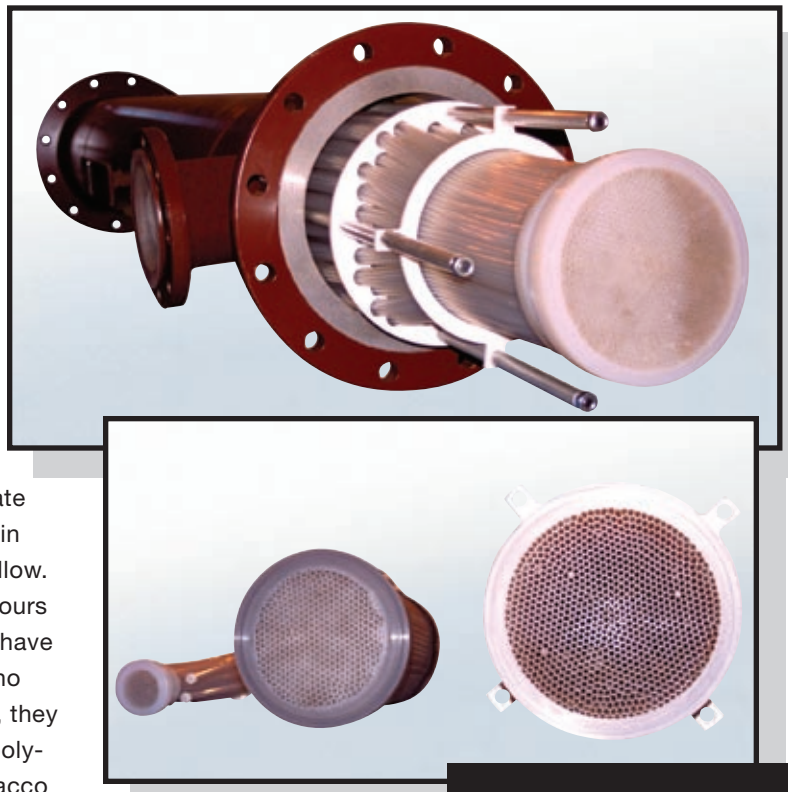
Safety and Repair Guidelines

SAFETY CONSIDERATIONS FOR REPAIRING AMETEK FLUOROPOLYMER HEAT EXCHANGERS

Large quantities of fluoropolymer resins have been processed safely by many different fabricators in a variety of operations. The record clearly proves that fluoropolymer resins can be processed at temperatures above 545°F (285°C) without hazard if proper ventilation is used. If ventilation is not adequate and fumes of heated fluoropolymer resin are inhaled in sufficient quantities, influenza-like symptoms may follow. The symptoms do not ordinarily occur until several hours after exposure and pass within 36 to 48 hours. They have no lasting effects, are not cumulative, and there are no records of serious injury. If such symptoms do occur, they usually follow exposure to vapors evolved from the polymer at 545°F (285°C) or above, or from smoking tobacco or cigarettes that have been in contact with it. The occurrence of these symptoms does indicate inadequate ventilation that should be improved.

Just as the fumes or decomposition products of many common resins, paints, elastomers, solvents—or even wood, silk and rubber—can be toxic in heavy concentration, so may the fumes from heated fluoropolymer or its decomposition products. Therefore, the ventilation precautions to be observed when heating fluoropolymers are the same as those which should be observed when heating conventional materials. If adequate ventilation cannot be provided, a respirator equipped with the appropriate cartridge filter will give the operator the protection required for short repair jobs. Consult the respirator manufacturer for the correct cartridge selection.

AMETEK Fluoropolymer Heat Exchangers are designed for ease of maintenance and repair. In fact, troubleshooting and repair of tubing leaks can usually be performed by on-site personnel without complete disassembly of the heat exchanger.



HONEYCOMB FACES

LOCATING A LEAK

Identification of a damaged tube is easily accomplished. For an immersion coil, simply attach the unit to a water supply and note the leaking tube. For smaller leaks, it may be necessary to submerge the heat exchanger under water and pressurize it with air at 50 psig maximum. Leaks can then be located by the "bubble trail."

