FTS FLUID TRACING SYSTEM

State-of-the-Art
STEAM TRACING
High Performance, Energy Savings

QMax FTS (Fluid Tracing System) combines performance comparable to jacketed pipe with the flexibility and low cost of standard steam tracing.

Best Overall Solution
Heating and maintaining temperatures in process piping is very important to the operation of many industrial facilities. Key criteria in selecting heating systems include:

•Performance •Capital Cost •Maintenance Cost •Energy Efficiency

For most piping systems, **QMax FTS** is the best overall heating solution. Here's why:

"QMax has supplied a unique design that delivers better heat transfer and improves heat tracing benefits when compared to typical installations. The QMax product is also easy to use and fairly simple to install."

– James Rawson
Reliability Manager
Hunt Refining Company

Weighing Your Options

Until recently, fully-jacketed pipe and tube tracing (or pipe tracing) were the only widely accepted systems using fluids as the heating medium.

Fully-Jacketed Pipe:
High Performance, But High Cost

When designed properly, fully-jacketed pipe (jacketing the core pipe with a second, outer pipe and conveying heating medium in the annular space) is the most effective system for maintaining process temperatures in piping. Jacketed pipe offers the greatest heating surface area around the process pipe and offers direct heating contact between the process and heating medium.

However, jacketed pipe comes with inherent liabilities:

- High capital cost
- Expensive and time consuming to modify
- High energy consumption
- Potential for leaking heating medium into the process
- Potential for leaking process into the heating medium

Tube Tracing: Low Cost, But Inferior Performance

Tube tracing (running a stainless or copper tube along the pipe which conveys a heating medium) is typically a non-engineered system with relatively low capital cost. Typical problems with tube tracing include:

- Tube tracing is often ineffective for maintaining elevated process temperatures due to poor heat transfer.
- Theoretically, there is a line contact between the tubing and pipe wall that facilitates a conductive heating path. Realistically, this line contact is never attained during installation.
- The uneven contact between the pipe and tubing results in convective heating.
- Convective heating is inefficient because it heats the air surrounding the tubing and the air then attempts to heat the process pipe.

QMAX INDUSTRIES INC.

QMax Industries, Inc.
is a technology company based in Charlotte, NC, with several patents in the field of process heating.

Our specialties include:

>High Performance Steam Tracing
>High Performance Electric Tracing
>Equipment Jacketing
>Tank Heating

"We're committed to be the world leader in steam tracing technologies"

Thomas W. Perry
President

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QMax FTS : High Performance, Low Cost

QMax FTS is a patented*, highly conductive aluminum channel that fits over standard stainless or copper tubing. It's aluminum body transforms the nature of standard stainless or copper tubing from inefficient convective heat transfer to high efficiency conductive heat transfer. The heating surface area is also increased to as much as three inches per strip. These two enhancements increase two of the three parameters in overall heat transfer from the heating medium to the process.

$$Q = U * A * \Delta T$$

Where…

1) Q = Heat Transfer from heating medium to process needed to overcome natural heat loss and/or to heat a process to a specified temperature.
2) U = Combined heat transfer coefficient from heating medium to process.
3) A = Contact Area between the heating medium and process.
4) ΔT = Temperature difference between heating medium and process.

Viewed from an operability standpoint, the main considerations are the solution's ability to heat the process from an upset condition to its desired operating temperature, and its ability to maintain target temperature during normal operation.

For example, consider raising the temperature of asphalt from 50 °F to 300 °F in an insulated 6 inch carbon steel pipe. Figure 2 compares the effectiveness of **QMax FTS**, jacketed pipe, and a stainless steel convection tracer in terms of energy transfer (BTU/hr/ft) from the heating medium (in this case, 150 psig saturated steam at 365 °F) into the asphalt. This comparison is also an indicator of each system's ability to maintain the desired operating temperature of 300 °F during normal operation.

