CiSCO USER'S GROUP

HEATED SAMPLE LINE
HEATED SAMPLE UMBILICAL
REPLACEMENT

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SEPTEMBER 2019

SAMPLE LINE REPLACEMENT

FACT

IF YOU HAVE AN EXTRACTIVE CEMS, SOONER OR LATER YOU WILL BE FACED WITH REPLACING THE HEATED SAMPLE LINE

SAMPLE LINE REPLACEMENT

A QUALITY CEMS

20 YEARS WITH PROPER MAINTENANCE AND SOME UPGRADES

SAMPLE LINE

8-10 YEARS BARRING UNFORESEEN EVENTS

SAMPLE LINE REPLACEMENT

MOST OF THE TIME

REPLACEMENT SOURCED FROM SAME SUPPLIER

HOWEVER

SOMETIMES THIS IS NOT DOABLE AND/OR IS NOT THE BEST SOLUTION

SAMPLE LINE REPLACEMENT

SO – WHAT SHOULD YOU KNOW NOW AHEAD OF TIME?

FIRST

SAMPLE LINES ARE NOT STOCKED

2 TO 6 WEEKS TO BUILD AND SHIP A REPLACEMENT LINE

SAMPLE LINE REPLACEMENT

WHY
ARE THEY NOT STOCKED?

SAMPLE LINES ARE DESIGNED & BUILT TO MEET THE SPECIFIC CEM SYSTEM & FACILITY REQUIREMENTS

SAMPLE LINE REPLACEMENT

SO… LET'S FIND OUT A LITTLE BIT ABOUT THE MANY VARIATIONS IN HEATED SAMPLE LINE DESIGNS AND WHAT MIGHT BE AN "IMPROVED" REPLACEMENT

SAMPLE LINE REPLACEMENT

THE HEATED SAMPLE LINE SERVES TWO FUNCTIONS;

1. IT TRANSPORTS SAMPLE GAS FROM THE SAMPLE PROBE TO THE CEM SYSTEM FOR ANALYSIS WITHOUT DEGRADATION OF THE GASES TO BE ANALYZED
   a. FAIRLY GENERIC BUT HAS OPTS.

SAMPLE LINE REPLACEMENT

2. AND IT SUPPORTS THE SAMPLE PROBE
   A. BECAUSE THERE ARE MANY DIFFERENT SAMPLE PROBE AND CEM SYSTEM DESIGNS – ITS DESIGN BECOMES VERY SPECIFIC

