Freeze Protecting Your Power Generation Assets

By: Jeff Daiber – Vogt Power International
Al Hughes – O'Brien Corporation

Do your power generating assets have adequate freeze protection? Will this winter be more severe than last? Can your simple or combined cycle power plants (CCPP) afford a trip instrument lines freezing? When coupled with high gas prices, increasing competition, and a colder than expected winter, the last thing you need is a heat tracing system that doesn't work when you need it. Thus we recommend having your system designed and installed by those that understand the processes and applications of the equipment you need to protect. Each system and component is integrated and completely dependent on the other. The best designed system if not properly installed, operationally checked, and insulated will fail.

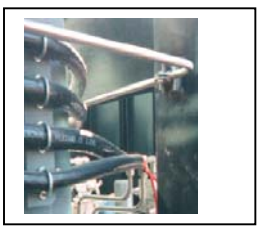
The ***number one cause*** of frozen instruments and/or impulse lines is they were over-looked during the construction phase or improperly heat traced. Once the ambient temperature drops to the freezing point of 32 deg. F, it can take as little as 25 minutes for the condensate in an impulse line to freeze resulting in a plant trip or worse. The freezing of condensate in the impulse lines or diaphragm area of a transmitter will cause false readings and will prevent the system from starting or operating. Additional causes for failure include; poor implementation, insufficient amperage, incorrect installation and insulation of the tracing itself. It is estimated that 60% of the systems currently installed are not working as designed.

Issues we have found are:

1. **Impulse lines were simply not heat traced**

2. **Failed Tracers**- Many applications of failed tracers have been determined to be the result of exposure of the tracer to the high temperature of the process lines. The self-regulating heater cables used today are usually rated for exposure to 420 deg. F intermittently, for a total of 1,000 hours. If the tracers are exposed to a higher temperature, the Teflon jacketing materials can melt and a short could result between the buss wires of the cable. This melting of the jacketing materials often occurs during the summer months, when plant operators are blowing down the impulse lines, calibrating the instruments and the ambient temperatures are at their highest. Anytime self-regulating heater cables are used on lines that are exposed to temperatures above 250 deg. F, they must be buffered or protected from the process temperature. <u>This is an engineering process</u>, not a field installation process.

   Pre-insulated tubing bundle manufacturers have been able to determine the exact thickness and quantity of insulation and wattage of various tracers required to provide freeze protection for the impulse lines that can see temperatures up to 1,200 deg. F. These engineered tubing bundles can prevent the tracers from being damaged at any ambient temperature. The pre-insulated bundles will also provide freeze protection on the coldest ambient days. Again these are engineered applications, and not a field traced and then insulated application.

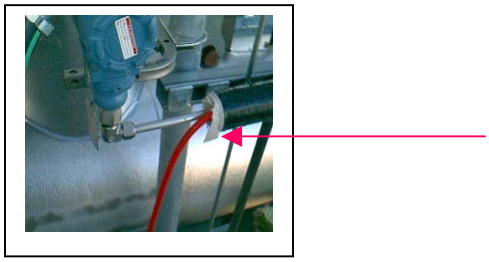


3. **Tightening/Clamping**
   Over tightening or the improper clamping of the tubing bundle to its supports can cause the insulation to be compressed and allow the process heat to reach the tracer.

4. **High Temperature Tubing Bundles / Bend Radius**
   Tubing bundles used for process temperatures of 1,200 deg. F often require a bend radius of 14" to 48", depending on manufacturer. Care must be made not to exceed the manufacturers minimum bend radius. If the radius is made too tight, the insulation is compressed locally and may cause failure or the tracer may be shifted from it's designed location and not be able to provide adequate heat. If the bend radius is exceeded, especially on the larger diameter tubing bundles, the tubing inside the bundle may wander, allowing for a wide variance of heat transfer and eventual failure.

INSIDE RADIUS TOO TIGHT

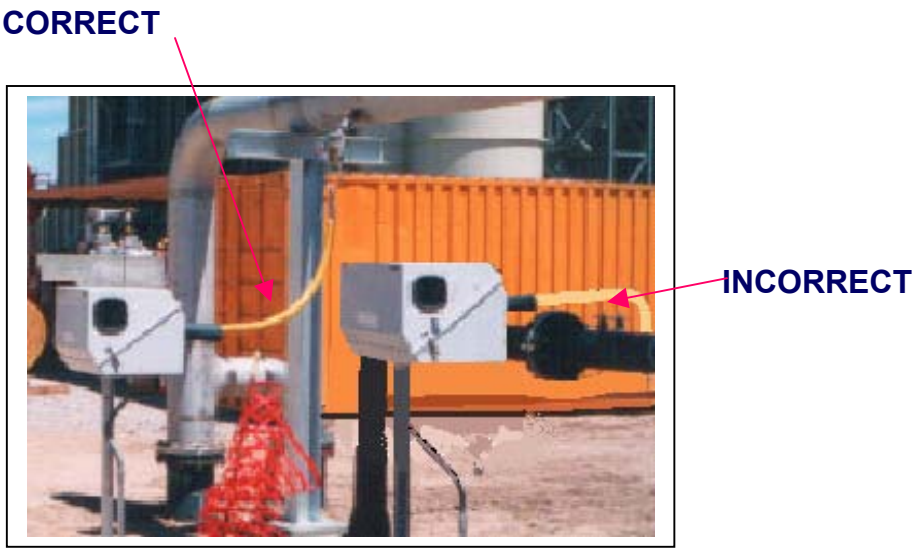
5. **Small-bore Pipe, Tube and Valves**
   Small-bore piping, tubing, and valves are often field heat traced and insulated incorrectly. These applications are particularly prone to freezing and present a problem for installers. The typical method of laying on insulating tape, applying an electric heater cable and then adding more insulation tape and sealing with mastic does not provide adequate protection. Only someone who understands the equipment, the installation methodology and its limitations will be able to instruct others how to correctly install said equipment; anything else will result in a trial & error approach that can leave your plant's freeze protection questionable.



