HYDRONICS SUPPLEMENT

Healthy H20

Keeping particulates out of the water might save the boiler system from failing

INSIDE

- Back to basics: Fan coil technology
- Hydronics product watch
- Water quality essentials

Denis Levebre of Denrite Mechanical, Edmonton, Alta., adjusts the setting of a boiler.
Photo: Denis Levebvre

BIG PERFORMANCE, SMALL DIAMETER.

Residential
Atmospheric Gas
Water Heater
(RG150T) 50 gallon
20" DIAMETER

Residential
Upright Electric
Water Heater
(RE250T) 50 gallon
20" DIAMETER

GAS OR ELECTRIC... OUR WATER HEATERS FIT.

When space is tight, trust Bradford White. These residential water heaters have an industry-best 20" diameter, so they're perfect for small spaces like closets. They should fit in the space of the water heater you're replacing, so you won't have to relocate and re-pipe the installation!

You still get big Bradford White-exclusive features including the HydroJet® Total Performance System to reduce sediment build-up and the Vitraglas® tank lining to protect against corrosion. Our gas models have the Defender Safety System® for increased safety and peace-of-mind operation.

BRADFORD WHITE®
WATER HEATERS

Built to be the Best®

FOR THE PRO

©2020, Bradford White Corporation. All rights reserved. BWPLHV1020

BACK *to* BASICS

When picking a fan coil, contractors should first pick a coil that will work for the application and then get into the technical resources.

Fan coils can easily be hidden by installing them within walls or ceilings

By Roy Collver

"Fan coil" as it relates to hydronic heating and cooling is a catch-all term. Multi-zone ducted heating/cooling fan coils are usually defined as "air handling units" and are considered fan coils. This article deals with less involved hydronic terminal units that range from simple suspended heat-only unit heaters, up to heat/cool unit ventilators, and simple ducted systems. When I plug the words "fan coil" into my search engine, I get 144 million hits in 0.59 seconds. Many of them are electric or heat pump units, but a large percentage are hydronic. Let's simplify and get down to just the basics of how they work and where and when they are best deployed.

How things work

Hydronic heat is delivered to a space in four basic ways: 1) radiation 2) conduction 3) convection 4) forced airflow. Many hydronic heat terminal devices use a combination of the first three. Despite the names, radiant floors and radiators

Continued on page 29

Easy ECM

Easy to install. Easy to program.

0034ePlus™ ECM High-Efficiency Circulators

The 0034ePlus are high-performance, variable speed, wet-rotor circulators with high-efficiency ECM permanent magnet technology. Their variable speed performance curves are equivalent to the Taco 009, 0010, 0011, 0012, 0012 3-Speed, 0013, 0013 3-Speed & 0014. Ideal for large residential and light commercial hydronic heating, chilled water cooling and domestic hot water systems.

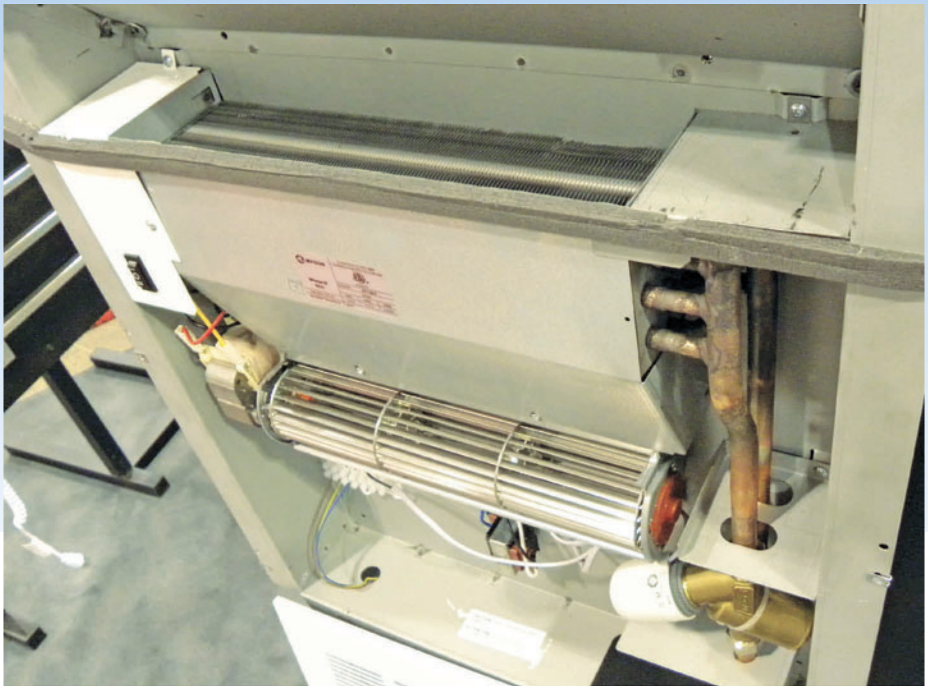
- ***ActiveADAPT ™*** self-adjusting, proportional pressure, variable speed
- ***0-10V and PWM*** variable speed
- ***BIO Barrier®*** protection against system contaminants
- ***SureStart®*** automatic unblocking and air purging
- Available in either Cast Iron or NSF certified Stainless Steel
- Rotatable control cover to simplify installation

