PENTAIR

Raychem

SKIN-EFFECT HEAT-TRACING SYSTEM (STS)

THERMAL MANAGEMENT SOLUTIONS | WWW.THERMAL.PENTAIR.COM

PENTAIR

ENGINEERED SOLUTIONS

Pentair Thermal Management offers innovative integrated technologies under our market leading brand, Raychem STS, 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 STS system 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, sub-sea transfer lines and prefabricated, pre-insulated lines. As the industry leader in offering single source responsibility for heat management, Pentair Thermal Management and the Raychem brand are uniquely qualified to offer Skin Effect Heating Systems that combine system engineering expertise with proven procurement, construction, and quality assurance capabilities.

GLOBAL LEADERSHIP

The Raychem STS Heat Management System occupies a unique position in the industry as the preferred choice for 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 various long crude oil pipelines in Russia including one pipeline over 160 km long and the world's longest 700 km underground heated pipeline in India. We've also successfully delivered heat for a large LNG concrete structure located in the Adriatic Sea. 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 TRACER

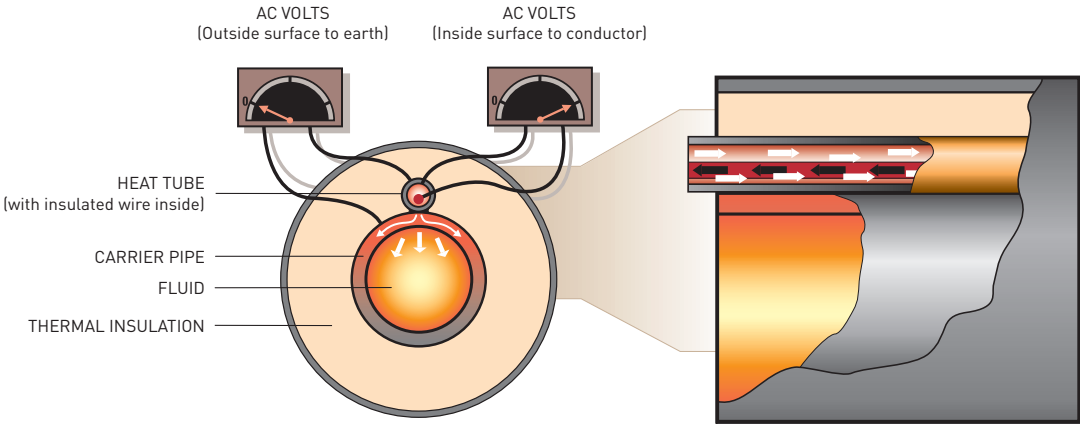
ENGINEERED SOLUTIONS FOR OPTIMUM SYSTEM PER

EACH STS SYSTEM IS CUSTOM ENGINEERED TO MEET THE HIGHEST PERFORMANCE STANDARDS

Raychem STS Systems can be designed for:

- Circuit lengths up to 25 kilometers (15 miles)
- Power outputs up to 150 W/m (49.2 W/ft)
- Maintain temperatures up to 200°C (392°F)
- Exposure temperatures up to 250°C (482°F)

