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(54) **MULTI-SPLIT HEAT PUMP SYSTEM AND CONTROL METHOD THEREFOR, AND
COMPUTER-READABLE STORAGE MEDIUM**

(57) Disclosed is a method for controlling a variable refrigerant flow (VRF) heat pump system. The VRF heat pump system includes a compressor, at least one hydraulic module and at least one air conditioner indoor unit. The at least one hydraulic module and the at least one air conditioner indoor unit are both connected to the compressor. The method includes: obtaining a first energy demand information of the at least one air conditioner indoor unit and a second energy demand information of the at least one hydraulic module; wherein the first energy demand information represents a heating capacity demand of the at least one air-conditioning indoor unit, and the second energy demand information represents a heating capacity demand of the at least one hydraulic module;

energy demand information represents a heating capacity demand of the at least one air conditioner indoor unit, and the second energy demand information represents a heating capacity demand of the at least one hydraulic module; and adjusting an operating frequency of the compressor according to target parameters corresponding to the first energy demand information and the second energy demand information. The present application further discloses a VRF heat pump system and a computer-readable storage medium.

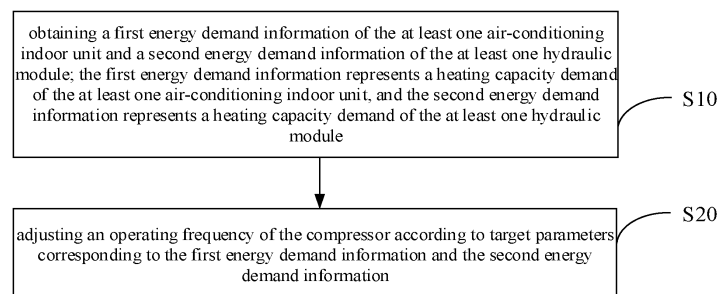


FIG. 3

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Description**CROSS-REFERENCE TO RELATED APPLICATIONS**

[0001] The present application claims priority to Chinese Patent Application No. 202111137871.4, filed on September 27, 2021, the entire contents of which are incorporated herein by reference.

TECHNICAL FIELD

[0002] The present application relates to the technical field of variable refrigerant flow (VRF) heat pump systems, and in particular to a method for controlling a VRF heat pump system, a VRF heat pump system, and a computer-readable storage medium.

BACKGROUND

[0003] With the development of economy and technology, the variable refrigerant flow (VRF) heat pump systems are increasingly used in daily life. For example, the air source heat pump adds a hydraulic module to provide heat source for capillary floor radiant heating, radiator heating, etc., and also to the water storage tank for domestic water.

[0004] At present, in VRF systems with indoor air duct units and hydraulic modules, the operating frequency of the outdoor compressor is generally regulated according to the preset fixed exhaust pressure or the temperature in the middle of the coil of the air duct unit, which is easy to cause the output capacity of the compressor does not match the actual indoor heat exchange demand, resulting in the inability to effectively balance the indoor ambient temperature adjustment and the heat supply of the hydraulic module.

SUMMARY

[0005] The main objective of the present application is to provide a method for controlling a variable refrigerant flow (VRF) heat pump system, a VRF heat pump system and a computer-readable storage medium, aiming to accurately match the output capacity of the compressor with the actual indoor heat exchange demand, so as to effectively balance the indoor ambient temperature adjustment and the heat supply of the hydraulic module.

[0006] In order to achieve the above object, the present application provides a method for controlling a VRF heat pump system. The VRF heat pump system comprises a compressor, at least one hydraulic module and at least one air conditioner indoor unit. The at least one hydraulic module and the at least one air conditioner indoor unit are both connected to the compressor, and the method for controlling the VRF heat pump system comprises the following steps:

obtaining a first energy demand information of the at least one air conditioner indoor unit and a second energy demand information of the at least one hydraulic module; the first energy demand information represents a heating capacity demand of the at least one air conditioner indoor unit, and the second energy demand information represents a heating capacity demand of the at least one hydraulic module; and
adjusting an operating frequency of the compressor according to a target parameter corresponding to the first energy demand information and the second energy demand information.

[0007] In an embodiment, the adjusting the operating frequency of the compressor according to the target parameter corresponding to the first energy demand information and the second energy demand information comprises:

in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is greater than a first preset value, adjusting the operating frequency of the compressor according to an indoor heat exchanger temperature of a currently turned-on air conditioner indoor unit, the target parameter comprises the indoor heat exchanger temperature; and
in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is less than or equal to the first preset value, and the second energy demand information indicating that the heating capacity demand of the at least one hydraulic module is greater than a second preset value, adjusting the operating frequency of the compressor according to an outlet water temperature of the hydraulic module, the target parameter comprises the outlet water temperature.

[0008] In an embodiment, the in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is greater than the first preset value, adjusting the operating frequency of the compressor according to an indoor heat exchanger temperature of the currently turned-on air conditioner

indoor unit comprises:

determining a first frequency correction value according to the indoor heat exchanger temperature and a preset heat exchanger temperature;
 obtaining a first target frequency after adjusting an initial frequency of the compressor according to the first frequency correction value; and
 controlling the compressor to operate at the first target frequency.

[0009] In an embodiment, the determining the first frequency correction value based on the indoor heat exchanger temperature and the preset heat exchanger temperature comprises:

determining a first temperature difference value between the preset heat exchanger temperature and the indoor heat exchanger temperature;
 in response to the first temperature difference value being greater than or equal to a first preset temperature difference, the first target correction value being the first frequency correction value; and
 in response to the first temperature difference value being less than a second preset temperature difference, the second target correction value being the first frequency correction value,
 the second preset temperature difference is less than or equal to the first preset temperature difference, the first target frequency corresponding to the first target correction value is greater than the initial frequency, and the first target frequency corresponding to the second target correction value is less than the initial frequency.

[0010] In an embodiment, before the adjusting the operating frequency of the compressor according to the indoor heat exchanger temperature of the currently turned-on air conditioner indoor unit, the method further comprises:

in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is greater than the first preset value, obtaining an exhaust pressure of the compressor;
 determining a condensation temperature of the currently turned-on air conditioner indoor unit according to the exhaust pressure, the indoor heat exchanger temperature comprises the condensation temperature; or
 in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is greater than the first preset value, obtaining a rated heating capacity of the currently turned-on air conditioner indoor unit and a coil temperature of an indoor heat exchanger corresponding to the currently turned-on air conditioner indoor unit;
 determining a weight value of each currently turned-on air conditioner indoor unit according to the rated heating capacity; and
 determining the indoor heat exchanger temperature according to the coil temperature and a weight value corresponding to the coil temperature.

[0011] In an embodiment, after the obtaining the first energy demand information of the at least one air conditioner indoor unit and the second energy demand information of the at least one hydraulic module, the method further comprises:

in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is greater than the first preset value, obtaining an installation status information of a pressure sensor on an exhaust side of the compressor;
 in response to the installation status information indicating that the pressure sensor is not installed on the exhaust side of the compressor, obtaining the exhaust pressure of the compressor, and determining the condensation temperature of the currently turned-on air conditioner indoor unit according to the exhaust pressure; and
 in response to the installation status information indicating that the pressure sensor is installed on the exhaust side of the compressor, obtaining the rated heating capacity of the currently turned-on air conditioner indoor unit and the coil temperature of the indoor heat exchanger corresponding to the currently turned-on air conditioner indoor unit,
 determining the weight value of each currently turned-on air conditioner indoor unit according to the rated heating capacity; and determining the indoor heat exchanger temperature according to the coil temperature and the weight value corresponding to the coil temperature.

[0012] In an embodiment, the in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is less than or equal to the first preset value, and the second energy demand information indicating that the heating capacity demand of the at least one hydraulic module is greater than a second preset value, adjusting the operating frequency of the compressor according to an outlet water temperature of the hydraulic module comprises:

in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is less than or equal to the first preset value, and the second energy demand information indicating that the heating capacity demand of the at least one hydraulic module is greater than a second preset value, determining a current first condensation temperature of the hydraulic module according to the outlet water temperature;
 determining a second frequency correction value according to the first condensation temperature and a target condensation temperature;
 obtaining a second target frequency after adjusting the initial frequency of the compressor according to the second frequency correction value; and
 controlling the compressor to operate at the second target frequency.

[0013] In an embodiment, the determining the current first condensation temperature of the hydraulic module according to the outlet water temperature comprises:

determining a temperature correction value according to the outlet water temperature and a set water temperature of the hydraulic module;
 obtaining a reference condensation temperature after correcting a preset condensation temperature according to the temperature correction value; and
 determining the first condensation temperature according to the reference condensation temperature.

[0014] In an embodiment, the determining the temperature correction value according to the outlet water temperature and the set water temperature of the hydraulic module comprises:

determining a second temperature difference value between the set water temperature and the outlet water temperature;
 determining a temperature adjustment value according to the second temperature difference value; and
 obtaining the temperature correction value after adjusting the set water temperature according to the temperature adjustment value,
 the temperature adjustment value shows an increasing trend as the second temperature difference value increases, and/or the temperature adjustment value shows a decreasing trend as the second temperature difference value decreases.

[0015] In an embodiment, the determining the first condensation temperature according to the reference condensation temperature comprises:

in response to the reference condensation temperature being within a preset temperature interval, the reference condensation temperature being the first condensation temperature;
 in response to the reference condensation temperature being less than a minimum critical value of the preset temperature interval, the minimum critical value being the first condensation temperature; and
 in response to the reference condensation temperature being greater than a maximum critical value of the preset temperature interval, the maximum critical value being the first condensation temperature.

[0016] In an embodiment, before the determining the first condensation temperature according to the reference condensation temperature, the method further comprises:

obtaining an outdoor ambient temperature and the current operating frequency of the compressor; and
 determining the maximum critical value based on the outdoor ambient temperature and the operating frequency.

[0017] In an embodiment, the determining the second frequency correction value according to the first condensation temperature and the target condensation temperature comprises:

determining a third temperature difference value between the target condensation temperature and the second condensation temperature;
 in response to the third temperature difference value being greater than or equal to the third preset temperature difference, a third target correction value being the second frequency correction value; and
 in response to the third temperature difference value being less than the fourth preset temperature difference, a fourth target correction value being the second frequency correction value,
 the fourth preset temperature difference is less than or equal to the third preset temperature difference, the second

target frequency corresponding to the third target correction value is greater than the initial frequency, and the second target frequency corresponding to the fourth target correction value is less than the initial frequency.

[0018] In an embodiment, in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is less than or equal to the first preset value, and the second energy demand information indicating that the heating capacity demand of the at least one hydraulic module is greater than a second preset value, adjusting the operating frequency of the compressor according to an outlet water temperature of the hydraulic module comprises:

in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is less than or equal to the first preset value, and the second energy demand information indicating that the heating capacity demand of the at least one hydraulic module is greater than a second preset value, determining the third target frequency according to the first target temperature difference, the second target temperature difference, the outlet water temperature and the set water temperature of the hydraulic module; and controlling the compressor to operate at the third target frequency;

the first target temperature difference is a temperature difference between a first actual condensation temperature of the hydraulic module and the set condensation temperature at a current moment, and the second target temperature difference is a temperature difference between the set condensation temperature and the second actual condensation temperature of the hydraulic module when a last time adjusting the operating frequency of the compressor according to a water temperature at an outlet of the hydraulic module, the first actual condensation temperature is a parameter corresponding to the outlet water temperature, and the second actual condensation temperature is a parameter corresponding to the water temperature at the outlet.

[0019] In an embodiment, the determining the third target frequency according to the first target temperature difference, the second target temperature difference, the outlet water temperature and the set water temperature of the hydraulic module comprises:

determining a third temperature difference value between the first target temperature difference and the second target temperature difference, and determining a fourth temperature difference value between the set water temperature and the outlet water temperature;

determining a target frequency adjustment value according to the third temperature difference value and the fourth temperature difference value; and

obtaining the third target frequency by adjusting the current operating frequency of the compressor according to the target frequency adjustment value,

the third target frequency shows an increasing trend as the third temperature difference value increases, and the third target frequency shows an increasing trend as the fourth temperature difference value increases.

[0020] In an embodiment, while or after the adjusting the operating frequency of the compressor according to the target parameter corresponding to the first energy demand information and the second energy demand information, the method further comprises:

adjusting an opening of a first electronic expansion valve of the air conditioner indoor unit so that the temperature difference between an actual heat exchange temperature of the air conditioner indoor unit and a first target heat exchange temperature is less than a first set temperature difference; and/or

adjusting an opening of a second electronic expansion valve of the hydraulic module so that the temperature difference between an actual heat exchange temperature of the hydraulic module and a second target heat exchange temperature is less than a second set temperature difference,

the first target heat exchange temperature and/or the second target heat exchange temperature are determined according to the first energy demand information and the second energy demand information.