SAMPLE LINE REPLACEMENT

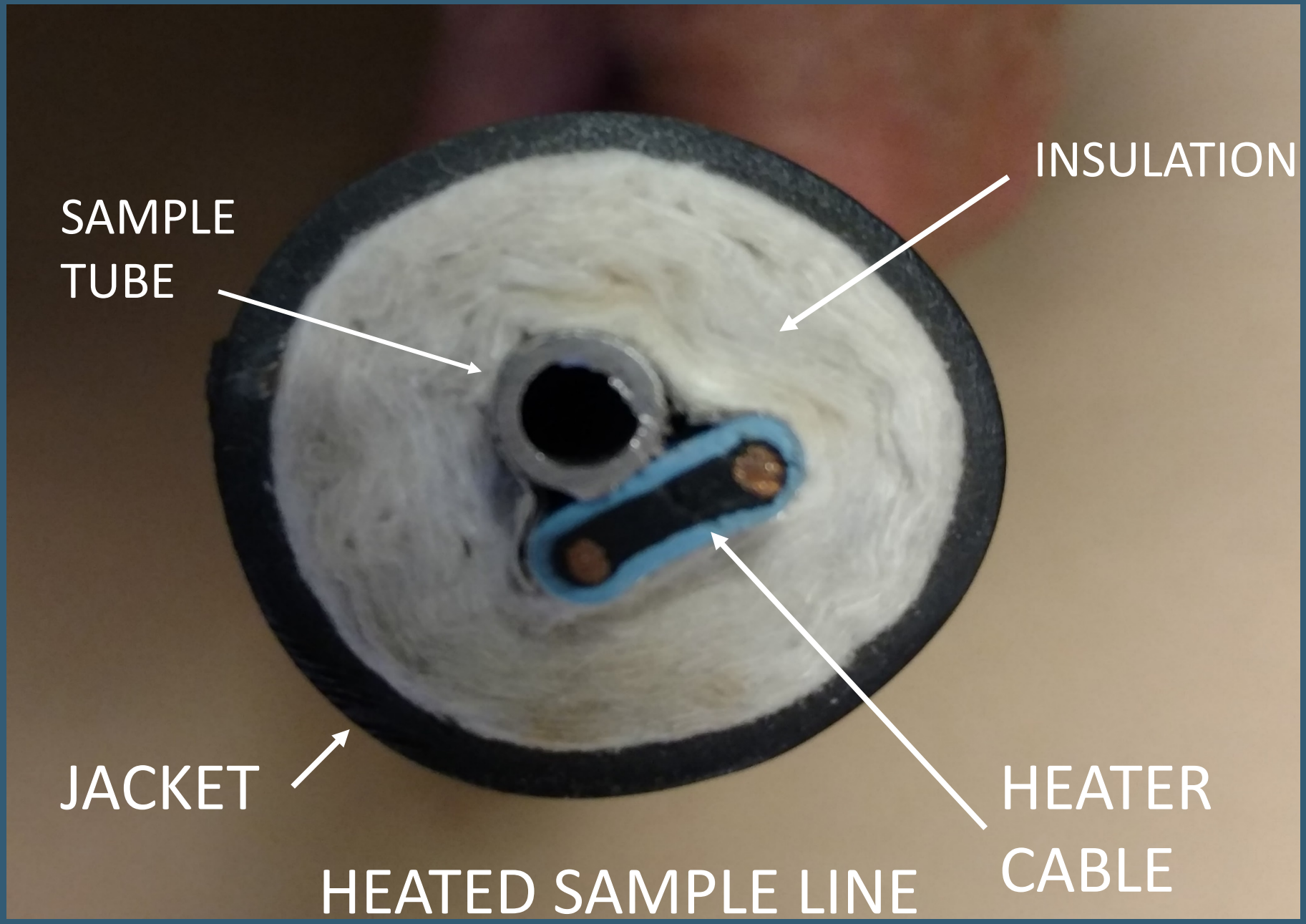
HEATED SAMPLE LINE

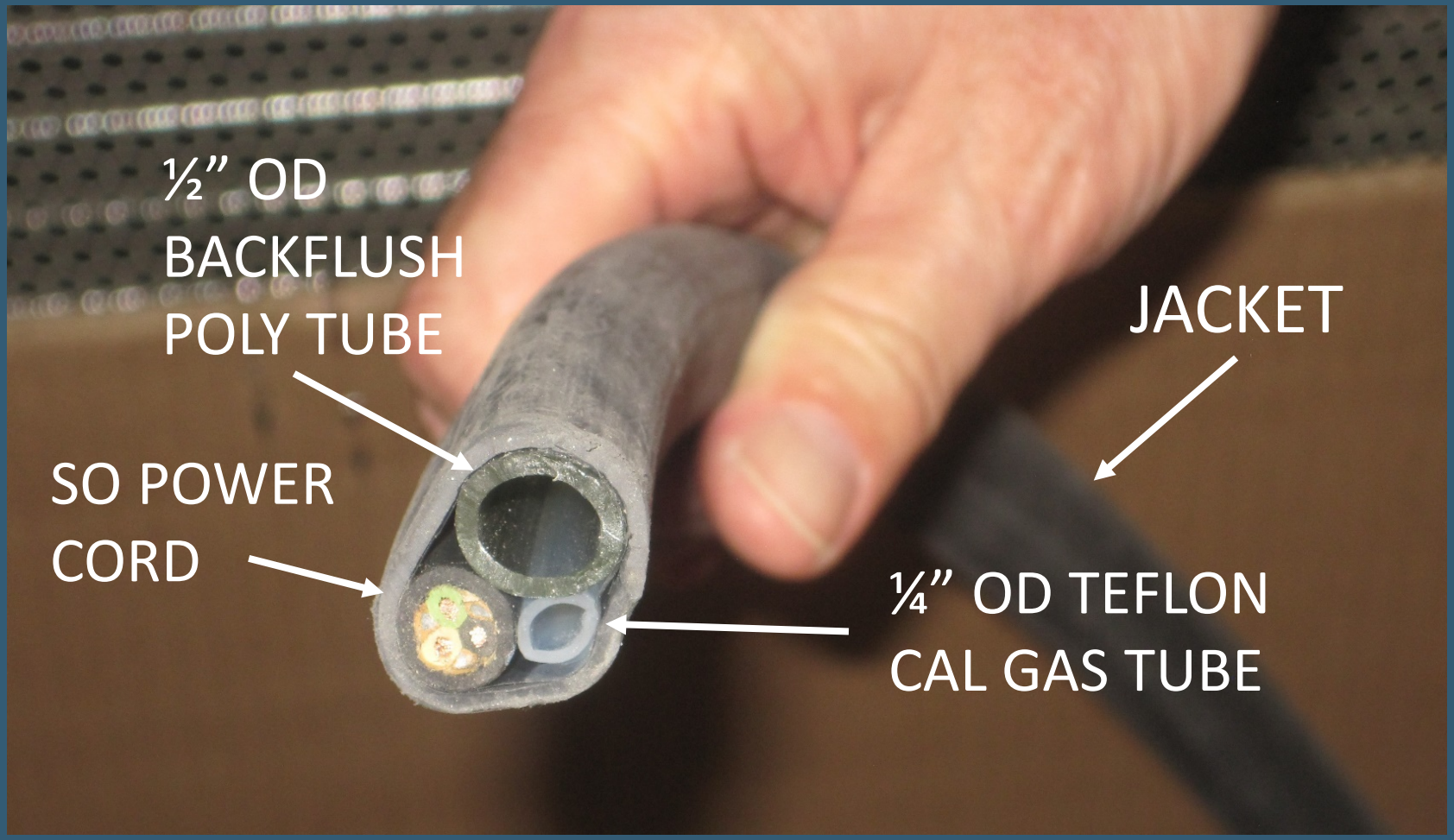
GENERIC CATCH ALL PHRASE

TWO FUNDAMENTALLY DIFFERENT DESIGN PHILOSOPHIES

SAMPLE LINE REPLACEMENT

1. SEPARATE BUNDLES FOR HEATED AND UNHEATED
   A. HEATED SAMPLE LINE (HSL)
      I. CONTAINS ONLY THE SAMPLE TUBE(S) AND THE HEATER
   B. PROBE SUPPORT BUNDLE (PSB)
      I. UNHEATED – CONTAINS WHAT IS NEEDED TO SUPPORT THE SAMPLE PROBE.


