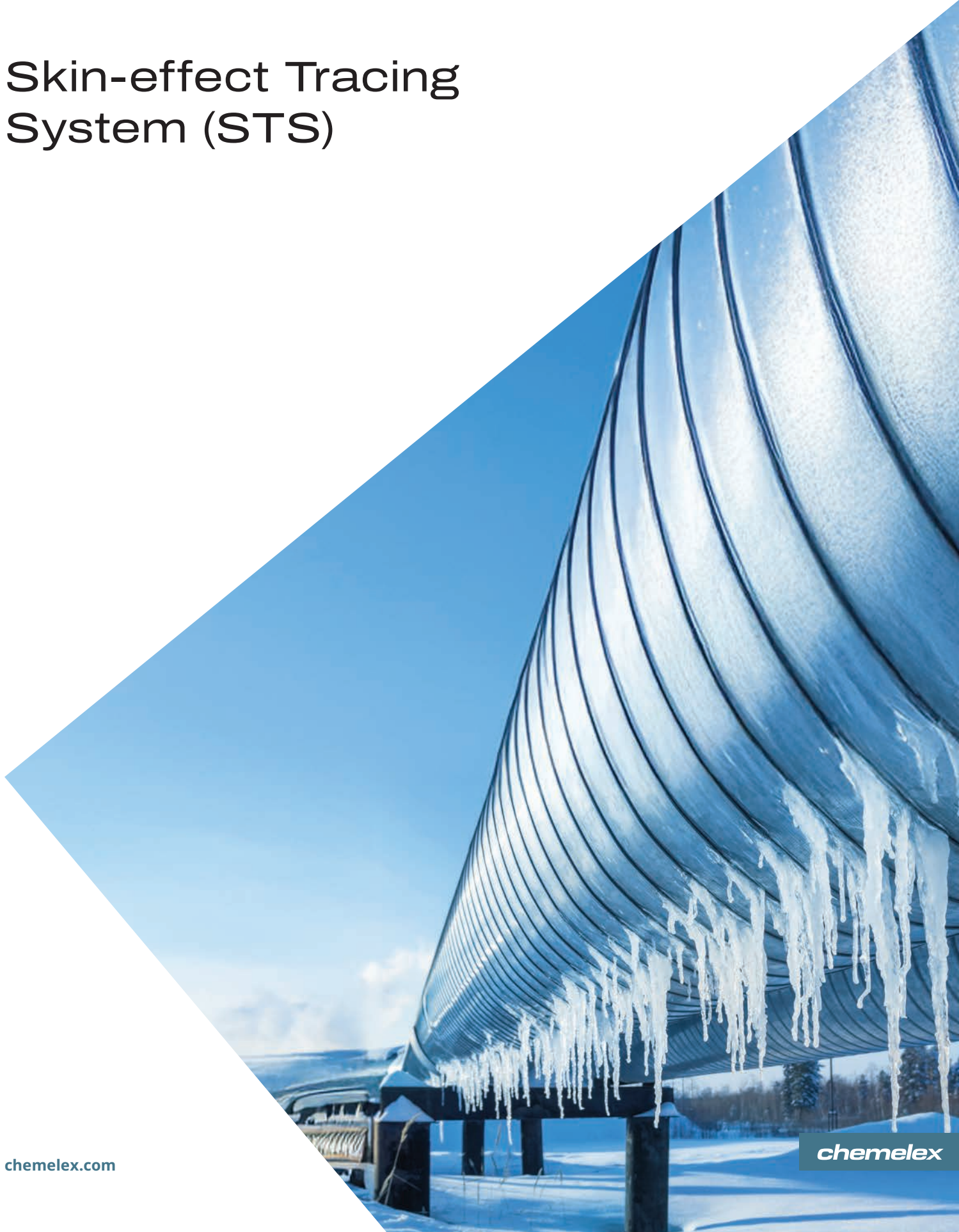


**Raychem**

*excellence is everything*

# Skin-effect Tracing System (STS)



## ENGINEERED SOLUTIONS

Chemelex offers innovative integrated technologies under our market leading brand, Raychem, to offer unique customized solutions for longline heat management systems and other specialized heating requirements. Our proven proprietary engineering design program offers optimized designs and engineered solutions for a variety of applications. Our global engineering network and regional knowledge centers combined with office presence in over 48 countries position us to handle heat management systems for many types of applications throughout the world.

