Cut AC energy costs

Rob Young and **Alex Strong** of service specialist Cool-Therm show how engineers can help to cut the air-conditioning energy bill

The aim of any efficiency drive is obviously to deliver the biggest savings for the least cost and effort. Here's how:

1 Reduce the condensing temperature and increase refrigerant liquid sub-cooling. For every 2 deg C reduction in condensing temperature, energy consumption is reduced by approximately 3 per cent.

On some applications it may be possible to cut condensing temperature by as much as 10 deg C, which translates into a 15 per cent saving in the energy bill. With the average UK temperature in the region of 12 deg C, this is easily achieved.

2 Make sure the refrigeration evaporating temperature or chilled water temperature is as high as possible, subject to meeting the cooling needs of the application.

For example, a 2 deg C increase can result in an increase in energy efficiency of around 5 per cent. This can represent many thousands of pounds off the company power bill.

3 An undercharged refrigeration system can result in a significant loss of capacity. In some cases this can be as much as 15 per cent. It is therefore essential to ensure that the refrigerant charge is optimised and sight glasses/liquid lines kept full.

4 Expansion valves should be carefully adjusted so that just the right amount of refrigerant is flowing through the evaporator. Too little refrigerant flow starves the evaporator, resulting in a loss of cooling capacity. Too much refrigerant will result in flooding back, which could damage the compressor.

5 Check regularly for blocked or obstructed airways at air cooled condensers. Even partially obstructed units suffer a double penalty due to wasted fan power and the increased work required of the compressor. Accumulated autumn leaves, weeds and crisp packets come with a heavy energy penalty.

6 Condenser air recirculation is another energy sapping situation. It's easy to check if recirculation is evident by measuring air temperatures on to the condenser(s) and comparing them with the local ambient temperature. If the air on condenser temperature is more than the ambient temperature, then air recirculation is more than likely occurring.

7 Improved logic control can ensure compressor run time is minimised. In the case of multiple fixed-speed compressor systems it is important to switch compressors on and off in the right way so as not to cause short cycling. On variable speed compressor systems, it is often more advantageous to operate all compressors at lower speed to benefit from improved isentropic efficiency.

"Bring the condensing temperature down and save 15 per cent on your power bill"

8 Hygiene on the other side of the system is equally important. A partially blocked air conditioning evaporator again wastes fan power, and demands higher compressor pumping energy to deliver the required conditions.

As well as compromised efficiency, blocked or dirty heat exchangers may result in inadequate duty output with resultant problems for the occupants of the building or the process application being cooled by the plant.

9 Where chillers are installed, it is important to ensure that water-flow through evaporators and condensers are in accordance with specification. If water-flow is too high, it puts more than necessary pressure on the pump(s) with a corresponding increase in power.

10 Moving up the scale in terms of cost and time, it may be worth investigating the options for improved speed control for fans and/or compressors. Moving to inverter control, in the case of plant without it, can make a big difference to power use.

Where plant is equipped with standard 'phase chop' inverters, it is worth considering switching to frequency inverters, which deliver better control and offers improved energy savings over the operating range.

All of these measures apply to general air conditioning or heat pump systems, whether air- or water-cooled.

Cautionary note – adjustments to air conditioning equipment as stated should only be carried out by fully qualified refrigeration engineers.

Fine-tuning the system

Simply optimising condensing and evaporating temperatures can result in significant energy savings in UK conditions, especially where there is a year-round load.

For example, many air-cooled chillers over five years old will have a refrigerant condensing temperature set point of around 45 deg C, with a chilled water set point of 6 deg C.

In most cases, the condensing temperature set point can safely be reduced to 35 deg C and the chilled water temperature can be raised to 7.5 deg C or even 8 deg C. Overall energy saving resulting from this would actually be in excess of 10 per cent.

With a typical building operating cost of around £35,000 there is therefore a potential saving of £3,500 just for making some simple adjustments.