NCPC
NATIONAL CLEANER PRODUCTION CENTRE
SOUTH AFRICA

BEST PRACTICE GUIDE

Heating ventilation air conditioning (HVAC) and cooling circuits

Both HVAC systems and cooling circuits usually have a refrigeration machine at their core. However, it must be noted that HVAC and cooling systems do not require refrigeration (or chiller) in all situations. Indeed, for purposes of energy economics there should be attempts to use as little refrigeration (or chiller) as possible. HVAC implies full conditioning including humidification and heating but these are not considered here.

Below are a few good operating practices which users of HVAC and cooling circuits can readily apply to reduce energy consumption

CONSIDERATION	GOOD PRACTICE
HVAC – Comfort: • Conditioned space • Set point • Hours of operation • Unoccupied areas	• Increase interior set point temperature to approximately 24°C during summer. - Winter temperature setting should be approximately 20°C. • Pre-cooling is not usually required unless the night-time electricity tariff is highly favourable. Set a system into operation as close as possible to the start of occupation. Similarly, a system could be turned off before the end of occupation. Close blinds on the east face of the building before leaving. • Ensure that temperature controllers don't cause different parts of the system to fight against each other. • Restrict conditioned supply to unoccupied areas, either temporarily or permanently.
HVAC – Process conditioning: • Conditioned space • Set point • Hours of operation • Unoccupied areas	• Increase the set point to the highest level that the process can tolerate without impairing performance. • Often process cooling is set into operation the day before the start of a shift-week. This is probably not necessary and should be tested. • Ensure that temperature controllers don't cause different parts of the system to fight against each other. • Conditioned supply to abandoned process areas should be permanently shut-off.
	HVAC AND COOLING CIRCUITS – GENERAL
Air filtration	• Clean or replace blocked filters to reduce air flow resistance.
Heat exchangers ('coils') in airstream.	• Clean and straighten fins.
Duct	• Ensure that joints are not leaking.
Pipes	• Ensure that joints at valves, etc. are not leaking.
Thermal insulation (ducts and pipes)	• Ensure that insulation is continuous and not broken, particularly where a vapour seal is required.
Motor drive belts	• These should be for the specified profile, number, length and tension. Consider replacing smooth faced belts with the toothed type.

Condenser water pipes – increased pressure drop	• Ensure that these are not corroded, as these could result in leaks, or scaled, resulting in increased pressure drops. Ensure that cooling tower chemicals are correct.
Condensers (water side) – increased pressure drop or increased temperature rise	• Similar to condenser water pipes. The surface of the condenser may require regular descaling to ensure design heat transfer capabilities.
Condensers (air) – increased condensing temperature	• Clean and straighten fins to improve heat transfer. Save between 2% and 4% of compressor power for every 1°C reduction in condensing temperature.
Cooling towers – increased water temperatures; increased water use	• Ensure that fans run at the lowest acceptable condensing pressure as high pressure increases compressor energy use at the chiller. • Ensure that 'pack' is in good condition and properly in place for good heat transfer. Similarly, the eliminators at the air outlet should not allow excessive quantities of moisture to escape. • Correct water treatment is necessary for reduced scaling. • Check ball valve at filler to ensure that there is proper cut-off when the sump is full - observe overflow.
Evaporators (air) – reducing evaporating temperature	• Clean and straighten fins to improve heat transfer. There is approximately 2% energy saving for every 1°C increase in temperature.
Refrigerant operating pressures	• The evaporator temperature, i.e. cooling, should be as high as the chilled product or that space will allow. • The condenser temperature should be as low as the refrigeration system will allow. • The closer the evaporation temperature and condensing temperature are, the more energy efficient the system will be for a given performance.
Process water temperature	• This should be as high as the process can tolerate. Note the pipe insulation integrity at the end of the runs to ensure water temperature is not influenced by ambient conditions.
Maintenance	• Regular and thorough maintenance should be seen as an investment. Insist on a detailed maintenance report after each inspection.
Refrigerant charge	• Many refrigerants currently in use cause environmental damage when released into the atmosphere. • Low refrigerant levels also result in reduced equipment efficiency and up to 15% increased energy cost. • Check sight glasses for bubbles and leak test system regularly. - Note that hydrofluorocarbon refrigerants are being phased out.
Multiple chillers serving one system	• Ensure that only minimum number of chillers operate to serve the load. Each compressor or chiller must operate at full load before the next load is allowed to run. • Compressors operating at part load are inefficient.
'Free cooling' – economiser or economiser cycle	• It may be possible to use ambient air for conditioning purposes at certain times of the year, i.e. when the refrigeration system does not need to run.

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