## THE HEART OF THE SOLUTION

As the inventor of self-regulating heat tracing and other heat management system solutions, our Raychem brand is recognized for technology leadership in the industries we serve. The Raychem Skin-effect Tracing System (STS) is a versatile Heat Management System (HMS) designed to deliver heat for pipelines that can be hundreds of kilometers long. Applications include: material transfer lines, snow and ice melting, tank foundation heating, structural heating, buried and submerged transfer lines and prefabricated, pre-insulated lines spanning rugged environments and the harshest climates across environmentally sensitive corridors, wetlands and densely populated regions. As the industry leader in offering single source responsibility for heat management, Chemelex is uniquely qualified to offer Skin-effect Tracing Systems that combine system engineering expertise with proven procurement, construction, and quality assurance capabilities.

## GLOBAL LEADERSHIP

Raychem STS occupies a unique position as one of the industries most preferred solutions for temperature-critical applications. With over 600 installations spread over several continents and geographical regions we provide safe and reliable solutions for the most demanding applications. We have successfully managed applications ranging from long sulphur pipelines spread over hundreds of kilometers in the hot deserts of the Middle East to maintaining the flow of products through the pipelines in the coldest parts of Canada. We've designed long crude oil pipelines in Russia including one pipeline over 160 km long and the world's longest 700 km underground heated and insulated pipeline in India. We've also successfully delivered heat for a large LNG concrete structure located in the Adriatic Sea and for an airport people mover in China that transports ~100 million passengers per year. These are just a few testimonials highlighting our ability to meet our customer's critical expectations throughout the world.

Pole to pole, a unique engineered system solution partner in Heat Management Systems.

**Raychem**



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# Engineered Solutions for Optimum System Performance

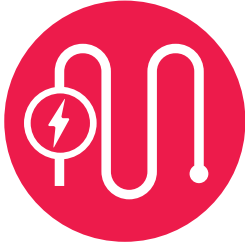
## STS BENEFITS

**Each STS System is custom engineered to meet the most challenging applications**

**Raychem STS Systems are well suited for the following application parameters:**

- Circuit lengths up to 50 kilometers (31 miles)
- Power outputs up to 149 W/m (45.7 W/ft)
- Maximum operating temperatures up to 250°C (482°F)
- Remote regions where power substation availability is limited
- Temperature-critical lines where precise fluid control is required
- Desolate regions where EHT system durability and reliability are essential
- Buried or submerged applications in environmentally sensitive regions

