Air Conditioning & Heat Pump Institute

System Servicing Tips

Effective service and maintenance of air conditioning and heat pump installed systems is critical to:

- **Ensure reliability**
- **Reduce running costs**
- **Prolong the life of equipment.**

It will thus save the customer money in the long term. This Bulletin is not designed to be comprehensive, but outlines some common service issues and responses:

1. Blocked or Dirty Filters

1.1 Potential impact of a blocked indoor unit

When the indoor unit filter becomes blocked by dust or other air-born particles the air flow to the heat exchanger can become seriously low which reduces its efficiency and cooling capacity and increases running times.

Note: Heat lost by air = heat gained by refrigerant. Thus less airflow results in less cooling.

In the cooling mode reduced air flow can cause severe icing of the heat exchanger which will, at very least, seriously reduce the cooling effect from the indoor unit.

1.2 Icing of the heat exchanger

Icing is the result of low evaporating temperatures caused by reduced air flow across the indoor unit heat exchanger, low return air temperature or by an incorrectly sized unit. Reduced air flow can be caused by a blocked or dirty air filter or failed evaporator fan motor.

In extreme cases a heavy build up of ice on the indoor heat exchanger will cause damage to the fan scroll through catching. The fan motor can, in the case of propeller fans in cassette units; burn out due to lack of cooling air passing across them.
Further, ice will damage printed circuit boards and other electrical components. It will thaw at the edges and leak onto walls and damage other equipment.

As much of the refrigerant in the heat exchanger does not have sufficient heat input to enable it to change its' state, liquid refrigerant can return to the suction. Which may result in damage to the valves, oil dilution, possible lock up and compressor burn out in systems that are not correctly charged.

1.3 Reduced heating effect

In the heating mode blocked air filters / low air flow will lead to reduced heating effect and excessive compressor discharge pressure and temperature. This may cause the compressor internal high temperature protection device to trip. These protection devices are normally self resetting and allow a re-start when the temperature falls. Note: this could be wrongly diagnosed as a failed compressor if insufficient time for the temperature to fall has been allowed.

If the situation is not rectified, the excessive heat will cause a breakdown of the compressor motor winding insulation and the motor will burn out.

1.4 Outdoor heat exchangers

Outdoor heat exchangers can also suffer from all of the above problems and must be kept clean. Outdoor units do not usually have filters fitted and the heat exchanger coils are generally accessible to brushing or washing. Never use refrigerant to blow through outdoor unit heat exchangers!

1.4 Frequency of cleaning

The recommended frequency of filter cleaning must be based on individual site conditions, but as a minimum a monthly inspection should be carried out.

Always turn off the indoor unit before taking out the filter and avoid loose debris being pulled onto the heat exchanger.

2. Moisture contamination

1.1 Indications of moisture left in system

Blockage at the capillary or expansion device in the outdoor unit may be the first sign of moisture contamination. This may be characterised by icing on the pipe work around the filter drier / capillary tube assembly and is caused by moisture freezing as it passes through the capillary tube with refrigerant.

Moisture may react with refrigerant and oil to form acidic substances which can attack the shellac coating of compressor windings and lead to motor burnout.

1.2 Elimination

Moisture in the system should be removed by recovering the entire refrigerant charge and putting the system through an evacuation and dehydration process.

- To ensure that moisture has been completely removed systems must be evacuated to below 2 Torr (2000 Microns).
- A “vacuum rise test” must then be carried out to prove that the system is dry.
- Once this has been carried out, break the vacuum and weigh in the correct refrigerant charge taking care with Zeotropic Blends (R410A/R407C/R422D etc) to make sure that the refrigerant leaves the cylinder in the liquid phase.
- It is recommended that a clean gauge manifold and hoses are used for charging refrigerant (ie NOT those used to recover refrigerant from the system in the first place as they may be contaminated).

The correct charge should be established from the name plate or system log book and any additional charge needed for longer than standard pipe length added. This activity must be recorded in the F Gas Records.

1.3 Prevention

Simple measures taken out at the time of installation can prevent moisture - such as keeping pipes capped until the last possible moment and pulling a proper vacuum, proved by a Torr gauge on the installed pipe work prior to releasing the refrigerant charge into the system.

3. Leakage

One the most important precautions to prevent unnecessary service work is to avoid refrigerant leaks. It is an offence to put refrigerant into any system before it is proven to be tight. A thorough tightness test must be carried out with Oxygen Free Nitrogen to BS EN378:2008 before system evacuation and dehydration is carried out.