[0021] In an embodiment, the adjusting the opening of the first electronic expansion valve of the air conditioner indoor unit comprises:

obtaining the current first heat exchange temperature of the air conditioner indoor unit;

determining a first opening adjustment value according to a first deviation value between the first heat exchange temperature and the first target heat exchange temperature; and

adjusting the opening of the first electronic expansion valve according to the first opening adjustment value;

the first opening adjustment value shows an increasing trend as the first deviation value increases.

[0022] In an embodiment, the adjusting an opening of a second electronic expansion valve of the hydraulic module comprises:

obtaining a first temperature of a refrigerant inlet of the hydraulic module and a second temperature of a refrigerant outlet of the hydraulic module;
 determining a second heat exchange temperature of the hydraulic module according to the first temperature and the second temperature;
 determining a second opening adjustment value according to a second deviation value between the second heat exchange temperature and the second target heat exchange temperature; and
 adjusting the opening of the second electronic expansion valve according to the second opening adjustment value, the second opening adjustment value shows an increasing trend as the second deviation value increases.

[0023] Moreover, in order to achieve the above objective, the present application further provides a VRF heat pump system, comprising: a compressor, at least one hydraulic module, at least one air conditioner indoor unit, and a control device. The at least one hydraulic module and the at least one air conditioner indoor unit are both connected to the compressor. The compressor, the at least one hydraulic module and the at least one air conditioner indoor unit are all connected to the control device. The control device comprises: a memory, a processor and a program for controlling the VRF heat pump system stored on the memory and executable on the processor. When the program for controlling the VRF heat pump system is executed by the processor, the method for controlling the VRF heat pump system as described above is implemented.

[0024] Moreover, in order to achieve the above objective, the present application further provides a computer-readable storage medium. A program for controlling the VRF heat pump system is stored in the storage medium, and when the program for controlling the VRF heat pump system is executed by a processor, the method for controlling the VRF heat pump system as mentioned above is implemented.

[0025] The method for controlling a VRF heat pump system provided by the present application is based on a VRF heat pump system in which a compressor is connected to at least one hydraulic module and at least one air conditioner indoor unit. Based on the first energy demand information and the second energy demand information representing the actual demand of the heating capacity of the air conditioner indoor unit and the hydraulic module, the method can determine the corresponding target parameters to regulate the compressor frequency, thereby ensuring that the compressor output capacity can simultaneously meeting the actual heat exchange demand of the air conditioner indoor unit and the hydraulic module, and realizing the output capacity of the compressors accurately matching the actual indoor heat exchange demand, so that the indoor ambient temperature adjustment and the heat supply of the hydraulic module can be effectively balanced.

BRIEF DESCRIPTION OF THE DRAWINGS

[0026]

FIG. 1 is a schematic structural diagram of a variable refrigerant flow (VRF) heat pump system of the present application.

FIG. 2 is a schematic diagram of a hardware structure involved in an operation according to an embodiment of the VRF heat pump system of the present application.

FIG. 3 is a schematic flowchart of a method for controlling the VRF heat pump system according to an embodiment of the present application.

FIG. 4 is a schematic flowchart of the method for controlling the VRF heat pump system according to another embodiment of the present application.

FIG. 5 is a schematic flowchart of the method for controlling the VRF heat pump system according to another embodiment of the present application.

FIG. 6 is a numerical relationship diagram between a second temperature difference value and a temperature adjustment value involved in an embodiment in FIG. 5.

FIG. 7 is a schematic flowchart of the method for controlling the VRF heat pump system according to another embodiment of the present application.

FIG. 8 is a schematic flowchart of the method for controlling the VRF heat pump system according to another embodiment of the present application.

[0027] The present application is further described with reference to the embodiments and the accompanying drawings.

DETAILED DESCRIPTION OF THE EMBODIMENTS

[0028] It should be understood that the embodiments described here are only used to explain the present application and are not intended to limit the present application.

[0029] The main technical solution according to the embodiments of the present application is to provide a control method based on a variable refrigerant flow (VRF) heat pump system. The VRF heat pump system comprises a compressor, at least one hydraulic module and at least one air conditioner indoor unit. The at least one hydraulic module and the at least one air conditioner indoor unit are both connected to the compressor, and the method comprises: obtaining a first energy demand information of the at least one air conditioner indoor unit and a second energy demand information of the at least one hydraulic module; the first energy demand information represents a heating capacity demand of the at least one air conditioner indoor unit, and the second energy demand information represents a heating capacity demand of the at least one hydraulic module; and adjusting an operating frequency of the compressor according to target parameters corresponding to the first energy demand information and the second energy demand information.

[0030] In the related art, in a VRF system provided with an indoor air duct unit and a hydraulic module, the operating frequency of the outdoor compressor is generally regulated according to the preset fixed exhaust pressure or the temperature in the middle of the coil of the air duct unit, which is easy to cause the output capacity of the compressor does not match the actual indoor heat exchange demand, resulting in frequent compressor shutdowns.

[0031] The present application provides solution to the above problems, aiming to accurately match the output capacity of the compressor with the actual indoor heat exchange demand, so as to effectively balance the indoor ambient temperature adjustment and the heat supply of the hydraulic module.

[0032] The embodiment of the present application provides a VRF heat pump system.

[0033] In the embodiment of the present application, as shown in FIG. 1 and FIG. 2, a VRF heat pump system comprises a compressor 1, at least one hydraulic module 2, at least one air conditioner indoor unit 3, and a control device. The compressor 1, at least one hydraulic module 2, and at least one air conditioner indoor unit 3 are all connected to the control device.

[0034] In an embodiment, the quantity of the air conditioner indoor unit 3 and the hydraulic module 2 is more than one. In other embodiments, the quantity of the air conditioner indoor unit 3 and the hydraulic module 2 can also be provided according to actual demands.

[0035] At least one hydraulic module 2 and at least one air conditioner indoor unit 3 can be installed in the same space or distributed in different space areas according to actual demands. Different spatial regions here specifically refer to spatial regions that are separated from each other.

[0036] The hydraulic module 2 is provided with water channels and refrigerant flow channels. A first electronic expansion valve 21 is provided on the refrigerant flow channel to regulate the refrigerant flow in the refrigerant flow channel. The refrigerant flow channel exchanges heat with the water channel to provide heat for the water in the water channel. The refrigerant flow channels in the compressor 1, outdoor heat exchanger 4, throttling device and hydraulic module 2 are connected in sequence to form a refrigerant circulation loop. Among them, the inlet and outlet of the refrigerant flow channel of the hydraulic module 2 are respectively provided with a first temperature sensor 01 and a second temperature sensor 02, which are configured to detect the first temperature of the refrigerant inlet and the second temperature of the refrigerant outlet of the hydraulic module 2. A third temperature sensor 03 is provided at the outlet of the water channel of the hydraulic module 2 to detect the outlet water temperature of the hydraulic module 2.

[0037] In an embodiment, the hydraulic module 2 can be connected to at least one floor heating module and/or at least one hot water module to provide heat for the floor heating module (such as capillary floor or radiator, etc.) and/or the hot water module. In an embodiment, the water outlet end of the hydraulic module 2 is connected to the water inlet end of the floor heating module, the water outlet end of the floor heating module is connected to the water inlet end of the hydraulic module 2, and the water channel in the hydraulic module 2 is connected with the floor heating module to form a water circulation loop. The water outlet end of the hydraulic module 2 is connected to the water inlet end of the hot water module, the water outlet end of the hot water module is connected to the water inlet end of the hydraulic module 2, and the water channel in the hydraulic module 2 is connected with the hot water module to form a water circulation loop.

[0038] The air conditioner indoor unit 3 comprises an indoor heat exchanger 31 and a second electronic expansion valve 32 connected to the indoor heat exchanger 31. The second electronic expansion valve can regulate the flow of refrigerant flowing into the indoor heat exchanger 31. The air conditioner indoor unit 3 further comprises a fan provided corresponding to the indoor heat exchanger 31. The fan can drive the indoor air to pass through the indoor heat exchanger 31 for heat exchange and drive the heat-exchanged air into the room. A fourth temperature sensor 04 is provided on the indoor heat exchanger 31 and is configured to detect the coil temperature of the indoor heat exchanger 31.

[0039] The exhaust side of the compressor can be provided with a pressure sensor 05, which is configured to detect the exhaust pressure of the compressor.

[0040] In the embodiment of the present application, as shown in FIG. 2, the control device of the VRF heat pump system comprises: a processor 1001 (such as a central processing unit (CPU)), a memory 1002, a timer 1003, etc. The

memory 1002 may be a highspeed random-access memory (RAM) or a stable memory (non-volatile memory (NVM)), such as a disk memory. In an embodiment, the memory 1002 may be a storage device independent of the aforementioned processor 1001.

[0041] The above-mentioned compressor 1, hydraulic module 2, air conditioner indoor unit 3, first temperature sensor 01, second temperature sensor 02, third temperature sensor 03, fourth temperature sensor 04 and pressure sensor 05 can all be connected to the above control device.

[0042] Those skilled in the art can understand that the device structure shown in FIG. 2 does not constitute a limitation of the device, and may comprise more or fewer components than shown, or combine certain components, or different components arrangement.

[0043] As shown in FIG. 2, a memory 1002, which is a computer-readable storage medium, may comprise a control program of a VRF heat pump system. In the device shown in FIG. 2, the processor 1001 may be configured to call the program for controlling the VRF heat pump system stored on the memory 1002 and perform relevant steps of the method for controlling the VRF heat pump system in the following embodiments.

[0044] Embodiments of the present application further provide a method for controlling a VRF heat pump system, which is configured to control the above-mentioned VRF heat pump system.

[0045] As shown in FIG. 3, an embodiment of the method for controlling the VRF heat pump system of the present application is provided. In the embodiment, the method for controlling the VRF heat pump system comprises:

[0046] Step S10, obtaining a first energy demand information of the at least one air conditioner indoor unit and a second energy demand information of the at least one hydraulic module; the first energy demand information represents a heating capacity demand of the at least one air conditioner indoor unit, and the second energy demand information represents a heating capacity demand of the at least one hydraulic module.

[0047] It should be noted that the first energy demand information represents the heating capacity demand of all air conditioner indoor units connected to the compressor 1, and the second energy demand information represents the heating capacity demand of all hydraulic modules connected to the compressor 1.

[0048] In an embodiment, the first energy demand information here can be determined based on whether all air conditioner indoor units are turned on and the indoor temperature reaching condition when the air conditioner indoor units are turned on (such as whether the indoor temperature reaches the set temperature, the temperature deviation between the indoor temperature and the set temperature, etc.). The second energy demand information here can be determined based on whether all hydraulic modules are turned on and the water temperature reaching condition when hydraulic modules are turned on (such as whether the outlet water temperature reaches the set water temperature, the temperature deviation between the outlet water temperature and the set water temperature, etc.).

[0049] The first energy demand information here can be represented by a first energy demand value. The first energy demand value is greater than the first set value (for example, greater than 0), indicating that the heating capacity demand of at least one air conditioner indoor unit is greater than the first preset value (for example, greater than 0W), that is, there is currently a turned on air conditioner indoor unit and the room temperature of the active space of the turned on air conditioner indoor unit has not reached the set temperature of the indoor unit. The first energy demand value is less than or equal to the first set value (for example, equal to 0), indicating that the heating capacity demand of at least one air conditioner indoor unit is less than or equal to the first preset value (for example, equal to 0W), that is, there is currently a turned on air conditioner indoor unit and the room temperature of the active space of the turned on air conditioner indoor unit has reached the set temperature of the indoor unit. The second energy demand information here can be represented by a second energy demand value. The second energy demand value is greater than the second set value (for example, greater than 0), indicating that the heating capacity demand of at least one hydraulic module is greater than the second preset value (for example, greater than 0W), that is, there is currently a turned on hydraulic module and the water temperature (such as outlet water temperature) of the turned on hydraulic module has not reached the set water temperature of the hydraulic module. The second energy demand value is less than or equal to the second set value (such as equal to 0), indicating that the heating capacity demand of at least one hydraulic module is less than or equal to the second preset value (for example, equal to 0W), that is, there is currently a turned on hydraulic module and the water temperature of the turned on hydraulic module has reached the set water temperature of the hydraulic module.

[0050] Step S20, adjusting an operating frequency of the compressor according to target parameters corresponding to the first energy demand information and the second energy demand information.

[0051] The target parameter here is specifically the basis for regulating the operating frequency of the compressor.

