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ERECTION OF CENTRALIZED CHILLED WATER PIPING SYSTEM FOR A COMMERCIAL PROJECT AT HYDERABAD

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Abstract:

Chilled water-based cooling systems are frequently used to air-condition large office buildings, commercial building and campuses that encompass multiple buildings. Many large buildings, campuses, and other facilities have plants that make chilled water and distribute it to air handling units and other cooling equipment. Chilled water has been a primary medium for the transfer of heat from building coils to the refrigeration system since the beginning of heating, ventilating, and air-conditioning design. Providing chilled water from a centrally located plant(s) has long been promoted as an energy efficient and low maintenance means of rejecting heat from air-conditioning systems across a commercial campus. The Project provides a detail evaluation of the requirements of the chilled water piping system connecting the chillers to the indoor machines, as a transportation system. The project further details into the standards and real time erection of such systems for a commercial project at Hyderabad. Chilled water piping system is one of the main utility systems used in a building space requiring cost and maintenance at regular time. A proper installation of such system with instruments for monitoring and controlling the flow of chilled water plays a vital role of a successful air conditioning system.

Introduction:

Chilled Water System, also called as Hydronic is one of the major requirement of a Centralized Air-Conditioning System. Chilled water is a commodity often used to cool a building's air and equipment, especially in situations where many individual rooms must be controlled separately, such as a hotel. The chilled water can be supplied by a vendor, such as a public utility or created at the location of the building that will use it, which has been the norm. Chilled water cooling is very different from typical residential air conditioning where a refrigerant is pumped through an air handler to cool the air. Regardless of who provides it, the chilled water (between 4° and 7°C) is pumped through an air handler, which captures the heat from the air, then disperses the air throughout the area to be cooled. Chilled water piping systems provide cooling for many air-conditioning and industrial processes. Regardless of size or complexity, every chilled water system is comprised of cooling loads, cooling

equipment, a distribution system, pumps, and control valves. Heat is added to a circulating stream of water by cooling coils, radiant panels, process heat exchangers and other loads and is removed by cooling equipment such as chillers, heat pumps, or heat exchangers. The distribution system is a piping network that transfers chilled water between loads and cooling equipment at rates determined by pumps and control valves. The design operation and maintenance of these chilled water plants has a very large impact on building energy use and energy operating cost. Not only do chilled water plants use very significant amounts of electricity (as well as gas in some cases), they also significantly contribute to the peak load of buildings. During this peak event, chilled water pump plants are often running at maximum capacity. When temperatures are moderate, chilled water pump plants are shut down or operated in stand-by mode. Chilled water piping systems are common challenge for many facilities, especially campus configurations (higher education, manufacturing, airports, etc.). Chilled water systems can successfully be operated in a district cooling system from years for supplying the cooling requirements. When faced with a major increase in campus cooling demand, unitary refrigerant systems were replaced with centralized chilled water systems to meet today's design standards. Some limitations were discovered that involved reduced cooling (tonnage) and distribution (flow) capacity, fluctuating supply temperature and low return temperature – challenges familiar to many district cooling system operators.

Chilled-water systems consist of these functional parts:

• Chillers that cool the water or fluid
• Loads, often satisfied by coils, that transfer heat from air to water
• Chilled-water distribution pumps and pipes that send chilled water to the loads
• Condenser-water pumps, pipes, and cooling towers or condenser fans that reject heat from the chiller to ambient air
• Controls that coordinate the operation of the mechanical components together as a system

In most cases, the chiller's purpose is to make water colder. Some chillers cool a mixture of water and other chemicals, most commonly added to prevent freezing in low-temperature applications. Other additives may be used to modify the properties of the fluid, thereby making it more suitable for its intended application. For the purposes of this manual, the term water can be understood to be any such acceptable fluid, with recognition of the diverse applications in which chillers are used. Each component of the chilled-water system is explained in more detail in the following sections.

i) Chiller

There are a variety of water chiller types. Most commonly, they are absorption, centrifugal, helical rotary, and scroll. Some reciprocating chillers are also available. Chillers can be either air- or water-cooled. Major vapor compression chiller components include an evaporator, compressor(s), condenser, and expansion device(s). This manual discusses the

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chiller's evaporator and condenser and their relationship to the chilled-water system.

