Heat Exchanger Tube Change Procedure

Application: DATS II, DATS III, CorrDATS, CFM-500 and high temp, 120 or 240 VAC manufactured after 1 May 01
Last Update: 17 Dec 02

The DATS II and III systems use identical silicone insulated heater elements in their heat exchangers. The high temperature systems use similar construction but the heater has an integral clamp and mineral insulation to extend its operating temperature.

The heat exchanger case for newer DATS systems is a stainless steel, splash resistant enclosure approximately 10 x 10 x 24" [25 cm x 25cm x 60cm]. The heat exchanger case is split around its circumference to allow easy access to internal components. The case is not water tight and should not be subjected excessive spray or immersion.

Procedure:

1) Stop fluid flow through the DATS tube and disconnect the fluid connections from the inlet and outlet ends of the heat exchanger.

2) Disconnect the power and signal connection cable from the DATS electronics or insure that no power is supplied to the Electronics while this procedure is performed.

Allow the heat exchanger core to cool if it has recently been in operation as it may burn you on contact, if hot.

3) Remove the four screws on the top cover of the enclosure. Lift off the cover and invert it and insure that the black gasket material is intact and in good condition as this forms the seal for the enclosure. Place it away from the heat exchanger.

4) Loosen the large tube grips on either end of the heat exchanger so that the tube can be moved. On standard systems these nuts will be black polypropylene plastic. On high temperature systems, these nuts will be stainless steel with teflon ferrules or all teflon. The purpose of these nuts is to support the tube and prevent twisting. They do not need to be tightened excessively and doing so may mar the tube surface. Loosen the outer nut only. You may have to hold the base of the tube grip while you loosen the outer nut, or the connection to the metal end plate will be loosened instead of the outer nut.

5) Remove the three screws on the end of each enclosure end plate. One screw on the discharge end has a nut on the inside surface holding the power cable shield wire. You may reach down with a needle nose pliers and grab this nut while loosening the screw from the exterior with a phillips head

screwdriver.

6) The enclosure end plates should slide off the tube from either end.

7) Remove the rigid yellow insulation from the top of the heat exchanger. Do this by sliding the insulation towards the inlet end and rotating the rear of the insulation out of the enclosure (to avoid the temperature amplifier modules on the rear right wall of the enclosure.

8) Follow the power wires out of the heater element and disconnect the power lead at the white IEC Euro connector. Leave the wires connected to the heat exchanger and disconnect the power wires from the electronics cable. Rewiring this connector will permit you to set the heater element for nominal 12 ohms (for 120 VAC operation) or nominal 48 ohms (for 230 VAC operation). Keep the same wiring configuration if you do not intend to change the voltage [red = hot, black = ground/neutral, blue = neutral/hot].

9) Locate both temperature sensors, one on the inlet block and one on the heater block. These are fragile 100 ohm platinum resistance temperature sensors approximately 1/8" in diameter. The platinum bobbin is contained in a stainless steel tube and is ~4" long. Loosen the brass compression nut (use 3/8" open end wrench to loosen if necessary) holding the sensor in the block and slide the sensor out of the block bringing the brass nut and ferrule with the sensor. White heat transfer paste will cover the temperature sensor at its end. Place the sensors in a location where they will not be contaminated or smeared clean. The wires will remain connected to the heat exchanger enclosure (and amplifiers). These temperature sensors are fragile and should not be grasped with a pliers or other tool. When properly loosened and aligned, they will slide out with light hand force.

9a) On CorrDATS systems, the electrical connections to the electrodes should be loosened at the connector screw terminals away from the heater block. The teflon insulated electrode wires will remain connected to the coupon blocks for the next tube installation.

10) The heat exchanger core may now be lifted out of the enclosure. For easy access you may use the two end plates inverted with the tube grips to hold the heat exchanger tube and blocks securely.

11) Loosen the nuts holding the heater element on the tube. On low temperature systems this will be three separate hose clamps with belleville type washers (use 1/2" rachet wrench). Loosen them all together until they slide loosely on top of the stainless steel sheath and heater element. On

high temperature systems, the heater element is two pieces with integral clamping bolts. Loosen the clamping bolts until you are able to gain access to the gap in the aluminum block by rotating the stainless exterior band (or heater elements for high tempertature systems) slightly.

11a) On CorrDATS systems the three threaded rods on the exterior cage assembly must be progressively loosened until all pressure is off the cage. The coupon sections will now fall free except for their electrical connections. Remove the threaded rods entirely from the cage blocks.

If the inlet and outlet tubes will be reused and only the coupons will be changed, set them aside and work on the coupon heater clamps. On CorrDATS systems, the 5" main block heater will remain with the inlet section of the heat exchanger tube.

Loosen the single nut holding the clamp on the exterior of the heating element on each coupon section and slip the small aluminum block and tube section free. The electrode wire will remain connected to the aluminum block. Gather the large teflon disks for reuse. The small PEEK rings will not be reused.

12) Pry the heater block open to release the tube using two flat blade screwdrivers. Do so by tapping the end of the stubby screwdrivers with a mallet or hammer into the block gap to slightly expand the aluminum block. After extended use or corrosion, you may have to tap the tube to break it free from the block.

Note: If the tube is bent or has been marred or a compression fitting is left on the exterior, you must cut of the tube end to remove the compression fitting and allow the heater and inlet blocks to slide off the tube end.

Rock the heater element on the tube slightly using hand pressure if it does not loosen immediately. Observe the tube where it penetrates the heater block to determine where opposing pressure is required on the block and tube to release the block.

