# Installation, Operation & Maintenance Manual

Guidelines for the installation, operation and maintenance of Madok branded fluid cooling, heating and refrigerant bearing coils manufactured by Madok in Brantford, Ontario have been provided to help ensure proper performance of the coils and their longevity. These are general guidelines that may have to be adjusted to meet the specific requirements of any one job. As always, a qualified installer should perform the installation and maintenance of any coil. Personal protective equipment (PPE) such as safety glasses, steel toe boots and gloves are recommended during the installation and routine maintenance of the coil.

## This manual contains guidelines for the following types of Madok brand heat transfer coils:

### Water Coils

- Chilled Water
- Hot Water

### Steam Coils

- Standard Steam
- Steam Distribution (Freeze Resistant)

### Refrigerant Coils

- Condenser Coils
- DX Coils (Evaporator)
- Heat Reclaim

# Receiving Instructions & Freight Damage Policy

This manual covers the basic installation, operation and maintenance recommendations for heat transfer coils manufactured by Madok Manufacturing.

Always follow local codes and standards for the installation of equipment and coils for the area in which the coils are to be operated. Following are recommendations for the installation of products manufactured by Madok Manufacturing. Please read this manual completely before installing and operating coils manufactured by Madok including the suggested maintenance in the guide that follows. Care should be taken when handling Madok coils to avoid damage or personal injury.

Failure to observe these recommendations could result in premature failure of the product and / or loss of the warranty provided. Madok will repair or replace any product determined to have failed due to a manufacturing defect after proper evaluation of the product and installation methods have been completed. Please see complete Warranty Statement below.

Madok Manufacturing reserves the right to request information (including digital photographs) concerning the installation of products it manufactures and / or the return of failed products to our facility for evaluation of the failure before any warranty will be considered.

# Freight Damage Policy

IMPORTANT – PLEASE READ IMMEDIATELY!

All Madok coils are factory tested, inspected and carefully packaged. Damage to the coils can occur after they have left the factory. Therefore, the coils should be inspected for shipping damage upon receipt.

Freight terms for Madok are F.O.B. factory. This means the seller is not responsible for damages or losses to equipment in transit. Although not legally bound, should damages or problems occur, Madok Manufacturing will offer assistance to purchasers provided the purchaser adheres to the following criteria.

## Freight Delivery Information

**When freight company drivers arrive, do not let them rush you. Do not sign anything until you inspect your crate/box/carton very carefully for damage upon receipt.**

Look for any indentations in box, protruding nails in crates, fork lift damage or obvious signs of mishandling. Even if outside package is acceptable, look very carefully inside to check the product. Sometimes it is difficult to see damage without taking product(s) out of the packaging. If there is any question in your mind that there is possible damage you can't see, or concealed damage, mark "DAMAGED" on the freight bill. Do not make the mistake of assuming the package is fine. You are protecting your own best interests. We strongly encourage our customers to take digital photographs to record and subsequently report damages.

If you have any questions regarding the foregoing, please contact Madok Manufacturing. Our Customer Service team will be more than happy to answer all your questions.

## IF THE FREIGHT IS DAMAGED – PLEASE DO THE FOLLOWING!

1. **Do not refuse shipment!**
   Refusal of a damaged shipment simply puts everything in limbo. Freight goes back to the terminal and remains there.

2. Accept shipment and sign freight bill – make sure you note the damage on the freight bill. **NOTE**: Accepting a damaged shipment does not hold you liable in any way unless "DAMAGE" fails to appear on the freight bill*.

   If shipment is not noted as damaged on the freight bill, Madok will not be responsible for the repair cost as we cannot file a damaged claim with the carrier. As far as the trucking company is concerned, the freight was received free and clear of all damage and they will not be held accountable for the repair charges*. It is the responsibility of the receiver to sign the bill as damaged and make certain that someone will be held responsible to get your product fixed at no charge to you.

