Contact your local Colmac Coil Representative for factory approved parts.

# Installation, Operation, and Maintenance

## HygenAir™ A+H Hygienic Air Handler

ENG00020828 Rev A


Contents

## 1. SAFETY INSTRUCTIONS

To avoid serious personal injury, accidental death, or major property damage, read and follow all safety instructions in the manual and on the equipment before attempting to rig or install a Colmac A+H Hygienic Air Handler. These installation instructions are provided to familiarize the installation personnel with the A+H product and are not intended to replace the knowledge and experience of a qualified and licensed installation contractor. It is recommended that any A+H unit be started up by trained Colmac Coil Manufacturing personnel. If **not** started by Colmac Coil Manufacturing, the startup must be performed by a licensed, experienced contractor who is familiar with all components in the A+H unit. The commissioning contractor is expected to have read this document and relevant component literature. The commissioning contractor should be familiar with and comply with all government standards and regulations associated with the hygienic air handler product. Maintain all safety labels in good condition. If necessary, replace labels by contacting the Colmac Coil Manufacturing factory.

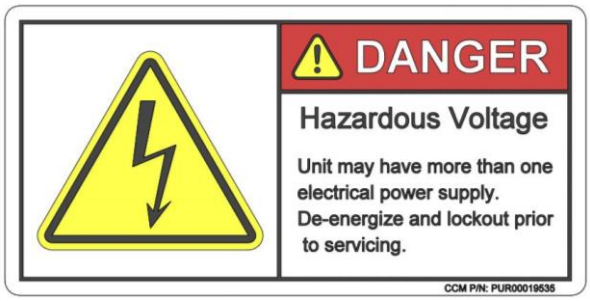
This is the safety alert symbol. It is used to alert potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible injury or death.

DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTICE indicates instructions that pertain to safe equipment operation. Failure to follow these instructions could result in equipment damage.

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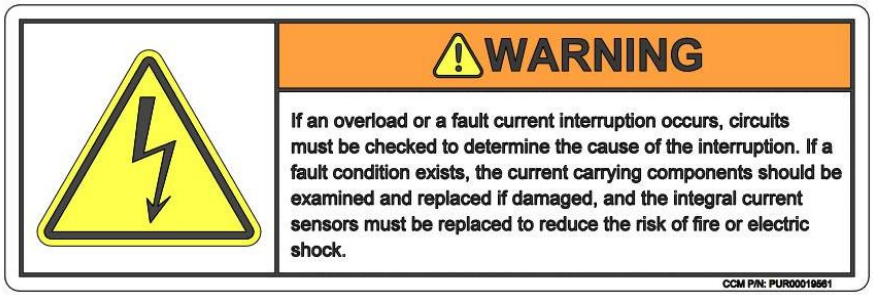


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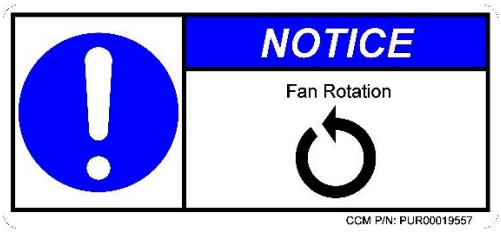


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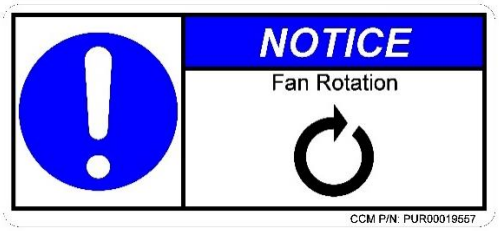


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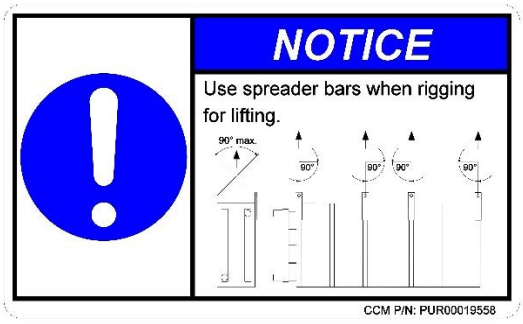


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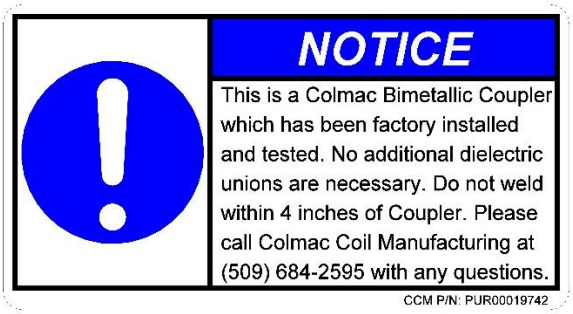


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1.1. Refrigerant Warning

1.1.1. Colmac A+H Hygienic Air Handlers installed in mechanical systems may contain refrigerants such as ammonia, CO2, R-507, etc. For this reason, A+H units should be installed, operated and serviced by qualified refrigeration technicians only.

1.1.2. Improper handling or uncontrolled release of refrigerants could be hazardous to personnel and may result in asphyxiation, frostbite, or burns.

1.1.3. Liquid refrigerant that is isolated in a mechanical system without an adequate means of pressure relief can rupture pipes or equipment if it is allowed to warm.

1.1.4. Hot refrigerant vapor when injected into an evaporator containing cold refrigerant, will rapidly condense. This rapid condensation can accelerate liquid slugs to dangerously high energy levels that can rupture pipes, valves and other components.

1.1.5. Refer to various manuals from organizations such as IIAR, ASHRAE, and RETA for more information concerning the safe operation of refrigeration equipment.

## 2. INSTALLATION

2.1. Inspection

2.1.1. Damage or Shortage – Upon receipt of equipment, inspect for shortages and damage. Any shortage or damage found during initial inspection should be noted on the delivery receipt. This action notifies the carrier there is intent to file a claim. Any damaged equipment is the responsibility of the carrier and should not be returned to Colmac Coil Manufacturing without prior notification. If any shortage or damage is discovered after unpacking the unit, call the carrier for a concealed damage or shortage inspection. The inspector will need related paperwork, delivery receipt, and any information indicating liability for the damage. All damage claims must be filed through the transportation company.

2.1.2. While Colmac will gladly provide information to assist with the process, the responsibility for filing such a claim is that of the purchaser or the purchaser's consignee.

2.1.3. Specified Equipment – Check unit nameplate for:

- Electrical specifications to ensure compatibility with electrical power supply.
- Model Nomenclature and other information to match original order.

2.1.4. Each coil installed in a Colmac A+H Hygienic Air Unit is shipped with a low-pressure air charge. Coils are supplied with a pressure gauge indicating the shipping charge pressure. Upon receipt of the unit, compare the gauge pressure to the recorded pressure noted on the accompanying tag. If the gauge pressure is 10 psig or more below the factory charge, contact Colmac Coil at 1-800-845-6778. It is recommended that this charge be maintained until just prior to connecting piping to the unit.

2.2. Handling and Storing

2.2.1. Safe rigging and handling are the responsibility of the installing contractor.

2.2.2. Colmac A+H Hygienic Air Handlers are designed to be lifted only by means of an overhead crane using spreader bars connected to the provided lifting lugs. Use caution when handling to prevent damage to the electrical control panels, walls, roofing materials, and exposed components. The unit should never be pulled or pushed as this could damage the structure and/or integrity of the unit.

2.2.3. Rigging points for the A+H Hygienic Air Handlers are shown on the rigging diagram included with each submittal. Each unit will be fitted with 4, 6, or 8 lifting lugs depending on the unit dimensions and weight.

2.2.4. All provided lifting lugs shall be utilized when lifting the unit from the truck and while flying the unit to the intended installation location. Failure to utilize all lifting lugs may result in damage to the unit.

2.2.5. Spreader bars shall be used when rigging the unit to prevent rigging components from contacting any portion of the enclosure or externally mounted components. Failure to use spreader bars may result in damage to the unit.

2.2.6. When using spreader bars for lifting Colmac A+H Hygienic Air Units, ensure that the side lifting angle does not exceed 10-degrees from vertical. See Figure 1. below.