For shell and tube units, it is best to remove the bundle from the shell. Remove all hardware from both ends and slide the bundle from the shell. Support the bundle on a flat surface or with slings to prevent severe bending and subsequent damage. Once the bundle is removed from the shell, proceed as above. If the leak is close behind the honeycomb, it may be necessary to replace the bundle in the shell and pressurize the shell side of the unit. Brush the face of the honeycomb with soap solution and deter-

FEP and PFA Series coils are considered inert to corrosive chemicals. Contact an AMETEK representative for chemical resistance data on your specific application. Q-Series heat exchangers are inert to most corrosive chemicals except for certain concentrated hot, oxidizing acids.

455 Corporate Boulevard, Newark DE 19702 U.S.A. • Tel: 302-456-4431 • 800-441-7777 • Fax: 302-456-4444
www.ametekfpp.com • E-mail: info.haveg@ametek.com

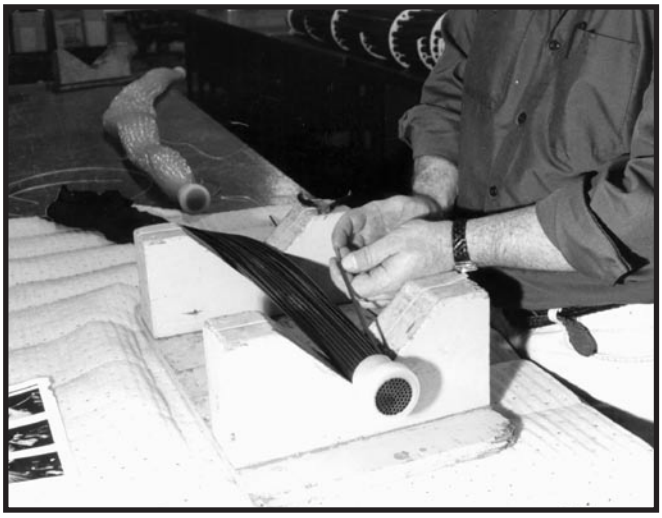


FIGURE 1—Separate the damaged tube away from the rest of the bundle.

FIGURE 2—Apply heat to the end of the tube with a plastic welding gun.

mine where the air is leaking. A honeycomb face repair will then be necessary. Be sure to check both ends for leaks, and repair both if necessary.

NOTE: Tube repairs are more simply achieved than honeycomb face repairs. Always consider tube repairs first. Call AMETEK to discuss the situation if you have questions.

REPAIRS TO THE TUBE BUNDLE

A leaking tube in an AMETEK Shell and Tube Fluoropolymer Heat Exchanger can be plugged easily once the bundle is removed from the shell. Once the leak is located, cut the damaged tube at the break and separate the two cut tube ends from the other tubes in the bundle. Then, recut the tube about 6 to 8 inches (150 to 200 mm) from each end of the bundle. The tube is now ready to be repaired.

CAUTION: DO NOT APPLY HEAT DIRECTLY TO THE BUNDLE. Move the tube away from the bundle body as shown in Figure 1.

Leaking Immersion Coil tubes can also be easily repaired. Due to the large number of tubes in a bundle, loss of one or even several tubes would not appreciably decrease the heat transfer capability of a coil. Once a leak is located, it can be plugged using the same procedure as for shell and tube bundle repairs. Cut the damaged tube at the break, separate the two cut tube ends from the other tubes in the bundle. Then, recut the tube about 6 to 8 inches (150 to 200 mm) from each end of the coil. The damaged tube ends are now ready for repair.

Clean the inside of the tube using a pipe cleaner or cotton swab dipped in alcohol or other appropriate solvent. Insert fluoropolymer plugging material into the tube end to a depth of approximately 1 inch (25.4 mm). Then, cut off about 1/8 inch (3 mm) of the tube and plug material in one clean slice. Apply heat to the end of the tube using a plastic weld gun with temperature set at 600^{O} to 700^{O}F (316^{O} to 371^{O}C). (See Figure 2.) Once the tube and/or plug becomes clear, grasp the tube with a damp cloth or paper towel and gently squeeze the tube while rolling it with your fingers. This completes the repair to one tube end; both ends must be repaired before the coil may be restored to full service.

