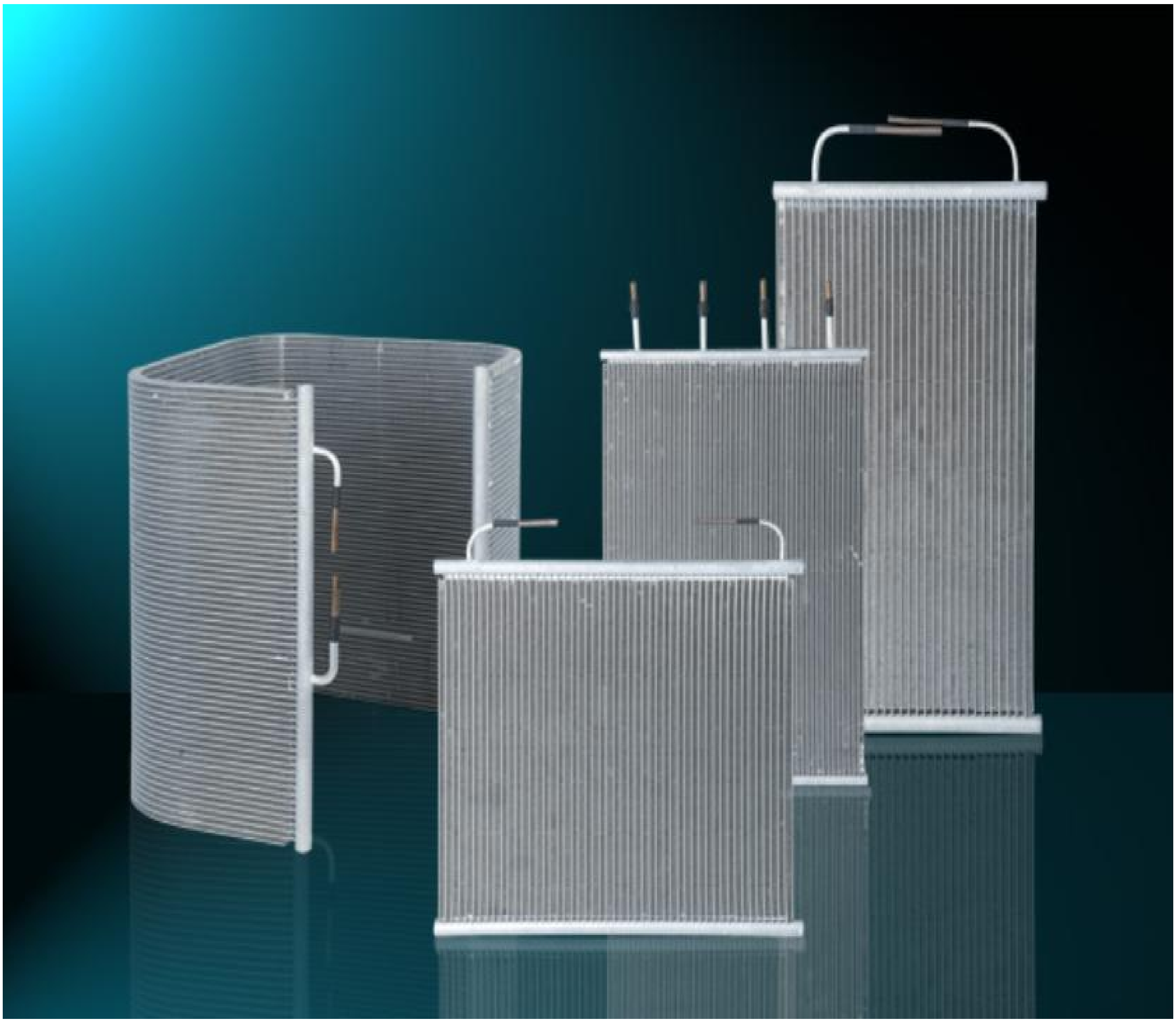

MICROCHANNEL HEAT EXCHANGER

INSTALLATION & MAINTENANCE MANUAL

Version1.1

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DANFOSS SANHUA (HANGZHOU) MICRO CHANNEL HEAT EXCHANGER CO., LTD.

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Foreword

This manual is a guide for installation and maintenance of Microchannel Heat Exchangers (MCHEs) supplied by Danfoss-Sanhua. We recommend that you read this manual carefully before commencing any work.

