CLEAN AIR ENGINEERING
EXPRESS MANUFACTURING DIVISION

STANDARD OPERATING PROCEDURES

OCTOBER, 2001

Corporate Headquarters
500 West Wood Street
Palatine,IL 60067

Contents

CHECK LIST FOR SAMPLE BOXES OVEN UNIT

Oven Unit Serial Number _____ Client _____
Date Manufactured _____ Date Shipped _____

_____ All panels are insulated and the foam hole in the back of the box is clean cut..

_____ Front and rear Silicone Rubber Gaskets should be installed on the inside of the box with cross slits for the probe. Both gaskets are secured with an aluminum bracket.

_____ The amphenol on the box gets the male insert with box plug amphenol casing. Threads are ok.

_____ Teflon wire MUST be used for wiring the boxes

_____ Insulation should be over bare wires and high temp connectors are used.

_____ Check continuity between amphenol connections:

_____ A Auxiliary
_____ B Neutral to the Aux and Probe receptacle
_____ C Filter
_____ D Probe
_____ GROUND-GROUND on the heater mounting terminal.

_____ Check ohms from the neutral on the 110 plug to B and C to see if the proper heater is installed. The ohms should read 27

_____ All fasteners are tight, not missing or stick out too far.

_____ A wing nut and washer are attached to the probe support arm screw. The threads on the screw have been scored so the wing nut can not come off

_____ K plug gets a twist type test. It should be straight and not loose when a solid thermocouple is inserted (Since this plug is different for a CATECO box a slight movement is allowed with this K plug)

_____ The type K plug will have 16" of thermocouple wire attached to it with a Quick tip. Heat shrink should cover the glass wire and be neatly trimmed. No shrink tubing is necessary if Teflon coated T/C wire is used. Check the Q-Tip to see if it comes off.

_____ Box is free of scratches and dirt.

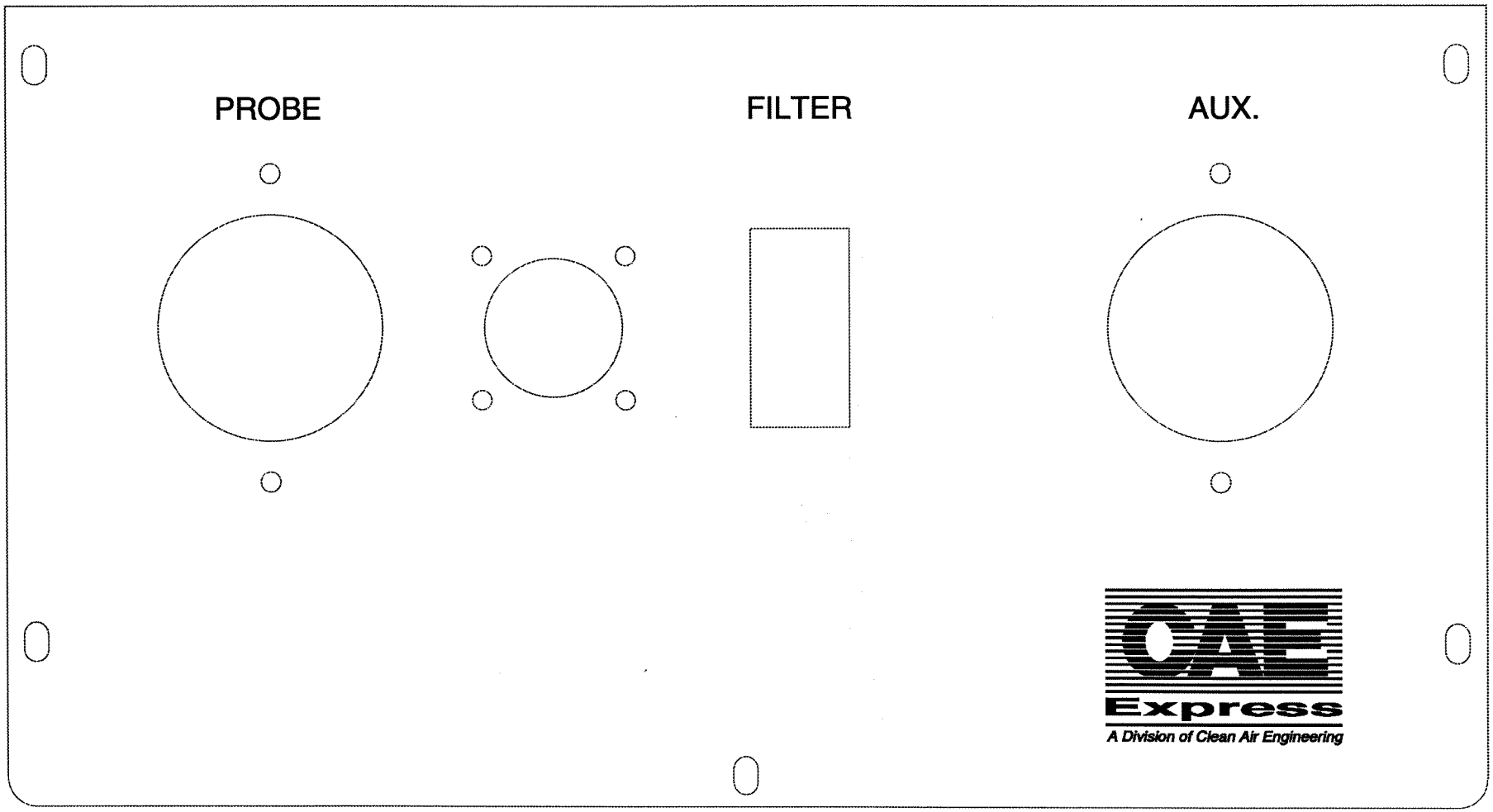
_____ TheSerial number is underneath the hinge, to the right side of the Rear door panel, that has no electrical components on it. The Serial number i.e. 03U-2001-63OU contains the following: 03 is the month, U the year, 20XX how many in the lot from the last serial nos., 63 Dept. 63 and OU for Oven Unit.

_____ The Oven Unit will be heated to 250° with a test probe and a test umbilical. The Oven Unit will hold 250° for 30 min.

_____ Amphenol connection has plastic cover for protection.

ASSEMBLED BY _____ **CHECKED BY** _____

OVEN COMPARTMENT
FACE PLATE



CHECK LIST FOR CATECO

CATECO Serial Number _____ Client _____
Date Manufactured _____ Date Shipped _____

_____ All panels are foam insulated.

_____ The amphenol on the box gets the male insert with box plug amphenol casing. Threads are ok.

_____ Teflon wire MUST be used for wiring the boxes. The wire must be kept short and not be wrapped. High temperture spade or fork terminals will be used at all connection points.

_____ Check continuity between amphenol connections:

- _____ A Not use covered with heat shrink
- _____ B Neutral
- _____ C Filter
- _____ D Probe
- _____ GROUND-GROUND on the heater mounting terminal.

_____ Check ohms from the neutral on the 110 plug to B and C to see if the proper heater is installed. The ohms should read 48

_____ The 110 plug has the ground pin to the bottom of the box

_____ All fasteners are tight, not missing or stick out too far.

_____ The wing nut is attached to the probe support arm screw and the thread on the screw has been scored so the nut can not come off.

_____ K plug gets a twist type test. It should be straight and not loose when a solid thermocouple is inserted

_____ The type K plug will have 7" of thermocouple wire attached to it with a Quick tip. No shrink tubing is necessary if Teflon coated T/C wire is used. If glass wire is used, heat shrink should cover the glass wire and be neatly trimmed .

_____ Box is free of scratches.

_____ Serial number is next to the upper left side of the hinge

_____ Serial numbers i.e. 03U-1001-63C , 03 is the month, U the year, 10... how many in the lot from the last serial nos. 63 Dept. 63 and C for CATECO

_____ Ceramic pieces are over the terminals of the heater and high temp connectors are used.

_____ Silicone rubber gaskets should be installed on the inside of the box with cross slits for the probe and filter exit.

_____ The CATECO will be heated to 250° with a test probe and a test umbilical. The CATECO will hold 250° for 30 min.

_____ The CATECO will have a wiring diagram shipped with the unit.

_____ Amphenol connection has plastic cover for protection.

ASSEMBLED BY _____ CHECKED BY _____

CHECK LIST FOR HEATER CONTROLLER

Heater Controller Serial Number _____ Client _____
Date Manufactured _____ Date Shipped _____

_____1. The amphenol on the box gets the female insert with box plug amphenol casing. Threads are ok.

_____2. High temperature wire MUST be used for wiring the boxes

_____3. Check continuity between amphenol connections before the box is final assembled and checked with the heated sample line.

_____ A
_____ B GROUND on 3 Pin Amps
_____ C
_____ GROUND

_____4. All fasteners are tight, not missing or stick out too far.

_____5. K plug gets a twist type test. It should be straight and not loose when a solid thermocouple is inserted

_____6. Box is free of scratches.

_____7. Serial number is on the back of the box with a red warning label and QC label

_____8. Serial numbers i.e. 04U-1001-63HC , 04 is the month, U the year, 10... how many in the lot from the last serial nos. 63 Dept. 63 and HC for heater controller .

_____9. The heater controller will hold 250° for 30 min., with a heated sample line, which is rated for the fusing.

_____10. Autotune the controller to 250° do not lock out the controller.

_____11. Amphenol connection has plastic cover for protection.

_____12. Temperature controller manual will be shipped with the unit.

ASSEMBLED BY _____ CHECKED BY _____

CHECK LIST FOR HEATER CONTROLLER

Heater Controller Serial Number _____ Client _____
Date Manufactured _____ Date Shipped _____

___6. Final Electrical Check: Controller

_____A. **Unlock controller:**

____1. Press and hold the SEL key until **A7-0** appears (approx 3 seconds).
____2. Tap the SEL key to bring up the lock (**LoC0, LoC1 or LoC2**).
____3. Use the ∧ and ∨ keys to change lock to **LoC0** (if **LoC0** appeared, skip this step).
____4. Press and hold the SEL key until the setpoint temperature appears (approx 3 seconds).

_____B. **Verify all controllers are set for type K thermocouple:**

____1. Press and hold the SEL key until **P** appears (approx 7 seconds).
____2. Tap the ∨ key 7 times or until **P-n2** appears.
____3. Tap the SEL key once to see the setting of the **P-n2** parameter.
____4. Adjust this parameter to **3** using the ∧ and ∨ keys.
____5. Press and hold the SEL key until the setpoint temperature appears (approx 3 seconds) to register the change.

_____C. **Configure the controller:**

____1. Tap the SEL key once to bring up the setpoint (SV led will light up).
____2. Use the ∧ and ∨ keys to adjust the setpoint to 250 (122 °C).
____3. Tap the SEL once to register the change.

_____D. **Autotuning:**

____1. Do not proceede until probe and filter reach setpoint temperature.
____2. Press and hold the SEL key until **A7-0** appears (approx 3 seconds).
____3. Use the ∧ and ∨ keys to change **A7-0** to **A7-1**.
The decimal point will begin flashing, indicating that autotuning has begun. Do not change any settings on the control until autotuning is complete (the decimal point stops flashing).

ASSEMBLED BY _____ CHECKED BY _____

CHECK LIST FOR DUAL HEATER CONTROLLER

Dual Heater Controller Serial Number _____ Client _____
Date Manufactured _____ Date Shipped _____

_____ The amphenol on the box gets the female insert with box plug amphenol casing. Threads are ok.

_____ Amphenol connection has plastic cover for protection.

_____ High temperature wire MUST be used for wiring the boxes

_____ Check continuity between all connections before the box is final assembled. Use the wiring diagram. The tech. should do this before the final inspection.

_____ All fasteners are tight, not missing or stick out too far.

_____ K plug gets a twist type test. It should be straight and not loose when a solid thermocouple is inserted

_____ Box is free of scratches and closes properly.

_____ Serial number is inside the lower half of the box on the right side with a red warning label and QC label

_____ Serial numbers i.e. 04U-5001-63DH , 04 is the month, U the year, 10... how many in the lot from the last serial nos. 63 Dept. 63 and DH for Dual heater controller .

_____ The heater controller will be heated to 250° with a test probe and a test umbilical. The heater controller will hold 250° for 30 min. with a heated sample line which is rated for the fusing.

_____ Use the digimite to calibrate the 6 or 10 channel indicator.

_____ Autotune the controller to 250° do not lock out the controller.

_____ Temperature controller manual will be shipped with the unit.

ASSEMBLED BY _____ CHECKED BY _____

CHECK LIST FOR UMBILICALS

Umbilical Serial Number _____
Date Manufactured _____

Umbilical Size _____
Stock Umbilical yes _____ no _____
Umbilical Type _____

Client _____

Date Shipped _____

CHECK √ or WRITE REJECT WHEN ITEMS APPLY, OTHERWISE NOTE NA.

_____1. Check catalog and Bill of Materials for umbilical description. The description and Bill of Materials will match the umbilical being checked.

_____2. Leak check pitot lines (polyvinyl tubing).

_____3. Leak check sample lines (gum rubber, teflon , or polyvinyl tubing).

_____4. Side with the amphenol to the meter box gets a male insert with a cable receptacle amphenol casing.

_____5. Side with the amphenol to the sample box gets a female insert with straight plug amphenol casing. This casing has a coupling ring which screws into a male connection..

_____6. ~~Check continuity between amphenol connections:~~

_____A. A-A (orange wire)
_____B. B-B (~~blue~~ wire) Black
_____C. C-C (~~red~~ wire) White
_____D. D-D (~~white~~ wire) Red
_____E. GROUND-GROUND (This is to the amphenol casing) (~~black~~ wire) GREEN

_____7. Side of the umbilical to the meter box receives 5 male plugs unless otherwise noted in the catalog.

_____8. Side of the umbilical to the sample box receives 4 female plugs and 1 male plug. unless otherwise noted in the catalog

_____9. Mesh ends 48" from the end of the umbilical . Use the gum rubber as your reference point for this measurement. The 1 1/2" heat shrink will cover this measurement. The measurements for the mesh may vary, however, each exposed end of the umbilical should match. The mesh can end from 36 to 54 inches from the end of the umbilical. On 10 foot or less umbilical the mesh can end 18 to 24 in before the heat shrink is applied.

_____10. The 1 1/2" heat shrink begins 45" from the end of the umbilical and ends 51".(See above for length variation). The heat shrink will cover a smoothly, electrical tape wrapped section of mesh and end on the mesh.

_____11. The 1 1/2" heat shrink will be 6" long. With a ± of .5 inches.

CHECK LIST FOR UMBILICALS CONT.

Umbilical Size _____
Umbilical Type _____

CHECK √ or WRITE REJECT WHEN ITEMS APPLY, OTHERWISE NOTE NA.

_____1. All thermocouple wires will have a number or description label on them. The label will be 2"± .5 from the bottom of the T/C plug. If a heat shrunk type label is used make sure the K wire is not burned.

_____2. The T/C labels will be straight and in line on both sides of the umbilical.

_____3. Check continuity between thermocouple connections:

_____A. STACK 1
_____B. PROBE 2
_____C. FILTER 3
_____D. IMPINGER OUTLET 4
_____E. AUXILIARY 5

_____4. The filter T/C plug will have 1 male plug at each end of the umbilical. This will be labeled 3 or filter unless otherwise noted in the catalog.

_____5. No red or yellow wire is seen below the T/C plugs.

_____6. Do a pull test on all plugs and recheck continuity. No unshielded wire will be seen after the pull test.

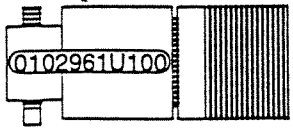
_____7. The ground wire will not be seen through the amphenol casing. (The ground wire will be between the cable and bottom of the casing.)

_____8. If the Bill of Material has a Q.C. after the catalog no. for the method 5 umbilical; A quarter inch male quick connect is put on each pitot line. This will be on the male or meter side of the umbilical. Leak check quick connects. A half inch male quick connect is on the sample line. This will be on the male or meter side of the umbilical. Leak check quick connects.

_____9. If the Bill of Material has a Q.C. after the catalog no for all other umbilicals check with QA or the procedure for attachment and size of the quick connects.

_____10. The umbilical will be heated to 250° with a test probe and a test sample box. The umbilical will hold 250° for 30 min.

_____11. Serial numbers i.e. 0102961U 100, 01 is the month, 02 is the day 96 is the year, 1 is how many inspected on that day, U is for M5 Umbilical and 100 is the umbilical length. Engrave this information on the male side of the plug. The engraving should be as small as possible and still can be read. Example below not scaled.



ASSEMBLED BY _____ **CHECKED BY** _____

CHECK LIST FOR VOST UMBILICALS

Umbilical Serial Number _____ Umbilical Size _____
Date Manufactured _____ Umbilical Stock _____yes _____no____

Client _____ Date Shipped _____

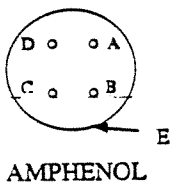
_____ Check catalog for umbilical description. The description will match the umbilical being checked.

_____ Leak check sample lines (polyvinyl tubing)

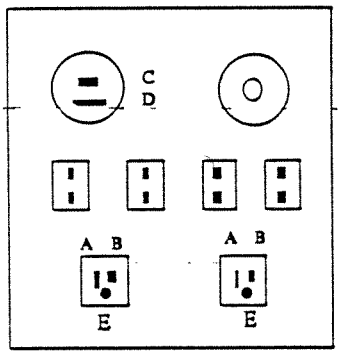
_____ Side of amphenol to the meter box gets the male insert with a cable receptacle amphenol casing.

_____ Check continuity between amphenol connections: (SEE DRAWING BELOW)

AMPHENOL		BOX
_____ A	-	B
_____ B	-	A and D
_____ C	-	NOT USED
_____ D	-	C
_____ E	-	E (The ground of the amphenol to the ground on the plugs and to the box)



AMPHENOL



BOX

_____ Side of the umbilical to the meter box receives 4 male plugs

_____ Side of the umbilical to the sample box receives 4 female plugs which are mounted in the box.

_____ Mesh ends 12" from the end of the umbilical . Use the gum rubber as your reference point for this measurement. The 1" heat shrink will cover this measurement.

_____ The 1 " heat shrink begins 10" from the end of the umbilical and ends 13". The heat shrink will cover a smoothly, electrical tape wrapped section of mesh and end on the mesh.

_____ The 1 " heat shrink will be 3" long.

_____ All thermocouple wires will have a number or description label on them. The label will be 2" from the bottom of the T/C plug. If a heat shrunk type label is used make sure the K wire is not burned.

CHECK LIST FOR VOST UMBILICALS CONT.

Umbilical Size_____
Umbilical Type_____

_____ The T/C labels will be straight and in line on both sides of the umbilical.

_____ No red or yellow wire is seen below the T/C plugs.
_____ Check continuity between thermocouple connections:

_____ ONE 1
_____ TWO 2
_____ THREE 3
_____ FOUR 4

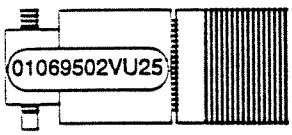
_____ Do a pull test on all plugs and recheck continuity. No unshielded wire will be seen after the pull test.

_____ The ground wire will not be seen through the amphenol casing. (The ground wire will be between the cable and bottom of the casing.)

_____ If the Bill of Material has a dash Q.C., put 1 half inch male quick connect on the sample line. This will be on the male or meter side of the umbilical.

_____ The umbilical will be heated to 250° with a test probe and a VOST meter box. The umbilical will hold 250° for 30 min.

_____ The umbilical will have a serial number engraved on the amphenol casing. This will be done by the person testing the umbilical. The serial number will consist of the following: The first 2 numbers will be the month, the second 2 numbers will be the day of the month inspected, the third 2 numbers will be the year, the forth 2 numbers will be the number checked for that day followed by VU and the last 2 numbers are the length of the umbilical. i.e. 01069502VU25 is an umbilical that was inspected on January 6, 1995. It was the second one looked at. It was a VOST umbilical that was 25 feet long.



ASSEMBLED BY_____ CHECKED BY_____

CHECK LIST FOR PUMPS

MFG. Pump Serial Number _____ Meter Box Serial Number _____
Date Assembled _____ Checked By: _____
Client _____ Date Shipped _____

_____1. The fan is wired to the pump.

_____2. The 110 plug is approx. 43" (cut size is 46")long and wired to the pump.

_____3. When there is a pump oiler hole on the side of the pumphead, the hole is plugged with a 1/8" NPT plug fitting.

_____4. The jar cap is drilled through with a 5/32 hole and the arrow is pointed towards the pump.

_____5. 1/4" female to 1/4 " male NPT fitting is connected from the hose to the small jar.

_____6. Outlet side of the pump has the large jar with 1/4" female - 1/4 "male NPT fitting on the hose connection.

_____7. The Inlet Hose is 13" long with a 3/8" male NPT quick connect.

_____8. The Outlet Hose is 17" long with a 3/8" male NPT quick connect.

_____9. The Outlet Hose and the Inlet Hose will be arranged so that they are equal in length and reach the meter connections.

_____10. The holes in the large jar are next to the pump.

_____11. The filters are in both jars. The small jar filter should be taken off and the large felt should be moved to the top of the felt arrangement.

_____12. The pump has rubber feet on the mounting plate.

_____13. The fan will blow over the pump.

_____14. Leak check pump lines.

_____15. Pump vacuum should read 26 -28 ins. of Hg. Regap rotor if necessary.

DATE

_____1. Pump run WITHOUT RESTRICTION the 1st 12 hrs. Pump has NO chatter*
Does the pump need to be regapped? YES_____ NO___date regapped_____

_____2. Pump run with restriction the 2nd 12 hrs. Pump cleaned and gapped as needed NO chatter*
Does the pump need to be regapped? YES _____NO___ date regapped _____

_____3. Pump run with restriction the 3rd 12 hrs. Pump cleaned and gapped as needed NO chatter*
Does the pump need to be regapped? YES_____ NO___date regapped_____

* If the pump is not running smoothly the pump is inspected per the pump cleaning procedure and rerun for the 24 hr break-in period.

CHECK LIST FOR SAMPLE PUMP

Sample Pump Serial Number _____ Client _____
Date Manufactured _____ Date Shipped _____

_____ All fasteners are tight, not missing or stick out too far.

_____ Check electrical between switch connections and pump

_____ Box is free of scratches.

_____ Flow meter works correctly

_____ Leak Check all lines and fittings.

_____ Arrow on the cartridge filter is toward the inlet of the pump head.

_____ Serial number is on the back of the box with a red warning label and QC label

_____ Serial numbers i.e. 04U-1001-63SP , 04 is the month, U the year, 10... how many in the lot from the last serial nos. 63 Dept. 63 and SP for sample pump .

ASSEMBLED BY _____ **CHECKED BY** _____

FINAL CHECK LIST FOR VOST METERS

VOST Meter Box Serial No_____ Dry Gas Meter Serial No._____
Date Assembled_____ Checked By:_____

Client_____ Date Shipped:_____

___1.Leak check the unit with the leak check procedure:

_____A. Leak check the unit . Remove rear door of console be sure the equipment is grounded.

_____B. Plug the unit in. Turn the main power switch to the "ON" position,

_____C. Close the coarse valve and check for leaks with the pump on..

_____D. Insert a 1/4" quick connection in the sample inlet and open the coarse valve. Cover the tube coming out of the quick connect and check for leaks. The float and water column should not move and the dry gas needle should stop for approx. 1 min.

___2.Running the pump

If the VOST meter is checked right after calibration the pump does not need to run. Otherwise run the pump for 15 min. Listen for a free running pump. If the pump is not running properly it needs to be replaced or freed up

___3.Appearance

_____A. The dry gas meter bracket has a hole in it to accommodate the pem for the case handle. This allows the bracket to mount flush against the top of the meter shell.
_____B. K plugs should be straight and not loose.
_____C. All fasteners are tight, not missing or stick out too far . Truss head screws must be used to attach the dry gas meter.
_____D. The 110 plug is 72" long.
_____E. The VOST meter has rubber feet on the mounting plate
_____F. There are no scratches chips or dings on the doors cabinets or face plate.
_____G. Paint decals and logos are readable. AUX FILTER and PROBE are on the fuse plate.
_____H. The exhaust hose has a label on it
_____I. The flow rate chart is on the front door cabinet

___4.Final Electrical Check

_____A. Check all connections for appearance in the back of the meter . The wiring harness should not be a mass of tangled wires. The wires should be neat and fastened with ties
_____B. Look for loose or damaged wires. Technician will replace or repair.
_____C. The terminal connections will be stuck firmly in place and not loose.
_____D. Warning labels and Q/A stickers will be in place. Red label on the side of the cabinet and Q/A sticker on the back of the dry gas meter. Fill in when complete.
_____E. The amphenol on the box gets the female insert with box plug amphenol casing. Threads are ok.
_____F. Amphenol connection has plastic cover for protection.