If a plastic weld gun is not available, most tube leaks can be repaired using a small, clean flame and flat-nose pliers. First, cut the tube at the leak, leaving enough tube remaining to move it away from the bundle. Then, use a cotton swab and alcohol to clean the inside of both tube ends. Apply an open flame to the tube at about 1/2 inch (13 mm) from the cut end; avoid depositing soot on the tube. Once the tube begins to sag or becomes clear in appearance, remove the flame. Then, using the flat-nose pliers, crimp the hot section of tube at about 1/2 inch (13 mm) from the cut end. Apply firm, steady pressure for about 10 seconds, but do not pull on the tube. Repeat this heating and crimping procedure for repairs to the other end of the tube.

For a stronger repair, insert plugging material into the

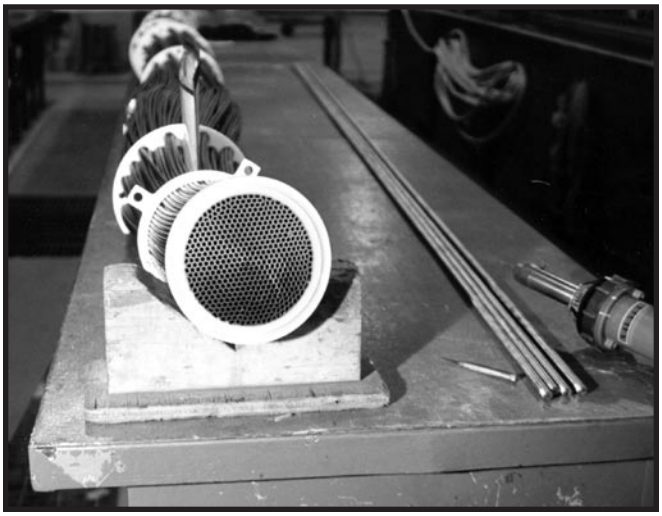


FIGURE 3—Ensure that the honeycomb face is clean and dry in the area to be repaired.

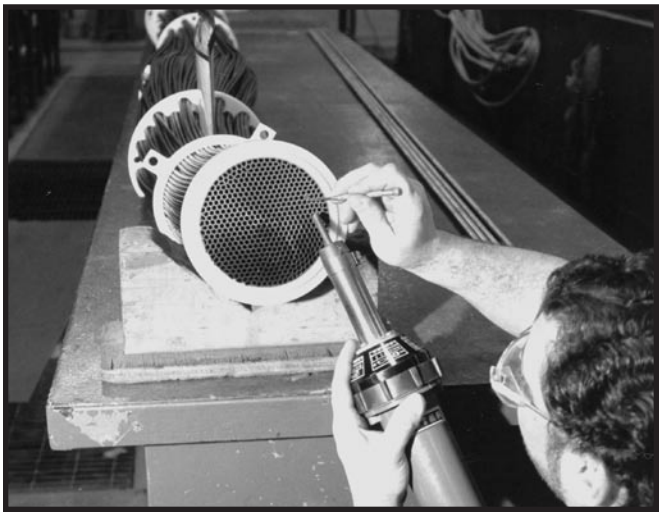


FIGURE 4—Using a hot air gun, carefully apply heat to the plug and surrounding honeycomb.

cut tube before heating. Always use plugging material for tube diameters of 1/4 inch (6.4 mm) O.D. or larger; plugging material is available from AMETEK.

DO NOT TRY TO SEAL THE TUBING WITH HEATED METAL PLIERS. The fluoropolymer resins will stick to the hot metal.

REPAIRS TO THE HONEYCOMB FACE

Identification of a damaged tube within a honeycomb bundle is easily accomplished by inserting a soft wire or pipe cleaner into the point of tube damage and working it toward the honeycomb face. The wire protruding through the honeycomb face identifies the affected tube within the bundle. Once the damaged tube has been located, repairs may be made as follows:

WARNING! Do not attempt to clear undamaged tubes by inserting welding rod, wire, or other devices.