3. **Do not move the damaged piece from the area in which it was received. Do not discard any packaging, even if it is coming apart.**
   A damaged shipment must have an inspector look at it before anything can be done with it. If the piece is moved, the inspector can blame the damage on you, claiming possible damage when moved. If the packaging is not available, the inspector can claim faulty packaging.

   4. **Contact Madok Manufacturing Immediately**
   Madok can begin by contacting the carrier to have an inspector come over to look at shipment. We can also get a preliminary damage report from you, the customer, in order to have accurate, reliable information before an inspector gives his report. We can also answer any questions or concerns you might have.

   5. **After inspection has been completed, contact7 Madok Manufacturing**
   As soon as inspection has been completed, we can begin steps to get your product repaired or replaced. A Return Authorization number (RA#) must be requested before the coil is returned to our manufacturing facility. Any product returned without an RA# will not be accepted and all charges for the shipment of the coil will be the shipper's responsibility. The product must be crated to prevent any damage from occurring during shipment. Any product without sufficient crating that allows damage to the product to occur will not be accepted and warranty will not be provided.

* Concealed Damage: Damage not noted on freight bill. The standard allowance from freight motor carriers on this type of claim is 25% of the total claim amount.

# Warranty

Seller warrants against defect in materials and workmanship in products that it manufactures for one (1) year from date of shipment, when properly installed and operated under normal use. The warranty does not apply to products that have been subject to misuse (including use in manner inconsistent with the design of the product), abuse, neglect, accident, improper installation or maintenance, or to products that have been altered or repaired by anyone other than Madok or its authorized representative.
This guarantee does not include any labor or other charges outside of the Seller's factory for replacement or repair of defective product. Warranty shall not be construed to cover the cost of removal or installation of product or replacement of any fluids or refrigerants.
Seller's only liabilities under this warranty, or otherwise, shall be the repair or replacement (at Seller's option) of non-conforming goods or parts, not to exceed the original cost of the product. Seller assumes no liability for incidental or consequential damages such as, but not limited to, injury to person or property, or lost profits. **The Seller will accept no expense, liability, or responsibility for repairs made outside the factory by others without prior written approval.** Warranty covers material only and not labor required to replace or install.
This guarantee supersedes and is in lieu of any and all other warranties by law or custom, either expressed or implied including, but not limited by this enumeration, any guarantee as to quality or fitness, for any particular purpose, except as set forth above. No person, or distributor/dealer, is authorized to give any warranties on behalf of Seller or to assume for Seller any other liability in connection with any of the Seller's products.

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# Fluid Coil Installation Recommendations

