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Instrument Performance Problems?

It could be the temperature inside your enclosure.

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Temperature-controlled enclosures are used to stabilize instrumentation accuracy in out-of-doors process environments such as this refinery. Photo courtesy: Opto 22/Flying J

Are your enclosed instruments under the weather? It might be time to check the temperature inside the enclosure.

Enclosures protect instrumentation against adverse weather conditions or physical damage, and ensure that instruments operate in the proper temperature ranges. However, enclosures may not always provide sufficient protection against temperature extremes that can affect instrument performance. High temperatures can cause some fluids to vaporize, while low temperatures 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 designed to maintain interior temperature within the range specified for optimal instrument performance.

Keeping warm

The most common systems used to keep enclosures warm involve steam or electricity-essentially using an outside heat source to keep equipment in the enclosure at a predetermined 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 has limits. In large installations, the electricity required can be expensive. If combustible substances are present, the possibility of electrical sparks poses risk. And, if the cable breaks, everything beyond the break could freeze.

In steam systems, small diameter copper or stainless steel 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 warmth needed to protect instrumentation. Steam systems can provide excellent protection, but they can also overheat if not properly controlled.

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

- A steam trap valve at the enclosure entrance 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.
- Temperature control valve allows 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.

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KEY WORDS

- Process control and instrumentation
- Enclosure
- Heating/cooling
- Steam tracing
- Instrument performance

- Steam trap valve at the enclosure exit drains condensate from the heater coil and provides back pressure in the heater.

Selecting steam tracing

Successful steam systems require highly durable valves. Brass or stainless steel elements prevent corrosion that can interfere with operation and shorten valve life. In addition, valves should have good "dirt handling" capability.

Selecting a valve from a company that produces its own actuators can provide more consistent quality and performance for the life of the installation. Custom actuators designed for optimum performance can be produced to meet specific installation requirements.

Keeping cool

Proper instrumentation performance also requires keeping enclosures from getting too hot, due to equipment operation, process materials, or surrounding environment. 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 considered.

Several design options can keep enclosure interiors cool. One of the most common is mechanical refrigeration, or air conditioning. While these systems can provide accurate temperature control, they can be expensive to install, maintain, and operate. They can be particularly expensive in plant areas requiring stringent electrical classifications, such as explosion-proof design.

Recirculating fluids, such as cooling water or glycol, can also be effective in enclosure cooling. However, as with refrigeration, these systems often require installation of many mechanical components, including recirculation loops, pumps, and heat exchangers. Maintenance of these systems can be high, including periodic checks for overall system function, coolant level, and specific gravity.

Into thin air

Another option for enclosure cooling is compressed air, which has several advantages as a cooling medium. Facilities with a compressed air system need no pump(s) for delivery to the enclosure and can eliminate the problem of system freeze-ups, if the air is kept dry. Temperature of compressed air can be reduced to well below its delivery temperature, even as low as -50°F, if need be, using equipment such as a vortex device.

Vortex devices have no moving parts and require no power or signal connections. Compressed air is routed through the device, which then produces the temperature drop in the outlet air directed into the enclosure. As cold air is generated, a percentage of the inlet air is heated and must be discharged from the enclosure to maintain cold air output. These two air streams are called the "cold fraction" and the "hot fraction," respectively.

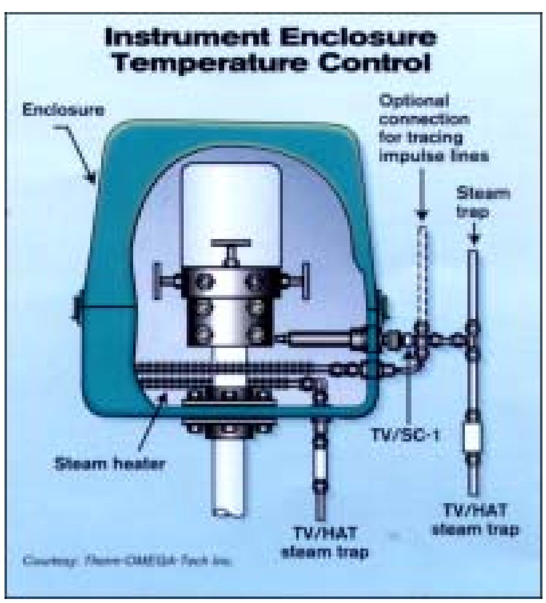
If the equipment inside the enclosure needs to be warmer than the coldest air temperature coming out of the vortex, a conventional thermostat can turn a solenoid valve on and off, as needed. In this case, however, electrical power would be required, which increases installed cost, especially in applications where code classifications require explosion-proof design.

Airflow to the vortex device can also be controlled by use of a self-operated, temperature-actuated valve. Requiring no power or signal connections, this type of valve and a vortex device provide a self-powered, accurate, compressed air temperature control system.

One cannot overstate the importance of temperature control. Without it, the overall performance of instrumentation within an enclosure may be in jeopardy. The key is to install enclosure heating and/or cooling system as needed to safeguard the required performance and meet project cost objectives. □

An enclosure is shown with Therm-Omega-Tech's instrumentation thermostatically controlled heater (the flat coil) and TW/SC-A sensing valve (the black object above the coil). This steam-powered assembly keeps the enclosure's internal temperature within ±2° of the desired control point. A similar setup can be used with glycol, water, or other cooling media in hot environments. Diagram of a typical instrumentation thermostatically controlled heater assembly shows external connections.

"The importance of temperature control cannot be overstated".



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