WE CLAIM

1. A refrigerant vapor compression system comprising:

a refrigerant compression device;

a refrigerant heat rejection heat exchanger downstream of said compression device;

a refrigerant heat absorption heat exchanger downstream of said refrigerant heat rejection heat exchanger;

a first expansion device disposed downstream of said refrigerant heat rejection heat exchanger and upstream of said refrigerant heat absorption heat exchanger;

a sensor coupled to an output of the heat rejection heat exchanger, the sensor to measure a refrigerant temperature; and

a controller to control operations of the refrigeration vapor compression system, said controller operative to indirectly verify the measured refrigerant temperature; characterized in that the compression device includes a first compression stage and a second compression stage, and in that the refrigerant temperature at the output of the heat rejection heat exchanger is determined by measurement using the sensor and is second determined by calculation using ambient temperature and vapor compression system capacity.

2. The refrigerant vapor compression system of claim 1, where a vapor compression system capacity has a prescribed relationship with an operating mode or difference between supply air temperature and return air temperature; and wherein an offset is added to the ambient temperature responsive to the vapor compression system capacity.

3. The refrigerant vapor compression system of claim 2, the controller to operate the vapor compression system with the calculated value for the refrigerant temperature when the measured refrigerant temperature is different from the calculated temperature value.

4. The vapor compression system of claim 1, where said sensor is a pressure sensor or a temperature sensor.

5. The refrigerant vapor compression system of claim 1, comprising a second sensor to measure a compressor mid stage pressure, said controller to indirectly verify said measured compressor mid stage pressure.

6. The refrigerant vapor compression system of claim 5, where the compressor mid stage pressure is calculated using a discharge pressure and an inlet pressure of the compressor.

7. The refrigerant vapor compression system of claim 6, wherein the controller is configured to operate the vapor compression system using the verified value of the compressor mid stage pressure where the measured compressor mid stage pressure does not match the indirectly verified value.

8. The refrigerant vapor compression system of claim 7, comprising:

a second valve disposed downstream of the heat rejection heat exchanger; and

an economizer circuit disposed downstream of the second valve and upstream of the first expansion device, the economizer circuit including a refrigerant injection line to open to an intermediate pressure stage of the compression device and a flow control valve disposed in the refrigerant injection line.

9. The refrigerant vapor compression system of claim 8, said controller being configured to close the flow control valve when the compressor mid-stage pressure is operative to cause refrigerant flow toward the economizer circuit.

10. The refrigerant vapor compression system of claim 1, comprising:

a flash tank economizer disposed in serial flow relationship between the heat rejection heat exchanger and the first expansion device, said flash tank economizer including:

a flash tank;

a first flow control device disposed between the heat rejection heat exchanger and said flash tank;

an economizer vapor line to fluidly interconnect said flash tank to a mid-stage of the compressor; and

a second flow control device disposed in said economizer vapor line.

11. A method for determining a characteristic of a refrigerant vapor compression system having a refrigerant circuit including a refrigerant compression device, a refrigerant heat rejection heat exchanger downstream of said compression device, a refrigerant heat absorption heat exchanger downstream of said refrigerant heat rejection heat exchanger, a sensor to sense the characteristic used to determine a system capacity of the refrigerant vapor compression system during operation, said characteristic being refrigerant temperature at an output of the heat rejection heat exchanger, and interconnecting refrigerant lines as active components, the method comprising:

operating the refrigerant vapor compression system in a mode where the refrigerant is circulating within the active components of the refrigerant circuit;

indirectly determining the refrigerant temperature at an output of the heat rejection heat exchanger;

comparing the sensed value of the refrigerant temperature at an output of the heat rejection heat exchangeragainst said indirectly determined value of the refrigerant temperature at an output of the heat rejection heat exchanger; and

determining an error condition of a corresponding sensor when a result of the comparison does not match.

12. The method of claim 11, comprising subsequently using the indirectly determined value in operating the vapor compression system.