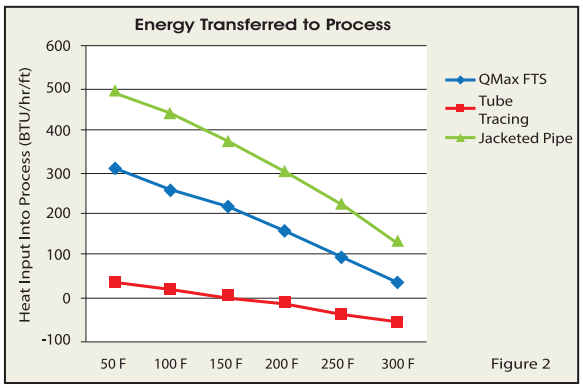


Figure 2

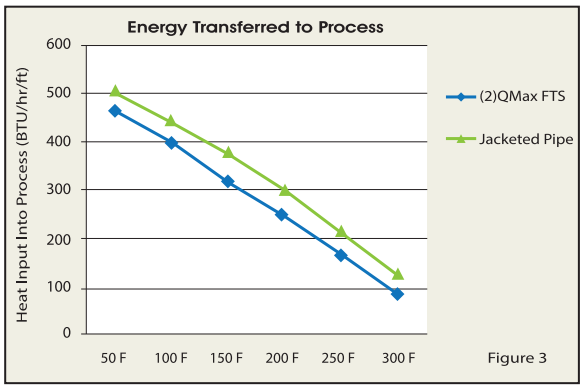


Figure 3

In jacketed pipe, the "UA" is maximized and more energy is being transferred from the steam into the process than in the other systems. After the operating temperature of 300 °F is reached, the jacketed pipe system continues to heat the process. This may be a liability if a process has an upper temperature limit that cannot be exceeded. Another liability with the jacketed pipe may be the operating cost. Due to the maximum energy transferred, the cost of the heating medium should be analyzed because it may be substantial.

The tube tracing is not effective at transferring energy into the process. The heat energy from the steam must transfer through stagnant air before entering the pipe and asphalt. Stagnant air is a great insulator (its "U" is very low) which prevents effective heat transfer. In fact, at 150 °F, the tube tracing has reached equilibrium and has no more available energy to heat the process. This inability to transfer the energy into the process makes the system appear to be energy efficient. As reflected in Figure 2, it uses less energy than any other system at every temperature. Once the maximum temperature of the process is met, every bit of extra energy is lost through the insulation.

> **" If you're not using the QMax System, you're spending too much"**
>
> **– Robert Hager**
> **Manager of Special Projects**
> **Eastman Chemical Co.**

QMax FTS heats the process effectively until it reaches the operation temperature of 300 °F. QMax uses innovative software that accurately models the heat transfer and allows the system to precisely control the amount of energy needed to meet the specific goal. In other words, the "UA" is specifically designed into the system. **QMax FTS** is effective at increasing process temperatures as needed yet also energy efficient because it does not continue to add unnecessary heat energy into the process once operating temperatures are met.

Normally **QMax FTS** is designed to reach equilibrium at a temperature slightly higher than the target temperature unless designing specifically for heat-up or melt-out. **QMax FTS** can be designed to approach the performance of fully jacketed pipe as shown in Figure 3 if heat-up or melt-out is the primary goal.

* USPTO: 8,469,082
8,662,156

Thermal FEA Modeling

QMax Industries, Inc. provides qualified customers with complimentary thermal FEA (Finite Element Analysis) on all applications to model the temperature profile of the system before it's put into service. Many different scenarios can be analyzed to improve the effectiveness and / or efficiency on a project. Customary advantages of **QMax FTS** include:

> Heat-up and/or melt-out time of the process is decreased dramatically
> Cold spots are eliminated
> Poor insulation is less problematic
> Steam Traps are reduced by 50% (less potential for failure)
> More energy is driven to the process instead of lost through insulation

Technical Analysis

This example represents a specific technical analysis to demonstrate how the patented **QMax FTS** steam tracing system can significantly reduce capital and long term maintenance costs through the reduction of steam tracing requirements and related infrastructure.

