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Research Article

Based on the water source heat pump system operation control and energy consumption optimization

Guangxiang Wang[1*], Wei Ding[2]

[1]Shengli Oilfield Central Hospital, Dongying 257000, Shandong Province, China;

[2]Zhongli Tianxi Technology Co., Ltd., Zibo 255000, Shandong Province, China.

Abstract: The contradiction between the increasing material demand and resource, is the country has faced problems, to better solve the material demand and the contradiction between the environment and resources, is applied to the development of new energy, new energy, not only can alleviate people and resources, environment and resources, the contradiction between people and the environment, also can promote the sustainable development of world economy, HVAC technology has emerged a new generation of energy-saving technology, HVAC has the characteristics of low consumption, low pollution, is a development of technology, to be promoted for environment-friendly, resource-conserving society has an important role in promoting. This paper focuses on the HVAC technology, water source heat pump system operation control and energy consumption optimization, for the relevant personnel reference.

Keywords: Heat pump system; Operation control; Optimization of energy consumption

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Corresponding author: Guangxiang Wang, dwdq0602@sina.com

1 System operation mode

1.1 Operation of the heat pump unit

In the water source heat pump system, the main components are four, respectively, the compressor, which can be said to be the core of the heat pump system, mainly through the action on the condensate, make it into the form of high temperature and high-pressure gas, and then through the compressor compression, transfer to the condenser; The condensing gas is mainly responsible for heating[1]. By acting on the refrigerant, the refrigerant removes the heat generated by the compressor in the condenser and absorbs the heat generated by the evaporator, generating a large amount of heat and transferring it to the place where the heat is needed, thus playing its role. Then flow into the throttle valve, through the throttle valve is to achieve the purpose of energy-saving, source saving; The reduced pressure of the refrigerant is transferred to the evaporator, in the evaporator, the refrigerant has a certain change of action, produce a certain amount of work, that is, the corresponding heat, after cooling into the compressor again, recycling, also completed a whole heat pump system operation.

1.2 Unit parallel connection and grouping scheme

In the process of heat pump unit operation, because of the large amount of operation, is usually not a single heat pump units, but by the combination of heat pump units and water source heat pump system, usually according to the actual demand, continuously adjust the number of units, a standard, determine whether the equipment operation normal change is observed at the ends of the parallel unit charge, according to the size of the charge change, the corresponding units in parallel. For a project with a small amount of work, the number of heat pump units is correspondingly small[2]. It can monitor the charge change at the end in real-time and choose to increase or decrease the number of units according to the actual situation to achieve the purpose

of the stable operation of the system. For larger projects of quantities, the need to a larger number of heat pump units, charge changes are relatively obvious, the number of increased significantly, leading to increased difficulties of systems and control, and to avoid the system crash or the phenomena of energy, you need to water source heat pump system is divided into several subsystems, when the excess energy, choose to close some subsystems, lack of power load, increase the number of subsystems.

1.3 Unit series

In the operation of the system, first of all, take the water pump to transfer heat source water at the same time into the heat exchange unit 1-4 of the evaporator, and then, heat pump units 1 and 2 of the condenser water with a water temperature of 50 ℃ or so again into the unit 3, 4, second heat exchange in unit 3, 4, will further enhance water temperature to 60℃ or so, in the end, again by the water pump to the end-user. After the heat is released at the end, the circulating water temperature drops to about 40℃ and then returns to the heat pump unit 1 and 2.FIG. 1 shows that for heat pump unit 1 and 2, the inlet and outlet water temperature of the condenser side is 40℃ and 50℃ respectively, and for heat pump unit 3 and 4, the inlet and outlet water temperature of the condenser side is 50 ℃ and 60 ℃ respectively, which effectively avoids the large temperature difference between the inlet and outlet water temperature[3].