FINAL CHECK LIST FOR VOST METERS

VOST Meter Box Serial No_____ Dry Gas Serial No._____
Date Assembled_____ Checked By:_____
Client_____ Date Shipped:_____

___5.Final Electrical Check Controllers.

_____A. The four channel controller should already be configured and checked by the technician that did the dry gas meter calibration. Check the set point it should read - 328°F (-220°C). Check the cal sheet. The temperatures should not be off by more than ± 1 degree

_____B. Lock out the four channel controller
____1.Press the 2 up and down controls until *AUT* appears
____2.Press the left key until *CnF9* appears
____3.Press the set button and hold. No will appear.
____4.Press the up and set button at the same time until yes appears. Release.
____5.Run through the menu key until TAG appears
____6.Press set button and hold. a blank screen will appear.
____7.Press the right key PCOA will appear this locks out all the parameters
____8.Release keys. TAG will appear
____9.Press the 2 up and down controls until temperature or ER 4 appears.
____10.The six channel indicator is now locked out.

_____C. Configure the probe and filter controllers:
____1Set up test equipment in a mini train, probe sample box and umbilical
____2Press the 2 up and down controls until *AUT* appears
____3Press the left key until *CnF9* appears
____4Press the set button and hold. No will appear.
____5Press the up and set button at the same time until yes appears. Release. IN appears.
____6Press set button and use UP control till H appears. Release
____7Press set button and use DOWN control till C-F appears. Set C/F

_____D. Autotuning:
____1.Press the set button and set the set point at 250° F (122 °C).
____2.Use the up and down buttons to change the set point
____3.Autotune the equipment to the set point
____4.Press the 2 up and down controls until *AUT* appears
____5.Press the set button and hold. No will appear.
____6.Press the up and set button at the same time until yes appears. Release.
____7.The controller will autotune to the new set point. The LED will flash *tune*.
____8.Autotuning is complete for the new set point when the flashing stops..

_____E. Heating the equipment:
____1.The meter will be heated to 250°(122 °C) with a test probe, a test umbilical, and sample box
____2.The VOST Meter will hold 250°(122 °C) for 30 min.

FINAL CHECK LIST FOR VOST METERS

Serial No:_____ Gas Meter Serial No:_____
Date Assembled:_____ Checked By:_____
Client:_____ Date Shipped:_____

_____ 6. Final Electrical Check: Controllers, continued.

_____**F. Autotuning:**

____1. Do not proceede until probe and filter reach setpoint temperature.
____2. Press and hold the SEL key until **A7-0** appears (approx 3 seconds).
____3. Use the ∧ and ∨ keys to change **A7-0** to **A7-1**.
The decimal point will begin flashing, indicating that autotuning has begun. Do not change any settings on the control until autotuning is complete (the decimal point stops flashing).

_____**G. Heating the equipment:**

____1. The meter will be heated to 250_(122 °C)) with a test probe, a test umbilical, and sample box.
____2. The meter will hold 250_(122 _C) for 30 min.
____3. Shut off the filter switch and open the door on the sample box.
____4. Each controller will work independently If the probe looses temperature or continues to climb in temperature there is a wiring problem. The technician will fix the problem.

_____**H. Lock out all controllers:**

____1. Press and hold the SEL key until **A7-0** appears (approx 3 seconds).
____2. Tap the SEL key to bring up **LoC0**.
____3. **6 channel indicator only:** Use the ∧ and ∨ keys to change **LoC0** to **LoC1**.
____4. **Probe and Filter controllers only:** Use the ∧ and ∨ keys to change **LoC0**to **LoC2**.
____5. Press and hold the SEL key until the setpoint temperature appears (approx 3 seconds).

_____I. Complete the Q/A sticker.

____7.Ready the VOST Meter For Shipment

_____A. Check the VOST Meter box for serial tag it should match the paper work and be attached in the lower left front corner of the box.
_____B. Refer to figure 1 in the Manual that will go with the VOST Meter box for the items listed below if you are not familiar with the parts.
_____C. Check the manual and be sure it is the correct one for the VOST Meter.
_____D. Enter the serial no. of the VOST Meter and dry gas meter in the front cover of the manual
_____E. Enter the serial no. on the VOST Meter Box Serial No. List. Fill in all the inf. on this sheet.
_____F. Set all the rocker switches(item 3) on the VOST Meter to the off position.
_____G. Turn the course control valve (item 15) to the closed position
_____H. Replace the VOST Meter box panels check for scratches and latch fitup. Adjust as needed
_____I. Check the calibration sheets and place them in a clear plastic sheet protector.
_____J. The VOST Meter manual, temperature controller manual and cal sheets should be placed in a self sealing shipping bag and attached to the top of the VOST Meter box.

LIST PROBLEMS THAT WERE CORRECTED AND NOTES HERE :

_____
_____
_____
_____
_____

CHECK LIST FOR PROBES

Pitot Serial Number _____ Probe Size _____
Date Manufactured _____ Stock Probe _____ yes _____ no _____

Client _____ Date Shipped _____

_____1. Leak check probe with liner (glass or stainless).

_____2. Leak check pitot lines.

_____3. Check the continuity on the silicon and nichrome wrapped liners.

_____4. Check ground to the probe.

_____5. The power cable sheath will be 18" long. The power plug will be tested for ease of use with a sample box and given a pull type test.

_____6. All exposed wire will have 1/8" shrink tubing on them.

_____7. The pitots are 6 1/2" from the center of the pitot, to the top of the sheath.

_____8. All exposed metal tubing will be free of burrs and sharp edges. (i.e. pitots and liners)

_____9. Solid thermocouple tip will be 2" away from the center of the pitot tip.

_____10. The pitots are 90° away from split collar.

_____11. A glass thermocouple SSE 0315-18 is taped to the liner. The tip will be approx. 12 " from the end of the liner.

_____12. All welds will be free of discoloration.

_____13. There will be no weld burn through on stainless steel liners.

_____14. The pitot is calibrated

_____15. The original calibration for the pitot is stored on the computer and a hard copy is printed and shipped with the client's probe.

_____16. The pitot hard copy is photocopied and stapled to the shop work copy. These are put in the Q/A in basket.

_____17. The pitot copies are filed and reviewed by the Q/A director.

_____18. Stock probe's hard copy calibration sheet will be stored on the computer until shipped. The stock probe will have the client up-dated in the computer file and the paperwork will be put in the Q/A in basket.

_____19. The check sheet is filed. IT DOES NOT GO TO THE CLIENT.

_____20. Heat probe up to 250°

NICHROME WRAPPED LINERS:

_____1. Make sure there are three layers of tightly wrapped tape applied to all stainless steel liners before the nichrome wire is wrapped on the liner.

_____2. Glass liners do not need the bottom layers of glass tape.

_____3. Make sure there are two layers of tightly wrapped glass tape on top of all nichrome wire.

_____4. Make sure the glass sock isn't put on until all layers of tape have been applied. Five layers for metal liners and 2 layers for glass liners.

_____5. Check ohms on nichrome wrapped liners. Use the Ohm chart for the correct reading.

WELDED BY _____ **ASSEMBLED BY** _____ **CHECKED BY** _____

NOTES: _____

CHECK LIST FOR WATERCOOLED PROBES

Pitot Serial Number_____
Date Manufactured_____
Client _____

Probe Size_____
Stock Probe _____yes _____no____
Date Shipped _____

_____1. The 3/8" couplings will be marked with an arrow in and an arrow out on 2 sides. The arrow in will be marked on the coupling that has the water in tube welded under it.

_____2. The 3/8" couplings will be 180° from the split collar.

_____3. Leak check all welds with trouble bubble and compressed air.

_____4. Run water through the probe to check water return and for water leaks.

_____5. Leak check probe, with liner (glass or stainless) and with a meter box.

_____6. Leak check pitots with a meter box.

_____7. Check the continuity on the silicon and nichrome wrapped liners.

_____8. Check ground to the probe.

_____9. The BX cable will be 18" long.

_____10. All exposed wire will have 1/8" shrink tubing on them.

_____11. The pitots are 4 1/2" from the center of the pitot, to the top of the sheath.

_____12. Solid thermocouple tip will be 2" away from the center of the pitot tip.

_____13. The pitots are 90° away from split collar.

_____14. A glass thermocouple SSE 0315-18 is taped to the liner.

_____15. All welds will be free of discoloration.

_____16. There will be no weld burn through on stainless steel liners.

_____17. High temperature packing material is used in place of a TFF or steel ferrule

_____18. The pitot is calibrated

_____19. The original calibration for the pitot is stored on the computer and a hard copy is printed and shipped with the client's probe.

_____20. The hard copy is photocopied and stapled to the shop work copy. These are put in the Q/A in-basket.

_____21. The copies are filed and reviewed by the Q/A director.

CHECK LIST FOR WATERCOOLED PROBES CONT.

Pitot Serial Number_____ Probe Size_____
Date Manufactured_____ Stock Probe _____yes _____no____
Client _____ Date Shipped _____

_____22. Stock probe's hard copy calibration sheet will be stored on the computer until shipped. The stock probe will have the client up-dated in the computer file and the paperwork will be put in the Q/A in-basket.

_____23. The check sheet is filed. IT DOES NOT GO TO THE CLIENT.

_____24. Heat probe up to 250°

NICHROME WRAPPED LINERS:

_____1. Make sure there are three layers of tightly wrapped tape applied to all stainless steel liners before the nichrome wire is wrapped on the liner.

_____2. Glass liners do not need the bottom layers of glass tape.

_____3. Make sure there are two layers of tightly wrapped glass tape on top of all nichrome wire.

_____4. Make sure the glass sock isn't put on until all layers of tape have been applied. Five layers ~~for metal~~ liners ~~and 2 layers for glass~~ liners.

_____5. Check ohms on nichrome wrapped liners. Use the Ohm chart for the correct reading.

WELDED BY _____ ASSEMBLED BY_____ CHECKED BY_____

NOTES:_____

CHECK LIST FOR PITOT ASSEMBLIES

Pitot Serial Number_____ Assembly Size_____
Date Manufactured_____ Stock Assembly _____yes _____no____

Client _____ Date Shipped _____

_____1. Leak check pitot lines.

_____2. The pitots are 6 " from the center of the pitot, to the top of the sheath.

_____3. Solid thermocouple tip will be 2" away from the center of the pitot tip.

_____4. All welds will be free of discoloration.

_____5. The pitot is calibrated

_____6. The original calibration for the pitot is stored on the computer and a hard copy is printed and shipped with the client's probe.

_____7. The pitot hard copy is photocopied and stapled to the shop work copy. These are put in the Q/A in-basket.

_____8. The copies are filed and reviewed by the Q/A director.

_____9. Stock probe's hard copy calibration sheet will be stored on the computer until shipped. The stock probe will have the client up-dated in the computer file and the paperwork will be put in the Q/A in-basket.

_____10. The check sheet is filed. IT DOES NOT GO TO THE CLIENT.

WELDED BY _____ ASSEMBLED BY_____ CHECKED BY_____

NOTES: _____

CHECK LIST FOR NOX001

NOX001 Serial Number _____ Client _____
Date Manufactured _____ Date Shipped _____

_____ High temperature wire MUST be used for wiring the boxes

_____ Check continuity between connections before the box is final assembled and checked with a probe.

_____ All fasteners are tight, not missing or stick out too far.

_____ K plug gets a twist type test. It should be straight and not loose when a solid thermocouple is inserted

_____ Box is free of scratches.

_____ Serial number is on the back of the box with a red warning label and QC label

_____ Serial numbers i.e. 04U-1001-63NOX , 04 is the month, U the year, 10... how many in the lot from the last serial nos. 63 Dept. 63 and NOX for NOX001 .

_____ The NOX001 will be heated to 250° with a test probe and a test umbilical. The heater controller will hold 250° for 30 min. with a heated sample line which is rated for the fusing.

_____ Autotune the controller for the probeto 250° do not lock out the controller for the probe.

_____ Do not autotune the controller for the flask

_____ Lock out the controller for the flask set point at -328°.

_____ Leak Check all lines and fittings.

ASSEMBLED BY _____ **CHECKED BY** _____

CHECK LIST FOR 240 TO 120V TRANSFORMER

Transformer Serial Number_____Date Manufactured_____

Stock Assembly _____yes _____no____

Client _____ Date Shipped _____

_____ Check the internal wiring with the schematic

_____ Check the stress relief on the input and output wire cable

_____ Physically inspect chassis for defects

_____ Apply caution label and serial number

_____ Apply input and output labels to the proper cords

_____ Verify output voltage with no load

_____ Test transformer with load and make sure the load is running properly.

_____ Test transformer with load and and physically touch the transformer watching for excessive heat output.

_____ When all the above is correct affix quality control labels and initial

ASSEMBLED BY_____ CHECKED BY_____

NOTES: _____

CATECO Heated Filter Unit (0035) Assembly Procedure

1. PURPOSE:
To explain how to assemble a CATECO Heated Filter Unit.

2. SCOPE:
To be used by all personnel who assemble a CATECO Filter Unit.

3. MATERIALS:
3.1. All items listed on the assembly parts list
3.2. Fire-Flex foam sheets
3.3. 18 ga. Teflon-coated wire
3.4. Millboard sheet
3.5. Silicone gasket sheet

Fasteners as follows:

3.6. Hex head socket 10-32 x 1/2" screws
3.7. Hex head socket 4-40 x 1/4" screws
3.8. High temperature eyelet
3.9. High Temperature Fork Connectors
3.10. K-lok 6-32 nuts
3.11. K-lok 1/4-20 nuts
3.12. Round Head 6-32 x 1/8" screws
3.13. Round head 6-32 x 1/4" screws
3.14. Truss head 10-32 x 1/2" screws
3.15. Truss head 10-32 x 1/4" screws

Tools along with Tech's shop tool box as follows:

3.16. Center punch
3.17. Drill bit #17
3.18. Foam work pad to protect item from scratches while being assembled
3.19. Hammer
3.20. 3M crimper tool and a crimper tool to attach the Quick- tip
3.21. Red gasket aluminum template
3.22. Rosin Core Solder (Kester type .031 dia. or similar product)
3.23. Screw drivers
3.24. Soldering iron
3.25. Vice Grip type pliers
3.26. Wire Strippers

4. DEFINITIONS:

4.1. Box: Same as CATECO Heated Filter Unit

4.2. CATECO Heated Filter Unit: inventory part no. 0035

4.3. Internal panel inserts: also referred to as panels. These are the aluminum pieces that hold the foam insulation in place inside the box.

4.4. Stand-off: Two 1/4 -20 nuts used to raise the heating element away from the bottom of the box.

5. PROCEDURE:

5.1. Check the inventory items to be sure all material has been pulled for the work order. Shop floor items and inventory items are arranged by the tech. on a work bench.

5.2. Roll foam as necessary. Cut out Fire-Flex foam inserts from the large sheets for all of the internal panels.. Foam tools are available for cutting the correct size holes in the front and rear panel inserts.

5.3. Cut out silicone gaskets for the front and rear of the box from the large sheets. Use the aluminum template. Cut **slits** for the probe holes.

5.4. Cut out mill board for the top of the box from the large sheets. A particle mask will be worn when cutting the material.

5.5. Put the pre-cut and rolled foam into the bottom of the box. Put the bottom aluminum plate with heater mount studs toward front of the box (front has five holes of various sizes for mounting components later in the assembly process).

5.6. Drill out amphenol panel mounting holes with a number 17 drill bit. Assemble the female 4-pin amphenol. Make sure letters on insert are upright and panel mount fitting has the center septum top and center.

5.7. Solder amphenol fitting according to the wiring diagram for this unit. Wire lengths are as follows: "D" is 8" long; "B" and "C" are both 5" long. Shrink tubing should be used on all solder connections, including the unused "A" connection. A heat gun should be used to shrink the protective tubing over the connection.

5.8. Mount wired amphenol fitting in front of outer shell. Use 4-40 hex head socket fasteners Tighten 1/2 turn past snug.

5.9. Attach a high temperature fork connector to wire "C" using the 3M crimper tool. Exposed wires are not to show outside of connection barrel. Attach a fork connector and a 4" length of wire to the end of Wire "B". The extra wire is attached to the heating element from the 115v receptacle.

5.10. Remove green ground screw from 115v receptacle Loosen two other screws labeled "white" and "black". Place receptacle through lower left hole in the front panel and turn receptacle so that "white" terminal faces up inside the box. Attach "B" wire fork connector to the white terminal. The second wire is hanging toward the inside of the box. Turn the receptacle so that the "black" terminal is facing up and attach "D" wire fork terminal here. All connections should be tightened so they will not come loose.

5.11. Mount the receptacle in the front face plate using 1/2" 10-32 Truss head screws, making sure that the ground connection on the receptacle faces up inside the box. Cut a 4" piece of Teflon wire and attach a high temperature eyelet to each end. Attach one end to the 115v receptacle using the green ground screw removed earlier.

5.12. All wires running from the amphenol fitting to the receptacle should be bent 180 degrees at the back of the amphenol connection and run along the wall of the box down to the receptacle, leaving some slack along the side of the receptacle. Wires should then come out from the wall of the box and turn 180 degrees to the terminal connections. Wire "C" should follow the same path and be run to the interior of the box for connection to the heating element later.

5.13. A Quick- Tip is attached with a crimper tool the thermocouple wire. Attach the 7" thermocouple wire with Quick-tip to panel mount K-type thermocouple plug. The red wire is attached to negative (-) and yellow to the positive(+) terminal. Mount thermocouple plug in front wall of enclosure. Use the snug ring provided. The ring should be tightened using a hammer and screwdriver making the teeth of ring bite into the wall. The K on the plug is parallel to the right side of the box when the ring is tightened.

5.14. Mount probe arm with silicone rubber gasket on outside front of box using 10-32 hex head screws, with socket on inside of box. Silicone gasket should be sandwiched between probe arm and face of box.

5.15. With three wires left leading into the interior of the box, the precut foam insert for the front panel should be fit into place. There should be no binding of the wires apparent when this is done.

5.16. On the aluminum front insert panel, use a half round flat file to widen the top half of the hole for the receptacle. An additional 1/8" will allow more room for the ground connection.

5.17. Place front insert into the box with bent edge up and facing front of box. Check the inside of top lip of box for excess weld material that may obstruct proper placement of insert. Remove excess material if necessary. If bottom of insert is placed against wall first, pushing the bottom panel down will allow top of insert to snap easily into place. Make sure there are no areas where connection wires are bound or scraped by the front insert.

5.18. Mount back panel gasket and bracket on studs mounted on the back of box. Silicone gasket should be sandwiched between bracket and rear panel of box, and the cross slits should center on hole in rear panel.

5.19. Fit the foam insert into the back of the box. Precut hole should line up with center of rear hole and cross slits. Fit rear panel aluminum insert into place, checking first for excess weld material on underside of lip of enclosure. Remove excess material if necessary. If bottom of insert is placed first, pushing bottom panel down should allow top of rear insert to snap easily into place.

5.20. Mount top panel insert with millboard insulation on lid of enclosure using 1/8" 6-32 screws.

5.21. Drill out two holes on latch strike using #17 drill bit. Mount strike latch. Mount strike latch on top of lid.

5.22. Mount lid on top of enclosure using 1/4" 10-32 truss head screws, placing a washer for each screw between lid flap and wall of enclosure as a spacer. This is a temporary mounting solution for proper alignment of enclosure latch. Try to adjust panel insert for ease of opening and closing lid onto box.

5.23. Hang latch from strike so that the latch action is half way. Mark both holes of latch in this position on enclosure wall (template is available for exact spacing of holes at this depth). Be sure latch is in middle of strike and will mount perpendicular to top lip of enclosure.

5.24. Center punch these holes and drill out using #17 drill bit.

5.25. Attach latch to outside of enclosure using 1/4" 6-32 screws, with K-lok nuts on the inside of enclosure and placing stainless steel plate between latch and enclosure wall. When opened, latch should meet strike and close down with reasonable tension to seal enclosure.

5.26. Tighten 4 screws holding lid onto enclosure, adjust as necessary to make lid open and close easily.

5.27. Place foam panels of side walls into enclosure. The fit should allow some excess material against front and back panels to ensure good insulation at the corners of the enclosure.

5.28. Place aluminum side inserts into box, angling front side (where heater studs lie on bottom panel) in first, aligning tab of side insert into slot of front insert. Push the other end of side insert toward wall, sliding minimally against back insert. Tab should snap into slot of back wall insert. Repeat for opposite insert.

5.29. Place 2 1/4-20 K-lok nuts on each heater mount stud on bottom panel of enclosure. Tighten the stand off nuts against panel.

5.30. Place heating element onto studs with terminal connections oriented closest to 115v receptacle. Fasten non-terminal end to stud using washer between heater and 1/4-20 K-lok nut.

5.31. Fit eyelet connection from ground on receptacle over other stud, placing washer below and on top of eyelet. Tighten a 1/4-20 K-lok nut onto stud, make sure complete connection is tight, and there is no damage to wires. The wire must not contact walls or heater.

5.32. Fasten one each high temperature fork to the end of remaining wires (two), and fit onto heating element terminals, using washers and nuts provided on element. Arrange all wires to eliminate contact with enclosure walls, other wires and **the heating element**. They should be neatly tucked away from center of box.

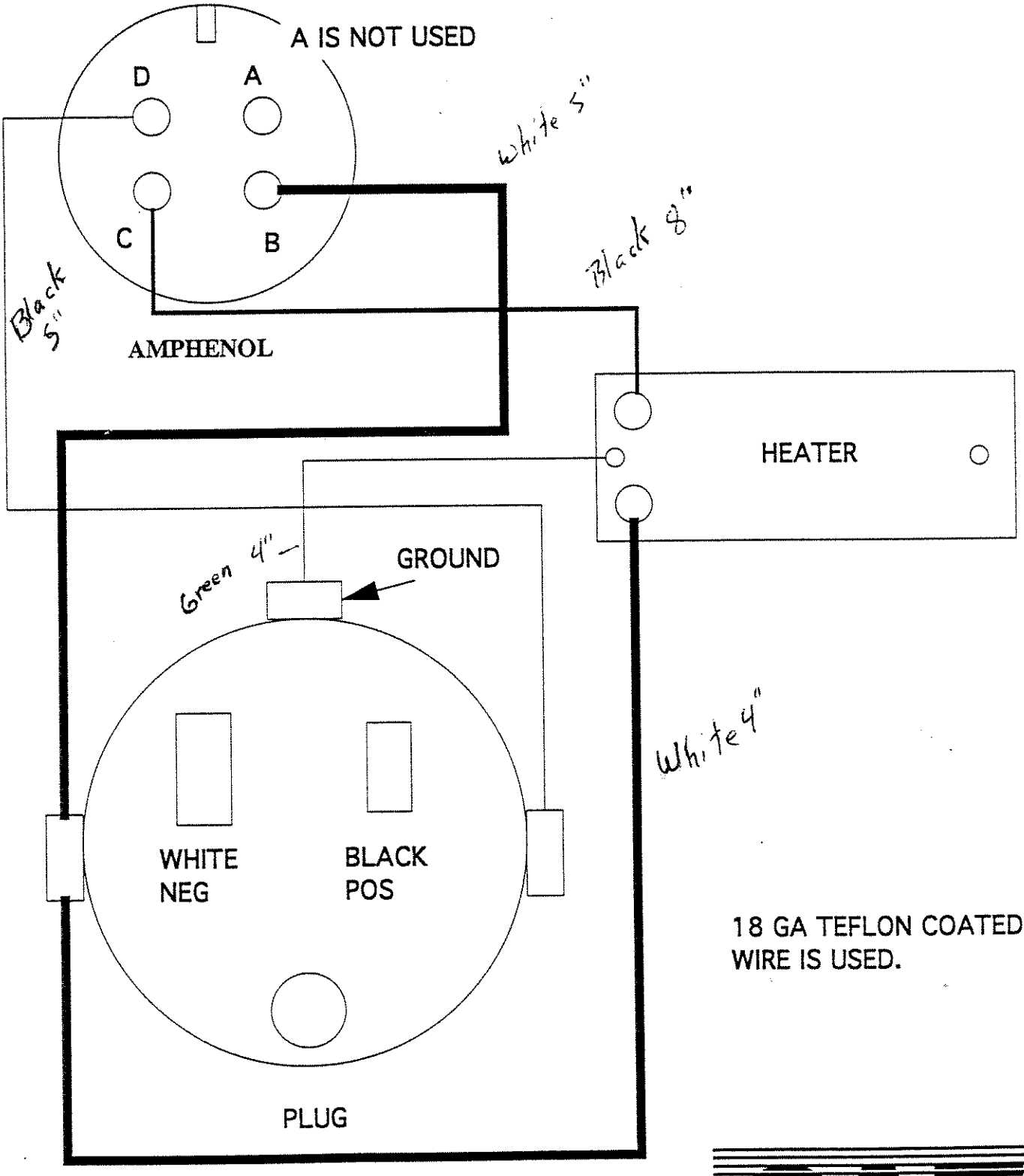
5.33. Place ceramic terminal covers onto each heater terminal and tighten to snug.

