

Introduction

Chilled Beams are a tried and tested technology (circa 50 years) and over more recent years have further developed for a wide range of applications, especially given the ever increasing awareness for 'Energy Efficient' solutions.

Chilled Beam technology is predominantly used in 'owner occupied' buildings or buildings where the persons paying the energy and/or maintenance bills are influential in the HVAC equipment selection / solution.

One such sector is 'Healthcare'. Frenger have a great deal of awareness of 'Healthcare' applications stemming back some 80 years when Frenger Troughton Young pioneered the supply and installation of Frenger heated ceilings to most if not all hospitals in the UK.

Currently Frenger mainly utilise active chilled beam technology to provide the heating as an integral part of the water driven cooling and fresh (filtered) air ventilation system, with shallow depth constructed active chilled beam (ACB) units that are purposely designed for 'Healthcare' applications.

Detailed below are some of the 'Plus Points' for ACB technology and some 'Project References' for Frenger supplied ACB units for healthcare / hospital applications.

Chilled Beam Technology Plus Points

- Long Life Expectancy (30 Year extended Warranty available) as ACBs have no moving parts, there are no components to wear out or replace.
- Low Maintenance, (only a bi-annual clean is recommended as ACBs have no moving parts, no filters to replace and all access for simple cleaning is from the room side, not the ceiling void).
- Energy Efficient (Typically 22 % lower than top tier Fan Coil Units - see energy study TFS 004 on Feta / HEVAC website for details).
- Optimum in room occupancy Thermal Comfort (compliance to all categories of BS EN ISO7730 'ergonomics of the indoor thermal environment').
- Low noise levels (less than 25 dB sound pressure levels are possible).
- Low Construction Depth (typically 300mm ceiling void is possible, reduced building heights available or more floor levels for same building height in building towers).
- Simple System to Control - soft landings not an issue and system performance is as design (no hidden energy usage as recently discovered with other HVAC equipment not factored into the total energy consumption).
- Best overall 25-year life cycle cost (see BISRIA Blue Book).

Selection of Active Chilled Beam (ACB) Projects supplied by Frenger for Healthcare / Hospital Applications

Queens Medical Centre – Nottingham, UK



Royal London Hospital – London, UK



Good Hope Hospital – Birmingham, UK



Royal Sussex Hospital – Brighton, UK



Meridian Court – Glasgow, UK



New Stobhill Hospital – Glasgow, UK



Botswana Academic Hospital – Botswana



Royal Hobart Hospital – Australia



Walsall Hospital – Walsall, UK



Warnambool Hospital – Victoria, Australia



St Bartholomew's Hospital – London – UK



Frimley Park Hospital – Surrey, UK



Kings College Hospital – London, UK



Additional Active Chilled Beam healthcare projects include:

- New Victoria Hospital – Glasgow, UK ● Royal Children's Hospital – Melbourne, Australia
- Monash Children's Hospital – Victoria, Australia ● Great Ormand Street Hospital, London, UK
- South Bucks Hospice – Buckingham, UK ● Gartnavel General Hospital – Glasgow, UK
- Kidderminster Hospital – Kidderminster, UK ● Alder Hey New Research Centre – Liverpool, UK
- Albury Wogonga Cancer Centre – Wangaratta, Australia ● St Luke Hospital, UK
- Kent & Canterbury Hospital – UK ● Beatson Oncology – Glasgow, UK
- Glasgow Royal Infirmary, Gynae – UK ● Macmillan Hospital – UK
- Kingston Aged Care – Australia ● KSAU Medical Health Science – Riyadh, Saudi Arabia
 - KSAU Medical Health Science – Jeddah, Saudi Arabia
 - KSAU Medical Health Science – Riyadh, Saudi Arabia
 - KSAU Medical Health Science – Al Ahsa, Saudi Arabia
 - Enhanced Bio Bank Medical Research – Saudi Arabia

Reduced risk of cross-contamination

Mechanical filtration at the air handling unit (AHU) can be effective in producing virtually bacteria-free supply (primary) fresh air in hospitals. Viruses and many gases, however, cannot be filtered.

By introducing filtered primary (fresh) air from the AHU to a patient rooms with healthcare Active chilled beam (ACB) units, coupled with all recirculated room air via the ACB closed back design and extract air not being reused avoids 'cross contamination' with ceiling voids and/or other patient rooms.

It is best practice to extract air from the corridors to yield a more positive air pressure in the patient room and under pressure in the corridor where old air is extracted.

Dependent upon patient room size / loads, one or more healthcare ACB units (each compact in design and no need for separate grilles taking up valuable ceiling space) can keep all fresh and recirculated air within the room space which prevents the conditioned clean air coming into contact with the ceiling void and/or other rooms.