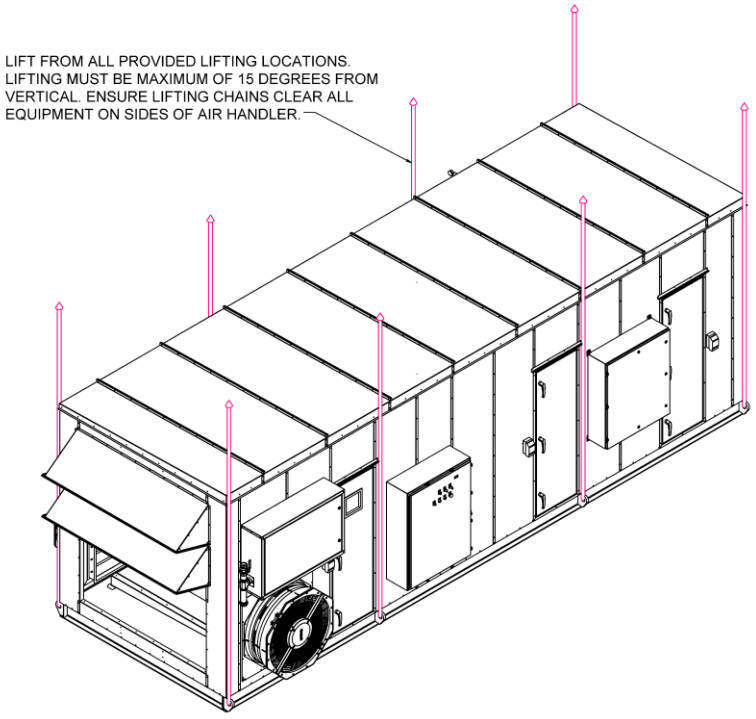



Figure 1.

2.2.7. Colmac A+H units may be an unbalanced or top heavy load, therefore it is important to make sure appropriate measures are taken to lift the unit properly. All rigging materials are to be provided by others.

2.2.8. Store unit in a clean, dry area protected from adverse ambient conditions, and away from traffic and congestion that could cause damage.

2.2.9. Units stored for long periods of time should have any fan motor shaft turned several revolutions on a monthly basis to prevent the motor bearings from seizing.

2.3. Location

2.3.1. Colmac A+H units are typically furnished with multiple service doors for access to the interior. Accessibility to the doors should be reviewed prior to finalizing the unit location and installation.

2.3.2. If the unit is located near the edge of the roof, consult local codes and OSHA requirements, which may dictate railings or other safety devices along the building edge to facilitate safe access to the unit.

2.3.3. It is recommended that on one side of the unit, a full unit width be provided to enable future service work that may involve replacing large internal components such as the supply fan or coils.

2.3.4. Drain lines should be pitched away from the drain connections on the unit.

2.3.5. The electrical control panels will require sufficient clearance for installation and maintenance access.

2.4. Unit Support

2.4.1. The unit must be mounted level. Any support structure must have no more deflection than L/360 and must not exceed 0.5” with the unit mounted on the support. Deflection in excess of this may result in misalignment and/or structural unit damage.

2.4.2. Roof mounting with full perimeter roof curb

- The unit can be mounted on a full perimeter roof curb. The flashing of the curb to the roof must follow standard roofing practices to ensure a watertight seal. A seal must be placed between the base of the unit and the top of the curb, including the roof membrane running over the curb to prevent water from leaking into the curb.

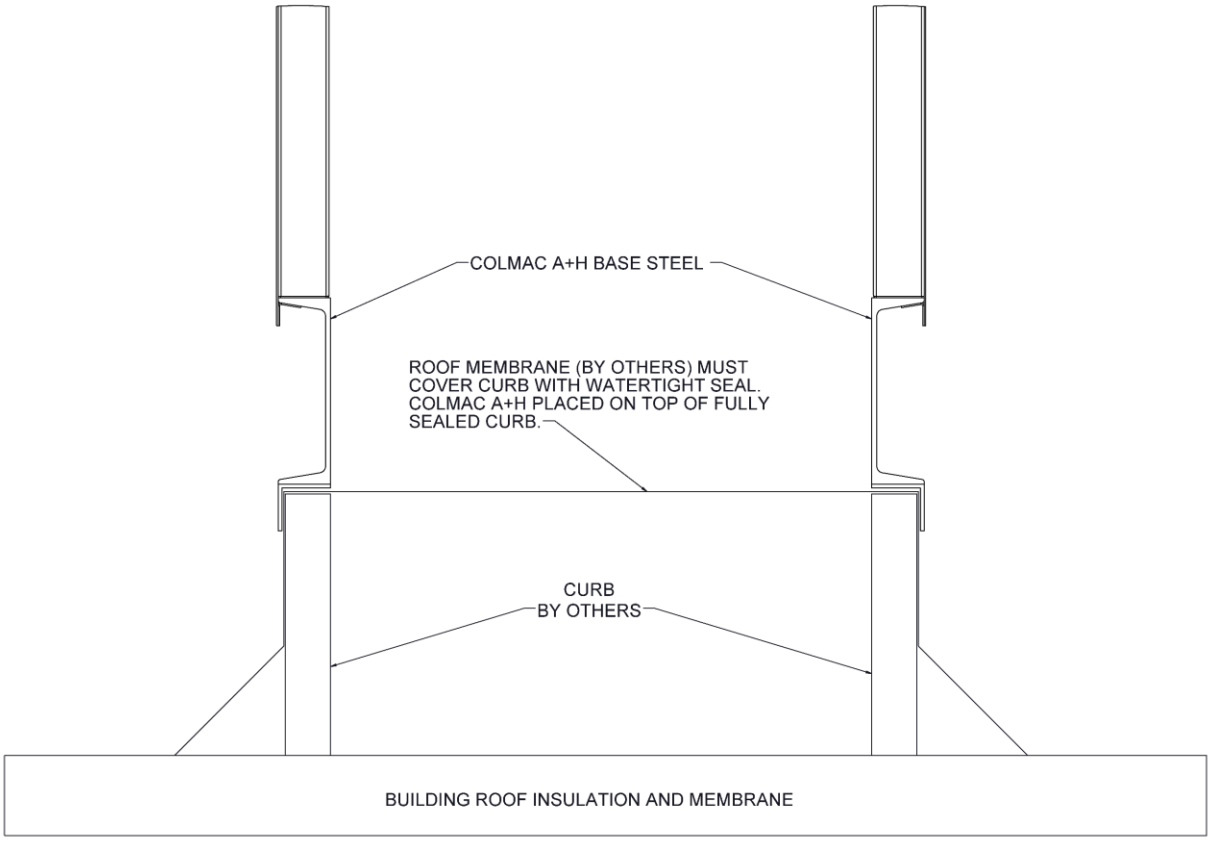



Figure 2.

- For lower temperature applications, the underside of the roof membrane running under the unit should be insulated with a minimum of 3.5” thick expanded polystyrene insulation to help prevent possible condensation issues.