MCHE is specially designed and manufactured for operating conditions that were specified by customer. Please consult Danfoss-Sanhua if want to change the operating conditions.

Please notice that Danfoss-Sanhua will not be responsible or liable for any damage caused by failure to comply with the instructions in this manual and/or due to incorrect installation, operation and maintenance of MCHE.

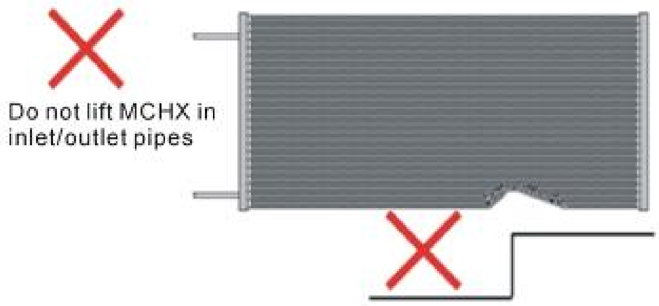
1. Storage and Working Environment

- Microchannel heat exchanger should be stored indoor with a dry and clean environment.
- The storage temperature range is -30° C to 121° C (-22° F to 250° F).
- Metal chips, or dust of copper or steel can cause galvanic corrosion, so please keep the storage and installation areas clean and separate from machining or welding areas. Add use separate tools and/or keep tools clean.
- To minimize potential damage, we recommend that you keep MCHEs in the package until ready to install them on your unit.
- Improper storage and stack can cause premature corrosion or deformation and will reduce MCHE’s life. Extra care should be taken!

2. Handling - Handle with care!

Comparing with fin & tube coils, microchannel heat exchangers are relatively light. The fins are less easy to be bent and cut fingers. However the overall coil assembly is made of soft aluminum, so that it is surprisingly easy to be bent. The combination of these features makes it easy to handle and easy to be damaged. The good news is that there should be much less fin damage than traditional tube and fin coils because the microchannel tubes support and protect the fins. Keep in mind:

- The inlet and outlet tubes are designed only for connection and support their own weight. Unfortunately they locate where handles would be and often look like handles. **Never lift a MCHE by the inlet and outlet tubes!**



Do not hit or drop MCHX on edges.

- Because they are made of soft aluminum, dropping, impacting, forcing, placing heavy objects on top of, or stepping on MCHEs will almost certainly deform them. Notice that if the coils end up bowed, it is possible to flatten them back out by laying them concave side down on a flat table and tapping them firmly with a large heavy flat plate (say 3-4 square feet of ½" plywood or plastic sheet with a couple of handles attached). This procedure works for bowed coils with flush fins, not for local fin protrusions.

3. Bending Procedure

The same bending machines can be used for MCHE and tube & fin heat exchangers. We recommend that ship flat MCHEs for efficient packing and bend them at customer's plant.

Bending radius

The minimal bending radius required to achieve acceptable manufacturing yields is a function of the microchannel tube, fin, and alloy, as well as the bending equipment, fixturing, bending speed and bending length. Therefore during the development process customer should test bending the specific coil on the specific configuration to verify the design's manufacturability. In general, tighter radius, thicker tube and longer bend line are harder to bend. The below table is a rough guide to the possible smallest radius under the most favorable conditions. **Use a more generous radius as possible.**

Recommended *minimal* bending radii (as determined by factory tests under *favorable* conditions) are shown below for different microchannel tubes and fins. Consult with Danfoss-Sanhua for the tubes not listed. **Do not extrapolate or interpolate the values arbitrarily.**

MC Tube	Structural parameters		Material	Minimal Recommended Bending R	
	Tube (Wmm*Hmm*Port #)	Fin (Hmm*Gage mm)		mm	in
1G16	16*1.8*10	8.1*0.1	3102	90	3.5
1G20	20*2*12	8.1*0.1	3102	110	4.3
2G16	16*1.3*16	8.1*0.08	3102	90	3.5
2G20	20.6*1.3*20	8.1*0.08	3102	140	5.5
2G20	20.6*1.3*20	8.1*0.08	31104	170	6.7
2G25	25.4*1.3*26	8.1*0.08	3102	200	7.87
2G25	25.4*1.3*26	8.1*0.1	3102	170	6.7
2G25	25.4*1.3*26	8.1*0.08	31104	>220	>8.7
2G25	25.4*1.3*26	8.1*0.1	31104	190	7.5
3G16	16*1.3*16	11.4*0.09	3102	110	4.3

