We Claim:

1. A method for preventing a frosted evaporator heat exchanger coil of a refrigerant vapor compression system for supplying conditioned air to a temperature controlled space, the method comprising:

determining whether a change in an air flow temperature differential across the evaporator heat exchanger coil over a preselected period of time at least equals a set point threshold change in air flow temperature differential;

determining whether a change in a refrigerant pressure condition on a low pressure side of the refrigerant vapor compression system over said preselected period of time at least equals a set point threshold change in refrigerant pressure condition;

if both the change in an air flow temperature differential across the evaporator heat exchanger coil over a preselected period of time at least equals a set point threshold change in air flow temperature differential and the change in a refrigerant pressure condition on a low pressure side of the refrigerant vapor compression system over said preselected period of time at least equals a set point threshold change in refrigerant pressure condition, determining whether a current magnitude of the air flow temperature differential across the evaporator heat exchanger coil at least equals a set point threshold magnitude for the air flow temperature differential, and determining whether a current magnitude of the evaporator heat exchanger coil refrigerant pressure condition at least equals a set point threshold magnitude for the refrigerant pressure condition; and

initiating a defrost of the evaporator heat exchanger coil if both the current magnitude of the air flow temperature differential across the evaporator heat exchanger coil at least equals a set point threshold magnitude for the air flow temperature differential, and the current magnitude of the evaporator heat exchanger coil refrigerant pressure condition at least equals a set point threshold magnitude for the refrigerant pressure condition.

2. The method as set forth in claim 1 further comprising generating a warning indicating that the evaporator heat exchanger coil is becoming frosted whenever both the change in an air flow temperature differential across the evaporator heat exchanger coil over a preselected period of time at least equals a set point threshold change in air flow temperature differential and the change in an evaporator heat exchanger coil refrigerant pressure condition over said preselected period of time at least equals a set point threshold change in refrigerant pressure condition.

3. The method as set forth in claim 1 wherein determining whether a change in an air flow temperature differential across the evaporator heat exchanger coil over a preselected period of time at least equals a set point threshold change in air flow temperature differential comprises:

at a first time sensing the return air temperature of the air flow returning from the temperature controlled space to pass over the evaporator heat exchanger coil, sensing the supply air temperature of the air flow having passed over the evaporator heat exchanger coil to be supplied to the temperature controlled space, and calculating the air flow temperature differential at the first time by subtracting the sensed supply air temperature from the return air temperature;

at a second time the preselected period of time after the first time sensing the return air temperature of the air flow returning from the temperature controlled space to pass over the evaporator heat exchanger coil, sensing the supply air temperature of the air flow having passed over the evaporator heat exchanger coil to be supplied to the temperature controlled space, and calculating the air flow temperature differential at the second time by subtracting the sensed supply air temperature from the return air temperature;

calculating a differential between the air flow temperature differential at the second time and the air flow temperature differential at the first time; and

comparing the differential between the air flow temperature differential at the second time and the air flow temperature differential at the first time to the set point threshold change in air flow temperature differential.

4. The method as set forth in claim 1 wherein determining whether a change an evaporator heat exchanger coil refrigerant pressure condition over said preselected period of time at least equals a set point threshold change in refrigerant pressure condition comprises:

sensing the evaporator heat exchanger coil refrigerant pressure condition at a first time and a second time the preselected period of time after the first time;

calculating a change in the evaporator heat exchanger coil refrigerant pressure condition over the selected period of time by subtracting the magnitude of the sensed evaporator heat exchanger coil refrigerant pressure condition at the first time from the magnitude of the sensed evaporator heat exchanger coil refrigerant pressure condition at the second time; and

comparing the calculated change in the evaporator heat exchange coil refrigerant pressure condition to the set point threshold change in refrigerant pressure condition.

5. The method as set forth in claim 4 wherein the refrigerant pressure condition on a low pressure of the refrigerant vapor compression system is selected from the group consisting of a compressor suction pressure, an evaporator outlet refrigerant pressure, and an evaporator inlet refrigerant pressure.

6. The method as set forth in claim 1 wherein the refrigerant vapor compression system comprises a transcritical refrigerant vapor compression system charged with carbon dioxide refrigerant.

7. The method as set forth in claim 6 wherein the set point threshold magnitude of the sensed evaporator heat exchanger coil refrigerant pressure condition is greater than 5.2 bars absolute.

8. The method as set forth in claim 6 wherein the set point threshold magnitude of the air flow temperature differential is greater than 20°F (11°C).

9. The method as set forth in claim 1 wherein the temperature controlled space comprises a refrigerated cargo box of an intermodal container, a trailer or a truck.