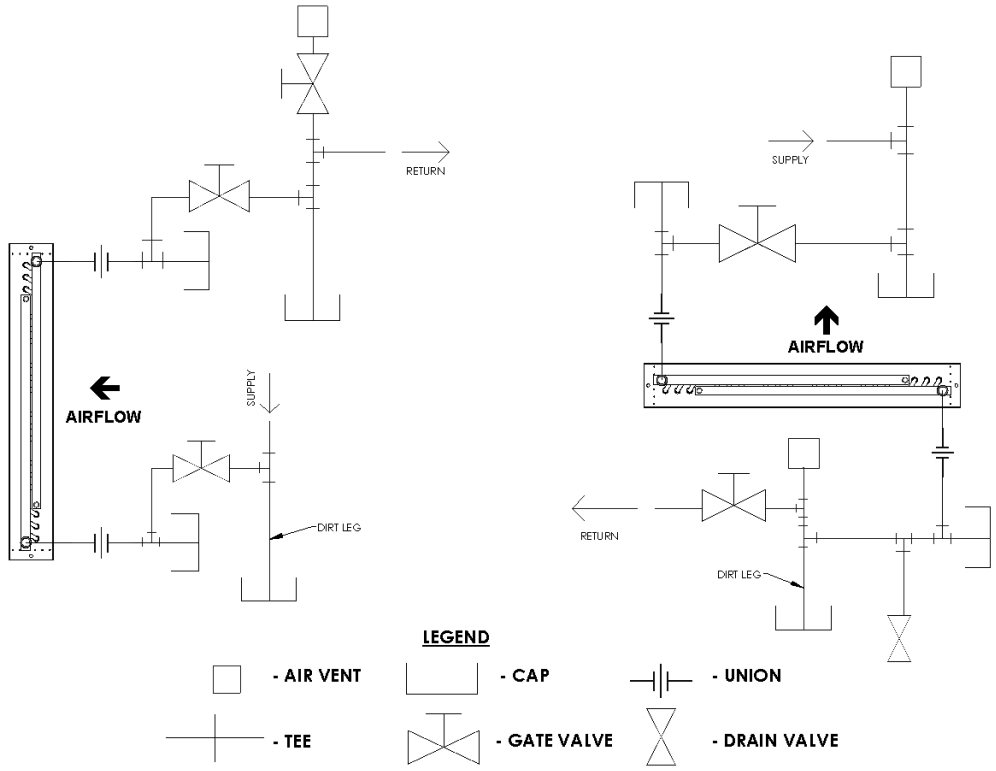
## MOUNTING

All water and glycol coils are designed to be fully drainable when properly mounted. Vertical air-flow is not recommended for de- humidifying coils.

## INSTALLATION

1. Carefully remove the coil from the shipping package to avoid damage to the finned surface area. Damaged fins can be straightened using an appropriate fin comb.
2. Madok recommends cleaning the coil with a commercially available coil cleaner prior to installation. Care should be taken to use an approved cleaner for coated coils when coil has been coated with Heresite protective coating.
3. Piping should be in accordance with accepted industry standards. Always use a back-up wrench on the coil connections when attaching the piping to the coil if pipe thread connections are utilized.
4. Check the coil hand designation to ensure that it matches the system. Water and glycol coils are generally plumbed with the supply connection located on the bottom of the leaving air-side of the coil and the return connection at the top of the entering air-side of the coil. This arrangement provides counter flow heat exchange and positive coil drainage. If a universal coil is supplied, cap off the two unused connections.
5. Standard coils must be mounted level to ensure adequate drainage.
6. Proper clearance should be maintained between the coil and other structures such as the fan, filter racks, transition areas, etc.
7. When drainable coils are desired, tubes should be installed in a horizontal position. Use a spirit level. If the tubes cannot be installed level, special drain headers are available on request.
8. All field brazing and welding should be performed using high quality materials and an inert gas purge (such as nitrogen) to reduce oxidation of the internal surface of the coil.

9. All field piping must be self-supporting. System piping should be flexible enough to allow for thermal expansion and contraction of the coil.
10. General piping diagrams for vertical and horizontal airflow as shown below:




11. Connect the water supply to the bottom connection on the air leaving side and the water return to the top connection on the air entering side.
12. When four connections are provided the extra bottom connection can be used for an auxiliary manual drain connection, and the extra top connection can be used for an automatic air vent or the extra connections can be capped. Connecting the supply and/or return in any other manner will result in very poor performance.
13. Water coils are not normally recommended for use with entering air temperatures below 40°F. Glycol solutions or brines are the only freeze-safe media for operation of water coils for low entering air conditions.
14. When fresh and return air are to be heated or cooled by a water coil, care should be used in the design of the ductwork to insure thorough mixing before the air enters the coil. The return air should always enter the bottom of the duct. Fresh air should enter the top of the duct. The greater the distance between the points of mixing and entrance to the coil, the better the application.
15. Two position control valves, modulating valves, three way valves or a combination of these controls can accomplish control of water coils. Follow the recommendations of the control manufacturer regarding types, sizing and locations. Face and bypass dampers may also be used, but do not close off tightly. Air leakage in cooling applications has no appreciable effect. In heating applications, however, the air temperature may rise several degrees and should be considered in system design. Low leakage dampers may be required.
16. Pipe sizes for the system must be selected on the basis of the head [pressure] available from the circulating pump. It is recommended that the velocity should not generally exceed 8 feet per second and that the friction loss should be approximately 3 feet per 100 feet of pipe.
17. When cooling coils are banked two or three high, an intermediate drain pan with plastic drain tubes extending into the main drain pan should be installed on the air leaving side of each coil.

