

Sample Acquisition & Probes

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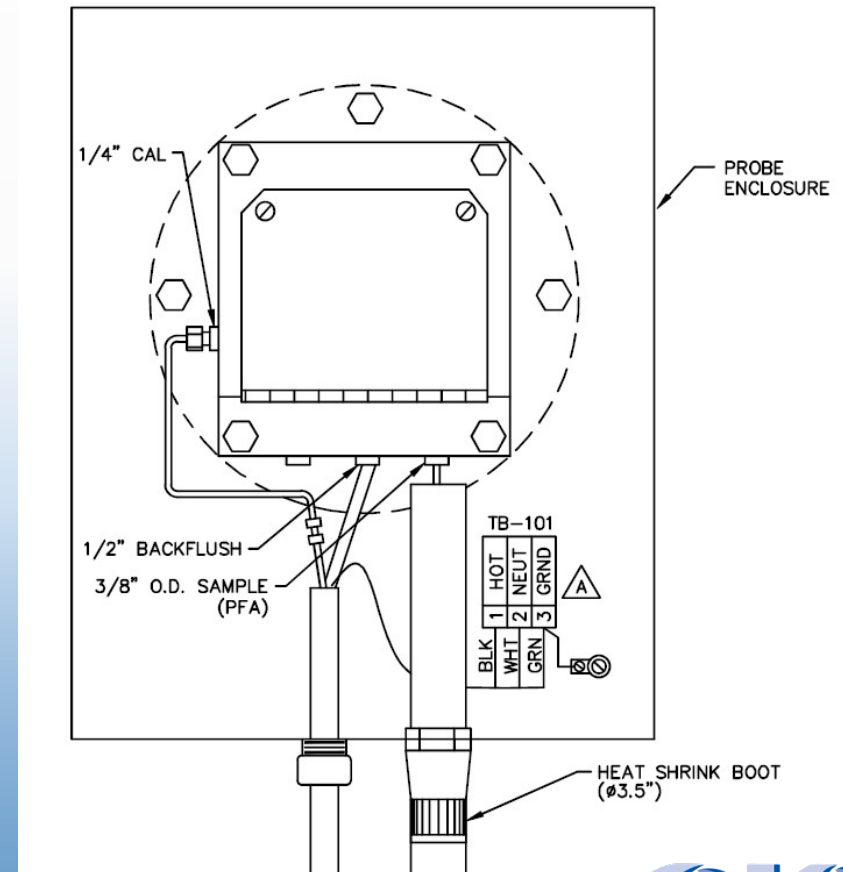
Project Engineer

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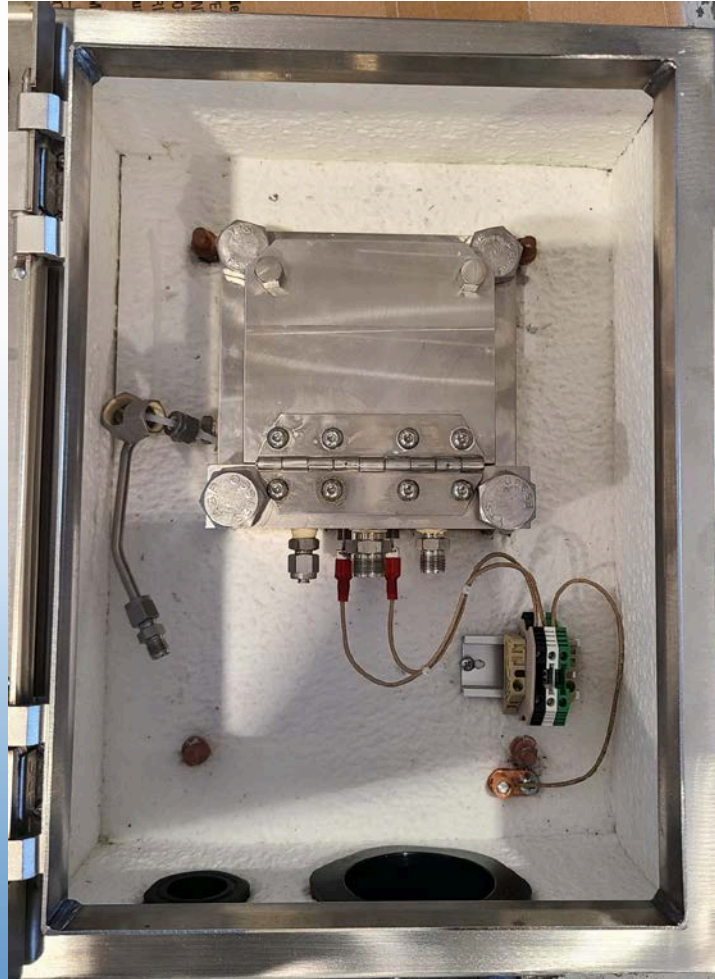


