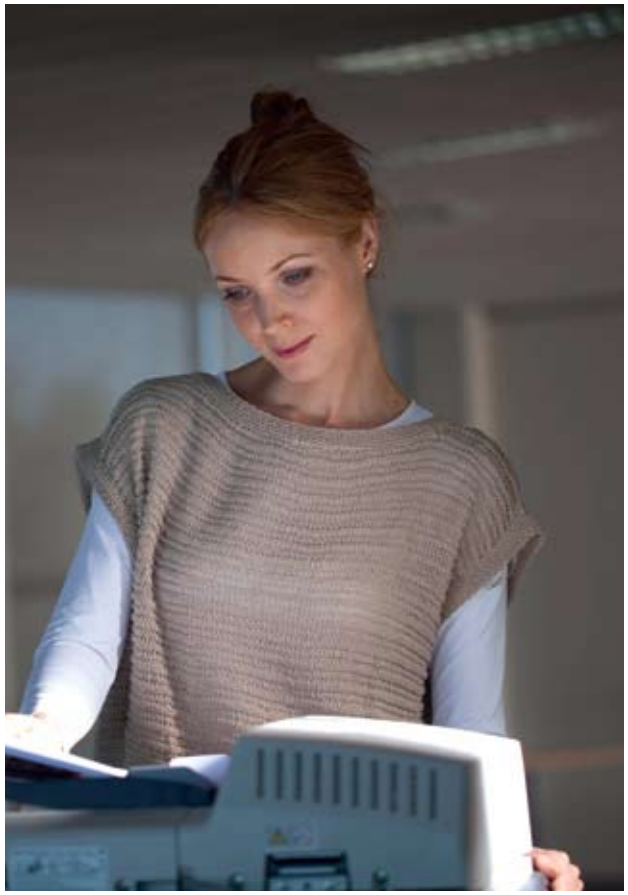
Air Conditioning and Air Handling

Air conditioning and air handling are becoming very popular in Ireland as a means to maintain set temperatures in industry and as a means to maintain comfort conditions in offices and other areas. Air conditioning does not come cheap and with today's rising energy costs, all alternatives should be considered before this more expensive option is adopted. There are also many energy saving opportunities that should be explored that will enable you to reduce operational costs of such systems – often by considerable amounts.

Types of High Velocity Air Conditioning HVAC) systems

There are numerous types of HVAC systems in use today. The most popular types are:

- Central HVAC systems with air handling units, and central chiller and boilers to supply cold and hot water to the cooling and heating coils in the air handling units.
- Decentralised systems where each room will have its own Air Handling Unit (AHU), with separate chillers.
- Stand-alone air conditioners which are wall or ceiling mounted coolers and outside condensers.



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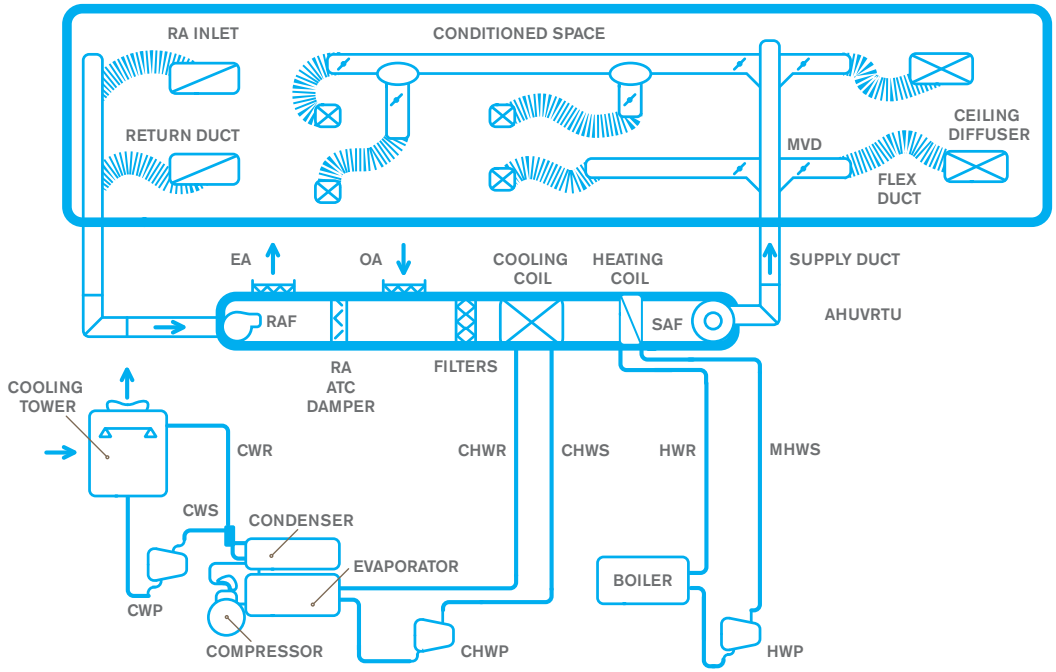
Schematic of air conditioning plant



A typical air conditioning system consists of an air handling unit with air filters, a heating coil supplied with either hot water, steam or sometimes an electric element, a supply air fan (SAF) and a return air fan (RAF). There may also be a cooling coil supplied with chilled water generated mainly by an electric chiller, although absorption chillers may also be present. A distribution system pipework ducts the air into the various rooms via grilles.