First, ensure that the honeycomb face is clean and dry in the area to be repaired. (See Figure 3.) Then, using a cotton swab or pipe cleaner, clean the inside of the tube with alcohol or other appropriate solvent. Insert a piece of fluoropolymer plugging material the proper diameter about 1/2 inch (13 mm) long into the leaking tube end, allowing approximately 1/16 inch (1.6 mm) protrusion from the honeycomb face. If the plugging material is too thick to enter the honeycomb, stretch the plugging material slightly to reduce its diameter. Using a hot air gun at 600° to 700°F (316° to 371°C), apply heat to the plug and surrounding honeycomb. (See Figure 4). Heat very carefully, allowing the material to slowly come up to temperature. Correct working temperature has been reached when the plug and adjacent tube material become transparent. Once that occurs, apply pressure to the side of the plug by inserting a scribe into the adjacent tubes and pressing the tube wall toward the plug. Then, using the scribe handle, apply a small amount of pressure to the top of the plug, applying heat as necessary. It is much better to go slowly than to rush this operation.

Allow the new plug seal to *slowly* air cool. Rapid cooling may result in stresses to the honeycomb area, which may lead to cracks or failure of the honeycomb. Once plugs on both ends are cool, the heat exchanger may be reassembled and pressure-tested. If further leaks appear, dry the area, reheat the plug, and rework with a scribe.

In some cases, the 1/4 inch (6.4 mm) plugging material may not be large enough to fill the tube. This may be remedied by inserting several pieces of plugging material to depth of 1/2 to 3/4 inch (13 to 19 mm) into the tube, leaving 6 to 7 inches (150 to 180 mm) of exposed plug. Holding the exposed plug end, use a hot air gun to heat the plug and adjacent tubes at the honeycomb face. Apply only enough heat to keep the plug material soft and transparent while working the sides and face until plug adheres to the tube wall and the tube is full. Once the tube is completely plugged, cut off excess material to make the plug flush with the honeycomb face. Then, use a scribe to work the sides of adjacent tubes toward the end-plug, and to work the top of the plug to the wall edges.

ROD COVERING REPAIR

Minor damage to the fluoropolymer which covers Slimline support rods can be repaired by melt-fixing a patch of FEP over the damaged area. Rod repair material is available from AMETEK. Clean the cut area and lightly sand. Apply heat to the area with a plastic welding gun set at 1100°F (593°C) to soften the covering. While the covering is in a softened state, flatten the area around the cut. Cut a length of material long enough to cover the damaged area with 1/2 inch (13 mm) overlap on each end.

Hold the material centered over the repair area and heat one end until tacked. Proceed to mold the patch to the contours of the rod by working from the center outwards using the heat gun. This will push any air from under the patch. When the patch has been melted to the contour of the rod, reheat in the center. Melt and press the patch, pushing outward, until the patch is completely bonded.

CLEANING THE BUNDLE

A fluoropolymer heat exchanger should always be chemically decontaminated before attempting repairs. Decontamination procedures vary widely based on the chemicals processed. Local safety personnel should approve procedures, and certify unit is safe for workers to proceed.

Do not attempt to clean the outside surface of the bundle by scraping or chipping. Do not use hard abrasive materials. Damage to the fluoropolymer bundle may result. The bundle should always be chemically cleaned by soaking in a bath (water, hot water, mild acid, etc.) of liquid tailored to dissolve the material on the unit. Do not flush with high pressure water, as the velocity will damage the bundle. Maximum flushing should be typically with a "garden hose flow."

Similarly, do not "rod" out plugged tubes with a hard metal rod. Backflush with water, solvent, or low pressure (40-50 psig maximum) steam to clean the tube insides.

AMETEK®

CHEMICAL PRODUCTS

455 CORPORATE BOULEVARD, NEWARK, DELAWARE 19702 U.S.A.

TEL: (302) 456-4431 • (800) 441-7777 • FAX: (302) 456-4444 • www.ametekfpp.com • E-mail: info.haveg@ametek.com

407PDF (040071)