CLAIMS

1. A chilled water circulation system comprising:

a cooling device comprising:

a thermal source machine that cools a chilled water;

a heat exchanger that performs heat exchange between the chilled water, which is chilled, and a cooling target, and cools the cooling target; and

a bypass pipe connecting a chilled-water inflow side of the heat exchanger and a chilled-water outflow side of the heat exchanger;

a parameter detector that detects a value of a parameter indicating a state of the cooling target;

a temperature detector that detects a temperature of the chilled water supplied to the heat exchanger; and

a control device that controls an operational state of the cooling device, signals outputted from the parameter detector and the temperature detector being inputted to the control device,

wherein an operation mode in which the chilled water in the bypass pipe is supplied to the heat exchanger so that a cooling capacity is demonstrated by the heat exchanger is defined as a pipe residual temperature operation mode, and

wherein the control device can perform:

a first determination process to determine whether a value based on a detection value of the parameter detector satisfies a preset management condition for the parameter;

a second determination process to determine whether a value based on a detection value of the temperature detector satisfies a preset capacity condition; and

a residual temperature operation process in which the cooling device is operated in the pipe residual temperature operation mode when at least the

management condition and the capacity condition are satisfied.

2. The chilled water circulation system according to claim 1,

wherein the control device performs the pipe residual temperature operation mode while the thermal source machine is in a stopped state.

3. The chilled water circulation system according to claim 1 or 2,

wherein the cooling capacity that can be demonstrated by the heat exchanger in the pipe residual temperature operation mode is defined as a capacity of residual temperature,

wherein an operation mode in which the cooling capacity larger than the capacity of residual temperature can be demonstrated by the heat exchanger is a normal operation mode, and

wherein the control device can perform:

a third determination process to determine, if the management condition is determined to be unsatisfied, whether the cooling capacity that satisfies the management condition can be demonstrated by the heat exchanger in a current operation mode; and

a normal operation process to operate the cooling device in the normal operation mode if the management condition is determined to be unsatisfied and if a determination is made in the third determination process that the cooling capacity that satisfies the management condition cannot be demonstrated by the heat exchanger in the current operation mode.

4. The chilled water circulation system according to any one of claims 1 to 3,

wherein a power consumed by the cooling device in the pipe residual

temperature operation mode is defined as a power during residual temperature use, and an operation mode in which operation is possible with a power smaller than the power during residual temperature use is defined as a power saving operation mode, and

wherein the control device can perform:

a fourth determination process to determine, if the management condition is determined to be satisfied, whether the cooling capacity demonstrated by the heat exchanger in the current operation mode can be further reduced; and

a power saving operation process to operate the cooling device in the power saving operation mode if the management condition is determined to be satisfied and if a determination is made in the fourth determination process that the cooling capacity demonstrated by the heat exchanger in the current operation mode cannot be further reduced.

5. The chilled water circulation system according to claim 4,

wherein the cooling device comprises an air blower that can cool an air discharged into a room as the cooling target and sends the air to the heat exchanger, and

wherein the control device can perform, as the power saving operation mode, an operation mode in which the air blower is operated while a supply of the chilled water to the heat exchanger is stopped.

6. The chilled water circulation system according to any one of claims 1 to 5,

wherein, after the control device performs a process to change the cooling capacity demonstrated by the heat exchanger and when a period of time determined under a preset rule passes, the control device can perform the first determination

process.

7. The chilled water circulation system according to any one of claims 1 to 6,

wherein, after the control device performs a process to change the cooling capacity demonstrated by the heat exchanger and when a period of time determined under a preset rule passes, the control device can perform at least one of a process to determine whether to further change the cooling capacity and a process to determine whether to change the current operation mode.

8. The chilled water circulation system according to any one of claims 1 to 7,

wherein the control device can perform a process to change the parameter.

9. The chilled water circulation system according to any one of claims 1 to 8 further comprising:

a primary pump that sends the chilled water discharged from the heat exchanger to the thermal source machine; and

a secondary pump that sends the chilled water supplied from the thermal source machine to the heat exchanger, a suction side of the secondary pump being coupled to the bypass pipe,

wherein the control device operates the secondary pump in the pipe residual temperature operation mode, while the primary pump is in a stopped state.

