



District Cooling Plant, Qatar Pearl

Only the best is good enough for the world's largest district cooling plant project located at Qatar Pearl in Qatar. Given this criterion, the installed balancing valves are naturally supplied by FlowCon International.

District cooling entails the production and circulation of chilled water to multiple buildings through a network of insulated underground pipes. In 2010, Qatar Cool inaugurated the world's largest district cooling plant. "The Integrated District Cooling Plant" (IDCP) at the Pearl-Qatar. The IDCP plant consists of 2 common headers each including 26 chillers serviced by 13 pumps - 2 chillers per pump.

Each chiller is mounted with FlowCon dynamic valves to prevent that the maximum flow of the chillers is exceeded at any point and thereby ensure that the chillers are operating at design efficiency even at partial load conditions. The performance at partial load is particularly important for IDCP, as the district cooling plant will not be in full operation until the 4 million square meter manmade island, developed by UDC, is fully developed. With more than 80 apartment towers, beachfront villas and townhouses, shopping complexes, offices, schools and hotels throughout the Island to be serviced from the IDCP, the construction will naturally stretch over a longer period of time, making partial load conditions the norm in the first years of operation. IDCP will ultimately supply 130,000 tons of refrigeration to the Island's 45,000 residents once fully developed.

With this district cooling plant Qatar Cool offers an environmentally friendly solution to address the nation's cooling requirements. The benefits of district cooling are increasingly being recognized by government, developers and end-users alike. Not only does it reduce operation costs and building maintenance costs, but it also helps reduce carbon footprints and offers other environmental benefits in line with the environmentally goals and the country's National Vision for 2030.

As a reason for using district cooling to service the Qatar Pearl, Qatar Cool has stated: "***It has been leading the focus on eco-friendly technologies in the region***", which has earned the distinction as "***the most efficient, cost-effective, and environmentally-friendly solution to meet Qatar's growing cooling demands***".

"Developers prefer district cooling - not only does it reduce operating costs and building maintenance costs but it also helps reduce carbon footprints, which is in line with the country's national objectives" said Qatar Cool chairman Bader al-Meer. "***District cooling is very favourable because it offers a sustainable and environment-friendly solution to address the increasing cooling requirements in the country***" he said.

In the long term, district cooling is significantly more cost-effective than conventional solutions. The production of cooling energy supplied by Qatar Cool has exceeded 170 million tons per hour in 2013, representing a savings of about 120 million kWh or approximately 40%, compared with providing the cooling load by conventional methods.

It is significantly more cost effective over the long term than conventional solutions. District cooling at the same time cares for the environment; in the past five years Qatar Cool has achieved over 880 million KW of energy which translated to the elimination of around 490 million KG of carbon dioxide from the atmosphere since 2010.

Qatar Cool has received multiple international awards including the one from IDEA (International District Energy Association), which cited Qatar Cool as 'System of the year' being the best cooling system in the world in 2014.

The mission is to pass on the benefits of district cooling and the innovative technologies to the society and the environment, which gives all the partners a good image.

Project configurations

FlowCon is the sole supplier of dynamic balancing valves to the 130,000 tons district cooling plant servicing "Qatar Pearl". The project configurations are as per below:

Contractor: C.A.T International

Supervising Engineer: Dar Al Handasah

Project Name: Integrated District Cooling Plant (IDCP) - Qatar Pearl

Configuration of plant: 13 pumps supplying 26 Chillers supplying to 2 common headers

Number of valves: 26 numbers of DN600 (24") dynamic balancing valves each supplying 471 l/sec of water

Valve model: FlowCon Wafer

Configuration: Maximum flow regulation for Chillers

Type of job/Application: New District Cooling Plant

Inauguration date: November 2010

Total Cooling Capacity: 130,000 tons of refrigeration

FlowCon International has delivered valves for the IDCP district cooling plants and in that process participated from design over value engineering to commissioning to ensure full functionality. FlowCon International has even modified the valves supplied to accommodate the actual site requirements of flow versus pressure drop. FlowCon International was originally introduced into the project from the consultant engineers who previously had used FlowCon valves on multiple projects, including Dubai Airport, with satisfaction. The experience from these projects made the involved parties to contact FlowCon International for a technical evaluation and optimizations of the project with the aim of minimizing the initial cost while reducing the general energy consumption, which was achieved by the implementation of dynamic balancing valves to serve as partial load protection on the chillers. During the project stages there were a few critical parameters to be achieved.



Performance = large differential pressure span due to start up sequence:

The start-up sequence of the district cooling plant is slightly unusual as the plant should be capable of supplying chilled water to the Qatar Pearl from the completion of the first building to the completion of the full project. In order to enable such operation, the pumps are to be faced gradually as per the completion of the buildings to be supplied. According to the pressure calculations made by FlowCon International, the pressure loss in the pipes would fluctuate between 2.8 bars and 11.1 bars depending on the number of pumps in operation. The dynamic balancing valve should in other

words be capable of providing a pressure drop as close to 0 as possible, when all pumps are in operation and a pressure drop in the region of 11 bars, when only one pump is operational. This requirement of large pressure range was successfully achieved by the FlowCon International design engineers through adjustments to the standard products and application recommendations.

Energy saving

= accuracy and valve pressure drop:

The valves supplied hold an accuracy of $\pm 5\%$ with a pressure drop below 5 kPaD when all chillers are in operation. Simultaneously the installed valves protect against overflow up to a differential pressure of 9 bars. The valves thereby ensure minimal energy consumption during full load and protecting the chillers against overflow in partial load conditions. Overflow would have resulted in high flow rates through the chillers, low ΔT and resulting in low chiller efficiency and increased pumping flow severely increasing overall energy consumption.

Reduction of construction costs: Automatic balancing valves are significantly more compact than other types of balancing valves, when reaching the size in question. The 600mm valves installed holds a weight of 217 kgs, whereas a DRV would be around 4 times this weight for similar size. The weight difference makes the dynamic balancing valve cheaper than a traditional DRV and will require less support of the pipes. Besides the material costs did the introduction of automatic balancing valves allow the contractor C.A.T International to eliminate the VFDs on the pumps as each 5,000 tons module (1 pump and 2 chillers) module is only 3.85% of the chiller plant capacity.

Reliability: The FlowCon International stainless steel insert has been sold in tens of millions over the past 50 years and is the most well proven dynamic balancing valve items in the world. Besides the general market data, the consultant engineer had personally experience with similar products previously installed in Dubai airport for multiple faces over a period of 15 years without any performance issues.

Clear footprint: The dynamic valves installed hold no piping restrictions allowing a very compact chiller installation. As a comparison, DRVs and metering stations will hold a piping restriction of 3 times pipe diameter before and 5 times pipe diameter after. With the pipe sizes in question such installation would require 8 times the pipe diameter or 4,6 meters in addition to the valve. Installation of a dynamic balancing valve is in other words significantly more compact.

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