[0052] Different first energy demand information and different second energy demand information correspond to different target parameters. The target parameters may be one of the first operating characteristic parameters of the air conditioner indoor unit (temperature of the indoor heat exchanger, room temperature of the space where the indoor unit is located, and/or the speed of the fan in the indoor unit, etc.) and the second operating characteristic parameters of the hydraulic module (such as water temperature, the opening of the electronic expansion valve of the hydraulic module and/or the room temperature of the space where the hydraulic module is located, etc.). In an embodiment, one of the

first operating characteristic parameter and the second operating characteristic parameter can be determined as the target parameter according to the first energy demand information and the second energy demand information, and the operating frequency of the compressor can be regulated according to the determined target parameter. In an embodiment, the target frequency of compressor operation can be determined according to the target parameters, and the compressor can be controlled to operate at the target frequency. The adjustment direction of the compressor frequency (such as increasing, maintaining the same, or decreasing) can also be determined according to the target parameters. The compressor operating frequency is adjusted according to the determined adjustment direction.

[0053] In other embodiments, the target parameters may also comprise the above-mentioned first operating characteristic parameters and second operating characteristic parameters. Different first energy demand information and different second energy demand information may correspond to different first operating characteristic parameters and second operating characteristic parameters. Based on this, the first operating characteristic parameter and the second operating characteristic parameter and their respective corresponding first weight value and second weight value can be determined according to the first energy demand information and the second energy demand information. The first frequency is determined according to the first operating characteristic parameter, and the second frequency is determined according to the second operating characteristic parameter. The target frequency of compressor operation is calculated according to the first frequency and its corresponding first weight value, the second frequency and its corresponding second weight value, and the compressor is controlled to operate according to the determined target frequency.

[0054] The embodiment of the present application provides a method for controlling a VRF heat pump system based on a VRF heat pump system in which a compressor is connected to at least one hydraulic module and at least one air conditioner indoor unit. Based on the first energy demand information and the second energy demand information representing the actual demand of the heating capacity of the air conditioner indoor unit and the hydraulic module, the method can determine the corresponding target parameters to regulate the compressor frequency, thereby ensuring that the compressor output capacity can simultaneously meeting the actual heat exchange demand of the air conditioner indoor unit and the hydraulic module, and realizing the output capacity of the compressors accurately matching the actual indoor heat exchange demand, so that the indoor ambient temperature adjustment and the heat supply of the hydraulic module can be effectively balanced.

[0055] In the above embodiment, step S20 comprises:

in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is greater than a first preset value, adjusting the operating frequency of the compressor according to an indoor heat exchanger temperature of a currently turned-on air conditioner indoor unit, the target parameters comprise the indoor heat exchanger temperature.

[0056] When the first energy demand information is that the heating capacity demand of at least one air conditioner indoor unit is greater than the first preset value, that is, when the air conditioner indoor unit connected to the compressor has energy demand or the energy demand is large, regardless of the second energy demand information is that the heating capacity demand of at least one hydraulic module is greater than the second preset value or the second energy demand information is that the heating capacity demand of at least one hydraulic module is less than or equal to the second preset value. At this time, the operating frequency of the compressor is regulated based on the indoor heat exchanger temperature of all air conditioner indoor units currently turned-on or the indoor heat exchanger temperature of the air conditioner indoor unit with the required heating capacity greater than the first preset value, which is beneficial to ensuring that the heat output by the compressor simultaneously meets the temperature adjustment demand of the space where the indoor unit is located and the heating demand of the hydraulic module.

[0057] The indoor heat exchanger temperature can be determined according to the temperature data detected by the temperature sensor provided on the indoor heat exchanger coil, or can be determined according to the operating parameters in the outdoor unit related to the indoor heat exchanger temperature (such as the exhaust pressure of the compressor and/or the exhaust temperature, etc.).

[0058] In response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is less than or equal to the first preset value, and the second energy demand information indicating that the heating capacity demand of the at least one hydraulic module is greater than a second preset value, adjusting the operating frequency of the compressor according to an outlet water temperature of the hydraulic module, the target parameter comprises the outlet water temperature.

[0059] In an embodiment, the outlet water temperature can be detected by a temperature sensor located at the water outlet of the hydraulic module.

[0060] In response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is less than or equal to the first preset value, and the second energy demand information indicating that the heating capacity demand of the at least one hydraulic module is greater than a second preset value, that is, the air conditioner indoor unit connected to the compressor has no energy demand or a small energy demand, and the hydraulic module connected to the compressor has an energy demand or a large energy demand. At this time, the operating frequency of the compressor is regulated by the outlet water temperature of the hydraulic module, which

can ensure that the indoor ambient temperature adjustment demand is met and avoid excessive heat output from the compressor, prevent the outlet water temperature of the hydraulic module from frequently reaching the set water temperature and causing the compressor to frequently reach temperature and shut down, thereby ensuring the stability of compressor operation and the persistency of heat supply of the VRF heat pump system.

[0061] In other embodiments, the first energy demand information is a first energy demand value determined based on the heating capacity demand of all air conditioner indoor units, and the second energy demand information is a second energy demand value determined based on the heating capacity demand of all hydraulic modules. When the first energy demand value is greater than the second energy demand value, the above-mentioned indoor heat exchanger temperature target parameter can be determined, and the compressor operating frequency is regulated according to the indoor heat exchanger temperature. When the first energy demand value is less than or equal to the second energy demand value, the outlet water temperature of the hydraulic module can be determined as the target parameter, and the operating frequency of the compressor can be regulated according to the outlet water temperature of the hydraulic module.

[0062] Based on the above embodiment, another embodiment of the method for controlling the VRF heat pump system of the present application is provided. In an embodiment, as shown in FIG. 4, the in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is greater than the first preset value, adjusting the operating frequency of the compressor according to an indoor heat exchanger temperature of the currently turned-on air conditioner indoor unit comprises:

Step S21, in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is greater than the first preset value, determining a first frequency correction value according to the indoor heat exchanger temperature and a preset heat exchanger temperature.

[0063] In an embodiment, the preset heat exchanger temperature is the preset temperature target value that the indoor heat exchanger of the air conditioner indoor unit needs to reach during the heating process.

[0064] Different indoor heat exchanger temperatures and preset heat exchanger temperatures may correspond to different first frequency correction values. A first correspondence relationship between the indoor heat exchanger temperature, the preset heat exchanger temperature and the first frequency correction value is established in advance. The first correspondence relationship may be a calculation relationship, a mapping relationship, etc. Based on the first correspondence relationship, the current first frequency correction value can be obtained according to the indoor heat exchanger temperature and the preset heat exchanger temperature by table lookup, and calculation, etc.

[0065] In an embodiment, the first temperature difference value between the indoor heat exchanger temperature and the preset heat exchanger temperature is determined. In response to that the first temperature difference value is greater than or equal to the first preset temperature difference, the first target correction value is the first frequency correction value. In response to that the first temperature difference value is less than the second preset temperature difference, the second target correction value is the first frequency correction value. The second preset temperature difference is less than or equal to the first preset temperature difference, the first target frequency corresponding to the first target correction value is greater than the initial frequency, and the first target frequency corresponding to the second target correction value is smaller than the initial frequency. In an embodiment, the first temperature difference value is the difference between the preset heat exchanger temperature M and the indoor heat exchanger temperature N (i.e. M-N). The first preset temperature difference is greater than 0, and the second preset temperature difference is less than 0. Based on this, when the first temperature difference value is greater than or equal to the first preset temperature difference, it indicates that the preset heat exchanger temperature is greater than the indoor heat exchanger temperature and the deviation is large. At this time, the initial frequency is obtained by increasing the first target correction value, which is conducive to quickly increasing the actual heat exchange temperature of the air conditioner indoor unit to the preset heat exchanger temperature. When the first temperature difference value is less than the second preset temperature difference, it indicates that the preset heat exchanger temperature is less than the indoor heat exchanger temperature, and the deviation is large, at this time, the first target frequency is obtained by reducing the initial frequency through the second target correction value.

[0066] In an embodiment, $X = \text{preset heat exchanger temperature} - \text{indoor heat exchanger temperature}$, then the corresponding frequency correction value can be determined according to the following table to adjust the initial frequency of the compressor:

First temperature difference value (°C)	$X < -3$	$-3 \leq X < -2$	$-2 \leq X < -1$	$-1 \leq X < 1$	$1 \leq X < 2$	$2 \leq X < 3$	$X \geq 3$
Frequency correction value (Hz)	-5	-2	-1	0	+1	+2	+3

[0067] 1 in the above table is the above-mentioned first preset temperature, and -1 in the above table is the above-mentioned second preset temperature.

[0068] Step S22, obtaining a first target frequency after adjusting an initial frequency of the compressor according to

the first frequency correction value.

[0069] In an embodiment, the initial frequency can be a preset fixed frequency or the current operating frequency of the compressor.

[0070] In an embodiment, the first target frequency can be obtained according to the first frequency correction value being increased, decreased, or maintained as the initial frequency. In the embodiment, the first frequency correction value can represent both the frequency correction direction and the frequency correction amplitude, and then the sum of the first frequency correction value and the initial frequency can be used as the first target frequency. In other embodiments, the first frequency correction value may only represent the frequency correction amplitude, and then the frequency adjustment direction may be determined according to the indoor heat exchanger temperature and the preset heat exchanger temperature. When the frequency adjustment direction is to reduce the initial frequency, the difference between the initial frequency and the first frequency correction value can be used as the first target frequency. When the frequency adjustment direction is to increase the initial frequency, the sum of the initial frequency and the first frequency correction value can be used as the first target frequency.

[0071] Step S23, controlling the compressor to operate at the first target frequency.

[0072] When the compressor operates at the first target frequency, the actual heat exchange temperature of the air conditioner indoor unit can maintain the preset heat exchanger temperature.

[0073] In this embodiment, when at least one air conditioner indoor unit has energy demand or the energy demand is large, the compressor frequency is regulated according to the above method, which can ensure that the heat exchange temperature of the air conditioner indoor unit is maintained at the preset heat exchanger temperature, thereby meeting the temperature adjustment demand of the indoor environment.

[0074] In an embodiment, before the adjusting the operating frequency of the compressor according to an indoor heat exchanger temperature of the currently turned-on air conditioner indoor unit, the indoor heat exchanger temperature of the currently turned-on air conditioner indoor unit can be obtained to regulate the frequency of the compressor in one of the following two methods.

[0075] Method 1: in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is greater than the first preset value, obtaining an exhaust pressure of the compressor; determining a condensation temperature of the currently turned-on air conditioner indoor unit according to the exhaust pressure, the indoor heat exchanger temperature comprises the condensation temperature.

[0076] In an embodiment, a quantitative relationship between the exhaust pressure and the condensation temperature can be preset, and based on the quantitative relationship, the condensation temperature of the currently turned-on air conditioner indoor unit is determined by calculating through the exhaust pressure. In an embodiment, a mapping table between exhaust pressure and condensation temperature may be preset, and the condensation temperature of the currently turned-on air conditioner indoor unit may be obtained by querying the mapping table through the exhaust pressure.

[0077] It should be noted that the condensation temperature here represents the temperature value of the comprehensive saturation temperature of the indoor heat exchangers of all air conditioner indoor units currently turned-on during the condensation process.

[0078] Method 2: in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is greater than the first preset value, obtaining a rated heating capacity of the currently turned-on air conditioner indoor unit and a coil temperature of an indoor heat exchanger corresponding to the currently turned-on air conditioner indoor unit; determining a weight value of each currently turned-on air conditioner indoor unit according to the rated heating capacity; and determining the indoor heat exchanger temperature according to the coil temperature and a weight value corresponding to the coil temperature.

[0079] For example, there are currently n indoor units that have energy demand, and the rated heating capacity is respectively n1, n2, n3...nx kW, and the coil temperature of each indoor unit corresponds to T21, T22, T23...T2x °C,

$$T_{2avg} = \frac{n1 \cdot T_{21} + n2 \cdot T_{22} + n3 \cdot T_{23} + \dots + nx \cdot T_{2x}}{n1 + n2 + n3 + \dots + nx}$$

then the indoor heat exchanger temperature

[0080] In an embodiment, after step S10, the method further comprises: in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is greater than the first preset value, obtaining an installation status information of a pressure sensor on an exhaust side of the compressor; in response to the installation status information indicating that the pressure sensor is not installed on the exhaust side of the compressor, obtaining the indoor heat exchanger temperature in the above method 1. In response to the installation status information indicating that the pressure sensor is installed on the exhaust side of the compressor, obtaining the indoor heat exchanger temperature in the above method 2. The installation status information here can be determined by obtaining instructions input by the user.

[0081] In an embodiment, through the above method, it can be ensured whether a pressure sensor is installed on the exhaust side of the compressor, and the indoor heat exchanger temperature representing the heat exchange situation

of the currently turned-on air conditioner indoor unit can be effectively obtained.

