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PRINCIPLES OF CLEANING REFRIGERATION SYSTEMS

Copeland strongly supports refrigerant recovery and recycling as part of the solution to the CFC/ozone depletion problem. Only the latest techniques should be used when servicing equipment containing CFCs.

Examination of compressors returned to the factory for replacement indicates that many such replacements could have been prevented if all contaminants had been removed from the refrigeration system at the time of field installation. Returned compressors are at times reported as motor failures, but in reality the return is due to damaged bearings, valve reeds, or connecting rods caused by contaminants, which in turn caused motor damage as a secondary effect.

It is essential that all foreign materials be removed from the system at the time of the original installation. Filings, shavings, dirt, solder, flux, metal chips, bits of steel wool, sand from sandpaper, and wire from cleaning brushes have all been found systems and frequently end up in the compressor. Many of these contaminants are so small they will pass through a fine mesh screen. In addition, the metal fragments may be rotating because of gas velocity and cut or break the usual compressor suction screen.

Suction Line Filters

As a result of the above types of contamination, a heavy duty suction line filter is recommended for every field installation. These are available with reasonable pressure drop, and will provide maximum protection for the most vulnerable part of the system. A pressure fitting should be provided ahead of the filter, preferably in the shell, to facilitate checking the pressure drop.

An additional benefit of a suction line filter is the added protection given the system if a burnout should occur. The filter will effectively prevent contamination resulting from the failure from traveling back through the suction line into the other parts of the system. This will minimize the contamination remaining in the system when the inoperative compressor is removed.

System Evacuation

Another important step in effectively cleaning a system before operation is proper evacuation. Air is very detrimental to refrigeration systems and must be removed before start up and after field service. Blowing out lines with dry nitrogen may remove a major part of the air from a system, but if air is trapped in the compressor during installation it is practically impossible to remove from the compressor crankcase by purging with nitrogen.

New and replacement compressors are shipped from the factory with a dry air holding charge, and must be evacuated before being put in service.

Triple evacuation of the system or compressor, as required, is strongly recommended (twice to 1,500 microns and finally to 500 microns), breaking the vacuum each time with dry nitrogen. The vacuum pump must be connected to both the high and low sides of the system through properly sized connections, since restrictive service connections may make the process so slow as to be unacceptable, or may lead to false readings because of pressure drop through the fittings.

System Cleaning Procedure After Hermetic Motor Burn-out

When a motor burnout occurs in the compressor, the resulting high temperature arc causes a portion of the refrigerant/oil mixture to break down into carbonaceous sludge, corrosive acid, and water.

It has long been recognized that such contamination resulting from a burnout can result in repeat failures if the contaminants are allowed to reach and remain in the crankcase of the replacement compressor. This situation can be prevented by following proper clean up procedures after a burnout.

Flushing out a refrigeration system with R-11 should not be considered since scientific evidence has linked ozone depletion to R-11 emissions. In case of a motor burn, Copeland recommends the filter-drier cleaning procedure. Basically this involves the use of approved filter-driers incorporating an adequate desiccant (not a filter only) in both the liquid and suction lines.

This system cleaning procedure has been used in countless installations over the years, and when this procedure has been properly followed, we do not know of a single instance where after proper cleaning there has been a second failure.

The filter-drier procedure has proven to be very economical, especially when the refrigerant in the system is recovered using safe recovery techniques. This can be easily accomplished if the compressor is fitted with service valves.

It is the only practical method we know of which can assure proper cleaning, especially where long lines and multiple evaporators and circuits are involved.

The size of the filter-driers (see Figures 1 and 2) used to clean up the system should be such that the maximum pressure drop under normal operating conditions is within the limits shown by the attached curves. The selection chart shown may be used as a general guide to the selection of an adequate filter-drier. The connections on the filter-drier should normally be the same size as the connecting lines.

Exercise caution. Use rubber gloves and safety glasses and ventilate the work space. The oil from a burnout could cause serious skin irritation and possibly burns. In some cases, the fumes are toxic.

1. If possible, close the compressor service valves to isolate the compressor from the system. In order to avoid losing refrigerant to the atmosphere Copeland strongly recommends recovering refrigerant using standard recovery procedures and equipment. At that point, remove the inoperative compressor, and install the replacement.

2. Since the normal color of refrigerant oil varies from oil to oil, take a sample of oil from the replacement compressor and seal in a small glass bottle for comparison purposes after the cleaning operation is complete. Suitable two ounce bottles are obtainable at any drug store.

   If the compressor does not have service valves, see step 6.

3. If the compressor has service valves, evacuate the compressor only, using the procedures previously outlined, since the rest of the system will be isolated. After evacuation, open the compressor service valves, close the liquid line valve, close any other available shut-off valves which will minimize the amount of refrigerant to be handled during pump-down, and pump the system down.

   Although some contaminants will be returned to the compressor during the pump down procedure, the compressor will not be harmed by the short period of operation required, and the contaminants will be removed as they are circulated through the system after the installation of the filter-driers .

4. Inspect all system controls such as expansion valves, solenoid valves, check valves, reversing valves, contactors, etc. Clean or replace if necessary, remove or replace any filter-driers previously installed in the system, and clean or replace any filters or strainers. Install a good quality moisture indicator if the system does not have one.

5. Install the recommended size filter-drier in the suction line, and an oversized filter-drier in the liquid line.

   Go to step 7.

