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# *HEATING & COOLING* *MEDIUM CONTROL*



THE MOST ADVANCED, RELIABLE AND COMPACT SELF CONTAINED VALVES  
AVAILABLE FOR TEMPERATURE CONTROL, FREEZE PROTECTION, STEAM TRACING  
AND CONSERVATION OF ENERGY



9001  
CERTIFIED

# HOT WATER TRACING SYSTEMS

## APPLICATION NOTES

### APPLICATION:

Some chemical products must be heated to an optimum temperature above ambient temperature, but are also sensitive to overheating, e.g.: formaldehyde.

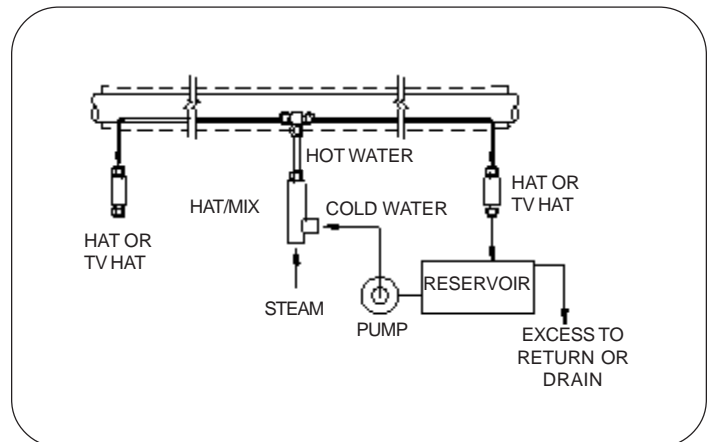
**THERM-OMEGA-TECH's HAT/MIX** valves can be used to provide a convenient, economical, reliable and effective hot water tracing system. Steam and water supplies are all that must be connected to the valve.

At an eastern specialty chemicals plant, it was required to maintain formaldehyde lines at about 100°F. Lower temperatures would affect product quality, while higher temperatures would cause the formation of formic acid and other undesirable side products.

The solution was to install **THERM-OMEGA-TECH's HAT/MIX-100** and **HAT-100** valves which together provide both temperature control and backup safety high limit control. Approximately 100 psig steam and 50 psig water were piped to each **HAT/MIX** valve. The outlet from the valve then supplied the 3/8" tracer lines on various formaldehyde process piping. At the end of each tracer line just before connection to the return system, a **HAT-100** valve was installed. After the system was started-up, the water temperature at the outlet of the **HAT/MIX** was approximately 100°F, exactly as the system design specified. As the safety backup, if for any reason the tracer temperature at the tracer end exceeds 110°F, the **HAT-100** will close off to prevent overheating. In this particular case, the customer chose to recycle the heated water to the cooling tower sump, where the water was cooled for reuse. A pump drawing from the cooling tower sump supplies water to the **HAT/MIX** valves.

In addition to the **HAT/MIX** and **HAT** valves, additional system protection and reliability was achieved by installation of **THERM-OMEGA-TECH's HAT/FP** valves at key locations and low points. These **HAT/FP** valves provide positive freeze protection to system components and piping in the event of a failure of the steam supply, which could happen if the boiler or its controls fail. The **HAT/FP** valves will drain the water from the system at 35°F to prevent freeze damage.

For further information about an application of this system, or for help in solving your other temperature control problems, please call **THERM-OMEGA-TECH, INC.** at 1-800-288-4878 to talk to an application engineer.



# CONTROL OF HEATING AND COOLING FLUIDS

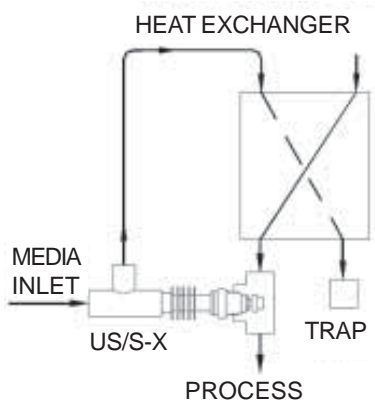
There are numerous applications where it is necessary to use one fluid to either heat or cool another. Probably the most common of these applications is the use of steam through trace lines to prevent freezing of water in pipe, valves, etc. Common practice has been to turn the steam on to these trace lines just prior to the first expected day where temperatures might drop below 32°F (0°C) and not turn the steam off until there is no longer any chance of seeing these freezing temperatures. During this period of time, there will be many hours where temperatures are above freezing. Significant energy reduction can be realized if the steam is turned off during those warmer periods. With the increasing costs of steam, large costs savings can be had.