CISCO Probe – Standard Temperature

- Heated, with insulated enclosure
- Optional NH_3 converter
- Ports:
 - Sample
 - Calibration
 - Backflush
 - Spare

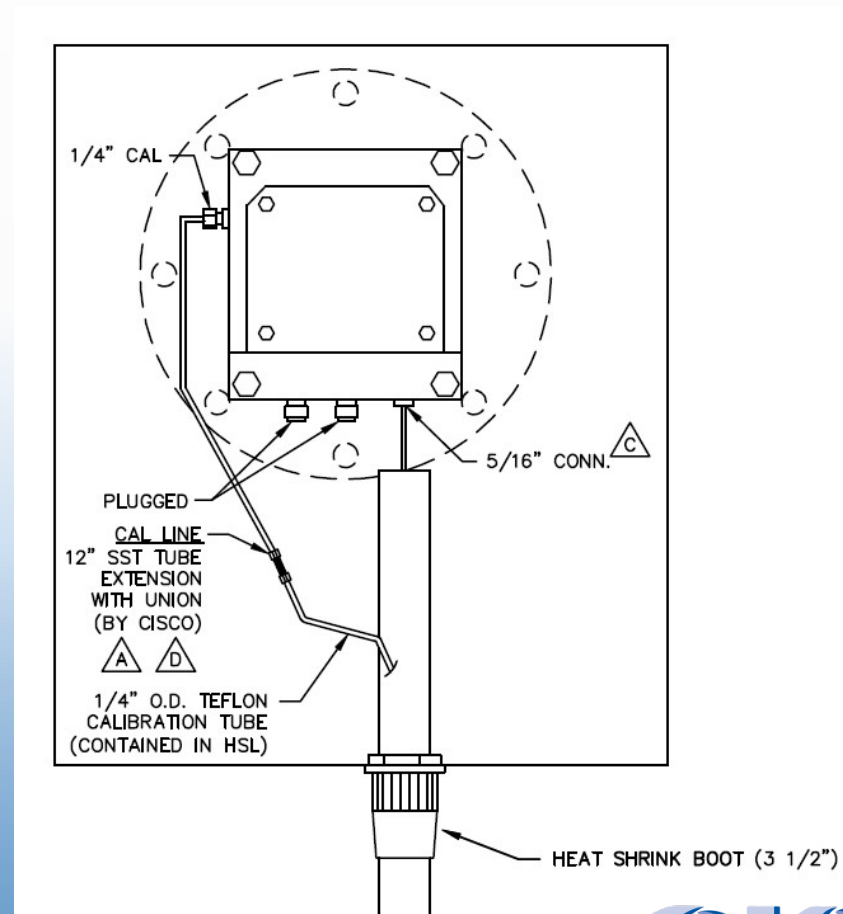


CISCO Probe – Standard Temperature



CISCO Probe – High Temperature

- Unheated
- Now enclosed
 - Protection of sample line terminations
- Ports:
 - Sample
 - Calibration
 - Backflush (plugged)
 - Spare