Taco Comfort Solutions®

TACO CANADA LTD.
8450 Lawson Road, Milton, ON L9T 0J8
Tel. 905-564-9422 Fax. 905-564-9436
www.tacocomfortsolutions.com

Continued from page 27

deliver heat through conduction and convection as well. Convectors are designed to induce airflow over a finned tube or coil via the chimney effect of hot air rising through an enclosed cabinet containing a hot water coil. Room air travels into the cabinet bottom and is heated by the coil before it exits through the top. More output requires bigger coils and taller cabinets—increasing airflow and delivering more heat. It wasn't long after electric fans were invented that bright people decided to affix them to



Fan coil terminology can get complicated during the design stage since many are manufactured all over the world. For instance, a Myson fan coil is manufactured in Europe but can be found within the Canadian market.

"Poorly designed air moving systems can waste energy, create thermal and physical discomfort, and noise."

convectors, greatly increasing their heat output without having to increase their size. Enter the fan coil.

Getting creative

Fan coils are made in a variety of shapes, sizes, and configurations. Fit them in closets, recess them in ceilings or walls, make them free standing and decorative, or hide them away in basements and attics. They can be ducted or discharged directly into occupied spaces. Some only have a heating coil, some have a heating coil that can double as a cooling coil, and some have one coil for heating and another one for cooling.

They can be used as spot heating and cooling to fix many comfort issues and solve design challenges like rooms with large amounts of glazing. Look at different manufacturer's offerings and you will likely have some "aha" moments as you discover what's available.

Fan coil basics are pretty simple. In heating mode: 1) a circulator pumps a heated fluid stream through a coil; 2) a fan pulls or pushes air over the heated coil; 3) energy is transferred from the heat source to the coil to the air stream. The temperature drop through the coil depends on water temperature and flow through the coil vs. the air temperature and flow over the coil. It is a two-part process that requires tight control for efficiency and comfort reasons. Poorly designed air moving systems can waste energy, create thermal and physical discomfort, and noise. There is a big quality difference between manufacturers and models. High-quality fan coils will be provided with internal acoustic insulation and quiet fans can hardly be heard from a few feet away.

Look at all of the design criteria, architectural desires and constraints, configuration, physical size, available water temperature, heat and/or cool, condensate removal, two pipe vs. four pipe, air filtration requirements, integration with exhaust or fresh air, control requirements, system integration and compatibility with boilers, pumps, etc.

Consider the design restrictions: noise, blowing air discomfort (velocity, temperature), budget restraints, desired level of comfort, and distance of air throw (projection and spread for unit heaters and unducted fan coils, or face velocity for ducted systems).

There is a wide span of choices, but the good news is that the variety of

Continued on page 31

HOME COMFORT BEGINS WITH HEATING.

Shop Wolseley for home heating and hydronic solutions this season.

Find your copy of the **2020 Wolseley Heating Catalogue** on Wolseley Express and in Wolseley Branches.

Discover the most innovative products available from top home heating and hydronic brands.

