**QMax™ FTS (Fluid Tracing System) – Effective and Efficient Fluid Heat Tracing**

**Introduction: The Right Tool for the Right Job**

Increasing and maintaining temperatures in process piping is very important to the operation of many industrial facilities. Selection of the heating system is not usually a quick and easy decision because there are short term and long term cost and operability implications. Important factors when making this decision are;

1) Effectiveness (will the system perform as intended)
2) Capital cost
3) Maintenance cost
4) Energy Efficiency

Until recently, fully-jacketed pipe and tube tracing (or pipe tracing) were the only widely accepted systems using fluids as the heating medium. **QMax FTS** (Fluid Tracing System) is a new and innovative heating system for process piping with distinct advantages over both traditional fluid heating methods. Its design addresses the important factors considered in selecting the heating system for piping. In many process applications, it is truly the right tool for the right job.

**Background: Traditional Fluid Heating**

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 such as;

- High capital cost
- Potential for leaking heating medium into the process
- Potential for leaking process into the heating medium
- Expensive and time-consuming to modify
- High energy consumption (this will be addressed in this paper).

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. This system is most often ineffective for maintaining elevated process temperatures due to poor heat transfer from the heating medium to the process. 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 rather than conductive heating, and leads to unpredictable performance. The convective heating is inefficient because it heats the air surrounding the tubing and the air then attempts to heat the process pipe.
QMax™ FTS (Fluid Tracing System): Latest Technology

QMax FTS (Fluid Tracing System) (Figure 1) maximizes heating performance and energy efficiency, yet is simple and cost effective. QMax FTS is a highly-conductive aluminum channel which fits over standard stainless or copper tubing. The high conductivity maximizes the heat transfer from the tubing (conveying the heating medium) to the process pipe. It offers the flexibility and low cost of a tube tracing system with the predictable results of jacketed pipe. This paper will outline the technical attributes which makes QMax FTS the best overall system for process heating for most piping systems.

QMax FTS transforms the nature of standard stainless or copper tubing from inefficient convective heat transfer to high-efficiency conductive heat transfer using highly conductive aluminum as its main heating body. 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 process to the heating medium;

\[ Q = U \cdot A \cdot \Delta T \]

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) \( \Delta T \) = Temperature difference between heating medium and process

System Comparison: Technical Performance

From an operability standpoint, the main selection considerations are the ability to heat the process from an upset condition to its desired operating temperature and its ability to maintain that temperature during normal operation.

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

Fully Jacketed Pipe:

In jacketed pipe, the “UA” is maximized and more energy is being transferred from the steam into the process than any other system. 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.
Tube Tracing:

The tube tracing is not effective at transferring energy into the process. The heat energy from the steam has to 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.

QMax™ FTS (Fluid Tracing System):

QMax FTS heats the process effectively until it reaches the operation temperature of 300 °F. The system is designed using 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.

QMax™ FTS (Fluid Tracing System): More about the system

QMax Industries, Inc. analyzes each system using innovative software to predict and prevent failure. Each application is specifically designed for specific heating requirements to offer precise temperature control and precise energy consumption. QMax FTS also offers the following advantages:

1. Lower cost – The total-installed and long-term maintenance costs of QMax FTS is consistently lower than Jacketed Pipe or (2) tube tracers
2. Easy Installation and Maintenance – QMax FTS fits over common tubing so installation and maintenance are well understood.
3. Customized fit - QMax FTS is made from aluminum, making field installation quick and simple.
4. Fewer Leaks - QMax FTS reduces the number of tracers required which reduces the number of fittings. No costly hoses are required with the system.
5. Engineered Systems – QMax FTS can be fully engineered and designed by QMax Industries if complete installation drawings are desired.

As the pressure to increase plant efficiencies and minimize downtime become more important, the need for new and innovative solutions is critical. QMax™ FTS is uniquely designed to offer both efficient and effective heat transfer to heat-up and maintain processes in piping systems. QMax Industries, Inc. will assist your company in project-specific cost analysis to make sure QMax FTS is the right solution for your company. Contact us at www.qmaxindustries.com or at 704-643-7299 to learn more.