Sometimes reheat coils, located in the pipework before various rooms, will be supplied to allow finer control on the air in these locations. In some cases the air supply is also dehumidified by using lower temperature water than would be required for cooling only. The effect of the lower temperature water is to drop moisture out of the air, resulting in lower moisture content. This air may have to be reheated again before being supplied into the air conditioned space.

Energy Saving Opportunities in HVAC and Air Handling Systems

- Avoid unwanted heat. The least expensive way to cool a building may be by not introducing unwanted heat into it in the first place. In many commercial buildings during the cooling season, most of the electricity used to power lights generates heat that must ultimately be carried away by the air conditioning and ventilation system. If ordinary lighting systems are replaced with more efficient ones, less electricity is needed to power the lighting system, and therefore less heat is given off, reducing the load for the cooling system.
- Size of HVAC. Once cooling loads have been reduced, an air conditioning designer may be able to specify a smaller, less expensive cooling system, reducing operating costs even further. Such a system would feature a smaller cooling plant, but often the designer can also specify smaller pipes, fans, and pumps. These savings may, in turn, offset any additional costs associated with installing the technologies that lightened the cooling load. Such reduction in cooling loads can be achieved by installing high frequency lights, controlling the use of computers, printers and stand-alone electric heaters.
- Switch Off. Needless operation of electrical equipment after hours and on weekends is one of the largest energy wasters in commercial buildings.
- Zone-by-zone scheduling. HVAC and lighting systems can be scheduled at the zone level, so that systems in unoccupied areas can be shut down.
- Night setup/setback. This strategy changes set points during unoccupied hours to save energy by reducing the differential between inside and outside temperatures.
- Optimum start. Optimum start produces energy savings by starting equipment only as early as required to bring the building to set point at the time it will be occupied.
- Optimum stop. The optimum stop strategy determines the earliest possible time to turn off equipment before unoccupied periods begin and still maintain occupant comfort.
- Morning warm-up/cool-down. Morning warm up strategies bring the building to the desired temperature before occupancy after a night setup or setback with the least amount of energy, by closing outside air dampers.
- Night ventilation purge. In climates with a large night time temperature depression (dry climates), purging or flushing the building with cool outside air in the early morning hours, can delay the need for cooling until later in the morning.
- Lockouts. Lockouts ensure that equipment does not come on when it is not needed. They protect against nuances in the programming of the control system that may inadvertently cause the equipment to turn on.
- Chiller system. The chiller and associated pumps can be locked out below a set outside air temperature, by calendar date, or when building cooling requirements are below a minimum.
- Direct expansion compressor cooling. Direct expansion (DX) cooling can be locked out when outside air conditions allow economiser operation to meet the cooling loads. This should be subject to any relative humidity control that may require dehumidification with the DX, even during economy cycles.
- Temperature reset. For chilled and heated water supply, set the temperature for the chilled water supply as high as possible, thereby increasing chiller efficiency. Likewise, in the heating season, set the temperature for heating water as low as possible.
- Dehumidification. If dehumidification of the air is required for industrial purposes, then consider desiccant type systems that use steam, rather then using electric chillers and cold coils to remove moisture.
- Building Management Systems or BMS. Modern BMS provide a great form of control and monitoring of all the components of a BMS. They save energy due to the fact the system can easily be interrogated and controlled. Fans and coolers will no longer be left running when they are not required. It is now possible to ensure that the right amount of cold air and recirculation air is used in summer and winter. Savings of 20% and more can be achieved with such systems.
- Minimise air flows. Accurately determine cooling and outside air requirements and specify variable-air-volume (VAV) controls that continuously adjust the volume of supply air to building loads.

- Minimise the friction of distribution system components. Mechanically delivered air must cover a lot of territory before it reaches a building occupant, winding its way through filters, cooling coils, silencers, ducts, dampers, and diffusers. Select components that offer low pressure drop wherever it will be cost effective. For example, doubling the diameter of a duct reduces its friction by a factor of 1/32nd of its original value.
- Specify high efficiency fans. With total efficiency ratings of 70-85%, the most efficient fans are well designed axial units and backward curved centrifugal models. Although widely used, forward curved fans are much less efficient, because the energy consumed to drive them turns into heat that must ultimately be removed from the building by the cooling system. When an air distribution system is made more efficient, the fan will consume less energy and the cooling load will also be reduced. This compounding of savings may add as much as 20% to the direct fan savings.
- Split units. Control split air conditioners on BMS timer functions or with occupancy detectors to ensure they are off when room is not in use.
- Heating and cooling simultaneously. Avoid operating heating and air conditioning units for cooling at the same time by incorporating a dead-band in the on/off control sequence.
- Check boilers for leakage of diesel fuel oil, and emission of carbon monoxide and smoke to the environment, due to incomplete combustion. Maintain an optimum air/fuel ratio, and avoid excessive flue temperature. The air/fuel ratio shall be adjusted at each change of season.
- Properly lag steam, hot water pipes and storage vessels with insulation to reduce heat loss to the environment, and also to maintain the system efficiency.
- Steam pipes should be repaired as soon as possible in the event of steam leakage.
- An additional boiler should be turned on only when the capacity of the operating boiler(s) is insufficient. The boilers should be turned off overnight.

Electric Ireland has considerable expertise in the efficient utilisation of Air Conditioning and Air Handling Systems. If you require further information, please call us on 0800 056 9914 or 1800 200 513 or contact your Customer Relationship Manager.