



## HVAC Solutions for Hospitals, Imaging Centers and Surgical Facilities

Medical facilities that run mission-critical linear accelerators or that seek to control the incidence of health care-associated infections (HAIs)<sup>1</sup> rely heavily on the performance, reliability and sustainability of their HVAC systems. This issue of *Tech Notes* presents three specifiable applications that medical facilities managers and HVAC specialists may want to consider when planning new or upgrading current systems.

### 1. Providing reliable cooling to linear accelerators and managing load demands

Linear accelerators and other magnetic resonance imaging (MRI) equipment require 24/7 availability, with heat loads typically carrying between 10 tons to 1 ton during scanning and standby modes. To accommodate these varying cooling requirements, MRI units are often paired with water-cooled chillers that bypass to city water. From a public utility perspective, this is an expensive, unstable configuration that wastes resources. It also introduces the risk of potential supply disruptions from water main breaks, third-party malicious attacks or natural disasters.

*A free-cooling medical chiller can reduce energy consumption by 70% as compared to traditional water-cooled systems used for linear accelerator cooling.<sup>2</sup>*

A better solution may be to use an air-cooled chiller along with an onboard storage (buffer) tank. This more efficient application maintains consistent (+/- 1° F) water temperatures and reduces the risk of equipment overheating and shutdowns.

Unlike conventional water-cooled chillers that run year-round, an air-cooled chiller can be paired with a free-cooling coil that does not need to operate continuously. During cooler seasonal weather and at low standby heat loads, the chiller uses cool outdoor air to pre-cool warm return glycol from the linear accelerators. Any heat not removed by the cooling coil is then cooled by the chiller's refrigeration system.

In addition, hospitals often need to replace a failed chiller within days, not weeks. Identifying a manufacturer that can deliver within this timeframe should be an important consideration.

### 2. Including electrostatic particulate filtration in air handling unit (AHU), pre-HEPA stage

According to one analysis of CDC survey data, on any given day approximately 1 of every 25 inpatients in U.S. acute-care hospitals has at least one HAI.<sup>3</sup> Increasing risk of airborne pathogens and total volatile organic compounds within surgical suites and common areas is causing many medical facilities managers to reexamine their indoor air filtration systems.

We have found that using semiconductor airborne contamination technologies can increase the efficiency and effectiveness of all air filtration systems. An Electronic Air

<sup>1</sup>The Centers for Disease Control and Prevention (CDC) defines HAIs as infections acquired while in the health care setting (e.g., inpatient hospital admission, hemodialysis unit or same-day surgery), with a lack of evidence that the infection was present or incubating at the time of entry into the health care setting. Horan, T. C., M. Andrus, and M. A. Dudeck. 2008. CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections in the acute care setting. *Am. J. Infect. Control* 36:309-332.

<sup>2</sup>Motivair Corp. Free-Cooling Medical Chillers create energy savings for Linear Accelerators. *Fact Sheet*.

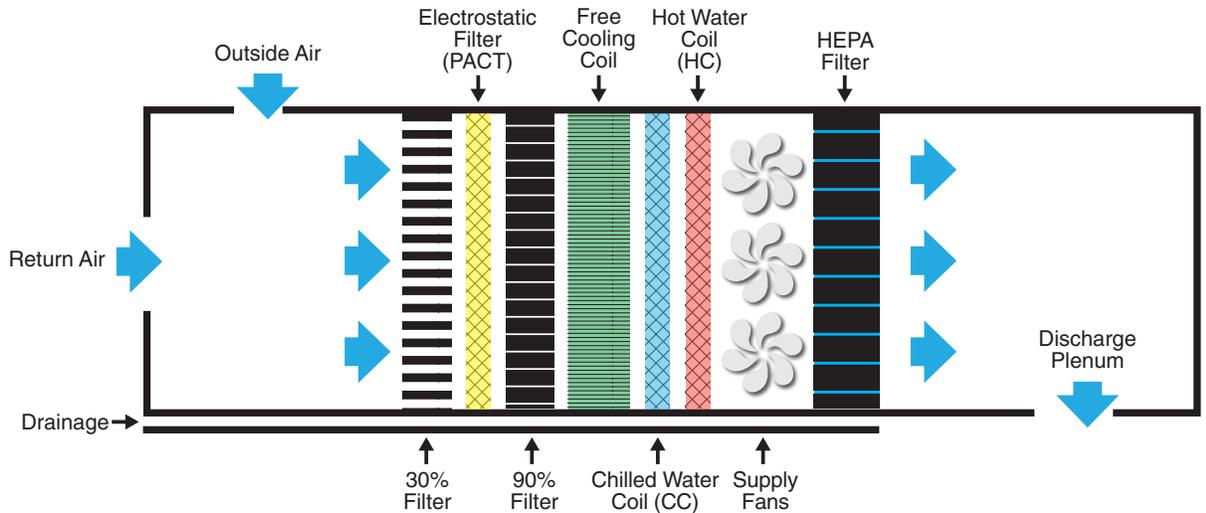
<sup>3</sup>Magill, S., J. Edwards, W. Bamberg, et al. 2014. Multistate Point-Prevalence Survey of Health Care-Associated Infections, *The New England Journal of Medicine*.

*With the passage of the Patient Protection and Affordable Care Act of 2013, there are steep financial penalties for hospitals that consistently have higher incidences of HAIs.*

Purification System (also known as Particle Accelerated Collision Technology, or PACT), uses airflow to create inelastic collisions between particles at the sub-micron level, thereby significantly improving the ability of standard 30%/90% filters to remove and reduce suspect indoor- and outdoor-generated contaminant levels. One PACT system was able to reduce small particulate count levels by 66%, while dramatically reducing peak contaminant levels.<sup>4</sup> Adding PACT in-line to the AHU, while leaving the 95% filters in their original position, also greatly lowers the frequency of needed filter changes, in the pre-HEPA stage (See Figure 1 for detail).

Furthermore, it is strongly recommended that filtration suppliers and manufacturers provide validation of their filter-efficiency claims. (Trumbull Campbell Associates offers in-house resources to measure and validate filtration performance.)

**Figure 1:** Layout of medical chiller package with free cooling coil and in-line electrostatic filtration.



### 3. Facilitating HVAC equipment wash-downs to meet health code requirements

Indoor Air Quality codes require hospitals and surgical centers to periodically wash down and steam clean AHUs in order to reduce the potential spreading of infectious diseases or mold caused by standing water or condensation along the box seals. This mandate requires specialized consultant engineering expertise and durable, sustainable, applied manufacturing solutions.

The strength and quality of materials used in AHU construction as well as access/design considerations are critical when specifying medical facility HVAC equipment. Hospitals should prefer designs that eliminate sweating at panel joints or door seals, and that include high quality drains. The entire unit should be designed for a 30-to-40 year life. Systems also should include redundant, failover fan systems armed with Variable Frequency Drives that are alarmed to detect the presences of abnormally high amperages, ensuring 24/7/365 reliability.

Working with a knowledgeable sales engineer early in the design development process can help address these three major owner requirements, as well as head off potential systems and performance issues before they become expensive fixes down the road.

#### For More Information

To learn more about medical-facility solutions from Trumbull Campbell Associates, please visit [www.trumbullcampbell.com](http://www.trumbullcampbell.com) or contact:

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<sup>4</sup> SecureAire, Inc. Lake Tahoe Surgery Center. Case Study.