Pay attention to the following matters during bending

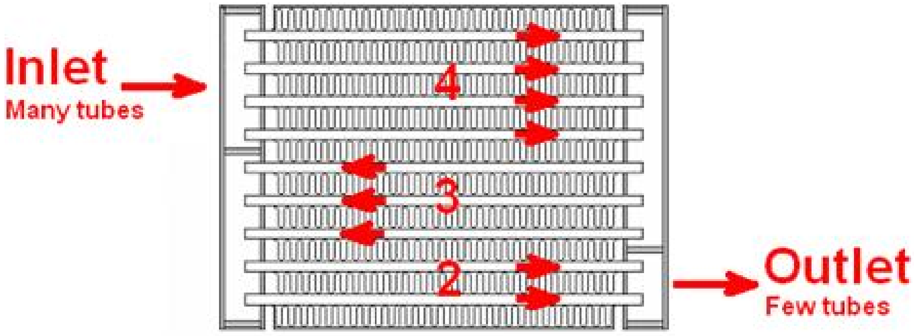
- Remember that microchannel coils are made of soft aluminum that is surprisingly easy to be bent during handling. Before you bend, make sure the MCHE is flat, square and undamaged. Consider a sizing operation to ensure this.
- Make sure the coils are loaded into the bender in a way that *keeps* them flat square and undamaged.
- Keep the flat tubes perpendicular to the spindle while bending the coil.
- Clamp the coil during the bending, being careful not to crush it.
- Smaller bending speeds will often yield better results.
- Vertical spindle bending machines are often set up so that the microchannel coil ends up sliding along the table with all its weight supported by to header ends and/or the dead tube on the bottom. The dead tube in particular is supported only by fins and really not designed to hold the whole weight of a large coil, particularly when combined with a frictional load that wants to push the fins over. Therefore be careful to insure that at no point during the bending operations is one end of the coil cantilevered off the edge of the table, because this can cause the coil to droop so that the tubes are no longer perpendicular to the spindle, resulting in corkscrewing or reduced bend quality and/or consistency. Note also that in some benders, portions of the table drop down during bending, creating more opportunities for cantilevers.
- Per the above with vertical spindle benders, the quality, parallelism, and height (relative to the header ends) of the bottom dead tube can become important to control (depending on your coil holding fixtures).

- Bending multi-bend coils on a horizontal spindle bender can also cause cantilevered loads from the dead weight of the unsupported bent legs. For instance on a three bend coil, depending on fixturing, the load of the first 75% of the coil may be put back into the remaining coil leg, possibly causing poor bend quality and/or permanent deformation. This problem is more severe with MCHE's than with similar fin and tube coils.

4. Installation

Pass Arrangement

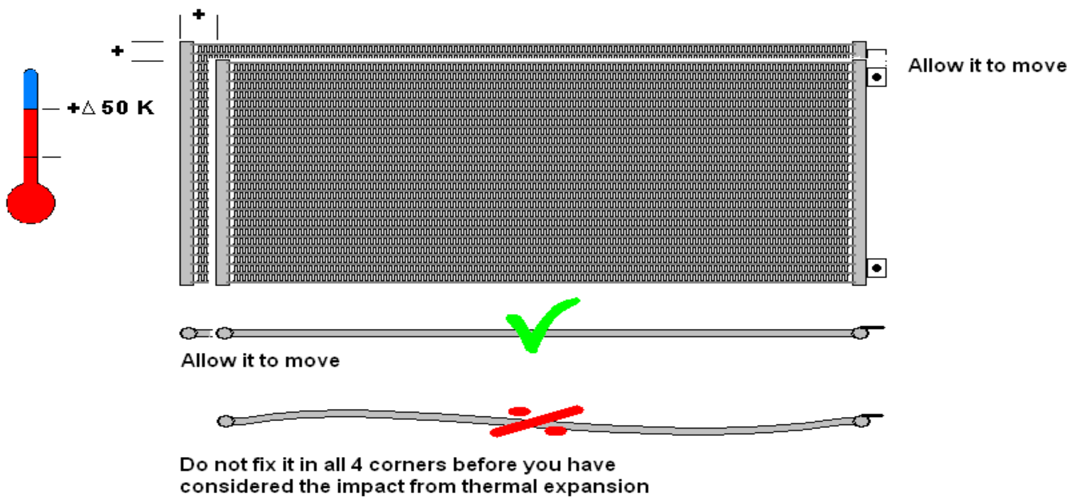
Carefully identify the locations of the inlet & outlet tubes. Microchannel condenser is often designed with multiple passages (parallel flow) that have fewer tubes in each successive pass.