SAMPLE
TUBE
INSULATION
JACKET
HEATER
CABLE
HEATED SAMPLE LINE



PROBE SUPPORT BUNDLE

SAMPLE LINE REPLACEMENT

CiSCO STANDARD DESIGN WITH CiSCO EP-750 SAMPLE PROBE

NOT THE “COMMON” DESIGN FOR MOST CEM SYSTEM SUPPLIERS

SAMPLE LINE REPLACEMENT

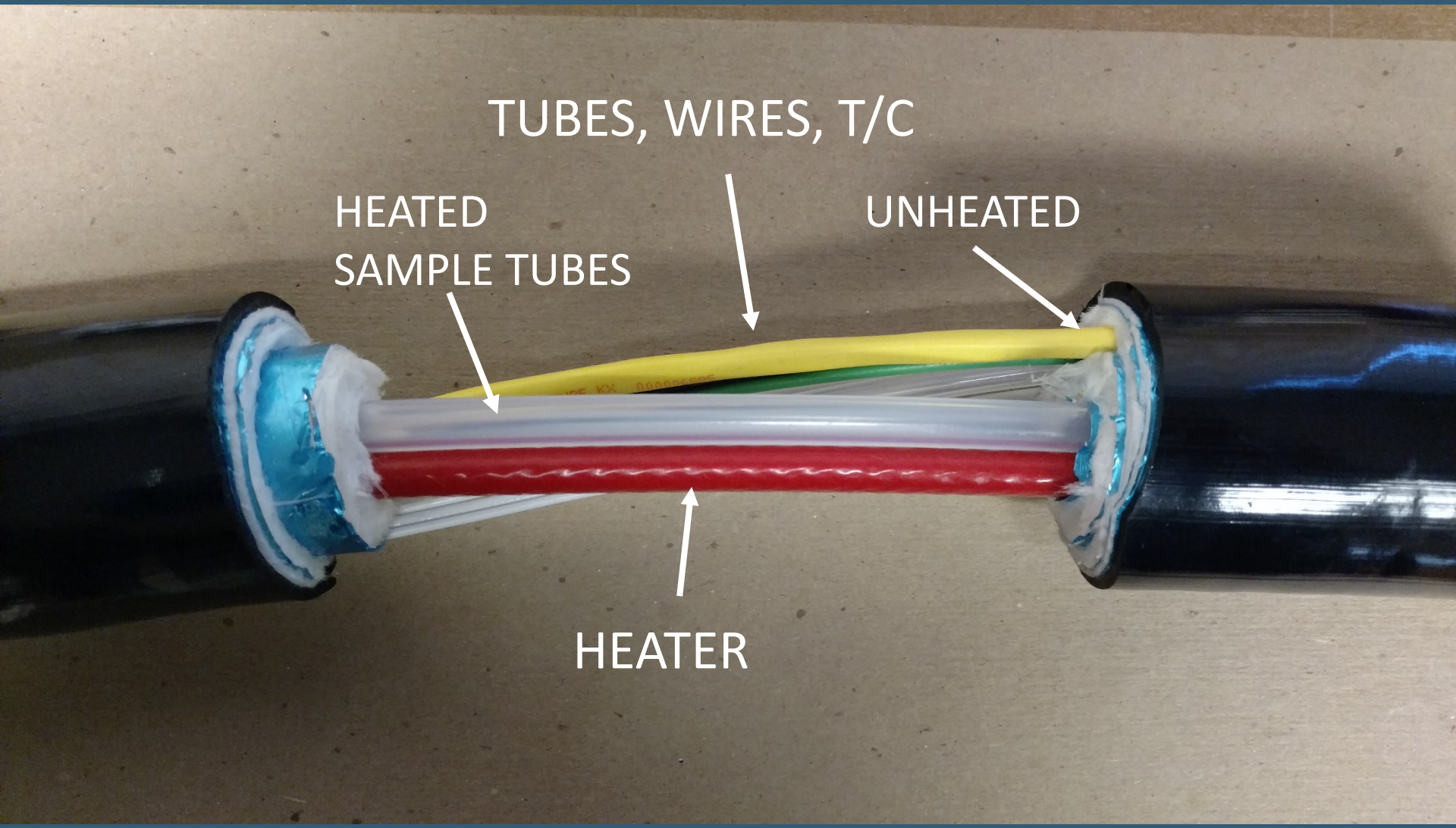
- ADVANTAGES:
  - SMALLER BUNDLES TO INSTALL
    - LIGHTER WEIGHT EACH
    - SMALLER BEND RADIUS
  - HEATER FAILURE – ONLY HSL NEEDS TO BE REPLACED
  - LESS EXPENSIVE, AS PSB BOUGHT/STOCKED IN BULK LENGTHS

SAMPLE LINE REPLACEMENT

- DISADVANTAGES:
  - TWO BUNDLES TO INSTALL ON INITIAL INSTALLATION
  - MOST ON-THE-MARKET SAMPLE PROBES DO NOT SUPPORT THIS DESIGN
    - ONE ENTRANCE HOLE INTO THE SAMPLE PROBE ENCLOSURE

SAMPLE LINE REPLACEMENT

2. ALL TUBES/WIRES IN SINGLE HEATED BUNDLE
   A. “SAMPLE UMBILICAL”
   B. SAMPLE TUBES WITH HEATER ARE IN CENTER OF BUNDLE
   C. PROBE SUPPORT TUBES & WIRES ARE EMBEDDED IN THE INSULATION



HEATED SAMPLE UMBILICAL

SAMPLE LINE REPLACEMENT

- ADVANTAGES:
  - SINGLE BUNDLE TO INSTALL
  - ALLOWS SPECIFIC DESIGN TO SUPPORT A SPECIFIC MANUFACTURER AND MODEL OF SAMPLE PROBE

SAMPLE LINE REPLACEMENT

- DISADVANTAGES:
  - LARGER BUNDLE OD
    - HEAVIER
    - LARGER BEND RADIUS
  - TYPICALLY MORE EXPENSIVE
  - REQUIRES TOTAL REPLACEMENT ON FAILURE OF THE HEATER OR ANY OTHER COMPONENT