On high latent installations, the condensate draining from top coils may load the lower coils with condensate, resulting in reduced air flow and performance or condensate being blown downstream into the ductwork. All individually installed water cooling coils and the bottom of all cooling coil banks should be mounted in drain pans extending at least ten inches from the leaving air edge of the coil. A drain line trap must be installed to allow condensate to drain freely. The drain line trap depth must be twice the negative static pressure of the operating system for the unit to drain correctly. Incorrect trapping can cause the drain pan to overflow.

18. Once installed, the coil should be pressurized to 100 psig with dry nitrogen or other suitable gas. The coil should be left pressurized for a minimum of 10 minutes. If the coil holds the pressure, the hook-up can be considered leak free. If the pressure drops by 5 psig or less re-pressurize the coil and wait another 10 minutes. If the pressure drops again, there is more than likely one or more small leaks which should be located and repaired. Pressure losses greater than 5 psig would indicate a larger leak that should be isolated and repaired. If the coil itself is found to be leaking, contact Madok immediately.

Note: Madok water coils include vent and drain connections unless otherwise specified. This allows the coils to be drained. Keep in mind that when draining the coils, all water may not drain from the coil. To completely drain the coil to prevent the possibility of freezing during cold ambient temperatures, air or nitrogen pressure must be utilized to blow any remaining water from the coil.

# OPERATION

### Initial Start-Up

1. Open all air vents so that air is eliminated from within the coil circuitry and headers. Verify that all vents and drains are not obstructed and do discharge a stream of water.
2. Fill the coil with water then close all vents.
3. Perform an initial hydrostatic leak test of all brazed, threaded or flanged joints, valves and interconnecting piping. Recheck the coil level and correct if necessary. When the setup is found to be leak free, discharge and discard initial water charge. It is important that all grease, oil, flux and sealing compounds present from the installation be removed.

### General

1. Proper air distribution is vital to coil performance. Air flow anywhere on the coil face should not vary by more than 20%.
2. The drain pan and associated piping (drain line and trap) should be installed so that there is no standing water in the drain pan and that no blow-through occurs.
3. Fluid and air velocities should be maintained within our recommended values.

| **Fluid Velocity** | |
|---|---|
| Water | 1 to 8 fps |
| Glycol | 1 to 6 fps |

| **Air Velocity** | |
|---|---|
| Cooling | Dry Surface: 200-800 fpm Wet Surface: 200-550 fpm |
| Heating | 200-1500 fpm |

# Steam Coil Installation Recommendations

## A. General

1. Provide separate supports and hangers for the coil and for the piping. Always use a back-up wrench on coil connections when attaching piping to the coil. Coils not designed with pitched casing or fin pack must be pitched 1⁄4" per foot towards the return connection at installation.
2. Be certain that adequate piping flexibility is provided. Stresses resulting from expansion of closely coupled piping and coil arrangement can cause serious damage.
3. Do not reduce pipe size at the coil return connection. Carry the return connection size through the dirt pocket, making the reduction at the branch leading to the trap.
4. Vacuum breakers and air vents must be installed on all applications to prevent retaining condensate or air in the coil. Generally, the vacuum breaker is to be connected between the coil inlet and the trap. For a system with a flooded return main, the vacuum breaker should be open to the atmosphere and the trap design should allow venting of large quantities of air.
5. Do not drip steam mains through coils.
6. Insure steam pressure and condensate line pressure differential is sufficient to allow efficient condensate removal from the steam coil, especially when using modulating steam control valves to control the leaving air temperature of the coil.
7. Do not attempt to lift condensate without the assistance of a condensate pump. The pressure required to lift condensate must also be considered for sufficient pressure differential. Check valves are also required to prevent reverse flow of condensate back into the coil.
8. Entering air temperatures should not be below 40° F to ensure freezing doesn't occur.