[0082] Based on any one of the above embodiments, another embodiment of the method for controlling the VRF heat pump system of the present application is provided. In the embodiment, as shown in FIG. 5, the in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is less than or equal to the first preset value, and the second energy demand information indicating that the heating capacity demand of the at least one hydraulic module is greater than a second preset value, adjusting the operating frequency of the compressor according to an outlet water temperature of the hydraulic module comprises:

Step S201, in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is less than or equal to the first preset value, and the second energy demand information indicating that the heating capacity demand of the at least one hydraulic module is greater than a second preset value, determining a current first condensation temperature of the hydraulic module according to the outlet water temperature.

[0083] In an embodiment, the first condensation temperature here is the saturation temperature of the water output from the hydraulic module during the heat exchange process (such as the saturation temperature of the capillary floor or radiator during the heat exchange process).

[0084] Different outlet water temperatures correspond to different first condensation temperatures. The second correspondence relationship between the outlet water temperature and the first condensation temperature can be preset, and can be a calculation formula, a mapping table, etc. Based on the second correspondence relationship, the first condensation temperature here can be calculated or queried through the outlet water temperature or the mapping table.

[0085] Step S202, determining a second frequency correction value according to the first condensation temperature and a target condensation temperature.

[0086] In an embodiment, the target condensation temperature here is the preset target temperature value that the hydraulic module needs to reach during the heating process.

[0087] Different first condensation temperatures and target condensation temperatures may correspond to different second frequency correction values. A third correspondence relationship between the first condensation temperature, the target condensation temperature and the second frequency correction value is established in advance. The third correspondence relationship may be a calculation relationship, a mapping relationship, etc. Based on the third correspondence relationship, the current second frequency correction value can be obtained according to the first condensation temperature and the target condensation temperature by table lookup, calculation, etc.

[0088] In an embodiment, a third temperature difference value between the target condensation temperature and the second condensation temperature is determined. When the third temperature difference value is greater than or equal to the third preset temperature difference, a third temperature difference value is determined. The target correction value is the second frequency correction value; when the third temperature difference value is less than the fourth preset temperature difference, the fourth target correction value is determined to be the second frequency correction value; the fourth preset temperature difference is less than or equal to the third preset temperature difference, the second target frequency corresponding to the third target correction value is greater than the initial frequency, and the second target frequency corresponding to the fourth target correction value is less than the initial frequency. In the embodiment, the third temperature difference value is the difference between the preset heat exchanger temperature P and the indoor heat exchanger temperature Q (i.e., P-Q). The third preset temperature difference is greater than 0, and the fourth preset temperature difference is less than 0. Based on this, when the third temperature difference value is greater than or equal to the third preset temperature difference, it indicates that the target condensation temperature is greater than the first condensation temperature and the deviation is large. At this time, the second target frequency is obtained by increasing the initial frequency through the third target correction value, which is conducive to the actual heat exchange temperature of the hydraulic module to quickly increase to the target condensation temperature. When the third temperature difference value is less than the fourth preset temperature difference, it indicates that the target condensation temperature is less than the first condensation temperature and the deviation is large. At this time, the second target frequency is obtained by decreasing the initial frequency through the fourth target correction value.

[0089] In an embodiment, $Y = \text{target condensation temperature} - \text{first condensation temperature}$, then the corresponding frequency correction value can be determined according to the following table to adjust the initial frequency of the compressor:

The third temperature difference value ($^{\circ}\text{C}$)	$Y < -3$	$-3 \leq Y < -2$	$-2 \leq Y < -1$	$-1 \leq Y < 1$	$1 \leq Y < 2$	$2 \leq Y < 3$	$Y \geq 3$
Frequency correction value (Hz)	-5	-2	-1	0	+1	+2	+3

[0090] 1 in the above table is the above-mentioned third preset temperature, and -1 in the above table is the above-mentioned fourth preset temperature.

[0091] Step S203, obtaining a second target frequency after adjusting the initial frequency of the compressor according to the second frequency correction value.

[0092] The initial frequency here can be a preset fixed frequency or the current operating frequency of the compressor.

[0093] In an embodiment, the initial frequency can be increased, decreased, or maintained according to the second frequency correction value to obtain the second target frequency. In the embodiment, the second frequency correction value can represent both the frequency correction direction and the frequency correction amplitude, and then the sum of the second frequency correction value and the initial frequency can be used as the second target frequency. In other embodiments, the second frequency correction value may only represent the frequency correction amplitude, and then the frequency adjustment direction may be determined based on the indoor heat exchanger temperature and the preset heat exchanger temperature. When the frequency adjustment direction is to reduce the initial frequency, the difference between the initial frequency and the second frequency correction value can be used as the second target frequency; when the frequency adjustment direction is to increase the initial frequency, the sum of the initial frequency and the second frequency correction value can be used as the second target frequency.

[0094] Step S204, controlling the compressor to operate at the second target frequency.

[0095] In an embodiment, when at least one air conditioner indoor unit has no energy demand or has a small energy demand and the hydraulic module has energy demand or a large energy demand, the compressor frequency is regulated in the above method to ensure that the indoor ambient temperature adjustment demand is met and the output capacity of the compressor can match the heat demand of the hydraulic module, preventing the water temperature of the hydraulic module from reaching the set water temperature too quickly, and effectively preventing the compressor from frequently reaching the temperature and shutting down.

[0096] In an embodiment, the determining the current first condensation temperature of the hydraulic module according to the outlet water temperature comprises:

Step S201a, determining a temperature correction value according to the outlet water temperature and a set water temperature of the hydraulic module.

[0097] In an embodiment, the set water temperature here is the target value that the outlet water temperature of the hydraulic module needs to reach in advance. The set water temperature may be a temperature set by the user, or may be a temperature determined according to the target temperature that a target object needs to reach, and the target object is set by the user to be heated through the hydraulic module.

[0098] In an embodiment, the temperature correction value can be calculated according to the outlet water temperature and the set water temperature. For example, the difference between the outlet water temperature and the set temperature can be used as the temperature correction value. The temperature correction value can also be obtained by querying the preset mapping table through the outlet water temperature and the set water temperature.

[0099] In an embodiment, a second temperature difference value between the set water temperature and the outlet water temperature is determined; a temperature adjustment value is determined according to the second temperature difference value. The temperature correction value is obtained after the set water temperature is adjusted according to the temperature adjustment value. The temperature adjustment value shows an increasing trend as the second temperature difference value increases, and/or the temperature adjustment value shows a decreasing trend as the second temperature difference value decreases. In an embodiment, the second temperature difference value is specifically the difference between the set water temperature and the outlet water temperature. In other embodiments, the second temperature difference value can also be the absolute value of the difference between the outlet water temperature and the set water temperature. The second temperature difference value can be directly used as the temperature adjustment value, or the temperature adjustment value can be obtained by calculating the second temperature difference value or looking up a table based on the preset correspondence relationship between the temperature difference and the adjustment value. In the embodiment, the changing trend of the outlet water temperature can be obtained, and the correspondence relationship between the temperature difference and the adjustment value here is obtained based on the changing trend of the outlet water temperature. Different changing trends correspond to different correspondence relationships. When the outlet water temperature has an increasing trend, the temperature adjustment value corresponding to the second temperature difference value is determined based on the fourth correspondence relationship. When the outlet water temperature shows a decreasing trend, the temperature adjustment value corresponding to the second temperature difference value is determined based on the fifth correspondence relationship. As shown in FIG. 6, the temperature adjustment value corresponding to the outlet water temperature in the fourth correspondence relationship is greater than the temperature adjustment value corresponding to the outlet water temperature in the fifth correspondence relationship. In the embodiment, the sum of the set water temperature and the temperature adjustment value is used as the temperature correction value. In other embodiments, the difference, product or ratio of the set water temperature and the temperature adjustment value can also be used as the temperature correction value.

[0100] Step S201b, obtaining a reference condensation temperature after correcting a preset condensation temperature according to the temperature correction value.

[0101] In an embodiment, the preset condensation temperature is a preset temperature value, which can be a preset

fixed value or a temperature selected from a plurality of preset temperature values according to the current set water temperature of the hydraulic module.

[0102] In an embodiment, the sum of the temperature correction value and the preset condensation temperature can be used as the reference condensation temperature. In other implementations, the difference, product or ratio of the preset condensation temperature and the temperature correction value may also be used as the reference condensation temperature.

[0103] Step S201c, determining the first condensation temperature according to the reference condensation temperature.

[0104] The reference condensation temperature obtained above can be directly used as the first condensation temperature, or the result corrected according to a preset fixed correction value can be used as the first condensation temperature. The reference condensation temperature can also be compared with the preset temperature interval. If the reference condensation temperature is within the preset temperature interval, the reference condensation temperature can be directly used as the first condensation temperature. If the reference condensation temperature is out of the preset temperature interval, the critical value of the preset temperature interval can be used as the first condensation temperature. The preset temperature interval may be a first temperature interval, a second temperature interval or a third temperature interval. The first temperature interval is a temperature interval with a minimum critical value but without a maximum critical value. The second temperature interval is a temperature interval with a maximum critical value but without a minimum critical value, and the third temperature interval is a temperature interval with both a minimum critical value and a maximum critical value.

[0105] In order to better explain the determination process of the first condensation temperature involved in the embodiment, a specific application of the solution in the embodiment is provided below.

[0106] Definition: the first condensation temperature is T_{w_ch} , T_{w-out} is the outlet water temperature, T_{w_ch0} is the preset condensation temperature (default value 45°C , recommended value $40\sim 52^{\circ}\text{C}$), T_{1S} is the set water temperature, k is the temperature correction value, C is the preset constant (default value 45°C , recommended value $35\sim 50^{\circ}\text{C}$), ΔT_{WS} is the second temperature difference value, ΔT_{rs} is the intermediate parameter determined based on ΔT_{WS} . Based on this, the first condensation temperature can be determined by combining the following formula and FIG. 6. Formula (1), $T_{w_ch} = T_{w_ch0} + (T_{1S} - C) + k$. Formula (2), $k = \Delta T_{rs} - 1$, k value range: $-2 \leq k \leq 10$.

[0107] In an embodiment, the ΔT_{rs} corresponding to ΔT_{WS} is determined based on FIG. 2, and then k is calculated through ΔT_{rs} and formula (2), and then the first condensation temperature is further calculated through formula (1).

[0108] In an embodiment, the first condensation temperature is obtained after correcting the preset condensation temperature with the temperature correction value determined by combining the outlet water temperature and the set temperature of the hydraulic module, which ensures that the obtained first condensation temperature can accurately represent the current heat load situation of the hydraulic module, and ensures the accuracy of regulating the compressor frequency based on the determined first condensation temperature, the output capacity of the compressor matching the actual heating demand of the hydraulic module, and effectively prevent the compressor from frequently reaching the temperature and shutting down.

[0109] In an embodiment, the above-mentioned process of determining the first condensation temperature according to the reference condensation temperature is as follows: in response to the reference condensation temperature being within a preset temperature interval, the reference condensation temperature being the first condensation temperature; in response to the reference condensation temperature being less than a minimum critical value of the preset temperature interval, the minimum critical value being the first condensation temperature; and in response to the reference condensation temperature being greater than a maximum critical value of the preset temperature interval, the maximum critical value being the first condensation temperature. The maximum critical value and the minimum critical value can be preset fixed temperature values, or parameter values determined according to the current operating conditions of the VRF heat pump system. In the embodiment, the minimum critical value of the preset temperature interval is recommended to be 30°C , ranging from 25 to 35°C . In an embodiment, the value of the first condensation temperature is limited by the preset temperature interval, which can avoid the first condensation temperature being too high or too low, causing the compressor operating frequency to be too high or too low, so as to ensure reliable and stable operation of the compressor.

[0110] In an embodiment, before the determining the first condensation temperature according to the reference condensation temperature, the method further comprises: obtaining an outdoor ambient temperature and the current operating frequency of the compressor; and determining the maximum critical value based on the outdoor ambient temperature and the operating frequency. In the embodiment, the maximum critical value is obtained by querying a preset mapping table according to the outdoor ambient temperature and the operating frequency. In other embodiments, the maximum critical value can also be calculated according to the outdoor ambient temperature, the operating frequency and the preset formula.

[0111] For example, the maximum critical value can be obtained by querying the following table through the outdoor ambient temperature T_4 and compressor frequency F :

T4(°C) \ F(Hz)	F(Hz)	F≤45	45<F≤60	60<F≤70	70<F≤90	F≥90
T4≤-25		40	40	40	40	40
-25<T4≤-11		56	56	56	56	40
-11<T4≤10		62	62	62	58	40
10<T4≤15		56	62	62	58	40
15<T4≤23		56	58	54	50	40
T4>23		40	40	40	40	40

[0112] In an embodiment, the maximum critical value of the first condensation temperature is determined according to the outdoor ambient temperature and the current operating frequency of the compressor, thereby limiting the first condensation temperature based on the maximum critical value to ensure that when the operating frequency of the compressor is regulated according to the first condensation temperature, the reliability and stability of compressor operation are improved.

