WE CLAIM:

1. A method for restarting a transport refrigerant vapor compression system, the refrigerant vapor compression system having a refrigerant circuit including a refrigerant compression device, a refrigerant heat rejection heat exchanger downstream of said compression device, the heat rejection heat exchanger to operate in refrigerant transcritical conditions, a refrigerant reservoir downstream of the heat rejection heat exchanger; a refrigerant heat absorption heat exchanger downstream of said refrigerant reservoir, the heat absorption heat exchanger to operate in refrigerant subcritical conditions, and a primary expansion device disposed in the refrigerant circuit downstream of said refrigerant reservoir and upstream of said refrigerant heat absorption heat exchanger; said method comprising:

restarting components in the transport refrigerant vapor compression system with the primary expansion device at a prescribed opening to controllably remove liquid from the refrigerant reservoir;

restarting the refrigerant compression device in a first mode;

operating the primary expansion device at the prescribed opening, opening an unload service valve and opening an economizer solenoid valve;

operating the transport refrigerant vapor compression system in a selected operating mode;

closing the unload service valve; and

transitioning the refrigerant compression device to a second mode.

2. The method of claim 1, wherein the second mode is set based on a cooling capacity requirement or wherein the second mode is a standard cooling mode or an economized mode.

3. The method of claim 2, wherein the transport refrigerant vapor compression system is transitioned to the economized mode after a prescribed interval has elapsed with the refrigerant compression device in the first mode.

4. The method of claim 1, wherein the second mode is set responsive to energy consumption.

5. The method of claim 1, wherein when the selected operating mode is a frozen cargo operating mode or a perishable cargo operating mode.

6. The method of claim 1, wherein the transport refrigerant vapor compression system is configured to use a high pressure natural refrigerant or a CO_2 refrigerant.

7. The method of claim 1, further comprising:

operating the refrigerant compression device with the unload service valve open; and

draining refrigerant from the refrigerant reservoir using a downstream refrigerant flow control device.

8. The method of claim 7, wherein draining refrigerant from the refrigerant reservoir using a downstream refrigerant flow control device comprises

pulsing the economizer solenoid valve in a refrigerant vapor line or pulsing a liquid injection valve in a liquid injection line between the refrigerant reservoir and an inlet port of the refrigerant compression device.

9. A method for distributing a refrigerant charge level in a refrigerant vapor compression system, the refrigerant vapor compression system having a refrigerant circuit including a refrigerant compression device, a refrigerant heat rejection heat exchanger downstream of said compression device, the heat rejection heat exchanger to operate in a transcritical mode, a refrigerant heat absorption heat exchanger downstream of said refrigerant heat rejection heat exchanger, the heat absorption heat exchanger to operate in a subcritical mode, and a primary expansion device disposed in the refrigerant circuit downstream of said refrigerant heat rejection heat exchanger and upstream of said refrigerant heat absorption heat exchanger; said method comprising:

driving components in the refrigerant vapor compression system,

restarting the refrigerant compression device in a first mode;

operating the primary expansion device independent of refrigerant heat absorption heat exchanger superheat;

comparing a condition at a refrigerant reservoir to a prescribed condition;

wherein when the condition is below the prescribed condition for a prescribed interval, operating the primary expansion device to control the refrigerant heat absorption heat exchanger superheat; and

transitioning the refrigerant vapor compression system to a second mode.

10. The method of claim 9, wherein when the condition is above the prescribed condition, operating a refrigerant flow device to controllably migrate refrigerant from the refrigerant reservoir to an inlet of the refrigerant compression device.

11. The method of claim 10, comprising:

operating an economizer solenoid valve in a refrigerant vapor line coupled to an intermediate port of the refrigerant compression device; and

opening an unload valve in a bypass line between the intermediate port and an inlet port of the refrigerant compression device when the condition is above the prescribed condition.

12. The method of claim 11, comprising:

pulsing a refrigerant flow device in a liquid injection line between the refrigerant reservoir and the inlet port of the refrigerant compression device when the condition is above the prescribed condition.

13. The method of claim 10, further comprising sensing pressure at a flash tank using a sensor, wherein the condition is supercritical condition of the refrigerant in the refrigerant reservoir, wherein the refrigerant vapor compression system is configured to use CO_2 refrigerant.

14. The method of claim 9, operating the primary expansion device at prescribed opening to controllable remove liquid from the refrigerant reservoir between the heat rejection heat exchanger and the heat absorption heat exchanger, wherein the refrigerant vapor compression system is transitioned to an economized mode after the prescribed interval has elapsed after the refrigerant compression device transitioned to the first mode.