## B. Traps

1 Size traps in accordance with the manufacturer's recommendations. Be certain that the required pressure differential will always be available. Do not undersize.

2 Float and thermostatic traps are recommended for high or low-pressure steam systems, but bucket traps may be used. Float and thermostatic traps should be used when air venting is necessary. Bucket traps are recommended for use with on-off control only. It is recommended that traps be located at least 12 inches below the coil return connection. When traps without air venting capabilities are used, air vents are required in the system.

3 Multiple coil installations-

a. Each coil or group of coils that is individually controlled must be individually trapped.

b. Coils in series; separate traps are required for each coil, or bank of coils, in series.

c. Coils in parallel; a single trap may be used but an individual trap for each coil is preferred. Size traps in accordance with the manufacturer's recommendations. Be certain that the required pressure differential will always be available. Do not undersize.

## C. Control

1. With coils arranged for series airflow, a separate control is required on each bank, or coil, in the direction of airflow.
2. On high-pressure installations, a two-position steam valve with a face and by-pass arrangement is preferred where modulating control is required.
3. Modulating valves must be sized properly—DO NOT OVERSIZE.

# Refrigerant Coil Installation Recommendations

Refrigeration coils manufactured by Madok Manufacturing are shipped with a small nitrogen holding charge. Care should be taken when opening these coils for installation. Follow accepted refrigeration piping practices and safety precautions per ASHRAE standards. If bends or 90 degree angles are necessary, long radius fittings must be used to keep the pressure drop through the piping at a minimum. General recommendations for component selection and line sizing follow. Nitrogen charged and capped piping is recommended.

## A. Liquid Line Sizing

All compressors have a Refrigerant Charge Limit [RCL] that must not be exceeded. Since the RCL and pressure drop are in direct conflict with each other, Madok recommends that the liquid line be sized as small as possible, while maintaining a low enough pressure drop to ensure 5°F of sub-cooling at the expansion valve.

## B. Liquid Line Components

Madok recommends the use of a properly sized liquid line filter-drier, installed upstream from the expansion valve and as close to the evaporator coil as possible. Filter-drier selection should be based on a maximum pressure drop of 2 psi at the design condition.

A moisture indicator / sight glass should be installed between the expansion valve and filter-drier. The moisture indicator / sight glass must be sized to match the size of the liquid line at the thermal expansion valve.

A liquid line shut-off valve with an access port should be sized with the selected liquid line OD, and installed close to the condenser,

The use of other valves, tube bends and reducers should be minimized, since these items tend to increase pressure drop and to reduce sub-cooling at the expansion valve. Liquid line receivers, other than those factory-installed, are **not** recommended.

The Thermal Expansion Valve [TEV] must be selected for proper size, capacity and refrigerant being used. A slightly oversized valve will allow the unit to operate satisfactorily at low-load conditions. An undersized valve should not be used at any time as this will starve the evaporator of refrigerant causing insufficient air temperatures. The use of a hot gas bypass valve should also be considered when sizing the TEV. Select expansion valves with external equalizer connections, and those designed to operate against a backpressure of 20 pounds per square inch higher than actual evaporator pressure.

The TEV must be installed directly on the evaporator coil liquid line connection provided. The liquid distributor must be in a vertical position. Insure that the distributor nozzle is installed in the distributor if required and that the correct nozzle for the refrigerant being used is installed. Sensing bulbs must be mounted on a clean horizontal suction line close to the evaporator outlet and insulated properly. The bulb must be tight against the suction line at a 10 or 2 o'clock position, but take care not to over tighten and cause damage to the sensing bulb. The bulb should not be mounted directly on top or bottom of the suction line.

**CAUTION:** Disassemble the thermal expansion valve before completing the brazing connections. If necessary, wrap the valve in a cool wet cloth while brazing. Failure to protect the valve from high temperatures may result in damage to the internal components.