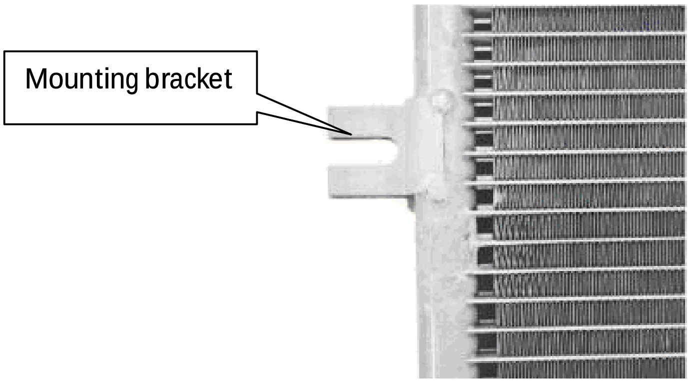
Confusedly connecting the inlet tube and the outlet tube of MCHE will result in excessively high refrigerant side pressure drop and poor heat exchanger performance.

Coil Mounting

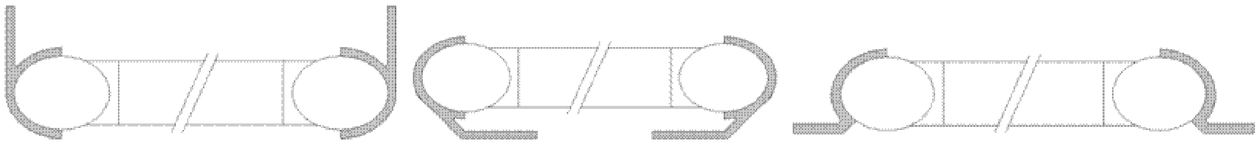
Thermal expansion of aluminum is higher than most other materials. To avoid continuous thermally induced stress that will shorten its life, the microchannel heat exchanger must be mounted with at least some flexible brackets, so movement is possible not to apply unnecessary stress/tension onto the heat exchanger or its connections.



・It is preferable for the mounting brackets of the MCHE to only touch rubber or plastic grommets, bumpers, etc.. Direct contact with metal fasteners and/or frames can result in galvanic corrosion unless appropriate measures are taken to prevent it thru careful alloy selection, paints/coatings, etc..



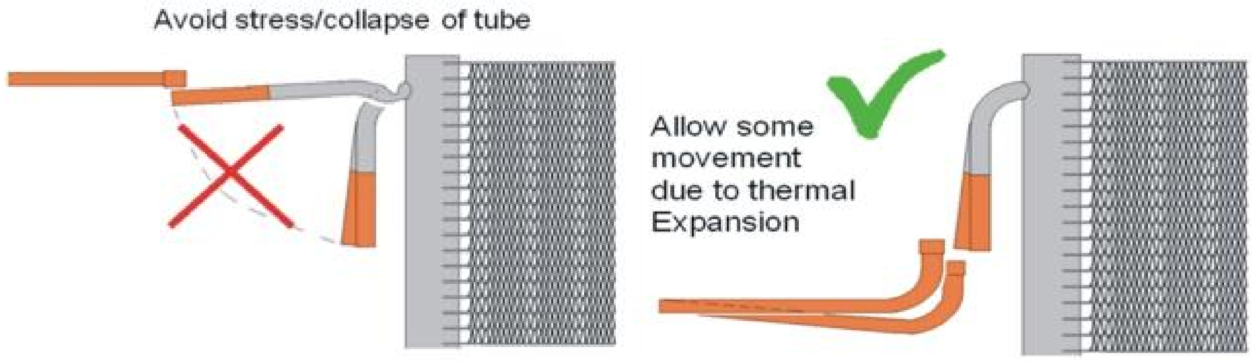
・In order to fulfill customer-specific requirements, a variety of different mounting brackets are available, including:



