EPA TYPE III Certification Study Guide
HET-190

Basic Systems

1. Type III certification is for equipment that uses low-pressure refrigerant (e.g. R-123, R-11).

2. Low-pressure units are mostly chillers. A chiller is a refrigeration unit that cools water or other liquid (not air). The chilled liquid is used to cool large buildings or for industrial processes.

3. Chillers are usually charged with liquid refrigerant through a charging valve in the evaporator.

4. Initially (first), charge the evacuated system with vapor only. This is to prevent the water in the system from freezing.
    a. Watch the gauge pressure.
    b. Convert gauge pressure to temperature using a P-T chart.
    c. When the pressure corresponds to a temperature above about 36°F (just above the freezing point of water), liquid refrigerant can be charged.

5. Chillers have a rupture disc as a safety device to relieve excessive pressure on the low side of the system. [*To rupture* means to tear or break open with force.]

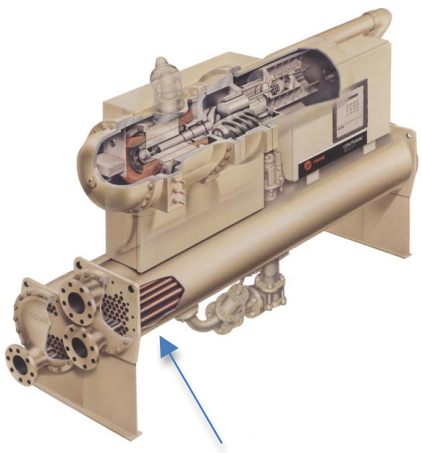
6. The rupture disc is usually set to open at 15 psig.

7. The rupture disc is installed on the low side of the system, in the suction line, between the evaporator and the inlet to the compressor.

8. The rupture disc discharges (vents) to the outdoors.

9. The chilled water pump should be running during refrigerant recovery. This prevents the water from freezing as refrigerant pressure is reduced.

10. A chiller evaporator consists of refrigerant lines enclosed in a shell. Water circulates in the shell, around the refrigerant lines.



Cutaway view of a chiller shell, exposing refrigerant lines to view.
Whitman, W. C. *et al.* (2009). Refrigeration and Air Conditioning Technology. 6th Ed. Fig. 48-41, pg. 1270.

11. The lowest access point on a low-pressure unit is the evaporator charging valve.

12. If a unit has had a leak or major component failure, an oil sample should be taken and tested for acids.

13. If a system is not fully evacuated, compressor head pressure can rise.

14. If a low-pressure system is idle (not operating), system pressure should be maintained slightly above atmospheric pressure to prevent air from entering the system.

Purge Unit

15. Type III systems operate at pressures *below* atmospheric pressure. Leaks cause air and moisture to enter (not escape from) the system and cause problems.

16. Most leaks are around gaskets and fittings. The shaft seal on open (not hermetically sealed) compressors is a common location of leaks.

17. When air leaks into a chiller it accumulates at the top (highest point) of the condenser. It stays there because air is non-condensable.

18. Air and water vapor are removed by a purge unit (or system). [*To purge* means to remove or to get rid of. A purge unit *purges* a system of non-condensables.]

19. The purge unit consists of a purge compressor, an oil separator and a purge drum. [A drum is a large storage container.]

20. The purge compressor pulls non-condensables and some refrigerant vapor from the evaporator and sends it to the oil separator. The oil is returned to the purge compressor.

21. In the purge drum, any refrigerant is separated from non-condensables. The refrigerant is returned to the system. The non-condensables are vented to the atmosphere.

22. High efficiency purge units minimize the loss of refrigerant to the atmosphere.

Leak Detection and Repair

23. Common signs of leaking: (i) The purge system runs excessively; (ii) excessive moisture in the purge unit; (iii) high head pressure.