### Increase



Circuit Lengths

### Reduce



Total Installed Costs

### Maximize



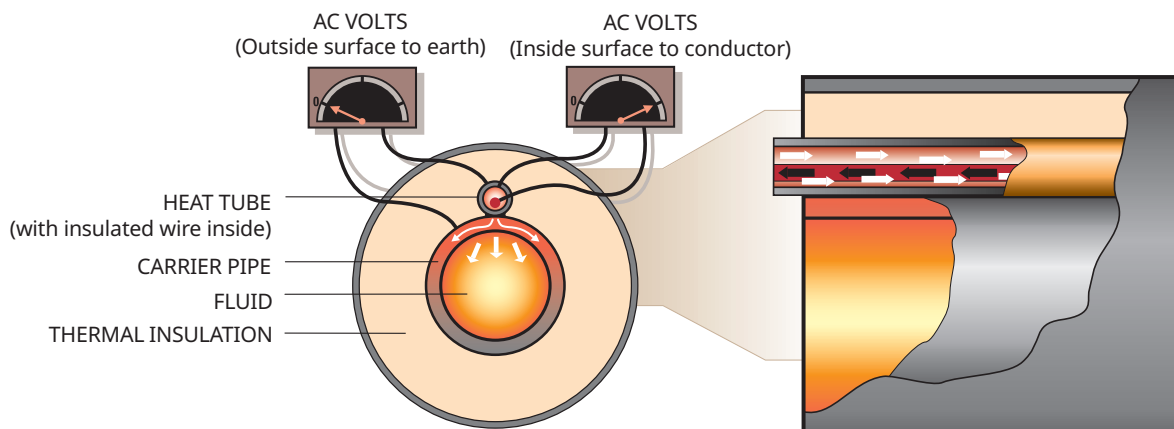
System Durability

### Enhance



Operational Efficiency

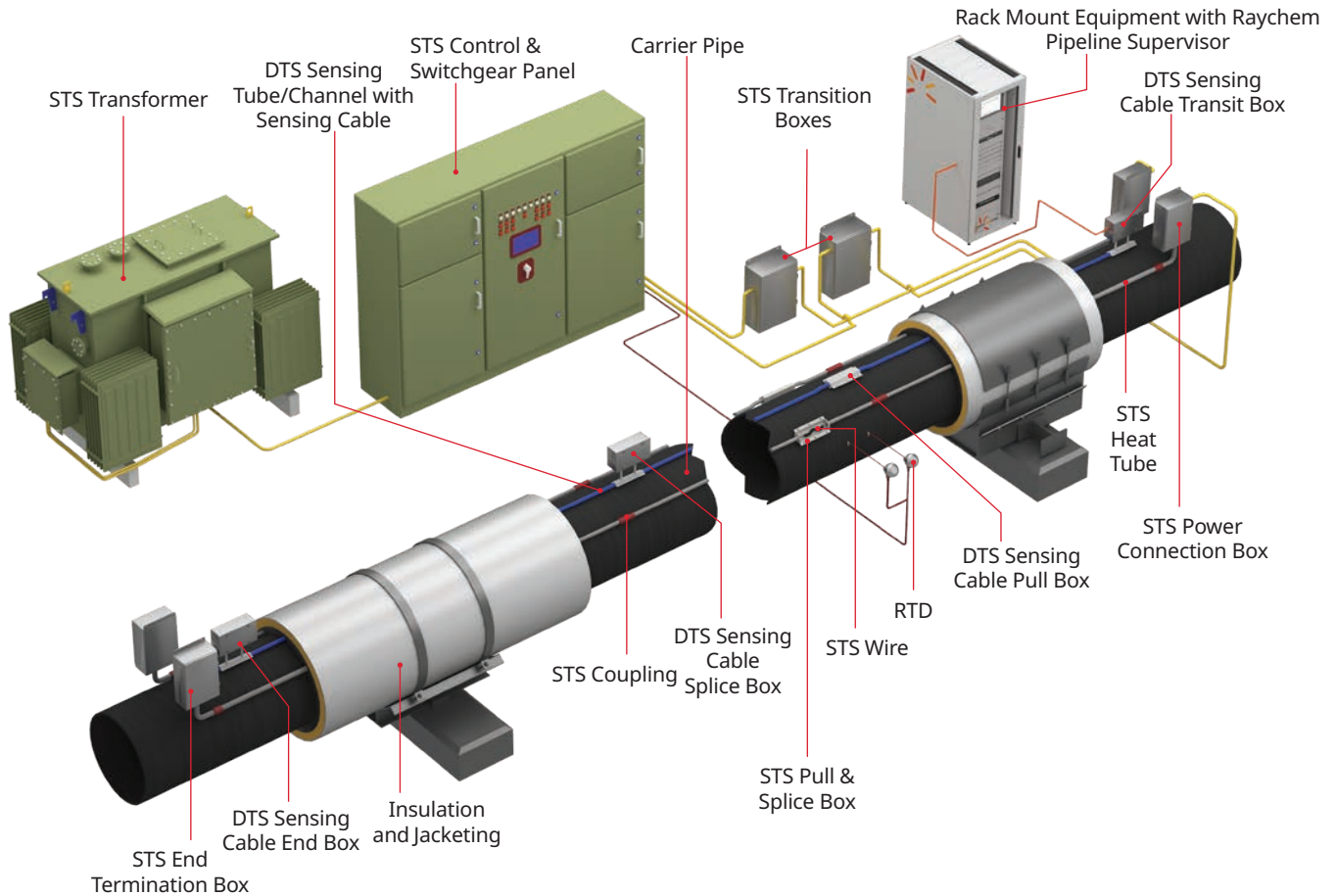
## STS TECHNOLOGY



# Engineered Solutions for Optimum System Performance

## STS SYSTEM

The Raychem Skin-effect Tracing System (STS) is a versatile engineered heat management system configured to deliver heat for long transfer pipeline applications. The system can generate significantly higher wattages compared to standard heat-tracing technologies.



