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Subject: Chillers Piped in Series Counter-flow

Applicability: Directive and Guidance

References:

a. ASHRAE HVAC Systems & Equipment Handbook 2012, Chapter 43, Liquid-Chilling Systems

b. ASHRAE Journal Article Jul 2011, “Optimizing Design and Control of Chilled Water Plants” by Steven T. Taylor, P.E.

1. Chillers equipped with magnetic bearing compressors are often a selection for projects requiring mechanical cooling. These chillers can offer very good kw/ton energy efficiencies at full and part load operation.
2. Another choice for competitive energy savings can be variable speed chillers piped in series counter-flow arrangement. Chillers with screw compressors can be operated at part load without losing much efficiency as compared to chillers with centrifugal compressors as temperature lift (saturated discharge temperature minus saturated suction temperature) is nearly constant with changes in refrigerant volume flow rate.
3. It should be noted that chillers with screw compressors themselves may not have as competitive efficiencies as other chiller types but when piped in a series counter-flow arrangement the screw type chillers can be very competitive. The series counter-flow piped chillers results in less work by the chillers due to less lift required and in turn an energy savings. The referenced ASHRAE handbook chapter and some chiller manufacturer’s webinars/websites addresses in more detail these chiller characteristics.
4. When considering a chiller selection the designer should be mindful that the energy savings of the chiller plant should be the ultimate focus. Factors such as pumping cost, first cost differences in piping configuration, chiller plant maintenance and all cost associated with the entire chiller plant should be weighed in for the life cycle cost. Commercial manufacturers have plant optimization programs available. The referenced ASHRAE Journal article provides an

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excellent overview of plant optimization addressing: Chilled water distribution selection, Condenser water system design, Pipe sizing and optimizing delta T, Chiller and cooling tower selection and Optimized control sequences in a five part series. Assure that projects requiring cooling, provide RFP language stressing the entire chiller plant rather than individual components.

5. The purpose of this E & C Bulletin is not to suggest the selection of chillers piped in series-counter flow but merely offer this as another alternative for chiller application. When a life cycle cost analysis is performed the designer should be aware of the potential energy savings that the series counter flow piping arrangement can offer.

6. The point of contact for this ECB is Timothy Gordon, CECW-CE, 202-761-4125.

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