24. A hydrostatic test is used to check tubing for leaks.

25. Drain water circuits before testing. This ensures that moisture will not be drawn into the refrigerant circuit.

26. Test Type III equipment for leaks by increasing pressure in the system. Hot water (at a controlled temperature) in the chiller tubes, heating blankets or nitrogen can be used.

27. If leak testing with dry N_2, do not exceed 10 psig or the rupture disc may fail.

28. If a system does not contain refrigerant it can be tested for leaks by pulling a deep vacuum (1 mm Hg). The vacuum should not rise to more than 2.5 mm Hg.

29. Units should be checked for leaks, and leaks repaired, on a regular schedule. This will minimize the need for purge cycles.

30. Testing for leaks between the refrigerant circuit and the water circuit can be made by removing the water and performing a leak check at the drain valve.

31. Refrigerant leaks in Type II and III equipment containing at least 50 lb. refrigerant must be repaired:
    1. if the leak rate is at least 35% per year in commercial refrigeration or industrial process equipment
    2. if the leak rate is at least 15% in other equipment.

Recovery Basics – Type III

32. Recover liquid refrigerant first, then vapor.

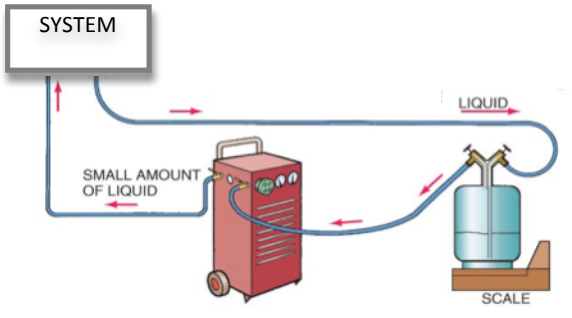
33. During recovery, water should be circulating in the system to prevent freezing.

34. Before removing oil, heat it to 130°F to release refrigerant contained in the oil.

35. Refrigerant recovery equipment can have an air-cooled or a water-cooled condenser. Water-cooled condensers are connected to the local (municipal) water supply.

Recovery Procedures – Type III

36. <u>Push-pull</u> recovery method: (i) vapor is pulled out of the recovery cylinder. This pulls liquid refrigerant from the system into the cylinder. (ii) A small amount of condensed liquid is pushed into the system. This increases pressure in the system and pushes more liquid into the recovery cylinder.



Whitman, W. C. *et al.* (2009). Refrigeration and Air Conditioning Technology. 6th Ed. Fig. 9-25, pg. 182.

37. When using the push-pull recovery method, set the recovery unit's high pressure cut-out to 10 psig. This ensures that the rupture disc will not be ruptured.

38. After the recovery machine shuts off automatically, there may still be refrigerant trapped in the system. If refrigerant is trapped, the system pressure will rise within several minutes. Continue with recovery.

39. If a system cannot be evacuated to the target level because it has leaks, or if recovery to this level would contaminate the refrigerant, you should evacuate the leaking components to the lowest level possible without substantially contaminating the refrigerant. ("Substantially" means to an important degree.)

40. If you are evacuating a leaking component, it must be evacuated to at least 0 psig.

41. EPA defines a "major repair" as removal of (i) the compressor, (ii) the evaporator, (iii) the condenser or (iv) any auxiliary heat exchanger coil.

42. Recovery and recycling machines are not required to recover more than one type of refrigerant.

Precautions When Recovering – Type III

43. When a system is evacuated quickly with a large (high-capacity) vacuum pump, it is possible that moisture in the system will freeze. If this happens, raise the pressure with dry nitrogen until the ice melts.

Safety

44. Equipment machine rooms must have refrigerant sensors (ASHRAE Standard 15). The sensors must be able to detect refrigerants in all safety groups.

45. An alarm and a ventilation system must be activated before refrigerant concentrations exceed specified levels. (ASHRAE Standard 15).

46. R-123, a low-pressure refrigerant, is in safety group B1 (higher toxicity).