The Therm-Omega-Tech Ambient Sensing Valves have been designed for this exact purpose. These valves include the TV/SC-A and US-A valves. For winterization these valves are set to be fully opened at 35°F and fully closed at 40°F. By placing these valves in the trace lines the steam flow is automatically turned on only when necessary. Please refer to Therm-Omega-Tech's Application Profile #2 for examples of cost savings by region.

Steam is certainly not only used for freeze protection but also to heat other fluids to above ambient temperature. Fluid in pipes, valves and pumps may need to be heated to lower viscosity so they will flow. Excessive heat may cause these fluids to break down or burn. It is therefore necessary to control the temperature of these fluids within a specified range. This can be done by controlling the flow of steam through trace lines based on required process temperature.

The Therm-Omega-Tech Surface Sensing Valves have been designed for this exact purpose. This valve is designated as the US/S-X valve. With this valve, the Thermoloid actuator is either directly inserted in to the pipe line through a tee or held against the outside surface of the pipe by use of a Band-O-Let fitting. The Thermoloid material is selected to provide the temperature to which the process fluid must be maintained. Automatically, this valve will control the flow of steam through the trace line to provide this temperature. With the use of the Band-O-Let fitting retrofitting existing trace lines is a snap.

Steam is certainly not the only fluid used for heating. Hot water has been used in trace lines to control excessive heating. Using the HAT/SWM to heat water with steam it is possible to provide a closed loop Hot Water Trace System. Please refer to Therm-Omega-Tech Application Profile #6.



Glycol has been used in trace systems for winterization. HAT or TV/HAT valves placed at the end of trace lines can be used to provide the correct flow of glycol for optimum use of energy.

Heat exchangers are a very common piece of equipment used to either heat or cool the process fluid. Any number of fluids are used for cooling or heating medium. One can control the outlet process temperature of a heat exchanger by controlling the flow of the heating or cooling fluid. The US/S-X valve is perfect for this requirement. By placing the Thermoloid actuator into the process fluid, in the outlet of the heat exchanger, through a tee or sensing the surface temperature through a Band-O-Let fitting it is possible to control the flow of the heating or cooling fluid through the US/S-X valve based on the required process temperature. This, again, can be accomplished for both heating and cooling.

Rotating equipment is subject to over heating. Cooling jackets or coils may be used to prevent this overheating. HAT or TV/HAT valves can be placed on the outlet of the jacket or coil to control flow of the cooling medium and maintain the optimum temperature in the jacket or coil. It is best to provide these valves with a leak port to allow for quicker response to temperature change. Cooling/heating jackets may also be place around vessels, reactors, etc. The same principle for temperature control can be used on this equipment.

The above referenced valves all use the Therm-Omega-Tech Thermoloid actuators. These actuators operate solely based on temperature change and require no outside source of power making them intrinsically safe and suitable for explosion proof areas. It's simplicity of operation, and installation, make it the choice where a single temperature must be maintained.



# MANUAL CONTROL OF STEAM TRACING SUPPLY vs. AUTOMATIC CONTROL USING US/A OR TV/SC-A VALVES

## EXAMPLE:

A winterizing steam tracing system in a plant located in Philadelphia, PA consumes about 500 pounds per hour of steam.

This system was manually turned on when danger of freezing temperatures approached (mid-September) and turned off in late Spring when danger of freezing had passed (mid-April). Total operating hours are 5,088:

$$212 \text{ days} \times 24 \text{ hours} = 5,088 \text{ hours in potential freeze season.}$$

The plant's steam cost is \$ 8.00 / 1,000 pounds of steam. The operating cost of this system can be calculated as follows:

## COST OF MANUALLY OPERATED SYSTEM:

$$500 \text{ pounds per hour} \times 5,088 \text{ hours} \times \$ 8.00/\text{thousand pounds} = \$20,352.00 \text{ per winter season.}$$

## COST OF AUTOMATICALLY OPERATED SYSTEM:

When using THERM-OMEGA-TECH ambient sensing TV/SC-A or US/A valves, steam tracing will be turned off automatically whenever ambient temperatures rise above 45°F (other closing temperatures can also be specified). Based on U.S. Weather Bureau data for Philadelphia, steam will be on for only 2,895 hours each winter.