[0113] Based on any one of the above embodiments, another embodiment of the method for controlling the VRF heat pump system of the present application is provided. In the embodiment, as shown in FIG. 7, the in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is less than or equal to the first preset value, and the second energy demand information indicating that the heating capacity demand of the at least one hydraulic module is greater than a second preset value, adjusting the operating frequency of the compressor according to an outlet water temperature of the hydraulic module comprises:

Step S210, in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is less than or equal to the first preset value, and the second energy demand information indicating that the heating capacity demand of the at least one hydraulic module is greater than a second preset value, determining the third target frequency according to the first target temperature difference, the second target temperature difference, the outlet water temperature and the set water temperature of the hydraulic module. Step S220, controlling the compressor to operate at the third target frequency.

[0114] The first target temperature difference is a temperature difference between a first actual condensation temperature of the hydraulic module and the set condensation temperature at a current moment, and the second target temperature difference is a temperature difference between the set condensation temperature and the second actual condensation temperature of the hydraulic module when a last time adjusting the operating frequency of the compressor according to a water temperature at an outlet of the hydraulic module, the first actual condensation temperature is a parameter corresponding to the outlet water temperature, and the second actual condensation temperature is a parameter corresponding to the water temperature at the outlet.

[0115] The water temperature at the outlet here is equivalent to the outlet water temperature at a corresponding time. The determination process of the first actual condensation temperature and the second actual condensation temperature can be analogously referred to the above-mentioned determination process of the first condensation temperature, which will not be described again here. In an embodiment, the set condensation temperature is the target value that the preset first condensation temperature needs to reach.

[0116] Step S10, step S210 and step S220 can be executed cyclically. Based on this, in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is less than or equal to the first preset value, and the second energy demand information indicating that the heating capacity demand of the at least one hydraulic module is greater than a second preset value, during the cycle, the current third target frequency is determined by combining the temperature difference between the first actual condensation temperature of the hydraulic module and the set condensation value with the temperature difference between the second actual condensation temperature of the hydraulic module and the set condensation temperature in the last process of the third target frequency.

[0117] In an embodiment, the preset correspondence relationship between the first target temperature difference, the second target temperature difference, the outlet water temperature, the set water temperature and the third target

frequency can be preset. The preset correspondence relationship can be calculation formulas, mapping tables, etc. Based on the preset correspondence relationship, the third target frequency here can be calculated through the first target temperature difference, the second target temperature difference, the outlet water temperature and the set water temperature and/or looked up through a table.

[0118] In an embodiment, determining a third temperature difference value between the first target temperature difference and the second target temperature difference, and determining a fourth temperature difference value between the set water temperature and the outlet water temperature; determining a target frequency adjustment value according to the third temperature difference value and the fourth temperature difference value; and obtaining the third target frequency by adjusting the current operating frequency of the compressor according to the target frequency adjustment value. The third target frequency shows an increasing trend as the third temperature difference value increases, and the third target frequency shows an increasing trend as the fourth temperature difference value increases. In other words, the third target frequency shows a decreasing trend as the third temperature difference value decreases, and the third target frequency shows a decreasing trend as the fourth temperature difference value decreases.

[0119] In an embodiment, the third temperature difference value is the difference between the first target temperature difference and the second target temperature difference, and the fourth temperature difference value is the difference between the set water temperature and the outlet water temperature. In other embodiments, the third temperature difference value may be the absolute value of the difference between the first target temperature difference and the second target temperature difference, and the fourth temperature difference value may be the absolute value of the difference between the set water temperature and the outlet water temperature.

[0120] For example, the third temperature difference value $\Delta T1$ and the fourth temperature difference value $\Delta T2$ can be used to query the matching results in the following table as the target frequency adjustment value ΔF :

ΔF		$\Delta T1$						
		≥ 3	2	1	0	-1	-2	≤ -3
$\Delta T2$	≥ 7	+8	+7	+6	+5	+4	+3	+2
	6	+7	+6	+5	+5	+4	+3	+2
	5	+6	+5	+4	+4	+3	+2	+1
	4	+5	+4	+3	+2	+2	+1	+1
	3	+4	+3	+3	+2	+1	+1	0
	2	+3	+3	+2	+2	+1	0	-1
	1	+3	+2	+1	0	0	-1	-2
	0	+2	+2	+0	0	-1	-2	-3
	-1	+1	0	0	-1	-2	-3	-4
	-2	0	0	-1	-2	-3	-4	-5
	≤ -3	0	-1	-2	-3	-4	-5	-6

[0121] After querying ΔF through the above table, the third target frequency = $F_r + \Delta F$, where F_r is the current operating frequency of the compressor.

[0122] Based on any one of the above embodiments, another embodiment of the method for controlling the VRF heat pump system of the present application is provided. In the embodiment, as shown in FIG. 8, while or after step S20 is executed, the method further comprises:

Step S30, adjusting an opening of a first electronic expansion valve of the air conditioner indoor unit so that the temperature difference between an actual heat exchange temperature of the air conditioner indoor unit and a first target heat exchange temperature is less than a first set temperature difference; and/or adjusting an opening of a second electronic expansion valve of the hydraulic module so that the temperature difference between an actual heat exchange temperature of the hydraulic module and a second target heat exchange temperature is less than a second set temperature difference. The first target heat exchange temperature and/or the second target heat exchange temperature are determined according to the first energy demand information and the second energy demand information.

[0123] When the first energy demand information indicates that the heating capacity demand of the at least one air conditioner indoor unit is greater than the first preset value, the first target heat exchange temperature is the indoor heat exchanger temperature of the currently turned-on air conditioner indoor unit mentioned in the above embodiment. When

the first energy demand information is that the heating capacity demand of the at least one air conditioner indoor unit is less than or equal to the first preset value, and the second energy demand information is that the heating capacity demand of the at least one hydraulic module is greater than the second preset value. The second target heat exchange temperature is the first condensation temperature mentioned in the above embodiment. The specific determination process of the first target heat exchange temperature and the second target heat exchange temperature may be referred to the above embodiments and will not be described in detail here.

[0124] The actual heat exchange temperature of the air conditioner indoor unit specifically refers to the coil temperature of the indoor heat exchanger; the actual heat exchange temperature of the hydraulic module is specifically determined according to the temperature of the refrigerant flow channel of the hydraulic module.

[0125] It should be noted that when more than one air conditioner indoor unit are provided, the first electronic expansion valve of each air conditioner indoor unit is independently controlled based on its actual heat exchange temperature. If the actual heat exchange temperature is different, the opening of the corresponding first electronic expansion valve is adjusted in different ways, so that the actual heat exchange temperature of each air conditioner indoor unit can reach the first target heat exchange temperature. When more than one hydraulic module is provided, the second electronic expansion valve of each hydraulic module is independently controlled based on its actual heat exchange temperature. If the actual heat exchange temperature is different, the opening of the corresponding second electronic expansion valve is adjusted in different ways, so that the actual heat exchange temperature of each hydraulic module can reach the second target heat exchange temperature.

[0126] In an embodiment, regulating the electronic expansion valves of the air conditioner indoor unit and the hydraulic module in the above method can ensure that the refrigerant obtained by each indoor unit and the hydraulic module is equalized, ensuring the indoor ambient temperature adjustment demand while meeting the heating demand of the hydraulic module, which is also helpful to further improve the energy efficiency of the system.

[0127] In an embodiment, the first electronic expansion valve can be regulated according to the following process: obtaining the current first heat exchange temperature of the air conditioner indoor unit; determining a first opening adjustment value according to a first deviation value between the first heat exchange temperature and the first target heat exchange temperature; and adjusting the opening of the first electronic expansion valve according to the first opening adjustment value. The first opening adjustment value shows an increasing trend as the first deviation value increases. In an embodiment, the coil temperature of the indoor heat exchanger in the air conditioner indoor unit can be obtained as the first heat exchange temperature. In an embodiment, the first opening adjustment value here may be determined according to the difference or ratio between the first heat exchange temperature and the first target heat exchange temperature. When the first opening adjustment value is less than 0, the opening of the first electronic expansion valve is decreased according to the first opening adjustment value. When the first opening adjustment value is greater than 0, the opening of the first electronic expansion valve is increased according to the first opening adjustment value.

[0128] In an embodiment, the second electronic expansion valve can be regulated according to the following process: obtaining a first temperature of a refrigerant inlet of the hydraulic module and a second temperature of a refrigerant outlet of the hydraulic module; determining a second heat exchange temperature of the hydraulic module according to the first temperature and the second temperature; determining a second opening adjustment value according to a second deviation value between the second heat exchange temperature and the second target heat exchange temperature; and adjusting the opening of the second electronic expansion valve according to the second opening adjustment value. The second opening adjustment value shows an increasing trend as the second deviation value increases. In the embodiment, the average value of the difference between the first temperature and the second temperature is used as the second heat exchange temperature to represent the equivalent coil temperature of the waterway in the hydraulic module. In other embodiments, the minimum value of the first temperature and the second temperature or the difference between the first temperature and the second temperature may be directly used as the second heat exchange temperature. In an embodiment, the second opening adjustment value may be determined according to the difference or ratio between the second heat exchange temperature and the second target heat exchange temperature. When the second opening adjustment value is less than 0, the opening of the second electronic expansion valve is decreased according to the second opening adjustment value. When the second opening adjustment value is greater than 0, the opening of the second electronic expansion valve is increased according to the second opening adjustment value.

[0129] After adjusting the opening value of the corresponding electronic expansion valve according to the first opening adjustment value and/or the second opening adjustment value, a new first opening adjustment value and/or a new second opening adjustment value may be redetermined to adjust the opening value of the corresponding electronic expansion valve at an interval of preset period.

[0130] In an embodiment, the difference between the first heat exchange temperature and the first target heat exchange temperature or the difference between the second heat exchange temperature and the second target heat exchange temperature is defined as Z , then the corresponding opening adjustment value can be determined according to the following mapping table:

condition	opening adjustment value	cycle
$Z < -3^{\circ}\text{C}$	+8	120s
$-3 \leq Z < -2^{\circ}\text{C}$	+4	
$-2 \leq Z \leq 2^{\circ}\text{C}$	0	
$2 < Z \leq 3^{\circ}\text{C}$	-4	
$Z > 3^{\circ}\text{C}$	-8	

[0131] It can be seen from the above table that when the first heat exchange temperature is less than the first target heat exchange temperature and the temperature deviation between the two temperatures is greater than the threshold 1, the corresponding first electronic expansion valve is operated with an increased opening and the opening adjustment shows an increasing trend as the temperature deviation increases. When the first heat exchange temperature is greater than the first target heat exchange temperature and the temperature deviation between the two temperatures is greater than the threshold 2, the corresponding first electronic expansion valve is operated with a decreased opening and the opening adjustment shows an increasing trend as the temperature deviation increases. When the second heat exchange temperature is less than the second target heat exchange temperature and the temperature deviation between the two temperatures is greater than the threshold 3, the corresponding second electronic expansion valve is operated with an increased opening and the opening adjustment shows an increasing trend as the temperature deviation increases. When the second heat exchange temperature is greater than the second target heat exchange temperature and the temperature deviation between the two temperatures is greater than the threshold 4, the corresponding second electronic expansion valve is operated with a decreased opening and the opening adjustment shows an increasing trend as the temperature deviation increases.

[0132] In addition, the embodiments of the present application further provide a computer-readable storage medium. The computer-readable storage medium stores a control program of a VRF heat pump system. When the program for controlling the VRF heat pump system is executed by a processor, relevant steps according to any one of the embodiments of the method for controlling a VRF heat pump system are realized.

[0133] It should be understood that, in the present application, the terms "comprising", "comprises" or any other variants are used for covering non-exclusive contents, so that a series of processes, methods, items are all incorporated herein. Or the system not only comprises those elements, but also comprises other elements that are not clearly listed, or further comprises the elements inherent in the process, the method, the item or the system. Without more restrictions, the elements limited by the description "comprise one..." are not intended to exclude additional same elements in the process, the method, the item, or the systems.

[0134] The serial numbers of the present application are only for description, and do not represent the advantages and disadvantages of the embodiments.

[0135] Through the above description of the embodiments, those skilled in the art can understand that the above embodiments can be implemented by instructing the software and the general hardware platform, and can also be implemented by the hardware. In many cases, the former is better for implementation. Based on this understanding, the essence or the part contributing to the related art of the technical solutions of the present application can be embodied in the form of a software product. The computer software product can be stored in the storage medium (such as a read-only memory (ROM) or a random-access memory (RAM), a disk, and an optical disk) as mentioned above, and may comprise several instructions to cause a VRF heat pump system to execute the methods described in the various embodiments of the present application.

