numerous applications for the shipping industry, each requiring specific knowledge and experience but also specific products. One of the typical fields is heat tracing of engine rooms and service lines.

One of the projects Thermon engineered and supplied was the heat tracing for the Audacia. This ship was originally built as a bulk carrier but converted into one of the world’s biggest pipe laying vessels. The Audacia can weld and lay pipes up to 60” to a depth of 3500m at a rate of up to 7km per day. The concept of the ship was entirely developed by Allseas, the Dutch company operator of the ship. The length of the ship, excluding the stinger of 106m, is 225m and can accommodate a crew of 240. Moreover the ship is equipped with 3 engine rooms, one for normal propulsion and the other 2 for powering the six electric thrusters, allowing for exact dynamic positioning.

Electric tracing was used for the following applications:
- Working air system
- Fire main system
- Fire fighting lines
- Sprinkler lines
- Pulper lines
- Waste water lines

Last but not least Thermon supplied the special products SafeTrace and ThermoTube. SafeTrace is a pre-insulated steam tracer with reduced heat output, allowing for longer lengths and less steam traps. ThermoTube is a pre-insulated steam supply and return line.

SafeTrace and ThermoTube were used for steam heating the following applications:
- Fuel oil service system
- Fuel oil drain system
- Fuel oil vent and overflow system

In total about 3500m electric heat tracing, 850m ThermoTube and 2800m SafeTrace were installed.
Application
For over five decades Thermon has helped heat tracing customers to get more heat out of their steam tubing. Very well known products in that respect are the Thermon Heat Transfer Compounds as well as the ThermoTube® pre-insulated tubing.
To meet the demands of the today’s steam market and to replace the traditional “one type fits all” concept of the past used in applying bare convection tracers Thermon designed a variety of new convection steam-tracing options, the SafeTrace™ product range. The design engineer may now choose convection tracers from several levels of heat delivery such as Standard Heat, Light Heat and Extra Light Heat. Each of these new types of external convection steam tracers offer a different level of heat delivery potential. These tracers with reduced heat delivery provide more practical temperature maintenance levels in the temperature range of 10 to 100 °C which covers a majority of the heat tracing applications and consequently can contribute to a considerable steam saving.

Steam tracers run both beneath the insulation as well as extend out of the insulation at flanges, valves equipment and expansion joint areas. These areas can be potential burn areas for the plant personnel who maintain the facility. The SafeTrace™ products have a unique “touch-safe” characteristic. This has been achieved by applying one or more non-thermally conductive coverings to steam tube’s exterior surface which reduces the instantaneous heat flow from the surface into the skin during an accidental touch event.

SafeTrace™ Benefits
- SafeTrace IT tracers comply with ASTM Std C-1055 for skin exposure temperatures of less than 60°C.
- Permits winterization for any size of pipe.
- Predictable temperature control.
- Eliminates hot/cold spots associated with bare metal tracers and spacer blocks.
- Prevents damage to temperature sensitive or corrosive products.
- Reduced installed costs.
- Lower operating/maintenance cost because of reduced steam usage up to 50%.
- Fewer fittings resulting in less maintenance and repair.
- No galvanic corrosion between pipe and steam tracer.
TubeTrace® THE ECONOMIC SOLUTION

General
TubeTrace® is quite often considered as a very nice but expensive solution. In case accurate cost comparisons are made it becomes very obvious that TubeTrace® is more economic than any conventional application. Not only compared with normal insulation but also with the lower price/quality snap-on types of insulation.

Comparison
The basis for the comparisons shown alongside is:
• tube diameter 12 mm
• material SS 316
• number of tubes 1
• freeze protection type of self-regulating heating cable.

Conclusion
The comparisons do not only show that for the example given at a bundle length of 7 meter TubeTrace® is more economic (depending on the type of TubeTrace® required this can even be as short as 3 meter!) but also that a considerable saving in installation time can be achieved.

Conventional insulated applications and applications with snap-on type of insulation take respectively 4 and 3 times longer than TubeTrace®!

TubeTrace® Advantages
• Less engineering disciplines involved.
• No coordination with insulation contractor.
• Reduced scaffolding hiring time.
• Extruded outer jacket so no ingress of moisture and consequently no deterioration of insulation and no corrosion of tubing.
Factory manufactured Pre-Insulated Tubing Bundle - ‘ThermoTube Bundles’ provides a quality, cost effective and long term solution to the need for insulated steam & fluid supply/condensate return requirements.

