



Tech Tip # 105

Procedures for Refrigeration System Component Replacement or Leak Repair

Keywords: Component Replacement, Charge, Evacuation, Leak

Desert Aire dehumidifiers are designed with quality components and manufactured with industry best practices to help ensure performance and longevity. Each dehumidifier is factory tested in all modes of operation before shipment. The mechanical nature of many components creates unforeseen wear and failure in certain instances. Special care must be taken to ensure that the system is returned to service without contamination and in proper condition to perform as expected.

This document is intended to provide guidance on specific procedures for installation and service of the refrigeration system on Desert Aire dehumidifiers. This is not an all encompassing document. It is assumed that the service technician is qualified to service refrigeration systems with the applicable refrigerant and holds the appropriate EPA certifications for stationary equipment. Refrigerants under high pressure are dangerous and improper handling and use can cause property damage, injury, or death.

Note that a new liquid line filter dryer will be required any time a refrigeration system is opened for servicing. New dryer should be of the same capacity as the original or larger.

Recovery

When there has not been a major refrigeration system leak, the system will contain refrigerant. This refrigerant must be either recovered to separate cylinders appropriate for the refrigerant type or isolated in a portion of the refrigeration system that will not be open for service. In all cases you must comply with Section 608 Refrigerant Recycling Rule of the Clean Air Act.

Recovery of Systems with a Refrigeration System Leak

As much refrigerant as possible must be recovered into separate refrigerant cylinders appropriate for the refrigerant being serviced. System pressure near the leak site should be monitored closely to ensure this area is not pulled to a vacuum. Isolate sections of the system as required and recover independently to avoid refrigerant contamination. Uncontaminated refrigerant can be reused in the refrigeration system it was recovered from.

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Recovery of Systems without a Leak

Systems that do not have leaks, but still require refrigeration system service, may have charge isolated in receivers and condensers if these particular components do not require direct service.

Desert Aire dehumidifiers have different receiver sizes depending on the model and size. Condenser sizes and configurations may also vary. In general, larger receivers will come equipped with isolation valves that will allow for a portion of the charge to be contained in the receiver during servicing. Units equipped with remote condensers will have isolation valves located inside the unit cabinet near the area where the connections are made.

The compressor can be used to move refrigerant to the system components that will be used to temporarily hold the charge. Note that cooling a condenser by running as many fans as possible and/or cooling the coil surface with a stream of water can assist in storing charge.

The low side pressure should be monitored closely while using this procedure to store charge. Under no circumstances should a compressor be allowed to run in a vacuum. When most of the refrigerant is isolated in the receiver and/or condensers, recover remaining charge into separate refrigerant cylinders appropriate for the refrigerant being serviced. **Carefully track the amount of refrigerant charge removed as this exact amount should be placed into the units when re-charging.**

Repair / Component Replacement

- If any portion of the system was at a vacuum, place dry nitrogen in the system until atmospheric pressure is reached.
- It is preferred that components are removed by heating the braze alloy to the re-melt temperature and mechanically moving the component. When this is not possible due to proximity of cabinet structure or other components, a tubing cutter can be used to remove sections of piping. Where new tube is required for replacement, use dehydrated tube where possible. Use the same type of fittings as original. Route the pipe in the exact manner as originally routed.
 - Use Type K per ASTM B 88 or ASTM B 819 or Type ACR per ASTM B 280 copper tubing or for all tubes 1 1/8" and smaller.

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- Tubes 1 3/8" and larger shall use Type K per ASTM B 88 or ASTM B 819.
- Cap sections of tube and components that are not actively being installed to prevent infiltration of moisture and contaminants.
- Use only braze alloys to join tube.
 - The selection of filler metals is highly dependent on the tube fit, clearance, and operator preference for flow. When flux is to be used, care should be taken to ensure that the flux is not introduced to the inside of the tube. It is recommended that phosphorous bearing alloys be considered for copper to copper connections due to their self-fluxing on copper to copper joints. Refer to alloy manufacturer's guidelines for details on compatibility.
- Flow nitrogen into tubing to prevent the formation of copper oxides.
 - Copper oxides form rapidly when copper is heated to temperatures required by the brazing process and exposed to oxygen in the air. Copper oxides flake easily on the inside of the tubing and dislodge easily when the system is filled with refrigerant and oil. The particulate can move throughout the system and cause contamination on valves and other critical components. System filters may become fouled.
 - Flowing nitrogen into the system and ensuring that the inside of the tube is significantly free from oxygen while brazing ensures that oxides do not form. As the last joints of a system are made, additional thought must be made on the location where the nitrogen can escape. Schrader valves are placed throughout the system. These valves can be opened to allow for nitrogen to flow without generating pressure behind the braze joint that is being created.
- See Tech Note 106 for special procedures related to compressor replacements.
- Replace liquid line filter dryer as last step in system repair. Note that the dryer will readily adsorb moisture from the ambient air and must be open only for as long as required for installation.
- After completion of all repairs, pressure test system using nitrogen pressure decay test or nitrogen with tracer gas and appropriate leak detector.