## C. Suction Line Sizing

Suction line tubes must be sized to maintain refrigerant vapor velocities that are high enough to ensure good oil return to the compressor under all operating conditions. It is necessary to pitch horizontal suction lines toward the compressor to insure sufficient oil return to the compressor. Traps should be provided at the bottom of suction line risers and at 15 foot intervals for sufficient oil return.

## D. Suction Line Components

A suction line pressure tap should be installed on the leaving side of the evaporator coil near the TEV sensing bulb location. Accurate superheat measurement and TEV adjustment demands that suction pressure and temperature be measured near the evaporator coil outlet.

Suction line filter-driers are usually only necessary on systems that have experienced a severe compressor motor burn out or other failure that results in extremely high refrigerant temperature. This filter-drier should not be left in the suction line permanently.

Suction lines should be insulated completely with sufficient wall thickness insulation for the application temperature range being utilized.

## Installation Checklist

Use the following checklist to verify that all necessary installation procedures have been completed.

1. Coils are installed with airflow in same direction as indicated on the coil casing.
2. Suction connection is at the bottom of the suction header on the evaporator coil, suction line is pitched towards compressor and traps are installed in suction risers. Suction line is insulated with correct wall thickness insulation for the temperature application utilized.
3. If stacking coils, stacking channels are properly installed and bypass air is prevented.
4. Condensate drain pans and piping is installed with a trap in the condensate line and piping insulated and heated if installed in applications that are below freezing.
5. Clean filters are installed upstream of the condenser coil when applicable.
6. A liquid line filter-drier is installed upstream of the expansion valve.
7. A moisture indicator/sight glass is installed between the expansion valve and filter-drier.
8. A liquid line shutoff valve with access port is installed close to the condenser.
9. A schrader valve is installed in the suction line close to the evaporator coil outlet.
10. The TEV, with external equalizer connections, is installed directly on the evaporator liquid connection, sensing bulb mounted in the horizontal position on the suction line and insulated. The liquid distributor must be in a vertical position.
11. Piping system is leak-tested with dry nitrogen, evacuated to 500 microns, and charged with correct refrigerant type and amount.
12. Superheat and sub cooling measurements are taken. Thermal expansion valve is adjusted to obtain desired superheat. Desired superheat on most applications is 8° to 12° at the outlet of the evaporator.

# Maintenance

## General

1. Filters should be inspected on a regular basis and changed as needed. Maintaining clean filters and mist eliminators is a cost effective way to help maintain maximum coil performance and service life.
2. Periodic inspection of the coil for signs of corrosion and/or leaks is recommended. Repair and replacement of the coil and the connection of piping, valves, etc. should be performed by qualified, licensed personnel.
3. The circulated fluid must be free of sediment, corrosive products and biological contaminants. Periodic testing of the fluid followed by any necessary corrective measures along with maintaining proper fluid velocities and filtering of the fluid will help to satisfy this requirement.
4. If automatic air vents are not installed in the system, periodic venting of the coil is recommended to remove accumulated air. High pressure and/or high temperature fluids can cause serious injury, so caution must be taken.

## Coil Cleaning

Coils should be kept clean to maintain maximum performance. For operation at its highest efficiency, the coil should be cleaned often during periods of high cooling demand or when dirty conditions prevail. Power should be disconnected and locked out and motors should be covered to ensure that no moisture penetrates into the windings causing motor failure if applicable.

Remove large debris from the coils and straighten fins before cleaning.

Should the coil surface need cleaning, caution must be exercised in selecting the cleaning solution as well as the cleaning equipment. Improper selection can result in damage to the coil and /or health hazards. Clean the coil from the leaving air side so that foreign material will be washed out of the coil rather than pushed further in. Clean refrigerant coils with cold water and detergent or with one of the commercially available chemical coil cleaners. Be sure to carefully read and follow the manufacturer's recommendations before using any cleaning fluid or agent. Rinse coils thoroughly after cleaning.