Traditional means have included the use of pipe in stick form welded at length in the field by mechanical contractors, field insulated with either rope wrap or pipe section insulation and clad with mastic or metal by the insulation contractor.

The disadvantages of this traditional method can include a high total install cost, having the need for multiple contractors on site which extends the install time and significant on-going maintenance. The quality of this system also relies on the skill of the contractors – once insulation becomes wet or missing – the effectiveness of the system is compromised with increased heat losses.

**ThermoTube® Pre-insulated Tubing Bundles solves all!**

**Advantages include:**
- Can be supplied in coil lengths up to 150 meters and cut to length on site.
- The bundle comes complete with tube, non-hygroscopic fiberglass insulation and a flexible polymer outer jacket.
- Once on site, simply attach and complete connection to tube fittings and seal the exposed ends of the bundle.
- The finished product is aesthetically pleasing and is of a uniform high quality that requires no further maintenance.
- Designed to be ‘touch-safe’ reducing risk of burns for operations personnel.

**ThermoTube® is available** in all tube materials and sizes (316 SS welded/seamless and copper in 3/8", 10mm, ½" and 12mm are commonly used and regularly stocked).
DO SEAL & CONDENSATE POTS NEED TO BE TRACED?

The answer depends on how these devices are used. An agreement on terminology will lead us to the answers.

There are two terms we need to deal with as they relate to instrumentation... “condensate pots” and “seal pots”. Both devices are similar in appearance but have slightly different functions. These terms have other meanings as they relate to steam handling systems.

Condensate Pots

Condensate pots are used to catch and hold condensate and foreign material. This helps keep manifold orifices clean and free of foreign material. They are located upstream of the instrument and have a bottom drain so that they may be cleaned. We do not often see condensate pots used in this manner for instrumentation. If a condensate pot is used in this manner it will usually require heat tracing.

Seal Pots

Seal pots (sometime called condensate pots) are used to allow a liquid seal between the instrument and flowing gases such as steam. Their function is to keep the liquid level constant in the impulse tubes. For example, in boiler liquid level applications the high pressure (HP) side of a differential pressure transmitter is connected to the vapor space on top of the steam drum. Steam condenses in the chamber or seal pot and fills the impulse line with condensate. The seal pot is located to allow the condensate to drain back to the source thus keeping the liquid level constant.

Insulating the seal pot would inhibit its function. The seal pot, unlike the impulse tubes, is not generally vulnerable to freezing during normal plant operation because it is in constant contact with a heat source, steam. The only time that the seal pot is vulnerable to freezing is if the plant is shut down during freezing ambient temperatures. In this case the seal pot would need to be drained.

Root Valves

While addressing the subject, another question often asked is, “Does the root valve need to be heat traced?” The root valve is a safety device. It is used to shut off the system in case of a downstream leak. In this application the root valve is normally open. As previously discussed, the seal pot is located to drain back through the root valve to the source. If installed and operated correctly there is no situation where the root valve would be filled with water. The water would always drain back into the pipe or vessel and therefore should not require heat tracing.
Application:
A hot water Heat Tracing system provides an alternative to the design and installation of hot water systems for prompt delivery of hot water at the fixtures.

Self Regulating cables eliminate some of the problems associated with conventional commercial hot water systems - providing the end user with instant hot water without the need for re-circulation pipework, balancing valves and pumps.

More importantly a Thermon WarmTrace system provides the end user with a hot water system that has a low carbon footprint due to its significant energy savings. No more over heating at the source and no more water wastage due to waiting for hot water at branch outlets.

The System:

Electric Heat Tracing systems replace the heat lost through the thermal insulation on hot water supply piping to maintain the water at desired nominal temperatures (e.g. 50°C, 60°C), preventing stagnant water in dead leg lines from cooling. It also ensures that hot water is readily available when required at fixtures.

Self Regulating cables are simply taped to the supply piping and insulated. The cable can be cut to length, tee spliced and terminated on site without the need for special tools.