Note: Do not mar the interior surface of the block as it must be free of defects to insure proper thermal contact. The block is made of (comparitivly) soft aluminum and can be easily damaged by burrs on the tube ends of hard materials like stainless steel or titanium.

12a) A snap ring pliers should be used to remove the snap rings from the inside end of the heater cage clamps. Save these snap rings for use on reassembly.

13) Perform the same procedure on the inlet block. First loosen

and remove the hose clamp. Then, using only one screw driver, pry open the block and slide it off the tube. You now have the tube removed so that it can be inspected or destructively tested. If you have a CorrDATS, the weight of the tube sections has been supplied with the original shipping paperwork for coupon weight loss analysis.

Tube installation procedure:

1) Prepare the tube exterior surface in the region where the heater block will be clamped. The tube must not have any dents or deformities which cannot be sanded out. Used 400 or 600 grit sand paper and steel wool to smooth the exterior surface of the tube along its entire length paying particular attention to the region where the heater and inlet blocks will be clamped.

2) Mark the heater and inlet clamp positions on the new tube with a magic marker. Mark the region upstream and downstream outside the coated area so that you can center the heater between the marks without removing any heat transfer paste.

3) Clean the interior of the heater block and inlet blocks using a rag or paper towel and wooden dowel.

3a) On the CorrDATS assemble the inlet and outlet tube ends first. Use the snap rings and tighten the heater cage blocks so that they rest directly against the snap rings.

4) Coat the tube exterior with heat transfer paste around the region where the heater block will be clamped. Use a silver bearing paste or DOW 340 silicone paste. The heat transfer paste should be only a translucent layer, no thicker, to optimize thermal conductivity between the heater block and tube.

4a) Coat the exterior of the corrosion coupons but take care not to coat the tube ends which will seal on the new PEEK washers. Clamp the heaters on each of the coupons first and insure that the coupons are centered beneath the heaters. Snap the new PEEK rings inside the teflon washers and assemble all the heaters in a stack between the inlet and outlet tube sections and cage clamp blocks.

Slide the alignent rod through the entire assembly working one section or washer at a time. The alignment rod should be properly sized for the replacement tube elements (.004" undersize) or they will not fit or not align well during assembly. The Teflon washers and PEEK rings are symetrical and can be put on in orientation.

Insure all the heater block gaps and electrical wires line up with the inlet block and or large heater block to ease stowing of the system electrical wires.

Insert the threaded rods in the heater cage clamp blocks and tighten them all to finger tight on the correct number of belleville washers. Then progressively tighten the nuts until the correct torque is reached on each nut. Test that the aligment rod can be twisted and removed from the assembly with only minor force.

5) Slide the heater block on the tube and tighten the clamps and heater in position as you hold it in place.

The remainder of the tasks are the reverse of disassembly with the following notes:

Use additional heat transfer paste on the temperature sensors if required.

Make the electrical connections and stow the wires so they will not come in direct contact with the heater element (especially on the high temperature models). A small channel should be cut in the exterior of the insulation for the temperature sensor probes for this purpose.

After the heat exchanger has been assembled, check the electrical connections with an ohmeter to insure proper configuration. The inlet water and heater block temperture sensors should measure approximately 100 ohms + .0385 ohms per degree C above 0 degrees C. Measure from the amplifier terminals inside the heat exchanger to insure all wiring is correct. Measure the heater element resistance from the exterior cable to the DATS electronics. The resistance should be as follows:

DATS 120VAC system	~12 ohms +-1 ohm
DATS 240VAC system	~48 ohms +-4 ohm
Corr DATS 120VAC system	~10 ohms
Corr DATS 240VAC system	~38 ohms

On CorrDATS there should be no electrical continuity amongst the electrodes and between any of the electrodes and ground. To insure you do not damage the sensitive inputs of the corrosion measurement electronics with your ohm meter, disconnect the electrode leads from the electronics during this test. Also, the exterior stainless heater element guards should be grounded to the threaded rod via their end tabs.

Make sure all electrical connections are remade and power up the system and check that the temperature sensors read similar values before heat has been applied. Then test the heat exchanger as per a normal installation.

Note: From JUN 93 to AUG 95 silicone heaters were shipped on the DATS II, but their lead locations were different from the present end tabs. This procedure is still applicable, but clamping hardware may differ slightly in appearence.

In MAR 95 we converted to dual element heaters for 120 or 240 volt operation. The same heater will be used and wired for high or low voltage (120 or 240 VAC) as requested.

In AUG 95 we began using silicone heater elements on our small heaters on the CorrDATS. They are wired for 120 or 240 VAC similar to the large heater elements.

In Jun 99 we eliminated the connector for power in the heat exchanger and now use IEC Euro style screw terminals for all power connections. Older systems should be modified to this standard.

In May of 01 we switched to the large stainless steel enclosures for heat exchangers in all systems. Older systems have white aluminum split enclosures for the heat exchangers.

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Suggested tool/parts list:

heat transfer paste, silver bearing, small tube
screwdriver, common, small head (electrical connections)
screwdriver, phillips, medium (to remove end screws)
screwdriver, common, broad flat head (2 required)
mallet, wood or metal (to drive flat head screwdrivers)
needle nose pliers (to grasp small nuts)
open end wrench, 1/2" (to remove temp. sensors)
1/4" socket drive allen wrench (CorrDATS only)
snap ring pliers, outside (for CorrDATS only)
rachet wrench and sockets, 3/8" drive (for clamps)
Torque wrench, 50-150 inch lb range (to torque heater clamps)
Alignment rod, OD as required (for CorrDATS)