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ENERGY SAVINGS

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

ISO 9001 CERTIFIED

Energy Savings

With the continued increase in the cost of generating steam it is becoming more imperative that manufacturing facilities look at methods for reducing steam consumption. One area where this can easily be accomplished is in the use of steam for freeze protection of water lines. Pipes, valves, pumps, etc. are often heat traced with steam. Most often, steam to these trace lines are turned on just prior to the earliest expected frost and then turned off after there is no longer any threat of temperatures falling below 32°F (0°C). Depending on location of their facilities, some to much of that time will see temperatures above freezing. By automatically turning off steam when not required significant cost savings can be realized. For estimated savings per location please refer to Therm-Omega-Tech Application Profile #2.

The simplest, least expensive method for controlling steam through trace lines is by utilizing self operating valves that respond to ambient temperature. Therm-Omega-Tech's Ambient Sensing valves operate utilizing our Thermoloid® solid-liquid phase change actuators. The Thermoloid® material responds only to temperature change. The expansion and contractions of this material during phase change opens and closes valves with no other source of power required.

Steam tracing will keep pipes like these from freezing during cold months.

These valves include our TV/SC-A & US/A valves and are available in 3/8" &1/2" tube fittings or ½" & ¾" NPT fittings for individual trace lines. For main steam headers 1" & 1 ½" NPT is available. For winterization, these valves are set to open steam lines as the ambient temperature starts to fall below 40°F and automatically close above that temperature.

Installation is simple and can be easily placed in existing trace lines. The low costs of these valves can be recovered in a matter of weeks through energy savings.

Another potential source of energy savings is the selection of steam traps on trace lines. The lower the temperature at which condensate is sent to drain the less energy is wasted. By having steam traps set below steam temperature more of the energy is utilized for freeze protection.

Therm-Omega-Tech's HAT & TV/HAT valves react strictly to temperature and can be selected to open at a wide range of temperatures from 210°F to 40°F. 180°F is the most common set point for traps on trace lines. These valves are designed to have a long life and are very economical.

THERM-OMEGA-TECH HAT VS. CONVENTIONAL STEAM TRAPS OPERATING COST SAVINGS

APPLICATION NOTES

The **THERM-OMEGA-TECH *HAT*** valves provide substantial savings when compared to the cost of operating conventional steam traps. The ***HAT*** valves sense condensate temperature and open to allow flow only when the condensate temperature is below the setpoint, well below saturated steam temperature. The condensate forms a liquid seal ahead of each valve preventing live steam losses. Also, the sensible heat in the condensate between steam temperature and the ***HAT*** discharge temperature is used for heating.

Most properly functioning conventional steam traps have inherent live steam loses: at least 2 lbs/hr. for inverted bucket traps, and over 5 lbs/hr for disc traps. Actual field studies have shown that live steam losses of disc traps increase considerably with time in service, with loses of 20 lb/hr after less than one year of service being not unusual. Losses from other types of conventional traps also increase with time, but usually less than loses from disc traps.

For this example, we will use 2 lb/hr of live steam loss for conventional traps in good condition and compare this to ***HAT*** valves which have **zero live steam loss.** Further, ***HAT*** valves achieve additional savings by discharging condensate at reduced temperature. These additional savings can be calculated based on the value of the heat content at varying discharge temperatures.

COMPARE OPERATING COSTS FOR TYPICAL SYSTEM:

One hundred 3/8" steam tracers (50 to 75 feet long)
70 psig steam pressure (316˚F saturated steam temperature)
Assumed steam cost @ $5.00/1000 lbs or $5.00/1,000,000 BTU
Estimated individual trap load: 20 lb/hr
Total system load: 100 X 20 lb/hr = 2000 lb/hr

	HAT	CONVENTIONAL TRAPS
Discharge Temperature	165˚F	316˚F
Heat of Condensate (From Steam Tables)	133 BTU/lb	286 BTU/lb
Live Steam Loss Per Trap	0 lb/hr	2 lb/hr

SENSIBLE HEAT SAVINGS:

286 BTU/lb - 133 BTU/lb = 153 BTU/lb Saved by ***HAT***

2000 lb/hr X 153 BTU/lb X 8760 hr/yr X $5/1,000,000 BTU:

Annual Savings Based On Reduced Condensate Temperature: $13,403

ANNUAL COST OF LIVE STEAM LOSS FOR CONVENTIONAL TRAPS:

2 lb/hr per trap X 100 traps X $5/1000 lbs X 8760 hr = $8760

SUMMARY OF ANNUAL SAVINGS FOR EXAMPLE SYSTEM

	HAT	CONVENTIONAL TRAPS
SAVINGS OF LIVE STEAM LOSS	$ 8,760	$0
SAVINGS FROM SENSIBLE HEAT	$ 13,403	$0
TOTAL SAVINGS:	**$ 22,163**	**$0**
SAVINGS PER TRAP	**$ 222**	**$0**

CONCLUSION: A typical steam tracer system using **THERM-OMEGA-TECH's *HAT*** valves can save at least $222 per valve each year.

Based on an average cost of $138 each for the **THERM-OMEGA-TECH** valve and neglecting installation labor, the savings will provide a simplified return on investment (R.O.I.) of 230%:

R.O.I. = $222/$138 = 1.6 or 160% or Payback = 7.5 months

STEAM TRACING BASICS*

Heat tracing is used for liquid-containing pipelines to prevent the liquids from freezing or becoming too viscous. With pipelines containing gases, heat tracing prevents gas components from condensing.
Heat tracing will normally be required when:

- The lowest ambient site temperature will be below the freezing point of the liquid carried in the pipes. An exception must be made for underground water-pipes installed below the ground frost level. *Examples of liquid lines requiring heat tracing are: phosphoric acid, molten sulfur, glacial acetic acid, benzoic acid, cresol, naphthalene, phthalic anhydride, sorbitol, p-xlene, and water*.

- The liquid becomes highly viscous at ambient temperatures. *Examples are: certain crude oils, fuel oils, polymeric materials, waxes, bitumen and tar residues, and caustic soda liquor.*

- The gas carried in the line has a dewpoint above the ambient temperature and, condensation of liquid from the gas is undesirable. *Examples are: fuel gas in oil refineries where the liquid causes trouble in the gas burners; natural gas containing moisture that may cause freezeup of control valves or even the whole system; compressor suction lines (liquid is harmful to compressors); and H_2S/water vapor (causes corrosion on condensation.)*

In winterizing practice, water lines are insulated in an effort to avoid tracing. However, there is always a heat loss from insulated lines. If the liquid cooling resulting from this heat loss cannot be tolerated, heat tracing will be necessary.

If there is no heat tracing, the line may have to be disassembled, with associated high costs and long shutdown times.

The length of a traced line is quite variable. It may be a few feet in a process area, a few thousand feet between offices and the process area, or over a hundred miles as in the case of underground lines carrying crude oil or fuel oil.

Still, steam tracing is commonly used because there is a surplus of low-pressure steam available in most plants.

Since steam has a high latent heat, only a small quantity is required for a given heating load. Also, steam has a high film heat-transfer-coefficient, condenses at constant temperature, and flows to the point of use without pumps.

The simplest method of external tracing is to wrap copper tubing around valves, pipe fittings and instruments. This procedure is unsuitable for horizontal runs because steam condensate collects at low points and may freeze during a shutdown. **THERM-OMEGA-TECH, INC**., as well as most engineers, recommend that horizontal runs be traced by strapping a single run of copper tubing to the bare underside of the pipeline. There are different means of insulating and increasing the thermal efficiency of the tracer.

It is essential to ensure that the tracer lines are self-draining.

The length of a single tracer tube (from steam supply valve to steam trap) is limited by the pressure drop in the tracer. The trap should have a condensate drainage capacity to match the heating load. At a steam pressure of 100 psig or higher, the length of a single tracer should not exceed 150 ft. If the steam pressure is lower, a tracer length of 100 ft. is recommended.

* excerpts from an article by I.P. Kohli, M.Sc.

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 days x 24 hours = 5,088 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 pounds per hour x 5,088 hours x $ 8.00/thousand pounds = $20,352.00 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 pounds per hour x 2,895 hours x $ 8.00/thousand pounds = $ 11,580.00 per winter season.