Healthcare ACB units are extremely low maintenance (because of no moving parts and all filters and controls being at the AHU / plant room and / corridors), but even so the healthcare ACB units are fully accessible from the room space below (inspection and cleaning of the coil and induction grille can be performed from the lower face of the ACB unit) without having to remove any ceiling tiles and/or accessing the ceiling void.

Additionally, healthcare ACB units are designed so they operate above dew point, hence avoiding condensation on the fin coil and preventing any need for drip trays as associated with FCU's. Coils that run wet (below dew point) such as FCU's collect dust and dirt and so require special maintenance (treatment of coils and regular dosing of drip trays with chemicals to avoid mould growth etc...) and inspection/replacement of other moving parts.

This simplistic but highly effective design approach is not possible with other systems such Fan coil units (FCUs) unless you have at least 3 grilles per patient room (one to supply fresh air from the AHU, another for recirculated room air ducted into the FCU and another for the conditioned air supplied from the FCU, all which takes up precious ceiling area and the FCU only serving the one patient room that it is located.

Optimum comfort and IAQ (indoor air quality)

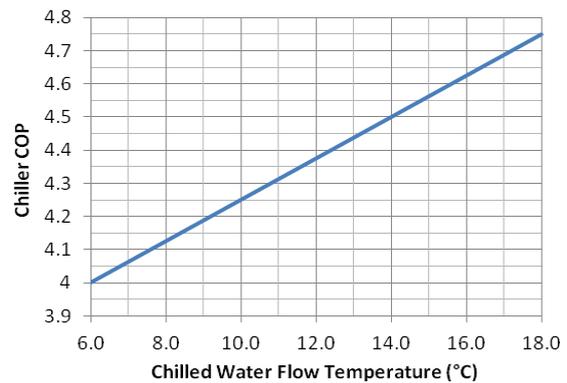
An Active chilled beam (ACB) system will typically control temperature and humidity in the occupied space via the air handling unit (AHU) with a constant supply of primary air (minimum fresh-air ventilation requirements are met at all times) and chilled water (above dew point) for sensible loads.

With the elevated chilled water (above dew point) providing the sensible cooling the space temperature is well regulated and thus allows constant-volume delivery of supply fresh filtered air, with comfortable recirculated room air temperatures and low air speeds for compliance to BS EN ISO7730 (ergonomics of the indoor thermal environment).

Air from the Active chilled beams is distributed evenly throughout a space (5:1 induction ratio) in a controlled manner with use of the Coanda effect to entrain conditioned air against the ceiling rather than cold air dumping which is more associated with FCU's given the much colder air off coil temperatures result in denser, less buoyant air.

Lower Energy system

An Active Chilled Beam (ACB) system operates on elevated chilled water supply temperatures (designed to run 'dry' ,above dew point from 14°C to 17°C supply temperature) and have no moving parts (i.e. no fans or motors) which provide a more energy efficient system when compared to a fan coil unit (FCU) system which is typically operated below dew point (wet) on a 6°C or 7°C supply temperature (which also means condensate drip tray is required) and are supplied with individual fans and motors. The coefficient of performance (COP) and or EER (energy efficiency ratio) is much higher for Chillers operating on 14/17 degrees (COP / EER is 4.5 standard chiller) when compared to FCU operation on 6/12 flow & return (COP / EER is 4.0) and with ACB units that run dry you can also make use of 'free cooling chillers to drastically increase the COP / EER to an average hourly rate of circa 13.5 for projects based on London weather data.



The total SFP (specific fan power) for an ACB system (in Watts energy used by the AHU for the total system per Ltrs / sec fresh air supplied) is typically much lower than that of a FCU system as ACB units have no fans and additional controls per terminal unit drawing energy all day / every day.

Quiet operation

High ambient-noise levels in patient rooms is believed to have negative impacts upon patients, ranging from loss of sleep, elevated blood pressure to extended recovery times. Properly designed Active Chilled Beam (ACB) systems contribute virtually no detectable noise to occupied spaces, with sound pressure levels which can be below 25 dB. Fan Coil units (FCU's) typically create more noise (higher sound pressure) levels, typically 38 dB which can be detrimental to patient recovery / occupancy room comfort.

Minimal Maintenance

Chilled beams have no internal moving parts and have little to no maintenance requirements. However, as large amounts of bedding are used in patient-care areas of hospitals. Lint from this bedding can become airborne, although chilled beams do not usually attract large amounts of lint as the velocity of the recirculated air moving through the fin coil battery heat exchanger element is too low, it still is a good practice to perform routine maintenance on them.

Healthcare Chilled-beams offer removable under plates and drop down fin coil heat exchangers battery's to enable for full access to the recirculation air chamber all cleaning of the battery to all 4 sides.

Ordinarily cleaning of the battery for lint is bi annually along with a wipe down of visual surfaces with a damp cloth with mild detergent and/or anti-bacterial cleanser.