Using (4) Bare Tracers

QSim FTS- Fluid Thermal Analysis for Heating Pipe	Bare Tubing	
Energy Transfer Into Process	22.9	Btu/hr ft
	22.0	W / m
Heat Load on Heating Medium	212.3	Btu/hr ft
	204.1	W / m
Steam Consumption	0.140	lb / hr ft
	0.208	Kg / hr m

Using (3) Bare Tracers

QSim FTS- Fluid Thermal Analysis for Heating Pipe	Bare Tubing	
Energy Transfer Into Process	-27.4	Btu/hr ft
	-26.3	W / m
Heat Load on Heating Medium	157.0	Btu/hr ft
	151.0	W / m
Steam Consumption	0.140	lb / hr ft
	0.208	Kg / hr m

Using (1) QMax Tracer

QMax FTS- Heat Load Calculations	QMax FTS	
Energy Transfer Into Process	=628.54	Btu/hr ft
	=604.25	W / m
Heat Load on Heating Medium	=847.8	Btu/hr ft
	=815.0	W / m
Steam Consumption	=1.000	lb / hr ft
	=1.484	Kg / hr m

Using (2) QMax Tracers

QMax FTS- Heat Load Calculations	QMax FTS	
Energy Transfer Into Process	=1458.64	Btu/hr ft
	=1402.29	W / m
Heat Load on Heating Medium	=1705.0	Btu/hr ft
	=1639.1	W / m
Steam Consumption	=2.012	lb / hr ft
	=2.985	Kg / hr m

This specific analysis reflects a requirement of maintaining heavy oil temperature at 130°F inside a 24 inch carbon steel pipe using 175 psig saturated steam using bare steam tracing. It assumes a cold climate and the use of 2 inches of fiberglass insulation around the piping system. The top number represents the heat transfer from the steam into the process. Notice that (3) bare tracers will not maintain the desired temperature.

We recommend using two **QMax FTS** tracers on large lines, as this offers automatic system redundancy in case of steam trap failure. If the ultimate goal is to eliminate as many steam traps as possible, a single **QMax FTS** tracer will maintain temperature.

"Thermal Modeling allows us to predict potential failure modes, maximize performance & uncover potential savings"

Thomas Perry
President
QMax Industries, Inc.