Why choose Wolseley Express?

wolseley express.com

Shop Online
and get 24/7 access to your account!

EXPRESS PICK-UP

Express Pick-Up
- Get your order in 60 minutes from your local branch*
- Curbside pick-up now available!

Convenient Payment Options

*Express Pick-Up varies by branch hours and product availability. Orders will be held for 24 hrs. Some products are excluded.

Get started today at wolseleyexpress.com

WOLSELEY

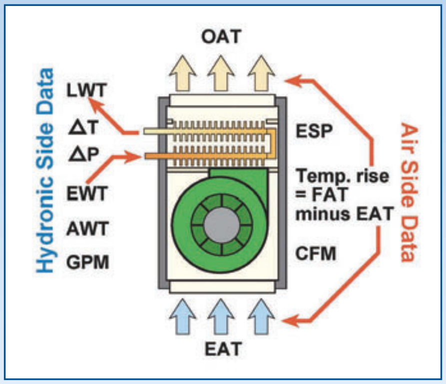
Continued from page 29

equipment available allows designers to pick and choose.

Use your resources

The best starting point is to pick a fan coil that you think will work in your application—then drill down into the technical data supplied by the manufacturer. That would be the literature with all of those charts and graphs and multiplication factors for airflow and waterflow and heat output, along with the pictures of all of the options and configurations. Keep in mind that the numbers are intended as "maximums at design conditions." When you get into the design stage, things can get tricky because we are seeing fan coils in our market from all over the world now. Terminology can be confusing between manufacturers. Some common terms and their abbreviations used in Canada when designing with fan coils include:

- **(EAT)** Entering air temperature for heating = return air entering fan coil
- **(EDB)** Entering dry bulb air temperature for cooling = return air entering fan coil
- **(EWB)** Entering wet bulb air temperature for cooling = return air entering fan coil
- **(OAT)** Outlet air temperature = discharge air leaving fan coil
- **(EWT)** Entering water temperature = hydronic supply water temperature entering coil
- **(LWT)** Leaving water temperature = hydronic return water temperature leaving coil
- **(AWT)** Average water temperature = average hydronic water temperature across coil

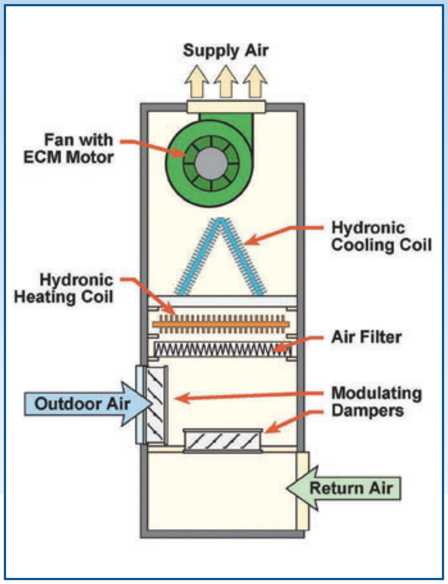


Fan coil engineering data inputs.

- **(ESP)** External static pressure = air pressure developed by the fan across factory installed components
- **(CFM)** Cubic ft/min = volume of air pushed or pulled through fan coil
- **(USGPM)** U.S. gallons/min = water flow through hydronic coils
- **(MBH)** 1,000 BTU/h (used to detail heat output of hydronic heating coil)
- **(HP)** Horsepower for fan motors (describes size of fan motor, used to define airflow of different models)

This is not even a complete list. Designers need to understand the input data required for equipment selection. Remember this article is not an engineering guide. Look at the technical data, and if you encounter some odd terminology or units of measure, contact the manufacturer's technical representative for clarity and design assistance. Remember the Gimli Glider!

Manufacturers simplify things by narrowing the choices. By providing some "givens" airflow, EAT, EWT, static pressure, the manufacturer "pins" certain factors and allows you to pick the rest. Their charts or software programs include data for "normal" systems with a few multiplication factors in case your system design is slightly different than their normal. Stay within their parameters and you will be in good shape, but often you will need to interpolate between



Hydronic unit ventilator—typical upflow vertical design.

two choices. One issue that seems to be getting resolved with most manufacturers is the need for their BTUH vs. EWT output charts to include lower water temperatures. Traditionally, the charts used 180F or even 200F EWT—which flattered the output numbers but made design more difficult for lower temperature heat pumps or condensing boilers. Many manufacturers are now adding columns to their charts that take EWT down to as low as 120F, some even lower—well done.