STS TECHNOLOGY

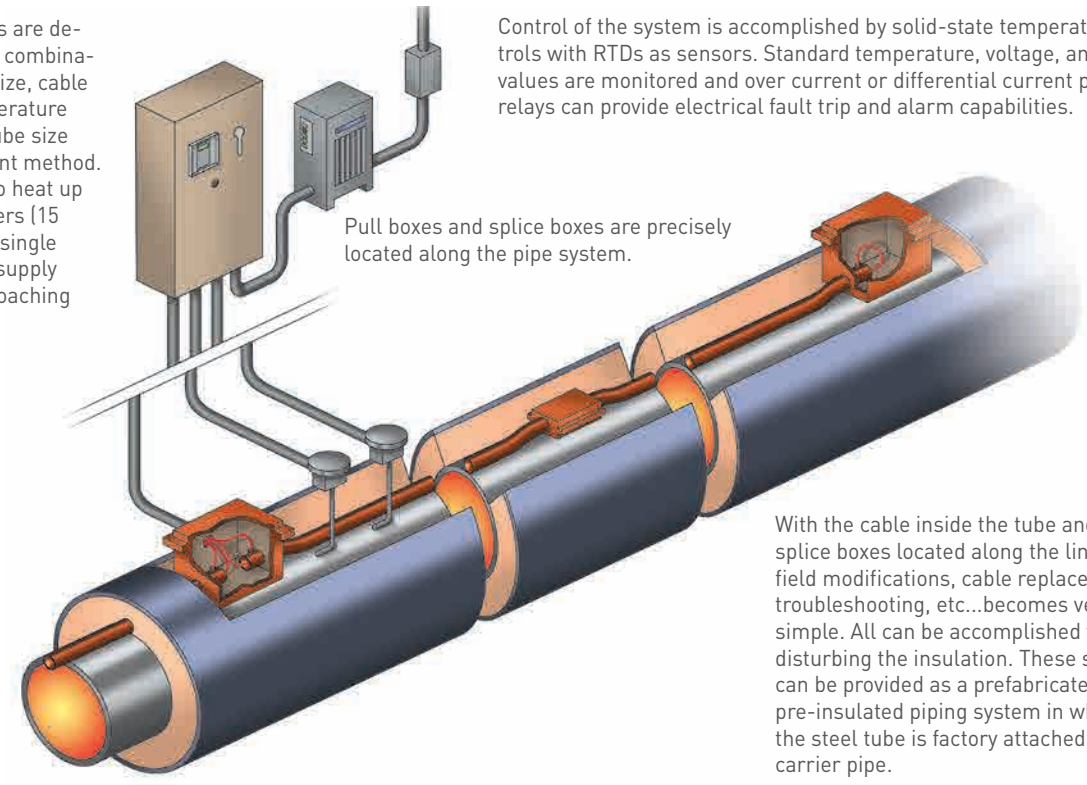


STS SYSTEM

Circuit lengths are determined by a combination of cable size, cable voltage, temperature rating, heat tube size and attachment method. It is feasible to heat up to 25 Kilometers (15 miles) from a single source using supply voltages approaching 5,000 volts.

Control of the system is accomplished by solid-state temperature controls with RTDs as sensors. Standard temperature, voltage, and current values are monitored and over current or differential current protection relays can provide electrical fault trip and alarm capabilities.

Pull boxes and splice boxes are precisely located along the pipe system.



With the cable inside the tube and pull/splice boxes located along the line, any field modifications, cable replacements, troubleshooting, etc...becomes very simple. All can be accomplished without disturbing the insulation. These systems can be provided as a prefabricated and pre-insulated piping system in which the steel tube is factory attached to the carrier pipe.

FORMANCE

The Raychem STS System 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 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.

STS WITH BUNDLED TECHNOLOGIES

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

- Fiber optic based distributed temperature sensing system (DTS) has significantly enhanced the safety and reliability
- Pre-insulated/pre-fabricated piping systems has proven to be a major factor in the thermal performance of the pipelines with homogenous temperature for the pipelines
- FEA / CFD modeling has become a critical tool in designing optimized systems and predictable system performance

WHY RAYCHEM STS?

Safe: Fully grounded system with zero electrical potential on pipe surfaces

Accurate Control:
A closed loop control system includes redundant temperature sensing

Engineered:
Systems are custom engineered in accordance with ANSI/IEEE 844, NEC 426/427 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 25 kilometers (15 miles) from a single power source

Simulation Studies:
Temperature profile plotting capability

Computerized Design:
Runaway temperature, dynamic static heat-up/cool-down calculations available

Flexibility:
Ideal for either factory fabricated, pre-insulated or field installed system

APPLICATIONS

MATERIAL TRANSFER LINES

Whether from dock to tank farm or direct to a process unit, the long circuit capabilities of the Raychem STS System provides the lowest cost and safest heat management system 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, the Raychem STS System provides a cost-effective solution to common snow and ice problems.

TANK FOUNDATION HEATING

The Raychem STS System can be used in Class 1 Division 2 and Zone 2 hazardous areas creating a technically superior, commercially-attractive solution to prevent frost heave damage of LNG, LPG, ethylene, propylene and ammonia tanks.