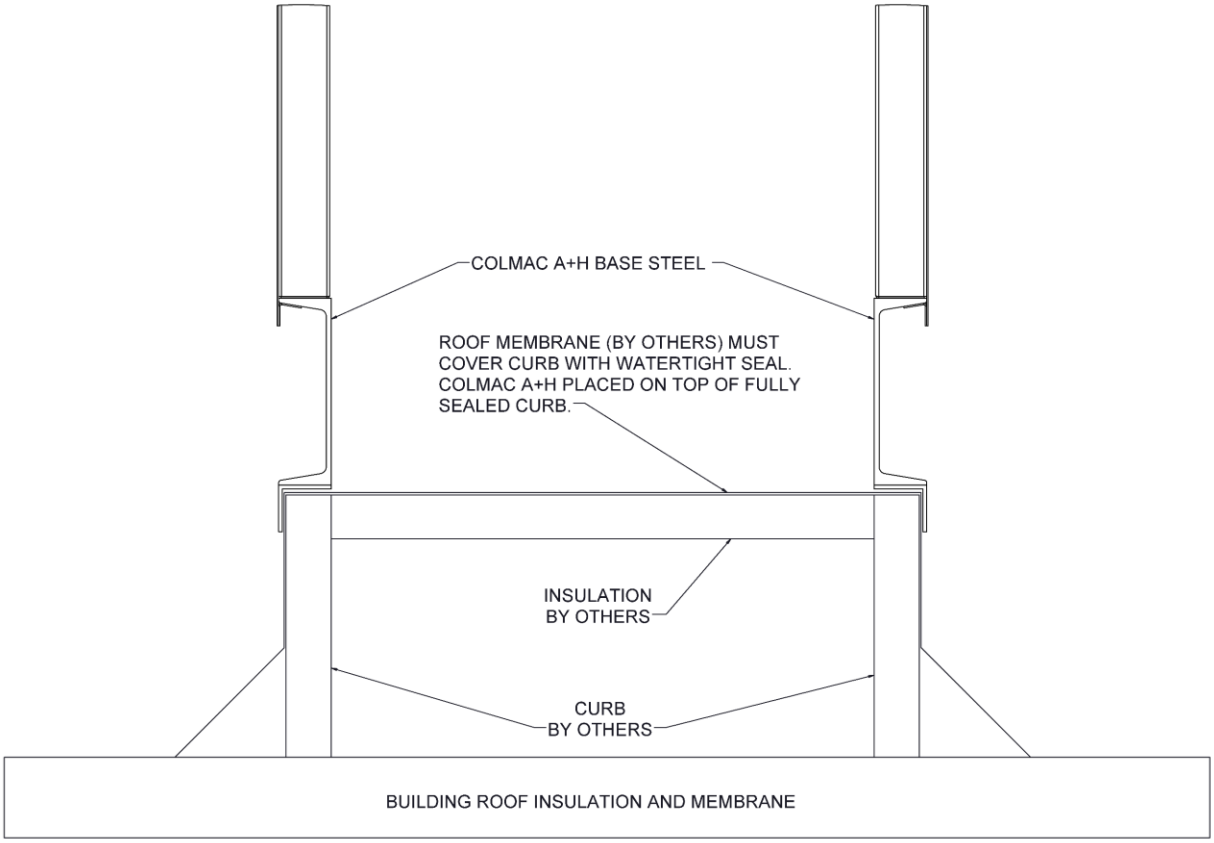



Figure 3.

2.4.3. Roof mounting with structural steel supports

- The unit can be mounted on a structural steel support frame that is designed for the weight of the unit plus any accessories such as piping, ductwork and service platforms. The structural steel frame should provide a full perimeter support around the outside frame of the unit.

2.5. Mounting – Single Piece Units

2.5.1. A+H units 22,000 cfm and smaller are shipped as a single piece and therefore do not require special mounting instructions since all seams are factory sealed.

2.6. Mounting – Multiple Piece Units

2.6.1. A+H units larger than 22,000 cfm are shipped in multiple pieces for ease of handling and shipment. The lifting lugs on the unit can be used to pull the sections together.

2.6.2. After pulling the unit sections together use provided joint kit to caulk where indicated in Figures 4, 5 and 6. Sections to be fastened together with the indicated bolts and joint caps to be installed over the roof and wall joint exterior as indicated.

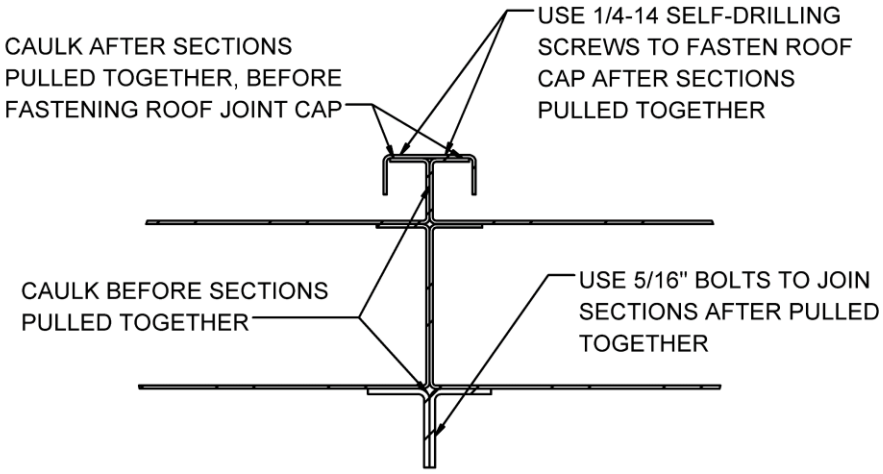



Figure 4.

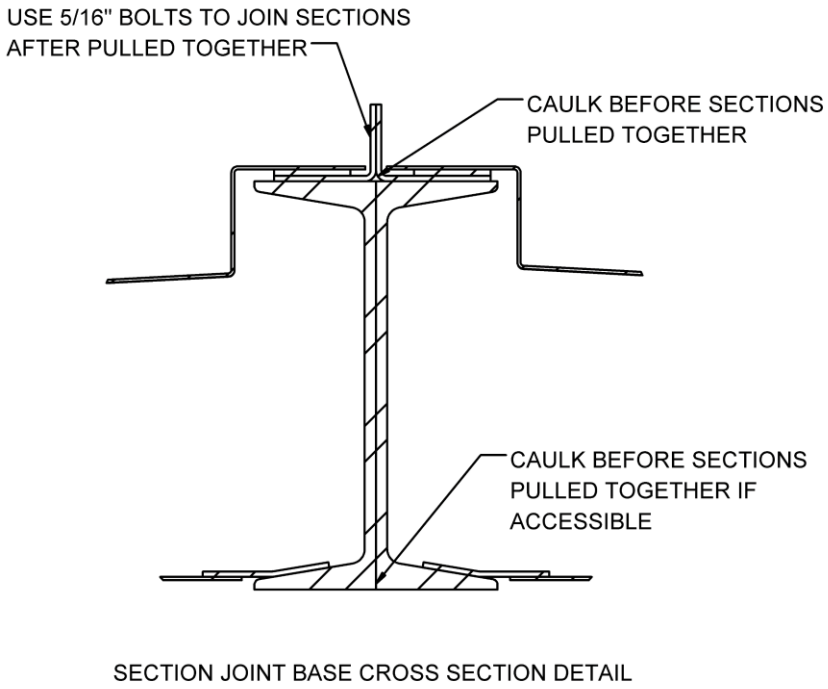
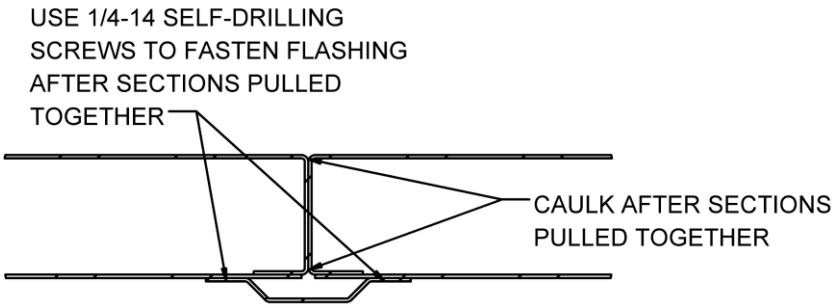



Figure 5.




SECTION JOINT WALL CROSS SECTION DETAIL (TOP VIEW)

Figure 6.

2.7. Duct Work Installation

2.7.1. All duct work must be fabricated and installed according to state and local codes and acceptable industry practices. The A+H unit is designed to be cleaned on the interior therefore it is recommended that any duct work to and from the unit also be designed so that it is fully cleanable. This means that the duct work is specially constructed such that it is air and watertight and fully drainable. All duct work should include access doors for inspection and/or cleaning purposes.

2.7.2. For roof mounted duct work, the exterior of the duct work must be insulated with exterior-rated insulation.

2.7.3. For room mounted duct work, the duct work must be insulated on the exterior and coated with a watertight, cleanable surface.

2.7.4. Duct openings on A+H units are a “finished” opening. The wall insulation is fully enclosed by sheet metal. Duct work can be fastened to the outside unit casing face or to the metal on the inside of the opening. The attachment method is dependent on the type of ductwork used. Duct flanges can be provided upon request.

2.8. Drain Pans

2.8.1. The A+H unit must be installed in a level position so that the drains will drain completely. This is a critical requirement in order to prevent standing water in the drain pans.