Raychem STS consists of a thermally rated, electrically insulated wire installed inside a ferromagnetic heat tube. The insulated wire is connected to the heat tube at the end termination, and an AC voltage source is connected between the heat tube and insulated wire at the power connection. AC current flows down the wire, returning on the inside surface (or skin) of the tube. The STS System is electrically safe and produces heat in the ferromagnetic tube through the effects of two well-known electrical phenomena: Skin Effect and Proximity Effect. These phenomena cause the current flowing in the heat tube to be concentrated on the inner surface; the current concentration is so complete there is virtually no measurable voltage on the outer wall of the heat tube. Heat is also generated due to the resistance of the heat tube and STS wire, and through eddy currents and hysteresis in the heat tube. Since the heat tube is attached to the process pipe and completely within the thermal insulation system, heat is efficiently transferred into the process pipe.

The latest offering to Raychem STS includes the STS-HV cable, which delivers power for circuits up to 50 km in length with a 10 kV rated cable design. This offering includes newly designed IP rated water-tight splice, power, end-termination and jumper enclosures and a robust cable design that supports pull lengths of up to 500 meters to minimize splice connections and reduce installation time. STS-HV was developed to deliver one of the most durable and efficient industry solutions for years of uninterrupted service, for any temperature-critical pipeline installation.

# Engineered Solutions for Optimum System Performance



## STS CABLE DESIGN PARAMETERS

### STS-HV



**Maximum Voltage Rating**  
10000 VAC

**Maximum Circuit Length**  
50 km (31.0 mile)

**Power Output Rating**  
(application dependent)  
70 W/m (21.3 W/ft)

**Maximum Operating Temperature**  
150°C (302°F)

**Cable Construction**  
Tin plated copper wire with  
Silicone insulation

PTB 21 ATEX 1005 X  
Ⓢ II 2 G eb IIB T6 ... T3 Gb

IECEX PTB 21.0011X  
Ex eb sb IIB T6 ... T3 Gb

### STS-MT



**Maximum Voltage Rating**  
5000 VAC

**Maximum Circuit Length**  
25 km (15.5 mile)

**Power Output Rating**  
(application dependent)  
150 W/m (45.7 W/ft)

**Maximum Operating Temperature**  
150°C (302°F)

**Cable Construction**  
Tin plated copper wire with  
Polyolefin insulation

PTB 21 ATEX 1005 X  
Ⓢ II 2 G eb IIC T6 ... T3 Gb

IECEX PTB 21.0011X  
Ex eb sb IIC T6 ... T3 Gb

### STS-HT




**Maximum Voltage Rating**  
2500 VAC


**Maximum Circuit Length**  
12.5 km (7.8 mile)

**Power Output Rating**  
(application dependent)  
150 W/m (45.7 W/ft)

**Maximum Operating Temperature**  
250°C (482°F)

**Cable Construction**  
Nickel plated copper wire with  
Fluoropolymer insulation

 FM STS-0D5A3-AX  
CL I, Div 2, Grps. B, C, D  
CL I, ZN 2, Grp. IIB+H2

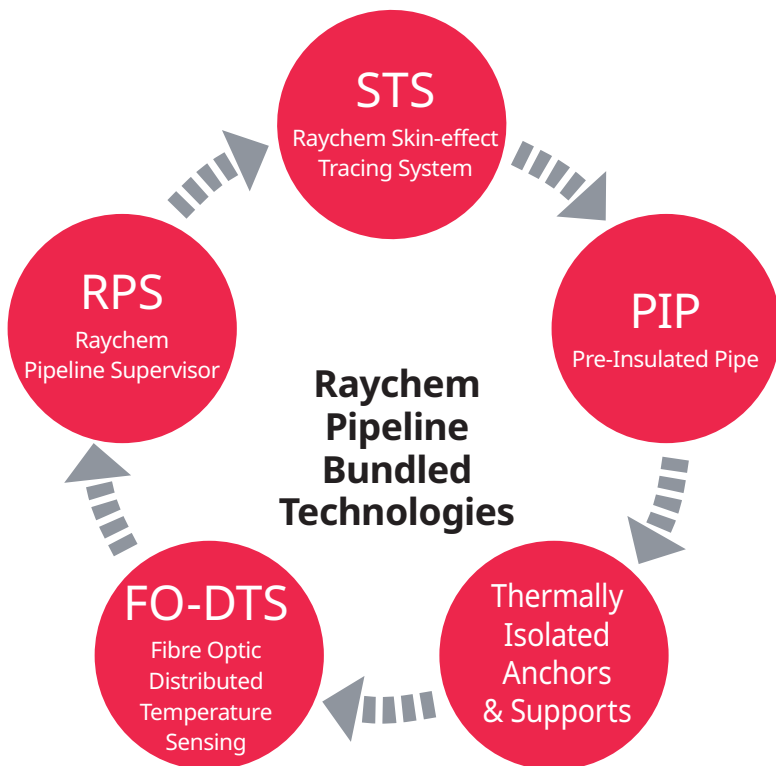
 BAS98ATEX2383X-STX  
Ex II 2 G, Ex e II T