**CAUTION: Do not clean the coil with hot water or steam. The use of hot water or steam as a refrigerant coil-cleaning agent will cause high pressure inside the coil tubing and subsequent damage to the coil.**

**CAUTION: Do not use acidic chemical coil cleaners. Do not use alkaline chemical coil cleaners that, after mixing, have a pH value greater than 8.5 without also using an aluminum corrosion inhibitor in the cleaning solution. Failure to follow these guidelines or the manufacturer's instructions for use of cleaning chemicals could result in damage to the unit.**

**WARNING: SOME CHEMICAL COIL-CLEANING COMPOUNDS ARE CAUSTIC, AS WELL AS TOXIC. USE THESE SUBSTANCES ONLY IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS. FAILURE TO DO SO COULD RESULT IN SERIOUS INJURY, DEATH OR EQUIPMENT DAMAGE.**

## Fin Straightening

Coil fins may have been bent during shipping or servicing, and should be straightened to maintain maximum heat transfer. Reduction of the effective coil surface will correspondingly reduce coil capacity. Always check fin appearance after any handling of the coil and after any servicing is done near the coils.

Fin combs are sized according to number of fins per inch of the coil. For relatively small bends that require only minor repair, other tools may be used to evenly space the fins. Be careful not to damage the coils.

## Steam Coil Considerations

A steam trap maintenance program should be implemented to ensure that steam traps are operating correctly and at maximum efficiency. Failure to do so could result in premature failure of the coil and loss of warranty due to condensate backing up into the coil causing leaks or allowing the coil to freeze during low ambient conditions if supply air drops below 40° F.

Note: Steam distr*ibuting coils may also be referred to as 'NON-FREEZE'* coils. At Madok, we prefer to *call steam distributing coils as 'FREEZE RESISTANT'.* These coils will freeze if temperatures drop below the freezing point. Care should be taken to ensure that these coils are not operated at or below freezing temperatures. If there is the possibility that the coils will experience freezing temperatures, freeze safeties should be installed in the system to prevent damage to the coils. Any coil that has failed due to freezing temperatures will not be covered under the standard warranty.

# Freeze Protection of Chilled Water Coils

### Freeze Protection

During the winter, chilled water coils need to be protected against freezing. The two predominant protective measures are blowing out coils and flushing coils. Both are covered next.

### Blowing - Out Coils

1. Isolate the coil from the rest of the system by closing the valves on both the supply and return lines (gate valves in Figure 1 - Horizontal Airflow and Figure 2 - Vertical Airflow on Page 3).
2. Drain the coil by opening all drain valves and/or the drain plug. Remove the vent plug to aid the draining process.
3. Once the coil has been fully drained, the blower can be hooked-up. Caps installed in the piping on straight runs going to the supply and return connections are ideal points to hook-up the blower. The air vent and drain plug are not suitable locations for hooking-up the blower. Caution should be exercised when installing the blower. The blower operator must take precautions to Ensure that water does not come into contact with any of the electrical components of the blower. Failure to do so may result in damage to the equipment and serious injury.
4. Close the vent or drain plug on the header which the blower is connected and open the drain valve or cap on the other header.
5. Operate the blower for 45 minutes and then check the coil to see if it is dry. A mirror placed in the discharge will become fogged if moisture is present. Repeat this procedure until the coil is dry.
6. Let the coil stand for several minutes then blow it out again. If water comes out, repeat the blowing operation.
7. Leave all plugs out and drains open until the threat of freezing has passed.

