Claims

1. A method of managing a compressor start operation ~~for a transport refrigeration unit including the compressor (210)~~, the method comprising controlling a valve ~~(250;275)~~ disposed ~~in a refrigerant line~~ upstream of a compressor to lower a saturated suction temperature of a refrigerant to be below an ambient temperature while starting the compressor;

~~characterised by:~~

~~actively controlling a valve disposed within a refrigerant line and upstream of the compressor,~~ wherein ~~actively~~ controlling the valve includes actively ~~adjusts~~ controlling the ~~pressure~~ valve ~~of the refrigerant~~ to lower the saturated suction temperature of the refrigerant to be below the ambient temperature by a threshold temperature difference such that solubility of the refrigerant with respect to oil is below a desired level;

wherein the saturated suction temperature of the refrigerant is lowered to be at least 38 degrees Celsius below the ambient temperature.

2. The method of claim 1, wherein the valve ~~(250;275)~~ is a suction modulation valve.

3. The method of claim 1, wherein the valve ~~(250;275)~~ is an electronic evaporator expansion valve.

~~4. The method of claim 1, 2, or 3, wherein the saturated suction temperature of the refrigerant is lowered to be at least 30 degrees Fahrenheit below the ambient temperature.~~

~~4~~5. The method of claim 1, wherein the saturated suction temperature of the refrigerant is lowered by adjusting a pressure of the refrigerant with the valve.

5. ~~The~~ A method of ~~any preceding claim~~managing a compressor start operation for a transport refrigeration, ~~wherein~~ the method comprising:

~~is performed when the~~ determining an ambient temperature surrounding a compressor;~~is below a threshold ambient temperature~~

starting the compressor; and

actively controlling a valve disposed within a refrigerant line and upstream of the compressor, wherein actively controlling the valve adjusts the pressure of the refrigerant to lower the saturated suction temperature of the refrigerant to be below the ambient temperature by a threshold temperature difference;

wherein controlling the valve includes actively controlling the valve to lower the saturated suction temperature of the refrigerant to be below the ambient temperature by a threshold temperature difference such that solubility of the refrigerant with respect to oil is below a desired level;

wherein the threshold temperature difference is at least 38 degrees Celsius.

~~7~~6. The method of claim ~~5~~5, wherein the valve is suction modulation valve.

~~8~~7. The method of claim ~~5~~5, wherein the valve is an electronic evaporator expansion valve.

~~9~~8. The method of claim 5, wherein the method is performed when the ambient temperature is below a threshold ambient temperature.

~~6~~109. The method of claim 5, wherein the method is performed when the ambient temperature is below the threshold ambient temperature ~~is equal to or less than 120 degrees Fahrenheit~~.

10. The method of claim 5, wherein the threshold ambient temperature is equal to or less than 120 degrees Fahrenheit.

~~7~~11. A transport refrigeration system comprising:

a compressor ~~(210)~~, a condenser ~~(230)~~ downstream of the compressor, an expansion device ~~(250)~~ downstream of the condenser, and an evaporator ~~(260)~~ downstream of the expansion device, and a refrigerant circulating from the compressor to the condenser, through the expansion device and the evaporator and then returning to the compressor; and

a control module ~~configured to manage a compressor start by adjusting~~ to adjust a valve ~~(250;275)~~ disposed in a refrigerant line and upstream of the compressor, adjustment of the valve ~~including actively controlling the valve to thereby adjust~~ adjusting the pressure of the refrigerant to lower the saturated suction temperature of the refrigerant to be below the ambient temperature by a threshold temperature difference;

wherein the control module actively controls the valve to lower the saturated suction temperature of the refrigerant to be below the ambient temperature by a threshold temperature difference such that solubility of the refrigerant with the respect to oil is below a desired level;

wherein the threshold temperature difference is at least 38 degrees Celsius.

~~8~~12. The transport refrigeration system of claim ~~7~~11, wherein the valve ~~(250;272)~~ is a suction modulation valve.

~~9~~13. The transport refrigeration system of claim ~~7~~11, wherein the valve ~~(250;272)~~ is an electronic evaporator expansion valve.

14. The transport refrigeration system of claim 11, wherein the transport refrigeration system includes a suction modulation valve and an electronic evaporator expansion valve, wherein the control module actively controls the suction modulation valve to lower the saturated suction temperature of the refrigerant to be below the ambient temperature by the threshold temperature difference.

15. The method of claim 1, wherein controlling the valve includes actively controlling the valve to lower the saturated suction temperature of the refrigerant to be

below the ambient temperature by a threshold temperature difference such that solubility of the refrigerant with respect to oil is below 10%.

16. A method of managing a compressor start operation, the method comprising controlling a valve disposed upstream of a compressor to lower a saturated suction temperature of a refrigerant to be below an ambient temperature while starting the compressor;

wherein controlling the valve includes actively controlling the valve to lower the saturated suction temperature of the refrigerant to be below the ambient temperature by a threshold temperature difference such that solubility of the refrigerant with respect to oil is below 10%