5.34. Place red amphenol cover back onto outside amphenol fitting to protect it.

5.35. Using a clean shop rag and some acetone or other cleaning solvent, wipe outside of box removing all dirt and marks.

5.36. Place completed unit in area for final checkout and inspection. Keep original work order with completed units.

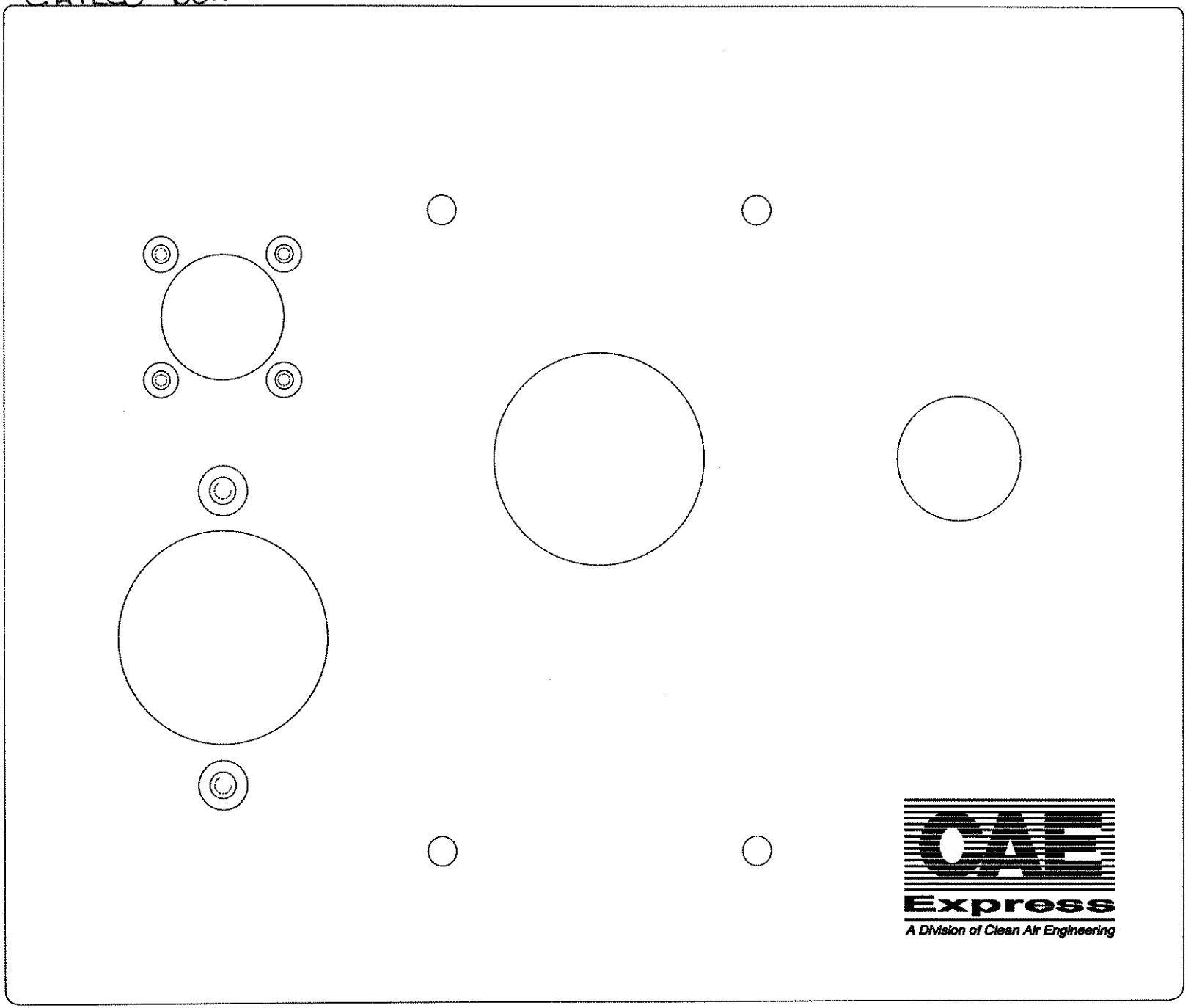
CATECO WIRING DIAGRAM



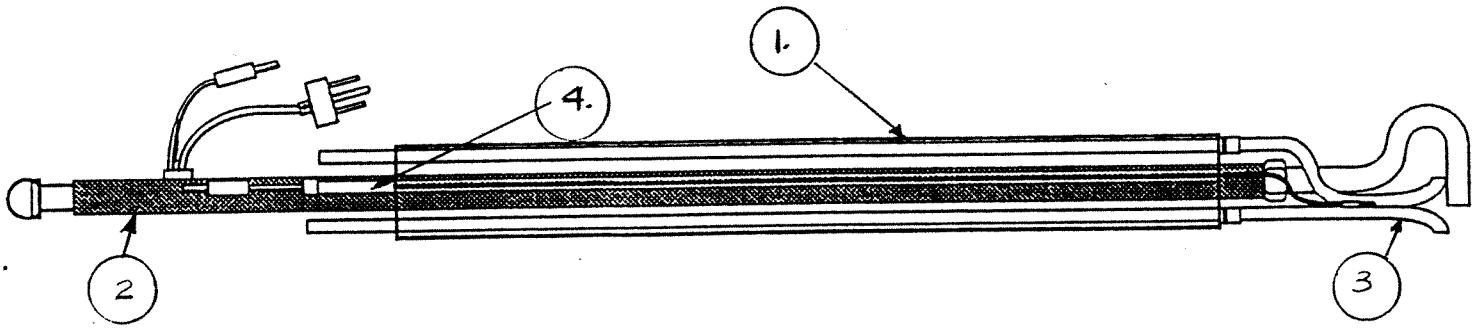
18 GA TEFLON COATED WIRE IS USED.

CAE Express
A Division of Clean Air Engineering

CATECO BOX



METHOD - 5 PROBE
STANDARD
MEASUREMENTS



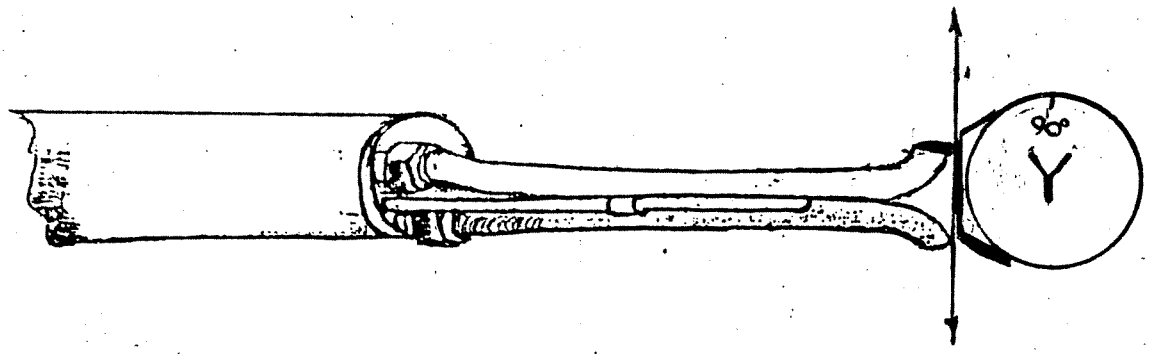
1. SHEATH	2 1" TUBE	3. PITOTS	4. SHEATH FOR THERM.
E.L -6 1/4"	E.L. + 9 3/4"	E.L. + 7"	E.L. -3 1/4"

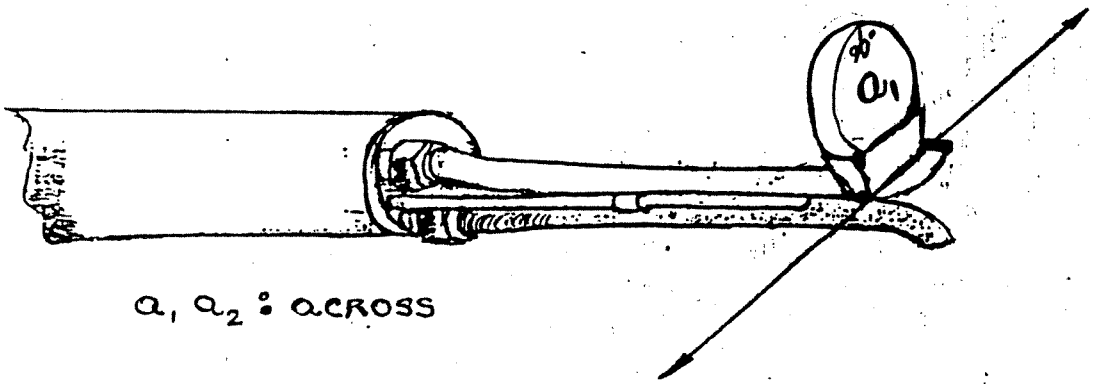
E.L.= EFFECTIVE LENGTH

LINER LENGTH= E.L. + 12"

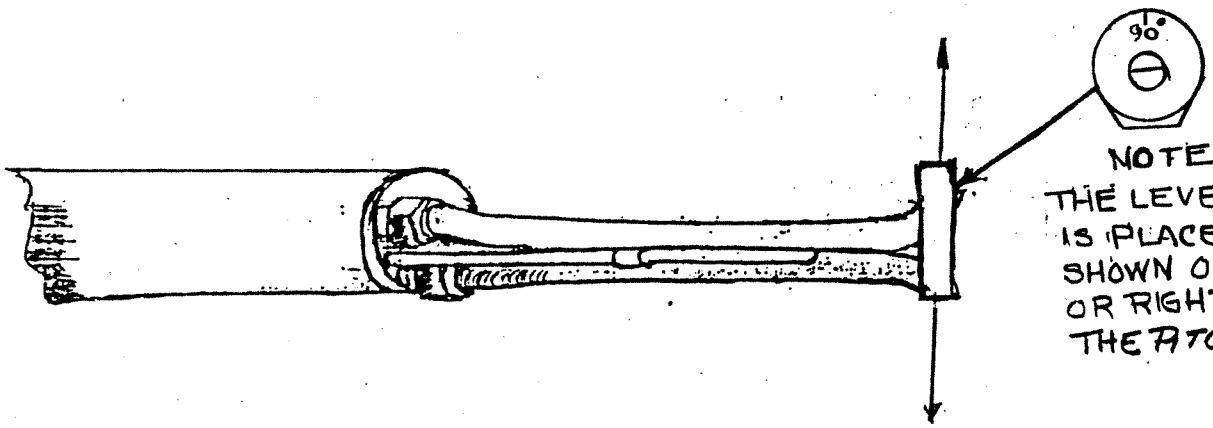
1. 1 1/4" SCH 5 T-304-SS PIPE 1 pc.
2. 1" OD x .035" W x T-304-SS TUBE 1 pc.
3. 1/4" OD x .035" W x T-304-SS TUBE 2 pcs.
4. 1/4" OD x .035" W x T-304-SS TUBE 1 pc.

PITOT TUBE LEVEL PLACEMENT FOR CALIBRATION

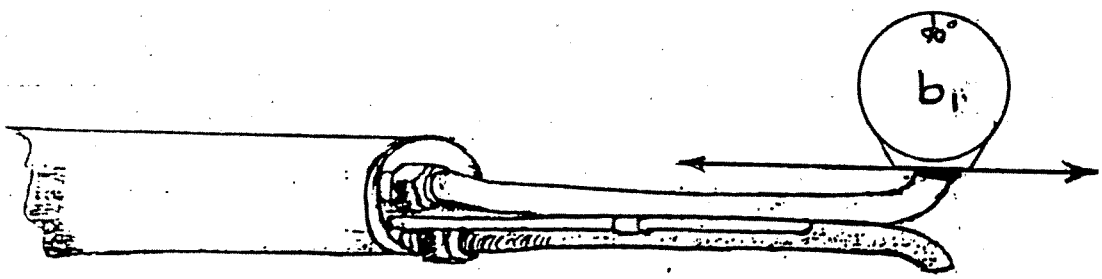




a_1, a_2 : ACROSS



NOTES
THE LEVEL FOR θ IS PLACED AS SHOWN ON THE LEFT OR RIGHT SIDE OF THE PITOT.



b_1, b_2 : BACK

Liner Thermocouple (031518) Assembly Procedure

1. PURPOSE:
To explain how to assemble a Liner Thermocouple.

2. SCOPE:
To be used by all personnel who assemble a Liner Thermocouple.

3. MATERIALS:
3.1. (1) 0316M Male K T/C Plug
3.2. (19") 0315G or 315T Glass or Teflon T/C Wire
3.3. (8") 9327 1/8 shrink tube
3.4. (1) 9944 Quick Tip

Tools along with Tech's shop tool box as follows:
3.5. Crimper for Quick Tip
3.6. Screw driver
3.7. Wire Strippers for teflon wire
3.8. Heat Shrink Gun

4. DEFINITIONS:

4.1. Pull Test: Give a slight tug on the wire to be sure it remains attached to the plug.

4.2. Quick Tip: Metal piece added to the end of T/C wire to form a circuit to obtain a temperature reading.

4.3. T/C: Thermocouple.

4.4. Terminal cover cap: The cap that covers the wiring screws in the T/C plug.

5. PROCEDURE:
5.1. Check the inventory items to be sure all material has been pulled for the work order. Shop floor items and inventory items are arranged by the technician. on a work bench.

5.2. Cut the glass or teflon wire to 19" for each of the liner T/C's. This starting length may be adjusted after practice, but the length needs to insure a length of 18" on the wire segment of the finished product.

5.3. Strip the outer sheath of the thermocouple wire at the end to be wired to the T/C plug 1/2", enough to give a good connection to the plug. Strip the inner red and yellow insulation about 1/4" from the end.

5.4. Remove the terminal cover cap on the thermocouple plug to be wired.

5.5. Wire the plug. The wire end should be hooked with needle-nose pliers to fit around the screw in the direction the screw is to be tightened. RED IS NEGATIVE. YELLOW IS POSITIVE. Tighten terminals securely and replace cap.

5.6. Make sure all three screws are tight on the thermocouple plug.

5.7. Look at the T/C wire and be sure no red or yellow wire is sticking out of the end of the plug. Give a slight tug on the wire to be sure it remains attached to the plug.

5.8. Slip a piece of 8" x 1/8" heat shrink over the attached thermocouple wire. The heat shrink should go into the back of the thermocouple plug to the point where the two wires are separated. Heat into place taking care not to burn or split the heat shrink.

5.9. Measure overall length of piece assembled to this point. Wire segment (without plug) should be trimmed to 18". Strip the unwired end of the plug the width of the Quick tip. (A razor works best to strip glass wire.) Place Quick tip onto exposed wires, making sure that quick tip butts against the outer sheath and no red or yellow insulation is seen between the two.

5.10. Crimp the Quick tip in place using the proper crimping tool. Be sure that both sides of the Quick tip are compressed by repeating the crimp

5.11. Check the completed liner T/C's to be sure that when a heat source is applied that they go up in temperature and register a temperature on a pyrometer. Gripping the quick tip between your fingers should be an adequate test. Do not use a torch to heat up the Quick tip, this will only melt the teflon or burn the glass wire.

5.12. The completed liner T/C should be 18" long + 1/2" from the end of the plug to the Quick Tip. (See figure 1.) No red or yellow wire should be seen after a second pull test.

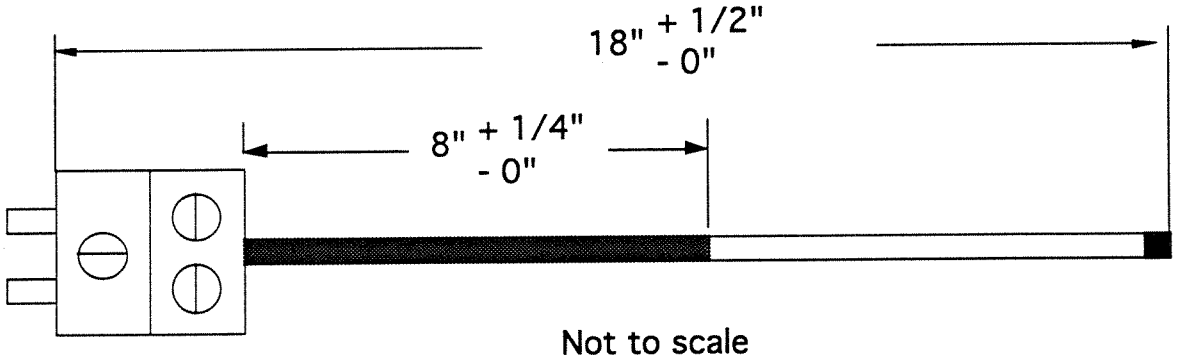


Figure 1

Manufacture Procedure For All 0151ØØ Probe Rod Kits

1. PURPOSE:
To explain how to assemble Probe Rod Kits.

2. SCOPE:
To be used by all personnel who assemble Probe Rod Kits.

3. MATERIALS:
Probe Rod Kit assembly components:
3.1. (1) 0155N Nylon Brush
3.2. (1) 10 -24" x 1" Full Thread Stud, measured end to end, 18-8 stainless steel
3.3. (1) Length of 0769250 Teflon 1/4" tubing that is 1.5 feet longer than the effective length of the Probe Rod Kit, E.g., A 5 foot probe rod kit will need 6.5 feet of 1/4" tubing.
3.4. (3) Small Tie Raps (4" or 6")
3.5. (1) Plastic Ziploc™ Sandwich Size Bag

Equipment Needed:
3.6. 10-24 Tap and Tap Handle
3.7. Parker Plastic Tubing Cutter
3.8. Tape Measure
3.9. Clean Rags
3.10. Compressed Air Line and Blow Gun
3.11. Vice to hold tubing
3.12. Black Marker

4. DEFINITIONS:
4.1. 0151ØØT : This number refers to the CAE Express part number of a Probe Rod Kit. Where 0151 is the probe rod kit number ØØ is a place holder that refers to the length of the probe rod kit. For example, if ØØ is relaced by 10, a ten foot probe kit should be made.

5. PROCEDURE:

5.1. The Probe Rod Kits will be assembled in an area where there is minimum dust. The Teflon tubing attracts dust and dirt. The dust and dirt will stick to the tubing. The Probe Rod is used to clean out probe liners and dirt and dust can have some effect on the test results.

5.2. Check the work order to see the size and number of probe rod kits that are to be built.

5.3. Use a tape measure to mark a work bench in foot increments. Mark one location at the beginning of the measurements with a 1.5 foot mark.

5.4. Measure out the correct length of tubing for the Probe Rod Kit.

5.5. Cut the tubing with the Parker Tubing Cutter. The cutter will give you a clean neat cut.

5.6. Hold the end of the tubing in the vice and use the 10-24 tap to tap 4-6 threads in each end of the tubing. Blow out the tubing after tapping to remove loose threads.

5.7. Thread one end of the 10-24 x 1" stud into the nylon brush until the stud bottoms out in the brush.

5.8. Thread the opposite end into one end of the threaded Teflon tubing until the tubing and brush meet.

5.9. Wipe the dust from the tubing while coiling the tubing to fit into the Ziploc™ sandwich size bag. A 4-6 inch coil will fit into the bag.

5.10. After the brush and tubing is coiled use three tie raps to secure the coil.

5.11. Use the air line to blow any remaining dust and debris from the probe rod.

5.12. Put the completed probe rod into a plastic sandwich size bag.

5.13. Seal the bag .

5.14. A black marker is used to label the bag with the effective length of the probe rod kit and the part number.

Manufacture Procedure For All 0151ØØT Probe Rod Kits

1. PURPOSE:
To explain how to assemble Probe Rod Kits for metals .

2. SCOPE:
To be used by all personnel who assemble Probe Rod Kits for metals.

3. MATERIALS:
Probe Rod Kit assembly components:
3.1. (1) 0155T Teflon Patch in a sealed bag
3.2. (1) Length of 0769250 Teflon 1/4" tubing that is 1.5 feet longer than the effective length of the Probe Rod Kit, E.g., A 5 foot probe rod kit will need 6.5 feet of 1/4" tubing.
3.3. (3) Small Tie Raps (4" or 6")
3.4. (1) Plastic Ziploc™ Sandwich Size Bag

Equipment Needed:
3.5. Pointed wooden dowel tool
3.6. Parker Plastic Tubing Cutter
3.7. 0155S Screw
3.8. Tape Measure
3.9. Clean Rags
3.10. Compressed Air Line and Blow Gun
3.11. Vice to hold tubing
3.12. Black Marker

4. DEFINITIONS:
4.1. 0151ØØT : This number refers to the CAE Express part number of a Probe Rod Kit. Where 0151 is the probe rod kit number ØØ is a place holder that refers to the length of the probe rod kit. For example, if ØØ is relaced by 10, a ten foot probe kit should be made. T stands for the teflon patch type .

5. PROCEDURE:

5.1. The Probe Rod Kits will be assembled in an area where there is minimum dust. The Teflon tubing attracts dust and dirt. The dust and dirt will stick to the tubing. The Probe Rod is used to clean out probe liners and dirt and dust can have some effect on the test results.

5.2. Check the work order to see the size and number of probe rod kits that are to be built.

5.3. Use a tape measure to mark a work bench in foot increments. Mark one location at the beginning of the measurements with a 1.5 foot mark.

5.4. Measure out the correct length of tubing for the Probe Rod Kit.

5.5. Cut the tubing with the Parker Tubing Cutter. The cutter will give you a clean neat cut.

5.6. Hold the end of the tubing in the vice and use the wooden dowel to open up one side of the tubing.

5.7. Thread a teflon screw into the end that was just opened. Use a nonmetalic instrument (Sharpened dowel that has been ain a nitric bath.)to help thread the teflon screw into the rod.

5.8. Wipe the dust from the tubing while coiling the tubing to fit into the Ziploc™ sandwich size bag. A 4-6 inch coil will fit into the bag.

5.9. After the tubing is coiled use three tie raps to secure the coil.

5.10. Use the air line to blow any remaining dust and debris from the probe rod.

5.11. Put the completed probe rod and the sealed teflon patch into a plastic sandwich size bag. The customer will attach the teflon patch unless the client requests that the patch be attached to the end of the tubing.

5.12. Seal the bag .

5.13. A black marker is used to label the bag with the effective length of the probe rod kit and the part number.

Manufacture Procedure For Teflon Patches 0155T

1. PURPOSE:
To explain how to assemble a Teflon patch.

2. SCOPE:
To be used by all personnel who assemble patches.

3. MATERIALS:
Patch Assembly Components:
3.1. (1) 0155T1 11" x 11" square of Teflon Material
3.2. (1) 0155S 10-32 x 1/2" Nylon Stud

Equipment Needed:
3.3. Paper cutter
3.4. Sharp scissors

4. PROCEDURE:

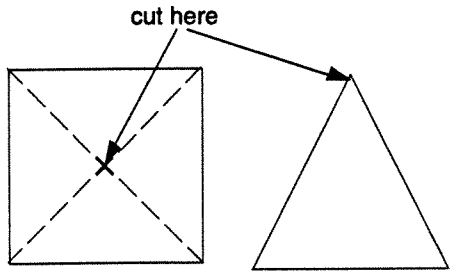
4.1. The Patches will be assembled in an area where there is minimum dust The office area or lab is preferred The patch is used to clean out probe liners and dirt and dust will have some effect on the test results.