# Engineered Solutions for Optimum System Performance

## STS WITH BUNDLED TECHNOLOGIES

Raychem STS combined with state of the art complementary technologies has revolutionized Heat Management System (HMS) performance

- FEA / CFD modeling has become a critical tool in designing optimized systems and predictable system performance
- Raychem Skin-effect Tracing System (STS) wire and components are designed to withstand harsh climates and sensitive environments for years of safe and secure usage
- Pre-insulated/pre-fabricated piping systems have proven to be a major factor in the thermal performance of the pipelines by providing a homogenous temperature profile for the entire length of the pipeline asset
- Thermally isolated pipe anchors and supports are engineered to minimize the impact of these traditional heat-sink zones
- Fibre optic based distributed temperature sensing systems (DTS) have significantly enhanced the safety and reliability of temperature-critical pipeline assets
- Raychem Pipeline Supervisor (RPS) predictive analytics software is essential to safely manage temperature-critical pipelines, especially for phase change management



## WHY RAYCHEM STS?

### Safe:

Fully grounded system with zero electrical potential on pipe surfaces

### Accurate Control:

A closed loop control system includes redundant pipeline temperature sensing

### Engineered:

Systems are custom engineered in accordance with IEEE and plant standards

### Maintainable:

Pull/splice boxes simplify access to the system without disturbing insulation

### Rugged & Reliable:

Entire circuit is encapsulated within rugged heat tubes and steel boxes

### Longline Capability:

Circuit lengths up to 50 kilometers (31 miles) from a single power source

### Thermal Simulation Studies:

Temperature profile modeling and plotting capability

### Computerized Design:

Runaway temperature and static and dynamic heat-up/cool-down calculations available

### Flexibility:

Ideal for either factory fabricated, pre-insulated or field installed systems

# Applications

## VISCOUS PRODUCT TRANSFER LINES

Whether from dock to tank farm or direct to a process unit, the long circuit capabilities of Raychem STS provides one of the safest and most cost-effective heat management systems available.



## SNOW & ICE PREVENTION

Sidewalks, people-moving platforms and airport ramps are examples of large critical areas demanding snow and ice prevention. By minimizing the number of circuits, Raychem STS provides a cost-effective solution to common snow and ice problems.



## TANK FOUNDATION HEATING

Raychem STS can be used in Class 1 Division 2 and Zone 2 hazardous areas creating a technically superior, commercially-attractive solution to prevent frost heave of the subsoil beneath LNG Gravity Based Structures (GBS), LPG, ethylene, propylene and ammonia tank foundations. Thereby, protecting the foundations and the tanks themselves.



## BURIED/SUBMERGED LINES & HDDS

The ever-increasing need to protect and maintain safe and reliable pipeline assets, demand a precise solution to heating underwater and buried transfer lines, spanning harsh and environmentally sensitive regions. With Raychem STS, long lengths of wires are pulled in the heat tubes without having to use conventional pull/splice boxes or field splices. This method can be an ideal application for longer horizontal directional drill (HDD) sections.

The STS pull-boxes are designed to be hermetically sealed for submerged applications, while the optional redundant STS wire provides an added level of back-up to minimize operational and environmental disruptions.



## PREFABRICATED PRE-INSULATED LINES

Raychem STS is ideally suited for use with prefabricated, pre-insulated piping installations. These factory-fabricated systems offer energy efficiency improvements to the thermal envelope and facilitate field erection to significantly reduce total installed cost, improve system performance and compress critical project schedules.



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**Raychem Tracer Pyrotenax Nuheat**