QMAX FTS FLUID TRACING SYSTEM
Clear Advantages

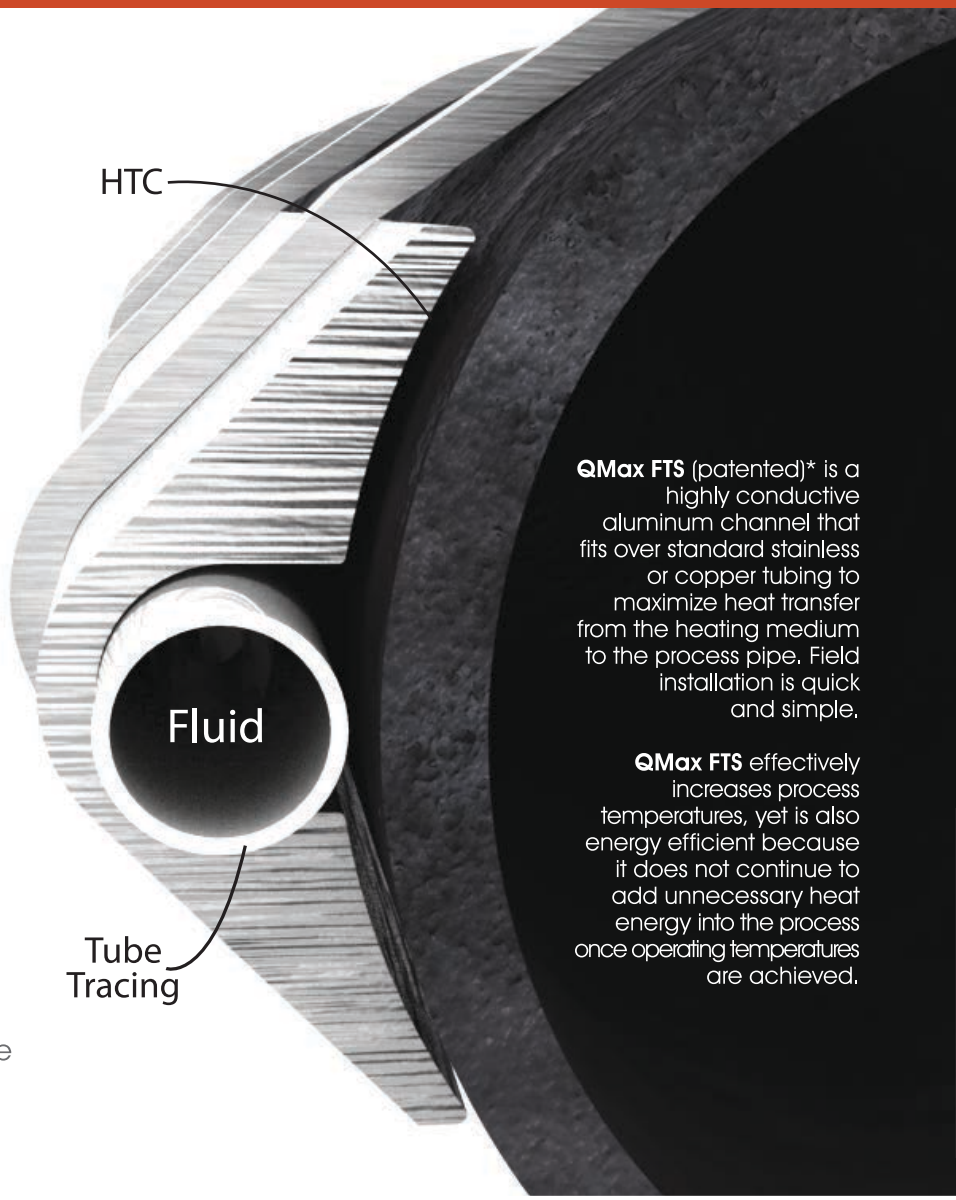
Lower cost
The total installed and long term maintenance costs of **QMax FTS** is consistently lower than jacketed pipe or tube tracers.

Easy installation and maintenance
QMax FTS fits over common tubing so installation and maintenance are well understood.

Customized fit
QMax FTS is made from aluminum, making field installation quick and simple.

Fewer leaks
QMax FTS reduces the number of tracers required which reduces the number of fittings. No costly hoses are required with the system.

Engineered systems
Each application is specifically designed for specific heating requirements to offer precise temperature control and precise energy consumption.



QMax FTS (patented)* is a highly conductive aluminum channel that fits over standard stainless or copper tubing to maximize heat transfer from the heating medium to the process pipe. Field installation is quick and simple.

QMax FTS effectively increases process temperatures, yet is also energy efficient because it does not continue to add unnecessary heat energy into the process once operating temperatures are achieved.

Estimated Cost Savings Example

Companies that implement **QMax FTS** as an improvement to standard bare tracing often realize significant capital and maintenance costs savings. The largest impact is the **reduction of steam and condensate infrastructure.** The following example demonstrates the potential savings based on historical prices. The material savings alone more than offset the cost of the **QMax FTS** system. To run a more detailed analysis of savings, please send us the unit prices that apply to your site specifications (for example, welded versus seamless affects the tubing price).

Material Savings*	Tubing	Fittings	Steam Traps	Pre-Insulated** Tubing
Input Unit Price	$4.00 / lf	$25	$750	$8.00 / lf
(4) Bare Tracers	24,000 lf	1,200	160	8,000 lf
(2) QMax Tracers	12,000 lf	600	80	4,000 lf
Potential Savings	$48,000	$15,000	$60,000	$32,000

*Labor not included
**Pre-insulated tubing is based on 50 ft lengths per circuit.

Total Savings: $155,000

QMAX FTS FLUID TRACING SYSTEM

> **Energy Savings**
More heat energy is input into the crude instead of lost through insulation.

> **Energy & Maintenance Savings**
Fewer steam traps means fewer potential for traps failed open or closed.

> **Energy & Maintenance Savings**
Less steam/condensate infrastructure means lower maintnance costs and less energy loss.