[0136] The above-mentioned embodiments are only some embodiments of the present application, and are not intended to limit the scope of the present application. Any equivalent structure conversion or equivalent process conversion made with reference to the description and the accompanying drawings of the present application, directly or indirectly applied in other related technical fields, should all fall in the scope of the present application.

Claims

1. A method for controlling a variable refrigerant flow (VRF) heat pump system, wherein the VRF heat pump system comprises a compressor, at least a hydraulic module and at least an air conditioner indoor unit, the at least one hydraulic module and the at least one air conditioner indoor unit are both connected to the compressor, **characterized in that**, the method for controlling the VRF heat pump system comprises:

obtaining a first energy demand information of the at least one air conditioner indoor unit and a second energy demand information of the at least one hydraulic module; wherein the first energy demand information represents a heating capacity demand of the at least one air conditioner indoor unit, and the second energy demand information represents a heating capacity demand of the at least one hydraulic module; and
 5 adjusting an operating frequency of the compressor according to a target parameter corresponding to the first energy demand information and the second energy demand information.

2. The method for controlling the VRF heat pump system according to claim 1, wherein the adjusting the operating frequency of the compressor according to the target parameter corresponding to the first energy demand information and the second energy demand information comprises:

in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is greater than a first preset value, adjusting the operating frequency of the compressor according to an indoor heat exchanger temperature of a currently turned-on air conditioner indoor unit, wherein the target parameter comprises the indoor heat exchanger temperature; and
 15 in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is less than or equal to the first preset value, and the second energy demand information indicating that the heating capacity demand of the at least one hydraulic module is greater than a second preset value, adjusting the operating frequency of the compressor according to an outlet water temperature of the hydraulic module, wherein the target parameter comprises the outlet water temperature.

3. The method for controlling the VRF heat pump system according to claim 2, wherein the in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is greater than the first preset value, adjusting the operating frequency of the compressor according to an indoor heat exchanger temperature of the currently turned-on air conditioner indoor unit comprises:

in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is greater than the first preset value, determining a first frequency correction value according to the indoor heat exchanger temperature and a preset heat exchanger temperature;
 30 obtaining a first target frequency after adjusting an initial frequency of the compressor according to the first frequency correction value; and
 controlling the compressor to operate at the first target frequency.

4. The method for controlling the VRF heat pump system according to claim 3, wherein the determining the first frequency correction value according to the indoor heat exchanger temperature and the preset heat exchanger temperature comprises:

determining a first temperature difference value between the preset heat exchanger temperature and the indoor heat exchanger temperature;
 40 in response to the first temperature difference value being greater than or equal to a first preset temperature difference, a first target correction value being the first frequency correction value; and
 in response to the first temperature difference value being less than a second preset temperature difference, a second target correction value being the first frequency correction value,
 wherein the second preset temperature difference is less than or equal to the first preset temperature difference,
 45 the first target frequency corresponding to the first target correction value is greater than the initial frequency, and the first target frequency corresponding to the second target correction value is less than the initial frequency.

5. The method for controlling the VRF heat pump system according to claim 2, wherein before the adjusting the operating frequency of the compressor according to the indoor heat exchanger temperature of the currently turned-on air conditioner indoor unit, the method further comprises:

in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is greater than the first preset value, obtaining an exhaust pressure of the compressor;
 55 determining a condensation temperature of the currently turned-on air conditioner indoor unit according to the exhaust pressure, wherein the indoor heat exchanger temperature comprises the condensation temperature; or
 in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is greater than the first preset value, obtaining a rated heating capacity of the

currently turned-on air conditioner indoor unit and a coil temperature of an indoor heat exchanger corresponding to the currently turned-on air conditioner indoor unit;
determining a weight value of each currently turned-on air conditioner indoor unit according to the rated heating capacity; and
5 determining the indoor heat exchanger temperature according to the coil temperature and a weight value corresponding to the coil temperature.

6. The method for controlling the VRF heat pump system according to claim 5, wherein after the obtaining the first energy demand information of the at least one air conditioner indoor unit and the second energy demand information of the at least one hydraulic module, the method further comprises:

in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is greater than the first preset value, obtaining an installation status information of a pressure sensor on an exhaust side of the compressor;
15 in response to the installation status information indicating that the pressure sensor is not installed on the exhaust side of the compressor, obtaining the exhaust pressure of the compressor, and determining the condensation temperature of the currently turned-on air conditioner indoor unit according to the exhaust pressure; and
in response to the installation status information indicating that the pressure sensor is installed on the exhaust side of the compressor, obtaining the rated heating capacity of the currently turned-on air conditioner indoor unit and the coil temperature of the indoor heat exchanger corresponding to the currently turned-on air conditioner indoor unit, determining the weight value of each currently turned-on air conditioner indoor unit according to the rated heating capacity; and determining the indoor heat exchanger temperature according to the coil temperature and the weight value corresponding to the coil temperature.

7. The method for controlling the VRF heat pump system according to claim 2, wherein the in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is less than or equal to the first preset value, and the second energy demand information indicating that the heating capacity demand of the at least one hydraulic module is greater than a second preset value, adjusting the operating frequency of the compressor according to the outlet water temperature of the hydraulic module comprises:

in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is less than or equal to the first preset value, and the second energy demand information indicating that the heating capacity demand of the at least one hydraulic module is greater than a second preset value, determining a current first condensation temperature of the hydraulic module according to the outlet water temperature;
35 determining a second frequency correction value according to the first condensation temperature and a target condensation temperature;
obtaining a second target frequency after adjusting the initial frequency of the compressor according to the second frequency correction value; and
40 controlling the compressor to operate at the second target frequency.

8. The method for controlling the VRF heat pump system according to claim 7, wherein the determining the current first condensation temperature of the hydraulic module according to the outlet water temperature comprises:

45 determining a temperature correction value according to the outlet water temperature and a set water temperature of the hydraulic module;
obtaining a reference condensation temperature after correcting a preset condensation temperature according to the temperature correction value; and
50 determining the first condensation temperature according to the reference condensation temperature.

9. The method for controlling the VRF heat pump system according to claim 8, wherein the determining the temperature correction value according to the outlet water temperature and the set water temperature of the hydraulic module comprises:

55 determining a second temperature difference value between the set water temperature and the outlet water temperature;
determining a temperature adjustment value according to the second temperature difference value; and
obtaining the temperature correction value after adjusting the set water temperature according to the temperature

adjustment value,

wherein the temperature adjustment value shows an increasing trend as the second temperature difference value increases, and/or the temperature adjustment value shows a decreasing trend as the second temperature difference value decreases.

- 5 10. The method for controlling the VRF heat pump system according to claim 8, wherein the determining the first condensation temperature according to the reference condensation temperature comprises:

10 in response to the reference condensation temperature being within a preset temperature interval, the reference condensation temperature being the first condensation temperature;

in response to the reference condensation temperature being less than a minimum critical value of the preset temperature interval, the minimum critical value being the first condensation temperature; and

15 in response to the reference condensation temperature being greater than a maximum critical value of the preset temperature interval, the maximum critical value being the first condensation temperature.

11. The method for controlling the VRF heat pump system according to claim 10, wherein before the determining the first condensation temperature according to the reference condensation temperature, the method further comprises:

20 obtaining an outdoor ambient temperature and a current operating frequency of the compressor; and

determining the maximum critical value based on the outdoor ambient temperature and the operating frequency.

12. The method for controlling the VRF heat pump system according to claim 7, wherein the determining the second frequency correction value according to the first condensation temperature and the target condensation temperature comprises:

25 determining a third temperature difference value between the target condensation temperature and the second condensation temperature;

in response to the third temperature difference value being greater than or equal to a third preset temperature difference, a third target correction value being the second frequency correction value; and

30 in response to the third temperature difference value being less than a fourth preset temperature difference, a fourth target correction value being the second frequency correction value,

wherein the fourth preset temperature difference is less than or equal to the third preset temperature difference, the second target frequency corresponding to the third target correction value is greater than the initial frequency,

35 and the second target frequency corresponding to the fourth target correction value is less than the initial frequency.

13. The method for controlling the VRF heat pump system according to claim 2, wherein in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is less than or equal to the first preset value, and the second energy demand information indicating that the heating capacity demand of the at least one hydraulic module is greater than a second preset value, adjusting the operating frequency of the compressor according to the outlet water temperature of the hydraulic module comprises:

45 in response to the first energy demand information indicating that the heating capacity demand of the at least one air conditioner indoor unit is less than or equal to the first preset value, and the second energy demand information indicating that the heating capacity demand of the at least one hydraulic module is greater than a second preset value, determining a third target frequency according to a first target temperature difference, a second target temperature difference, the outlet water temperature and the set water temperature of the hydraulic module; and

controlling the compressor to operate at the third target frequency;

50 wherein, the first target temperature difference is a temperature difference between a first actual condensation temperature of the hydraulic module and a set condensation temperature at a current moment, and the second target temperature difference is a temperature difference between the set condensation temperature and a second actual condensation temperature of the hydraulic module when a last time adjusting the operating frequency of the compressor according to a water temperature at an outlet of the hydraulic module, the first actual condensation temperature is a parameter corresponding to the outlet water temperature, and the second actual condensation temperature is a parameter corresponding to the water temperature at the outlet.

14. The method for controlling the VRF heat pump system according to claim 13, wherein the determining the third

target frequency according to the first target temperature difference, the second target temperature difference, the outlet water temperature and the set water temperature of the hydraulic module comprises:

determining a third temperature difference value between the first target temperature difference and the second target temperature difference, and determining a fourth temperature difference value between the set water temperature and the outlet water temperature;
determining a target frequency adjustment value according to the third temperature difference value and the fourth temperature difference value; and
obtaining the third target frequency by adjusting the current operating frequency of the compressor according to the target frequency adjustment value,
wherein the third target frequency shows an increasing trend as the third temperature difference value increases, and the third target frequency shows an increasing trend as the fourth temperature difference value increases.

15. The method for controlling the VRF heat pump system according to any one of claims 1 to 14, wherein while or after the adjusting the operating frequency of the compressor according to the target parameter corresponding to the first energy demand information and the second energy demand information, the method further comprises:

adjusting an opening of a first electronic expansion valve of the air conditioner indoor unit so that a temperature difference between an actual heat exchange temperature of the air conditioner indoor unit and a first target heat exchange temperature is less than a first set temperature difference; and/or
adjusting an opening of a second electronic expansion valve of the hydraulic module so that a temperature difference between an actual heat exchange temperature of the hydraulic module and a second target heat exchange temperature is less than a second set temperature difference,
wherein the first target heat exchange temperature and/or the second target heat exchange temperature are determined according to the first energy demand information and the second energy demand information.

16. The method for controlling the VRF heat pump system according to claim 15, wherein the adjusting the opening of the first electronic expansion valve of the air conditioner indoor unit comprises:

obtaining a current first heat exchange temperature of the air conditioner indoor unit;
determining a first opening adjustment value according to a first deviation value between the first heat exchange temperature and the first target heat exchange temperature; and
adjusting the opening of the first electronic expansion valve according to the first opening adjustment value;
wherein, the first opening adjustment value shows an increasing trend as the first deviation value increases.

17. The method for controlling the VRF heat pump system according to claim 15, wherein the adjusting an opening of a second electronic expansion valve of the hydraulic module comprises:

obtaining a first temperature of a refrigerant inlet of the hydraulic module and a second temperature of a refrigerant outlet of the hydraulic module;
determining a second heat exchange temperature of the hydraulic module according to the first temperature and the second temperature;
determining a second opening adjustment value according to a second deviation value between the second heat exchange temperature and the second target heat exchange temperature; and
adjusting the opening of the second electronic expansion valve according to the second opening adjustment value,
wherein the second opening adjustment value shows an increasing trend as the second deviation value increases.

18. A variable refrigerant flow (VRF) heat pump system, **characterized by** comprising:

a compressor;
at least a hydraulic module;
at least an air conditioner indoor unit, wherein the at least one hydraulic module and the at least one air conditioner indoor unit are both connected to the compressor; and
a control device, wherein the compressor, the at least one hydraulic module and the at least one air conditioner indoor unit are all connected to the control device, and the control device comprises: a memory, a processor and a program for controlling the VRF heat pump system stored on the memory and executable on the processor,

when the program for controlling the VRF heat pump system is executed by the processor, a step of a method for controlling the VRF heat pump system according to any one of claims 1 to 17 are implemented.

- 5 **19.** A computer-readable storage medium, **characterized in that**, a program for controlling a variable refrigerant flow (VRF) heat pump system is stored in the storage medium, and when the program for controlling the VRF heat pump system is executed by a processor, a step of a method for controlling the VRF heat pump system according to any one of claims 1 to 17 is implemented.