Chilled-Water Distribution System:

Chilled water is circulated through fixed piping—most commonly steel, copper, or plastic—that connects the chiller with various load terminals. Piping is sized to meet pressure loss, water velocity, and construction cost parameters. The chilled-water pump creates pressure to circulate chilled water within the loop. Generally, the pump must overcome the frictional pressure losses caused by the piping, coils, and chiller and the pressure differential across open control valves in the system. The pump, while working at the system static pressure, does not need to overcome this static pressure. For example, in a forty-story building, the pump need not overcome the static pressure due to those forty stories. The chilled water distribution system consists of chillers, pumps, piping, cooling coils, controls and other components on the evaporator side of the chillers. This dynamic system, which provides cooling for many air conditioning applications, is one of the most energy intensive systems in commercial buildings. Understanding how hydronic distribution systems react to varying loads and how their components interact is essential for designing an energy efficient and cost-effective chilled water plant.

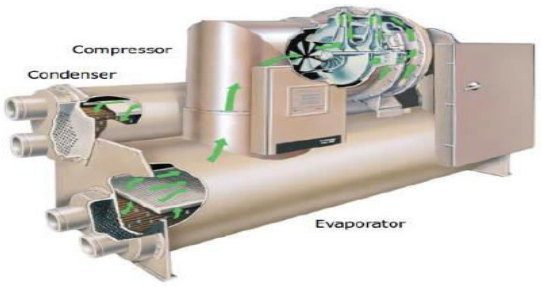

Fig.1: Chiller

Chilled-Water Air-Conditioning System:

A chilled water system is a means by which heat, generated in a space or by a process, is conveyed from that space and ultimately released to the outside. This chapter is intended to acquaint the facility operator with chilled water systems and identify a minimum level of maintenance activities that must be performed to maintain a chilled water system for continuous day-to-day operation. Each chilled water system is designed to transfer heat by the most efficient and cost-effective method. While there is no right way to design a chilled water system, chilled water systems have common characteristics and use common types of components. Basically, a chilled water system circulates the chilled water through a loop piping system. Pumps force the water from the water chiller through the heat transfer components and back to the chiller via the piping system. Heat is transferred to the chilled water as it circulates through the heat transfer device that causes the temperature of the chilled water to increase. The portion of the system that supplies the water from the chiller to the heat transfer equipment is typically designated the chilled water supply system. Once the water is through this heat transfer equipment, the piping system delivering it back to the chiller is termed the chilled water return system.

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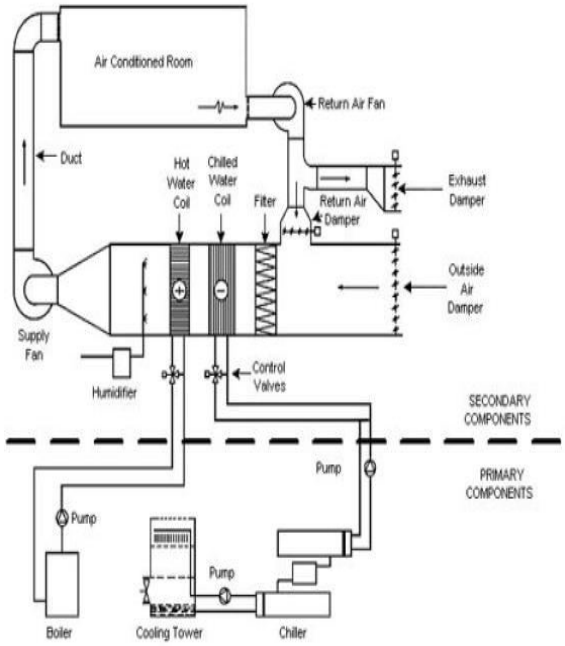

Fig 2: Schematic of HVAC System

Piping System:

There are two common types of chilled water piping systems: two-pipe and dual temperature, with numerous variations of each. Two-pipe systems for comfort air conditioning typically operate with a design supply temperature of 40 to 55oF and a system pressure of approximately 125 psi. Antifreeze or brine solutions may be used for chilled water systems (usually process applications) that require supply temperatures below 40oF. In addition, well water type chilled water systems can use supply temperatures of 60oF or higher. Dual-temperature systems are a combined water heating and cooling system that circulate hot and/or chilled water to heat or cool with common piping and terminal heat transfer apparatus. This chapter will consider two-pipe chilled water systems that supply 40 to 55oF supply water only; however, much of the information presented in this chapter will apply to dual temperature systems as well.