10. The chilled water circulation system according to claim 9,

wherein the control device can perform a process to enhance the cooling capacity demonstrated by the heat exchanger by increasing a discharge amount from

the secondary pump.

11. The chilled water circulation system according to claim 10,

wherein the secondary pump is composed on a plurality of pumps, and wherein the control device can increase the discharge amount from the secondary pump by increasing the number of operating pumps among the plurality of pumps.

12. The chilled water circulation system according to claim 10 or 11,

wherein the control device can control the discharge amount from the secondary pump by controlling a frequency of voltage applied to an electric motor that operates the secondary pump, and

wherein the control device can increase the discharge amount from the secondary pump by increasing the frequency of voltage applied.

13. The chilled water circulation system according to any one of claims 9 to 12,

wherein the control device can perform a process to reduce the cooling capacity demonstrated by the heat exchanger by decreasing the discharge amount from the secondary pump.

14. The chilled water circulation system according to claim 13,

wherein the secondary pump is composed on a plurality of pumps, and wherein the control device can decrease the discharge amount from the secondary pump by decreasing the number of operating pumps among the plurality of pumps.

15. The chilled water circulation system according to claim 13 or 14,

wherein the control device can control the discharge amount from the secondary pump by controlling a frequency of voltage applied to an electric motor that operates the secondary pump, and

wherein the control device can decrease the discharge amount from the secondary pump by decreasing the frequency of voltage applied.

16. A program for a chilled water circulation system, the chilled water circulation system including:

a cooling device including:

a thermal source machine that cools a chilled water;

a heat exchanger that performs heat exchange between the chilled water, which is chilled, and a cooling target and cools the cooling target; and

a bypass pipe connecting a chilled-water inflow side of the heat exchanger and a chilled-water outflow side of the heat exchanger;

a parameter detector that detects a value of a parameter indicating a state of the cooling target;

a temperature detector that detects a temperature of the chilled water supplied to the heat exchanger; and

a control device that controls an operational state of the cooling device, signals outputted from the parameter detector and the temperature detector being inputted to the control device,

the program being adopted in the chilled water circulation system and installed in the control device,

wherein an operation mode in which the chilled water in the bypass pipe is supplied to the heat exchanger so that a cooling capacity is demonstrated by the heat exchanger is defined as a pipe residual temperature operation mode, and

wherein the program for the chilled water circulation system causes the control device to perform:

a first determination process to determine whether a value based on

a detection value of the parameter detector satisfies a preset management condition for the parameter;

a second determination process to determine whether a value based on a detection value of the temperature detector satisfies a preset capacity condition; and

a residual temperature operation process in which the cooling device is operated in the pipe residual temperature operation mode when at least the management condition and the capacity condition are satisfied.

17. A heat medium circulation system comprising:

a cooling device comprising:

a thermal source machine that cools a heat medium;

a heat exchanger that performs heat exchange between the heat medium, which is chilled, and a cooling target and cools the cooling target; and

a bypass pipe connecting a heat-medium inflow side of the heat exchanger and a heat-medium outflow side of the heat exchanger;

a parameter detector that detects a value of a parameter indicating a state of the cooling target;

a temperature detector that detects a temperature of the heat medium supplied to the heat exchanger; and

a control device that controls an operational state of the cooling device, and signals outputted from the parameter detector and the temperature detector being inputted to the control device,

wherein an operation mode in which the heat medium in the bypass pipe is

supplied to the heat exchanger so that a cooling capacity is demonstrated by the heat exchanger is defined as a pipe residual temperature operation mode, and

wherein the control device can perform:

a first determination process to determine whether a value based on

a detection value of the parameter detector satisfies a preset management condition for the parameter;

a second determination process to determine whether a value based on a detection value of the temperature detector satisfies a preset capacity condition; and

a residual temperature operation process in which the cooling device is operated in the pipe residual temperature operation mode when at least the management condition and the capacity condition are satisfied.