CLAIMS

[Claim 1] A refrigeration system utilizing a Brayton cycle which generates cold heat by using a refrigerant compressed by a compressor unit arranged on a refrigerant path,

wherein the compressor unit includes:

a plurality of compressors arranged in parallel to each other on the refrigerant path;

a plurality of first motors for driving the plurality of compressors, respectively;

an expander-integrated compressor configured integrally with an expander capable of expanding the refrigerant compressed by the compressor unit; and

a second motor for driving the expander-integrated compressor, and

wherein the number of the plurality of compressors is larger than the number of the expander-integrated compressor,

wherein the plurality of compressors are configured to be operated simultaneously to compress the refrigerant flowing through the refrigerant path.

[Claim 2] The refrigeration system according to claim 1,

wherein the plurality of first motors and the second motor are common.

[Claim 3] A refrigeration system utilizing a Brayton cycle which generates cold heat by using a refrigerant compressed by a compressor unit arranged on a refrigerant path,

wherein the compressor unit includes:

a plurality of compressors arranged in parallel to each other on the refrigerant path;

a plurality of first motors for driving the plurality of compressors, respectively;

an expander-integrated compressor configured integrally with an expander capable of expanding the refrigerant compressed by the compressor until; and

a second motor for driving the expander-integrated compressor, and

wherein the number of the plurality of compressors is larger than the number of the expander-integrated compressor,

wherein the refrigeration system comprises a control device for controlling the plurality of compressors,

wherein the control device is configured to control the plurality of compressors to operate some of the plurality of compressors, based on a temperature of the refrigerant at an inlet of the expander at startup of the refrigeration system.

[Claim 4] A refrigeration system according to claim 3,

wherein the control device is configured to perform control to decrease a rotational speed of an operating compressor and then control to change the number of operating compressors of the plurality of compressors.

[Claim 5] A refrigeration system utilizing a Brayton cycle which generates cold heat by using a refrigerant compressed by a compressor unit arranged on a refrigerant path,

wherein the compressor unit includes:

a plurality of compressors arranged in parallel to each other on the refrigerant path;

a plurality of first motors for driving the plurality of compressors, respectively;

an expander-integrated compressor configured integrally with an expander capable of expanding the refrigerant compressed by the compressor unit; and

a second motor for driving the expander-integrated compressor, and

wherein the number of the plurality of compressors is larger than the number of the expander-integrated compressor,

wherein the refrigerant path includes:

a bypass line connecting upstream and downstream sides of a compressor of the expander-integrated compressor to bypass the compressor, and

a bypass valve disposed on the bypass line.

[Claim 6] The refrigeration system according to claim 5,

wherein the bypass valve is configured to set a flow rate of the refrigerant in the

compressor of the expander-integrated compressor to a predetermined value or more, based on a temperature of the refrigerant at an inlet of the expander.

[Claim 7] The refrigeration system according to claim 6,

wherein a rotational speed of the compressor or the expander-integrated compressor is controlled in cooperation with an opening degree of the bypass valve so that a cooling rate of the refrigerant is substantially constant.

[Claim 8] The refrigeration system according to any one of claims 1 to 7,

wherein each of the plurality of compressors is a common-shaft compressor including a plurality of compressors connected in series on the refrigerant path.

[Claim 9] The refrigeration system according to any one of claims 1 to 8,

wherein the plurality of first motors and the second motor each include:

output shafts with identical shaft diameters to each other;

bearings supporting the output shafts with identical specifications to each other; and

motor casings with identical specifications to each other.

[Claim 10] The refrigeration system according to claim 9,

wherein the plurality of compressors and the expander-integrated compressor each include:

compressor impellers with different shapes from each other; and

compressor impeller casings with different specifications from each other.