As much as I like fan coils, they have moving parts and need regular service. Can you maximize the advantages of hydronics and do the same job with panel radiators, radiant floor, or convectors? ✚

Roy Collver is an author and consultant on hydronic heating based in Qualicum Beach, B.C. He can be reached at ***hoth2o@shaw.ca***

PROVEN. LEADER.

Navien... the PROVEN performer of highly engineered condensing tankless water heaters

Navien... the LEADER in high efficiency condensing tankless innovations since 2012

Exclusive dual stainless steel heat exchangers resist corrosion better than copper

ComfortFlow® built-in recirculation pump & buffer tank for NPE-A models

Easier installs with 2" PVC, 1/2" gas and field gas convertibility

Intuitive controls for faster set up, status reports and troubleshooting

To learn why Navien NPE tankless is the best selling* condensing brand in North America, visit NavienInc.com

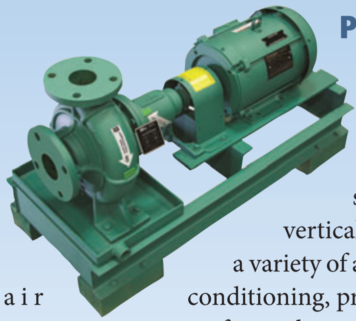
*According to BRG

Navien NPE series condensing tankless water heaters

KD Navien®

The leader in condensing technology

Pumps on pumps



Taco Comfort Solutions, Milton, Ont., has redesigned their commercial pump line. The FI and CI series end suction pumps and KV and KS vertical in-line pumps can be used in a variety of applications, including heating, air conditioning, pressure boosting, cooling water transfer and water supply applications. ECM motors up to 30 horsepower are available as part of Taco's Oe package. All Taco commercial pumps come with Taco Tags featuring eLink.

Taco ◆ www.TacoComfort.com

High-efficiency condensing boiler

Weil-McLain Canada, Burlington, Ont., introduces their new Eco Tec high-efficiency condensing boiler. Is available in seven sizes—four heating sizes: 80, 110, 150, and 199 MBH, and three combi sizes: 110, 150, and 199 MBH. It can provide space heating and up to 5.4 GPM of domestic hot water at a 70F rise. It features a stainless-steel fire tube heat exchanger, four thermostat inputs, built-in ECM circulator, and can power and control up to five circulators. Two-inch or three-inch venting can be used on all sizes.

Weil-McLain Canada ◆ www.weil-mclain.ca

Flow-activated water heaters

Bosch Thermotechnology, Mississauga, Ont. announces the Bosch Tronic 3000, a series of electric instantaneous water heaters for the commercial market. The new series includes four new models— US3-2R, US4-2R, US7-2R, and US9-2R models. It is flow activated and can be triggered with as little as 0.3 GPM to 0.7 GPM. The unit converses energy by automatically shutting off when the water flow ceases. It features a design that can be rotated in any orientation for easy installation regardless of the location of the connecting water pipes. This provides 360-degree installation options. The Tronic 3000 features an LED light that illuminates to indicate water is running.

Bosch Thermotechnology ◆ www.bosch-thermotechnology.us

Set-and-go

Watts, Burlington, Ont., introduces the iDroset CSD series of static balancing valves for hydronic heating and cooling systems. Using patented flow measuring technology, the static balancing valve lets contractors set and read flow without additional tools. The valve features a large gauge that continuously indicates flow without the need to actuate a bypass circuit. A hand wheel sets the flow and can be locked when the desired rate is set.

Watts ◆ www.watts.com

Digital mixing valve

Caleffi, Milwaukee, Wisconsin, has expanded its commercial digital mixing valve line with the Legiomix Station. It features a 6000 series electronic mixing valve to provide temperature control for commercial domestic hot water systems. A self-cleaning function features daily exercising of the internal ball valve mechanism to prevent scale build-up. The digital mixing valve features an automatic scheduling of thermal disinfection to control Legionella bacterial. The station is pre-built and includes union connections, stainless steel check valves, purge test ports, isolation valves and a Legiomix controller.

