CLAIMS:

1. A method of operating a refrigeration system comprising:

initiating a compressor shutdown operation;

recording shutdown conditions;

calculating one or more restart characteristics based on the recorded shutdown conditions, wherein the one or more restart characteristics comprises at least one of a static pressure ratio or a predicted static saturated evaporator/suction temperature;

comparing the calculated restart characteristics with one or more compressor restart safety limits;

when the calculated restart characteristics do not satisfy the restart safety limits, performing a temperature modulation pump down operation; and

when the calculated restart characteristics satisfy the restart safety limits, completing the compressor shutdown operation.

2. The method of claim 1, wherein the shutdown conditions include at least one of return air temperature to an evaporator of the refrigeration system, supply air temperature to a volume cooled by the refrigeration system, or ambient air temperature.

3. The method of claim 1, wherein the static pressure ratio is a function of ambient air temperature and return air temperature to an evaporator of the refrigeration system.

4. The method of claim 1, wherein the predicted static saturated evaporator/suction temperature is based on a return air temperature at an evaporator of the refrigeration system.

5. The method of claim 1, wherein the one or more calculated restart characteristics is a calculated static pressure ratio.

6. The method of claim 5, wherein the restart safety limit is a predetermined static pressure ratio limit and the comparison comprises determining if the calculated static pressure ratio is less than the predetermined static pressure ratio limit.

7. The method of claim 1, wherein the one or more calculated restart characteristics is a predicted static saturated evaporator/suction temperature.

8. The method of claim 7, wherein the restart safety limit is a predetermined static saturated evaporator/suction temperature limit and the comparison comprises determining if the predicted static saturated evaporator/suction temperature is less than the predetermined static saturated evaporator/suction temperature limit.

9. The method of claim 1, wherein the temperature modulation operation comprises at least one of (i) closing an evaporator control valve, (ii) running a compressor of the refrigeration system in an energized state, (iii) performing a pump down operation, or (iv) performing a suction operation.

10. The method of claim 1, further comprising repeating the recording, calculating, and comparing after performing the temperature modulation operation.

11. A refrigeration system comprising:

a compressor;

an evaporator;

a fluid path fluidly connecting the compressor and the evaporator;

an evaporator control valve operably connected to the fluid path to control fluid flow to or form the evaporator; and

a controller configured to:

initiate a compressor shutdown operation;

record shutdown conditions;

calculate one or more restart characteristics based on the recorded shutdown conditions, wherein the one or more restart characteristics comprises at least one of a static pressure ratio or a predicted static saturated evaporator/suction temperature;

compare the calculated restart characteristics with one or more compressor restart safety limits;

when the calculated restart characteristics do not satisfy the restart safety limits, control the refrigeration system to perform a temperature modulation pump down operation; and

when the calculated restart characteristics satisfy the restart safety limits, control the compressor to complete the shutdown operation.

12. The system of claim 11, wherein the shutdown conditions include at least one of return air temperature to an evaporator of the refrigeration system, supply air temperature to a volume cooled by the refrigeration system, or ambient air temperature.

13. The system of claim 11, wherein the static pressure ratio is a function of ambient air temperature and return air temperature to an evaporator of the refrigeration system.

14. The system of claim 11, wherein the predicted static saturated evaporator/suction temperature is based on a return air temperature at an evaporator of the refrigeration system.

15. The system of claim 11, wherein the one or more calculated restart characteristics is a calculated static pressure ratio and wherein the restart safety limit is a predetermined static pressure ratio limit and the comparison comprises determining if the calculated static pressure ratio is less than the predetermined static pressure ratio limit.

16. The system of claim 11, wherein the one or more calculated restart characteristics is a predicted static saturated evaporator/suction temperature and wherein the restart safety limit is a predetermined static saturated evaporator/suction temperature limit and the comparison comprises determining if the predicted static saturated evaporator/suction temperature is less than the predetermined static saturated evaporator/suction temperature limit.

17. The system of claim 11, wherein the temperature modulation operation comprises at least one of (i) closing an evaporator control valve, (ii) running a compressor of the refrigeration system in an energized state, (iii) performing a pump down operation, or (iv) performing a suction operation.

18. The system of claim 11, wherein the compressor is a scroll type compressor.