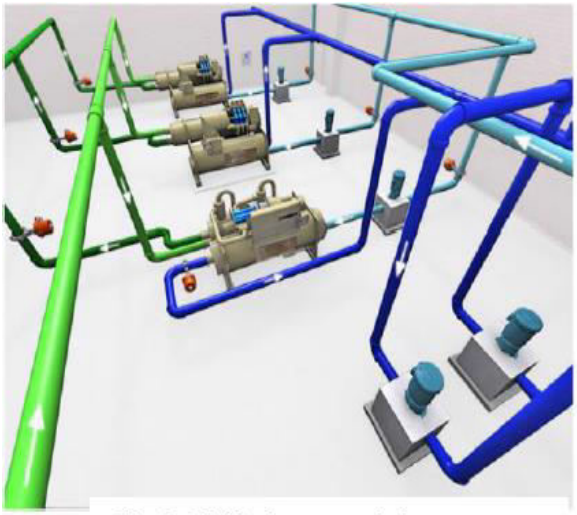

Fig 3:Chilled water piping system

In general, HVAC systems shall utilize parallel piping systems with a two-pipe main distribution system arranged in a reverse return configuration. If applied, series loop piping for terminal or branch circuits shall be equipped with automatic flow control valves at terminal units.Each terminal unit or coil shall be provided with isolation valves on both the supply and return and a flow indicating balance valve on the return line. Isolation valves shall be provided on all major branches, such as at each floor level, building wing or mechanical room.For new chilled water HVAC distribution, a pumping and piping arrangement is generally appropriate, with constant volume primary pumping and variable volume secondary is pumping. The primary and secondary circuits shall be separate, with neither having an effect on the pumping head of the other. The primary circuit serves the source equipment (chillers), while the secondary circuit serves the load.

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Piping Installation:

The chilled water piping installation method is prepared in order to outline the activities and the methods used for installation of chilled water pipes and accessories. All activities will be carried out in accordance with the contract details and in full compliance to the contract specifications and documents. All work within the rights of way of the standards and specifications will be done in compliance with the requirements issued by authorities.Before starting the chilled water piping installation, tools shall be arranged and necessary measures will be taken for the safety of the equipment. Relevant entities which might require protect include any such works in the vicinity of the area of work or on the service access or discharge path. The construction team will ensure that any such requirements are documented. The Project provides a detail evaluation of the requirements of the chilled water piping system connecting the chillers to the indoor machines, as a transportation system. The project further details into the standards and real time erection of such systems for a commercial project at Hyderabad. Chilled water piping system is one of the main utility systems used in a building space requiring cost and maintenance at regular time. A proper installation of such system with instruments for monitoring and controlling the flow of chilled water plays a vital role of a successful air conditioning system.

Fig 3:Piping Installation

Site Details:

Project Name : Commercial Hospital Project
Capacity : 1400TR
HVAC System : Centralized Chilled Water System
Type of Chillers : Water-Cooled Chillers

Conclusion:

Chilled water piping systems is an efficient way of providing cooling or air conditioning to large space buildings of higher capacity. These system utilizes the use of chilled water as secondary refrigerant, thus decreasing the cost of investment on charge of refrigerant also reducing the maintenance cost of refrigerants. The review on the concept of installation of chilled water piping system for the given commercial project as per the standards of ASHRAE can effect of the actual working procedures, can lead for effective piping installation for having very efficient heat transfer. The methods that shall be used will be as per the client requirements and drawings already made by the CAD engineers. The project will also tend to identify the requirements including transportation, storage and effective inspection of the laid down piping system.

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