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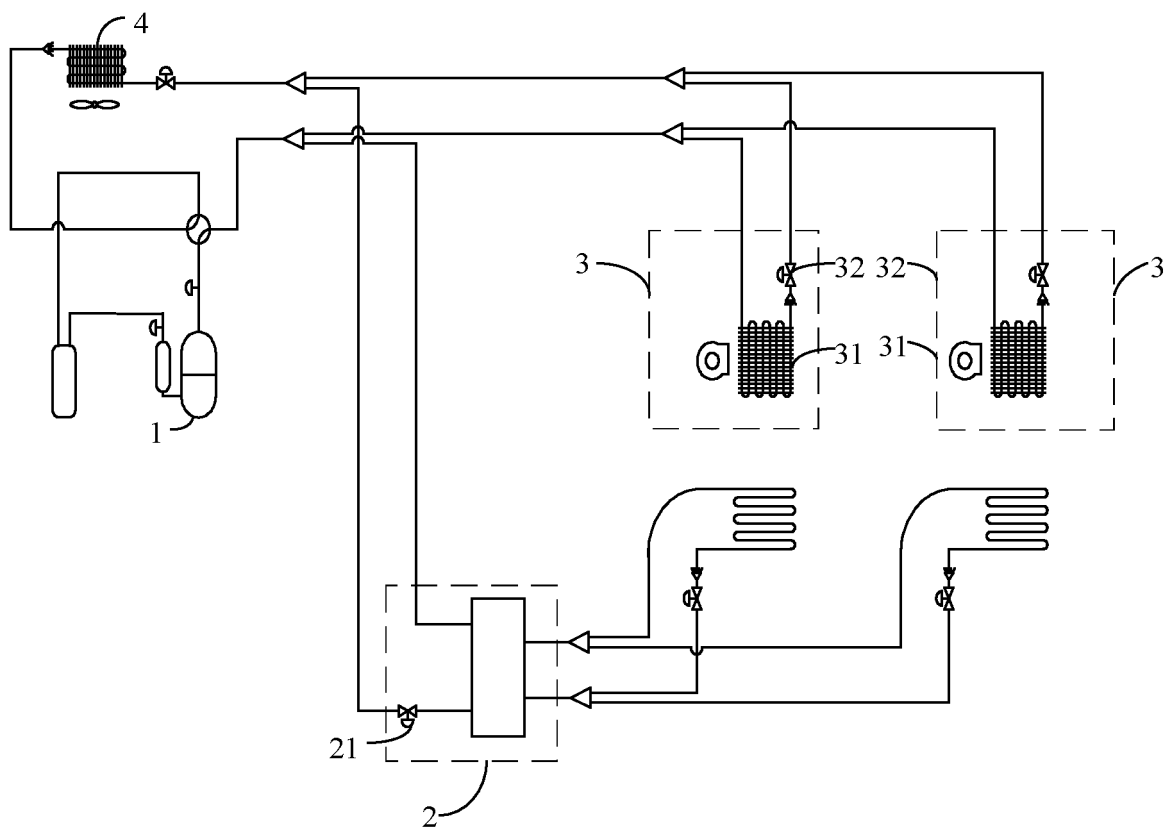