SAMPLE LINE REPLACEMENT

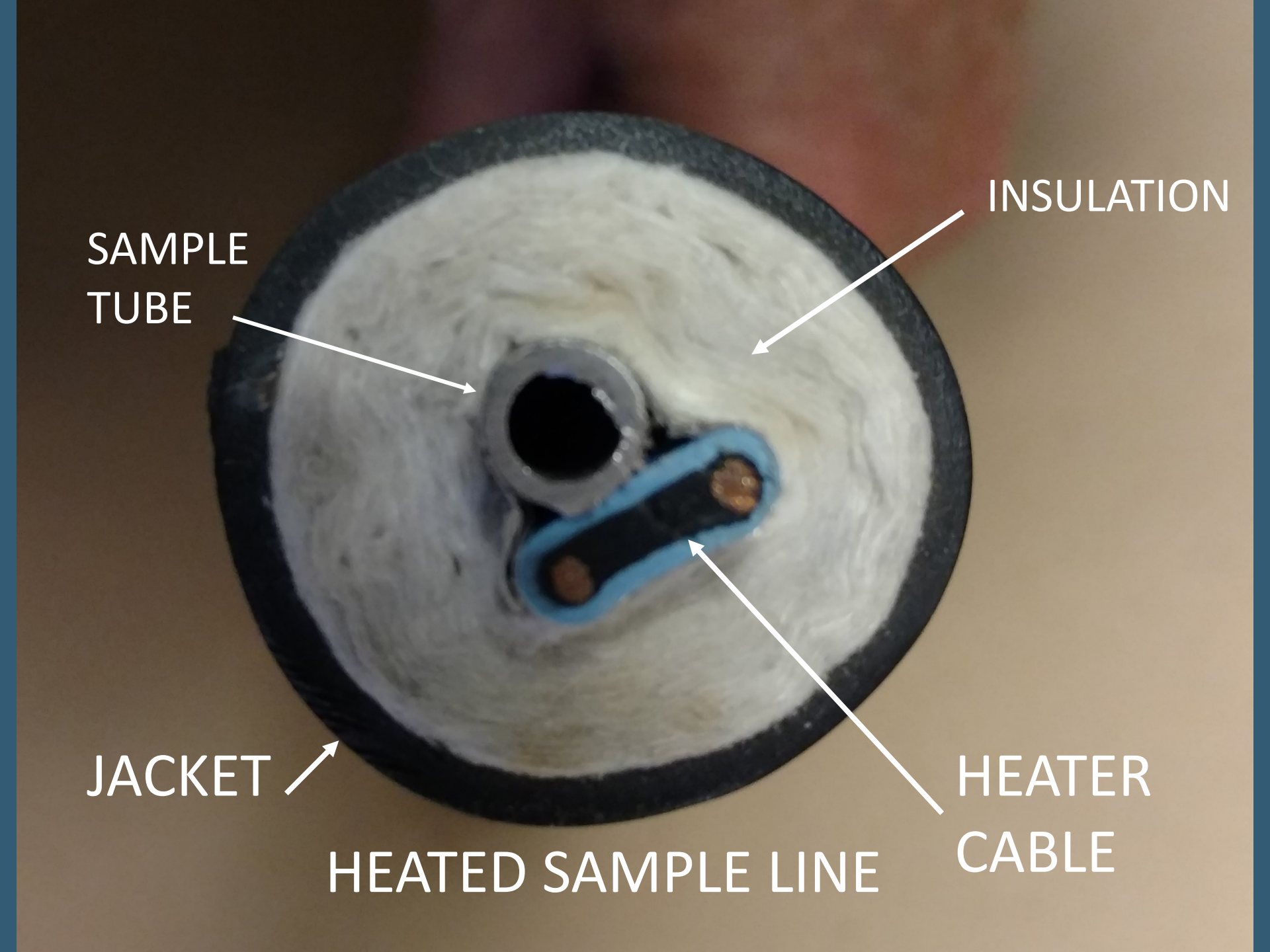
- HOW DO SAMPLE LINES FAIL?
  - PRIMARY FAILURE IS HEATER FAILURE
    - COLD SAMPLE LINE
    - THE HEATER IS AN “ACTIVE” COMPONENT AND SO IT “AGES”
  - LESS OFTEN IS THERE A PNEUMATIC (TUBE) FAILURE
    - VACUUM SIDE LEAK(S)