### Flushing Coils

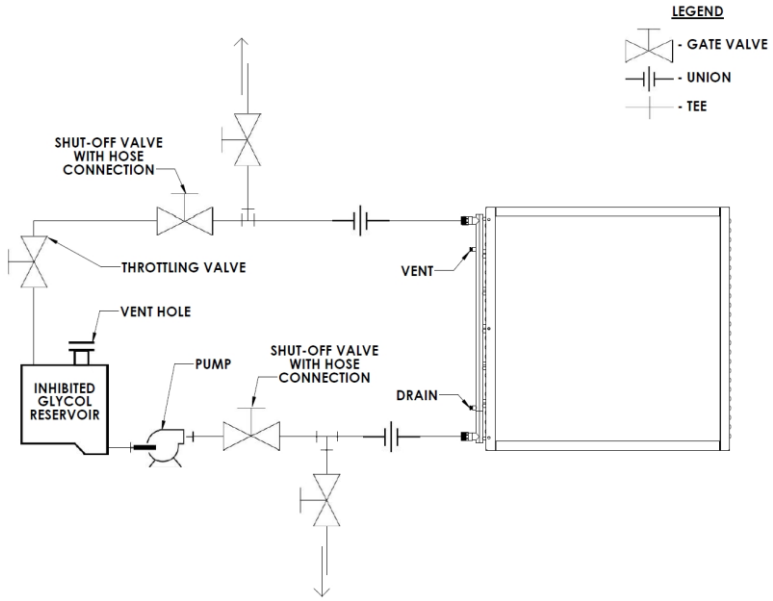
1. We recommend the use of inhibited glycol designed for HVAC applications for corrosion protection. The use of uninhibited glycol has produced formicary corrosion in copper tubing. The complete filling of water coils with an inhibited glycol solution for freeze protection can be expensive. In some instances, it is more cost effective to flush the coils with an appropriate concentration of inhibited glycol solution. Residual fluid can be left in the coil without the threat of freeze damage provided the correct concentration of inhibited glycol was used. The recovered fluid can then be used to flush other coils. Select an inhibited glycol solution that will protect the coil from the lowest possible temperatures that can occur at the particular coil's locality. The following tables have been provided for your reference.

| % Ethylene Glycol by Volume | Freeze point [1] |
|---|---|
| 0 | 32°F |
| 10 | 25°F |
| 20 | 16°F |
| 30 | 3°F |
| 40 | -13°F |
| 50 | -34°F |
| 60 | -55°F |

| % Propylene Glycol by Volume | Freeze point [1] |
|---|---|
| 0 | 32°F |
| 10 | 26°F |
| 20 | 19°F |
| 30 | 8°F |
| 40 | -7°F |
| 50 | -28°F |
| 60 | -60°F |

NOTE: Freeze points may vary from product to product.

2. Estimate the volume of the coil in gallons. For 0.625” tubes with 1.5” face tube spacing.
   (fin height (in) x (finned length (in) x (# of rows) x 0.0011 = gallons
   For 0.5” tubes (1.25” face tube spacing)
   (fin height (in) x (finned length (in) x (# of rows) x 0.00083 = gallons
3. Isolate the coil from the rest of the system by closing the valves on both the supply and return lines (gate valves in Figure 1 - Horizontal Airflow and Figure 2 - Vertical Airflow diagrams).
4. Drain the coil by opening all drain valves and/or the drain plug. Remove the vent plug to aid the draining process.
5. Close the drain valve(s) and drain plug.
6. Connect the flushing system to the coil. A typical system is shown in Figure 5 - Flushing System Diagram.
7. With the throttling valve closed, start the pump and operate until the air is vented from the coil. Next, close the air vent.
8. Open the throttling valve about half-way and circulate the fluid through the coil for 15 minutes. Check the strength of the fluid. A hydrometer or test kit from the fluid manufacturer is suitable for this application.
9. Adjust the solution strength as needed and circulate the fluid for another 15 minutes.
10. Repeat steps 8 and 9 until the desired concentration is reached.
11. Shut the pump down and drain the inhibited glycol from the coil.
12. The recaptured fluid can be used to flush other coils.




NOTE! Be sure to follow the manufacturers’ recommendations before utilizing any glycol based antifreeze solution. Additional fluid will be required for the pump, connected piping and fluid reservoir. Formulae are for estimation purposes only.