



Instrument Temperature Control



The Most Advanced, Reliable and Compact Self Contained
Valves Available for Temperature Control, Freeze Protection,
Steam Tracing and Conservation of Energy

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Instrument Performance Problems?

It could be the temperature inside your enclosure.

Instrument enclosures are commonly used to protect instrumentation against adverse weather conditions or physical damage and to ensure that the instrument operates at the proper temperature range. However, enclosures may not always provide sufficient protection against the temperature extremes that can affect instrument performance. Temperatures that are too high, for example, can cause some fluids to vaporize. And temperatures that are too low can cause some lines to freeze, or some products to thicken - even damaging sensitive equipment.

For many instruments, the correct temperature of the instrument and sample will affect measurement accuracy.

The best way to solve this problem is to equip enclosures with systems that are designed to maintain interior temperature within the range specified for optimal instrument performance.

Keeping the Enclosure Warm

Steam vs. Electricity

The most common systems used to keep enclosure temperatures warm involve either steam or electricity - essentially using an outside heat source to keep the equipment in the enclosure at a pre-determined temperature.

Electrical heating can take several forms. Typically, a radiant heater or heating cable is installed inside the enclosure. A thermostat is used to control temperature or the cable may be self-limiting.

However, electrical heating is not without problems. In large installations, the electricity required can be a substantial expense. If combustible substances are present, there is also the risk posed by electrical sparks. And if the cable breaks, there could be even more trouble, since everything beyond the break would be subject to freezing.

In steam systems, small diameter copper or stainless tubing is dressed around the inside of the enclosure, or a coil or finned-tubed heating element is installed within the enclosure. Steam, hot water, a heat transfer fluid, or even hot condensate is circulated through the tubing or heater, providing the source of heat needed to protect the instrumentation. Steam systems can provide excellent protection, but can also result in the instrumentation overheating, if not properly controlled.

This can be avoided with systems that use self-contained, temperature-actuated valves to automatically control the internal temperature of the enclosure. The most common installations consists of the following:

- **A steam trap valve at the enclosure entrance:** This bleeds off any condensate that can form in the supply line, thereby keeping the line warm and ready to supply instant heat when the temperature control valve calls for it. It can also keep the steam supply line from freezing in cold weather when the steam to the box is turned off.
- **A temperature control valve:** This valve is designed to allow steam into the enclosure, should the temperature fall below a specified level. It's a self-actuated valve containing a temperature-sensitive material that contracts when temperatures fall to a certain level, allowing the valve to open and steam to enter. As the temperature in the enclosure approaches the upper limit, the thermal material expands and closes the valve. In this way, the valve acts as a silent sentinel to ensure that the desired temperature within the enclosure is maintained.
- **A steam trap valve at the enclosure exit:** This drains condensate from the heater coil and provides back pressure in the heater.

Selecting the proper steam tracing system

Successful steam systems require valves of high durability and construction. Brass or stainless steel elements are highly desirable to prevent the corrosion that can interfere with operation and shorten valve life. In addition, valves should have good dirt-handling capability. It also makes sense to select a valve from a company that produces its own actuators, instead of a company that uses generic actuators produced by another supplier. This way you can be sure that quality has been controlled from start to finish. These actuators are specifically designed to give optimum performance for each application, and can even be produced to meet specific requirements.



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

Keeping the Enclosure Cool

Proper instrumentation performance also requires keeping the enclosure from getting too hot, whether the heat is generated by the equipment itself or by the process materials that are flowing through it. This is a significant problem when the temperature inside needs to be lower than the temperature outside. External heat sources, such as nearby hot process equipment or solar radiation, must also be taken into account.

There are several design options that can keep enclosure interiors cool. One of the most common is mechanical refrigeration, or air conditioning. However, this can be particularly expensive, especially in plant areas requiring stringent electrical classifications, such as explosion-proof design.

Fluids, such as cooling water or glycol, can also be used for enclosure cooling. But the circulating system needed to support this can also pose problems. You'll need to install and maintain recirculation loops, pumps, and cooling systems. And you'll need to take steps to prevent these from freezing up during operation.

One of the most interesting and practical enclosure cooling methods is compressed air. Commonly found in most industrial plants, compressed air has two distinct advantages: it needs no pumps to be delivered to the enclosure, and it can eliminate the problem of freeze-ups, if the air is kept dry.