Inlet/outlet connections

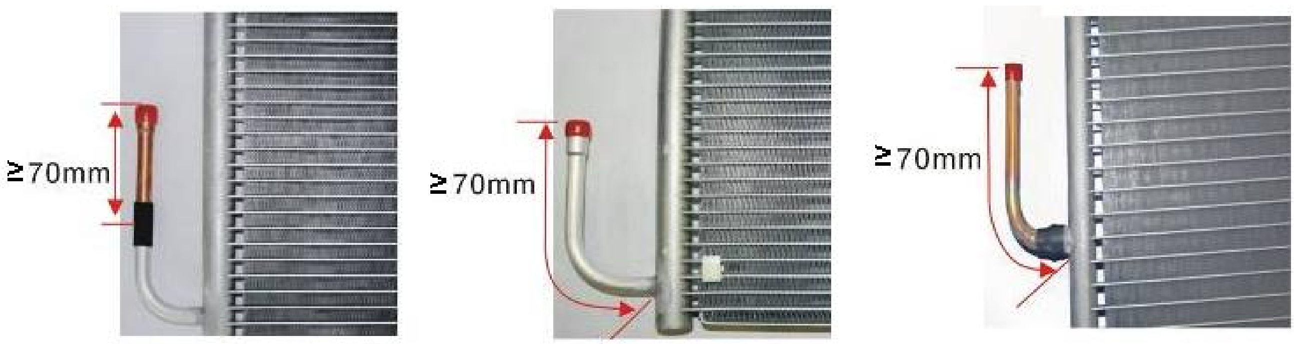
Inlet/outlet connections are designed to support themselves and for connections, *not* to act as handles, support mating tubes, resist thermal expansion, or be forced into position with mating tubes during assembly, etc.. In particular:

- Inlet/outlet connections should also be assembled & supported so the brazed joints are not exposed to stress/tension.
- To avoid damaging or collapsing the thin walled aluminum inlet/outlet tubes, mating tubes should be pre-bent/prepared so no bending/forcing is needed during installation.



When copper and aluminum tubes are joined together, galvanic corrosion of the aluminum can result. Prevent this by protecting the joint with paint or a plastic heat shrink tube. (This will prevent moisture from entering the area and enabling corrosion by completing the galvanic circuit.)

To protect the Cu-Al brazing joint and shrink tube from the heat of later brazing, the tube length after the joint on inlet/outlet pipes should be longer than 70mm. When brazing the coil into your system, additional protection can be obtained by dry nitrogen purging and/or wrapping the copper stub tube with a wet cloth. The aluminum inlet/outlet tube on the MCHE also needs to be at least 70mm long to protect the tube-header braze joint.



The pipe length after the brazing joint should be longer than 70mm.

5. Leak Repair Procedure

The below instructions assume that you are familiar with general air conditioning repair procedures and have the appropriate equipment to evacuate the unit before the repair, then charge and performance test the unit afterward.

Leak point detection

Leak check per the A/C unit instructions or as follows. Use nitrogen or compressed dry air to pressurize the heat exchanger, and then detect the leak point by spraying the coil with a soap solution and looking for bubbles and/or foam. Alternatively, pressurize the MCHE with refrigerant or helium then detect the leak point by passing the appropriate sensor over the coil and mark the point.

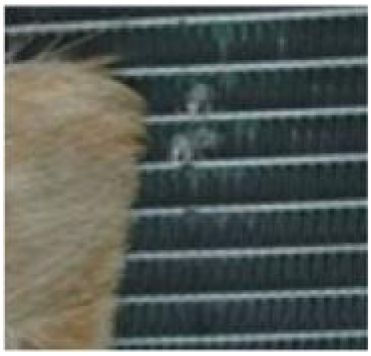
Microchannel tube leak repair by gluing

If MCHE flat tube is leaking due to material/brazing failure or minor damage, it can be repaired quickly and easily by filling the hole with glue.

- Obtain the following materials and tools
  - -2 component epoxy semi-viscose resin such as:
    - High Performance Acrylate Structural Adhesive (WD-1001) - available in China
    - JB WELD - available in US.
    - Huntsman 2014-1 - available in China, US, Europe
    - 3M Scotch-Weld Epoxy Adhesive (DP100 clear) - available in US.
  - -Dispenser or injector (if not included with the resin)
  - -Heat gun (if recommended to cure the resin)
  - -Vacuum pump
  - -Alcohol
  - -Water
  - -Knife
  - -Brush

