The turbo chiller according the second aspect further has a configuration wherein a liquid refrigerant from the refrigeration cycle can be circulated as a cooling and lubricating medium for at least one of a bearing housing of the bearing and an air gap of the motor.

[0014]

According to this configuration, the liquid refrigerant can be circulated from the refrigeration cycle as a cooling and lubricating medium for at least one of the bearing housing of the bearing and the air gap of the motor. By cooling and lubricating the ceramic bearings with the liquid refrigerant, the durability of the bearings can be increased, and heat loss and failsafe operations due to an excessive temperature rise in the motor can be reduced by ensuring the cooling performance of the liquid refrigerant cooling the high rotation motor. This configuration successfully cools and lubricates the oil-free ceramic bearing and the motor, improving their durability and performance, thus imparts high performance and reliability to the turbo chiller.

[0015]

The turbo chiller according the second aspect further has a configuration, wherein instead of the liquid refrigerant, a low-pressure gas refrigerant can be supplied to the air gap of the motor.

[0016]

According to this configuration, instead of the liquid refrigerant, the low-pressure gas refrigerant can be supplied to the air gap of the motor. By supplying the low-pressure gas refrigerant as the cooling medium, agitation loss due to the motor can be reduced more than in configurations in which the liquid refrigerant is supplied. Thus, heat loss and the like can be reduced due to sufficient cooling of the motor, and agitation loss can be further reduced. As a result, motor efficiency can be increased enabling higher rotations.

[0017]

The turbo chiller according to the second aspect further has a configuration, wherein a helical groove which allows the liquid refrigerant or the low-pressure gas refrigerant supplied to the air gap of the motor to flow axially outward is provided on at least one of an inner peripheral surface of a stator of the motor, an outer peripheral surface of a rotor, and an outer peripheral surface of a balance ring provided on an end surface of the rotor.

[0018]

According to this configuration, the helical groove which allows the liquid refrigerant or the low-pressure gas refrigerant supplied to the air gap of the motor to flow axially outward is provided on at least one of the inner

Claims

[Claim 1]

A turbo chiller comprising:

a closed refrigeration cycle that includes a turbo compressor, a condenser, a decompression device, and an evaporator connected in sequence via piping and is filled with a refrigerant; wherein

the refrigerant is a low-pressure refrigerant R1233zd(E) refrigerant with low global warming potential and low ozone depletion potential;

the turbo compressor has a direct drive configuration in which a rotating shaft of an impeller is directly joined to a motor; and

the rotating shaft is supported by a magnetic bearing.

[Claim 2]

A turbo chiller comprising:

a closed refrigeration cycle that includes a turbo compressor, a condenser, a decompression device, and an evaporator connected in sequence via piping and is filled with a refrigerant; wherein

the refrigerant is a low-pressure refrigerant R1233zd(E) refrigerant with low global warming potential and low ozone depletion potential;

the turbo compressor has a direct drive configuration in which a rotating shaft of an impeller is directly joined to a motor; and

the rotating shaft is supported by an oil-free ceramic bearing.

[Claim 3]

The turbo chiller according to claim 1 or 2, wherein a liquid refrigerant from the refrigeration cycle can be circulated as a cooling and lubricating medium for at least one of a bearing housing of the bearing and an air gap of the motor.

[Claim 4]

The turbo chiller according to claim 3, wherein instead of the liquid refrigerant, a low-pressure gas refrigerant can be supplied to the air gap of the motor.

[Claim 5]

The turbo chiller according to claim 3 or 4, wherein a helical groove which allows the liquid refrigerant or the low-pressure gas refrigerant supplied to the air

gap of the motor to flow axially outward is provided on at least one of an inner peripheral surface of a stator of the motor, an outer peripheral surface of a rotor, and an outer peripheral surface of a balance ring provided on an end surface of the rotor.