FIG. 1

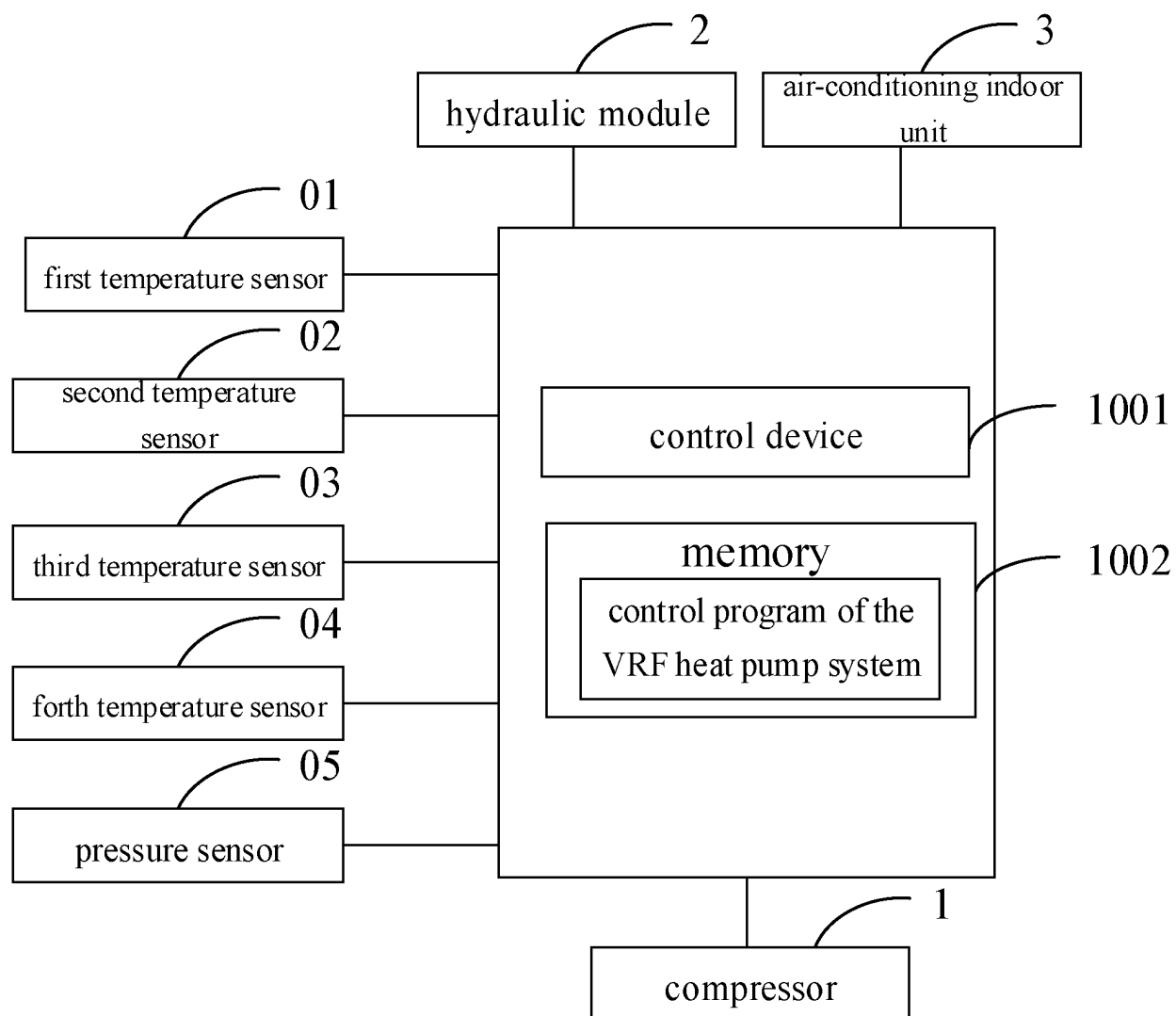


FIG. 2

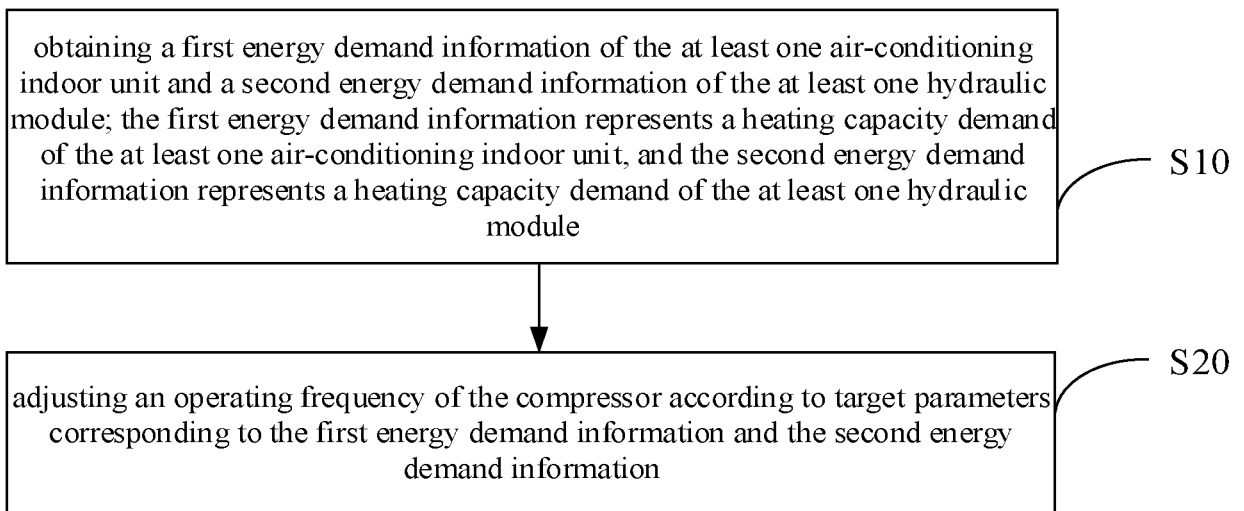


FIG. 3

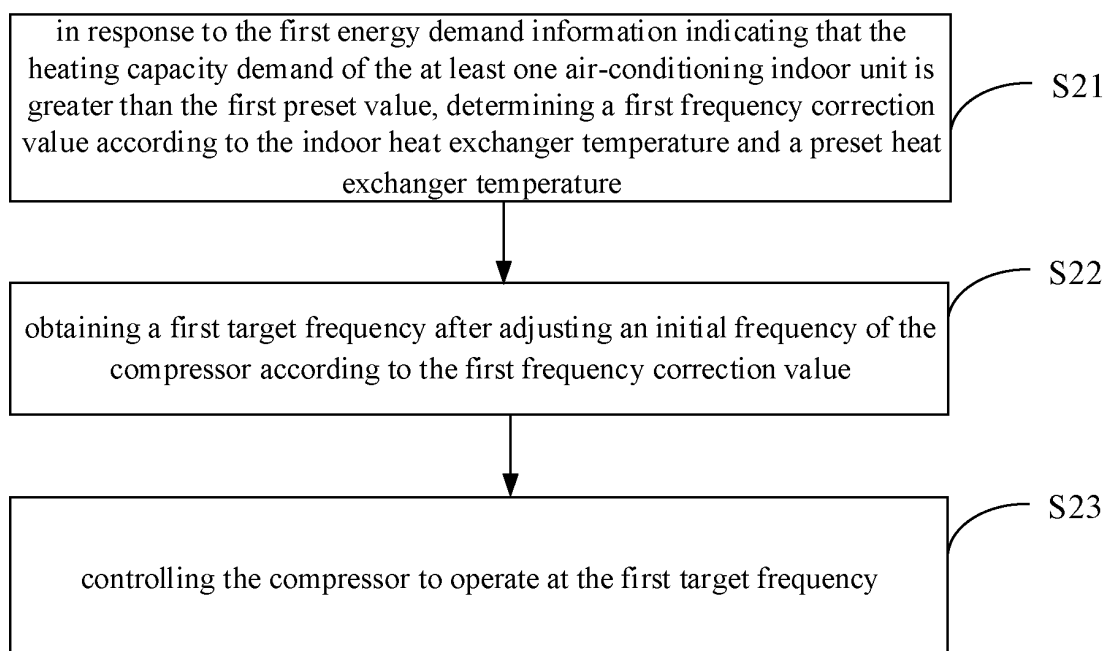


FIG. 4

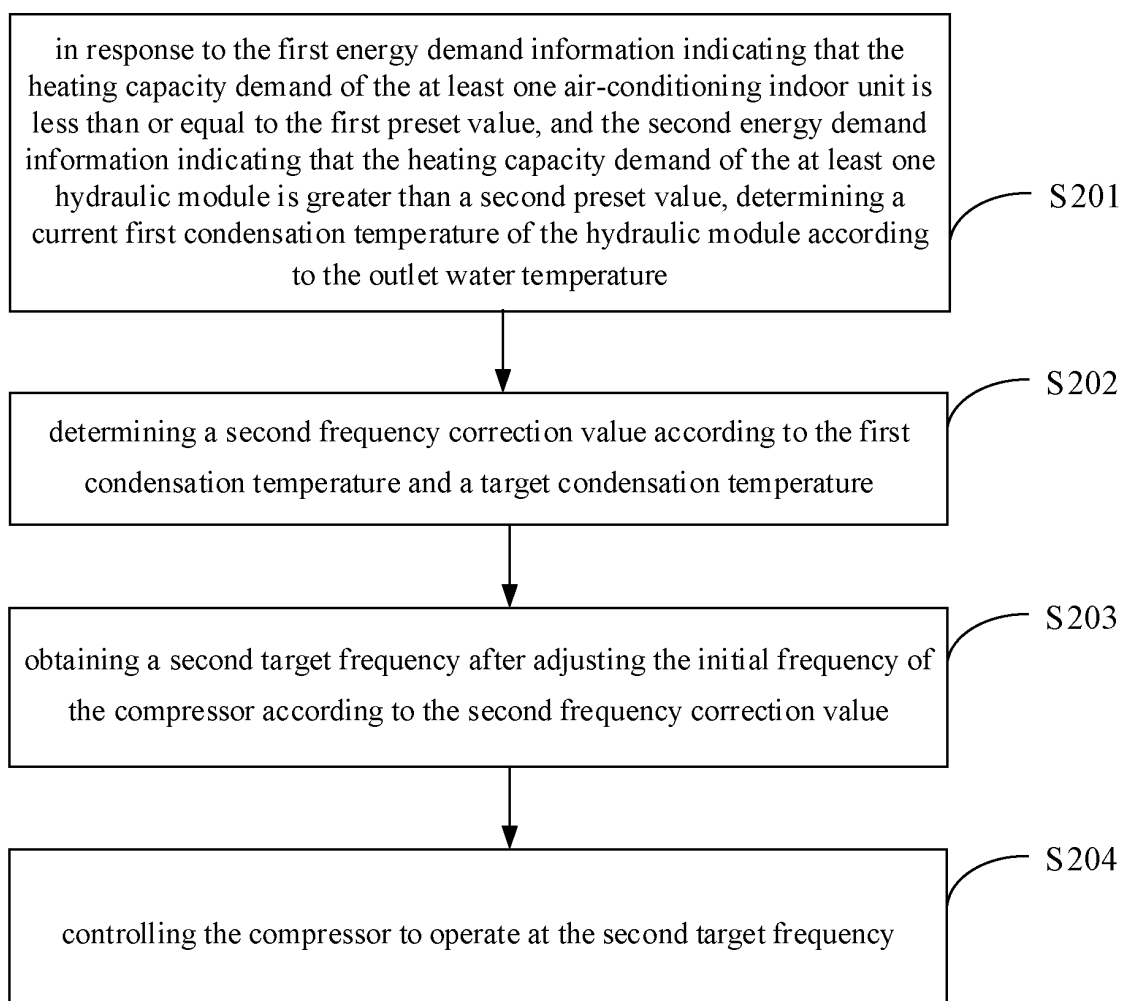


FIG. 5

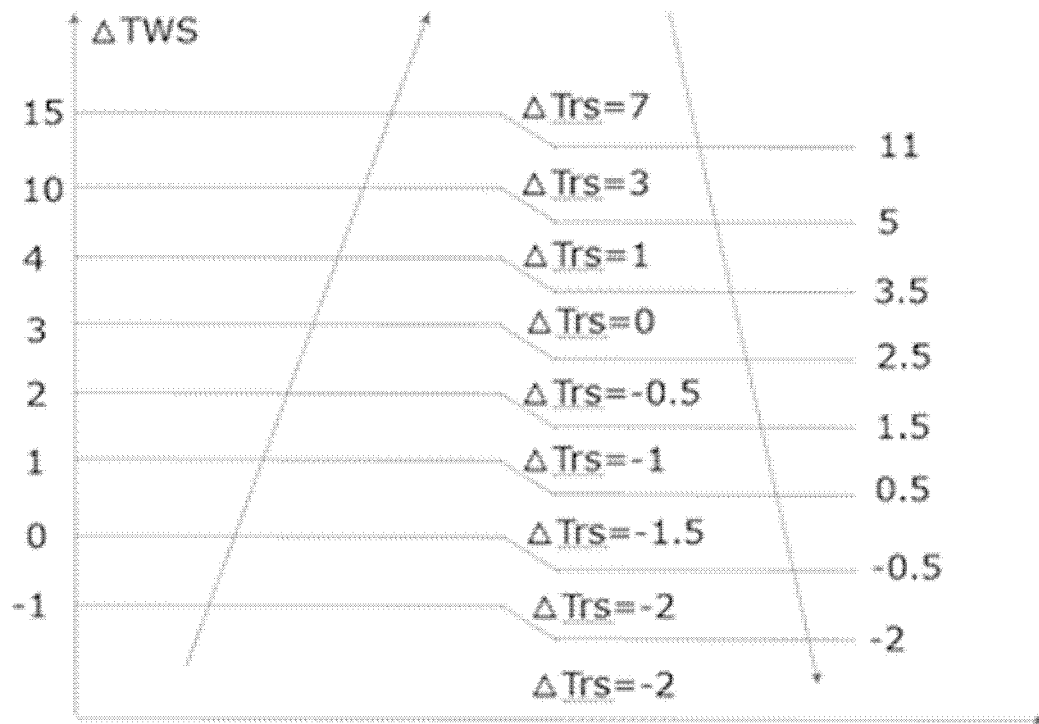


FIG. 6

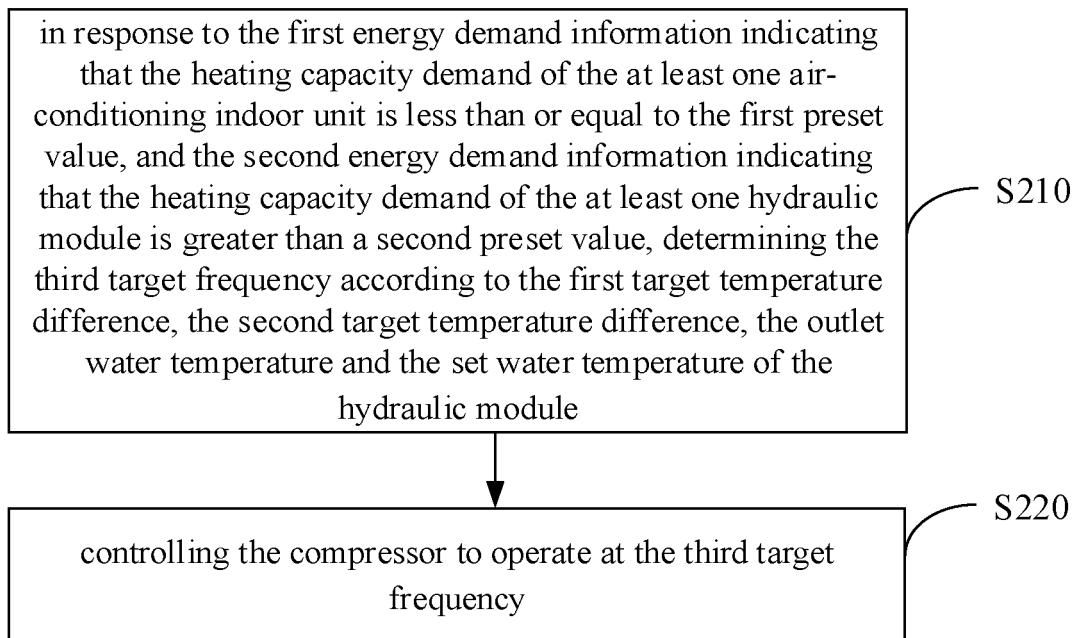


FIG. 7

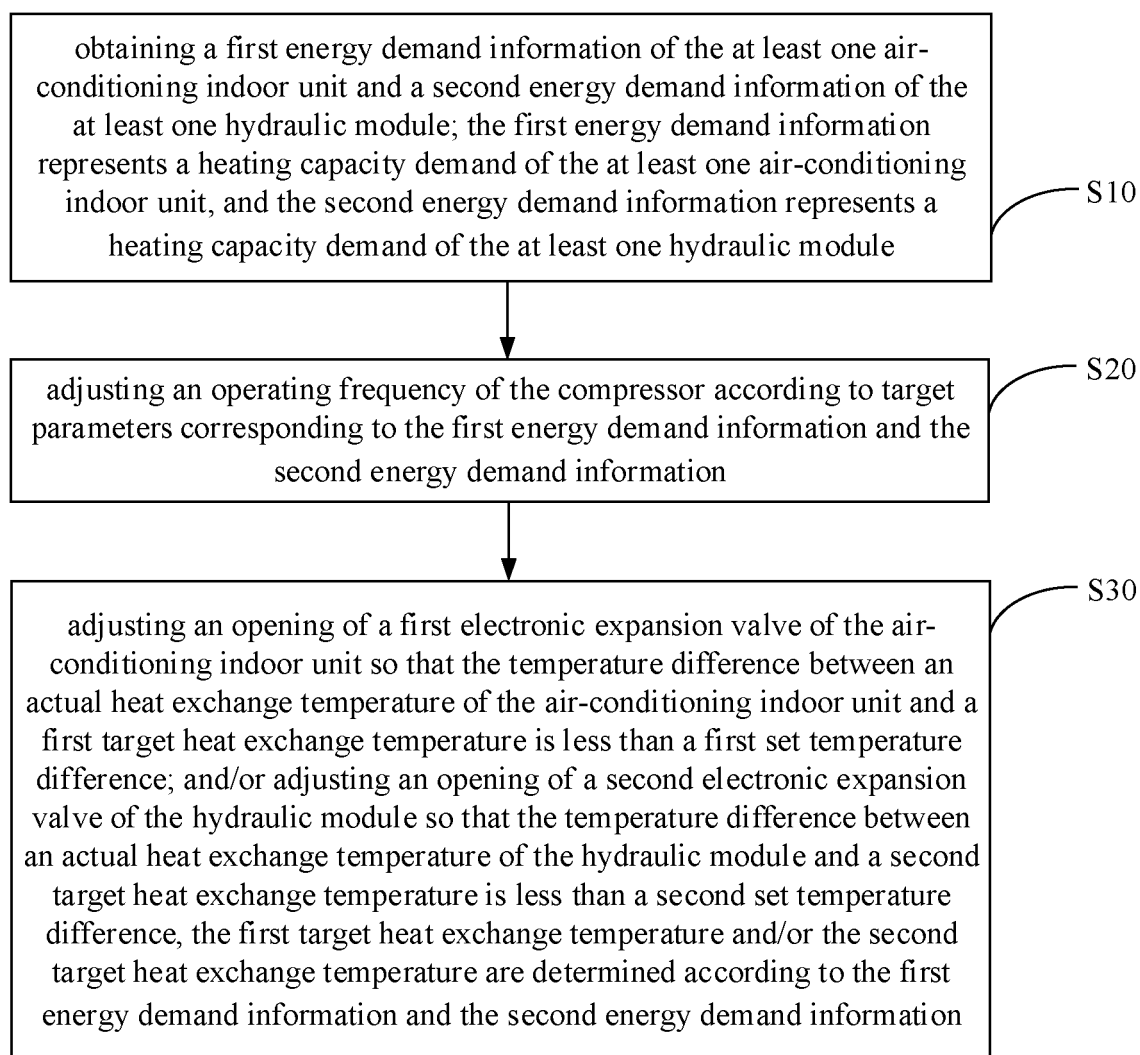


FIG. 8

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/082329

A. CLASSIFICATION OF SUBJECT MATTER

F24F 5/00(2006.01)i; F24F 11/86(2018.01)i; F24F 11/64(2018.01)i; F25B 30/02(2006.01)i; F25B 49/02(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F24F; F25B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

VEN, SIPOABS, CNABS, CNTXT, CNKI: 空调, 热泵, 室内机, 热水, 制热, 水力, 变频, 压缩机, 频率, 能需, 温度, 换热器, 排气, 压力, 预设, 膨胀阀, 开度, air, condition+, heat, pump, indoor, unit, hot, water, heating, variable, frequency, compressor, energy, temperature, heat, exchanger, exhaust, pressure, expansion, valve, opening, degree

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	CN 113834150 A (GUANGDONG MIDEA REFRIGERATION EQUIPMENT CO., LTD.) 24 December 2021 (2021-12-24) claims 1-19	1-19
X	CN 109579299 A (GUANGDONG CHIGO HEATING & VENTILATION EQUIPMENT CO., LTD.) 05 April 2019 (2019-04-05) description, paragraphs [0018]-[0044], and figure 1	1, 18, 19
Y	CN 109579299 A (GUANGDONG CHIGO HEATING & VENTILATION EQUIPMENT CO., LTD.) 05 April 2019 (2019-04-05) description, paragraphs [0018]-[0044], and figure 1	2-17
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A	CN 103486692 A (QINGDAO HISENSE HITACHI AIR CONDITIONING SYSTEM CO., LTD.) 01 January 2014 (2014-01-01) entire document	1-19

☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

16 June 2022

Date of mailing of the international search report

23 June 2022

Name and mailing address of the ISA/CN

China National Intellectual Property Administration (ISA/
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Authorized officer

Facsimile No. (86-10)62019451

Telephone No.

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2022/082329

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International application No.

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REFERENCES CITED IN THE DESCRIPTION

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