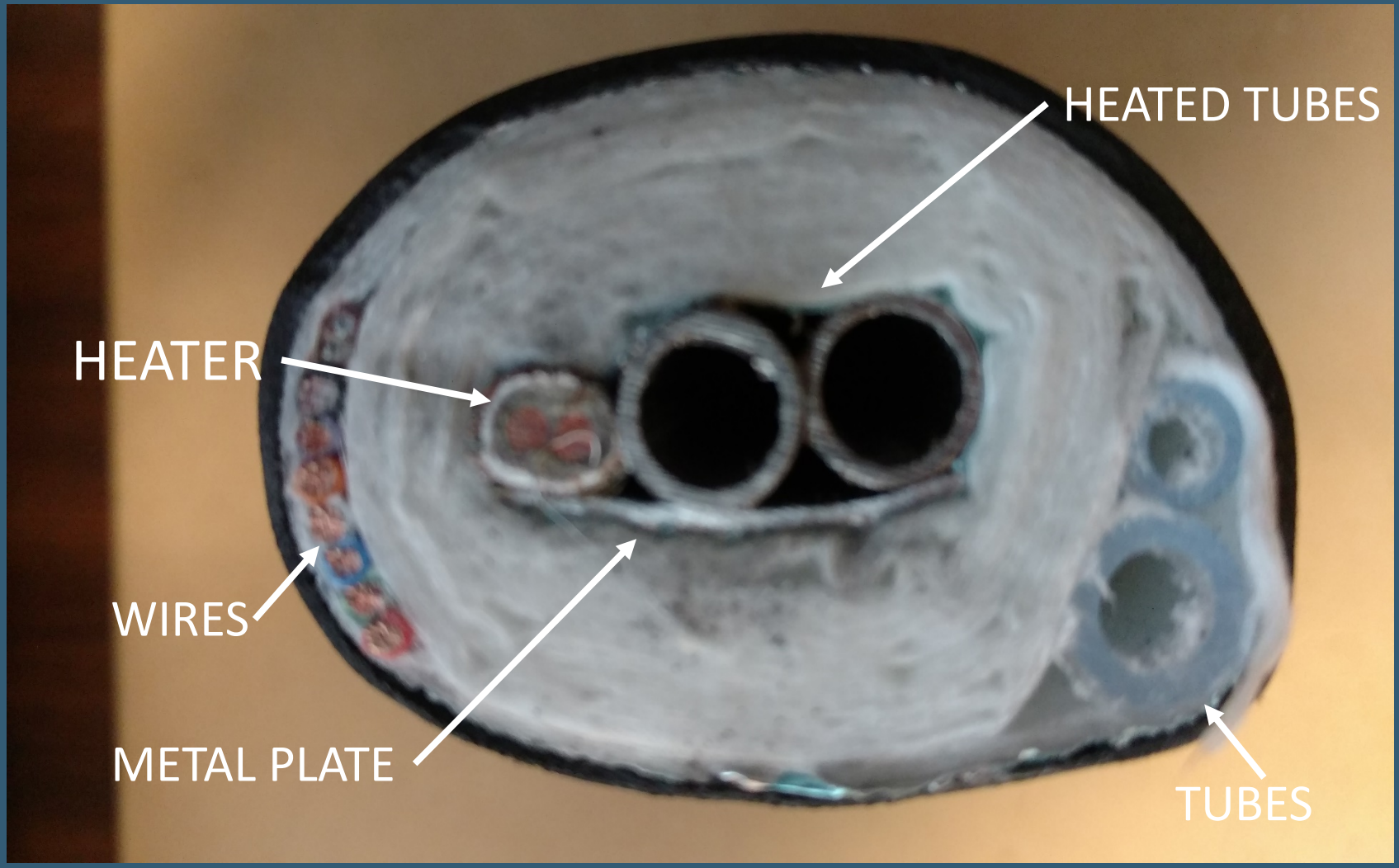
SAMPLE LINE REPLACEMENT

- PROACTIVE – ADDS COST
  - SPARE SAMPLE TUBE
    - GAS FIRED – WASTE OF MONEY
  - SPARE HEATER
    - NOT COMMON
    - CAN BE DONE WITH HEATED SAMPLE LINE (HSL) BUT NOT WITH HEATED SAMPLE HOSE (HSH)

SAMPLE LINE REPLACEMENT

- TWO DESIGNS- HSL vs. HSH
  1. SEPARATE TUBE AND HEATER
     - A. BUNDLED IN CLOSE PROXIMITY (TOUCHING) TO EACH OTHER
     - B. “HEATED SAMPLE LINE”
     - C. MOST HEATED SAMPLE LINES
       - I. DEKORON
       - II. THERMON
       - III. O’BRIEN
       - IV. PARKER

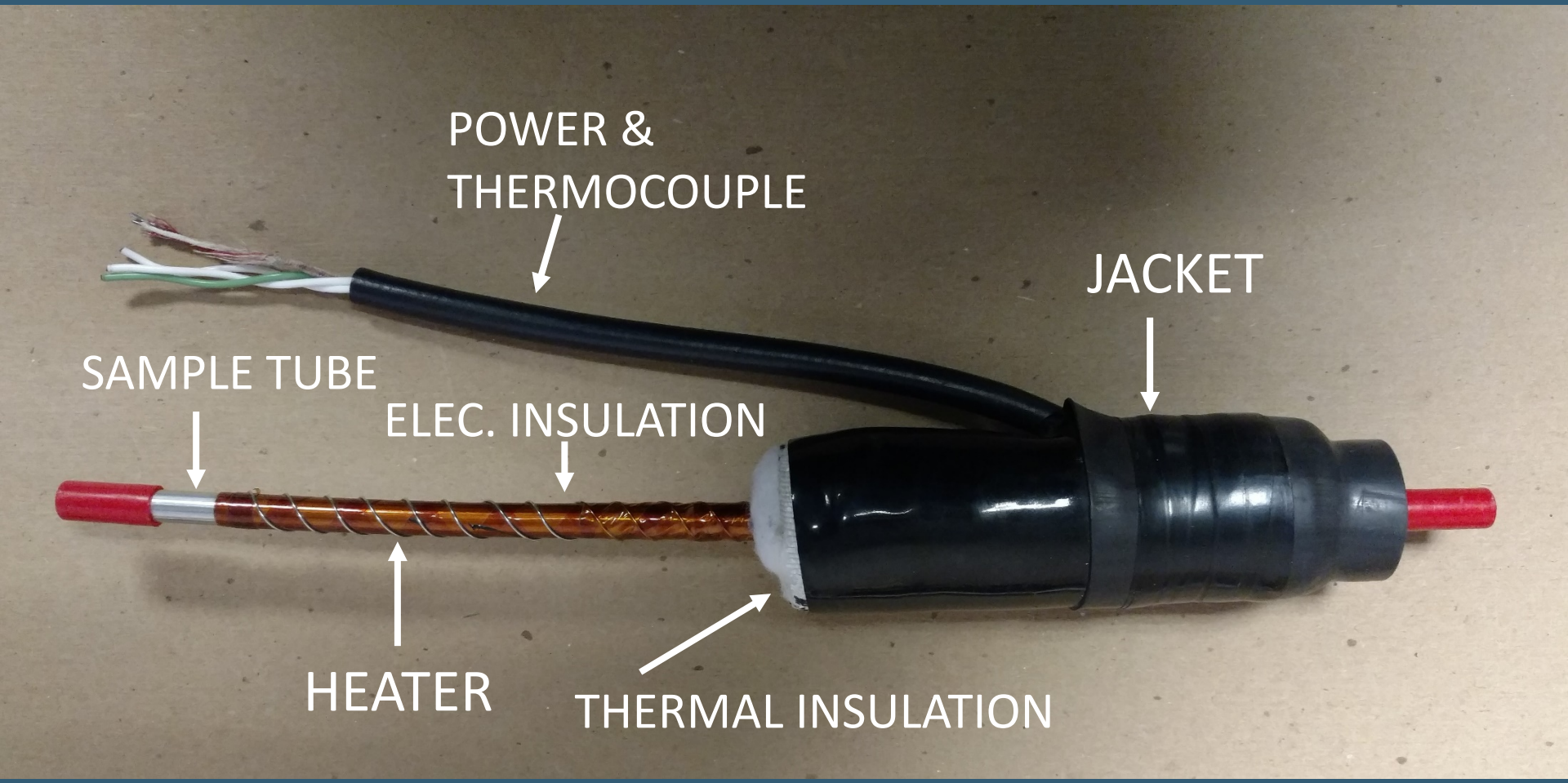

SAMPLE TUBE
INSULATION
JACKET
HEATER CABLE
HEATED SAMPLE LINE



HEATED SAMPLE UMBILICAL

SAMPLE LINE REPLACEMENT

2. HEATER AND TUBE IS ONE ASSEMBLY
   A. HEATING ELEMENT IS WOUND AROUND TUBE(S)
   B. ELEMENT IS ELECTRICALLY INSULTED FROM TUBE
   C. THEN INSULATION IS ADDED
   D. KNOWN AS “HEATED HOSE”
      I. TECHNICAL HEATERS
      II. CLAYBORN LABS