4.2. Be sure your hand are clean and free of grease.

4.3. The 11" x 11" material will be cut into 1" x 1" squares. The paper cutter is used for this operation. The material will shift so it is important to cut the strips carefully. Cut 1" x 11" pieces (this can vary in length) from the material. Do not stack the strips to cut the strips into 1 inch pieces. They will tear. You can lay 3 -4 strips on the paper cutter next to each other to complete the square. Try to keep the squares as close to 1 inch as possible. Try to limit your waste. Don't worry if the pieces are not exactly 1" x 1" when the pieces are rotated on the stud they will fan out .

4.4. When the sheet is completely cut up start to assemble your patches.

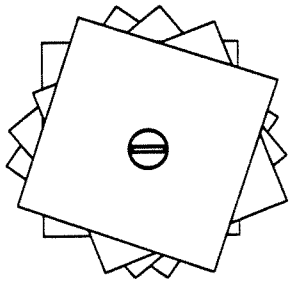
4.5. Fold the squares from corner to corner to make a triangle Use the scissors to cut a small piece from the tip of the triangle.



Fold on the dotted line

4.6. Thread 5 pieces onto the 10-32 x 1/2" Nylon Stud. Bigger pieces should be put on first. These bigger pieces should not be more than .150" greater than 1" on any side.

4.7. When five pieces have been screwed into place fan the pieces out so that they form a circle.



4.8. When all the patches are complete they need to go to the glass prep lab to be put in a nitric acid bath. This will remove any trace metals on the patch from the scissors and paper cutter. Follow the preparation procedure to remove any trace metals. This process takes approximately 4 hours.

4.9. Allow the patches to dry completely before storing

4.10. Store the patches in a clean covered container or plastic bag. A plastic container that glass tape comes in can be used.

Sample Pump(0728) Assembly Procedure

1. PURPOSE:
To explain how to assemble a sample pump.

2. SCOPE:
To be used by all personnel who assemble a sample pump.

3. MATERIALS:
All items listed on the assembly parts list.

3.1. Fasteners as follows:

3.2. (3) Red insulated spade connectors
3.3. (1) Blue insulated spade connector
3.4. (4) 8-32 K-lock nuts
3.5. (4) 8-32 x 3/8" S.S. Truss head screws for mounting P.C. bracket
3.6. (3) 8-32 x 3/8" S.S. Truss head screws for pump
3.7. (5) 8-32 x 1/2" S.S. Truss head screw for 1/4" cable tie down
3.8. (1) 1/4" Cable Tie down for power cord
3.9. (1) Yellow barrel connector

3.10. Tools along with Tech's shop tool box as follows:

3.11. Center punch
3.12. Drill bit # 21
3.13. Foam work pad to protect item from scratches while being assembled
3.14. Hammer
3.15. Rosin Core Solder (Kester type .031 dia. or similar product)
3.16. Screw drivers
3.17. Soldering iron
3.18. Vice Grip type pliers
3.19. Wire Strippers

4. PROCEDURES:

4.1. Installing the Power Cord Bracket and Cord:

4.1.1. Install the feet in case with 8-32 x 1/2" S.S. Screws and K-lock nuts

4.1.2. Position power cord bracket with hole facing top of case.

4.1.3. Position Power Cord bracket in the Bud Box (9930) and mark mounting holes.

4.1.4. Center punch holes so that dimple can be seen on outside of case. Center punch dimple on outside of case and drill with a #21 drill bit. Deburr the holes.

4.1.5. Insert the cord (9109) into the strain relief (9110SR) so 2 ft. is inside the enclosure facing toward the face plate. The remainder of the cord (5 ft.)goes out the back of the box.

4.1.6. Install Power Cord Bracket into box with 8-32 x 3/8" Truss head screws and 8-32 K-locks. These screws are to replace the self tapping screws that come with the box.

4.2. Face Plate Assembly (NOTE: ONLY TRUSS HEAD SCREWS SHOULD BE USED ON OUTSIDE OF ENCLOSURE.)

4.2.1. Install Power Switch into face plate. Make sure switch is in proper position and tighten.

4.2.2. Install (2) S.S. Bulkhead Fittings (0742 and 9212) into intake and exhaust holes and tighten.

4.2.3. Install 5 amp circuit breaker making sure it is seated properly.

4.2.4. Install Small Red Light (9105) and tighten down.

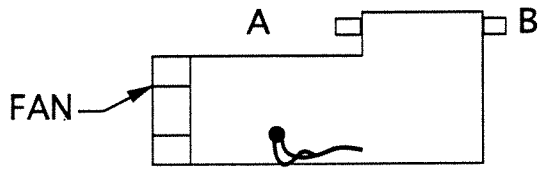
4.2.5. Prior to installation of the flow gauge (0756) the two S.S. 1/4" to 1/8" NPT SS fittings should be mounted onto the flow meter. Use the mounting screws and brackets to attach the flow gauge to the unions.

4.2.6. Drill a through hole for a 8-32 screw (#21 drill bit) into face plate, 5 3/4" down from top and 1 5/8" in from left side. (Hole to be used for mounting a cable tie down for power cord.)

4.2.7. Install S.S. Elbows (07281 and 0744M) on pump with Teflon tape. Insert approx. 20" of 1/4" Teflon tubing into each elbow and tighten down ferrule.

4.3. Mounting of Pump Inside of Box:

4.3.1. Remove the four screws from the pump (9949) turn the pump head around and reinstall the pump head. This will allow the wiring to face the front of the box. A is toward the fan end and B is closest to the edge of the pump.



4.3.2. The power cord bracket should be installed into the enclosure at this point. Place the pump mounting template against the front edge of the cord bracket along the bottom of the enclosure with the two-holed end on the right side. Make sure pump is in correct position that it will be when mounted on inside of box. The wires should face the face plate in the final mounting position

4.3.3. Center punch all three holes without moving the template at all. Dimples should show on the outside of the enclosure.

4.3.4. Flip the box over and center punch each of the dimples created from inside the enclosure. Drill holes in each of these marks using a #21 drill bit. Holes should line up perfectly with pump feet. Do not drill out the holes in the pump feet.

4.3.5. Mount pump inside of box. The 8-32 x 1/2" screws should be threaded into the feet so that the screw heads are on the outside of the box. (Make sure 20" of Teflon tubing is attached to elbow fittings on the pump head and tightened before installation. Step 4.2.7). Install the pump in the box so that the pump head faces the right side of the box with the power wires in front of the pump toward the face plate. (see the figure in sec 4.3.2)

4.4. Wiring (Note: Wire lengths should be cut for a good neat fit.)

4.4.1. Strip the power cord casing to leave 6" of wire exposed.

4.4.2. Mount Power Cord to a 5/16" cable clamp on face plate leaving approx. 6" of wire exposed. Green wire from power cord is ground. Attach the ground to the cable clamp screw on face plate with #8 ring terminal between two K-lock nuts.

4.4.3. Brown wire is hot. Attach the brown wire to the off-side of power switch (9103) with an insulated spade pin.

4.4.4. Attach a black wire to the on-side of switch and jump this to the circuit breaker (9118).

4.4.5. Attach the circuit breaker (either pole) using large insulated spade pin (Blue) with a second piece of black wire which jumps to red light.

4.4.6. Solder to light post and cover with heat shrink.

4.4.7. The blue wire is neutral. Attach the blue wire to a barrel connector. On the opposite side of the barrel connector install one of the wires from the pump and add another piece of white wire to jump to light.

4.4.8. Crimp wires into barrel connector.

4.4.9. Solder white jumper wire to light pole and cover with heat shrink.

4.4.10. The second pump wire goes to opposite pole on circuit breaker. Wire tie the wires neatly.

4.5. Plumbing

4.5.1. Mount the filter (0756) into the back of the intake bulkhead with the arrow on the filter pointing away from the faceplate.

4.5.2. Fix a 1/4" union (S.S.) to the other end of the filter, and attach the 20" piece of teflon from port "B" of the pump to this.

4.5.3. Tighten all the fittings carefully. New fittings should be turned 1 and 1/4 turns past snug.

4.5.4. Attach 20" piece of teflon from port "A" of the pump to bottom of flow gauge.

4.5.5. Use a small piece of Teflon tubing (8-10") to jump exhaust bulkhead to top of flow gauge.

4.6. Leak Check

4.6.1. Before closing up the front panel a leak check is required.

4.6.2. Plug in the power cord and turn on power . The pump should run and the light switch should light..

4.6.3. Open the flow gauge to complete the air flow circuit.

4.6.4. While pump is running, plug off intake until ball on flow gauge is at zero.

4.6.5. Hold for 1 minute. The ball should not move.

4.6.6. If the leak check is good, turn off power and insert face place into box. Use screws provided with case to close.

PROCEDURE FOR MAINTENANCE OF ISOKINETIC CONTROL CONSOLE PUMP MOTORS *(METER BOX PUMP MOTORS)*

5.1.1 PURPOSE: To detail the proper maintenance of the rotary pump and assembly for a meter box. The rotary pump is a precision product. With regular inspection and maintenance the pump will perform for years.

5.1.2 SCOPE: Service of the meter box pump by equipment personnel.

5.1.3 MATERIALS:

1. Gast Model #0523-V36 G582DX 1/3 HP motor
2. Nonflammable flushing solvent.
3. Lubricating Oil (SAE #10 for ambient below 100° F. SAE #20 for ambient above 100° F.)
4. A 3/8 inch socket
5. A 3/16 inch hex key wrench.
6. Brass hammer
7. Spark gap feeler gage or .002 shim stock
8. Teflon tape.
9. Clean rags.
10. Replacement parts as needed.

5.1.4 DEFINITIONS:

1. Body: See figure 5.1 Metal plate that is attached to the front of the motor with 2 1/4-20 socket cap screws.

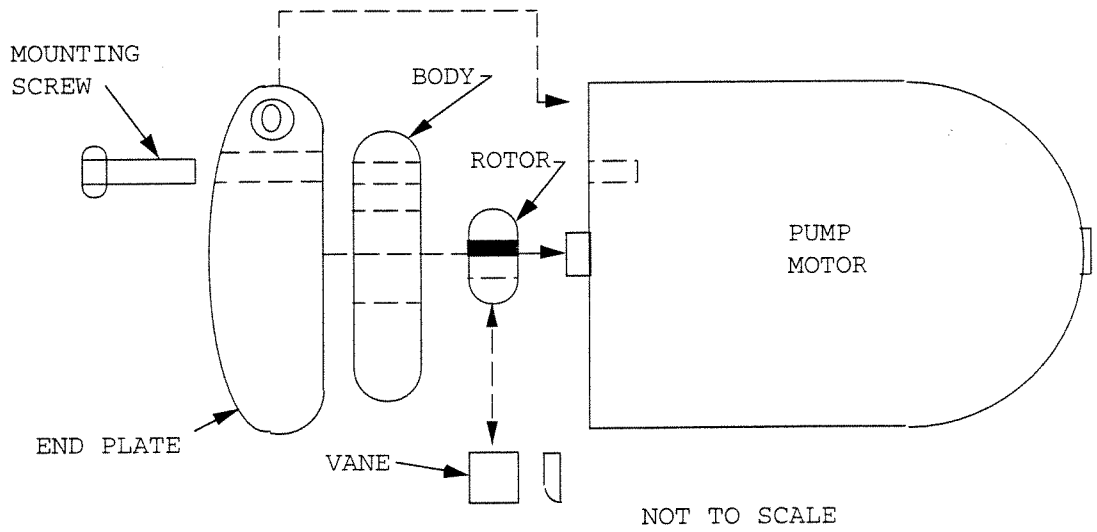


fig 5.1

5.1.4 DEFINITIONS CONT.:

2. End Plate: See figure 5.1. Metal plate that is attached to the end of the pump motor, with 6 Indented Hex Washer 1/4-20 screws.
3. Fittings: Plumbing used to connect the inlet and outlet jars to the body.
4. Intake Filter Assembly: Jar that is attached to the inlet side of the pump. The assembly consists of a felt filter, oil wick, cover gasket, attachment bracket,brass elbow and motor oil.
6. Muffler Assembly: Jar that is attached to the outlet side of the pump. The assembly consists of a felt filter, cover gasket, attachment bracket and arm.
7. Rotor: See figure 5.1 Metal piece that rotates with the 4 vanes.
8. Testing: The period of time that an isokinetic unit is out in the field
9. Shim stock: Thin metal material used to space the rotor.
10. Free moving piece of molded fiber. When the vane is rotated about the rotor, it causes the vacuum action of the pump.

5.1.5 GENERAL:

1. Section 5.1.6 will cover preventive maintenance and six (6) month maintenance of the pump.

5.1.6 PROCEDURE:

1. Little maintenance is needed to keep the Gast pump in working order. Periodic checks of the oil and muffler jars are mandatory.

2. PREVENTIVE MAINTENANCE :

When testing is complete and the meter returns to the maintenance area, the pump will be flushed with nonflammable flushing solvent. **WARNING: DO NOT USE KEROSENE, GASOLINE OR ANY OTHER FLAMMABLE LIQUID TO FLUSH THE PUMP.** Harmful vapors and combustible liquids can result in personnel injury or damage to the meter box pump.

2.1 Remove the pump cover.
2.2 Loosen the oiler jar and remove.
2.3 Remove the felt filter and wick.
2.4 Connect the outlet hose to a waste container.
2.5 Tip the pump on its side.
2.6 While the pump is running squirt flushing solvent into the hole in the inlet jar's cap.
2.7 Let the pump run from 1 to 3 minutes or until an inch of dirty flushing liquid accumulates in the muffler jar. Empty the jar.
2.8 Squirt a small amount of clean pump oil into the opening after the cleaning. Run the pump to circulate the new oil and allow traces of the flushing liquid to evaporate.
2.9 Clean the oil wick and felt filter. Be sure the wick is bent slightly. The wick will be pointed in the direction of the arrow, which is on the top of the oil bracket.
2.10 Check and replace cover gasket as needed.
2.11 Fill the jar to the oil line with the clean appropriate oil. To ensure a good seal put a layer of Teflon tape around the threads on the jar. Put the intake filter assembly jar back on the pump.
2.12 Empty and clean the muffler assembly jar.
2.13 Check and replace cover gasket as needed.

2.14 Clean or replace the muffler filter and jar. To ensure a good seal put a layer of Teflon tape around the threads on the jar.
2.15 Replace the pump cover.

3. A thorough cleaning of the pump is recommended every six (6) months or if one of the following conditions exist:
   1. Foreign matter has entered the pump.
   2. The Muffler jar has 1/4 inch of black material on the bottom of the jar.
   3. The Oiler jar's hole is plugged.
   4. The Pump is not drawing a vacuum or has stalled.
   5. The Felt Filters have become dirty or clogged.
   6. The tapping of the vanes can be heard.

4. SIX (6) MONTH MAINTENANCE :
Every 6 months a thorough cleaning of the pump is recommended. The pump will be flushed with nonflammable flushing solvent. **WARNING: DO NOT USE KEROSENE, GASOLINE OR ANY OTHER FLAMMABLE LIQUID TO FLUSH THE PUMP.** Harmful vapors and combustible liquids can result in personnel injury or damage to the meter box pump
4.1 Remove the pump cover.
4.2 Loosen the oiler jar and remove.
4.3 Remove the felt filter and wick.
4.4 Connect the outlet hose to a waste container.
4.5 Tip the pump on its side.
4.6 While the pump is running squirt flushing solvent into the hole in the inlet jar's cap.
4.7 Let the pump run from 1 to 3 minutes or until an inch of dirty flushing liquid accumulates in the muffler jar. Empty the jar and clean the filter.
4.8 Remove the 6 Indented Hex Washer 1/4-20 screws.
4.9 Clean the End Plate.
4.10 Remove the two 1/4-20 socket cap screws and take off the Pump Body and clean.
4.11 Examine the parts for wear and damage and replace as needed.
4.12 Slide the vanes out of the rotor and clean and replace as needed. If replacement of (1) one vane is necessary it is recommended that all (4) four vanes be replaced.
4.13 When the End Plate, Body, and Rotor are clean or replaced a thin film of oil is placed on the parts before assembling and gapping the rotor.
4.14 Reinsert the vanes. Take care to position the vanes properly. The curved edge of the vane will be placed to match the curve of the rotor.

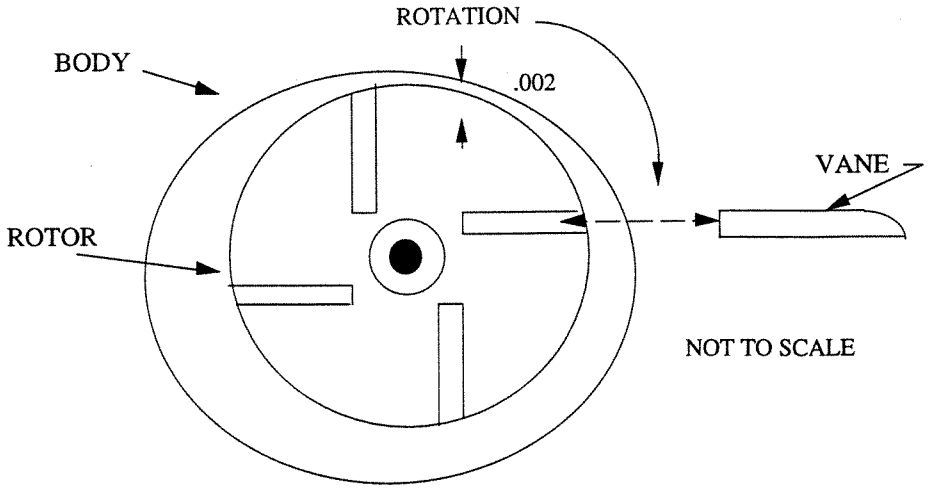


FIG 5.2

4.15 Proper gapping of the rotor is necessary .
- .1 To gap the rotor place the body over the rotor tighten the socket cap screws to allow the body to be moved with light taps from a brass hammer.
- .2 Adjust the gap by placing a .002 shim between the rotor and body tighten the socket cap screws
- .3 Turn the rotor to be sure clearance is uniform. Clearance may vary from.0025 to .0035 inch. Adjustments may be made by tapping and loosening the body as necessary.

4.16 Put the lightly oiled Body back on the pump motor and tighten the 6 Indented Hex Washer 1/4-20 screws.

4.17 Inspect and check inlet and outlet fittings replace Teflon tape as needed.

4.18 Squirt a small amount of clean pump oil into the opening of the jar bracket. No holes will be plugged.

4.19 Clean or replace the oil wick and felt filter. The wick is bent slightly at approximately 3/8 of an inch. The wick will be pointed in the direction of the arrow on the top of the oil bracket, as it is inserted into the hole, in the cap.

4.20 Check and replace cover gasket as needed.

4.21 Fill the jar to the oil line with the appropriate oil. To ensure a good seal put a layer of Teflon tape around the threads on the jar. Put the assembly back on the pump.

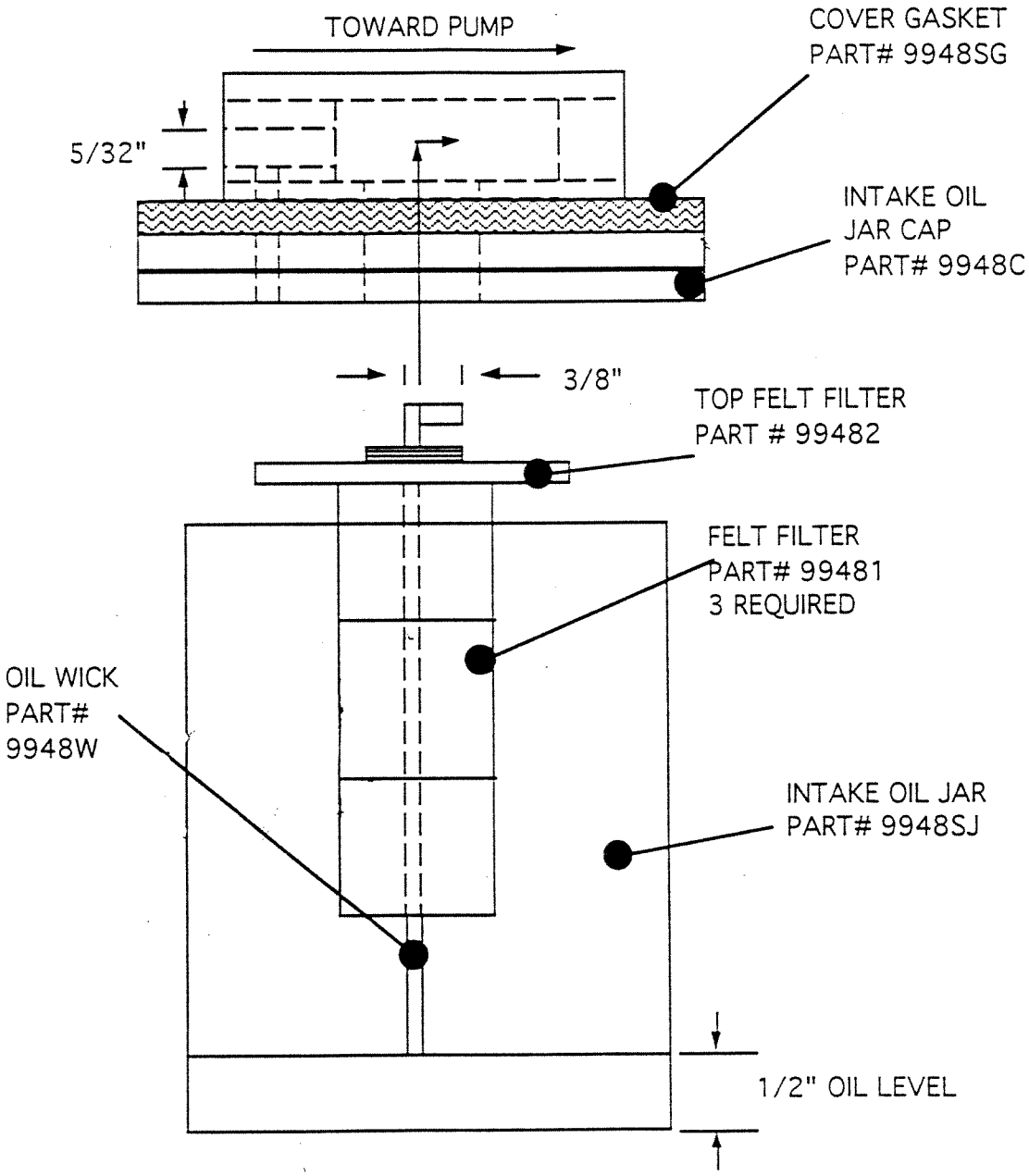
4.22 Check and replace cover gasket as needed.

4.23 Let the pump run to allow any traces of flushing solvent to evaporate.

4.24 Clean or replace the muffler filter and jar. To ensure a good seal put a layer of Teflon tape around the threads on the jar. Put the assembly back on the pump.