CISCO Probe – High Temperature



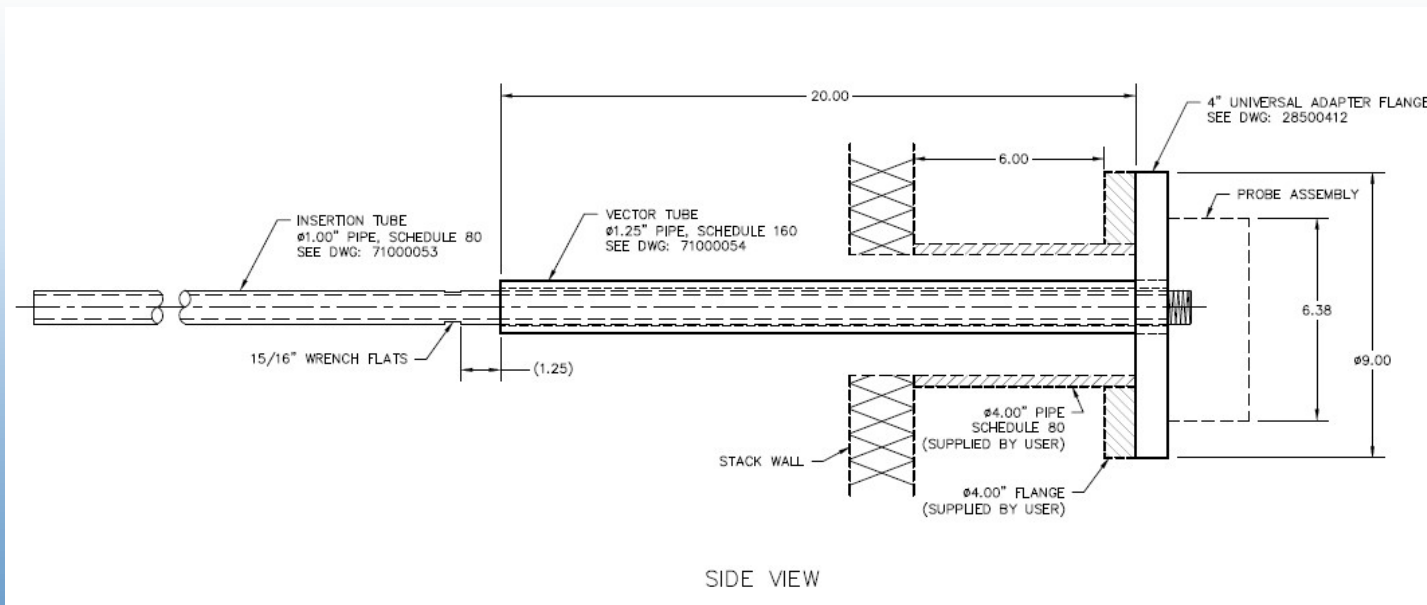
CISCO Probes – What's New?

- Calibration tube routed over the top
- 316L SS insertion tubes – no more 310 SS
 - Less expensive, better availability
- Specialty materials and coatings still available:
 - Inconel
 - C-276
 - SilcoTec