13. A computer program product comprising a computer usable storage medium to store a computer readable program that, when executed on a computer, causes the computer to perform operations to operate a transport refrigeration unit, the operations comprising:

operating the transport refrigeration unit in a mode where a refrigerant is circulating within a refrigerant circuit;

sensing a characteristic used to determine a system capacity of the transport refrigeration unit during operation;

indirectly determining said characteristic used to determine the system capacity, said characteristic being refrigerant temperature at an output of the heat rejection heat exchanger, using ambient temperature and system capacity;

comparing the sensed value of the refrigerant temperature at an output of the heat rejection heat exchanger against said indirectly determined value; and

determining an error condition of a corresponding sensor when a result of the comparison does not match.

WE CLAIM

1. A refrigerant vapor compression system comprising:

a refrigerant compression device;

a refrigerant heat rejection heat exchanger downstream of said compression device;

a refrigerant heat absorption heat exchanger downstream of said refrigerant heat rejection heat exchanger;

a first expansion device disposed downstream of said refrigerant heat rejection heat exchanger and upstream of said refrigerant heat absorption heat exchanger;

a sensor coupled to an output of the heat rejection heat exchanger, the sensor to measure a refrigerant temperature; and

a controller to control operations of the refrigeration vapor compression system, said controller operative to indirectly verify the measured refrigerant temperature; characterized in that the compression device includes a first compression stage and a second compression stage, and in that the refrigerant temperature at the output of the heat rejection heat exchanger is determined by measurement using the sensor and is second determined by calculation using ambient temperature and vapor compression system capacity.

2. The refrigerant vapor compression system of claim 1, where a vapor compression system capacity has a prescribed relationship with an operating mode or difference between supply air temperature and return air temperature; and wherein an offset is added to the ambient temperature responsive to the vapor compression system capacity.

3. The refrigerant vapor compression system of claim 2, the controller to operate the vapor compression system with the calculated value for the refrigerant temperature when the measured refrigerant temperature is different from the calculated temperature value.

4. The vapor compression system of claim 1, where said sensor is a pressure sensor or a temperature sensor.

5. The refrigerant vapor compression system of claim 1, comprising a second sensor to measure a compressor mid stage pressure, said controller to indirectly verify said measured compressor mid stage pressure.

6. The refrigerant vapor compression system of claim 5, where the compressor mid stage pressure is calculated using a discharge pressure and an inlet pressure of the compressor.

7. The refrigerant vapor compression system of claim 6, wherein the controller is configured to operate the vapor compression system using the verified value of the compressor mid stage pressure where the measured compressor mid stage pressure does not match the indirectly verified value.

8. The refrigerant vapor compression system of claim 7, comprising:

a second valve disposed downstream of the heat rejection heat exchanger; and

an economizer circuit disposed downstream of the second valve and upstream of the first expansion device, the economizer circuit including a refrigerant injection line to open to an intermediate pressure stage of the compression device and a flow control valve disposed in the refrigerant injection line.

9. The refrigerant vapor compression system of claim 8, said controller being configured to close the flow control valve when the compressor mid-stage pressure is operative to cause refrigerant flow toward the economizer circuit.

10. The refrigerant vapor compression system of claim 1, comprising:

a flash tank economizer disposed in serial flow relationship between the heat rejection heat exchanger and the first expansion device, said flash tank economizer including:

a flash tank;

a first flow control device disposed between the heat rejection heat exchanger and said flash tank;

an economizer vapor line to fluidly interconnect said flash tank to a mid-stage of the compressor; and

a second flow control device disposed in said economizer vapor line.

11. A method for determining a characteristic of a refrigerant vapor compression system having a refrigerant circuit including a refrigerant compression device, a refrigerant heat rejection heat exchanger downstream of said compression device, a refrigerant heat absorption heat exchanger downstream of said refrigerant heat rejection heat exchanger, a sensor to sense the characteristic used to determine a system capacity of the refrigerant vapor compression system during operation, said characteristic being refrigerant temperature at an output of the heat rejection heat exchanger, and interconnecting refrigerant lines as active components, the method comprising:

operating the refrigerant vapor compression system in a mode where the refrigerant is circulating within the active components of the refrigerant circuit;

indirectly determining the refrigerant temperature at an output of the heat rejection heat exchanger;

comparing the sensed value of the refrigerant temperature at an output of the heat rejection heat exchangeragainst said indirectly determined value of the refrigerant temperature at an output of the heat rejection heat exchanger; and

determining an error condition of a corresponding sensor when a result of the comparison does not match.

12. The method of claim 11, comprising subsequently using the indirectly determined value in operating the vapor compression system.