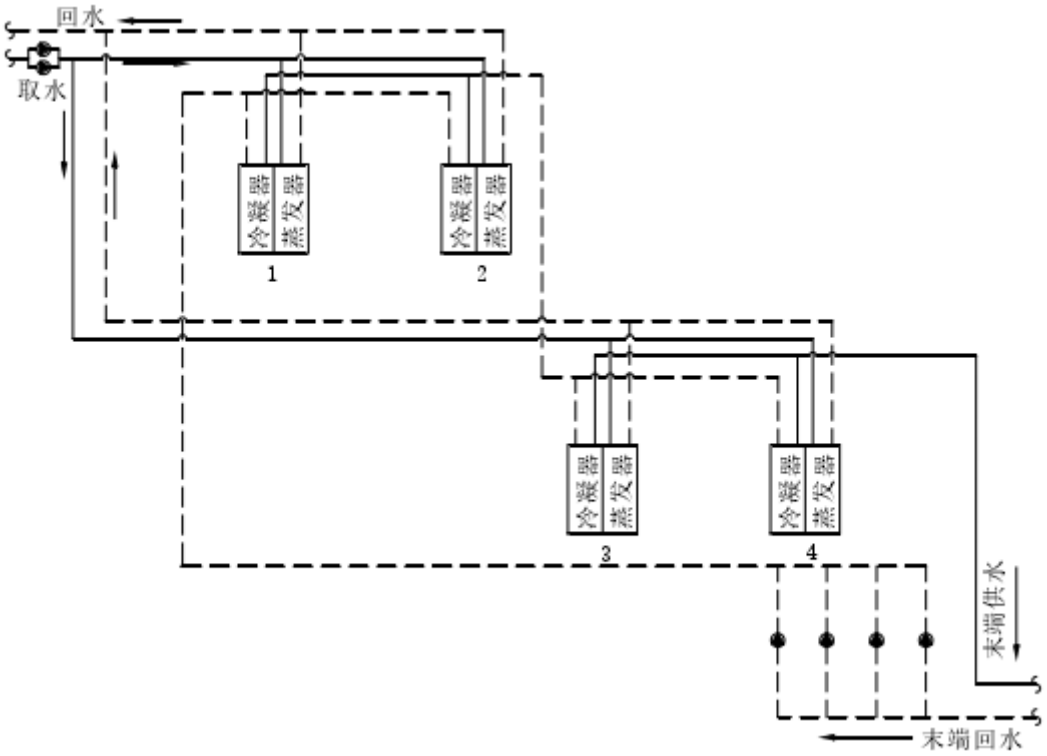

Figure 1. series process diagram of the unit

1.4 Operation of water pump

As water source heat pump system, the important part of the water pump and water source heat pump system of energy consumption an important part of energy consumption is the main characteristic of water source heat pump, can absorb the heat of water, through the heat pump unit operation, produce the required energy, therefore, the operation of the pump is to learn all kinds of water and then transferred to the heat pump system, recycling, avoid excessive energy loss[4].

2 Operation control strategy of water source heat pump system

2.1 Peration control of the water pump

2.1.1 Constant flow operation

Constant flow operation is the most common operation mode of the water pump in the water delivery system. No matter how the load of the user changes, the water pump always runs with constant flow and fixed

head, which does not have the function of real-time regulation of the system flow. However, as mentioned at the beginning of this chapter, when the system is under partial load, the heat production of the system can only be changed through the adjustment of the heat pump unit itself, and the system cannot be supplied on demand according to the actual demand of the end-user, resulting in the waste of energy consumption and unable to achieve the effect of energy-saving.

2.1.2 Parallel coupling operation of the water pump

In the process of water source heat pump control, the pump can be used in parallel coupling method, to adjust and control of water source heat pump, the water source heat pump control system, the water pump in parallel coupling can be divided into two categories, one is the same model of coupled parallel pumps, at the time of calculation work, at this time is the sum of all the water pump, the other is a different type of pumps in the parallel coupling, to calculate the lift, need to calculate and collect. Before designing water source heat pump system, when choosing the pump model, usually choose according to maximum flow in the pipeline, this option will cause the corresponding energy loss, to avoid this kind of situation, need to be other than the maximum flow parameters and the corresponding statistics and analysis, integrated data, statistical correlation calculation, choose the appropriate pump type, the section can source resources, and can reduce the loss, is a very good method, the choice of the main pump and the choice of deputy pump, water source heat pump system is running in an important measure to adjust and control[5].

2.1.3 Variable flow operation

Variable frequency regulation, the water pump in the water delivery system USES variable frequency technology, when the load of the heat pump unit changes according to the user load and then adjust, the pump also synchronous variable frequency speed regulation, adjust to the actual load of the unit to match or the closest to the flow and head. When the water pump is variable frequency, it is through adjusting the frequency of the water pump, through the frequency change to control the speed of the water pump, and then change the output flow rate of the water pump, the water pump frequency corresponds to the speed of the water pump, the two are proportional, the frequency and the change of the flow also shows a linear relationship. At the same time, to ensure the stability and efficiency of the operation of the water pump after frequency conversion, the frequency after frequency conversion should not be lower than 25Hz, that is, when the water pump adopts frequency conversion technology, the lower limit of its flow range should not be lower than 50% of the rated flow.