2.8.2. The A+H unit has a drain pan in each section of the unit such that the entire floor is composed of multiple drain pans. Under most operating conditions, the drain pans under the cooling coils and just downstream of the cooling coils will experience continuous water flow. The drain piping connected to these drain pans must be properly trapped.

2.8.3. The remaining drain pans are normally only used for cleaning purposes and therefore can be either trapped or valved off during normal operation. The sections within the unit have different air pressures and therefore airflow between the sections is possible if the drains are not either valved off or individually trapped. If all sections

are trapped, the traps should be checked weekly to ensure the traps maintain their water seal.

2.8.4. The trap requires static head to overcome the resistance to flow. For this reason, it should be located at least 4” below the outlet of the drain connection from the enclosure. The trap should be heated if it is located where the temperature could drop below freezing.

2.8.5. All drain piping should be adequately supported independent of the unit so no load is imposed on the pan connection. In some cases, consideration should be given to using a union at/near the pan connection to enable disconnecting the drain line for maintenance.

2.8.6. **CAUTION**: Do not apply torque to the drain pan connection; use two wrenches to secure the pipe union.

2.8.7. **CAUTION**: Do not reduce the diameter of the drain piping.

2.8.8. Electrical service for drain trap heat trace, with GFCI protection is provided by others unless specifically shown in the unit wiring diagram.

## 3. PIPING

### 3.1. Refrigerant Piping

3.1.1. For ammonia applications, all refrigeration and piping components must be installed by qualified personnel in accordance with the IIAR Ammonia Refrigeration Piping Handbook and other applicable local and national codes. Piping practices for ammonia are also described in the “System Practices for Ammonia Refrigerant” chapter in the ASHRAE Refrigeration Handbook.

3.1.2. For halocarbon applications, all refrigeration and piping components must be installed by qualified personnel in accordance with the “System Practices for Halocarbon Refrigerants” chapter in the ASHRAE Refrigeration Handbook and other applicable local and national codes.

3.1.3. Piping is to be designed and supported independent of the evaporator to minimize the transmission of vibration, to permit expansion and contraction, and to impose no load on the evaporator connections.

3.1.4. Do not stand on or apply any unnecessary weight to piping.

3.1.5. Pipe sizes are to be established according to good engineering design practices, taking into account all applicable facets of the system. The connection size provided by Colmac should not be used to determine the system piping.

3.1.6. The air holding charge in the coil should be permitted to remain intact as long as possible. When ready to connect the refrigerant piping, slowly vent the charge to the atmosphere, and then remove the temporary connection caps. Note that these temporary capping provisions are not intended for refrigeration service and must be removed prior to placing the coil in service.

3.1.7. Standard coil connections for units having all aluminum coil construction utilize bimetallic couplings with carbon steel stubs which can be welded directly to system piping after removal of the factory welded cap. Remove cap so that at least 4” of the connection stub remains. Do not weld within 4” of the bimetallic coupler.

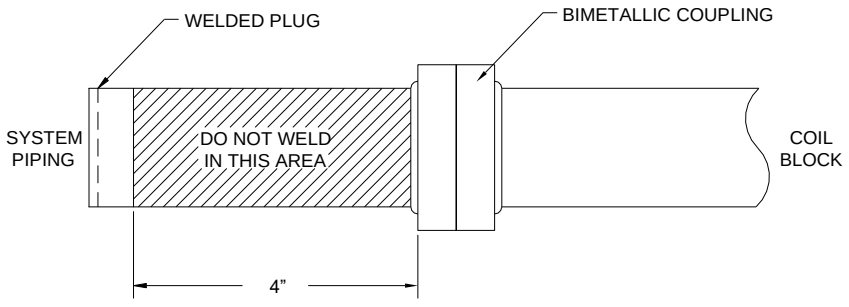



Figure 4: Bimetallic coupler

3.1.8. Carbon steel connections will be Schedule 80 pipe for connections less than or equal to 1-1/2” in diameter or Schedule 40 for connections 2” in diameter and greater.

3.1.9. Standard coil connections for halocarbon systems are copper “sweat” connections.

3.1.10. Prior to charging the system with refrigerant, the entire system must be pressure tested to ensure there are no leaks and then evacuated to remove all moisture.

3.2. Steam Piping

3.2.1. If the A+H unit is supplied with a steam coil, the piping must be installed in accordance with safe and local codes and accepted industry practices. Refer to the unit submittal information to ensure that the coil is supplied with the proper steam pressure.

3.3. Water or Glycol Coil Piping

3.3.1. Water or glycol piping must be installed in accordance with state and local codes and accepted industry practices. It is critical that the piping is installed so it can be drained, to avoid freezing damage. All piping must be pitched away from the unit. In applications where the coils will be exposed to freezing temperatures, it is recommended that the coils and piping be drained and filled with an antifreeze mixture to eliminate the possibility of freezing damage.

3.4. Expansion Valves for Direct Expansion (DX) Evaporators

3.4.1. Follow expansion valve manufacturer's instructions carefully when installing expansion valves and associated sensors.

3.4.2. **CAUTION**: It is recommended that a suction trap, or suction accumulator, be used on all direct expansion systems for compressor protection.

3.5. Hot Gas Defrost Piping

3.5.1. With this method of defrost, some of the hot discharge gas from the compressor is routed into the evaporator instead of the condenser. During hot gas defrost, the coil temperature should be high enough to melt frost and ice on the coil, but low enough so that heat and steam loss to the refrigerated space are minimized.

3.5.2. Only 1/3 of the evaporators in a system should be defrosted at one time. Example: if total evaporator capacity is 100 tons (352 kW), then evaporators with no more than 33 tons (116 kW) of capacity should be defrosted at once. Consult factory if your system does not permit this.

3.5.3. Suggested methods of piping can be found in Colmac's technical bulletin ENG000019934, as well as at www.colmaccoil.com.

3.5.4. For evaporators with cooling capacity 15 tons and greater, a soft start solenoid valve is recommended. Soft Start uses a secondary, smaller solenoid capable of letting a reduced amount of hot gas into the defrost system at the beginning of defrost, while the main hot gas solenoid remains closed. Once the system is up to a pre-designated pressure (~40 psig), the main hot gas solenoid is opened, allowing the system to approach its normal operating pressure. The Soft Start system eases the unit cooler into the defrost cycle, limiting unwanted problems like check valve chatter, pipe movements, and most of all, liquid hammer. This control method is particularly useful on larger systems.

3.5.5. All hot gas piping located in cold spaces should be insulated. All hot gas piping located outdoors in cold climates should be insulated.

3.5.6. The amount of hot gas supplied will depend on the inlet pressure of the hot gas, and the capacity of the air unit.

3.5.7. Ammonia - Hot gas is typically supplied to evaporators by one of two methods:

- Install a pressure regulator in the compressor room at the hot gas takeoff. Set the regulator to approximately 100 psig (689.5 kPa), then size the piping to achieve 75 to 85 psig (517 to 586 kPa) hot gas pressure at the evaporators, accordingly.

- In branches leading to each evaporator from the main hot gas line, install a pressure regulator set at approximately 75 to 85 psig (517 to 586 kPa), then size the branches accordingly.

3.5.8. Halocarbon – Hot gas piping is typically sized to accommodate twice the normal refrigerant mass flow to the evaporator. Pressure drop is not as critical for the Halocarbon defrost cycle, so refrigerant velocity can be used as the criterion for line size. It is suggested that hot gas lines are sized for the refrigerant velocity between 1000 to 2000 ft/min (5 to 10.2 m/s).

## 4. ELECTRICAL

### 4.1. General

4.1.1. All wiring must be performed by qualified personnel, and in compliance with national and local codes and standards. Ensure that all sources of power have been deenergized and locked out prior to servicing.

4.1.2. A+H units larger than 22,000 cfm may be shipped in sections. The control and/or power wiring must be split at each section via a junction box with terminals. It is the installation contractor's responsibility to reconnect the wires at each junction box.

4.1.3. Retighten all terminals and electrical connections. All conduit penetrations into the control panels must be sealed tight. Installing conduit into the top of a control panel is not recommended.

4.1.4. The grounding of the unit is critical to the proper operation of the unit. Improper grounding of the unit and panel can cause faults or damage to the electronic systems. Follow all NEC guidelines.