4.25 Replace the pump cover.

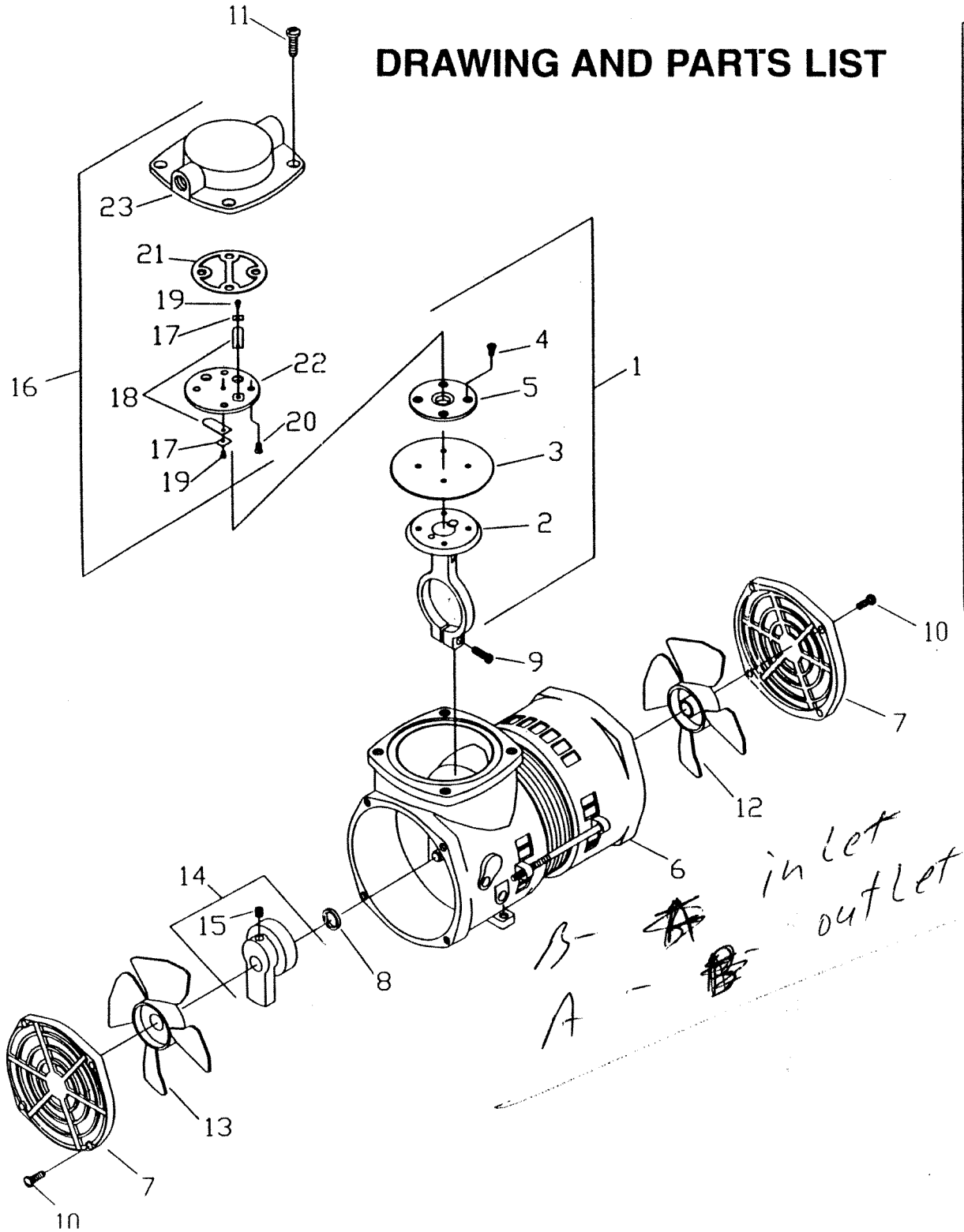
INTAKE FILTER JAR



PART NUMBER FOR THE COMPLETE ASSEMBLY 99370

NOT TO SCALE

DRAWING AND PARTS LIST



Item	Part No.	Component No.	Description	Qty.
1	607182		Connecting Rod Assembly	1
2		607139	Connecting Rod	1
3		608169	Diaphragm	1
4		625540	Screw - Hold Down Plate	4
5		654651	Diaphragm Hold Down Plate	1
6	614425-504		Motor End Cap Assembly	1
7	614609		Vented Cover - Front & Rear	2
8	615403		Spacer - Eccentric	1
9	625114		Connecting Rod Screw	1
10	625266		Front Cover Screw	8
11	625444		Head Screw	4
12	633544		Fan - CW Natural	1
13	633545		Fan - CCW Gray	1
14	645373		Eccentric & Bearing Assembly	1
15		625244	Eccentric Set Screw	1
16	660795-504		Head & Valve Plate Assembly	1
17		617045	Valve Keeper Strip	2
18		621102	Valve Flapper	2
19		625160	Valve Flapper Screw	2
20		625606	Screw - Valve Plate	4
21		633439	Valve Plate Gasket	1
22		654356	Valve Plate	1
23		660248-504	Head	1

Ecc. Ass'y. No.	Eccent. No.	Brg. No.	Str.
645684	645410	646069	.050
645599	645354	646069	.110
645298	645214	646069	.140
645372	645215	646069	.160
645373	645216	646069	.180
645374	645217	646069	.200

Model No.	Stator No.	Voltage
107 CAB	608102	115/60
107 CB	608152	115/50
107 CD	608107	230/50
107 CA	608113	115/60

First Name in Innovation

THOMAS®

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COMPRESSORS & VACUUM PUMPS

MODEL NUMBERS:

107CBTFE 107CATFE 107CABTFEL 107CDTFE 107CDTFEL

Read and understand the following information and instructions included with this product before using. This information is for your safety and to prevent damage to this product.

⚠ CAUTION: To reduce risk of electrical shock . . .

1. Do not disassemble. Disassembly or attempted repairs if accomplished incorrectly can create electrical shock hazard. Refer servicing to qualified service agencies only.
2. If this plug is supplied with a three pronged plug, connect unit to a properly grounded outlet only.

⚠ WARNING: To reduce risk of electrocution . . .

1. This product should never be left unattended when plugged in.
2. Always unplug this product immediately after using and store in dry place.
3. Do not use this product in or near area where it can fall or be pulled into water or other liquids.
4. Do not reach for this product if it has fallen into liquid. Unplug immediately.
5. Never operate this product outdoors in the rain or in a wet area.

⚠ DANGER: To reduce risk of explosion or fire . . .

1. Do not use this product in or near explosive atmospheres or where aerosol (spray) products are being used.
2. Do not pump anything other than atmospheric air.
3. Do not pump combustible liquids or vapors with this product or use in or near an area where flammable or explosive liquids or vapors may exist.
4. Do not use this product near flames.

⚠ CAUTION: To prevent injury . . .

1. Close supervision is necessary when this product is used near children or invalids. Never allow children to operate the unit.
2. Never operate this product if it has a damaged cord or plug. If it is not working properly. If it has been dropped or damaged. Or if it has fallen into water, return the product to a service center for examination and repair.
3. Keep the cord away from heated surfaces.
4. Never block any air openings (inlet) of this product or place it on a soft surface where the openings may be blocked. Keep all air openings free of lint, dirt and other foreign objects.
5. Never use while sleeping or drowsy.
6. Never drop or insert fingers or any other object into any openings.
7. Do not operate this product where oxygen is being administered.
8. This unit may be thermally protected and can automatically restart when the protector resets. Always disconnect power source before servicing.
9. Wear safety glasses or goggles when operating this product.
10. Use only in well ventilated areas.
11. Do not use any tools or attachments without first determining maximum air pressure for that tool or attachment.
12. Never point any air nozzle or air sprayer toward another person or any part of the body.
13. All electrical products generate heat. To avoid serious burns never touch unit during or immediately after operation.

Failure to observe the above safety precautions could result in severe bodily injury, including death in extreme cases.

SAVE THESE INSTRUCTIONS

⚠ Warning: Thomas compressors are precision-made, and carefully assembled and wired. Therefore do not disassemble or attempt to repair these products. Only qualified personnel should perform repair service. ⚠

IMPORTANT NOTICE TO PURCHASER: WARRANTY AND EXCLUSIVE REMEDIES

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Because Thomas OEM warranties and remedies extend only to our direct customers, the customer is not authorized to extend warranties on our behalf to anyone. Unauthorized extensions of warranties by the customer shall remain customer's responsibility.

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Form No. 636625 Rev. M 7/95

dgm outlet -Female

dgmout -male

T/C connections

#1 - AUX
#2 - Stack
#3 - dgm Inlet
#4 - dgm outlet
#5 - Imp outlet
#6 - Ambient

PROBE cont

0 0 0 0 0 0 0 0
1 2 3 4 5 6 7 8
20 19 7 23-1

FILTER cont

0 0 0 0 0 0 0 0
1 2 3 4 5 6 7 8
22 21 8 24-1

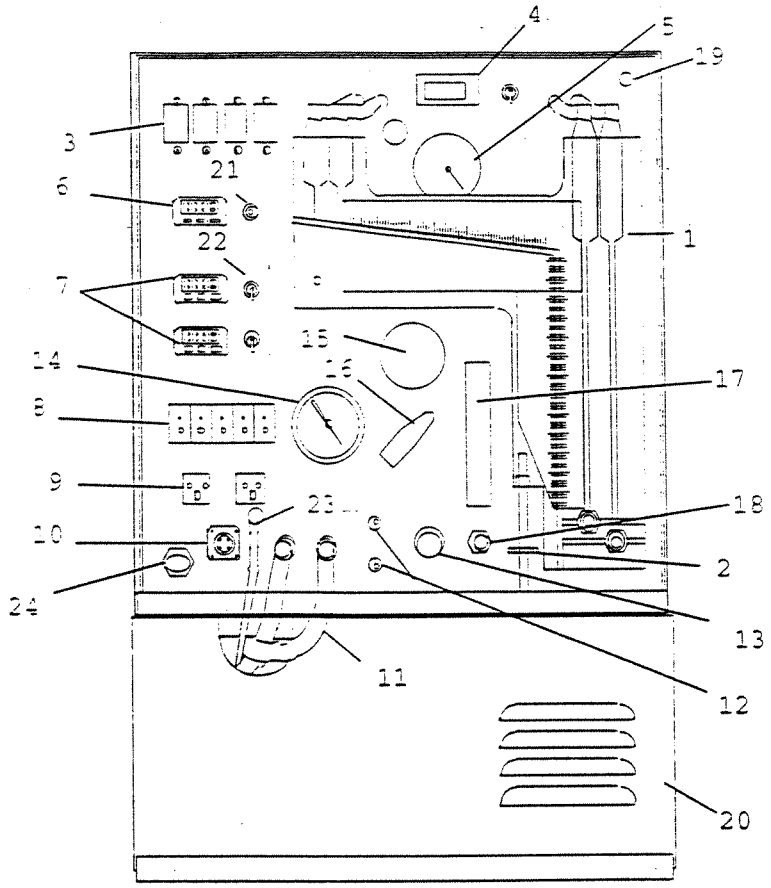
MAIN cont

0 0 0 0 0 0 0 0
1 2 3 4 5 6 7 8
6 25

PUMP 10 AMP C/B
VALVES NO C/B
LEAK CHECK NO C/B
TIMER
TEMP INDICATOR
S.S.R. FILTER
FILTER CONT.
T/C RECP FILTER
S.S.R. PROBE
PROBE CONT.
T/C RECP PROBE
SV-1
SV-2
SV-3
T/C RECP AUX.
T/C RECP STACK
T/C PLUG DGM INLET
T/C PLUG DGM OUTLET
T/C RECP IMP. OUT
AMBIENT TEMP T/C
PUMP
AUX.
110V/AC
POWER 15 AMP 220V/AC
DOUBLE POLE C/B

DIM. & TOL PER ANSI Y 14.5 DIMENSIONS ARE IN INCHES TOLERANCES ARE: DECIMALS .XXX ± .010 .XX ± .03 .X ± .08 ANGLES ± 1/2° SURFACES DA@.005 TR	PART NO. DOUBLE POLE 110		CAE EXPRESS 212 N. WOODWORK LN PALATINE IL. 60067
	APPROVALS	DATE	CAE Express M-5 Meter Box 110 V/AC WIRING DIAGRAM
	DRAWEN R.R.	10/17/95	
MATERIAL	DRAWEN		SIZE GCAD DWG NO. C:\CADD6.1\GCD\ M-5\DBL110 REV
FINISH	ISSUED		SCALE NONE

ISOKINETIC CONSOLE



1.	DUAL 8" INCLINE MANOMETER	part#SSE 0058-8
2.	MANOMETER LEVELING WHEEL	part#NA
3.	SWITCHES 30 AMP	part#MFG 9135
3.	SWITCHES 15 AMP	part#MFG 9134
3.	SWITCHES 10 AMP	part#MFG 9136
4.	MINI-SEC TIMER	part#MFG 9133
5.	DRY GAS METER INDEX	part#NA
6.	6 CHANNEL TEMPERTURE INDICATOR	part#MFG 9130-1
7.	TEMPERATURE CONTROLLER PROBE	part#MFG 9130-1
	TEMPERATURE CONTROLLER FILTER	part#MFG 9130-1
8.	THERMOCOUPLE PLUG INPUT BANK	part#SSE 0316-PM-SI
9.	POWER CONNECTIONS	part#MFG 9141
10.	UMBILICAL AMPHENOL CONNECTIONS	part#MFG 9418
11.	VACUUM PUMP CONNECTIONS	part#MFG 9507
12.	PITOT TUBE CONNECTIONS	part#MFG 9518
13.	UMBILICAL CONNECTIONS	part#MFG 9501
14.	VACUUM GAUGE	part#SSE.0017
15.	FINE CONTROL ADJUSTMENT VALVE	part#MFG 9938-1
16.	COARSE CONTROL ADJUSTMENT VALVE	part#MFG 9939-1
17.	IGS ROTOMETER	part#CEM 0757-.1
18.	IGS SAMPLE CONNECTION	part#NA
19.	FLOW CLAMP(POSITIVE LEAK CHECK TUBE)	part#MFG 9952
20.	VACUUM PUMP ASSEMBLY	part#WIP 0028
21.	6 POSITION SWITCH	part#MFG 9444-DBL-6
	SWITCH KNOB	part#MFG 9180
22.	15 AMP SWITCH	part#MFG 9103-1
23.	PUMP POWER CORD	part#MFG 9109
24.	POWER CORD	part#MFG 9110

FINAL CHECK LIST FOR METERS

Meter Box Serial No_____ Dry Gas Meter Serial No._____
Date Assembled_____ Checked By:_____
Client_____ Date Shipped:_____

____7. Final Electrical Check Controllers Continued.

_____F. Lock out the temperature controller
- ___1. Press the 2 up and down controls until *AUT* appears
- ___2. Press the left key until *CnF9* appears
- ___3. Press the set button and hold. No will appear.
- ___4. Press the up and set button at the same time until yes appears. Release.
- ___5. Run through the menu key until TAG appears
- ___6. Press set button and hold. a blank screen will appear.
- ___7. Press the right key PCOA will appear. This locks out all the parameters
- ___8. Press the right key again and PCO will appear this locks out all the parameters but autotune.
- ___9. Release keys TAG will appear
- ___10. Press the 2 up and down controls until temperature or ER 4 appears.
- ___11. The probe and filter indicator are now locked out.

____8 Ready the Meter For Shipment

_____A. Check the pump and meter box serial tag they should match . Place the serial no. from the pump inspection bag in the back of the meter just in front of the pump handle

_____B. Refer to figure 1 in the Manual that will go with the meter box for the items listed below if you are not familiar with the parts.

_____C. Check the manual and be sure it is the correct one for the meter.

_____D. Enter the serial no. of the meter and dry gas meter in the front cover of the manual

_____E. Enter the serial no. on the Meter Box Serial No. List. Fill in all the info on this sheet.

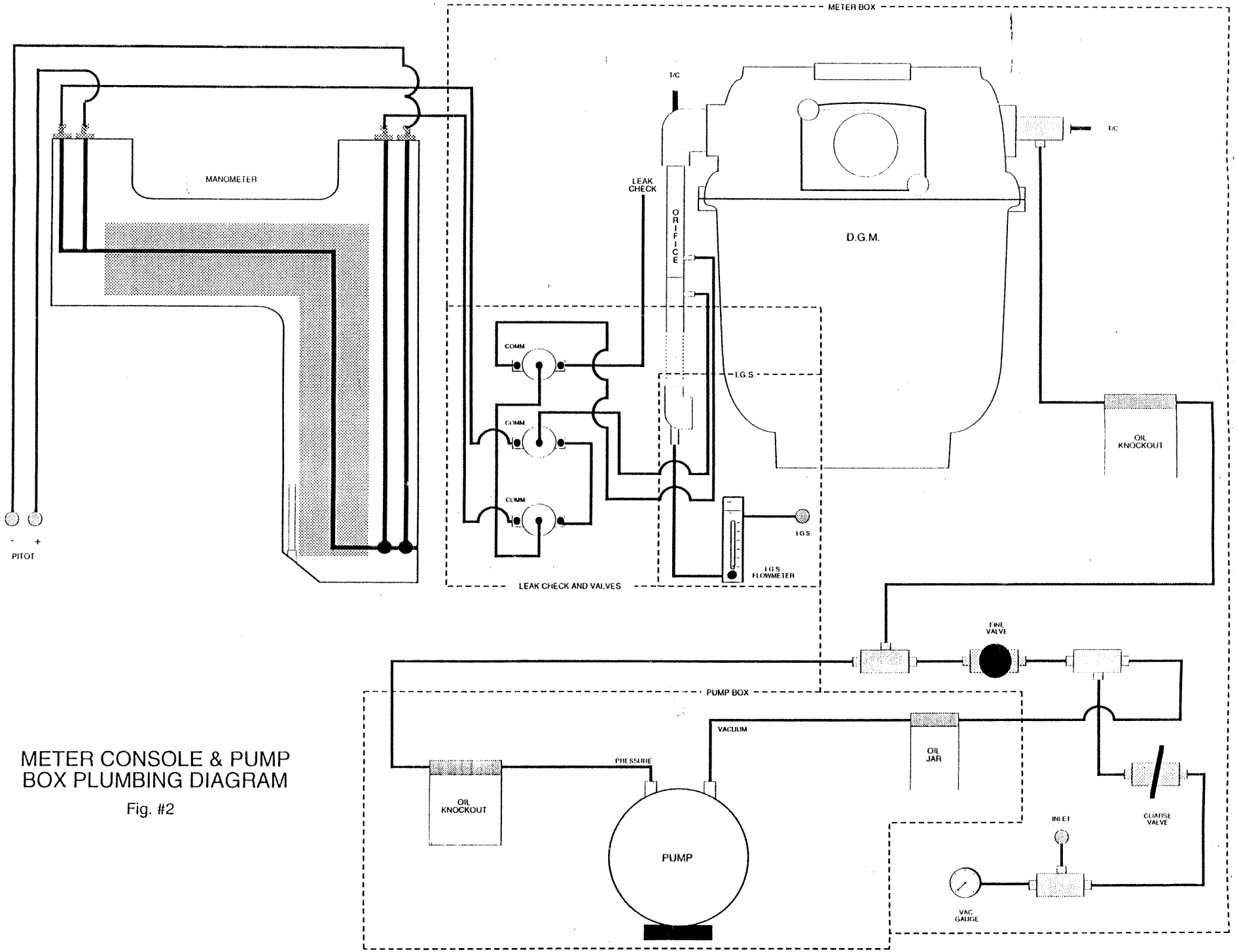
_____F. Set all the rocker switches(item 3) on the meter to the off position.

_____G. Turn the course control valve (item 16) to the closed position

_____H. Disconnect the vacuum pump connections (items 24 and 11) from the meter control console; pump power cord, pump pressure and vacuum lines

_____I. Disconnect the male manometer quick connect fittings (item 25). This prevents the gauge oil from leaving the manometer. Use bubble bags to wrap 2 connections per bag.

_____J. Remove any unused oil from the intake filter assembly oil jar. Pour this into a 60 ml polyethylene bottle. Fill the bottle the rest oil the way with **10 weight oil** Put the lid on the bottle and tape it shut. Use electrical tape. Put this oil in a bubble wrap bag along with 1 red and 1 orange oil. Place this in the pump compartment.



METER CONSOLE & PUMP BOX PLUMBING DIAGRAM

Fig. #2

Method 5 Meter Box #0028 Face Plate Assembly

1. **PURPOSE**: To explain how to assemble Method 5 Meter Box Face Plate

2. **SCOPE**: To be used by all assembly personnel.

3. **MATERIALS**:

All items listed on the assembly parts list (pick list generated by the business leader).

FASTENERS:

3.1. Pan Head 8-32 x 1/4 screws
3.2. Truss Head 8-32 x 1/2 screws
3.3. Socket Head 6-32 x 5/16 cap screws

TOOLS:

3.4. Foam work pad to protect face plate from scratches
3.5. Phillips screwdriver
3.6. Flat head screwdriver
3.7. Wire stripper
3.8. Wire crimper
3.9. Solder
3.10. Solder iron
3.11. Quicktip crimper tool
3.12. Small nose pliers
3.13. Allen key
3.14. Deep well socket set

4. **PROCEDURE**:

4.1. Mount valves onto the face plate. The Coarse valve in the lower position. The Fine valve in the upper position. When the coarse valve is open be sure the handle on the front points toward the "open" mark on face plate.

4.2. SOLENOID ASSEMBLY:

4.2.1. Prepare all brass fittings which will be attached to the solenoid valves and the flowmeter using teflon tape. Attach the fillings to valves and flowmeter, before mounting on the face plate.

4.2.2. The 3/8" tube x 1/8" male elbows attach to solenoid valve, each solenoid valve has 3 elbows.

4.2.3. The Top Solenoid arrangement of brass fittings: The elbow on the lower left points down, the elbow on the lower right points up, the elbow on the top center points down.

4.2.4. Middle solenoid arrangement of brass fittings: The elbow on the lower left points up, the elbow on the lower right points up, the elbow on top center points up.

4.2.5. Bottom solenoid arrangement of fittings: The elbow on the lower left points up, elbow lower right points down, the elbow on the top center points down.

4.2.6. Mount the three solenoids onto the face plate using 8-32 x 1/4 pan head screws.

4.3. FLOW METER ASSEMBLY:

4.3.1. Attach the 3/8" tube x 1/8" male elbow to lower end of flowmeter at a 45° angle pointing down. Attach a 1/4" Barb connector to top half of flowmeter

4.3.2. Mount the flow meter to the face plate. The flow meter should line up with the silk-screening on the front of the face plate. Make sure the flow meter is straight up and down.

4.4. ATTACH FITTINGS AND GAUGES:

4.4.1. Bulkhead union to the vacuum gauge

4.4.2. Mount the vacuum gauge.

4.4.3. Mount the 1/2" quick connect in the hole for the sample inlet on face plate

4.4.4. Mount the 1/4" quick connect in the hole for the pitot on face plate

4.4.5. Mount the 3/8" quick connect in the holes for vacuum and pressure on the face plate

4.5. PLUMBING:

4.5.1. First tee to 1/2" quick connect

4.5.2. Second tee to fine valve

4.5.3. Third tee to coarse valve

4.5.4. Attach 5/16" Flexible tubing

4.5.5. Follow plumbing diagram attached to this procedure

4.6. ELECTRICAL:

4.6.1. Mount five panel, mount thermocouples, they are mounted next to vacuum gauge, they snap into place.

4.6.2. Mount three Watlow temperature controllers, mount using clip provided in the controller box, they snap on easily.

4.6.3. Mount two 91031 dpst 12V switches, one for probe and one for filter, they mount right next to the controllers

4.6.4. Mount four circuit breakers, use 6-32 x 5/16 socket head screws

4.6.4.1. The 15 amp breaker for the power

4.6.4.2. The 10 amp breaker for the pump

4.6.4.3. The 30 amp breakers for valves and + leakcheck

4.6.5. The Face plate is labeled for each circuit.

4.6.6. Mount timer switch in the hole for the timer. Use the clip provided in timer box.

4.6.7. Mount 9103 spst 12V switch, mount next to timer power on/off on face plate.

4.6.8. Mount the two 9141 panel mount receptacles for the pump and AUX to the face plate.

4.7. WIRING THE YELLOW "K" WIRE TO THE PANEL MOUNT SWITCH:

4.7.1. Attach yellow "K" wires from 6 pos. switch to panel mount thermocouple as follows:

#1 Aux. #3 Dry Gas Meter Inlet #5 Impinger Outlet

#2 Stack #4 Dry Gas Meter Outlet #6 Ambient Temp.

4.7.2. The Yellow "K" wire going from the from 6 pos. switch as follows:

#3 female yellow mini "K" plug

#4 male yellow mini "K" plug.

#6 gets a quicktip attached for the ambient temperature.

4.7.3. Attach the yellow "K" wire from probe panel to your probe controller and from filter on panel to filter controller.

4.8. FINISH WIRING:

4.8.1. Wire back of controller panels according to diagram in section 4.8.9.

4.8.2. Wire terminal blocks following the wiring schematic provided with this procedure.

4.8.3. Terminal blocks should be tight no visible wire showing through. After you wire the blocks give a slight pull test to be sure the wires remain tight.

4.8.4. Attach Amphnol to face plate. Solder the wires according to wiring schematic. Cover all solder joints with heat shrink.