$$500 \text{ pounds per hour} \times 2,895 \text{ hours} \times \$ 8.00/\text{thousand pounds} = \$ 11,580.00 \text{ per winter season.}$$

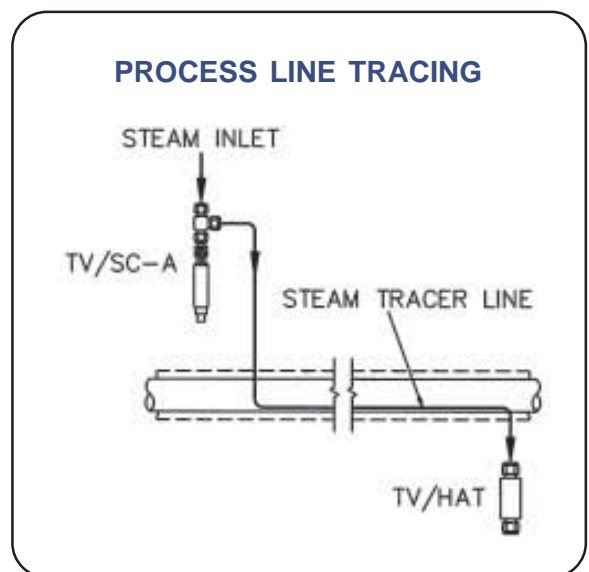
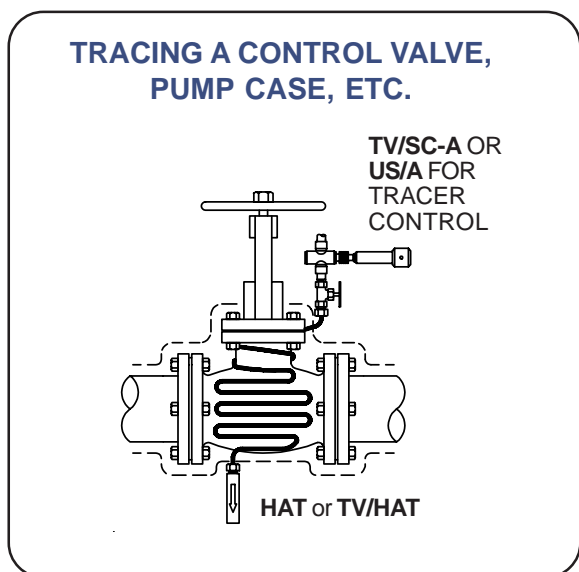
## SAVINGS REALIZED PER WINTER SEASON BY USING THERM-OMEGA-TECH VALVES:

$$\$20,352.00 \text{ less } \$11,580.00 = \$ 8722.00 \text{ per year}$$

## SIMPLIFIED PAYBACK (R.O.I. RETURN ON INVESTMENT)

Assuming an installed cost of \$ 500.00 for the THERM-OMEGA-TECH valve to control the above system, the simplified payback on investment for this application is:

$$\$8,772.00 \div \$ 500.00 = 17.5 \text{ R.O.I.}$$



## Estimated Savings Per Tracer

Location	Number of Months Annually That Air Temperature Can Fall To 32°F or Lower <sup>(1)</sup>	Normal Hours Below 45°F <sup>(2)</sup>	% Of Steam Saved During Months Freeze Can Occur <sup>(3)</sup>	Dollars Saved Annually, With Tracers On During Months Freezing Can Occur <sup>(4)</sup>				Dollars Saved Annually, With Tracer On 12 Months <sup>(5)</sup>			
				Winterization Steam Use, lb/hr				Winterization Steam Use, lb/hr			
				10	20	30	50	10	20	30	50
Great Falls, MT	9	4152	36	186.62	373.25	559.87	933.12	359.42	546.05	732.67	1105.92
Buffalo, NY	8	3829	34	156.67	313.34	460.42	783.36	387.07	543.74	690.82	1013.76
Charleston, WV	7	2716	46	185.47	370.94	556.42	927.36	473.47	658.94	844.42	1215.36
Charlotte, NC	6	1769	59	203.90	407.81	611.71	1019.52	549.50	753.41	957.31	1365.12
Chicago, IL	8	3838	33	152.06	304.13	456.19	760.32	382.46	534.53	686.59	990.72
Cleveland, OH	8	3499	39	179.71	359.42	539.14	898.56	410.11	589.82	769.54	1128.96
Houston, TX	5	229	94	270.72	541.44	812.16	1353.60	673.92	944.64	1215.36	1756.80
Los Angeles, CA	2	117	92	105.98	211.97	317.95	529.92	739.58	787.97	893.95	1105.92
Memphis, TN	6	1829	58	200.45	400.90	601.34	1002.24	546.05	746.50	946.94	1319.04
Mobile, AL	4	759	74	170.50	340.99	511.49	852.48	631.30	801.79	972.29	1313.28
New Orleans, LA	4	468	84	193.54	387.07	580.61	967.68	654.34	847.87	1041.41	1428.48
New York, NY	6	2856	34	117.50	235.01	352.51	587.52	463.10	580.61	436.32	933.12
Philadelphia, PA	7	2895	43	173.38	346.75	520.13	866.88	461.76	634.75	808.13	1154.88
Pittsburgh, PA	7	3512	30	120.96	241.92	362.88	604.80	408.96	529.92	650.88	892.80
Portland, ME	8	4140	28	129.02	258.05	387.07	645.12	359.42	488.45	617.47	875.52
St. Louis, MO	7	2838	44	177.41	354.82	532.22	887.04	465.41	642.82	820.22	1175.04
Seattle, WA	6	2915	33	114.05	228.10	342.14	570.24	460.48	573.70	687.90	915.84
Tulsa, OK	6	2127	51	176.26	352.51	528.77	881.28	521.86	698.11	874.37	1226.88

- (1) U.S. Weather Bureau Data. It is assumed that tracers for winterization are normally left on during this time.
- (2) THERM-O-TECH valves automatically turn on steam to tracers.
- (3) Based on number of hours ambient air temperature is above 45°F. THERM-O-TECH valves automatically turn off steam to tracers.
- (4) Steam Cost Assumed: \$8.00/1,000 lb. Steam Load should include needed heat plus losses due to leaks.
- (5) Steam Cost Assumed: \$8.00/1,000 lb. It is assumed that steam use is a constant 10 lb/hr during "Summer".  
*Example: Winterization steam may average 30 lb/hr during 7 months when freezing can occur. For the balance of the year (5 months), if tracer is allowed to remain active, it has been assumed steam use is 10 lb/hr.*

*Therm-Omega-Tech, Inc. reserves the right to change the design and specifications without notice*

# Therm-Omega-Tech recommends these valves for your heating and cooling applications



**TV/HAT: (Tube Valve/Heat Actuated Trap)** valves are ideal for use in conjunction with tubing and tracing systems using pre-traced tubing bundles. These versatile valves are ideal for replacing conventional steam traps on winterization tracing, instrument tracing, condensate return system freeze protection, process tracing and other applications requiring in-line flow control based on temperature. Reverse-acting valves (open on temperature rise) are also

available. **TV/HAT** valves are available with 1/4", 3/8" or 1/2" tube compression fittings and setpoints from 55°F to 240°F (13°C to 116°C).

Dimensions: **TV/HAT:** 3-1/2" x 1". These valves save space, eliminate the use of extra, expensive, and time consuming piping. They install in seconds. The unique ram-type plug & seat provide reliable, tight shut off longer than any other design available. Since TV/HAT valves discharge condensate well below steam temperature, live steam losses are eliminated. For heating of temperature sensitive instruments or process fluids, the reduced temperature available for tracing simplifies operations and eliminates overheating problems.

**HAT/MIX:** valves can be used in any application in which a constant outflow of water at a specific temperature is desired. These self-contained valves are designed around our exclusive Thermoloid sensor/controller that automatically adjusts the steam or hot water component to temper outflow water to the specified temperature. The devices are factory set and are not user adjustable, therefore tamper-proof. The valve is designed to yield outflow temperatures within a given range; if water is inadvertently not turned on, the Thermoloid sensor/controller turns off the steam flow at the set point temperature preventing the typical "hose full of steam" problem. **HAT/MIX** valves are perfect for hot water tracing when used in conjunction with **HAT** or **TV/HAT** valves. Typical set points available are 90, 105, 125, 145, 155, 180 & 210°F (32, 41, 52, 63, 68, 82 & 99°C).



These valves can be used in any application in which a constant low flow rate (under 1 gpm) of water at a specified temperature is desired. These valves, like any mixing valve, must be installed with check valves on both hot and cold inlets for the water/water mixing and at least on the cold side for steam/water mixing. Pressure reducing valves are recommended on water/water mixing installations in which system pressures are likely to vary.



