



Custom Instrumentation Services Corporation

2017 USERS GROUP PRESENTATION:
Heated Sample Lines

Heated Sample Lines: Replacement and Types

■ Basics of Sample Lines

- Must be able to maintain Sample Temperatures up to 350°F.
- Must accommodate multiple functions such as Sample, Cal Gas and Blowback Air transport as well as Power and Signal connections.
- Tubes may be Stainless Steel or Teflon, Polyethylene may be used for air/Backflush

Types of Lines

- **Two basic Types CISCO uses:**

- **Serial Construction**

- Suppliers include Technical Heaters or Clayborn Labs out of California

- A single Heater is wrapped closely to the sample line from the bottom to the top.

- **Parallel Heater Construction.**

- Suppliers include Thermon, Obrien, Dekoron, others.

- Pair of Buss wires extend the length of the heating cable. Parallel heaters are connected inside the heating cable every 12-24 inches.

Serial Lines

■ Serial Line Advantages

- Better and more consistent heating is possible since the heating wire is wrapped directly around the sample tube(s).
- A fault in the heater will be indicated since the entire line will be faulted. This eliminates potential for dead spots.
- Three phase power may be used. This decreases the current flow and allows for higher heating densities, up to 24 watts per foot for cold applications
- Line is dressed and ready for connection from the factory, eliminating the need for time consuming line termination/reconstruction at site.
- Can be designed to order, adding multiple tubes, power and signal wires.

Serial Lines

■ Serial Line Disadvantages

- Serial lines are not meant to be cut in the field. This is due to the fact that the sample line as a whole is designed to carry only so much power. If the line is cut, then the loss of the resistance of the cut portion will cause more current to flow through what is left, possibly causing the line to burn up.
- If a fault occurs, it may be possible to open the line and repair it, but may also necessitate the replacement of the whole line.
- Length of lines is limited to certain lengths due to factory limitations. Tech Heaters can only make them about 200 feet, Clayborn Labs a little longer. Longer lines require splitting the line electrically, making it a 2-heater parallel line.

Parallel Lines

■ Parallel Line Advantages

- Lines can be cut! Many sites consider the trim fit of the sample lines esthetically pleasing and many insist on this.
- Can be designed to order, adding multiple tubes, power and signal wires.
- Line is dressed and ready for connection from the factory, eliminating the need for time consuming line termination/reconstruction at site.
- Longer Lengths of a single circuit power feed are possible, over 300 feet.

Parallel Lines

■ Parallel Line Disadvantages

- Longer installation time since the line has to be cut back carefully, and then reterminated
- Heating element is a separate cable that can only be placed in close proximity to the sample tubes, not wrapped around the tubes.
- Field preparation/cutting must be done carefully to prevent a cold spot at the points of termination.
- Thicker diameter due to the need of more insulation.

Self Limiting versus Temp Control

■ Comparison

- Both Series and Parallel construction lines can be self limiting or Temperature Controlled.
- Self Limiting saves money since temp control components are not needed.
- Self Limiting control may result in higher temperatures, using more power and potentially overheating
- Temperature controlled lines allow for online/offline control setpoints, extending the life of the heaters by lowering the heating requirement when the cold air is pulled through the line when the process is not running.
- Having Temperature control by the PLC allows recording of the HSL temperature for historical analysis.

The Problem with all Sample Lines

■ Line Failures

- Installation of lines is critical. The line jacket must not be damaged. The line must be supported without pinching by the fasteners.
- Line must be sloping all the way down to the CEMS sample dryer.
- Line must be handled carefully and the bend radius adhered to so to prevent kinking of stainless tubes.

Teflon Versus Stainless Steel Tubes

■ CO Offgassing

- CO is created in the sample line by the burning of the insulation and other materials inside the line.
- CO Offgassing is increased as the line temperature is increased.
- CO Offgassing will permeate a Teflon Tube and contaminate the sample and calibration checks.
- Stainless Steel tubes are preferred for Gas Fired Turbines since it will not allow contamination by CO Offgassing.
- Not recommended to place the Teflon calibration tube in a sample line, even if it is outside the heated core of the line.
- Can not place a Stainless Steel Calibration tube outside of the core because it will make bending of the line impossible.
- Teflon Sample Tubes are more corrosive resistant and can be used if CO is not measured, or if the measured concentrations of CO are high.

CISCO Considerations Regarding the Choice of Line

■ Break with Tradition

- CiSCO has used Technical Heaters lines for over 32 years. Almost exclusively the entire time over hundreds of systems.
- Greater pressure from customers to have us use cuttable lines has prompted us to begin using parallel construction lines more.
- In addition, longer sample line lengths has made the parallel construction line a better choice by eliminating dual HSL Circuits in most cases.
- Technical Heaters/CiSCO suffered a period where several lines were built below our quality specifications and faulted in the field. They have corrected the issue with their Jacket extruder since.
- There is some criticism of the rigidity of the Tech Heaters Line due to a new insulation they are using.

Replacing a Sample Line? Stay the Same or Switch?

- **Stay with what works**

- Systems that use Technical Heaters lines have had lines last 10-14 years, which is as good as can be expected.
- Replacing with another Technical Heaters line means you will get a line that is easily terminated and does not require cutting and fitting the line.
- Switching to a parallel line means you might have to cut larger holes in the probe box or CEMS Bulkhead.
- Switching to a parallel line will require a check of the electrical load requirements due to a three phase versus single phase change.
- CiSCO does not install Sample Lines.

Questions?

- Thanks –

Bob Salerno

Manager of Project Engineering

Custom Instrumentation Services Corporation (CiSCO)

Englewood, CO

(303) 790-1000

bsalerno@ciscocems.com