SUBSEA/SUBMERGED LINES

Emerging subsea technologies, including the development of integrated production umbilical (IPU) and submerged pipelines, demand a precise solution to heating underwater transfer lines. With the Raychem STS System pre-inserted wire/heat tube configuration, long lengths of wires are pulled in the heat tubes without having to use conventional pull/splice boxes or field splices.

PREFABRICATED PRE-INSULATED LINES

The Raychem STS System 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.

PENTAIR

WWW.THERMAL.PENTAIR.COM

NORTH AMERICA

Tel: +1.800.545.6258
Fax: +1.800.527.5703
Tel: +1.650.216.1526
Fax: +1.650.474.7711
thermal.info@pentair.com

EUROPE, MIDDLE EAST, AFRICA

Tel: +32.16.213.511
Fax: +32.16.213.603
thermal.info@pentair.com

ASIA PACIFIC

Tel: +86.21.2412.1688
Fax: +86.21.5426.2917
cn.thermal.info@pentair.com

LATIN AMERICA

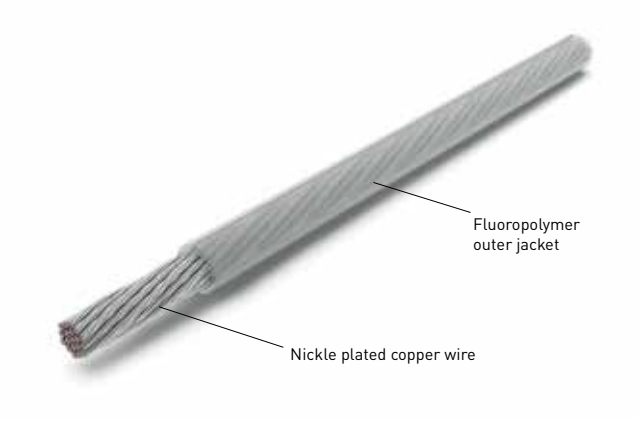
Tel: +55.11.2588.1400
Fax: +55.11.2588.1410
thermal.info@pentair.com

Raychem STS-HT

SKIN EFFECT TRACE HEATING SYSTEM WIRE

Electrical process temperature maintenance for high temperature pipelines and embedded applications

Skin-effect Insulated Conductor Construction



PRODUCT OVERVIEW

STS-HT Tracing Wire is a specially formulated, chemical resistant wire made specifically for high temperature STS Trace Heating applications up to 250°C. STS Systems using STS-HT Wire are ideal for heating pipelines transporting materials such as sulfur and asphalt.

These STS Wires meet all requirements of internationally recognized standard IEEE 844 at 2,500 VAC and are approved for use in hazardous and non-hazardous locations when used as part of a Pentair designed STS Trace Heating System.

Pentair's STS Trace Heating Systems are ideal for embedded or long pipeline applications to minimize the number of connection and power source locations. Circuit lengths up to 25 km (15 miles) are possible.

Raychem STS-HT Wires meet the requirements of the U.S. National Electrical Code, the Canadian Electrical Code, ATEX, and Russian standards when properly installed and commissioned in a STS Trace Heating System designed by Pentair. For additional information, contact your local Pentair Industrial Heat Tracing Solutions office.

APPLICATION

Area Classification	Hazardous and non-hazardous locations
Traced surface type	Metal and Concrete
Chemical resistance	Organic and aqueous inorganic chemicals and corrosives

PERFORMANCE RATINGS

Voltage Rating	2,500 Vac maximum
Maximum Operating Temperature	250°C (482°F)
Power Output Rating (maximum)	150 W/m (45.7 W/ft)

APPROVALS

FM APPROVED	FM STS-0D5A3-AX CL 1, Div 2, Grps. B, C, D CL 1, ZN 2, Grp. IIB+H2
Ex	BAS98ATEX2383X-STS Ex II 2 G, Ex e II T
EAC	TC RU C-BE.ME92.B.00067 2 Ex e s IIT2/T3 (T5) Ge X

DESIGN AND INSTALLATION

STS-HT Wires are an integral part of a complete, engineered Raychem STS Trace Heating System. These systems are custom designed and engineered based on the specific needs of the application. Pentair requires that all STS Trace Heating System designs be completed and approved by Pentair engineers. Pentair Field Service personnel are also recommended for installation and commissioning of STS Trace Heating Systems