4.8.5. Attach Strain relief to face plate use two plastic nuts.

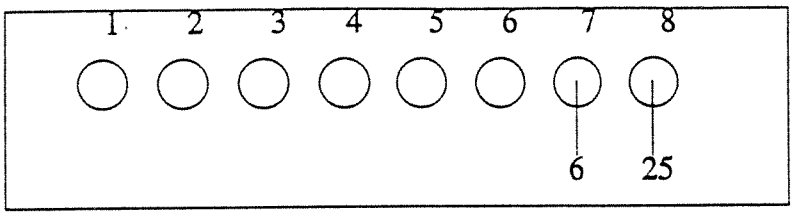
4.8.6. Power cord should be 72" long from end of face plate

4.8.7. Mount the 6 pos. switch, use wire ties to secure thermocouple to base of switch carefully tighten to face plate.

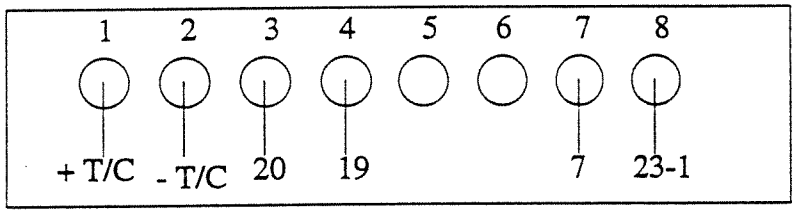
4.8.8. Wire relays according to the wiring schematic

4.8.9.

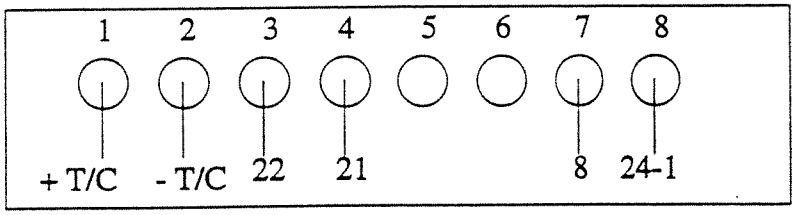
Main Controller

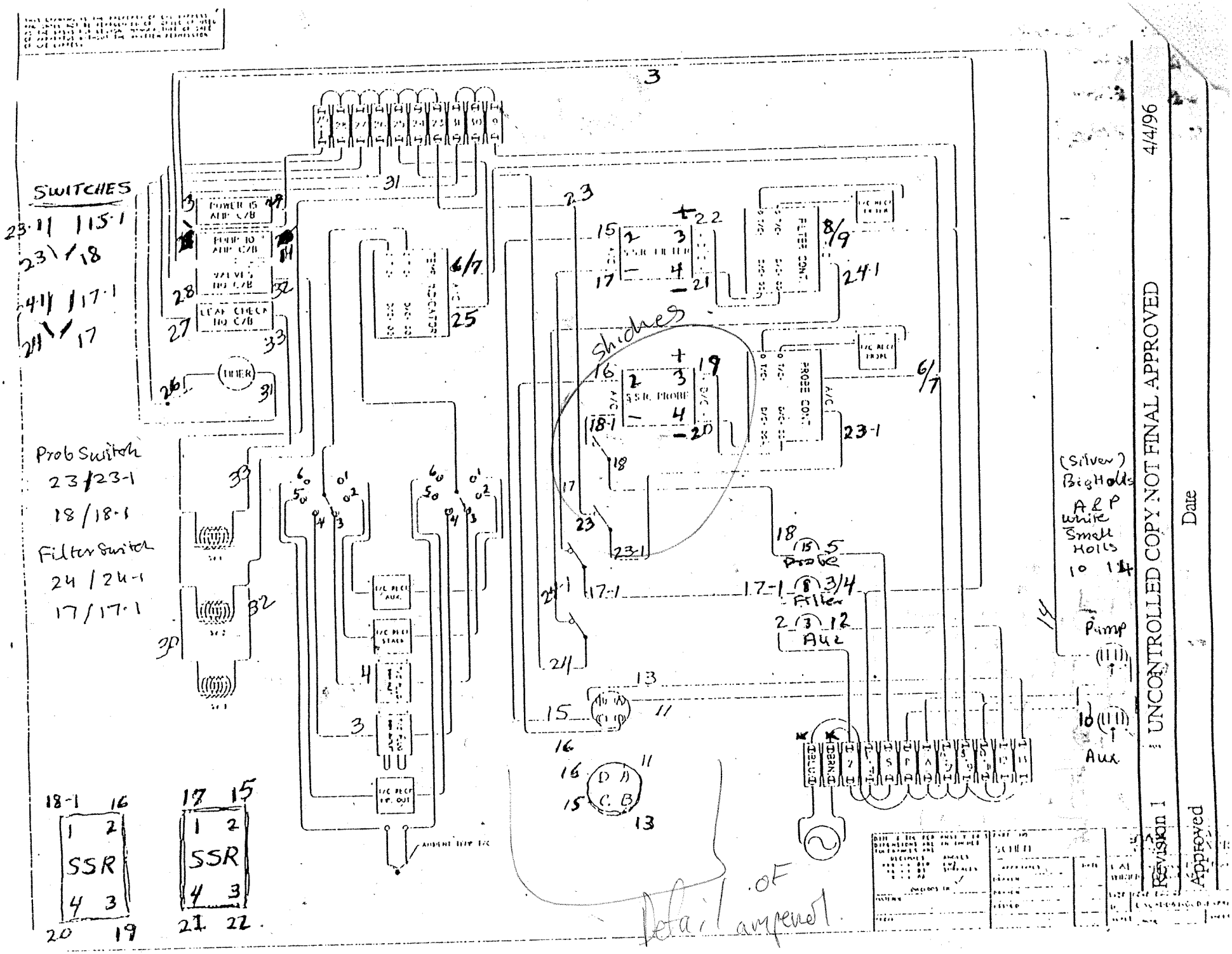


Probe



Filter




SWITCHES
23-1 / 15-1
23 / 18
41 / 17-1
21 / 17
Prob Switch
23 / 23-1
18 / 18-1
Filter Switch
24 / 24-1
17 / 17-1
Shades
(Silver)
BigHolls
A&P
White
Small
Holes
Pump
Aux
Probe
Filter
Aux
SSR
SSR
UNCONTROLLED COPY NOT FINAL APPROVED
Revision 1
Approved
4/4/96
Date

FINAL LEAK CHECK FOR M5 METERS

Serial No:_____ Gas Meter Serial No:_____
Date Assembled:_____ Checked By:_____
Client:_____ Date Shipped:_____

___1. Positive Pressure Leak check procedure:

_____A. Remove rear door of console, check that the equipment is grounded.
_____B. Check that all Tygon tubing is routed neatly, free of kinks and fastened as required.
_____C. Plug the orifice with the rubber stopper that is to be shipped with the unit.
_____D. Remove the elbow fitting on the low side of the manometer yellow gauge oil column. Replace with the extra fitting being shipped with the unit. **DO NOT** attach tubing to the new fitting. This open fitting is now venting the manometer.
_____E. Plug the unit in. Turn the main power switch to the "ON" position.
_____F. **CLOSE THE COARSE VALVE.**
_____G. Turn valve switch to "OFF" position and the leak check switch to the "ON" position.
_____H. Pull out the tubing from upper right hand corner of the console. A white tube clamp is provided on the tubing.
_____**I.** Blow into tube to pressurize dry gas meter. Keep blowing until 7" pressure is indicated on the manometer column, then close the white pinch clamp. Allow the gage oil to run down the channel before timing. If no leaks are present, gauge oil will remain steady for one minute. If leaks are present gauge oil will move towards zero. **Any leaks must be located and fixed before meterbox is shipped.**
_____J. Replace the rubber stopper and manometer fitting in the back of the meter. Reattach the hose to the manometer.

___2. Running the pump

If the meter is final checked after calibration, the pump does not need to run. Otherwise run the pump for 15 min. Listen for clatter or other pump maintenance problems. If the pump is not running smoothly the pump is inspected per the pump cleaning procedure and rerun for the 24 hr restricted break-in period.

___3. Appearance

_____A. K plugs get a twist type test. They should be straight and not loose when a solid thermocouple is inserted.
_____B. All fasteners are tight, not missing or stick out too far. Truss head screws must be used to attach the dry gas meter.
_____C. The 110 cord is 72" long.
_____D. The meter has rubber feet on the mounting plate.
_____E. There are no scratches, chips or dings on the doors, cabinet or face plate.
_____F. Paint decals and logos are readable. AUX FILTER and PROBE sticker is on the fuse plate.

FINAL LEAK CHECK FOR M5 METERS

Serial No:_____ Gas Meter Serial No:_____
Date Assembled:_____ Checked By:_____
Client:_____ Date Shipped:_____

___4. Manometer Check

_____A. The oil in the manometer is at the correct oil level (see fig. 1). Remove or fill as needed. Do not mix colors.
_____B. The oil level goes to zero when the manometer is level and the adjustment knobs are half way out.
_____C. The adjustment wheel for the level turns freely.
_____D. The manometer is clean and free of defects or scratches.
_____E. All connections work and seal
_____F. Stainless steel pad is in place under the adjustment wheel and mounted with double sided tape.

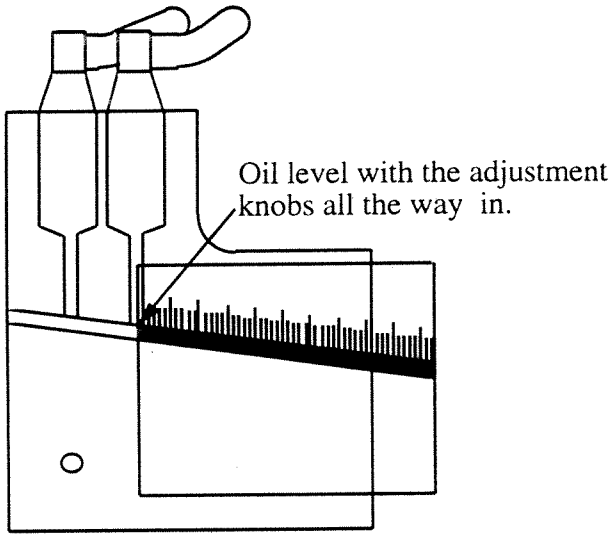


Figure 1

___5. Final Electrical Check

_____A. Check all connections for appearance in the back of the meter. The wiring harness should not be a mass of tangled wires. The wires should be neat and fastened with ties.
_____B. Look for loose or damaged wires. Technician will replace or repair.
_____C. Check that terminal connections are stuck firmly in place and not loose.
_____D. The amphenol on the box gets the female insert with box plug amphenol casing.
_____E. Amphenol threads are ok.
_____F. Check that there is no strain on the power cord wires inside the console, and that the strain relief nut is tight.
_____G. Check operation of Aux. recepticle on meter face with circuit tester.
_____H. Warning labels and Q/A stickers will be in place. Red label on the side of the cabinet and Q/A sticker on the back of the dry gas meter.

FINAL LEAK CHECK FOR M5 METERS

Serial No:_____ Gas Meter Serial No:_____
Date Assembled:_____ Checked By:_____
Client:_____ Date Shipped:_____

___6. Final Electrical Check: Controllers

_____**A. Unlock all 3 controllers:**

____1. Press and hold the SEL key until **A7-0** appears (approx 3 seconds).
____2. Tap the SEL key to bring up the lock (**LoC0, LoC1 or LoC2**).
____3. Use the ∧ and ∨ keys to change lock to **LoC0** (if **LoC0** appeared, skip this step).
____4. Press and hold the SEL key until the setpoint temperature appears (approx 3 seconds).

_____**B. Verify all controllers are set for type K thermocouple:**

____1. Press and hold the SEL key until **P** appears (approx 7 seconds).
____2. Tap the ∨ key 7 times or until **P-n2** appears.
____3. Tap the SEL key once to see the setting of the **P-n2** parameter.
____4. Adjust this parameter to **3** using the ∧ and ∨ keys.
____5. Press and hold the SEL key until the setpoint temperature appears (approx 3 seconds) to register the change.

_____C. **OPTIONAL - Switch between °F and °C scales:**

____1. Press and hold the SEL key until **P-n1** appears (approx 9 seconds).
____2. Tap the ∨ key 6 times or until **dSP4** appears.
____3. Tap the SEL key to see the setting of the **dSP4** parameter.
____4. Use the ∧ and ∨ keys to subtract 2 from the setting. If set to 3, change to 1.
____5. Press and hold the SEL key until **P** appears (approx 7 seconds).
____6. Tap the ∨ key 13 times or until **P-F** appears.
____7. Tap the SEL key to see the setting of the **P-F** parameter.
____8. Use the ∧ and ∨ keys to change **F** to **C** or **C** to **F**.
____9. Press and hold the SEL key until the setpoint temperature appears (approx 3 seconds) to register the change.
____10. Place a sticker °C over the °F label on the controller.

_____**D. Configure the 6 channel temperature indicator:**

____1. Press and hold the SEL key until **P-n1** appears (approx 9 seconds).
____2. Tap the ∨ key once or until **P-dF** appears.
____3. Tap the SEL key once to see the setting of the **P-dF** parameter.
____4. Adjust this parameter to **0.0** using the ∧ and ∨ keys.
____5. Press and hold the SEL key until the setpoint temperature appears (approx 3 seconds) to register the change.
____6. Adjust the setpoint temperature to 32 (0 °C) using the ∧ and ∨ keys.
____7. Tap the SEL once to register the change.

_____**E. Configure the probe and filter controllers:**

____1. Tap the SEL key once to bring up the setpoint (SV led will light up).
____2. Use the ∧ and ∨ keys to adjust the setpoint to 250 (122 °C).
____3. Tap the SEL once to register the change.

Serial No:_____ Gas Meter Serial No:_____
Date Assembled:_____ Checked By:_____
Client:_____ Date Shipped:_____

_____ 6. Final Electrical Check: Controllers, continued.

_____**F. Autotuning:**

____1. Do not proceede until probe and filter reach setpoint temperature.
____2. Press and hold the SEL key until **A7-0** appears (approx 3 seconds).
____3. Use the ∧ and ∨ keys to change **A7-0** to **A7-1**.
The decimal point will begin flashing, indicating that autotuning has begun. Do not change any settings on the control until autotuning is complete (the decimal point stops flashing).

_____**G. Heating the equipment:**

____1. The meter will be heated to 250_(122 °C)) with a test probe, a test umbilical, and sample box.
____2. The meter will hold 250_(122 _C) for 30 min.
____3. Shut off the filter switch and open the door on the sample box.
____4. Each controller will work independently If the probe looses temperature or continues to climb in temperature there is a wiring problem. The technician will fix the problem.

_____**H. Lock out all controllers:**

____1. Press and hold the SEL key until **A7-0** appears (approx 3 seconds).
____2. Tap the SEL key to bring up **LoC0**.
____3. **6 channel indicator only:** Use the ∧ and ∨ keys to change **LoC0** to **LoC1**.
____4. **Probe and Filter controllers only:** Use the ∧ and ∨ keys to change **LoC0**to **LoC2**.
____5. Press and hold the SEL key until the setpoint temperature appears (approx 3 seconds).

_____**I. Complete the Q/A sticker.**

____7. Ready the Console For Shipment

_____A. Check that the pump and console serial tags match . Place the console serial no. tag inside the console on the base just in front of the pump handle.
_____B. Refer to figure 1 in the Manual that will go with the console for the items listed below if you are not familiar with the parts.
_____C. Check the manual and be sure it is the correct one for the meter.
_____D. Enter the serial no. of the meter and dry gas meter in the front cover of the manual.
_____E. Set all the rocker switches(item 3) on the meter to the off position.
_____F. Turn the course control valve (item 16) to the closed position.
_____G. Screw the manometer zero knobs all the way in.
_____H. Disconnect the vacuum pump connections (items 24 and 11) from the meter control console; pump power cord, pump pressure and vacuum lines.
_____I. Disconnect the male manometer quick connect fittings (item 25). Wrap in bubble wrap to protect faceplate from scratches.

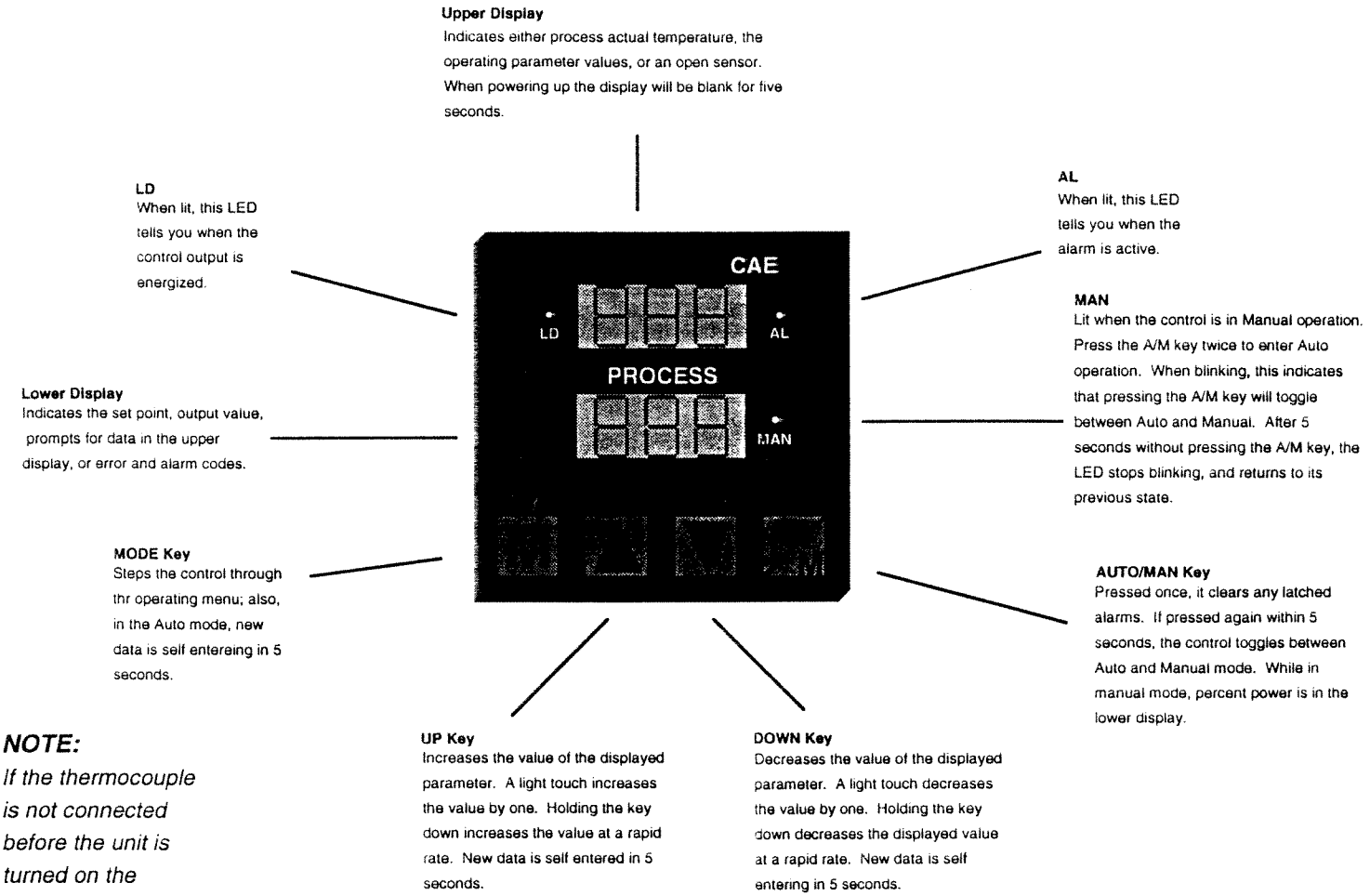
Serial No:_____ Gas Meter Serial No:_____
Date Assembled:_____ Checked By:_____
Client:_____ Date Shipped:_____

_____7. Ready the Console For Shipment, continued

_____J. Put a plastic cover over the Amphenol connection for protection.
_____K. Check that tie-downs for the leak check cork and IGS fitting are installed tight and square.
_____L. Fasten down the IGS fitting, the leak check cork and manometer quick connect vent fitting.
_____M. Remove any used oil that may be present in the meter knockout jar. Use a shop rag.
_____N. Remove any used oil that may be present in the pump knockout jar. Use a shop rag.
_____O. Remove any unused oil from the intake filter assembly oil jar. Pour this into a 60 ml polyethylene bottle. Fill the bottle with **10 weight oil.** Put the lid on the bottle then tape it shut using electrical tape. Put this oil along with 1 red and 1 yellow gage oil in a bubble wrap bag and place in the pump compartment.
_____P. Replace the meter box and vacuum pump housing panels. Check for scratches and latch fitup. Adjust as needed
_____Q. Check the calibration sheets and place them in a clear plastic sheet protector.
_____R. The meter manual, temperature controller manual and cal sheets should be placed in a self sealing shipping bag and attached to the top of the meter box.

___8. Finish the Final Check sheet for pump

LIST PROBLEMS THAT WERE CORRECTED AND NOTES HERE :



NOTE:

If the thermocouple is not connected before the unit is turned on the conntroller will sense a t/c break and automatically go into manual mode. If this occurs the controller needs to be reset. To do this the unit has to be turned off then back on again and the mode key has to be pressed twice.

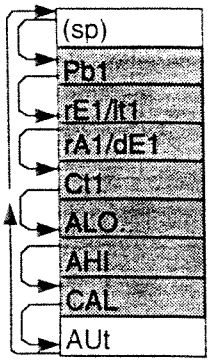
Tuning the Controller

The controllers in the Heater Control Box have been previeously set for 250 , but in some cases it may be necessary to either change the set point or to re-tune the controller because of extreme temperature variations. The set point value can be changed by using the UP or DOWN keys on the face of the controller. Whenever the set point is changed or in the case of temperature variations the controller must be auto tuned the procedure for tuning is as follows:

Temperature Change

Use the UP and DOWN keys to enter desired temperature, the value will automatically be entered into the memory in five seconds. After the temperature has been entered use the mode key and scroll through the setup parameters until you reach AUt. AUt is the auto tune mode, there are three levels to chose from one, two, and three. Three is the most suitable for quick results. Use the UP or DOWN keys to pick the appropriate level and press the Mode key to start the auto tunning process.

Setup Parameters



Extreme Temperature Variations

If the controller is not maintaining the set temperature because of an unusual application auto tunning is necessary. This is done the same way as if there was a temperature change made, accept the temperature is left at the original set point.

Sensor Break

If a thermocouple sensor break occurs the controller will automatically go into manual mode and automatically apply a percentage of power that has been used for the last ten minutes. A sensor break is indicated by error 7 this will appear in the lower display for five seconds, also three dashes will be shown in the upper display. When the controller is in manual mode it can be used as a Vari-AC. The percent power can be adjusted by using the UP and DOWN keys, the value is shown on the lower display. If the sensor break is repaired auto mode can be restored by turning the controller off and then back on again.

Method 5 Control Console (0028) Leak Check Procedure

1. PURPOSE:
   To explain how to leak check a Method 5 Meter Box.

2. SCOPE:
   Be used by all personnel who check method 5 equipment for leaks.

3. PROCEDURE:

   3.1. If the meter control console and pump box are not connected together do so at this point.

   3.2. Plug the meter control console into a power source (power is needed to do a leak check).

   3.3. Perform Negative Leak Check.

   3.4. Switch positions on the meter control console should be: power on, valves off, and leak check off.

   3.5. Install a 1/2" quick connect on the sample inlet.

   3.6. Turn the Fine Valve all the way counter clockwise, and turn the Coarse Valve to the open position.

   3.7. Reset the timer.

   3.8. Turn the Pump switch on.

   3.9. Put your thumb over the opening to the 1/2" quick connect (If done properly the vacuum gauge should read about 24-26 "hg..

   3.10. Observe the dial on the Dry Gas Meter Index.. It should slowly stop rotating.

   3.11. After the dial has completely stopped rotating turn the timer on.

   3.12. If dial does not move at all for a time period of one minute Negative Leak Check is complete.

   3.13. Perform Positive Leak Check

   3.14. Unplug unit from power source.

   3.15. Remove the back door on the Control Console.

   3.16. Remove the black rubber stopper from the bottom of the Control Console.

   3.17. Install the rubber stopper in the outlet tube from the Dry Gas Meter tightly so that it will seal properly.

   3.18. Remove the quick connect located on the bottom of the Console.

   3.19. Replace the back cover on the Control Console.

   3.20. Plug the Control Console into a power source.

   3.21. Turn the power switch and the leak check switches on. The pump and the valves switches should remain in the off position.

   3.22. Turn the Coarse Valve to the closed position.

3.23. Use the quick connect from the rear of the Control Console to replace the quick connect on the right hand side of the yellow column on the draft gauge.