You can reduce the temperature of compressed air to well below its delivery temperature - even as low as -50°F - by using a vortex device. Vortex devices have no moving parts and require no power or signal connections. The compressed air is simply routed through the device, which then produces a substantial temperature drop in the outlet air that's directed into the enclosure. As the cold air is being generated, a percentage of the inlet air is heated at the same time and must be discharged from the enclosure. These two air streams are respectively referred to as the "cold fraction" and the "hot fraction." To maintain the cold air output, it is necessary to discharge some of the inlet air as the hot fraction.

If the air and equipment temperature inside the enclosure needs to be higher than the coldest air temperature coming out of the vortex, a thermostat may be required. Of course, various types of conventional thermostatic switches can be used to turn a solenoid valve on and off, as needed. However, these require electrical power to the enclosure and can increase costs if the code classifications require an explosion-proof design.

You can also control airflow to the vortex by using a self-operated temperature-actuated valve. Such a valve requires no power or signal connections, making it an excellent match to the vortex device. What's more, the valve can also provide accurate control without the cost associated with electrical components. This control valve, together with a vortex device, provides a completely self-powered temperature control system that requires only the availability of compressed air at the enclosure.

The importance of temperature control can not be overstated. Without it, the overall performance of the instrumentation within the enclosure may be in jeopardy. The key, then, is to install an enclosure heating and cooling system that meets your cost and performance requirements.

Therm-Omega-Tech recommends these valves for your instrument temperature controlling 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-RA** 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.

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



The **Enclosure Air Conditioning System** will keep process equipment from overheating and going out of calibration or worse yet, going out of service. This self-contained unit provides a reliable, economic alternative to costly, hazardous electric cooling such as muffin fans or air conditioning systems. It does not require a special NEMA-7 or -9 enclosure even in potentially explosive environments. Combined with the optional control valve, enclosure temperatures can be maintained for pennies a day.

The Enclosure Air Conditioning System

is connected to a typical plant air supply. The vortex device cools the air entering the enclosure, venting the warmer air into the atmosphere. The combination of the vortex cooler and the optional control valve maintains the temperature in the enclosure within a preset range.



HST (High Sample Temperature safety shutoff)

The HST valve is used to sense the sample temperature after the sample cooler. The sample passes through this normally open valve whenever the sample temperature is below the valve setpoint. If the sample temperature exceeds the valve setpoint, the **HST** valve closes to protect expensive and delicate analyzers and other instruments from overtemperature damage. When the **HST** cools about 10°F below the setpoint, it will reset open again. Low flow or total loss of sample cooling water or unusually high inlet sample temperatures into the sample cooler are typical reasons why this self-operating protective device should be considered.



The standard **HST** valve body has 1/2" NPT female threaded ends and is rated for 3000 psig @ 600°F. The **HST**'s internal valve mechanism (valve engine) is rated up to 3000 psig and 150°F above the specified shutoff temperature. Therm-Omega-Tech offers many setpoints for the **HST**.

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 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. **TV/SC-A** may also be used to control instrument enclosure temperatures (see **TV/SC-I** and **ITCH** product fact sheets).

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.



At the designated control point, a thermostatic element located at one end of the **TV/SC-I** (inside the enclosure) regulates the steam supply to the heater to accurately maintain the desired temperature, operating like the thermostat in an oven. Heat radiating from the steam coil heater reaches the actuator causing it to quickly shut off the steam supply when the desired temperature is reached, regardless of outside ambient. In cooling applications, the **TV/SC-IR** opens on rising temperature to regulate the flow of cooling media to the enclosure.

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-IA** 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 3/8" and 1/2" tube compression fittings, single or double outlets.

ITCH Assembly: (Instrument Temperature Control Heater) assures accurate



temperature control in an instrument enclosure. The assembly comes complete with steam coil, mounting bracket and **TV/SC-A** valve assembly, two **TV/HAT** valves and two weather-tight bulkhead fittings for 3/8" or 1/2" tubing connection. The compact thermostatic control valve senses enclosure temperature and automatically regulates the flow of steam to the coil to maintain the desired temperature. In applications where the enclosure needs to be cooled, a reverse-acting **ITCH/RA** can be used to regulate the flow of glycol, water or other cooling media.

ITCH Assemblies will maintain enclosure temperature

accurately over a wide range of ambient temperatures with steam supply pressures from 15 psig to 200 psig (1.0 to 13.8 BAR) without danger of overheating delicate instruments. No special NEMA-7 or -9 housings are required even in potentially explosive environments. Enclosure temperatures can be maintained within 2°F (1.1°C) for pennies a day.

Therm-Omega-Tech, Inc. is an Industry Expert and Leading Manufacturer of Custom Thermostatic Valves, Actuators and Controls serving domestic and international markets for over 25 years.



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