6. For systems without service valves, including refrigerant recovery, evacuate the system, following the procedures previously recommended. Perform the inspections and filter-drier

changes listed in steps 4 and 5, and charge through a filter-drier with the refrigerant which was removed and recovered. Add additional refrigerant as necessary.

7. Start the compressor and put the system in operation. As the contaminants in the system are filtered out, the pressure drop across the filter-drier will increase. Observe the pressure differential across the filter-driers for a minimum of four hours, preferably by means of one gauge and a manifold to eliminate gauge error. If the pressure drop exceeds the maximum limits shown on the curves on Figure 1 and Figure 2, replace the filter-drier and restart the system.

8. After the completion of step 7, allow the unit to operate for 48 hours. Check the odor (warning: smell cautiously) and compare the color of the oil with the sample taken in step 2. If an acid test kit is available, test for acid content. If the oil is discolored, has an acrid odor, is acidic, or if the moisture indicator indicates a high moisture content in the system, change the filter-driers. The compressor oil can be changed if considered desirable. Allow the system to operate for an additional 48 hours, and recheck as before. Repeat until the oil remains clean, odor free, and the color approaches that of the original sample.

9. Replace the liquid line filter-drier with one of the normally recommended size. Remove the suction line filter-drier and replace with permanent type suction line filter.

10. After the cleaning procedure is completed, recheck in approximately two weeks to ensure that the system condition and operation is completely satisfactory.

FILTER DRIER PRESSURE DROP
(MAXIMUM RECOMMENDED)

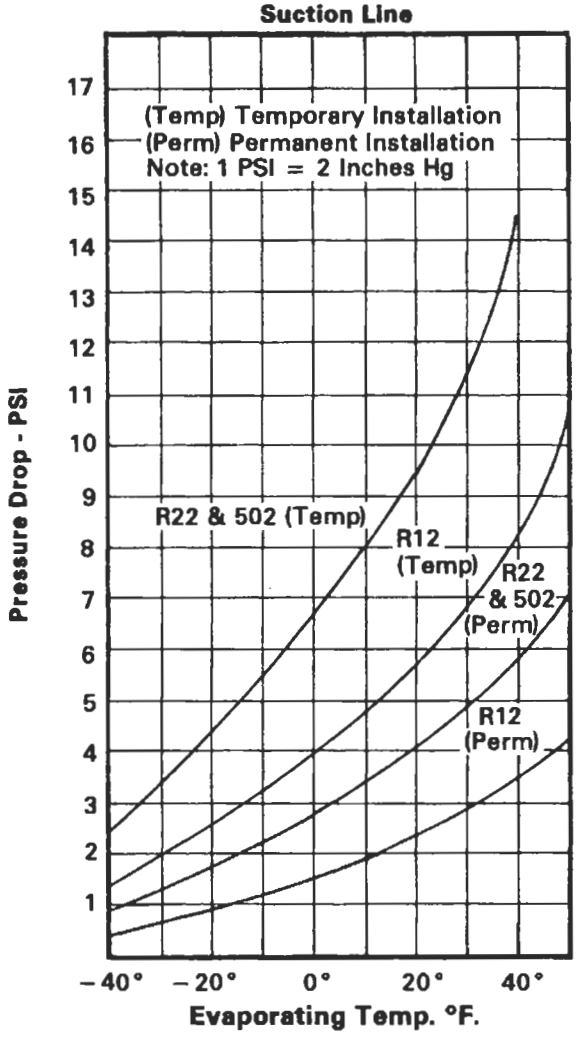

FIGURE 1

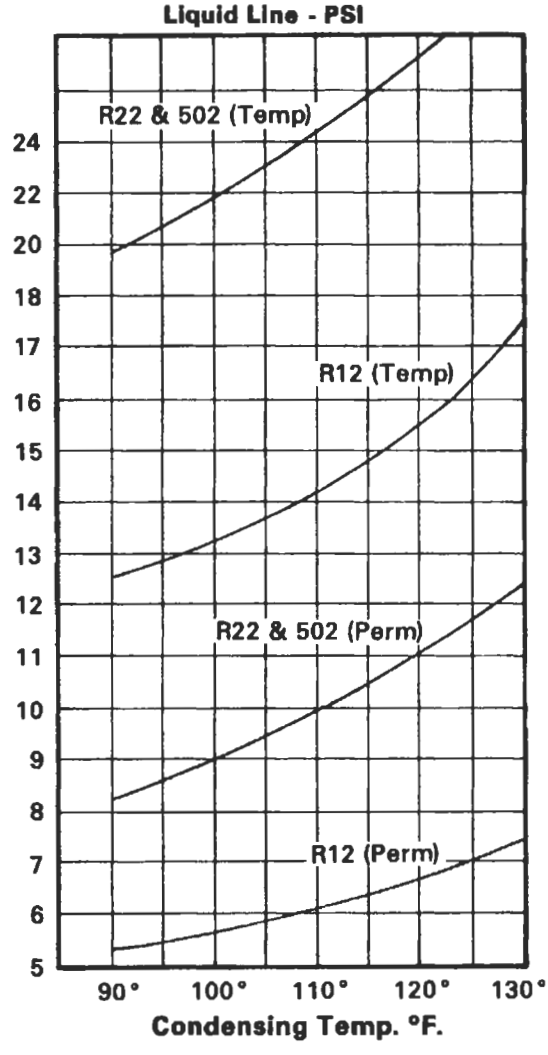

FIGURE 2