3.24. Locate the piece of tygon tube with the pinch clamp on the front of the Control Console.

3.25. Blow into the tygon tube until the yellow column on the draft gauge reads eight inches of water and close the pinch clamp tightly.

3.26. Wait a minute or two for the oil to settle and take an exact reading off the yellow column.

3.27. Reset the timer

3.28. Turn the timer switch in the on position.

3.29. If the yellow oil hasn't moved in one minute Positive Leak Check has been Proven.

3.30. Unplug the unit and return the components the rear of the Control Console.

VOST Meter Assembly Procedure

1. Purpose:
To explain how to assemble a VOST meter.

2. Scope:
To be used by all personnel who assemble VOST meters.

3. Materials:
All items listed on the assembly parts list (pick list generated by the business leader).

Fasteners as follows:

3.1. Truss head 10-32x1/2" screws
3.2. Truss head 8-32x3/8" screws

Tools along with Tech's shop tool box as follows:

3.3. Foam work pad to protect item from scratches while being assembled
3.4. crimper tool
3.5. Quick-tip crimper tool
3.6. Rosin core solder
3.7. Screw Drivers
3.8. Soldering Iron
3.9. Wire Strippers

4. Definitions:

4.1. Face Plate Sub-assembly
4.2. Dry Gas Meter Sub-assembly
4.3. Meter Box Chassis Sub-assembly
4.4. Pump: KNF 115V Sampling Pump

5. Procedure:

5.1. PLUMBING:

5.1.1. Prepare all brass and Nylon tee fittings to be used with flow control valves using thin Teflon tape. Attach fittings to proper port before mounting valve in face plate sub-assembly.

5.1.2. Mount valves into faceplate, coarse valve in the lower position, needle (fine adjustment) in the upper valve position. Needle valve receives two Nylon tees in connection ports, where branches of tees are aligned perpendicular to axis of handle.

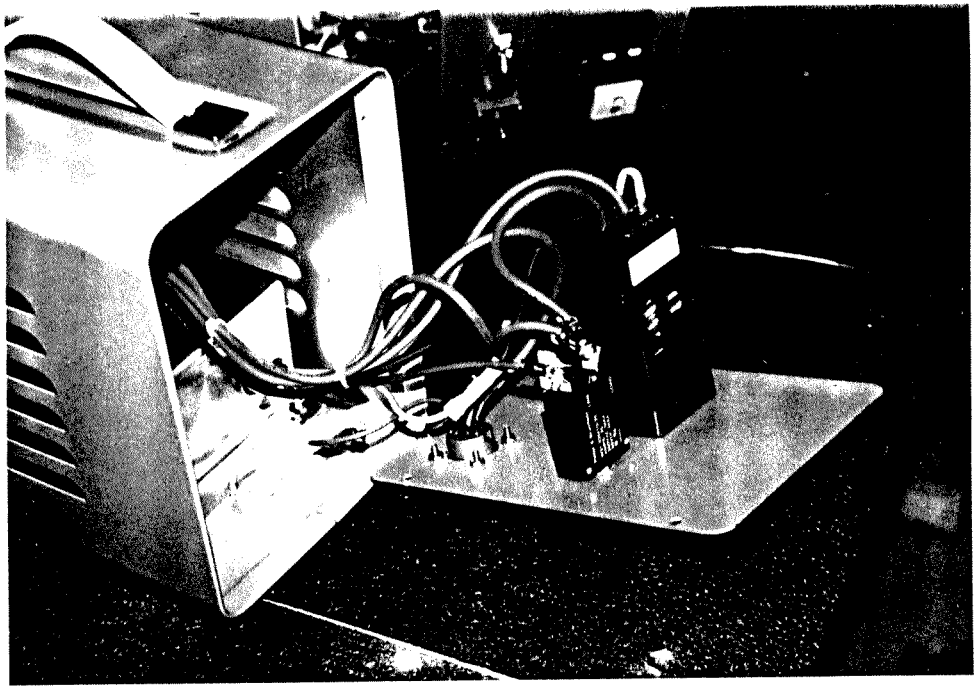
5.1.3. Coarse valve receives one short brass hose barb connector toward the bottom of faceplate when mounted, and one long brass hose barb connector toward the top of face plate when mounted.

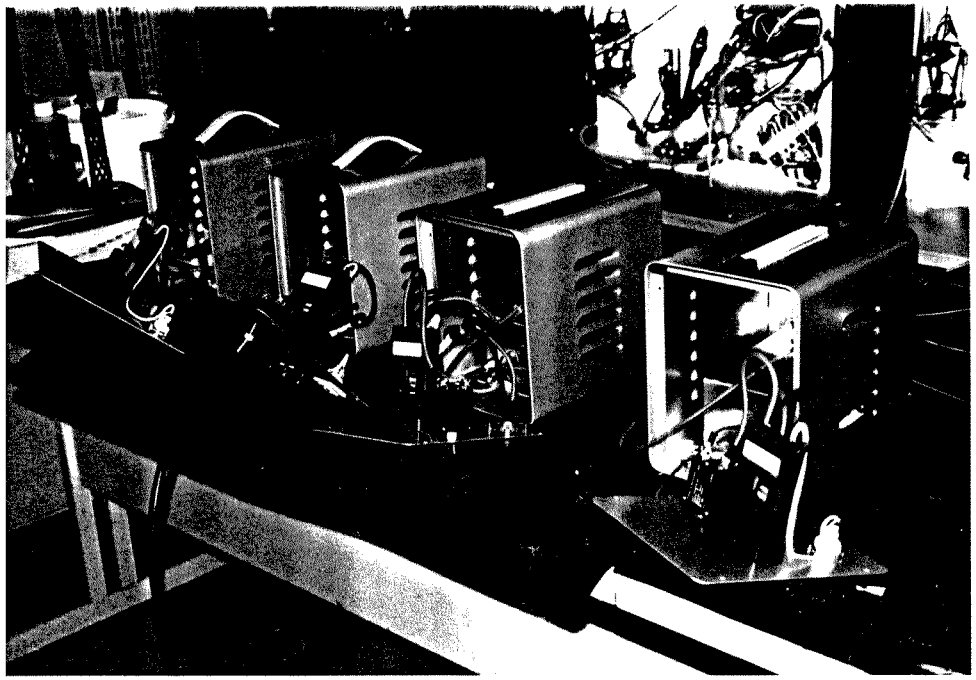
5.1.4. On the coarse valve, be sure that when valve is open, the handle on the front points toward the "OPEN" label.

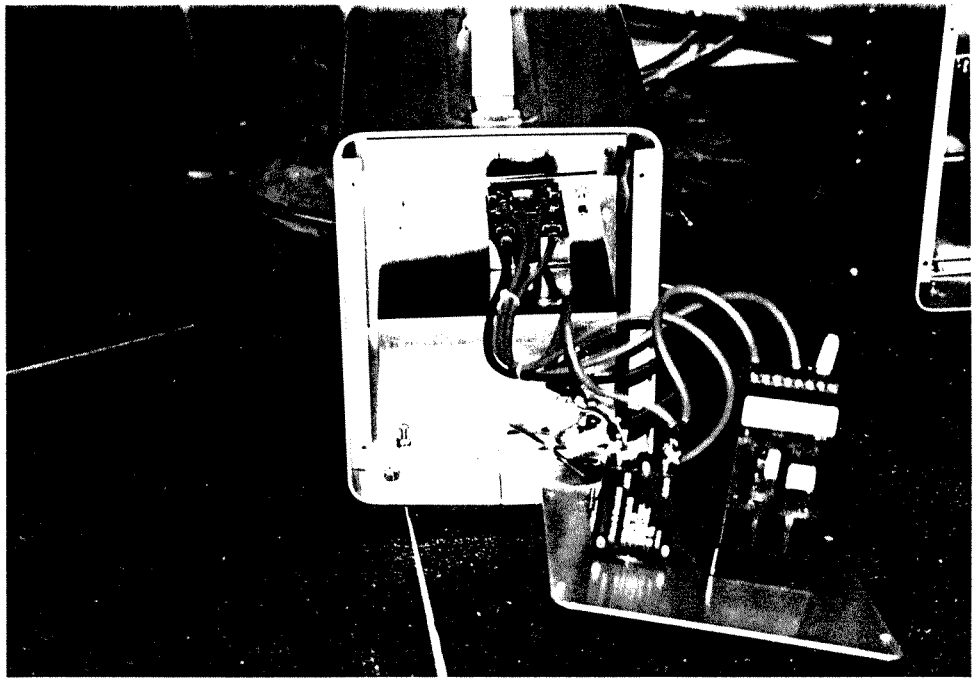
5.1.5. Valves should lie in roughly 45 degree line to top of faceplate, dictated by where the handle on the coarse valve lines up with the "OPEN" and "CLOSED" labels on the faceplate. The "FINE" valve should follow the same alignment for plumbing purposes.

5.1.6. Prep and attach two short, brass hose barb fittings to port on flow meter.

bogen







5.1.7. Mount flow meter to faceplate using snug rings provided with flow meter.

5.1.8. Attach long, brass hose barb fitting to back of vacuum gage, using Teflon tape on nipple of gage.

5.1.9. Mount vacuum gage in face plate using provided hardware.

5.1.10. Mount Minihelic gage in face plate using provided hardware. HI port should be down.

5.1.11. Mount sample inlet Quick Connect in face plate.

5.1.12. Attach in-line filter to back of sample inlet Quick connect, using provided short length of stainless steel 1/4" tubing between quick connect and filter.

5.1.13. PLUMB COMPONENTS according to provided diagram, including proper lengths.

5.2. ELECTRICAL

5.2.1. Mount four K-type thermocouple adapters into faceplate using provided stainless steel clips.

5.2.2. Mount provided amphenol fitting after removing 90 degree elbow from front side. Ring piece on back of panel mount should be scored, such that it will bight into both the panel mount and the face plate when tightened into place. Use male shell over female fitting to tighten amphenol onto faceplate, making sure that alignment rib is centered at the top of the final position.

5.2.3. Mount power cord sleeve, leaving power cord unattached for later positioning. Cut Back 4"

5.2.4. Mount switches for Watlow control units.

5.2.5. Mount 6-channel indicator switch, using zip-ties to secure thermocouple wire to base of switch after it is tightened into it's proper alignment on faceplate (use 5/16" wrench) according to silk-screening on front of face plate.

5.2.6. Timer receives provided adapter which clips onto back of timer.

5.2.7. Mount timer switch.

5.2.8. Mount assembled timer using included snug clip.

5.2.9. Mount electrical outlet for WATER control.

5.2.10. Mount circuit breaker/ power switches in upper right corner of faceplate according to wiring diagram (POWER receives 15 Amp CB; PUMP and WATER receive 30 Amp with no circuit breaker;) Silk screening is different from wiring diagram, so for now, follow silk-screen layout. Use 6-32 5/16" socket head screws for mounting.

5.2.11. Mount Watlow temperature controllers into faceplate, using included brackets.

Cut to power cord length +/- 12" insert cord into cord sleeve

5.3. WIRING

5.3.1. Wire provided terminal blocks according to wiring schematic, only 9 posts on each block. Cut extra posts from the end of each block.

5.3.2. Blocks should be wired to harness before other components and checked for tightness.

5.3.3. Use black wire where indicated, and white wire where indicated.

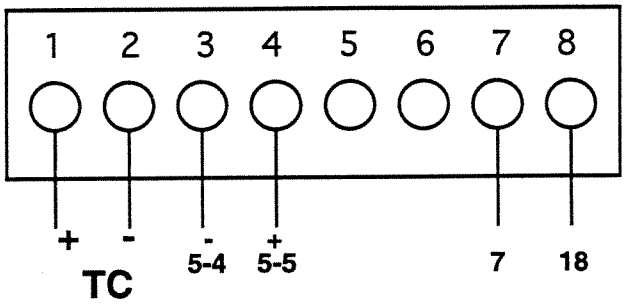
5.3.4. Position wiring harness so that wires 15 and 19 (longer than the rest) reach up toward the timer, and the rest of the harness hangs down the right side from the back of the faceplate.

5.3.5. Assemble a jumper out of black wire to connect timer switch to back of timer, using a female spade connector at one end. Piece should be about 2" in length.

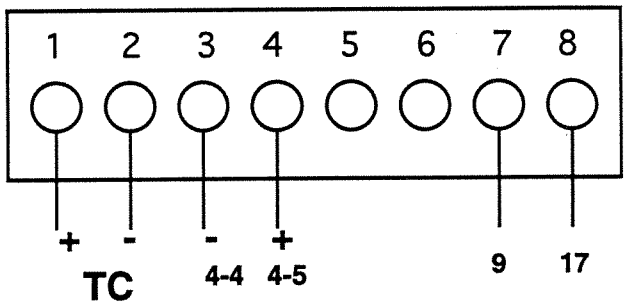
5.3.6. Connect circuit breaker/rocker switches to appropriate female connectors.

5.3.7. Wire back panels of Watlow controllers according to the diagram below, being sure that there is a white wire attached to terminal 3 and 7 for each of the controllers with the matching black wire attached to terminals 4 and 8. The back of each Watlow controller can be removed for greater ease in wiring and then reattached to the correct controller.

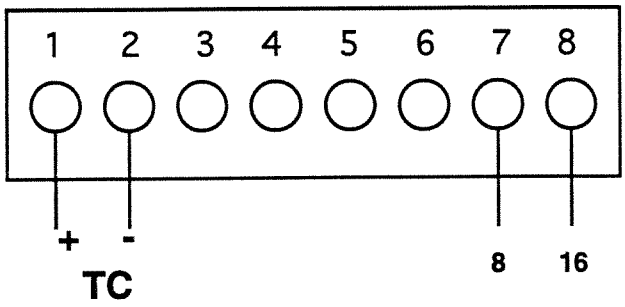
PROBE



FILTER



TEMPERATURE



5.3.8. Connect wires according to most updated diagram, adjusting lengths in the harness as necessary.

5.3.9. Amphenol fitting should be soldered in place, using the schematic by letter rather than position on the diagram. No flux is necessary when soldering with these materials.

5.3.10. Shrink tubing (1/8") should be used over all soldered fittings.

5.3.11. Check wiring positions against common sense, to make sure that there are no obvious mistakes in either your work or other assemblers on parts such as the wiring harnesses.

5.4. Chassis Assembly

5.4.1. Fit face plate (assembled to this point) into front of top chassis portion, aligning holes in chassis with PEM's in face plate. Fit screws into place without tightening.

5.4.2. Mount pump (with hose barb fittings already installed) onto chassis base, and attach pre-measured tygon tubing from face plate onto pump fittings.

5.4.3. Fit top portion of chassis onto base, arranging wires and plumbing tubing as necessary to prevent any chaffing of wires of crimping of tubing after final fitting.

5.4.4. Fit screws into place and tighten, being sure to also attach screws from under the base into the face plate.

5.4.5. Tighten all screws holding face plate.

5.4.6. Fasten top and bottom portions of chassis together using the proper fasteners (~~1/4" 10-32~~ 3/8" 8/32 Truss head).

5.5. Fuse Bracket Assembly

5.5.1. Mount fuse bracket to studs on chassis wall.

5.5.2. insert fuses through proper hole, with snug rings fit loosely onto fuse body.

5.5.3. Fit proper wires onto spade connectors of each fuse, then snug mounting ring against bracket wall. This is the easiest sequence of assembly.

5.6. Dry Gas Meter Assembly (DGM)

5.6.1. Remove top plate of dry gas meter and save screws.

5.6.2. Drill hole in DGM mounting bracket to allow for placement over PEM for chassis top handle.

5.6.3. Replace, checking alignment of mounting PEM's with proper alignment of DGM. Be sure original cork gasket is in place between the two surfaces and screw holes line up with all parts.

5.6.4. Assemble included brass pipe fittings into the proper configuration for each side of the DGM, using teflon tape around all threads.

5.6.5. Thread all fittings into proper place in DGM, making sure they are tight without over tightening. Both sides should have final segment pointing down.

5.6.6. Attach and fasten critical orifice tube to DGM outlet fittings, so that the pair of horizontal tubes that are welded on face in the opposite direction of the index face plate.

5.6.7. Mount included 3" solid thermocouples into brass fittings and tighten to the proper torque.

5.6.8. Using zip-ties, fasten lead of solid thermocouple (T/C) from the DGM outlet as neatly as possible toward the DGM inlet. Fasten a short portion of the lead from the inlet back toward the DGM body, and then fasten the two leads together so that there is a 5" or 6" length left to attach mini-K T/C plugs to.

CATECO Heated Filter Unit (0035) Assembly Procedure

1. PURPOSE:
To explain how to assemble a CATECO Heated Filter Unit.

2. SCOPE:
To be used by all personnel who assemble a CATECO Filter Unit.

3. MATERIALS:
3.1. All items listed on the assembly parts list
3.2. Fire-Flex foam sheets
3.3. 18 ga. Teflon-coated wire
3.4. Millboard sheet
3.5. Silicone gasket sheet

Fasteners as follows:
3.6. Hex head socket 10-32 x 1/2" screws
3.7. Hex head socket 4-40 x 1/4" screws
3.8. High temperature eyelet
3.9. High Temperature Fork Connectors
3.10. K-lok 6-32 nuts
3.11. K-lok 1/4-20 nuts
3.12. Round Head 6-32 x 1/8" screws
3.13. Round head 6-32 x 1/4" screws
3.14. Truss head 10-32 x 1/2" screws
3.15. Truss head 10-32 x 1/4" screws

Tools along with Tech's shop tool box as follows:
3.16. Center punch
3.17. Drill bit #17
3.18. Foam work pad to protect item from scratches while being assembled
3.19. Hammer
3.20. 3M crimper tool and a crimper tool to attach the Quick- tip
3.21. Red gasket aluminum template
3.22. Rosin Core Solder (Kester type .031 dia. or similar product)
3.23. Screw drivers
3.24. Soldering iron
3.25. Vice Grip type pliers
3.26. Wire Strippers

4. DEFINITIONS:

4.1. Box: Same as CATECO Heated Filter Unit

4.2. CATECO Heated Filter Unit: inventory part no. 0035

4.3. Internal panel inserts: also referred to as panels. These are the aluminum pieces that hold the foam insulation in place inside the box.

4.4. Stand-off: Two 1/4 -20 nuts used to raise the heating element away from the bottom of the box.

5. PROCEDURE:

5.1. Check the inventory items to be sure all material has been pulled for the work order. Shop floor items and inventory items are arranged by the tech. on a work bench.

5.2. Roll foam as necessary. Cut out Fire-Flex foam inserts from the large sheets for all of the internal panels.. Foam tools are available for cutting the correct size holes in the front and rear panel inserts.

5.3. Cut out silicone gaskets for the front and rear of the box from the large sheets. Use the aluminum template. Cut **slits** for the probe holes.

5.4. Cut out mill board for the top of the box from the large sheets. A particle mask will be worn when cutting the material.

5.5. Put the pre-cut and rolled foam into the bottom of the box. Put the bottom aluminum plate with heater mount studs toward front of the box (front has five holes of various sizes for mounting components later in the assembly process).

5.6. Drill out amphenol panel mounting holes with a number 17 drill bit. Assemble the female 4-pin amphenol. Make sure letters on insert are upright and panel mount fitting has the center septum top and center.

5.7. Solder amphenol fitting according to the wiring diagram for this unit. Wire lengths are as follows: "D" is 8" long; "B" and "C" are both 5" long. Shrink tubing should be used on all solder connections, including the unused "A" connection. A heat gun should be used to shrink the protective tubing over the connection.

5.8. Mount wired amphenol fitting in front of outer shell. Use 4-40 hex head socket fasteners Tighten 1/2 turn past snug.

5.9. Attach a high temperature fork connector to wire "C" using the 3M crimper tool. Exposed wires are not to show outside of connection barrel. Attach a fork connector and a 4" length of wire to the end of Wire "B". The extra wire is attached to the heating element from the 115v receptacle.

5.10. Remove green ground screw from 115v receptacle Loosen two other screws labeled "white" and "black". Place receptacle through lower left hole in the front panel and turn receptacle so that "white" terminal faces up inside the box. Attach "B" wire fork connector to the white terminal. The second wire is hanging toward the inside of the box. Turn the receptacle so that the "black" terminal is facing up and attach "D" wire fork terminal here. All connections should be tightened so they will not come loose.

5.11. Mount the receptacle in the front face plate using 1/2" 10-32 Truss head screws, making sure that the ground connection on the receptacle faces up inside the box. Cut a 4" piece of Teflon wire and attach a high temperature eyelet to each end. Attach one end to the 115v receptacle using the green ground screw removed earlier.

5.12. All wires running from the amphenol fitting to the receptacle should be bent 180 degrees at the back of the amphenol connection and run along the wall of the box down to the receptacle, leaving some slack along the side of the receptacle. Wires should then come out from the wall of the box and turn 180 degrees to the terminal connections. Wire "C" should follow the same path and be run to the interior of the box for connection to the heating element later.

5.13. A Quick- Tip is attached with a crimper tool the thermocouple wire. Attach the 7" thermocouple wire with Quick-tip to panel mount K-type thermocouple plug. The red wire is attached to negative (-) and yellow to the positive(+) terminal. Mount thermocouple plug in front wall of enclosure. Use the snug ring provided. The ring should be tightened using a hammer and screwdriver making the teeth of ring bite into the wall. The K on the plug is parallel to the right side of the box when the ring is tightened.

5.14. Mount probe arm with silicone rubber gasket on outside front of box using 10-32 hex head screws, with socket on inside of box. Silicone gasket should be sandwiched between probe arm and face of box.

5.15. With three wires left leading into the interior of the box, the precut foam insert for the front panel should be fit into place. There should be no binding of the wires apparent when this is done.

5.16. On the aluminum front insert panel, use a half round flat file to widen the top half of the hole for the receptacle. An additional 1/8" will allow more room for the ground connection.

5.17. Place front insert into the box with bent edge up and facing front of box. Check the inside of top lip of box for excess weld material that may obstruct proper placement of insert. Remove excess material if necessary. If bottom of insert is placed against wall first, pushing the bottom panel down will allow top of insert to snap easily into place. Make sure there are no areas where connection wires are bound or scraped by the front insert.

5.18. Mount back panel gasket and bracket on studs mounted on the back of box. Silicone gasket should be sandwiched between bracket and rear panel of box, and the cross slits should center on hole in rear panel.

5.19. Fit the foam insert into the back of the box. Precut hole should line up with center of rear hole and cross slits. Fit rear panel aluminum insert into place, checking first for excess weld material on underside of lip of enclosure. Remove excess material if necessary. If bottom of insert is placed first, pushing bottom panel down should allow top of rear insert to snap easily into place.

5.20. Mount top panel insert with millboard insulation on lid of enclosure using 1/8" 6-32 screws.

5.21. Drill out two holes on latch strike using #17 drill bit. Mount strike latch. Mount strike latch on top of lid.

5.22. Mount lid on top of enclosure using 1/4" 10-32 truss head screws, placing a washer for each screw between lid flap and wall of enclosure as a spacer. This is a temporary mounting solution for proper alignment of enclosure latch. Try to adjust panel insert for ease of opening and closing lid onto box.

5.23. Hang latch from strike so that the latch action is half way. Mark both holes of latch in this position on enclosure wall (template is available for exact spacing of holes at this depth). Be sure latch is in middle of strike and will mount perpendicular to top lip of enclosure.

5.24. Center punch these holes and drill out using #17 drill bit.

5.25. Attach latch to outside of enclosure using 1/4" 6-32 screws, with K-lok nuts on the inside of enclosure and placing stainless steel plate between latch and enclosure wall. When opened, latch should meet strike and close down with reasonable tension to seal enclosure.

5.26. Tighten 4 screws holding lid onto enclosure, adjust as necessary to make lid open and close easily.

5.27. Place foam panels of side walls into enclosure. The fit should allow some excess material against front and back panels to ensure good insulation at the corners of the enclosure.

5.28. Place aluminum side inserts into box, angling front side (where heater studs lie on bottom panel) in first, aligning tab of side insert into slot of front insert. Push the other end of side insert toward wall, sliding minimally against back insert. Tab should snap into slot of back wall insert. Repeat for opposite insert.

5.29. Place 2 1/4-20 K-lok nuts on each heater mount stud on bottom panel of enclosure. Tighten the stand off nuts against panel.