4.1.5. Refer to the unit nameplate and the project specific wiring diagrams for details on the control wiring and operation. Follow all wiring diagrams for the unit. Do not make any field modifications to the controls or wiring since improper wiring can cause component failure, damage to the control system, damage to the unit, damage to the building, or personal injury or death.

4.1.6. Field wiring connections are made at a common electrical enclosure. The electrical enclosure and internal components may differ depending on unit type and customer specification.

4.1.7. Units can be designed with staggered motor starting to reduce the overall starting current, and/or to allow for the operation of a reduced number of fans.

4.1.8. When staggered motor starting has been specified, care must be taken to minimize the time delay between the staggered start of fans, so that no reverse rotation occurs in the fans that have a delayed start. This delay is factory programmed for 1-2 seconds for operation in the "Hand" mode. The time delay setting should be confirmed on site by the customer and also duplicated for the staggered start initiated from the BMS. Attempting to start fan motors that are reverse rotating may result in tripping the motor overloads.

4.1.9. When operating only a portion of the fan motors in an A+H unit for air circulation, the operating fan motors must be de-energized and allowed to stop completely prior to restarting all fan motors. Attempting to start fan motors that are reverse rotating may result in tripping the motor overloads.

4.1.10. A+H units specified with door safety interlocks will initiate a shutdown of the unit fan motors and other components when the man doors are opened during operation. The door interlock utilizes a magnetic switch to provide a run permissive for the fan motor control circuit. The door safety interlock should be tested periodically to ensure proper operation.

4.1.11. A+H units specified with ammonia detection sensors will have the associated wiring terminated in the main control panel. Ammonia detector wiring will need to be incorporated into the facility ammonia detection system. Ammonia sensors shall be

calibrated and maintained in accordance with the requirements of standard ANSI/IIAR-2.

4.1.12. A+H units specified with smoke detection sensors will have the associated wiring terminated in the main control panel. Smoke detector wiring will need to be incorporated into the facility fire detection system. Smoke detectors shall be calibrated and maintained in accordance with the requirements of the local authority having jurisdiction.

4.1.13. A+H units specified with VFDs (Variable Frequency Drives) will be factory wired and tested. Bypass contactors may be supplied in this configuration, to allow for across the line starting of the fan motors in case of VFD failure.

## 5. OTHER COMPONENTS

5.1. Filters

5.1.1. The filters for A+H units are shipped in their original packaging, either inside of the air handling unit or on a separate pallet. It is recommended that once the unit is received these filters be removed and placed in a secure, dry location for installation prior to startup.

5.1.2. The final filters should not be installed until the unit has been tested and final cleaning of the duct, unit, and room has been performed.

5.1.3. Refer to the maintenance section of this manual for filter installation instructions. It is also recommended to review the website for the manufacturer of the filters for the most specific and up-to-date installation instructions.

5.2. Inlet Hood (Optional)

5.2.1. Depending on the size of the inlet air hood, it may be shipped separately for field mounting.

5.2.2. Attach the inlet hood to the outdoor air opening of the A+H unit using the provided fasteners. Caulking should be applied to prevent water ingress.

5.3. Surge Drum (Optional)

5.3.1. A+H units supplied with flooded ammonia coils can be provided with an optional roof support for the surge drum assembly. The roof support may be shipped loose for field mounting. Colmac Coil Manufacturing will supply detailed installation drawings to aid in installation.

5.3.2. With the roof mounted surge drum support, special structural steel support is provided in the unit and cross support. Do not support any component directly on the roof of the unit without this support option. Roofing or casing damage can result from improper supporting of the components on the unit. Use only the factory supplied surge drum roof support system.

5.3.3. The surge drum cross support should be centered on the cooling coil to allow the coil feed connection on the surge drum to line up with the coil inlet connection.

5.4. Room Pressure Control (Optional) and Safety Cutoff

5.4.1. All A+H units are shipped with a pressure sensor that acts as a safety guard against over-pressurizing the supplied room. Installer is responsible for running appropriate pressure tubing to this sensor and connecting it to the A+H controller.

5.4.2. This sensor is set to 0.25 IWG pressure differential as standard from the factory (room internal to outside atmospheric pressure). Please contact Colmac Coil if a different setting is required.

5.4.3. Some A+H units include an automatic room pressure control option. The sensor described in 5.4.1 is also used in this case to allow the unit to modulate room pressure to a setpoint.

5.5. Motor Removal System (Optional)

5.5.1. Some units include the motor removal system option which can facilitate easier and safer removal of the motors inside the unit. The trolley is shipped loose and can be installed on the support beam after the unit is in place.

5.6. Ultraviolet Light System (Optional)

5.6.1. Caution: Never expose eyes or skin to UV light from any source. Always turn off power before entering or wear proper personal protective equipment.

5.6.2. Improper installation, adjustment, alteration, service, maintenance or use can cause fire, electrical shock, or other conditions which may cause personal injury or property damage.

5.6.3. To prevent shipping damage, the lights are shipped in their original packaging. Remove from original packaging and perform the following steps to install:

- Remove the “thumb nuts” and washers from the lamp mounting studs.
- Insert lamp through hole into plenum until lamp base is aligned with mounting studs.
- Replace the washers and thumb nuts, finger tighten snug.
- Repeat with additional lamp.
- Align lamp connector with pins on lamp and push until pins are completely inserted into connector.
- Replace fixture lid with 6 screws and tighten to ensure tight fit.
- Exit the A+H unit and energize the UV light system.

5.7. Ammonia Detection (Optional)

5.7.1. A+H units are optionally provided with ammonia detectors to provide unit shutdown and/or alarm upon an ammonia release. Refer to the specific manufacturer’s website for the most up-to-date details and operation. The ammonia sensor will normally be unplugged and with a cap covering the sensor. The sensor will need to be plugged in and the cap removed

5.7.2. The ammonia detector comes factory calibrated. However, if the detector requires gas calibration after installation, it is the responsibility of the installation contractor to perform this gas calibration procedure.

## 6. GENERAL OPERATION

6.1. CAUTION: Disconnect all electrical power to the unit and follow the facility's lock-out-tag-out policy / procedure before attempting to check or service the blower, motor, and drive system. Failure to do so could result in bodily harm or death.

6.2. Before Startup – The following is a representative checklist of items to be checked prior to startup. It is not, nor is it intended to be, a comprehensive checklist for the many varying types of industrial refrigeration systems. Consult with a qualified system startup expert for assistance.

6.2.1. Make sure unit is mounted securely and is level.

6.2.2. Make sure unit voltage agrees with supply voltage.

6.2.3. Make sure system is wired correctly and in accordance with the guidelines laid out in this IOM, as well as all local and national standards that may apply.

6.2.4. Check torque on all electrical connections.

6.2.5. Confirm the supply voltage is within 10% of design and the phase-to-phase imbalance is within 2%.

6.2.6. Make sure that all fans and blower wheels rotate freely. Then check the tightness of the blower wheel to motor shaft and check the tightness of all motor mounting bolts.

6.2.7. Check fan direction and amperage.

6.2.8. Make sure all piping is done completely and in accordance with the guidelines laid out in this IOM, as well as in accordance with standard good practice.

6.2.9. Make sure that liquid supply, suction, and hot gas supply (as applicable) service valves are open.

6.2.10. Check drainage of drain pan and drain piping by pouring water into drain pan.

6.3. After Startup

6.3.1. Check fan rotation of all fans to make sure rotation is correct.

6.3.2. Confirm all control systems are functioning properly.

6.3.3. Look and listen for any excessive vibration, severe valve chatter, water hammer, or moving pipes, and correct as necessary.

6.3.4. Evaporators with liquid feed orifices for liquid overfeed must have liquid refrigerant supplied to the coil inlet at a pressure 5 psig (35 kPa) above saturated suction pressure, and at a temperature not exceeding 30°F (16.7°C) above saturated suction temperature. Please consult factory if conditions exceed these recommendations.

6.4. Field Adjustments - Perform the following functions when commissioning A+H units, based on the refrigerant feed system and defrost technique being employed on the particular unit. These instructions are not, nor are they intended to be, a comprehensive list of tasks required to successfully commission all A+H units. Consult with a qualified system startup expert for assistance.