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Evacuation

- Carefully inspect pump and related equipment before connecting to system. Ensuring gaskets are in good condition and pump is capable of low vacuum levels can save time. Connect pump(s) to as many locations as possible ensuring all locations are well sealed. If a field charge will be required, connecting a refrigerant tank to the system with a good valve is recommended. Any hose connections requiring purging of non-condensable can be done at this point.
- Evacuate the line and remote condenser to 400 microns measured at a point on the system furthest away from the pump.
 - Note that a gauge installed on the pump or in close proximity will give a lower reading while the unit is being evacuated.
 - A deep vacuum gauge should be used to evaluate the pressure. Compound manifold gauges do not allow for enough accuracy at the pressures required.
 - The system should be able to hold a vacuum under 500 microns for more than 10 minutes.
 - If pressure continuously rises at a rapid rate there is likely a system leak. Review all piping connections and correct before continuing evacuation.
 - Pressure rising above 500 microns and tending to stabilize at a higher pressure indicates the system has moisture above specifications. Continue evacuation until 500 microns or lower can be held for a minimum of 10 minutes.

Alternate Evacuation Specification by Process

After components have been repaired or replaced evacuation procedure should take place. Very small amounts of refrigerant may still be mixed with the oil in the system. Out-gassing of this refrigerant may interfere with the evacuation and vacuum decay testing.

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If, and only if, a unit has been previously charged with refrigerant, and standard evacuation method has not been successful after 24 hours minimum using the standard procedure, the following alternate method should be used.

1. Check vacuum level. It should be a maximum of 1,500 microns absolute pressure. If this is not the case, review system for leaks and continue evacuation process until 1,500 microns is achieved.
2. Purge system with nitrogen to atmospheric pressure (0 gauge pressure). Ensure all portions of systems are at this pressure. Seal system and wait 10 minutes.
3. Start vacuum pump and draw system to 1,500 microns or less.
4. Purge system with nitrogen to atmospheric pressure (0 gauge pressure). Ensure all portions of systems are at this pressure. Seal system and wait 10 minutes.
5. Start vacuum pump and draw system to 500 microns. Seal system. System may rise to higher level, but should not rise above 1000 microns in 10 minute timeframe. If unsuccessful, continue evacuation or check for leaks.

It is anticipated that the system was clean and tight from the original process and refrigerant only is mixed with oil. Alternate process should not be considered if there is chance of free water entering the system or the system was open for any significant time.

Charging

- Charge should be weighed into the system using a scale. In cases where the full charge was recovered, weigh in the charge with the recovered refrigerant and add the appropriate amount to meet the rating plate and field charge (if applicable). This should be placed in the high side of the system at the receiver.
- In cases where the full charge cannot be added to the system high side, the charge can be added to the low side of the system only when compressors are energized. If this is required, the compressors should be energized and the charge should be slowly metered into the suction line as far as possible upstream of the compressor. If the unit is equipped with an accumulator, the charge needs to be added to the port upstream of this location. The bulkhead fittings on the side of the unit should not be used for charge addition. Monitor superheat at the compressor suction inlet using the bulkhead fitting and a temperature sensor on the suction line near the

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compressor. Superheat should not drop below 10 degrees during the process of adding charge.

Testing and Final Diagnosis

Check the oil level in the compressor after the system has been running for 24 hours. Oil may have been contained in the liquid refrigerant when recovered from the system. Most of this oil will be returned if the recovered refrigerant is used. If new refrigerant is added, additional oil should be added based on the following ratio:

New Refrigerant Charge Added, lbs. x 0.352 = Oil charge, oz.

It is of critical importance to ensure that the system is operating as expected before unit is returned to normal service. Test component replaced and function of the system. Many times a separate component in the system may have set a condition that causes the failure of another. Thoroughly test systems to ensure repeat failures do not occur.