2.2 Control strategy of the heat pump unit

The heat pump unit is an important part of the water source heat pump system. To better promote the operation of the water source heat pump system, the heat pump unit can be regulated from three aspects.

2.2.1 During the operation of the heat pump system, real-time monitoring is needed to master the changes of the data in the heat pump system. The contents to be monitored also include pressure, flow and water temperature, etc. Only by monitoring these data can the role of the water source heat pump system be better players and the maximum efficiency be achieved.

2.2.2 After the operation parameters are collected and sorted out, the problems or phenomena are reflected through the data, and the compressor in the heat pump system or the heat pump unit is adjusted to achieve the desired purpose.First of all, at the time of water source heat pump system design, fully consider to appear some problems in the operation of the system, through the detailed analysis of the data and finishing, the parameters of the compressor or heat pump units to the scope of the corresponding provisions, to better selection of compressor model and the pump in heat pump units model; Secondly, the main purpose of real-time data monitoring is to complete the dynamic control of the water source heat pump system. Finally, more water temperature changes, the regulation of water source heat pump system, within the scope of the regulation of water temperature, reasonable regulation of water source heat pump system, increase or decrease the number of heat pump units, according to the specific situation choose the install and uninstall compressor, ensure to keep water thermal energy of the system within a certain range, the stable operation of the water source heat pump system, improve the working efficiency of the water source heat pump system.

2.2.3 Setting of the automatic protection device.To avoid the water source heat pump system malfunction, or substantial energy loss problem, should be installed in the water source heat pump system since the protection of water source heat pump system can effectively in the process of running abnormal monitoring, the set was hit, the scope of automatic

protection device, and provide an alarm, led regulators for inspection, make the corresponding adjustment measures, in the process, to achieve the system or the requirements of the project, change the unit or the number of connections, to remove the failure problem of the water source heat pump system.At present, the general water source heat pump system or recognized water source heat pump unit rated flow is 50%, the maximum range of water source heat pump change control in the range of 50%-100%, in this range of water source heat pump unit rated flow change, will not cause the system alarm device. For example, in the water source heat pump system control, according to actual condition choose different operation strategies, a system in full with a total of 2.3.4. Sets of the same heat pump for heating, when 75% of the full user load, there are two ways to satisfy the client required: one is 4 units at the same time, with 75% of the load operation; The other is that one unit is shut down and the other three units run at full load. According to the principle of fewer units, the second operation mode should be selected. When the load of the client continues to increase and the 3 units cannot meet their needs, the fourth unit should be started gradually.

3 Energy consumption optimization of water source heat pump

3.1 Pump frequency conversion operation optimization

Water source heat pump system, it can be said that the main energy consumption is concentrated in the water pump, the water pump is an important part of water source heat pump system, to lower the pump energy consumption, can be adjusted by using frequency conversion technology will pump system, to achieve the aim of saving resources, reduce energy consumption, the main characteristics of frequency conversion technology is based on water source heat pump system statistics and analysis of the variation of load, achieve the goal of reducing energy consumption, through the use of frequency conversion technology, can be found, can effectively reduce energy consumption, as in the water source heat pump system load change and the pump parameter as a way to control the amount of heat pump units and parallel, the overall energy consumption, Greatly reduced, to achieve the purpose of saving energy[6].

3.2 Pump parallel switching operation optimization

Water source heat pump in parallel switch optimization, to control energy consumption, increase traffic, in the process, as a whole, can be the same flow rate can be reduced by 5% of energy consumption, running total energy consumption by 5% or so, conveying the total energy consumption was reduced by 17% or so, at the same time traffic increased by about 5%, water source heat pump system is very stable at this time.

4 To summarize

In a word, the emergence of the water source heat pump system is a very important new generation of energy-saving technology, to better reduce the Hangzhou energy, to achieve a resource-saving, environmentally friendly society. Need to be an important part of water source heat pump system, and the corresponding connection manner, according to the need of the actual situation, continuously adjust and control of water source heat pump system, to achieve the goal of energy saving, by the transformation of the water pump in parallel, the change of the water pump frequency, to achieve the aim of reducing energy consumption, better promote the operation of the water source heat pump system and promotion.

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