15. The method of claim 9, wherein the condition is a two-phase refrigerant in the refrigerant reservoir, or wherein the condition is a pressure condition and the prescribed condition is a prescribed pressure threshold or a prescribed temperature threshold, wherein the prescribed pressure threshold is a critical refrigerant pressure.

16. A method for transitioning a refrigerant vapor compression system to a second mode, the refrigerant vapor compression system having a refrigerant circuit including a refrigerant

compression device, a refrigerant heat rejection heat exchanger downstream of said compression device, the heat rejection heat exchanger to operate above a refrigerant critical point, a refrigerant heat absorption heat exchanger downstream of said refrigerant heat rejection heat exchanger, a primary expansion device disposed in the refrigerant circuit downstream of said refrigerant heat rejection heat exchanger and upstream of said refrigerant heat absorption heat exchanger, and a secondary expansion valve upstream of a refrigerant reservoir between the heat rejection heat exchanger and the heat absorption heat exchanger, said method comprising:

restarting the refrigerant vapor compression system with the primary and secondary expansion devices at first and second prescribed openings, respectively;

restarting the refrigerant compression device in a first mode;

operating the refrigerant vapor compression system in a prescribed operating mode;

operating a third refrigerant flow device to controllably migrate additional liquid refrigerant from the refrigerant reservoir to an inlet of the refrigerant compression device; and

when a prescribed interval has passed since restarting the refrigerant compression device, transitioning the refrigerant vapor compression system to the second mode.

17. The method of claim 16, wherein the second mode is a standard cooling mode, an economized mode or the second mode is different from the first mode.

18. The method of claim 16, wherein the prescribed interval is 30 seconds, 1 minutes, two minutes, or five minutes.

19. The method of claim 16, wherein upon shut-down of the refrigerant vapor compression system, refrigerant transitioned from the heat rejection heat exchanger, wherein the refrigerant is carbon dioxide, the heat rejection heat exchanger to operate in a transcritical mode and the heat absorption heat exchanger to operate in a subcritical mode.

CLAIMS

1. A method for restarting a transport refrigerant vapor compression system, the refrigerant vapor compression system having a refrigerant circuit including a refrigerant compression device, a refrigerant heat rejection heat exchanger downstream of said compression device, the heat rejection heat exchanger to operate in refrigerant transcritical conditions, a refrigerant reservoir downstream of the heat rejection heat exchanger; a refrigerant heat absorption heat exchanger downstream of said refrigerant reservoir, the heat absorption heat exchanger to operate in refrigerant subcritical conditions, and a primary expansion device disposed in the refrigerant circuit downstream of said refrigerant reservoir and upstream of said refrigerant heat absorption heat exchanger; said method comprising:

restarting components in the transport refrigerant vapor compression system with the primary expansion device at a prescribed opening to controllably remove liquid from the refrigerant reservoir;

restarting the refrigerant compression device in a first mode;

operating the primary expansion device at the prescribed opening, opening an unload service valve and opening an economizer solenoid valve to provide refrigerant from the refrigerant reservoir to an intermediate inlet port of the refrigerant compression device to remove refrigerant from said refrigerant reservoir;

operating the transport refrigerant vapor compression system in a selected operating mode;

closing the unload service valve; and

transitioning the refrigerant compression device to a second mode.

2. The method of claim 1, wherein the second mode is set based on a cooling capacity requirement or wherein the second mode is a standard cooling mode or an economized mode.

3. The method of claim 2, wherein the transport refrigerant vapor compression system is transitioned to the economized mode after a prescribed interval has elapsed with the refrigerant compression device in the first mode.

4. The method of claim 1, wherein the second mode is set responsive to energy consumption.

5. The method of claim 1, wherein when the selected operating mode is a frozen cargo operating mode or a perishable cargo operating mode.

6. The method of claim 1, wherein the transport refrigerant vapor compression system is configured to use a high pressure natural refrigerant or a CO.sub.2 refrigerant.

7. The method of claim 1, further comprising: operating the refrigerant compression device with the unload service valve open; and draining refrigerant from the refrigerant reservoir using a downstream refrigerant flow control device.

8. The method of claim 7, wherein draining refrigerant from the refrigerant reservoir using a downstream refrigerant flow control device comprises pulsing the economizer solenoid valve in a refrigerant vapor line or pulsing a liquid injection valve in a liquid injection line between the refrigerant reservoir and an inlet port of the refrigerant compression device.