EXPOSED PIPING

6. **Improper Sloping of Lines and Root Valves**
   Slope the lines and the root valves so they are self-draining during a shut down period. If the valves are not self-draining, then Mineral Insulated (MI) tracing can

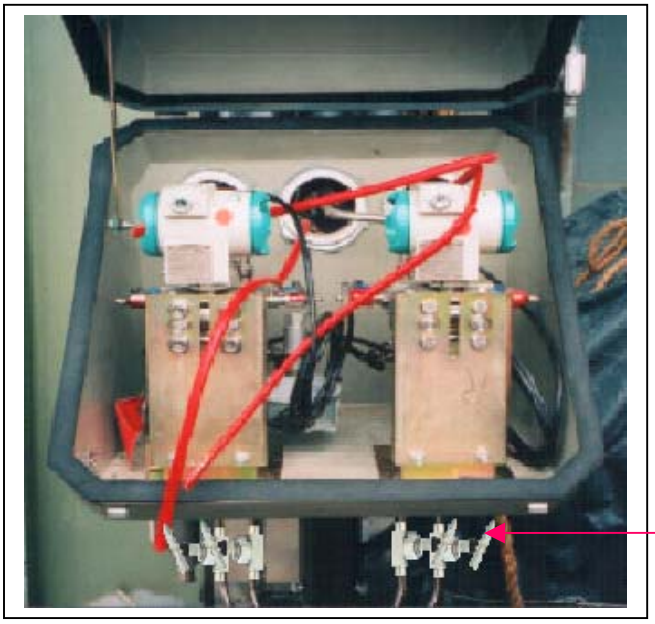
be applied for most applications. MI tracing can withstand continuous temperatures of 1,100 deg. F without degradation. A limitation for the use of MI cables is that the cable must be factory finished to a specific length prior to installation. Using MI cable requires the fitters to install the tubing, electricians to put on the tracers, and insulators to finish the process, often without proper engineering guidance. This is yet another reason to purchase a "engineered system solution".



7. **Instrument enclosures**

   Albeit expensive, quality enclosures are essential for reliable long term freeze protection. There are two primary types of instrument enclosures used today. Flexible covers that protect only the wetted parts of the instrument and the rigid type enclosure that covers the entire instrument and the associated fittings. The latter method is the best and they can be customized.

   Rigid, heated, enclosures that enclose the entire instrument are the best method of ensuring instrument freeze protection. These instrument enclosures cannot be arbitrarily removed and they provide the maximum instrument protection and provide freeze protection regardless of the ambient conditions.



Un-insulated VALVES

As the picture above illustrates, all exposed tubing and valves outside an enclosure must be heat traced and insulated to avoid freezing. If the drain valves are outside the enclosure a separate high temperature heating system must be designed to protect them. It is by far cheaper, easier, and safer to enclose the blow down valves and fittings with the instrument, inside the temperature-controlled enclosure, to provide for their protection.

DUCT TAPE

8. **Inadequate Weatherproofing**
   Proper weatherproofing of the pipe insulation, mastic finishes for applied tapes, and the ends of pre-insulated tubing bundle are essential to ensure a trouble free winter season.

9. **Ownership**
   Responsibility of the freeze protection system must be a priority for everyone. Too little money is typically allocated to provide proper winterization protection or operationally checking of the system periodically. One way Vogt can assist is through annual inspections. In this manner, we can assist the Owner/Operator in assuring the existing system remains operable.

10. **Education**
    All heat tracing is not created equal. Knowledge of these systems and the options that are available can only be evaluated by trained personnel.

Winterization is not an option. As we saw this past winter, the failure of the winterization system can actually cost more (in repairs and lost revenue) than a new system properly engineered and installed. Responsible ownership, responsible design, quality products and proper installation with reputable back up engineering and technical support are the best way to secure your assets for the future.
Please contact the Vogt team for further information at www.VogtPower.com or 502-899-4515.