6.4.1. Recirculated & Controlled Pressure Receiver Feed:

- Open hand expansion valves (HEVs) slowly and observe frost/condensate formation on all return bends, top and bottom alike.
- The proper setting may be achieved by observing the frost or condensate on all return bends and opening the HEV until all return bends are evenly wetted or frosted.
- Alternatively, if the defrost relief regulator is connected to the liquid line and is equipped with a gauge, set the HEV to achieve a 5 psi rise in pressure when the liquid solenoid valve is energized.

6.4.2. Flooded Feed:

- Verify that the liquid level is at the design level in the surge drum.
- Open and adjust the liquid feed HEV to allow for the solenoid to be energized approximately 70% of the time at design temperature difference (TD).

6.4.3. Direct Expansion Feed:

- After room temperature has been achieved, check the superheat, and adjust the expansion valve or expansion valve controller.
- If the coil is being starved, resulting in too much superheat at the desired room temperature, reduce the superheat setting of the valve or controller.
- If there is not enough superheat, increase the setting of the valve or controller.
- After waiting approximately 30 minutes, re-check the superheat and re-adjust as necessary.
- Repeat until the unit operation is stable.
- Note that 10°F is the minimum superheat required to fully stroke a typical expansion valve and that 10°F superheat requires an 11 or 12°F split between the room return air temperature and the evaporating temperature.

6.4.4. Manual Hot Gas Defrost:

- Allow the unit to frost, then initiate the defrost cycle.
- Monitor the leaving air temperature. It should show a rise if the pump-out time is sufficient.
- Monitor the condensate flow. It should diminish to a trickle prior to hot gas termination.
- Check the bottom of the coil for residual ice or frost.
- Do not allow long hot gas times that cause coil steaming.

- If more than 15 minutes of hot gas is required, there may be system design problems.
- Monitor the bleed time. The pressure of the coil should be within 25 psig of suction pressure by the end of the bleed cycle.
- Monitor the fan delay. The free water on the coil should be frozen prior to the fans starting.
- Make adjustments to the various function times as necessary

6.5. Hot Gas Defrost Operation

6.5.1. Condition of Operation - Hot Gas Defrost can be used for any design criteria, including Low-Temp and Medium-Temp.

6.5.2. Proper hot gas defrost operation is entirely dependent on refrigerant latent condensation during the defrost operation. This requires hot gas to be delivered to the evaporator at a saturation pressure necessary for condensation to occur during defrost. Typical design hot gas saturation temperatures run between 50°F (10°C) to 60°F (15.6°C). Table 1 shows the equivalent saturation pressures, for a variety of refrigerants, required at the evaporator to accommodate this temperature range.

**Table 1**
**Hot Gas Pressures for Various Refrigerants**

| **Refrigerant** | **R22** | **Ammonia (R717)** | **R507a** | **R404a** |
|---|---|---|---|---|
| **Hot Gas Pressure @ Evaporator** | ~85 to100 psig (~688 to 791 kPa) | ~75 to 90 psig (~619 to 722 kPa) | ~105 to 125 psig (~826 to 964 kPa) | ~105 to 125 psig (~826 to 964 kPa) |

6.5.3. Hot Gas Supply line pressure should be maintained at less than the system condensing pressure. This serves two purposes; the first being decreased energy losses due to excessive heat gain, and the second being that condensing pressure has a tendency to fluctuate with ambient conditions and with the load. Maintaining the Hot Gas Supply pressure at less than the system condensing pressure helps ensure a constant Hot Gas pressure at the evaporator.

6.5.4. Sequence of Manual Hot Gas Defrost Operation

- Recirculated Bottom Feed Evaporators

  a) Close Liquid Solenoid and continue operating fan motors.

  b) Pump down liquid refrigerant from coil for a period of approximately 15 minutes (or as long as required). Any cold liquid refrigerant remaining in the coil at the beginning of defrost will greatly reduce the effectiveness of the hot gas defrost operation and can extend the time required for defrost. Evidence of residual liquid refrigerant can be seen in the form of uneven melting or the absence of melting on the lower tubes of the evaporator coil.

  c) Stop fan motors.

d) Open Hot Gas Pilot Solenoid to close Gas-Powered Suction Stop Valve.

e) On Coils with 15 tons cooling capacity and larger, open Soft Start Hot Gas Solenoid to gradually bring coil up to near defrost pressure.

f) Open Hot Gas Solenoid to start defrosting. Duration of defrost should be long enough to clear coil and pan. Extending the defrost period longer than this is not necessarily better.

g) Close Hot Gas Solenoid (and Soft Start Hot Gas Solenoid if applicable) to end defrost.

h) Open Equalizing Bleed Valve to gradually bring evaporator back down to suction pressure.

i) Close Hot Gas Pilot Solenoid to open the Gas-Powered Suction Stop Valve. At the same time, open the Liquid Solenoid to start cooling the coil.

j) After a delay to refreeze remaining water droplets on the coil, restart the fans.

- Recirculated Top Feed and Direct Expansion Evaporators

a) Close Liquid Solenoid and continue operating fan motors.

b) Pump down liquid refrigerant from coil for a period of approximately 15 minutes (or as long as required). Any cold liquid refrigerant remaining in the coil at the beginning of defrost will greatly reduce the effectiveness of the hot gas defrost operation. Evidence of residual liquid refrigerant can be seen in the form of uneven melting or the absence of melting on the lower tubes of the evaporator coil.

c) Stop fan motors.

d) Open Hot Gas Pilot Solenoid to close Gas-Powered Suction Stop Valve.

e) On Coils with 15 tons cooling capacity and larger, open Soft Start Hot Gas Solenoid to gradually bring coil up to near defrost pressure.

f) Open Hot Gas Solenoid to start defrost. Duration of defrost should be long enough to clear coil and pan. Extending the defrost period longer than this is not necessarily better.

g) Close Hot Gas Solenoid (and Soft Start Hot Gas Solenoid if applicable) to end defrost.

h) Energize the Defrost Relief Regulator to the wide open position to gradually bring the evaporator back down to suction pressure (equalize).

i) Close Hot Gas Pilot Solenoid to open the Gas-Powered Suction Stop Valve. At the same time, de-energize the Defrost Regulator Valve.

j) Open the Liquid Solenoid to start cooling the coil.

k) After a delay to refreeze remaining water droplets on the coil, restart the fans.

- Gravity Flooded Evaporators

a) Close Liquid Solenoid and stop fan motors.

b) Open Hot Gas Pilot Solenoid to close the two Gas-Powered Stop Valves in the coil liquid and suction lines.

c) On Coils of 15 tons cooling capacity and larger, open Soft Start Hot Gas Solenoid to gradually bring coil up to near defrost pressure.

d) Open Hot Gas Solenoid to start defrosting. Duration of defrost should be long enough to clear coil and pan. Extending the defrost period longer than this is not necessarily better.

e) Close Hot Gas Solenoid (and Soft Start Hot Gas Solenoid if applicable) to end defrost.

f) Energize the Defrost Relief Regulator to the wide open position to gradually bring the evaporator back down to suction pressure (equalize).

g) Close Hot Gas Pilot Solenoid to open the Gas-Powered Suction Stop Valves. At the same time, de-energize the Defrost Regulator Valve.

h) Open the Liquid Solenoid.

i) After a delay to refreeze remaining water droplets on the coil, restart the fans.

- Setting Hot Gas Defrost Timer. Time periods should be set as follows:

a) Length of defrost should be set to the minimum time necessary to melt all frost. Defrost operation beyond this point will convert liquid water to steam, leading to secondary condensation and freezing on non-heated areas of the unit cooler and introduced unwanted heat gain into the controlled space.

b) Depending on frost loading conditions, defrost duration can typically last anywhere from 12 to 20 minutes, and in most cases, should never exceed 30 minutes.

c) Actual defrost times must be determined from careful observation of defrost operation and adherence to the previously mentioned guidelines. Frost is usually heaviest on the air-entering side of the coil, and inspection of fins on this side can usually be used to determine if complete defrost has occurred. Periodic observation of the defrost cycle throughout the year is necessary to maintain a properly operating defrost system.

**NOTICE:** Once frost turns to ice, the amount of time required to melt increases. Incomplete defrosting may allow excessive ice to build up which could damage the machinery. Allowing ice to build up on the fan blades will result in excessive vibration which could lead to catastrophic failure. It is imperative that the end user inspect the unit coolers regularly for proper defrosting. Manual defrosting may be required to remove ice buildup.