HEATED SAMPLE HOSE

SAMPLE LINE REPLACEMENT

- WHY DO SAMPLE LINES FAIL?:
  1. AGE (HEAT RELATED)
  2. IMPROPER INSTALLATION
  3. AMBIENT CONDITIONS
  4. LINE OPERATION
  5. PROCESS OPERATION

SAMPLE LINE REPLACEMENT

- INSTALLATION
  - UNROLL!!!!
  - DO NOT UNWIND!!!
  - IF HSL IN BOX – ROTATE BOX AS LINE IS BEING REMOVED – DO NOT JUST “LIFT” OUT OF BOX

SAMPLE LINE REPLACEMENT

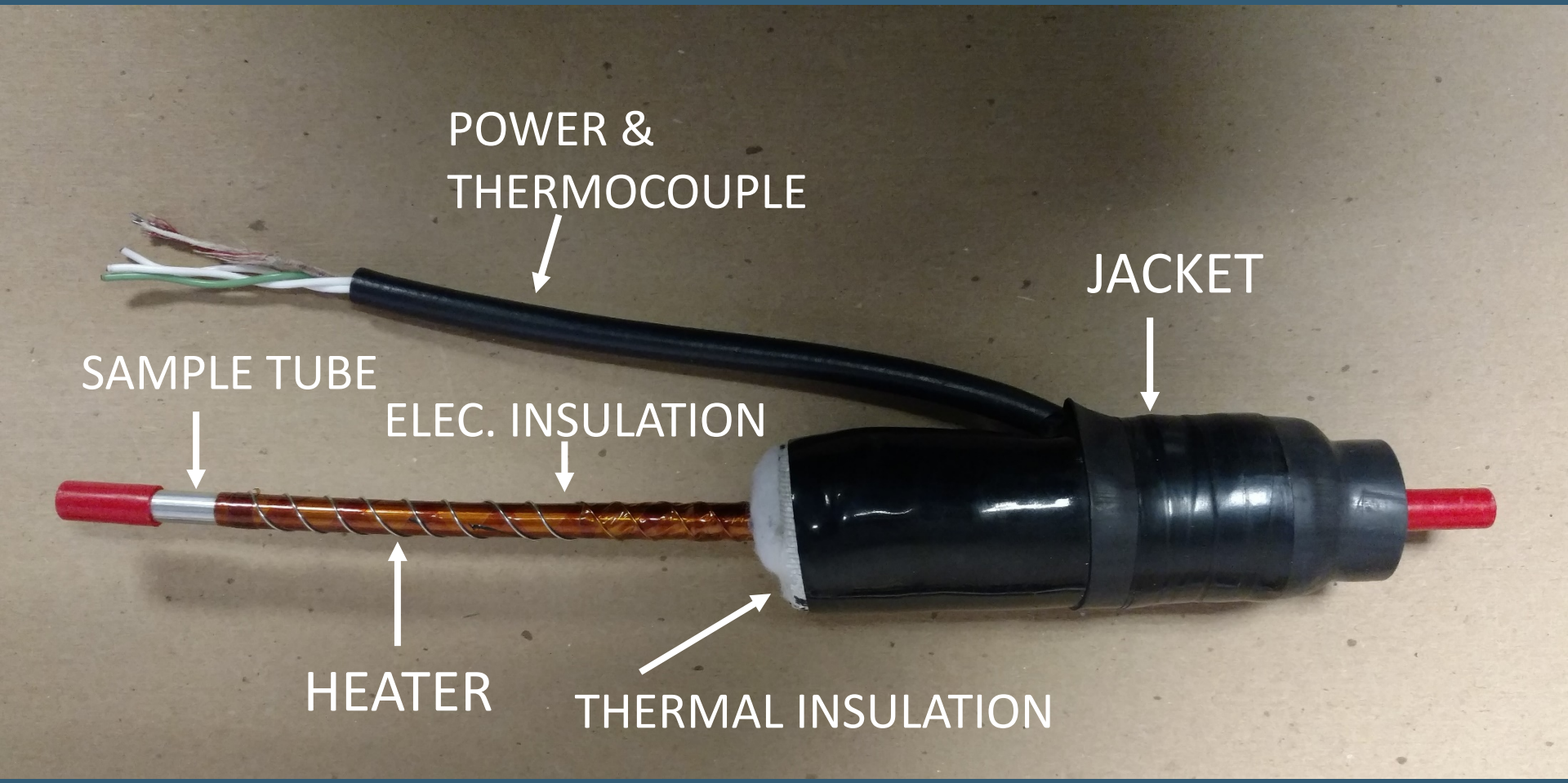
- TEMPERATURE CONTROLLED vs. UNCONTROLLED
  - UNCONTROLLED HEATER
    - MINIMUM DESIGN TEMPERATURE
      - SELF LIMITING
      - CONSTANT WATT (POWER) DENSITY
  - CONTROLLED HEATER
    - ON-LINE / OFF-LINE CONTROL
    - PEAKER UNITS

SAMPLE LINE REPLACEMENT

- FIELD CUTTABLE vs. NON-CUTTABLE
  - DEPENDS PRIMARILY ON THE TYPE OF HEATER
    - SERIES vs. PARALLEL HEATER

SAMPLE LINE REPLACEMENT

- SERIES HEATER
  - TYPICALLY NOT FIELD CUTTABLE
  - LENGTH SPECIFIED FOR SPECIFIC INSTALLATION
  - ADVANTAGE – HOT OR NOT
    - SINGLE TEMPERATURE SENSOR
  - DISADVANTAGE MUST KNOW LENGTH