Caleffi ◆ www.caleffi.com

Multi-directional heat pumps

Daikin, Minneapolis, Minnesota, announced the expansion of their SmartSource compact water source heat pump product line, adding a horizontal configuration. They are designed for commercial applications and can be configured for boiler tower or geothermal applications. It senses when the space reaches the desired temperature and diverts hot refrigerant gas to the reheat coil. When water loop temperatures are cool enough, the waterside economizer reduces energy consumption by using the loop water to condition a space without engaging the compressor.

Daikin ◆ www.daikin.com

ECO-KING

Premium Performance and Quality
Efficient Heat and Hot Water

INTRODUCING & NOW AVAILABLE:
ECO-KING *ULTIMATE* COMMERICAL BOILERS

Eco-King Boilers & Indirect Tanks
www.ecokingheating.com

All Eco-King residential boilers, combi boilers, commercial boilers and stainless steel indirect tanks available across Canada.

MORE INFO @ www.ecokingheating.com

Subscribe to Eco-King on: YouTube

Water Quality: Why it Matters

Red flags in water quality shouldn't be ignored before they lead to system failure

By Bill Hooper

When we have a hydronic system to install and/or put into service, perhaps a question that should have a higher priority on our checklist is to confirm the quality of the fluid that will be used for heat transfer. We are fortunate to live in a country where water quality is generally good, however, over time, fluid quality can break down for a number of reasons.

> The truth is that **fluid quality** is a very important element in the effectiveness and longevity of hydronic systems.

In an ideal sense, hydronic system fluids (typically water) should contain very little soluble substances (chemical quality), and zero insoluble substances (physical quality). Chemicals that co-exist with the water will certainly be present in both municipal and well water systems—and it can make sense to find out their concentrations. Insoluble substances like oil, grease, particulates from corrosion in the system, or other metal is somewhat manageable—and there are specialized hydronic system components available that can help.

Maintain a healthy system

The truth is that fluid quality—whether plain old H_2O, or glycol mixtures—is a very important element in the effectiveness and

Continued on page 33

A system with reduce fluid conductivity will minimize galvanic corrosion, which has taken over the fitting/pipe.

THE CHOICE IS SIMPLE

ENDLESS HEAT & HOT WATER

Only 5 Moving Parts

The New SUPERFLOW Condensing Instantaneous Water Heaters & Combi's. European design meets Canadian serviceability.

Discover more at ibcboiler.com

IBC®

Continued from page 35

longevity of hydronic systems. We have devices in the boiler room to move the fluid, get the air out of the system, or heat or cool it. All of these are primary considerations… but if the fluid quality is poor, or has become poor, it can affect how well the main system components do their job to bring comfort to the occupied environment.

Since hydronic systems are "closed" and do not introduce fresh water unless there is a leak, it makes it even more important to ensure that the fluid we plan to "re-use" over the life of the system is appropriate in its chemistry, quality, and flow characteristics.

It seems that determining water quality is a back-burner issue, but there are compelling reasons to make it more of a priority.

Metal particulates in the system can cause corrosion as seen in this sink.

Casualties

In smaller systems for residential applications, wet rotor circulators may be the first casualty in poor water quality situations, as these pumps use the system fluid as a lubricant to keep the shaft spinning quietly and efficiently. Hard water, or water with particulates, will not be able to navigate the small spaces between the shaft and rotor without causing some friction and eventual issues that could lead to failure.

In larger or commercial systems, pumps with mechanical seals can be affected. Mechanical seals use a very thin layer of fluid to lubricate between their faces—and since this fluid layer evaporates—remnants of dissolved solids or other issues will come out of the liquid and scratch up seal faces until a failure occurs.

Let's consider our customers for a moment. Having fluid pumped around a heating system might be a reason for them to choose another type of system for heating/cooling (that doesn't require fluid). It is a good proactive measure for us, as professionals, to understand how fluid quality affects the system, and the available methods to remedy any issues that arise. Interestingly, an internet search for "water quality in hydronic systems" yields over 1.7 million results, so it will be difficult for the average consumer to gain a good background on this topic and weed through the noise on their own.