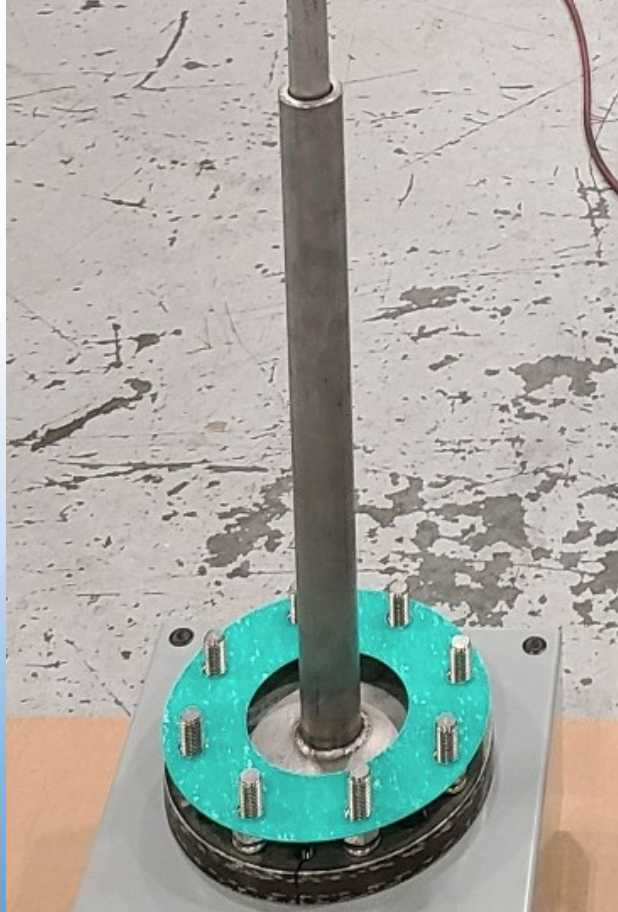


CISCO Probes – What's New?

- Welded pipe section for extra support
 - High velocity conditions
 - Long insertion tubes



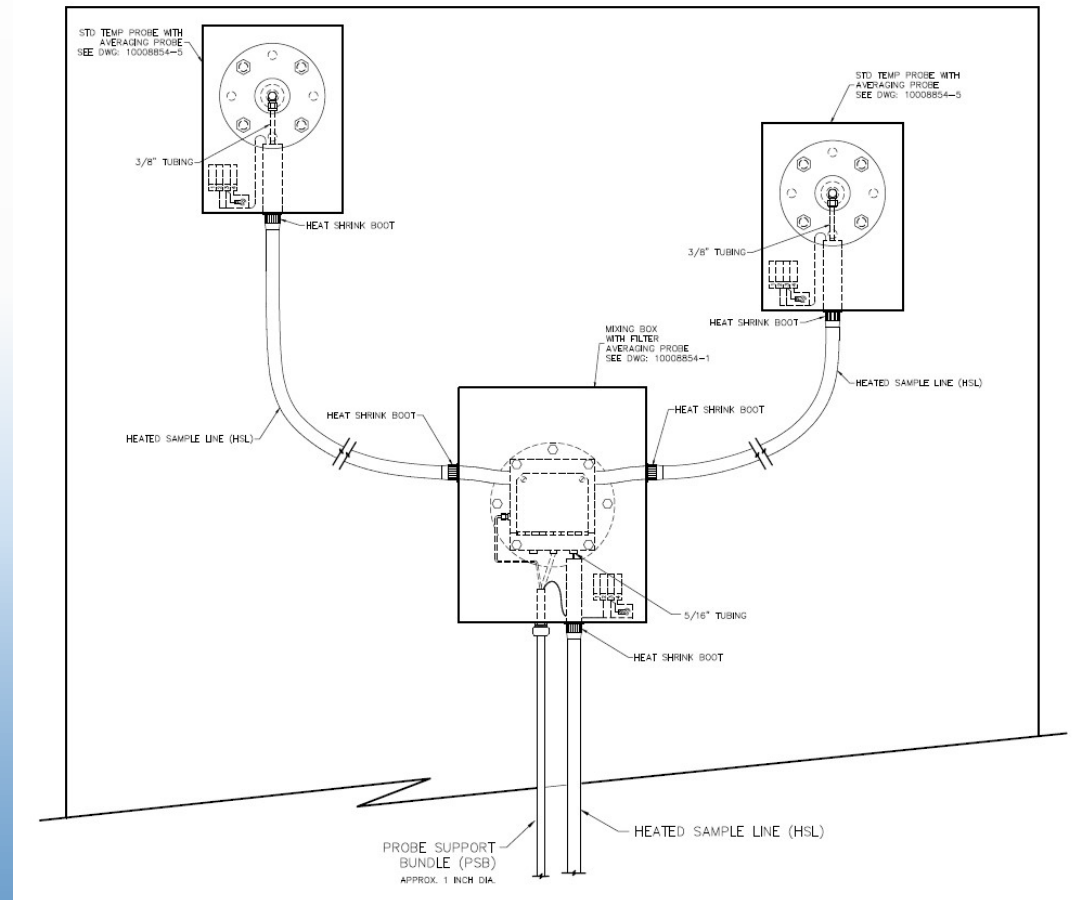
CISCO Probes – What's New?



