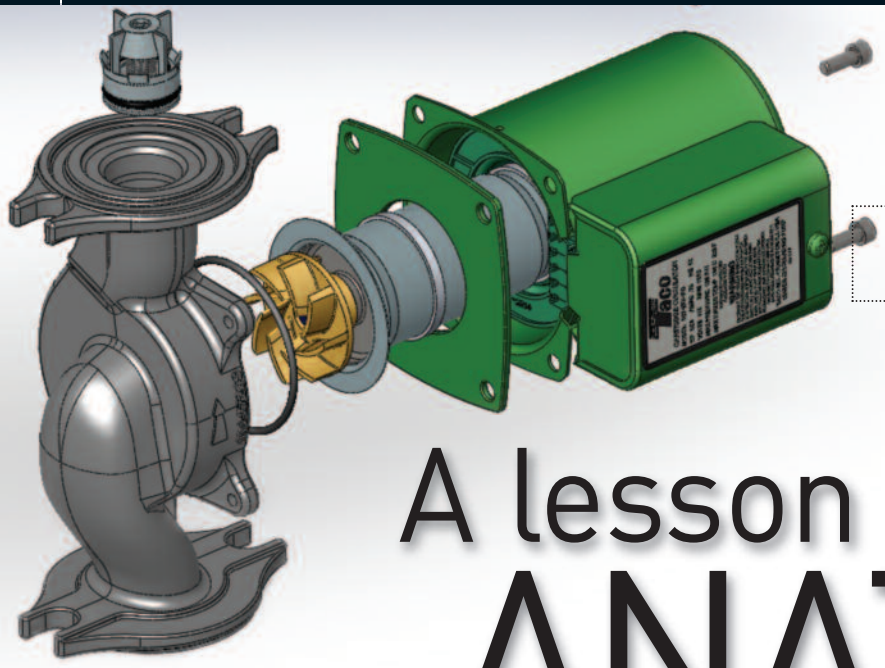


Did you know?

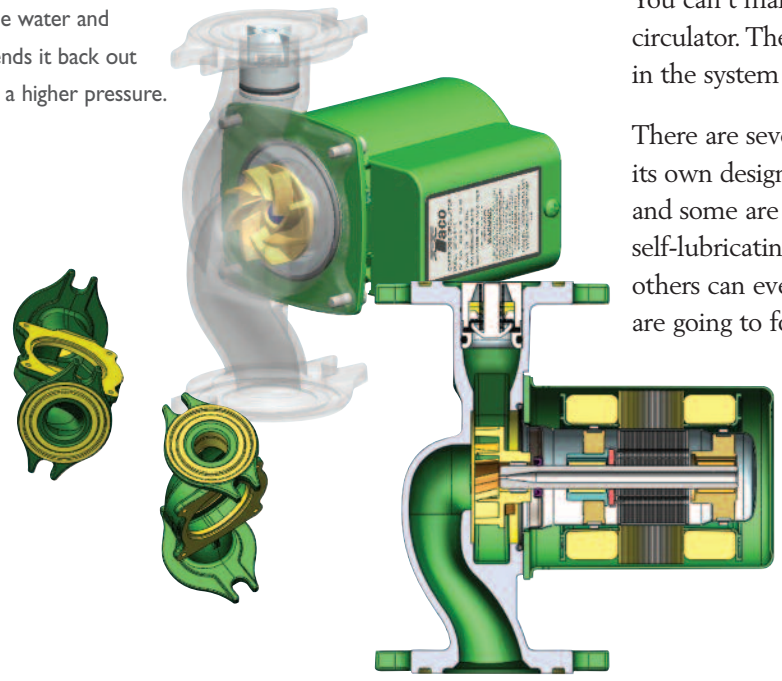
Things that affect the selection of a circulator include the shape of the volute; the size, shape and design of the impeller; and the power of the motor. Working together, they determine the characteristics and capabilities of any circulator.

A lesson in ANATOMY

PUMP OR CIRCULATOR?

A circulator creates flow. It does this by using centrifugal force to create a pressure differential. A circulator does not lift water. A pump lifts water. A circulator circulates water through a continuous loop system by creating a pressure differential.

Water enters the circulator at a lower pressure, the circulator accelerates the water and sends it back out at a higher pressure.



In most circles, a course in anatomy is thought to be a rather ugly ordeal, but don't worry, this lesson will be scalpel-less with no cadaver, toe tag or messy incision. We are going to do a bit of dissection along the way though, so feel free to don a lab coat and goggles.