PRODUCT CHARACTERISTICS

	Dimensions (Max OD)	Weight Per 3m (10FT)	Bend Radius (@-40C)	Conductor Size
STS-HT/33.25 Wire	13.2 mm (0.52 in.)	1.5 kg (3.3 lb.)	84 mm (3.3 in.)	33 mm^2 (#2AWG)
STS-HT/21.25 Wire	11.2 mm (0.44 in.)	1.0 kg (2.2 lb.)	77 mm (3.0 in.)	21 mm^2 (#4AWG)
STS-HT/13.25 Wire	9.9 mm (0.39 in.)	0.7 kg (1.6 lb.)	60 mm (2.4 in.)	13 mm^2 (#6AWG)
Maximum Pull Force	90 Kgs (200 Lbs)			
Outer Jacket Color	Clear			

ORDERING DETAILS

	Description	Part number
	STS-HT/33.25 Wire	P000001474
	STS-HT/21.25 Wire	P000000635
	STS-HT/13.25 Wire	P000001475

STS SYSTEM COMPONENTS

Pentair offers a full range of connection kits for power connections and splices for STS Wires. These connection kits must be used to ensure proper functioning of the product and compliance with warranty, code, and approvals requirements.

Additional components, installation tools and accessories required to install, test and commission an STS Trace Heating System are available from Pentair.

PENTAIR

WWW.PENTAIRTHERMAL.COM

NORTH AMERICA
Tel: +1.800.545.6258
Fax: +1.800.527.5703
Tel: +1.650.216.1526
Fax: +1.650.474.7711
thermal.info@pentair.com

EUROPE, MIDDLE EAST, AFRICA
Tel: +32.16.213.511
Fax: +32.16.213.603
thermal.info@pentair.com

ASIA PACIFIC
Tel: +86.21.2412.1688
Fax: +86.21.5426.3167
cn.thermal.info@pentair.com

LATIN AMERICA
Tel: +1.713.868.4800
Fax: +1.713.868.2333
thermal.info@pentair.com

Skin Effect System Wire – Type HT

STS-HT Tracing Wire is a temperature resistant wire for high temperature STS applications. STS-HT Tracing Wire is available in three conductor sizes. Since the STS Wire is an integral part of the heating circuit, it is critical that only the STS wire type and size specified by Tyco Thermal Controls be used.

Model Numbers	**STS-HT/13.2**	**STS-HT/21.2**	**STS-HT/33.2**
Voltage Rating	2500	2500	2500
Conductor Size	13mm^2	21mm^2	33mm^2
Temperature Rating	250˚C	250˚C	250˚C

Material

Conductor	Flexible stranded nickel plated copper, Class H
Insulation	Fluoropolymer, PFA
Insulation Thickness	Per NEC, Publication NFPA

Testing

According to testing requirements listed in IEEE 844-2000, *IEEE Recommended Practice for Electrical Impedance, Induction and Skin Effect Heating of Pipelines and Vessels*.

Use

As a component of a Skin Effect Heating System, designed by approved and qualified personnel.

Raychem STS-MT

SKIN EFFECT TRACE HEATING SYSTEM WIRE

Electrical freeze protection and process temperature maintenance for pipelines and embedded applications

Skin-effect Insulated Conductor Construction

PRODUCT OVERVIEW

STS-MT Tracing Wire is a specially formulated, chemical resistant wire made specifically for medium temperature STS Trace Heating applications.

These STS Wires meet all requirements of internationally recognized standard IEEE 844 at 5,000 VAC and are approved for use in hazardous and non-hazardous locations when used as part of a Pentair designed STS Trace Heating System.

Pentair's STS Trace Heating Systems are ideal for embedded or long pipeline applications to minimize the number of connection and power source locations. Circuit lengths up to 25 km (15 miles) are possible.

Raychem STS-MT Wires meet the requirements of the U.S. National Electrical Code, the Canadian Electrical Code, ATEX, and Russian standards when properly installed and commissioned in a STS Trace Heating System designed by Pentair. For additional information, contact your local Pentair Industrial Heat Tracing Solutions office.