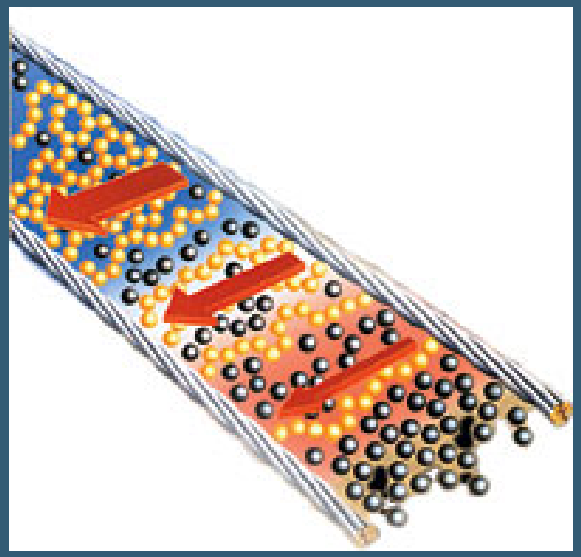


HEATED SAMPLE HOSE


CAT

SAMPLE LINE REPLACEMENT

- PARALLEL HEATER
  - FIELD CUTTABLE
  - SOMETIMES ONLY AT SPECIFIC POINTS (NODES)
  - KNOW WHAT YOU ARE DOING
    - NOT AS EASY AS IT SOUNDS
  - TEMPERATURE SENSOR MEASURES ONLY AT POINT

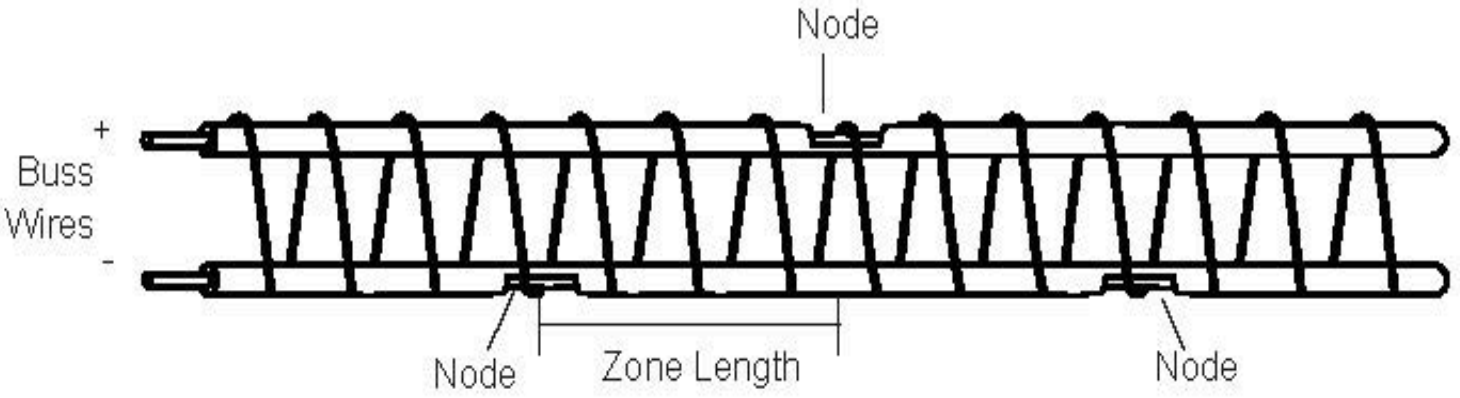


Heat is generated as electric current passes through the conductive polymer core between the parallel conductors.

As the ambient temperature drops, the number of electrical paths through the core increases and more heat is produced.

Conversely, as the temperature rises, the core has fewer electrical paths and less heat is produced.

CUT ANYWHERE HEATER



When installed, the first node must be a minimum of 6" (150mm) away from the junction box entry gland or the end termination fitting. The heater cable from the cut end to the first node will be unheated.

PARALLEL ZONE HEATER

SAMPLE LINE REPLACEMENT

A WORD OF CAUTION

WHEN MEASURING LOW LEVELS OF CARBON MONOXIDE (CO) USE STAINLESS STEEL SAMPLE TUBE

TEFLON TUBE PERMITS CO OFF GASSING OF INSULATION TO PERMEATE AND ALTER THE SAMPLE

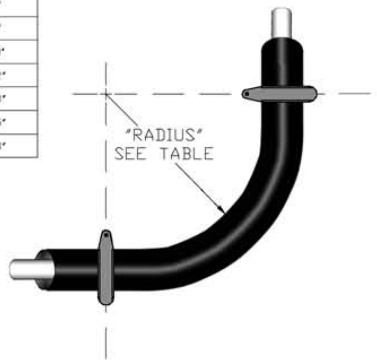
SAMPLE LINE REPLACEMENT

QUESTIONS?

COMMENTS?

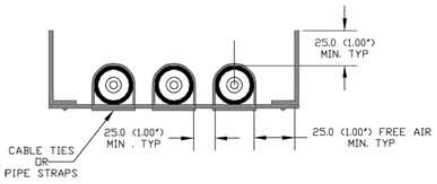
EXPERIENCES?

HOSE SIZE	RADIUS
4	6"
5	7"
6	8"
8	10"
10	12"
12	13"
16	15"
20	18"

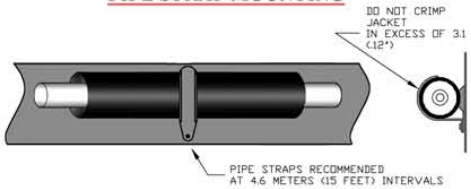


HORIZONTAL MOUNTING

DO NOT USE "U" BOLTS OR OTHER COMPRESSION TYPE CLAMPS

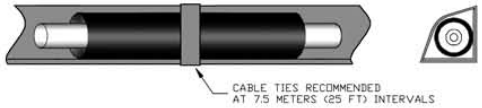


PIPE STRAP MOUNTING



OVERALL HOSE O.D.	PIPE STRAP WITH BACK	KELLEM STANDARD SUPPORT GRIP
1" - 1 1/4" (25.4 - 31.8 MM)	3/4"	022-03-041
1 1/4" 1 1/2" (31.8 - 38.1 MM)	1"	022-03-042
1 1/2" - 1 3/4" (38.1 - 45 MM)	1 1/2"	022-03-043
1 3/4" - 2" (45 - 50.8 MM)	1 1/2"	022-03-044
2" - 2 1/2" (63.5 - 76.5)	2 "	022-03-045
2 1/2" - 3" (63.5 - 76.5MM)	2 1/2"	022-03-046

ANGLE MOUNTING



VERTICAL MOUNTING

SEE NOTE # 2

KELLEM STANDARD SUPPORT GRIP MOUNTING

(SPLIT W/ROD CLOSING EYE)

INSTALLATION OF KELLEM GRIPS

WRAP KELLEM GRIP AROUND THE TUBE BUNDLE AND THREAD THE ROD THROUGH THE PREFORMED LOOPS WITH THE CORKSCREW MOTION USING THE CURVE END OF THE ROD TO ENGAGE THE LOOPS. THE ACTION REQUIRED IS A STEADY SIMULTANEOUS PUSH & TWIST MOTION. THE FINGERS OF THE LEFT HAND ARE USED TO BRING THE LOOPS TOGETHER JUST AHEAD OF THE HOOK ON THE END OF THE ROD.
TO REMOVE, SIMPLY PULL THE ROD OUT BY THE HOOK END.