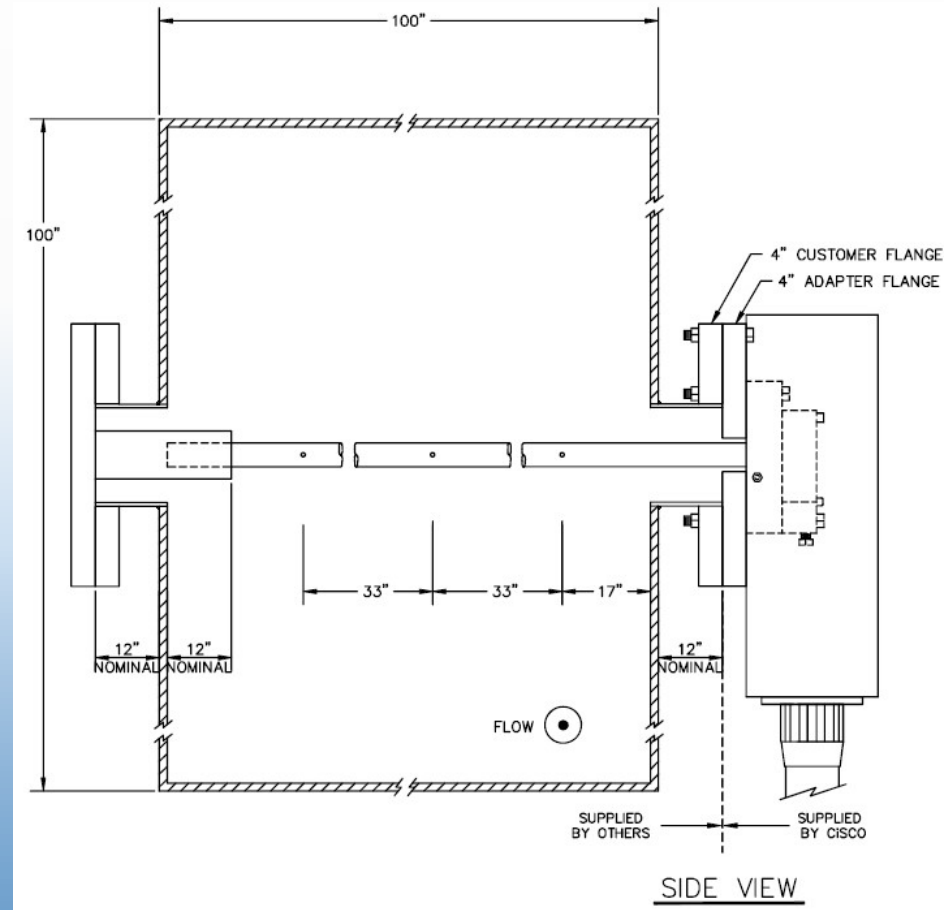
CiSCO Probes – Multi-Point Probe

- Used for capturing an average sample where stratified emission concentrations exist
- 1 or 2 cross-stack averaging probes
- Standard probe enclosure for mixing when required
- Not certified for South Coast AQMD
- Simplified design for cost control and long-term durability

