Article ID: 33163

Applies to (product revision/patch):

Water Cooled Chillers

Problem:

I'm often asked: In Variable Primary Flow (VPF) piping systems, what rate of change can YORK chillers handle?

Solution:

The rate of change will depend upon several things, the most important of which is related to the system in which the chiller is placed. For example, a specific centrifugal chiller can handle 30% per minute rate of change in some systems and only 5% per minute rate of change in others. It's the same chiller, but the system in which it is connected is the governing factor.

Here are the 4 items that determine the max rate of change:
1.The Type of Chiller. Centrifugal chillers can typically handle the fastest rates of change while absorption chillers typically handle the slowest rates. Screw and scroll chillers typically have a rate of change close to centrifugal chillers. It all depends upon the response time of the chiller's specific unloading control. For a specific model, either contact application engineering or product portfolio management.

2. The % of Design Capacity. The higher the capacity (% load) at the time a flow rate change occurs, the faster rate of change is acceptable. Thus at 100% load, a chiller can handle the fastest rates of change and at minimum load, the slowest rates of change. In fact, at minimum load, practically any rate of change will trip the chiller off. This goes for any brand (including Trane).

3.Thermal Capacitance of the Chilled Water System. The volume of water in the system (chillers, pumps, piping, coils, buffer tank, etc.) has the greatest impact on the rate of change a chiller can handle. The larger the system, the greater the rate of change allowed and vice versa. A way to view this is, the longer it takes for a gallon of water to leave the chiller, disassemble into all paths, reassemble in the return piping and arrive back at the chiller, the faster the rate of change is allowed. Hence, the larger the system, the faster the rate.

4. Active Loads. This is a corollary of item 3. above. It assumes all loads are equally distributed in the system, that 50% load in one coil is 50% in all coils, something we know is rare. When loads are active (heavy) near the end of the system and relatively inactive (light) close to the chiller, that gallon of water travels a longer distance, increasing the effective rate of change allowed. The reverse is true if loads are heavy near the chiller and light far away.

Items 2 through 4 are all determined outside of the chiller and are also the greatest influence on acceptable rates of change. Now to the best part. Most VPF systems doing air-conditioning duty rarely need rates of flow change faster than 5% per minute, so there is no need for high settings like 30%, or even 20%. Our recommendation is to set the change to 10%/min. This can be done via Metasys or through an setting in the variable speed drive (VSD) control panels for the pumps. This often is referred to as the "ramp function" or as "accel' and "decel" rates. These are usually in seconds to go from 0 to max speed (accel) or max speed to 0 (decel). Since there are 60 seconds in a minute, then 10%/min would be 600 seconds. This can be easily handled during the commissioning process. Once set, if the chiller(s) trips off on Low Water Temp (LWT) cutout, the setting is too fast. Adjust to 700 seconds (something higher than 60). If the setting is too slow, the chilled water temperature of the chillers will hunt up and down, not settling. In this case decrease the accel/decel rates to 450 seconds (15%/min of a value lower than 600).

Notes for BE employees:

None

Keywords:

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