APPLICATION

Area Classification	Hazardous and non-hazardous locations
Traced surface type	Metal and Concrete
Chemical resistance	Organic and aqueous inorganic chemicals and corrosives

PERFORMANCE RATINGS

Voltage Rating	5,000 Vac maximum
Maximum Operating Temperature	150°C (302°F)
Power Output Rating (maximum)	150 W/m (45.7 W/ft)

APPROVALS

FM APPROVED	FM STS-0D5A3-AX CL 1, Div 2, Grps. B, C, D CL 1, ZN 2, Grp. IIB+H2
Ex	BAS98ATEX2383X-STS Ex II 2 G, Ex e II T
EAC	TC RU C-BE.ME92.B.00067 2 Ex e s IIT2/T3 (T5) Ge X

DESIGN AND INSTALLATION

STS-MT Wires are an integral part of a complete, engineered Raychem STS Trace Heating System. These systems are custom designed and engineered based on the specific needs of the application. Pentair requires that all STS Trace Heating System designs be completed and approved by Pentair engineers. Pentair Field Service personnel are also recommended for installation and commissioning of STS Trace Heating Systems.

PRODUCT CHARACTERISTICS

	Dimensions (Max OD)	Weight Per 3m (10FT)	Bend Radius (@-40C)	Conductor Size
STS-MT/33.50 Wire	14.0 mm (0.55 in.)	1.3 kg (2.9 lb.)	84 mm (3.3 in.)	33 mm^2 (#2AWG)
STS-MT/21.50 Wire	12.7 mm (0.50 in.)	0.9 kg (1.9 lb.)	77 mm (3.0 in.)	21 mm^2 (#4AWG)
STS-MT/13.50 Wire	11.4 mm (0.45 in.)	0.6 kg (1.3 lb.)	60 mm (2.4 in.)	13 mm^2 (#6AWG)

Maximum Pull Force	90 Kgs (200 Lbs)
Outer Jacket Color	Black

ORDERING DETAILS

	Description	Part number
	STS-MT/33.50 Wire	A42886-000
	STS-MT/21.50 Wire	F93310-000
	STS-MT/13.50 Wire	F74409-000

STS SYSTEM COMPONENTS

Pentair offers a full range of connection kits for power connections and splices for STS Wires. These connection kits must be used to ensure proper functioning of the product and compliance with warranty, code, and approvals requirements.

Additional components, installation tools and accessories required to install, test and commission an STS Trace Heating System are available from Pentair.

PENTAIR

WWW.PENTAIRTHERMAL.COM

NORTH AMERICA
Tel: +1.800.545.6258
Fax: +1.800.527.5703
Tel: +1.650.216.1526
Fax: +1.650.474.7711
thermal.info@pentair.com

EUROPE, MIDDLE EAST, AFRICA
Tel: +32.16.213.511
Fax: +32.16.213.603
thermal.info@pentair.com

ASIA PACIFIC
Tel: +86.21.2412.1688
Fax: +86.21.5426.3167
cn.thermal.info@pentair.com

LATIN AMERICA
Tel: +1.713.868.4800
Fax: +1.713.868.2333
thermal.info@pentair.com

Skin Effect System Wire – Type MT

STS-MT Tracing Wire is a specially formulated, medium voltage, temperature resistant wire made specifically for medium temperature STS applications. STS-MT Tracing Wire is available in three conductor sizes. Since the STS Wire is an integral part of the heating circuit, it is critical that only the STS wire type and size specified by Tyco Thermal Controls be used.

Model Numbers	STS-MT/13.5	STS-MT/21.5	STS-MT/33.5
Voltage Rating	5000	5000	5000
Conductor Size	13mm^2	21mm^2	33mm^2
Temperature Rating	150˚C	150˚C	150˚C

Material

Conductor	Tinned stranded copper
Insulation	150˚C rated cross linked polyolefin
Insulation Thickness	Per NEC, Publication NFPA

Testing

According to testing requirements listed in IEEE 844-2000, *IEEE Recommended Practice for Electrical Impedance, Induction and Skin Effect Heating of Pipelines and Vessels*.

Use

As a component of a Skin Effect Heating System, designed by approved and qualified personnel.