5.30. Place heating element onto studs with terminal connections oriented closest to 115v receptacle. Fasten non-terminal end to stud using washer between heater and 1/4-20 K-lok nut.

5.31. Fit eyelet connection from ground on receptacle over other stud, placing washer below and on top of eyelet. Tighten a 1/4-20 K-lok nut onto stud, make sure complete connection is tight, and there is no damage to wires. The wire must not contact walls or heater.

5.32. Fasten one each high temperature fork to the end of remaining wires (two), and fit onto heating element terminals, using washers and nuts provided on element. Arrange all wires to eliminate contact with enclosure walls, other wires and **the heating element**. They should be neatly tucked away from center of box.

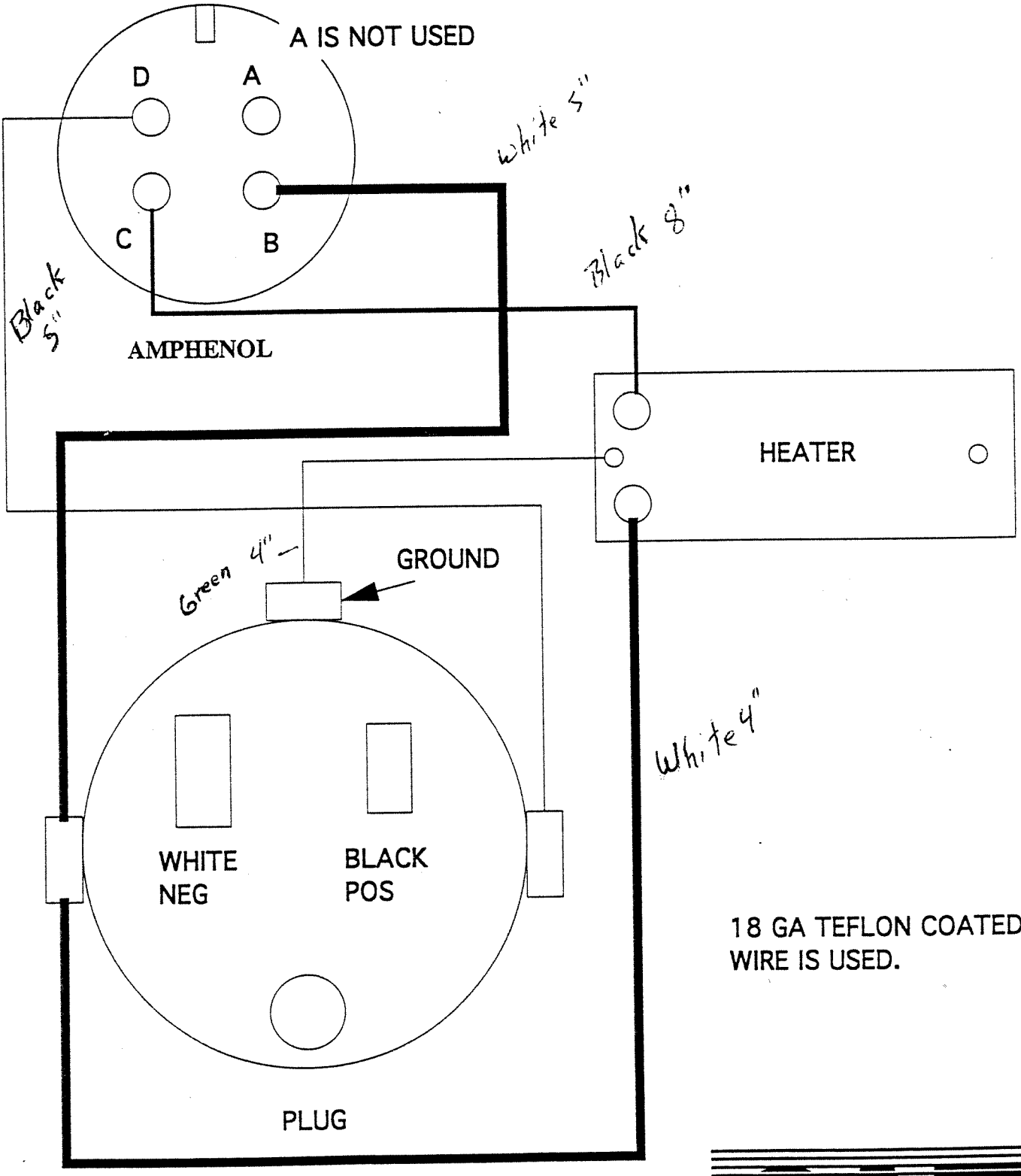
5.33. Place ceramic terminal covers onto each heater terminal and tighten to snug.

5.34. Place red amphenol cover back onto outside amphenol fitting to protect it.

5.35. Using a clean shop rag and some acetone or other cleaning solvent, wipe outside of box removing all dirt and marks.

5.36. Place completed unit in area for final checkout and inspection. Keep original work order with completed units.

CATECO WIRING DIAGRAM



18 GA TEFLON COATED WIRE IS USED.

CAE Express
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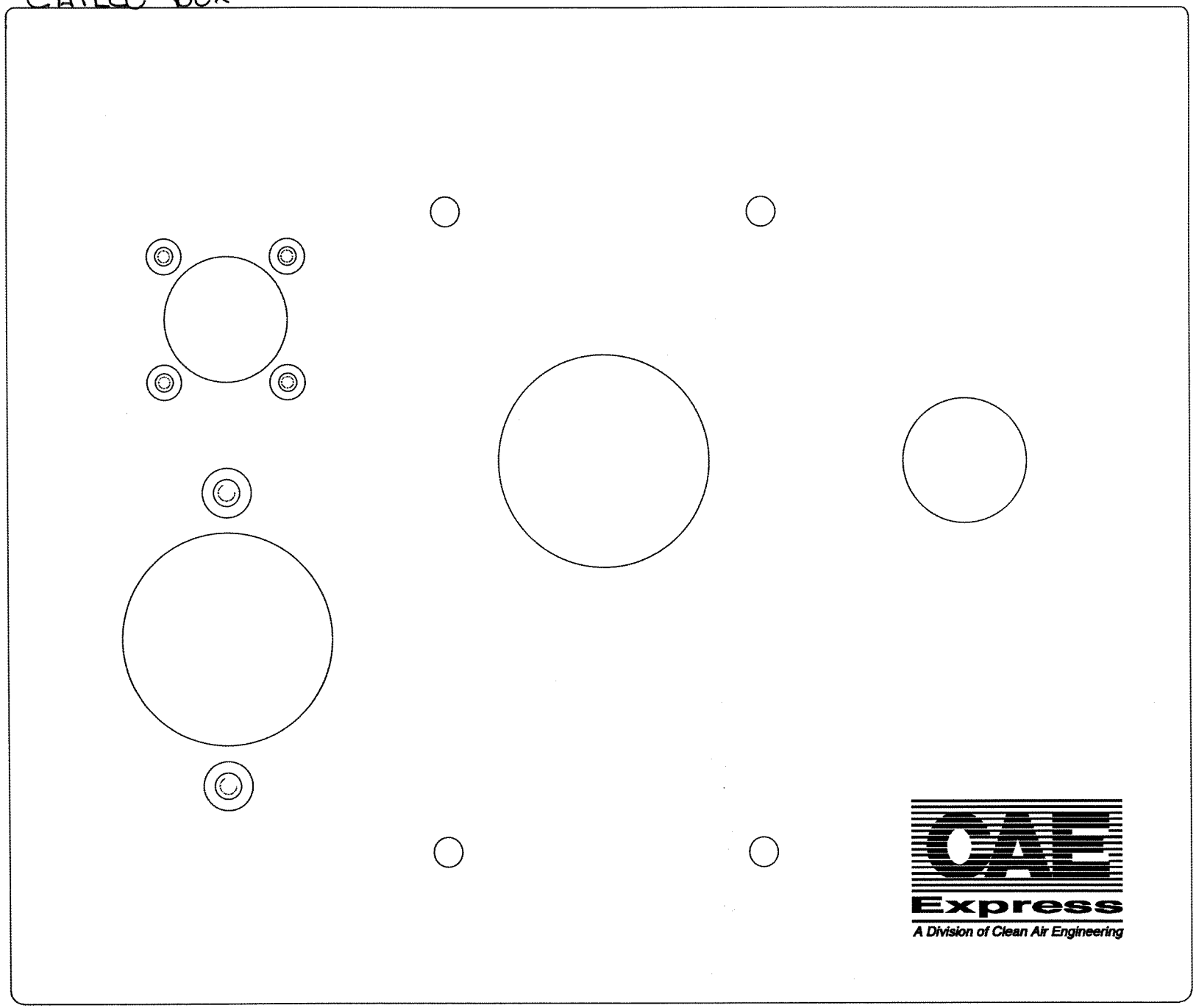
CATECO BOX



OAE
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Procedure for Testing Critical Orifices

1. PURPOSE:
   To explain how to calibrate and size critical orifice sets

2. SCOPE:
   To be used for the assembly and calibration of Critical Orifices.

3. MATERIALS:

   Critical Orifices assembly components:

   3.1.1. Black Top Cover part no. 000022
   3.1.2. Quick Connect part no. 92341
   3.1.3. H Adapters 6 sizes:
   3.1.3.1. 10 LPM part no. 00200
   3.1.3.2. 15 LPM part no. 00210
   3.1.3.3. 20 LPM part no. 00022
   3.1.3.4. 25 LPM part no. 00230
   3.1.3.5. 30 LPM part no. 00240
   3.1.3.6. 34 LPM part no. 00025
   3.1.4. Black Lower Cover part no. 000021
   3.1.5. Case part no. 99451100

Figure 1

   Equipment Needed:

   3.1.6. Calibrated Meter
   3.1.7. Assembled components
   3.1.8. Work sheet
   3.1.9. Excel Spread Sheet for Calibration Orifices (CALSHTNEW)
   3.1.10. Barometric Pressure on the day of calibration
   3.1.11. Calculator

4. DEFINITIONS:
   4.1. H Adapters 6 sizes: O'Keefe Precision Orifices
   4.2. Final volume: finish volume
   4.3. Fly Readings: Readings taken while the gas meter is running and is not turned off.
   4.4. Initial volume: starting volume
   4.5. Run: testing or trial times for an orifice
   4.6. Work Sheet: Used for hand calculation of data from the test runs

5. PROCEDURE:

Sizing the set

1. The flow rate for each of the different hole sizes should be determined. This step can be omitted if O'Keefe Precision Orifices are used

2. The coarse valve should be completely open for each of the tests.

3. Ranges for the flow rates need to be found.

4. To find the ranges the pump vacuum needs to be at 60% of the barometric pressure on the day of testing for each of the different hole sizes. The barometric pressure is read from the weather station located in Dept. 67 or in the Inorganics lab.

5. Write down the initial volume number from the dry gas meter. Readings should be made on the fly

6. Run the meter with the orifice for one minute.

7. Write down the final volume from the dry gas meter

8. Subtract the Initial volume number from the final volume number then multiply that number times 28.316. This will give you your answer in liters per minute.

9. The ranges for the orifices should be as close to 10, 15, 20, 25,30, and 35 liters per minute. The sets should contain 6 different ranges.

10. The orifice should then be locked into the quick connect for testing and to see if the orifice will reach critical vacuum.

Testing the orifice sets

1. Two pumps may have to be put in series to achieve critical vacuum for large hole size orifices. If two pumps will be used they both must be warmed up before testing and the system will leak check.

2. The meter must be warmed up for an hour before testing a set of orifices.

3. The correct ambient temperature (C° or F°) will be recorded on the work sheet. The temperature will be noted at the start of each test.

4. The barometric pressure for the day is recorded on the work sheet. See item 4 of Sizing the set.

5. The vacuum pressure for the test will be run at 60% of the barometric pressure.

6. Each test will be run for exactly 10 minutes. If this is exceeded the test will be rerun.

7. Each orifice to be tested is run a minimum of two times. The variation between tests should be no more than ± .002. Determine pass or fail at the end of the 2 Runs and circle pass or fail at the top of the work sheet.

8. Write down the initial reading on the dry gas meter at the start of the test on the work sheet.

9. Record the inlet and outlet temperatures of the dry gas meter on the work sheet. at the start of the test. Readings for the inlet and outlet temperatures will be recorded after 5 minutes and at the end of the test.

10. While the test is running record the ΔH from the manometer (draft gage) for the orifice on the work sheet. Each of the runs for the same orifice should have the same ΔH reading.

11. At the end of the 10 minute test write down the final reading on the dry gas meter.

12. With all the data collected for the test the K' factor is now ready to calculate.

13. The formula used to calculate K' is equation 5-9 from the 40 CFR part 60.

The formula: $K' = \frac{K_1 * Vm * Yd * (Pbar + \Delta H/13.6) * \sqrt{Tamb}}{Pbar * Tm * \emptyset}$

Where:

$K_1 = 17.64$

Vm = is the difference in the initial reading from the final reading from the dial on the dry gas meter.

Yd = is the Yd which is from the calibration sheet of the meter box that you are using for the test.

Pbar = is the barometric pressure that is recorded on the day of testing.

ΔH = is the inches of water pulled and recorded from the draft gage.

√Tamb = is the ambient temperature added to 460. The square root of this number is taken.

Tm = is 460 + the average of the inlet and out let temperatures from the dry gas meter.

ø = The time of the test always 10 minutes.

Data Entry

1. The tests are void if they are run for more than 10 minutes

2. The data on the work sheet is calculated.

3. The K' factor must not vary more than ± .002 between runs (tests)

4. A new orifice set is assigned a series letter. The series letter is the next letter in the alphabet. See the file in the file cabinet. If all letters are used the next series will be AA to AZ the following 26 will be BA to BZ ect.

5. If calibration is for an old set or a single orifice, the clients ID is used or some other means of ID can be used. An example would be the client's name.

6. The data is entered on a data sheet titled CALSHTNEW on the Q/A director's computer. The file is found in a desk top folder titled gascals. The data sheet is printed on CAE *Express* letterhead

7. The hard copy is inserted in the Critical Orifice Manual to be sent to the client's ordering new sets. Single orifices and recalibration orifices receive the hard copy of their report.

8. A Photocopy is kept on file with the worksheet and filed by the Q/A director.

Set Final Assembly

If a new set of six orifices are going to a client the following is done:

1. A copy of the Critical Orifice Manual is made up for the new set .

2. The orifice's O'Keefe hole size and the series number is engraved on the orifice in small figures.

3. The orifices are labeled with the K' factor with a P-touch type label. The label is placed over the engraved series and hole size figures. See figure 1 section 3.

4. Protection caps are placed on both ends.

5. The orifices are then placed in Case part no. 99451100

If a recalibration or single orifice is going to a client the following is done:

1. A hard copy of the calibration sheets are set with the instrument.

2. The orifices are relabeled with the K' factor with a P-touch type label.

3. Protection caps are placed on both ends.

4. The orifice is placed in it's original packing from the client or in a suitable shipping case.

Work Sheet see sec. 4.1.3

ORIFICE #: DRY GAS STANDARD#: DATE: CALIBRATED BY:	RUN NUMBER 1	 2
	Pass Fail	Pass Fail
Dry Gas Meter:		
Final reading m^3 (ft^3)		
Initial reading m^3 (ft^3)		
Difference, Vm m^3 (ft^3)		
Inlet/Outlet Temperatures:		
Initial °C (°F)	/	/
5 min. °C (°F)	/	/
Final °C (°F)	/	/
Avg. Temperature, °C (°F)		
Time =	10 min.	10 min.
Orifice man. rdg.,ΔH mm (in.) H_2O		
Bar. pressure, Pb mm (in.) Hg		
Ambient temperature, °C (°F)		
Pump vacuum, mm (in.) Hg		
K' factor =		
Average K' =		

The formula: $K' = \frac{K_1 * Vm * Yd * (Pbar + \Delta H/13.6) * \sqrt{Tamb}}{Pbar * Tm * \phi}$

Where:
K_1 = 17.64
Vm = is the difference in the initial reading from the final reading from the dial on the dry gas meter.
Yd = is the Yd which is from the calibration sheet of the meter box that you are using for the test.
Pbar = is the barometric pressure that is recorded on the day of testing.
ΔH = is the inches of water pulled and recorded from the draft gage.
√Tamb = is the ambient temperature added to 460. The square root of this number is taken.
Tm = is 460 + the average of the inlet and out let temperatures from the dry gas meter.
ø = The time of the test always 10 minutes.

Work Sheet Calibration Orifices

ORIFICE #: DRY GAS STANDARD#: DATE: CALIBRATED BY:	RUN NUMBER 1 Pass Fail	RUN NUMBER 2 Pass Fail
Dry Gas Meter:		
Final reading m^3 (ft^3)		
Initial reading m^3 (ft^3)		
Difference, Vm m^3 (ft^3)		
Inlet/Outlet Temperatures:		
Initial °C (°F)	/	/
5 min. °C (°F)	/	/
Final °C (°F)	/	/
Avg. Temperature, °C (°F)		
Time =	10 min.	10 min.
Orifice man. rdg.,ΔH mm (in.) H_2O		
Bar. pressure, Pb mm (in.) Hg		
Ambient temperature, °C (°F)		
Pump vacuum, mm (in.) Hg		
K' factor =		
Average K' =		

The formula: $K' = \frac{K_1 * Vm * Yd * (Pbar + \Delta H/13.6)^{*} \sqrt{Tamb}}{Pbar * Tm * \phi}$

Where:
$K_1 = 17.64$
Vm = is the difference in the initial reading from the final reading from the dial on the dry gas meter.
Yd = is the Yd which is from the calibration sheet of the meter box that you are using for the test.
Pbar = is the barometric pressure that is recorded on the day of testing.
ΔH = is the inches of water pulled and recorded from the draft gage.
√Tamb = is the ambient temperature added to 460. The square root of this number is taken.
Tm = is 460 + the average of the inlet and out let temperatures from the dry gas meter.
ø = The time of the test always 10 minutes.

Delta H for OrificesBought at OKeefe Controls

	43		52		63		70		76		81		
set		43K'		52K'		63K'		70K'		76K'		81K'	P_b
A	0.36	0.263	0.73	0.378	1.50	0.549	2.60	0.706	3.80	0.812	5.30	0.946	29.82
B	0.37	0.270	0.76	0.393	1.60	0.556	2.70	0.718	3.90	0.826	4.80	0.923	29.53
C	0.37	0.268	0.71	0.374	1.60	0.552	2.60	0.700	3.90	0.824	4.90	0.928	29.62
D	0.38	0.276	0.79	0.408	1.70	0.580	2.70	0.731	3.70	0.855	4.70	0.961	29.63
E	0.37	0.2775	0.76	0.395	1.60	0.570	2.70	0.744	3.70	0.858	4.80	0.981	29.69
F	0.37	0.275	0.81	0.404	1.70	0.587	2.70	0.736	3.70	0.859	4.70	0.971	29.41
G	0.36	0.276	0.80	0.405	1.70	0.580	2.70	0.730	3.60	0.842	4.60	0.950	29.69
H	0.37	0.274	0.75	0.390	1.60	0.568	2.60	0.723	3.70	0.848	4.90	0.952	29.96
MOE	0.38	0.269	0.75	0.384	1.70	0.573	2.60	0.725	3.60	0.843	4.70	0.955	29.62
J	0.37	0.275	0.79	0.401	1.60	0.570	2.50	0.701	3.70	0.845	4.90	0.947	29.16
K	0.35	0.269	0.76	0.390	1.60	0.576	2.70	0.728	3.50	0.825	4.90	0.959	29.55
L	0.38	0.278	0.75	0.388	1.60	0.569	2.60	0.712	3.60	0.837	4.90	0.957	29.34
M	0.39	0.273	0.75	0.384	1.60	0.570	2.50	0.703	3.60	0.836	4.70	0.956	29.61
N	0.38	0.271	0.78	0.395	1.60	0.582	2.60	0.719	3.60	0.835	4.90	0.957	29.62
SECO	0.32	0.2485	0.93	0.427	1.60	0.561	1.90	0.606	2.60	0.702	4.50	0.921	29.39
P	0.39	0.276	0.78	0.394	1.60	0.564	2.50	0.708	3.60	0.845	4.70	0.963	29.62
Q	0.43	0.271	0.76	0.389	1.60	0.574	2.70	0.724	3.60	0.840	4.70	0.956	29.34
R	0.41	0.274	0.75	0.388	1.60	0.565	2.55	0.710	3.60	0.842	4.50	0.940	29.20
SMIX	0.41	0.272	0.79	0.396	1.50	0.553	2.50	0.698	3.50	0.825			29.14
	43	43K'	52	52K'	63	63K'	70	70K'	76	76K'	81	81K'	P_b
AVE	0.38	0.271	0.77	0.394	1.61	0.568	2.58	0.712	3.61	0.832	4.78	0.951	29.523

GLASS FIBER SUBSTRATES

FILTER #5

1, 3, 5, 7

FIT ON TOP OF STAGES 1, 3, 5, 7 RESPECTIVELY

FILTER #6

2, 4, 6, 8

FIT ON TOP OF STAGES 2, 4, 6, 8 RESPECTIVELY

FIGURE 1A

Manufacture Procedure For Particle Substrate Sets(0635)

1. PURPOSE:
To explain how to assemble Particle Substrates Sets.

2. SCOPE:
To be used by all personnel who assemble Particle Substrates Sets.

3. MATERIALS:
Substrates assembly components:
3.1. 0634 Substrate Filter Set
3.2. 06351 6.35 cm Glass Filter
3.3. 0622PL Pan Liners
3.4. 0622PD Petri Dish
3.5. CAE Express Envelope
3.6. Clear "Scotch" Tape

Equipment Needed:
3.7. Number Stamp and Indelible Ink
3.8. Tweezers
3.9. Clean sheets of white paper (copy paper)

4. DEFINITIONS:
4.1. Substrate Filter Set 0634: A sheet which is stamped with 2 substrates. One substrate will have a 10 mm center (small) and the other a 15 mm center (large). One side of the filter will have a smooth texture the opposite side will have a bumpy or rough texture.

5. PROCEDURE:

5.1. The assembler will have clean hands and will use tweezers when handling substrates and filters.

5.2. Substrates will be assembled in an area that is clean and dust free to allow minimum particle contamination.

5.3. Open the box of substrates. Use care in opening the sealed plastic bag. The bag will be used to keep the unused substrates clean.

5.4. Use the tweezers to lay out 4 sets of substrates, in 4 rows, on a clean sheet of copy type paper. The rough side of the filter will be up. The substrates with a 10 mm (small) center will be on the left and the substrates with a 15 mm (large) center will be on the right.

5.5. Put a piece of paper on top of the eight substrates.

5.6. Continue to lay out sets until the work order is filled.

5.7. Take sheet of eight substrates from the pile and put it on the table top.

5.8. The numbers 1-8 are used for each set. Odd Numbers 1,3,5, and 7 are stamped on the substrates with the small centers. Even numbers 2,4,6, and 8, are stamped on the substrates with the large centers.

5.9. Start stamping each substrate. The rough side of the substrate is stamped in the center.

5.10. As a set is stamped, tweezers will be used to stack the substrates in numerical order with 1 on the bottom of the stack and 8 at the top. Do not use your hands to touch the substrates. A clean metal ruler could be helpful in stacking.

5.11. Put the stamped stacked sets on a clean sheet of paper. Complete stamping numbers 1-8 on all the substrates in the work order.

5.12. Clean 6.35 solid filters are laid out. Tweezers are used to lay out the filters. The smooth side of the filter is placed up. One filter is needed per set.

5.13. Each solid filter will have a 2 digit number stamped on it. The two digit number is the filter I. D. number.

5.14. Check to see if stamped filters are in inventory. No filters that are in inventory will have the same I. D. number as the new work order sets.

5.15. The numbers will start with 10 and go to 99, as needed to complete the work order.

5.16. The stamped solid 6.35 filters will be placed on top of the stamped substrate sets.

5.17. A stamped set will be placed in a CAE Express Envelope using tweezers. Stack at the return address side of the envelope.

5.18. The envelope is folded in three parts so that the return address is up and can be read. Inside the envelope the substrates will be in a neat pile and fold free.

5.19. A small piece of tape is used on the edge envelope so that it will not unfold.

5.20. The envelope is placed on pan liner 0622PL and placed inside petri dish 0622PD.

5.21. The petri dish is taped closed with 2 pieces of scotch tape.

5.22. Steps 5.17-5.21 are repeated until the work order is complete.