The Self Regulating phenomenon occurs along the entire length of the heat traced supply line, to balance the heat output of the cable with the heat loss of the insulated pipe, therefore outputting heat only where it is required, without the need for additional thermostat control.
For the Engineer:

- Reduces Layout time compared to re-circulation systems
- Easily adapted to buildings with multiple temperature zones
- Greater flexibility for buildings with complex designs
- Excellent for retrofit or building additions
- Helps meet greater environmental requirements – for more ‘green’ building designs

For the Plumbing Contractor:

- Faster and less expensive to install when compared with a re-circulation system
- Metallic and non-metallic pipes can be heat traced
- Simple to use pipe mounted connections which require no special tools
- No maintenance call backs
- Can complete a project in stages

For the owner:

- Saves water by maintaining hot water at the fixtures
- Lower operating cost
- No moving parts means no maintenance
- Realizes important and significant energy savings

For an advanced, cost effective approach to water saving and water heating, consider a THERMON WarmTrace hot water temperature maintenance system.
Application
THERMON self regulating heat tracing cables cover the complete range of applications from frost protection to high temperature industrial installations. This leaflet outlines applications in the freezer industry where THERMON heat tracing cables can be utilised. These cables together with a complete range of accessories specifically designed for low temperature use in the freezer industry. The Self Regulating design renders the heater burnout proof particularly at 'cross-overs' as the output will vary over its entire length depending on temperature.

Typical Refrigeration Plant
The schematic diagram shows many applications where THERMON heat tracing cables may be used on refrigeration plant. In outdoor installations, particularly in cold climates it is most important to maintain minimum operating temperatures to ensure that refrigerant gases remain as a vapour. The following application notes describe where the heating cables may be used on refrigeration plants, cool rooms, and commercial freezer cabinets. Thermon will be pleased to provide assistance on the selection of heating cables to suit your application. All heating cables operate on 240Vac power supply. Low voltage designs are available with TESH.

Liquid Receiver
A heating cable may be required in cold climates to maintain refrigerant liquid temperature for optimum system efficiency.

Oil Separator
A heating cable may be required to prevent liquid refrigerant returning to the compressor by maintaining it as a vapour.

Suction Line Accumulator
A heating cable will assist boil off and ensure that the refrigerant remains as a vapour back to the compressor. Suitable Heating cables for these applications are FLX and CSR, CCH crankcase heater with strap, or CDH condensate drain heater.
**Cool Room Doors**
Warm air entering a cool room will condense and freeze upon contact with a cold surface. Heating cable installed in the doorway architrave or sliding door seal increases the surface temperature above 0°C and prevents ice forming between frame and door. Heating cable; THERMON FLX Self Regulating Heating Cable or TESH Low Voltage Heating Cable.

**Cool Room Thresholds**
Ice may form at the cool room threshold where warm air enters, condenses, and freezes. This is prevented by running three or four runs of heating cable in floor channels, conduits, or sawn slots directly in the concrete. Heating cable; THERMON FLX Self Regulating Heater Cable.

**Compressor Crankcase Heaters**
Compressors may be damaged by the formation of refrigerant liquid in the crankcase particularly after long ‘off’ periods. It may be necessary to heat the crankcase to evaporate the refrigerant trapped in the oil, particularly outdoor installations in cold climates. Heating cable; THERMON FLX Self Regulating Heating Cable or purpose made crankcase heater for compressors, type CCH complete with strap.

**Drain Lines**
The drain line from the drip trays also requires heat tracing to prevent ice formation. The cable may be attached to the underside of the pipe in one straight run, or spiralled if required. On plastic pipes the heating cable should be covered with aluminium foil tape to assist heat dispersion. The heating cable may also be run inside the pipe provided the connection and end seal are external. The drain line must be insulated with minimum thickness of 25mm. Heating cable; THERMON FLX Self Regulating Heating Cable or purpose made Condensate Drain heater for drains, type CDH.
Pressure Relief Ports or Safety Vents.
These are mounted in the cool room wall and used to maintain normal atmospheric pressure allowing air to enter or exhaust as required. They typically comprise a box section with moving vanes which must not become frozen. Heating cable is spiralled around the box section at approximately 80mm centres and preferably insulated. Heating cable; THERMON FLX Self Regulating Heating Cable.

Fire Protection Sprinklers
Where these are installed in cool rooms trace heating will be required to prevent freezing on exposed pipe work and fittings. The heating cable rating will depend on the cool room temperature, pipe size, and insulation thickness. Heating cable; THERMON FLX Self Regulating Heating Cable.

Drip Trays
Drip trays are required to collect water droplets from the evaporator coils during defrost cycles. Formation of ice may be prevented by laying a heating cable in the tray, alternatively, attached under the tray. The spiral pitch should be 150-200mm, and the underside of the tray should have a minimum of 25mm insulation. THERMON FLX Self Regulating Heating Cable.