Actual quality concerns

Water quality issues can come as small, medium, and large. Small are somewhat benign, and perhaps a cosmetic issue will give us a heads up to potential issues. Medium would be something like degraded heat transfer (inefficient) but still providing heat. Larger issues in water quality can alert us to a problem because a system component has actually stopped working.

It is best to understand the indicators for the small and medium sized issues in fluid quality before it becomes a system failure—which we all know happens late on a weekend evening on a very cold night!

In some dialogue with one of my colleagues, we had a few interesting observations about water quality problems that can lead up to more significant issues.

Particulates or sediment: With metals in the system, there is a chance of corrosion activity precipitating and plugging up screens and filters. Changing the filters and cleaning the screens are

Continued on page 39

CALEFFI
Hydronic Solutions

www.caleffi.com

THE GOLD STANDARD
FOR HEALTHY
HYDRONIC SYSTEM FLUIDS

The DISCAL® air separator and DIRTMAG® fluid cleaning duo helps ensure maximum protection and efficiency in hydronic systems. The DISCAL high efficiency air separator features a large, low-flow zone, coalescing element and automatic air vent to minimize corrosion formation. The DIRTMAG's magnetic technology and particle mesh removes both ferrous and non-ferrous debris helping to keep expensive heat exchangers and ECM circulators healthy. **CALEFFI GUARANTEED.**

Poor water quality can cause staining on surfaces.

Continued from page 37

the easy solutions. The real solution lies in making sure that the water chemistry is optimal to deliver the system performance. In theory, as water delivers its energy and cools, it will tend to want to precipitate certain chemicals in the water/fluid. This can lead to clogs and poor performance.

Glycol and glycolic acids: We typically use a mix of water and food-grade glycol to charge or fill a hydronic system. Using the wrong chemical can lead to challenges and an eventual failure. Make sure to use the right chemicals.

Iron: With black iron pipes, and other ferrous sources in the water, there is a chance that iron can react with the water/fluid. Removing iron from the water source is critical in maintaining a well operating system.

Hardness: Certain chemicals tend to precipitate as they experience temperature and pressure fluctuations. Hardness in the water can precipitate on heat exchangers, and as scale builds up. It takes more energy to heat or cool water—not to mention additional friction losses can affect the design Delta T and reduce comfort levels.

The effect of water hardness on heat transfer efficiency shows up as a scale build-up increasing inside pipes, and the percentage of energy required to heat or cool water increases linearly.

The Water Quality Association and the Battelle Institute have studied this and states that as little as 0.5 mm of hard scale increases fuel costs by 9.4 per cent.

Generally, a system that has reduced fluid conductivity will minimize galvanic corrosion—and this is the strategy of water treatment for problem systems with this issue.

Total dissolved solids (TDS) and pH

If the water/fluid is high in TDS, then as we adjust pH higher to manage corrosion risks. Some of the TDS tend to precipitate and coat surfaces—which fouls the system, screens, and filters. This is especially a concern as temperatures change (lower) on the cool side of the system (return lines).

As water ages, pH tends to change especially as glycol degrades to glycolic acids. Any metal becomes sacrificial and will lead to pinholes, leaks, and failure.

In summary, how we deal with water quality tends to be governed by our specialty. If we are a systems specialist, we tend to care about what affects our components. If we are a boiler specialist, the concern is directed toward heat transfer surfaces. If you are into piping systems, poor water quality can show up in erosion and/or corrosion issue.

We can work to have an overall systems' view of how fluid quality affect a hydronic system and learn how to effectively deal with the challenges this quality will impose.

Maintaining good hydronic system fluid quality over time is important, and this is an ongoing maintenance cycle that can provide an opportunity for service work. ✚

Bill Hooper is a certified engineering technologist with many years experience in hydronic heating. He is a former chairman of the Canadian Hydronics Council, was involved in creating the CSA B214 Hydronic Heating Code and has worked with ASHRAE. Today Bill is Atlantic Region manager for Uponor Ltd. He can be reached at ***bill.hooper@uponor.com.***