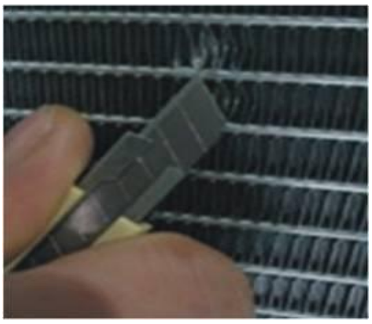
Step 1: Clean the leak point

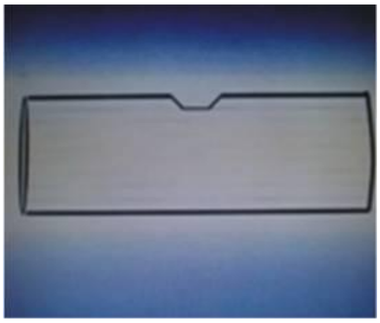
• Remove the dirt from the surface around the leak point with brush and water, then wash off any residual oil with the alcohol.



Step 2: Open up the leak point with a knife

• Open up the leak point to at least 1mm width by using the tip of the knife carefully. Remove all aluminum fragments. Shape the cut to make it easy for epoxy resin to enter the microchannel like the below right picture shows.





Step 3: Clean the surface around the leak point with alcohol.

Step 4: Pull a vacuum

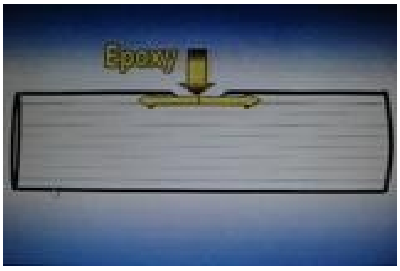
• Connect MCHE with vacuum pump and start evacuating the heat exchanger, preferably from both sides of the leak point.

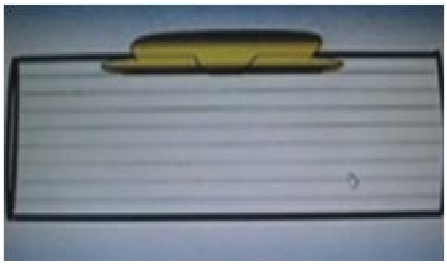
Step 5: Apply the epoxy (while unit is under vacuum)

• Prepare the high performance epoxy resin, and mix about 1~2cm^3 of resin per the resin instructions and put it into the injector (For some resins this is done automatically in a dispenser).

• Inject the resin carefully into the leak hole and make sure that a good amount of the resin is sucked into the opening when you are finished.

Note: The vacuum pump should be able to pull your A/C unit's recommended vacuum and the cut area should be covered by epoxy (see the below right)





• Stop evacuating and verify that the vacuum holds.

• Blow hot air on the epoxy per the resin instructions if required and wait until the resin cures.

Step 6: Repeat original leak check the system per the A/C service instructions to verify that the leak has been plugged.

6. Cleaning Procedure

Relative to fin and tube heat exchangers, microchannel coils tend to accumulate more of the dirt on the surface and of the less dirt inside which can make them easier to clean.

Step 1: Remove surface debris

Remove surface dirt, leaves, fibers, etc. with a vacuum cleaner (preferably with a brush or other soft attachment rather than a metal tube), compressed air blown from the inside out, and/or a soft bristle (not wire!) brush. Do not impact or scrape the coil with the vacuum tube, air nozzle, etc..

Step 2: Rinse

Do not use any chemicals (including those advertised as coil cleaners) to wash microchannel heat exchangers. They can cause corrosion. **Rinse only.**

Hose the MCHE off gently, preferably from the inside out and top to bottom, running the water thru every fin passage until it comes out clean. Microchannels fins are stronger than traditional tube & fin coil fins but still need to be handled with care. Do not bang the hose into the coil. We recommend putting your thumb over the end of the hose rather than using a nozzle end because the resulting spray is gentler and the possibility for impact damage is less.

Step 3: Optional blow dry

Microchannel heat exchangers, because of their fin geometry, tend to retain water more than traditional fin & tube coils. Depending on the specific design and installation of your coil, it may be beneficial to blow or vacuum out the rinse water from your unit to speed drying and prevent pooling.

Warning!

It is possible to carefully clean a coil with a pressure washer, **but it is also possible to totally destroy a coil with a pressure washer so we do not recommend their use.**

Warranty claims related to cleaning damage, especially from pressure washers or chemical attack, will not be honored.

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