IN THE WAKE OF RECENT FLOODING THE FINAL MANY MONTHS. HOW CAN DEHUMIDIFIERS

A major set back in the post-flood restoration process is the time taken to dry out buildings prior to starting remedial building work. As a result, buildings remain unfit for use or occupation for many months during which time high internal humidity levels can cause secondary damage and increase the risk of dangerous mould growths.

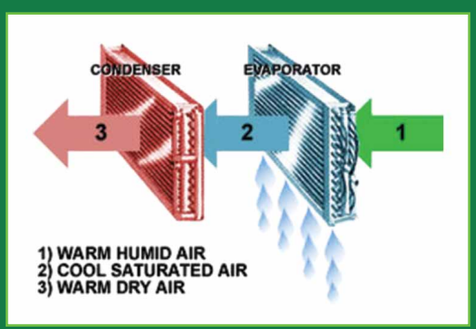
Whilst there is no shortage of useful information relating to flood damaged buildings, it's astounding how much emphasis is put on the use of dehumidifiers when there is clearly little understood about them. The aim of this article is to explain some misconceptions and home truths about the dehumidifier.

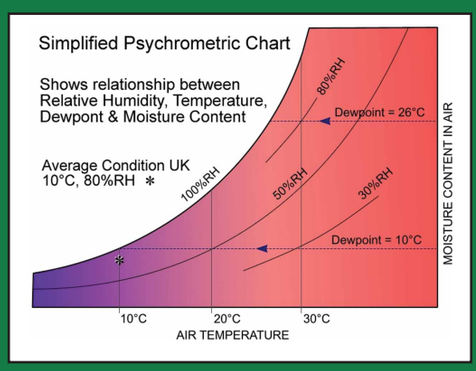
Refrigeration dehumidifier – operation

The primary benefit of a refrigeration type dehumidifier is that it performs exceptionally well when used in warm, humid conditions. This is achieved by first passing the air across the evaporator coil to cool it to a point where condensation occurs, then across the condenser coil which heats it. Condensation formed on the cold coil drips into a collection tray where it is either drained away or collected in a container in the base of the unit.

The effectiveness of the dehumidifier depends upon the relative humidity (RH) of the incoming air. The slightest cooling of air which is at 100%RH will result in water being condensed. Latent heat rejected by the water during its change in state is transferred by the refrigerant gas to the condenser to provide "free" heat. At low relative humidities the air needs to be cooled down to its dewpoint (°Cdp) before any water is released. In this case much of the refrigerant cooling goes into lowering the air temperature and only a small part is left to remove moisture.

As the air becomes drier its dewpoint is lowered, so the temperature necessary to create condensation on the cold evaporator also becomes lower. If the dewpoint of the incoming air is already below 10°C, the evaporator coil temperature necessary to create condensation is likely to be sub-zero. As airborne water vapour makes contact with the cold tube surface the evaporator will begin to freeze. This restricts air flow and reduces operating efficiency. Despite many dehumidifiers using a defrost system, below 10°C dewpoint, extraction rates are typically very low which effectively increases running costs.





Are UK consumers being misled?

Throughout Europe, suppliers of refrigeration dehumidifiers generally state their dehumidifier drying capacity based on operating conditions of 30°C, 80%RH (26°Cdp). This is usually re-phrased as "capacity up to". One UK manufacturer even quotes performance at 32°C, 90%RH (30°Cdp); conditions more appropriate to Calcutta, one of the most humid places on this planet! At these extreme levels refrigeration dehumidifiers will perform at their very best.

At more realistic conditions for UK and NW Europe of 20°C, 60%RH (12°Cdp) a typical refrigeration dehumidifier will often extract less than one third of that suggested. In the USA the Association of Home Appliance Manufacturers (AHAM), has set a standard which sets the conditions at 26.7°C and 60% RH. Japanese Industrial Standards (JIS), Hong Kong and Canada adopt similar test conditions. Similarly, to ensure best use of energy, these countries now also include refrigeration dehumidifiers in the Energy Star system. Sadly, no such standards are actively enforced in the UK.

Drying concepts

Whilst the drying rate of a material will vary according to its porosity and density, it is also determined by the ability of moisture to evaporate into the surrounding air. Drying rates can be greatly improved by lowering relative humidity, adding heat and increasing air movement, the latter (in conjunction with ventilation) being the cheapest single option. Whichever method(s) are employed, it is essential to be able to measure both relative humidity and temperature. Digital thermo-hygrometers retail around £15.00.

In summer, particularly during the day, drying is best achieved by introducing as much warm fresh air as possible, using fans to blow air across damp surfaces to speed

STAGE OF DRYING OUT A BUILDING CAN TAKE HELP AND WHAT ARE THEIR LIMITATIONS?

up evaporation rates. This method is simple and cost effective. Heating or dehumidification should not be used during this time.

In winter, although the outside RH is high, because it is also cold, the air actually contains very little moisture. Effective drying can be achieved using a combination of heating (18°C to 20°C) and air circulation; the internal relative humidity can be reduced by increasing fresh air ventilation.

At other times, when the outside air is cool and humid, maintain an internal temperature of 20°C to 23°C. Ensure there is sufficient ventilation to prevent the RH rising above 65% OR use a commercial dehumidifier – but NOT both.