CISCO Probes – Multi-Point Probe



CISCO Probes – Multi-Point Probe



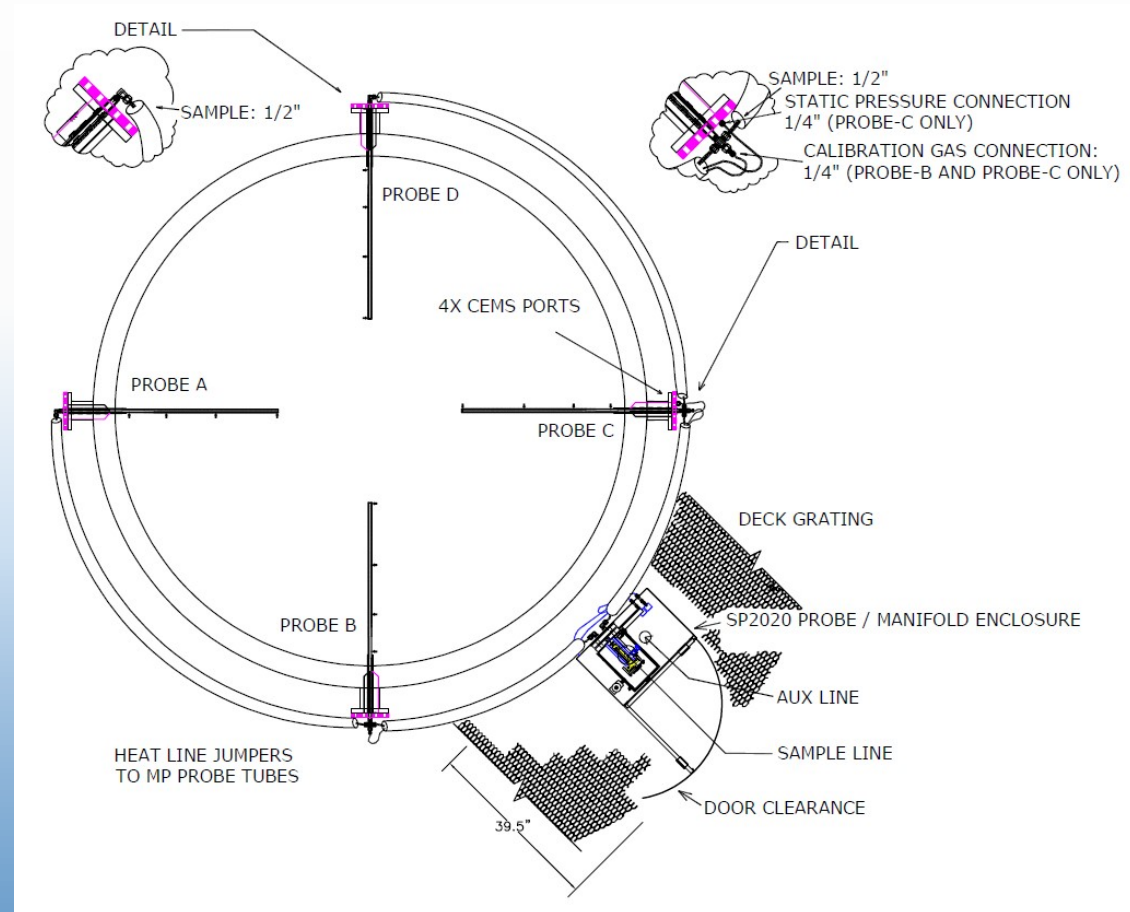
M&C Multi-Point Probe

- Certified for use in SCAQMD
- Required in this district when stratified emissions concentrations are found
- Stratification test is required during CEMS certification
 - Typically there is no time to add a multi-point probe if the test determines that stratification exists
 - Avoid risk of delays – assume stratification exists and include MP probe in the design

M&C Multi-Point Probe – Configuration

- Custom designed to fit your stack
- Round stacks
 - 16 sample points, 4 probe tubes with 4 holes each (typical) every 90° around the stack
 - Mixing box required
- Rectangular stacks
 - Grid design, number of sample points and probe tubes determined by dimensions of the stack cross-section
 - Mixing Box required

M&C Multi-Point Probe – Configuration



M&C Multi-Point Probe – Configuration



M&C Multi-Point Probe – Options

- Backflush tank at the probe or in the shelter
- Fast-loop eductor to increase flow through tubes, without increasing sample flow
 - Turned off during calibration to reduce calibration gas usage
 - Does not increase the sample cooler capacity requirements
- NH₃ converter
- Local temperature controller for mixing box enclosure
- Inconel probe tubes with silica coating (standard)

Unwanted NH₃ Conversion into NO in Sample Tubes

- $4\text{NH}_3 + 5\text{O}_2 \rightarrow 4\text{NO} + 6\text{H}_2\text{O}$
- Risk at high temperatures (>750°F)
- Catalyzed by metal – stainless steel or Inconel tubes
- Reaction rate is dependent on:
 - NH₃ slip
 - Temperature
 - Specific type of metal catalyst
 - Residence time of the sample gas in the probe tubes
- Can cause RATA failure
- Preventable with Silica coatings