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

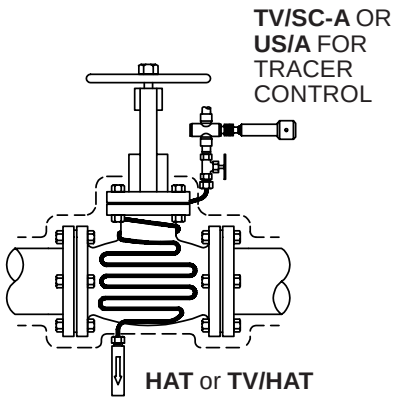
$20,352.00 less $11,580.00 = $ 8722.00 per year

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

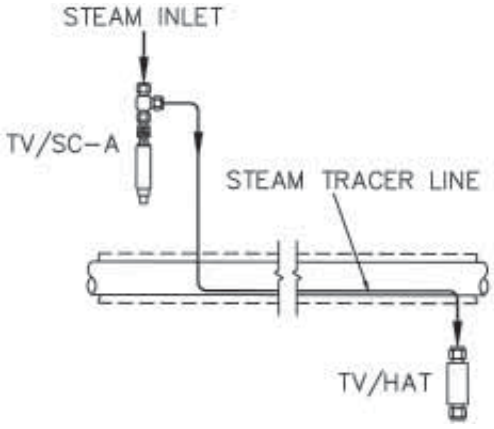
Assuming an installed cost of $ 500.00 for the THERM-OMEGA-TECH valve to control the above system, the simplified payback on investment for this application is:

$8,772.00 ÷ $ 500.00 = 17.5 R.O.I.

TRACING A CONTROL VALVE, PUMP CASE, ETC.



PROCESS LINE TRACING



Estimated Savings Per Tracer

Location	Number of Months Annually That Air Temperature Can Fall To 32°F or Lower (1)	Normal Hours Below 45°F (2)	% Of Steam Saved During Months Freeze Can Occur (3)	Dollars Saved Annually, With Tracers On During Months Freezing Can Occur (4)				Dollars Saved Annually, With Tracer On 12 Months (5)			
				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 to save energy in your applications

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.

Steam Applications: **HAT** 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. Typical set points range from 55°F to 240°F (13°C to 116°C).

Cooling Applications**: HAT/RA** valves are perfectly suited for controlling cooling water or other cooling medium flow in response to fluid temperature. For most common cooling control applications, the valves are available with a "control leakage" leak port to allow the valve to sense changing upstream temperature. Since they open on rising temperature, the HAT/RA can also be used for a variety of other thermal relief applications.

TV/HAT: ***(Tube Valve/Heat Actuated Trap)*** These valves save space and are easy and inexpensive to install. 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. For other heat transfer fluids, **TV/HAT** valves maintain a constant discharge temperature, thus providing benefits of accurate process temperature control and improved efficiency.
These 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. **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).

US/A: ***(Ambient Temperature Control)*** There are many uses for these compact, self-contained, automatic control valves. Ambient sensing valves can be used to turn on steam, air, gas or liquids compatible with teflon and stainless steel, in response to temperature change. The **1½"** and **2" US/A** valves are perfectly suited for controlling flow to steam headers supplying winterization tracing or other tracing that can be controlled based on ambient temperature. They are also suitable for controlling steam flow to unit heaters up to the maximum flow capacity of the valve. They are also ideal for controlling steam heated drum heater enclosures, plate or panel coil clad tanks, and ambient sensing water line freeze protection.

TV/SC-I: ***(Instrument Enclosure or Analyzer Housing Temperature Controller)*** The ***TV/SC-I*** assures extremely accurate temperature control in an instrument or analyzer enclosure. This self-contained unit provides a reliable, economical alternative to costly hazardous electric heating. The compact thermostatic control valve senses enclosure temperature and automatically regulates the flow of steam to maintain the desired temperature.

The ***TV/SC-I*** comes complete with a weather-tight bulkhead fitting for the valve body; optional bulkhead fittings for 3/8" tubing connections are available. Also available is a short configuration for installations with the valve and all connections completely within the enclosure *(see **TV/SC-A** and **ITCH** product fact sheets)*. These economical valves are available with set points from 40°F to 210°F (4.4°C to 98.9°C) and available with single outlet 3/8" or 1/2" tube compression fittings.

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; the ***TV/SC-AR*** opens on rising 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 *(see **TV/SC-I** and **ITCH** product fact sheets).*

For a copy of specific product data sheets please visit our website at www.thermomegatech.com

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

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