Dehumidifier – there are 1,000 litres in one cubic metre of water!

Following post flood restoration work, there are potentially hundreds of litres of water that remain hidden within the building's structure. The water evaporates from the material surface at a rate determined by the relative humidity, temperature and velocity of the surrounding air. Whilst ideal drying conditions are 35 to 55 %RH, it can only be controlled if the dehumidifier capacity is greater than the rate at which moisture is being evaporated.

If dehumidifiers are used, it is imperative that the building is effectively sealed by closing windows, extracts, vents, etc. If this causes the internal relative humidity to rise uncontrollably (e.g. condensation on external walls), it is a clear indication that the dehumidifier is far too small.

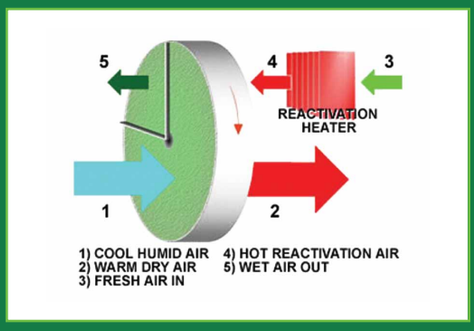
A domestic dehumidifier is intended for normal residential use and does not have sufficient capacity to deal effectively with these additional amounts of moisture. If high capacity dehumidifiers are unavailable then use heating, ventilation and air circulation as this will achieve faster drying rates. Do not ventilate and dehumidify simultaneously as this simply wastes energy.

Desiccant type dehumidifiers

A desiccant dehumidifier operates on a totally different principle to a refrigeration type. The heart of the dehumidifier is the rotor. It is manufactured using a desiccant material which has a high affinity for adsorbing water. A vast number of axial air channels run parallel through the rotor structure. As air is pulled through, moisture vapour is transferred between the air and the desiccant material.

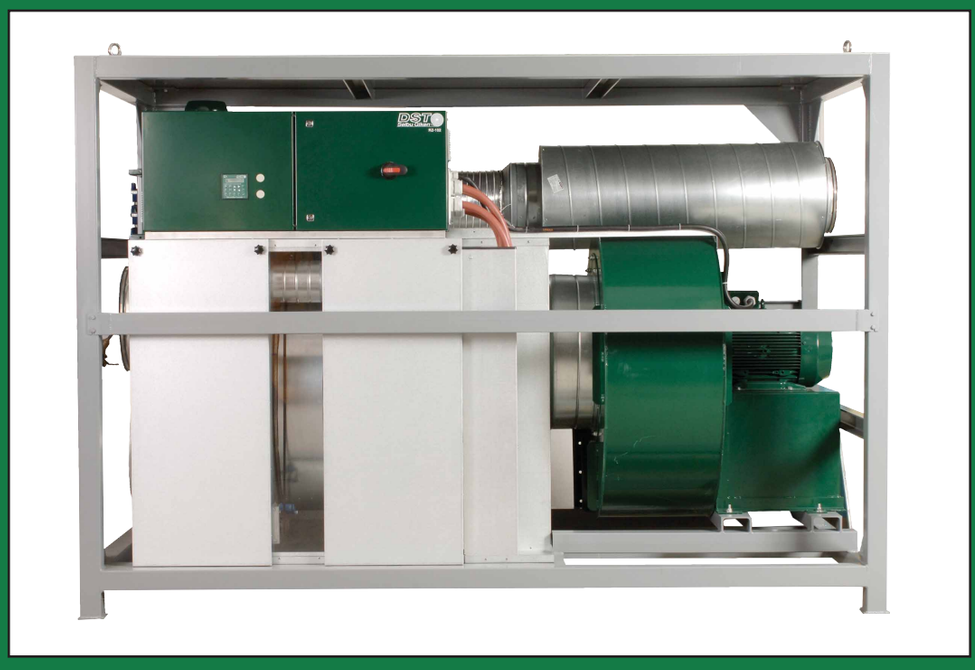
The rotor (which rotates slowly) is divided into two air zones, the process and the reactivation sectors. System air is pulled through the larger process sector where moisture is adsorbed. A smaller heated air stream is pulled through the reactivation sector and is used to drive out moisture from the rotor. The reactivation air leaves the dehumidifier warm and wet and is exhausted to outside. As these two opposing airflows pass through the rotor simultaneously, a continuous and automatic dehumidification process is achieved.

The main benefit of a desiccant dehumidifier is that it performs exceptionally well when used in cooler climates, or when lower dew points are required. As there is no water produced during the drying process, these units work effectively at sub-zero temperatures. Air leaving a desiccant dehumidifier is warm, very dry and at high velocity, thereby providing the three essential ingredients necessary for increased drying rates. The dry air can be easily ducted to where drying is needed most, whether it is under a floor, into a wall cavity or simply distributed to serve multiple areas.



Whilst the purchase of a desiccant dehumidifier is probably not within the financial budgets of most home owners, some restoration companies now also provide smaller units for hire. High capacity desiccant dehumidifiers should always be considered for drying larger areas such as schools, warehouses, municipal buildings, etc.

The photograph shows a typical electric reactivated industrial desiccant dehumidifier complete with lifting frame. The model shown has a drying capacity 1200 litres/day. Industrial models using gas and diesel reactivation heaters are also available.



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