CISCO HSL Design Updates

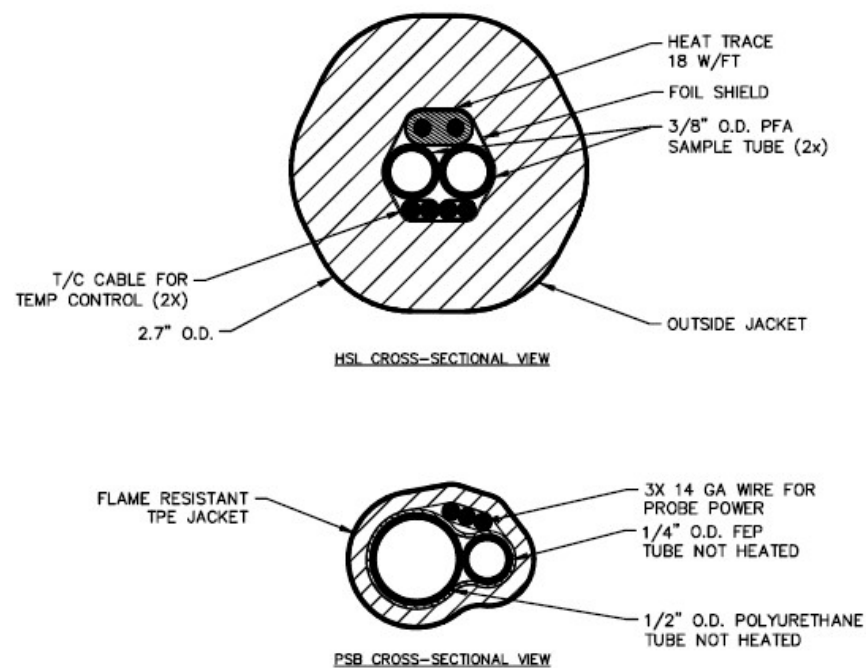
- Original design:
 - Standard temp probe needs Heated Sample Line and Probe Support Bundle
 - PSB includes calibration tube, backflush tube, and 120V power cable
 - PSB is unheated, uninsulated
 - HSL and PSB are routed together between probe and CEMS shelter
- New design:
 - HSL will include required support components in the bundle with the sample tube
 - PSB components are insulated from the heater cable

CISCO HSL Design Updates

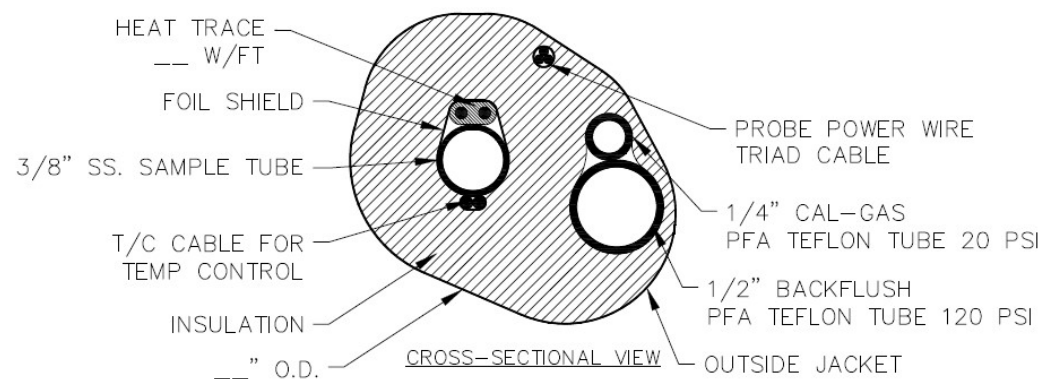
- Advantages:
 - Single bundle to route and install
 - Cheaper initial cost
 - Replacement cost goes up only if the PSB is not replaced as well, otherwise cost goes down
- Disadvantages:
 - Bundle size increases – a few rare instances where this caused problems

CISCO HSL Design Updates

Old Design



New Design



Questions and General Discussion