Claims

1. A refrigeration device which comprises a refrigerant circuit including an evaporator, and which performs low-temperature treatment operation for treating a cargo in an interior of the device under a predetermined low-temperature condition,

the refrigeration device comprising:

a blow-out temperature detector that detects a blow-out temperature of air which is cooled in the evaporator and blown out into the interior;

a cargo temperature detector that detects a temperature of the cargo; and

an operation controller that performs cooling control of the interior on the basis of the temperature detected by the blow-out temperature detector and the temperature detected by the cargo temperature detector so that the temperature of the cargo satisfies the low-temperature condition in the low-temperature treatment operation.

2. The refrigeration device according to claim 1, further comprising:

a storage unit that stores a first set temperature as a control target value for the blow-out temperature in the low-temperature treatment operation and a cargo target temperature as a target value for the temperature of the cargo in the low-temperature treatment operation; and

a time measurement unit that measures a treatment time elapsed for low-temperature treatment of the cargo in the low-temperature treatment operation,

the operation controller being configured to control the refrigerant circuit so that the blow-out temperature approaches the first set temperature upon starting the low-temperature treatment operation, and

the time measurement unit being configured to start measuring the treatment time when the temperature of the cargo is lower than the cargo target temperature upon starring the low-temperature treatment operation.

3. The refrigeration device according to claim 2, further comprising a setting switching unit that switches control target values for the blow-out temperature in the low-temperature treatment operation, wherein

the storage unit stores

a second set temperature lower than the first set temperature as a control target value for the blow-out temperature in the low-temperature treatment operation and

a switching reference temperature higher than the cargo target temperature, and

the setting switching unit is configured to switch the control target value for the

blow-out temperature from the first set temperature to the second set temperature when the temperature of the cargo reaches the switching reference temperature after the time measurement unit starts measuring the treatment time.

4. The refrigeration device according to claim 3, wherein the setting switching unit is configured to lower the control target value for the blow-out temperature from the first set temperature to the second set temperature in a step-by-step manner when the setting switching unit switches the control target value for the blow-out temperature from the first set temperature to the second set temperature.

5. The refrigeration device according to claim 3 or 4, wherein the setting switching unit is configured to switch the control target value for the blow-out temperature from the second set temperature to the first set temperature when the temperature of the cargo reaches the cargo target temperature after the setting switching unit switches the control target value for the blow-out temperature to the second set temperature.

6. The refrigeration device according to claim 5, wherein the setting switching unit is configured to raise the control target value for the blow-out temperature from the second set temperature to the first set temperature in a step-by-step manner when the setting switching unit switches the control target value for the blow-out temperature from the second set temperature to the first set temperature.

7. The refrigeration device according to any one of claims 3 to 6, further comprising a setting changing unit that accepts at least one of setting change for the control target value by an input from a user and setting change for the control target value via communication means, and changes the control target value to the accepted value.

8. The refrigeration device according to any one of claims 2 to 7, wherein

the storage unit stores a cargo upper limit temperature which is higher than the cargo target temperature, and

the time measurement unit is configured to reset the treatment time measured up to a point in time when the temperature of the cargo exceeds the cargo upper limit temperature after the time measurement unit starts measuring the treatment time.

9. The refrigeration device according to claim 8, further comprising a warning unit that

issues a warning when a warning condition is satisfied, the warning condition including a state in which the temperature of the cargo exceeds the cargo upper limit temperature.

10. The refrigeration device according to any one of claims 2 to 9, wherein

the storage unit stores a cargo reference temperature which is higher than the cargo target temperature, and

the time measurement unit is configured to extend a time for performing low-temperature treatment on the cargo by a predetermined period when the temperature of the cargo exceeds the cargo reference temperature after the time measurement unit starts measuring the treatment time.

11. The refrigeration device according to any one of claims 1 to 10, wherein the operation controller is configured to:

perform first control in which the refrigerant circuit is controlled so that the blow-out temperature approaches the control target value when the low-temperature treatment operation is started, and

switch to second control in which the refrigerant circuit is controlled so that the cargo target temperature as a target value for the temperature of the cargo in the low-temperature treatment operation is set as a control target value and the temperature of the cargo approaches the cargo target temperature, when a predetermined condition is satisfied.

12. The refrigeration device according to any one of claims 1 to 11, wherein the operation controller is configured to:

control the refrigerant circuit to increase a flow amount of refrigerant passed to the evaporator in order to increase refrigeration capability when the blow-out temperature is higher than the control target value for the blow-out temperature, and

control the refrigerant circuit to reduce the flow amount of refrigerant passed to the evaporator in order to lower the refrigeration capability when the blow-out temperature is lower than the control target value for the blow-out temperature.

13. The refrigeration device according to claim 12, wherein the flow amount of refrigerant is regulated by regulating a flow amount of refrigerant discharged from a compressor in the refrigerant circuit by adjusting an operation capacity of the compressor.

14. The refrigeration device according to claim 12 or 13, wherein the flow amount of

refrigerant is regulated by regulating the flow amount of refrigerant discharged from the compressor by adjusting an opening degree of a suction regulating valve provided on a suction side of the compressor in the refrigerant circuit.

15. The refrigeration device according to any one of claims 1 to 14, further comprising an indicator that indicates a data piece extracted from accumulated data pieces related to the low-temperature treatment operation.

16. The refrigeration device according to any one of claims 1 to 15, further comprising a suction temperature detector that detects a temperature of air in the interior to be sent to the evaporator, wherein

the cargo temperature detector is a temperature sensor that is provided separately from the suction temperature detector and the blow-out temperature detector.