Frost Heave Prevention
The substrata of freezer floors will withstand cold temperatures for a period of time, however if the ground temperature will eventually drop below freezing. At that point if water is present in the substrata frost heave of the freezer floor will occur. If severe, this will damage the foundation slab with the formation of cracks. Design and installation guides are available for these applications and Thermon staff is available to assist with the design process. Heating cable; THERMON FLX Self Regulating Heating Cable.
Supermarket Frozen Food Cabinets
Wherever warm air is in contact with cold surfaces such as the ‘frost-line’ or rail on open chest freezers then condensation will occur. Similarly with display cabinets, around doors and light fittings. Trace heaters, or ‘anti-sweat’ heaters successfully overcome these problems. Heating cable; THERMON FLX Self Regulating Heater Cable or TESH Low Voltage Heating Cable.

Air or Water Cooled Condensers
Where these are installed outdoors in cold climates a trace heater may be required to prevent freeze-up. Insulation should be applied over the heating cable; THERMON FLX Self Regulating Heating Cable.

Fan Cowlings
Fan cowlings on evaporator-blowers may ‘ice up’ and cause fan seizure. This may be avoided by spiralling heating cable around the cowling at 50-80mm centres. Aluminium foil tape and insulation over the heater would assist. Heating cable; THERMON FLX Self Regulating Heating Cable.

Evaporator bends
Defrost heaters in evaporators may not always extend to the bends, and therefore these may be traced with heater cables to assist the defrost operation. Heating cable; THERMON FLX Self Regulating Heating Cable.
Thermon manufactured a composite range of bespoke Insulation Jackets which are supplied with integral heating cables. These units are manufactured to suit each individual application and facilitate quick and easy removal of the complete assembly.

An integral heating cable is used to maintain the equipment at the required process temperature, which may vary from freeze protection to high process temperature maintenance.

Each unit may be supplied with a trace heating power connection junction box or thermostat to provide temperature control.

As well as Industrial applications, the units may also be used within Hazardous areas, with all trace heating materials holding valid ATEX hazardous area approvals.

The Insulation Blanket is manufactured from grey silicone coated cloth on the inner and outer faces, with 50mm thick mineral wool inner insulation. Velcro fastenings and draw straps secure the unit in place.
Heat tracing is used in numerous applications, each requiring specific knowledge and experience. One of the typical fields is heat tracing of sprinkler systems for tunnels. The use of heating cables is paramount, to be sure that the sprinkler systems safeguard the people using the tunnels, even at low temperatures. For the tunnel operators Thermon is consequently the logical choice.

A project Thermon recently completed is the Betuwe-route in The Netherlands. The Betuwe-route is the name of the new 160km long railway from the industrial areas in Rotterdam to the German border. The railway is designed for freight trains only and complies with the highest safety standards. Besides 130 fly overs and bridges with a total length of 12km it also comprises 5 tunnels with a total length of 18km. All the dead legs of the sprinkler systems in the tunnels, between the hydrant and premix lines and the valve stations have been freeze protected with Thermon BSX self regulating heating cables.

The project has been put into service after a construction time of more than 10 years. An increasing number of freight trains will use the track to reduce the enormous number of lorries travelling between Rotterdam and the industrial areas in Germany.
Snow accumulation on flat roofs can cause dangerous situations if no measures are taken. When snow builds up and the weight increases ultimately the roof can collapse and human life can be at risk. Over the past 2 years that already happened in a number of cases with schools, shopping centres and sport accommodations. On request of the owner of a big shopping centre Thermon designed and supplied a heating system to protect a roof of 1.500m².

Because of the roof size and to keep the total cost of ownership as low as possible it was decided to:

- Design a heating system only for critical snow melting and escape routes.
- Select a heating cable minimizing the number of electrical circuits.

Of the 1.500m² roof surface 1.000m² is equipped with electric heating cables, at a spacing of 15cm, resulting in a total length of 6.000 meter of heating cable, divided over 450 heating circuits.

The heating cable selected was the special heavy duty Thermon series cable type TESH. To meet the designed power output the heating cables were connected to a power supply 400V, 3 phase. The complete system is switched on and controlled by a snow detector, installed at a height of 5cm. The system will melt the snow within one hour so that critical snow levels can never be reached. In order to limit the start up current the heat tracing system has been split up in 3 heating zones switching on with a time delay.

During the first year of operation a test was done with a snow height of 20cm to check the melting response of the system. On the photo’s along side the proper functioning system can clearly be seen, before and after switching on the system. For a snow height of 20cm it took 6 hours to completely melt the snow and drain is safely. Depending on the weather conditions, it takes less than an hour to melt 2cm of snow.
Improved ZT Terminator
Available now

Switch Rating 25A
Minimum Ambient
Operating Temperature -60°C