6.6. Air Defrost Operation

6.6.1. For air defrost operation, consult submittal documents and/or unit specific sequence of operations.

## 7. EMERGENCY SITUATIONS

7.1. During normal operation, the units described in this IOM contain either ammonia, CO2, or one of several possible halocarbon refrigerants. There are hazards and risks associated with all refrigerants. Refrigerant leaks can cause an emergency situation. Refer to the facility "Emergency Planning Policy" and "Hazardous Chemical Communication Policy" for the proper methods of dealing with any potential emergency situation resulting from a refrigerant leak.

7.2. During normal operation, the units described in this IOM may contain natural gas or propane as part of the heating system. There are hazards and risks associated with flammable substances. Natural gas or propane leaks can cause an emergency situation. Refer to the facility "Emergency Planning Policy" and/or the facility "Fire Response Policy" for the proper methods of dealing with any potential emergency situation resulting from a natural gas or propane leak.

## 8. MAINTENANCE

8.1. **WARNING:** Prior to any maintenance being performed, the unit must be locked out and tagged out per the Lockout/Tag Out policy of the facility where installed.

8.2. Interior Sanitation

8.2.1. Note that equipment may be damaged by incompatible cleaning agents or water condensate that is contaminated by airborne impurities. It is the responsibility of the owner/operator to be familiar with these chemicals and the room environment and to select compatible agents and materials of construction.

8.2.2. Refer to the unit submittals for a listing of the materials used and consult with a qualified chemical/corrosion expert to ensure compatibility and to develop a plan to address any special circumstances, such as airborne impurities.

8.2.3. The interior of the unit should be cleaned and sanitized periodically. The frequency of the cleaning will be dependent on the specific application and Hazard Analysis Critical Control Point (HACCP) procedures outlined for the air-handling unit. It is critical that the chemicals used to clean the unit are compatible with the materials and components located in the unit interior.

8.2.4. When cleaning the unit:

- Make sure the unit is locked out and tagged out per the facility policy and procedures.
- Personnel who enter the unit for cleaning should have proper personal protective equipment, as per the facility policy and procedures.
- All air filters should be removed from the unit prior to cleaning.
- Control devices located inside the unit should be covered with a waterproof covering.
- If ultraviolet lights are present, protect both the light and the fixture from the cleaning process.
- Check to ensure that all drain connections are open and freely flowing.
- Take care not to direct spray near the motor bearings. Aggressive washing can damage the seal and wash out the grease, which can lead to premature failure of the bearing.

- The coils can be cleaned with water wash spray, however, take care not to spray with a pressure that results in bent or damaged fins. For coils with aluminum fins, do not use caustic cleaners, otherwise corrosion of the aluminum may take place.
- Do not aggressively spray the gasketing on the filters.
- Do not aggressively spray the caulked seams in the unit. This can damage or dislodge the sealing caulk bead.

8.2.5. Prior to putting the unit back in operation:

- Dry the interior of the unit as much as possible. Operating before the unit is dry can cause water to become airborne which could damage electrical components and could also cause filter damage.
- Make sure any drain caps are replaced and/or drain valves are shut.
- Remove all waterproof protective coatings used during the cleaning process.
- Check all caulked seams in the unit for integrity. Caulking will need to be replaced as a routine maintenance task.
- Check the gasketing on the filter frames and replace as needed.
- Replace all filters.

8.3. Pre-filter Service

8.3.1. The pre-filters in the A+H unit are typically a pleated, synthetic media filter with a moisture resistant frame, each held in place with metal holding clips.

8.3.2. The frequency of changing the pre-filters is determined by the cleanliness of the air and the proper operation of the unit during the cleanup cycle. Most pre-filter systems are changed on a preventative maintenance schedule, and not purely by the appearance of the filter because visible dirt on the surface is not a true indication of full loading of the filter. If the A+H unit is supplied with a filter gauge, the filters should be changed whenever the air pressure drop reading approaches the “dirty” value as described in the unit submittal information. Typical MERV 8 and MERV 9 filters have a final/dirty resistance of 0.40 to 0.50 inwg.

8.3.3. Use the following procedure to change the pre-filters:

- Stop the fan motor and lockout / tagout according to the facility’s policy / procedures.
- Put on appropriate personal protective equipment.
- Remove each filter from its holding frame.
- Inspect the filter frame gasketing, caulking between the frames, and holding clips and replace as needed.
- Clean and sanitize the pre-filter section.
- Install new pre-filters. The pre-filters normally have the pleats in the vertical position.
- Start the fan motor.
- Re-check the pre-filters after 8 hours of operation to ensure they have been installed properly.
- Record that the filters were changed in the facility maintenance records for that unit.

8.4. Final-filter Service

8.4.1. A+H units can be supplied with several types of final filters ranging from MERV 11 to MERV 16, as well as HEPA filters. Final filters are typically located at the supply air end of the unit.

8.4.2. MERV 11 through MERV 16 filters are cartridge type filters where each filter is held in place with spring holding clips. Typically, the filter media is a glass microfiber media.

8.4.3. If the A+H unit is supplied with a filter gauge, the filters should be changed whenever the air pressure drop reading approaches the “dirty” value as described in the unit submittal information. Typical MERV 11 through MERV 15 filters have a final/dirty resistance of 0.6 to 0.8 inwg. Typical MERV 16 filters have a final/dirty resistance of 1.0 to 1.2 inwg.

8.4.4. Typically, the final filters should last 6 to 12 months, depending on the cleanliness of the application, frequency of pre-filter changes, and if the cleanup cycle is operated properly.

8.4.5. Use the following procedure to change the final filters:

- Stop the fan motor and lockout / tagout according to the facility’s policy / procedures.
- Put on appropriate personal protective equipment.
- Remove each filter from its holding frame.
- Inspect the filter frame gasketing, caulking between the frames, and holding clips and replace as needed.
- Clean and sanitize the filter section.
- Install new filters.
- Start the fan motor.
- Re-check the filters after 8 hours of operation to ensure they have been installed properly.
- Record that the filters were changed in the facility maintenance records for that unit.

8.5. HEPA Final Filter Service

8.5.1. A+H units can be supplied with HEPA filters. HEPA final filters are typically located at the supply air end of the unit.

8.5.2. HEPA filters are cartridge type filters each held in place with metal holding clips.

8.5.3. If the A+H unit is supplied with a filter gauge, the filters should be changed whenever the air pressure drop reading approaches the “dirty” value as described in the unit submittal information. Typical HEPA filters have a final/dirty resistance of 1.4 to 1.6 inwg.

8.5.4. Typically, the final filters should last 6 to 12 months, depending on the cleanliness of the application, frequency of pre-filter changes, and if the cleanup cycle is operated properly.

8.5.5. Use the following procedure to change the final filters:

- Stop the fan motor and lockout / tagout according to the facility’s policy / procedures.
- Put on appropriate personal protective equipment.

- Remove each filter from its holding frame.
- Inspect the filter frame gasketing, caulking between the frames, and holding clips and replace as needed.
- Clean and sanitize the filter section.
- Install new filters.
  a) Carefully open the packaging. Touch only the frame, never the white media.
  b) Slide the filter into the frame, centering on the filter frame.
  c) Install spring clips / bolts to a compression of approximately 30 to 50%.
- Start the fan motor.
- Re-check the filters after 8 hours of operation to ensure they have been installed properly.

8.6. Blower, Motor and Drive Service

8.6.1. Every 6 months, the fastening bolts for the blower, motor and drive should be checked for tightness. Also check the blower hub set screws as well as any bearing set screws, if equipped.

8.6.2. Motors that do not have re-grease capability are factory lubricated for the normal life of the bearings. For motors with re-grease capability, they should be lubricated at these intervals:

| Motor Lubrication Intervals, (hours of operation) | | | | |
|---|---|---|---|---|
| Motor Horsepower | Rated Speed (RPM) | | | |
| | 3600 | 1800 | 1200 | 900 |
| | | | | |
| 2 | 5500 | 12000 | 18000 | 22000 |
| 10 | 3600 | 9500 | 15000 | 18000 |
| 40 | 2200 | 7400 | 12000 | 15000 |
| 50 and above | 2200 | 3500 | 7400 | 10500 |

8.7. Electrical Connections

8.7.1. The control system for the unit should be checked at least two times per year for proper operation of the system. All wiring terminals should be checked for tightness.