**HAT: (Heat Actuated Trap)** valves are a compact, reliable way to optimize steam use, prevent pipe damage due to freezing, eliminate over-temperature water, or otherwise control flow based on media temperature. **Therm-O-Tech's** unique design provides bubble-tight shut-off and eliminates the clogging problems encountered with other type designs. **HAT** valves are available in 1/2" or 3/4" NPT sizes. The HAT valve responds only to temperature. After condensate forms and cools to near the setpoint, the HAT valve

modulates the flow to maintain a constant condensate discharge temperature. HAT valves are wide open at start-up for rapid venting and initial heat-up. HAT valves are self-draining after shutdown, to eliminate freeze damage. Since HAT valves discharge condensate well below steam temperature, live steam losses are eliminated. For heating of temperature sensitive instruments or process fluids, the reduced temperature available for tracing simplifies operations and eliminates overheating problems. The unique ram-type plug & seat provide reliable, tight shut off longer than any other design available.

**TV/SC-A: (Tube Valve/Steam Control-Ambient Sensing)** There are literally hundreds of applications for these compact, self-contained, automatic control valves. Tubing connections allow quick installation at low cost. Ambient sensing valves can be used to turn on steam, air, gas or liquids compatible with Teflon® and stainless steel in response to ambient temperature change. Applications include automation of steam trace lines, operation of pneumatically operated pumps for injection of anti-freeze liquids, etc. Available with single outlet 3/8" or 1/2" tube compression fittings. At the designated set point, a thermostatic element located at one end of the valve (and thermally isolated from the body of the valve), will open or close within a 10°F (5.6°C) differential (e.g. 35-45°F, etc.) and control the flow of steam, gas, or fluid through the valve based on ambient temperature. The TV/SC-A opens on falling temperature. An optional solar shield (when used) allows the device to be installed where solar heating may affect the set point of the device. The TV/SC-A may also be used to control instrument enclosure temperatures



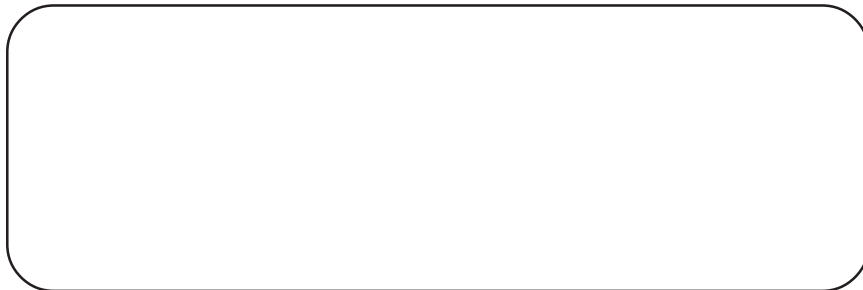
**US/A & US/A-R: (Ambient-Sensing Control)** At any chosen setpoint from 30°F to 140°F (-1°C to 60°C), these valves can economically automate a system in response to ambient temperature for control of steam, air, gas or liquids compatible with Teflon® and stainless steel. Applications include automation of winterization steam tracing lines, control of pneumatically operated pumps for injection of antifreeze liquids, ambient sensing water line freeze protection, etc. They also offer maximum economy as unit heater controls. They are also ideal for controlling steam heated drum heater enclosures, plate or panel coil clad tanks, etc. US/A-R (Reverse acting) valves can be used to automate cooling sprinklers, cooling baths, etc.

**US/S-X& US/S-XR: (Surface or Fluid-Sensing Control)**

These compact self contained control valves can affect very close temperature control of any number of control loops using steam, liquid phase heat transfer media such as Dowtherm®, hot water, hot oil, etc. The reverse acting model (US/S-XR) can be used to control cooling media to economically remove heat from equipment or a process. The sensor/controller element may be placed against the process line or pipe with the optional weld-o-let or band-o-let or in the line with the integral 3/4" NPT bushing offering unlimited piping variations. This allows the temperature element to be in contact with the process, regulating the in flow of heating media (or cooling media with the US/S-XR). Input temperatures or steam supply can vary widely, and yet the control temperature is maintained within desired limits. Available standard set points from 30°F to 240°F (-1°C to 116°C).



Contact your local representative for information on our full product line.



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