The consequences of leaks are many and serious. Some examples are lack of cooling or heating performance, partial icing up of cooling coils due to low evaporating pressure / temperature, lack of

cooling to the compressor motor causing overheating and eventually leading to failure.

It is a requirement of the F Gas Regulation that equipment operators undertake regular leak checks on certain equipment and take appropriate action to prevent and fix leaks of F Gas or ODS refrigerant.

The IOR REAL Zero material provides practical guidance on reducing leakage and effective leak checking procedures. See www.realzero.org.uk

4. Use of Gauges

An indication of system performance can be obtained by using a thermometer to measure the temperature difference across the heat exchanger. There should be a Δ t of 10 to 12K in the cooling mode and 12 to 18K in heating - depending on room condition.

It is not possible to gain an accurate impression of what is happening within the system purely from gauge readings. Furthermore each time you connect or disconnect a gauge line from a split system there will be a slight loss of refrigerant leading in time to refrigerant shortage and compressor failure.

Important Note: These systems must not be "topped up". The system charge is **critical**. If you are in any doubt about the refrigerant charge it should be removed. Once you have made sure that the system is tight and dry, you can then weigh in the correct amount of the correct refrigerant.

5. Infra Red Controllers

Ensure that batteries are fully charged and correctly inserted. Many controllers have four batteries, two for the signal and two for the display. It is not unusual to have working display batteries but no signal, then to assume that the controller is working correctly. The assumption is that the receiver on the unit must be defective when in fact all that is required is two batteries.

Controllers often have multiple frequency selectors, usually A –B – C and D. It is important to select the band recommended by the manufacturer, usually A, or make the necessary modifications on the control board to use a different band. These modifications will be shown in the installation instructions.

A simple way to test if an infra red controller is sending a signal is to point it at a portable radio which is tuned to an AM station; a definite buzz will be heard if the controller is transmitting a signal.

6. Installation and Operating Instructions

The best source of information regarding operating of split system heat pumps and air conditioning equipment can be found in the manufacturer's installation and operating instructions. These booklets contain invaluable set up information which can help to prevent future service problems including fault codes to help diagnose problems.

Replacement booklets can be obtained from the manufacturer and codes are often shown on their website.

Sources of further information and advice

Record Keeping under F Gas Regulations
http://www.defra.gov.uk/environment/quality/air/fgas/documents/fgassupport-rac6.pdf

Sample F Gas record sheet is available at
http://www.defra.gov.uk/environment/quality/air/fgas/documents/fgassupport-rac-fgas-logsheet.doc

Guidance on reducing refrigerant leakage and effective leak checking is available at
www.realzero.org.uk

Helpful tips on maintenance are available at
http://inspectapedia.com/aircond/aircond1123.htm
Feedback on their website material is encouraged

7. Refrigerant Records

Systems containing over 3kg of F Gas refrigerant (or 6kg if hermetically sealed) must have a set of system records containing information about refrigerant additions and removals, system faults or failures and the name of personnel involved in service and maintenance work.

They provide a useful record of system service issues which should be consulted where necessary.

Records must be made available on demand by an authorised person. See www.defra.gov.uk/fgas for details and sample records.

8. Planned Preventative Maintenance Schedules

The actual maintenance measures needed for each piece of equipment or site will vary depending on the type of equipment and it's age and condition. The following is a list of measures needed to ensure plant operates as efficiently as possible:

- Clean condensers and make sure they are in good condition;
- Where air cooled condensers / condensing units are fitted with housings, ensure they are a good fit and that condenser air is not restricted and cannot recirculate;
- Clean evaporators and drain lines if necessary;
- Check the system for leaks (by appropriately certified personnel) and ensure leaks are reported to the system operator so that the appropriate action can be taken;
- Check all control settings to ensure they allow the system to operate as efficiently as possible;
- Check the air flow filters;
- Check suction line insulation (and expansion line insulation if applicable) and replace or repair if damaged or missing;
- Fill out the site record to document what you have done including any leak checks carried out or refrigerant added to or removed from the system.

9. User Guidance

The operation of the equipment will improve if the customer has a good awareness of how it works and how they can effect its performance. For example, you can advise on:

- Simple checks that operators can do on equipment. With appropriate training your customer will be able to use the log to call you out before problems become critical faults;
- Keeping restrictions (e.g. packaging or plants etc.) away from air cooled condensers;
- Keeping system information and records on site.

The ACHPI Is grateful to John Ellis of Ellis Training for supplying information on which this bulletin is based and to http://www.inspectapedia.com for use of photographs

Published by the Air Conditioning and Heat Pump Institute, a section of the Institute of Refrigeration.