8.8. Smoke Detector (Optional Feature)

8.8.1. Smoke detector, if equipped, must be tested and maintained regularly as per NFPA requirements. The detector should be cleaned and tested at least once per year. Detailed information on the maintenance and service can be found on the manufacturer's website for the specific smoke detector model in the A+H unit.

8.8.2. **WARNING: Without proper service and maintenance, the smoke detector could initiate false alarms or fail to function properly in the case of a fire. Strict service and maintenance schedules must be followed along with complete and detailed service records.**

8.9. Ammonia Detector (Optional Feature)

8.9.1. To ensure proper operation, it is essential that the test and calibration schedule be followed. Refer to the manufacturer's website for the specific ammonia detector model in the A+H unit. Typically, the following maintenance schedule should be followed:

- Perform a monthly response test by exposing the solution to ammonia/water solution to verify proper sensor response and alarm functions. This test may need to be performed more frequently in highly critical applications.

- Calibration should be performed with certified calibration gas every six months and all tests and calibrations should be properly recorded. Note – the sensor must have a 12 hour warm up before it can be calibrated.

8.9.2. Typical sensor life in a refrigerated area will be two to three years. Typical life in a non-refrigerated area will be one to two years. Exposure to high levels of ammonia will shorten the life of the sensor. A preventative maintenance program of periodic cell replacement should be implemented.

8.9.3. **WARNING: Without proper service and maintenance, the ammonia detector could initiate false alarms or fail to function properly in the case of an ammonia leak. Strict service and maintenance schedules must be followed along with complete and detailed service records.**

8.10. Ultraviolet Lights (Optional Feature)

8.10.1. **WARNING: Eye damage may result from directly viewing the light produced by these lamps. To reduce the risk of exposure to UV radiation, take UV-radiation protective measures for personnel during servicing**.

8.10.2. To prevent exposure to ultraviolet light, be sure the ultraviolet air treatment system is disconnected before servicing any part of the HVAC system or removing any access panel or the equivalent.

8.10.3. Improper service and maintenance can cause fire, electrical shock or other conditions that may cause personal injury or property damage.

8.10.4. Ultraviolet lamps should be replaced annually if operated continuously (recommended) or after 9,000 hours if operated intermittently. Replacement lamps must be the specific size and wattage as originally supplied from the factory. Note**:** Although the lamps may continue to generate a characteristic blue glow beyond 9,000 operating hours, the ultraviolet radiation emitted by the lamp(s) degrades over time and will no longer provide the intended benefit.

8.10.5. The intensity of the ultraviolet energy emitted from the UV lamps is dependent on the cleanliness and lamp age. The surface of the lamp should be kept as clean as possible for optimum intensity. Depending on the filtration level of the system and the general hygiene of the building, periodic cleaning may be necessary. Before attempting any maintenance procedures, always follow all warnings and cautions as detailed in this maintenance section.

8.10.6. Note: If lamps are found to be broken, see the proper warning and cautions below regarding broken lamps and hazardous vapors.

- Disconnect all electrical power to the unit and the UV lamps. Wearing soft cloth gloves and safety glasses remove lamp from fixture.

- Wipe down each lamp with a clean cloth and isopropyl alcohol. Avoid touching lamp glass with hands as skin oils can accelerate lamp degradation. (If lamps are coated with Teflon they can be touched with bare hands).

8.10.7. UV lamps should be treated the same as other mercury-containing devices, such as fluorescent bulbs, according to local regulations. Most lamps must be treated as hazardous waste and cannot be discarded with regular waste. Low-mercury bulbs often can be discarded as regular waste; however, some states and local jurisdictions classify these lamps as hazardous waste. The U.S. EPA's universal waste regulations allow users to treat mercury lamps as regular waste for the purpose of transporting to a recycling facility. The National Electrical Manufacturers Association (NEMA) maintains a list of companies claiming to recycle or handle used mercury lamps at www.lamprecycle.org.

8.11. PLC Control Systems (Optional Feature)

8.11.1. The control panel enclosing the PLC controls may contain an ambient air cooling / ventilation system. This cooling system is used to control the interior control panel temperatures. The cooling system contains a filter which must be periodically cleaned. It is recommended it be cleaned as least as often as the pre-filters in the unit and more frequently if the atmosphere around the unit is very dirty and dusty. **WARNING: Failure to keep the panel cooling filter clean can cause reduced cooling air flow to the control panel. This can result in overheating of the PLC which can cause faults and or failure of the control system.**

8.12. Heating System

8.12.1. The burner (direct fired) or heat exchanger and stack (indirect fired) should be inspected before the start of each heating season. Make sure the stack is intact and has not deteriorated or the roof cap leaking. Check the drain to ensure it is open and free flowing. Check the heat exchanger for cracks or other deterioration.

8.12.2. Completely check the gas train for leaks. Check the complete control system and all safeties for proper operation.

8.12.3. Caution: Indirect fired heat exchangers and flue vent stacks are supplied with condensate drain connections piped to the outside of the unit. This condensate can be corrosive and extreme care should be exercised when selecting a location for discharge of the condensate. Condensate should not be discharged on to a roof. Follow all state and local codes.

8.12.4. Semi-annually check the drains and drain piping / traps to ensure they are free flowing. Failure to effectively drain condensate formed in the heat exchanger can result in premature catastrophic failure of the heat exchanger.

8.13. Miscellaneous Items

8.13.1. Check the operation of the dampers every time the electrical controls are checked. Make sure that all the linkage operates freely and the dampers function correctly

8.13.2. Check the seal between the sections on the units. Make sure the section split seals remain water and airtight.

8.13.3. Check all drain traps to make sure they are not plugged and have an adequate water seal. Make sure that the other drain pans do not have standing water in them.

8.13.4. Check all door gasketing yearly to make sure there is an airtight seal.

8.13.5. If the unit is equipped with a control panel cooling system, clean or replace the filter regularly.

8.14. Replacement Parts

8.14.1. Replacement parts which are covered under the conditions of Colmac Coil's warranty (see Limited Warranty) will be reimbursed at the part cost only. For replacement parts, warranted or otherwise, contact Colmac Coil directly. When contacting Colmac Coil with the explanation of failure, have the complete model number, serial number, date of installation, and date of failure at hand.

8.15. Coil Cleaning

8.15.1. Many cleaning products found in a typical food preparation and packing environment are safe to use on coils, depending on coil materials.

8.15.2. Coils should be cleaned in the same manner as any other piece of equipment in a food safe environment, along with proper rinsing to avoid prolonged chemical contact on the heat exchanger surfaces.

8.15.3. Cleaning Solutions

- Cleaning solutions suitable for stainless steel tube/stainless steel fin coils, stainless steel tube/aluminum fin coils, aluminum tube/aluminum fin coils, and copper tube/aluminum fin coils.

| Name | Manufacturer |
|---|---|
| CL-122 | NALCO |
| CL-127 | NALCO |
| LMC-44 | LW Chemical |
| SoilSolv | DuChem |
| FS Process Cleaner | Zep |
| Formula 940 | Zep |

- Cleaning solutions suitable for galvanized materials

| Name | Manufacturer |
|---|---|
| CL-127 | NALCO |
| E+ | Refrigeration Technologies |
| FS Process Cleaner | Zep |
| Formula 940 | Zep |

8.15.4. Sanitizers

- Sanitizers suitable for stainless steel tube/stainless steel fin coils, stainless steel tube/aluminum fin coils, aluminum tube/aluminum fin coils, and copper tube/aluminum fin coils.

| Name | Manufacturer |
|---|---|
| CoilClear | NALCO |
| DQS | DuChem |
| Amine A | Zep |
| Amine Z | Zep |

- Sanitizers suitable for hot dipped galvanized coils

| Name | Manufacturer |
|---|---|
| DQS | DuChem |
| Amine A | Zep |
| Amine Z | Zep |

8.15.5. To minimize corrosion, chemical exposure should be less than 30 minutes and temperatures should not exceed 70º F. Rinsing is important to avoid prolonged chemical contact on the heat exchanger surfaces.

Colmac reserves the right to change product design and specifications without notice.

For more information on Colmac products call us at 1-800-845-6778 or visit us online at:

WWW.COLMACCOIL.COM