CAUTION:

THE ABOVE SUGGESTIONS MUST BE FOLLOWED IN INSTALLING HIGH TEMPERATURE TUBE BUNDLE OR LINE FAILURE WILL RESULT.

3. SUGGESTED HARDWARE SUPPLIER: LOCAL ELECTRICAL SUPPLY HOUSE

2. WHEN MOUNTING SAMPLE LINE INTO VERTICAL POSITION, MAINTAIN WEIGHT OF LINE ON SUSPENSION APPARATUS. LINE IS NOT DESIGNED TO SUPPORT ITS OWN WIEGHT, WHEN HOT, FOR MORE THAN 15 METERS (50 FEET) WHEN MOUNTED VERTICALLY. DO NOT PULL OR STRETCH BUNDLE MORE THAN FREE HANGING WEIGHT OR KINK SAMPLE LINE DURING INSTALLATION

1. DO NOT ENERGIZE SAMPLE LINE WHILE IN A COIL.

UNLESS OTHERWISE SPECIFIED

GUY WIRE SUPPORT

CUSTOMER NAME

CUSTOMER PART NO.

Technical Heaters, Inc.
THERMOLAB

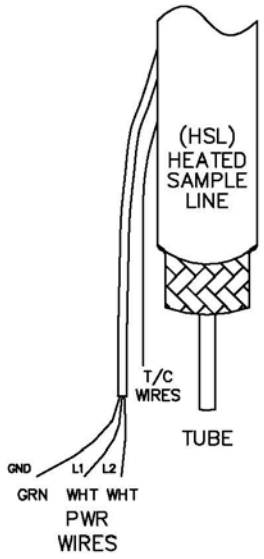
APPROVALS	DATE
DRAWN	
CHECKED	
ENGR	
DESIGN APPR	

INSTALLATION RECOMENDATIONS FOR HEAT-LINE HOSES

SIZE	CODE IDENT NO.	DRAWING NO.	REV.
D	32446	70403	N/C

SCALE NONE | RELEASE DATE: | SHEET OF

SINGLE PHASE POWER



WARNING

TWO HSL RESISTANCE TESTS
MUST BE PERFORMED
BEFORE APPLYING POWER
TO THE HEATED SAMPLE LINE

1. TAKE RESISTANCE READINGS UPON RECEIPT AND BEFORE REMOVING HSL FROM BOX OR SPOOL.
2. TAKE RESISTANCE READINGS AFTER INSTALLATION.

RESULTS

LINE TO LINE READINGS
SHOULD BE < 100 OHMS

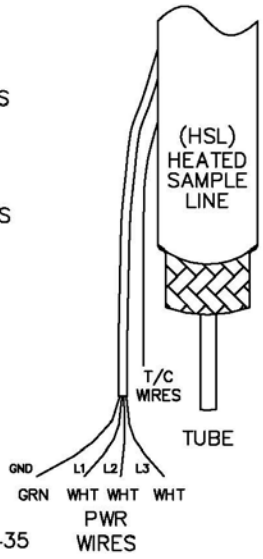
LINE TO GROUND READINGS
SHOULD BE > 1 MEG-OHM

STOP

IF YOU DO NOT OBTAIN
THE ABOVE RESULTS.

CALL CISCO 303-790-1000
OR
TECHNICAL HEATERS 800-394-9435

THREE PHASE POWER



RESISTANCE READINGS IN BOX

L1 TO L2:	OHMS < 100 OHMS
L1 TO GND:	OHMS > 1 MEG-OHM
L2 TO GND:	OHMS > 1 MEG-OHM

RESISTANCE READINGS AFTER INSTALLATION

L1 TO L2:	OHMS < 100 OHMS
L1 TO GND:	OHMS > 1 MEG-OHM
L2 TO GND:	OHMS > 1 MEG-OHM

WARNING

THIS COMPLETED FORM MUST BE
RETURNED TO CISCO FOR
THE RECORD PRIOR TO STARTUP
OR THE WARRANTY WILL BE VOID.

HSL CISCO PART NO.

HSL TECH. HEATERS PART NO.

HSL SERIAL NO.

CUSTOMER SIGNATURE

DATE

RESISTANCE READINGS IN BOX

L1 TO L2:	OHMS < 100 OHMS
L1 TO L3:	OHMS < 100 OHMS
L2 TO L3:	OHMS < 100 OHMS
L1 TO GND:	OHMS > 1 MEG-OHM
L2 TO GND:	OHMS > 1 MEG-OHM
L3 TO GND:	OHMS > 1 MEG-OHM

RESISTANCE READINGS AFTER INSTALLATION

L1 TO L2:	OHMS < 100 OHMS
L1 TO L3:	OHMS < 100 OHMS
L2 TO L3:	OHMS < 100 OHMS
L1 TO GND:	OHMS > 1 MEG-OHM
L2 TO GND:	OHMS > 1 MEG-OHM
L3 TO GND:	OHMS > 1 MEG-OHM

CISCO CUSTOM INSTRUMENTATION SERVICES CORPORATION

HSL INSTALLATION REQUIREMENTS

HSL RESISTANCE TESTS

SCALE	REVISION	DRAWN BY	DRAWING NO. / DATE
NONE	1	BBH	HSL TESTS / 2-21-08