We Claim:

1. A method for preventing a frosted evaporator heat exchanger coil of a refrigerant vapor compression system for supplying conditioned air to a temperature controlled space, the method characterised by comprising:

determining whether a change in an air flow temperature differential across the evaporator heat exchanger coil over a preselected period of time is greater than or equal to a set point threshold change in air flow temperature differential;

determining whether a change in a refrigerant pressure condition on a low pressure side of the refrigerant vapor compression system over said preselected period of time is greater than or equal to a set point threshold change in refrigerant pressure condition;

if both the change in air flow temperature differential across the evaporator heat exchanger coil over a preselected period of time is greater than or equal to the set point threshold change in air flow temperature differential and the change in refrigerant pressure condition on a low pressure side of the refrigerant vapor compression system over said preselected period of time is greater than or equal to the set point threshold change in refrigerant pressure condition,

determining whether a current magnitude of the air flow temperature differential across the evaporator heat exchanger coil is greater than or equal to a set point threshold magnitude for the air flow temperature differential, and

determining whether a current magnitude of the evaporator heat exchanger coil refrigerant pressure condition less than or equal to a set point threshold magnitude for the refrigerant pressure condition; and

initiating a defrost of the evaporator heat exchanger coil if both the current magnitude of the air flow temperature differential across the evaporator heat exchanger coil is greater than or equal to the set point threshold magnitude for the air flow temperature differential, and the current magnitude of the evaporator heat exchanger coil refrigerant pressure condition is less than or equal to the set point threshold magnitude for the refrigerant pressure condition.

2. The method as set forth in claim 1 further comprising generating a warning indicating that the evaporator heat exchanger coil is becoming frosted whenever both the change in an air flow temperature differential across the evaporator heat exchanger coil over a preselected period of time is greater than or equal to the set point threshold change in air flow temperature differential and the change in an evaporator heat exchanger coil refrigerant

pressure condition over said preselected period of time is greater than or equal to the set point threshold change in refrigerant pressure condition.

3. The method as set forth in claim 1 wherein determining whether a change in an air flow temperature differential across the evaporator heat exchanger coil over a preselected period of time is greater than or equal to the set point threshold change in air flow temperature differential comprises:

at a first time sensing the return air temperature of the air flow returning from the temperature controlled space to pass over the evaporator heat exchanger coil, sensing the supply air temperature of the air flow having passed over the evaporator heat exchanger coil to be supplied to the temperature controlled space, and calculating the air flow temperature differential at the first time by subtracting the sensed supply air temperature from the return air temperature;

at a second time the preselected period of time after the first time sensing the return air temperature of the air flow returning from the temperature controlled space to pass over the evaporator heat exchanger coil, sensing the supply air temperature of the air flow having passed over the evaporator heat exchanger coil to be supplied to the temperature controlled space, and calculating the air flow temperature differential at the second time by subtracting the sensed supply air temperature from the return air temperature;

calculating a differential between the air flow temperature differential at the second time and the air flow temperature differential at the first time; and

comparing the differential between the air flow temperature differential at the second time and the air flow temperature differential at the first time to the set point threshold change in air flow temperature differential.

4. The method as set forth in claim 1 wherein determining whether a change an evaporator heat exchanger coil refrigerant pressure condition over said preselected period of time is greater than or equal to the set point threshold change in refrigerant pressure condition comprises:

sensing the evaporator heat exchanger coil refrigerant pressure condition at a first time and a second time the preselected period of time after the first time;

calculating a change in the evaporator heat exchanger coil refrigerant pressure condition over the selected period of time by subtracting the magnitude of the sensed evaporator heat exchanger coil refrigerant pressure condition at the first time from the

magnitude of the sensed evaporator heat exchanger coil refrigerant pressure condition at the second time; and

comparing the calculated change in the evaporator heat exchange coil refrigerant pressure condition to the set point threshold change in refrigerant pressure condition.

5. The method as set forth in claim 4 wherein the refrigerant pressure condition on a low pressure of the refrigerant vapor compression system is selected from the group consisting of a compressor suction pressure, an evaporator outlet refrigerant pressure, and an evaporator inlet refrigerant pressure.

6. The method as set forth in claim 1 wherein the refrigerant vapor compression system comprises a transcritical refrigerant vapor compression system charged with carbon dioxide refrigerant.

7. The method as set forth in claim 6 wherein the set point threshold magnitude of the sensed evaporator heat exchanger coil refrigerant pressure condition is greater than 5.2 bars absolute.

8. The method as set forth in claim 6 wherein the set point threshold magnitude of the air flow temperature differential is greater than 20°F (11°C).

9. The method as set forth in claim 1 wherein the temperature controlled space comprises a refrigerated cargo box of an intermodal container, a trailer or a truck.