Why should we care about a circulator, or the details of how a particular circulator is designed and manufactured?

The circulator is the vital heart of any hydronic system. You can't make a hydronic system work without a circulator. The circulator has one purpose; to move water in the system by creating flow.

There are several different types of circulators, each with its own design and best application. Some are "wet rotor" and some are dry. Some need to be lubricated, others are self-lubricating. Some run fast, some run slow, while others can even vary their speed. For this discussion, we are going to focus on wet rotor circulators.

continued on page 42

John Barba is the residential training/trade program manager with Taco and offers the Anatomy of a Circulator course as part of the company's FloPro University e-learning self-study course for hydronic system installers. Check it out at **www.floproteam.com**.

 continued from page 40

ANATOMICALLY CORRECT FOR THE APPLICATION

A circulator's design, and the influence of horsepower and impeller speed, factor into its performance curve. Flat-curve circulators are used in radiator and baseboard applications which require higher flow rates but have lower overall head losses.

With steep-curve circulators, small changes in flow rate will result in relatively large changes in head pressure. These can work well for fan coils, solar thermal systems, and for radiant floor heating.

CIRCULATOR COMPONENTS

THE VOLUTE

Designed to maintain a steady stream with as little turbulence as possible, the suction side (inlet side) of the volute is bigger around than the discharge side. This helps create the pressure differential. Arrows on the outside of the volute indicate the proper direction of water flow.

THE IMPELLER

The thickness, diameter and construction of the impeller all play a role in the performance of the circulator. The thickness of the impeller determines its flow capacity. The thicker the impeller, the greater the flow. If you have two circulators with the same horsepower, the one with the thicker impeller will generate more flow.

The diameter determines the amount of speed that can be imparted into the fluid. The larger the diameter, the more velocity. More velocity means the greater the pressure differential, and the greater the amount of head (system resistance) that the circulator can overcome.

Other factors affecting performance include the number of vanes, curvature of the vanes, the location of the vanes, and whether the impeller has open or closed vanes. Open-vaned impellers are used in circulators with high flow and relatively low head. This includes "flat-curve" circulators, which work well for radiator and baseboard applications.

Closed-vaned impellers are used in higher head and medium-high flow circulators. Possible applications for this type of circulator include those used for geothermal, solar and radiant heating systems.

THE MOTOR

A single-phase AC induction motor uses magnetism to operate. It has a stator (wire coils) on a spinning shaft.

The rotor is made up of an equal number of steel laminations fitted with evenly-spaced copper bars along the outside edge. This is a so-called "squirrel cage" rotor, for obvious reasons.

During the manufacturing process, the rotor is mounted on a hollow ceramic shaft. The shaft spins on two carbon bearings positioned on either side of the rotor.

The entire assembly is then slid into the stainless steel cartridge sleeve. Two rings are positioned over the cartridge sleeve to line up with the bearing supports and shaft. The top of the cartridge is capped off so water can only enter through the hollow shaft. Finally the impeller is mounted on the end of the shaft.

At the end of all this, you have a device that's ready to work. Apply electrical power and the rotor spins in the magnetic field, turning the impeller.

As we mentioned before, the size of the motor, its horsepower rating, directly affects its performance. A circulator with a more powerful motor will produce more pressure and more flow than a circulator with a smaller motor.

KEEPING WET WITH WATER

With water lubricated circulators, there's always water in the cartridge. There's no need for oil or grease. The system water lubricates the bearings inside the circulator cartridge just like having oil lubricate the engine pistons in your car.

Once the system is filled and pressurized, small amounts of air must be purged by running the circ for a few minutes. But once the cartridge is full of water, the hollow ceramic shaft will act like a mini expansion tank, providing the exact amount of space needed for the water in the cartridge to expand and contract as it heats and cools.

DIFFERENTIAL DIFFERENCES

Just as it is with weather fronts, a fluid must flow from an area of higher pressure to one of lower pressure.

Water enters the casing and runs into the eye of the impeller which spins it to outside with (you guessed it) centrifugal force. It's this action that adds velocity to the water, creating higher pressure before leaving the circulator.

Hydronic systems mimic Mother Nature: the greater the pressure differential, the greater the flow. Ah, there's magic in the flow when an installer selects the right circulator, enabling appropriate flow through the system.