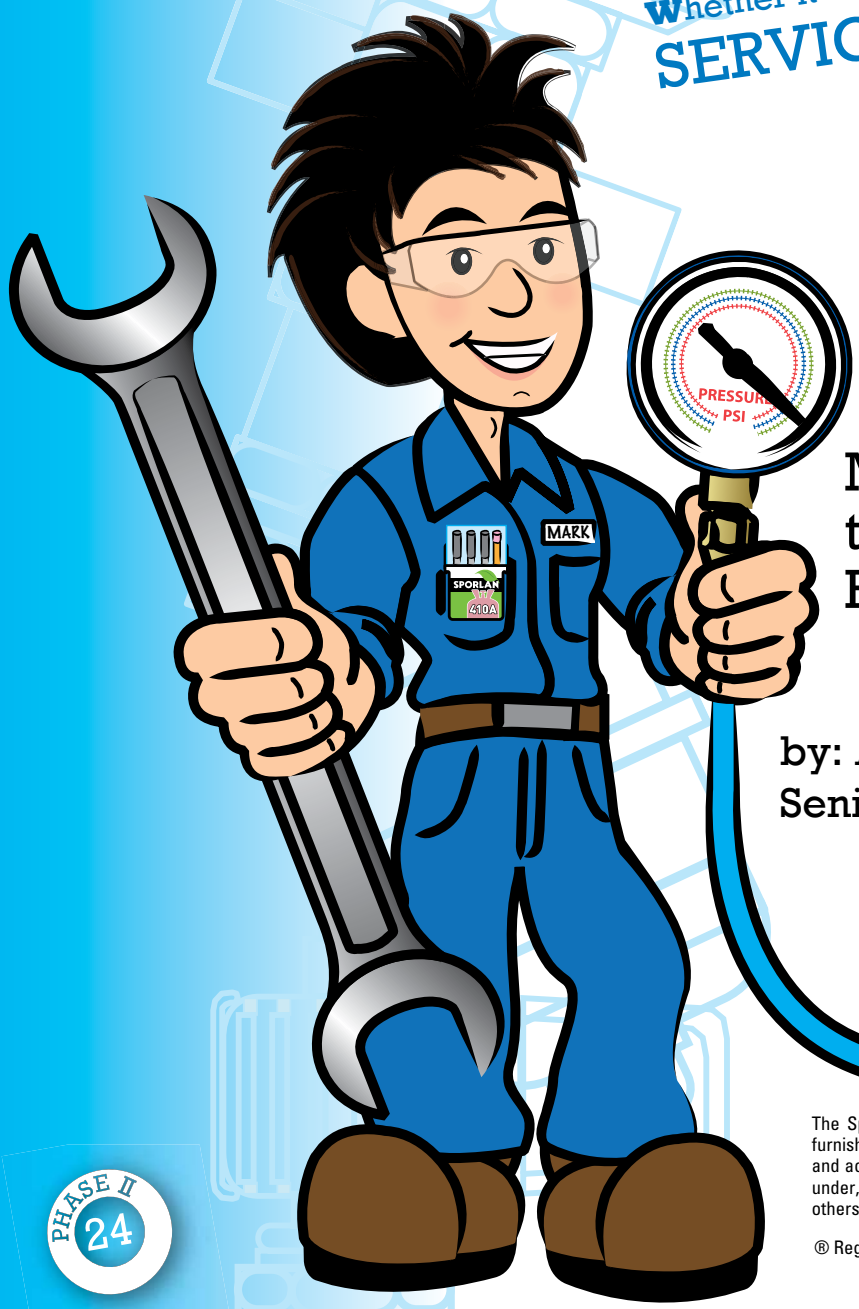
A collection of short pointed topical papers.

October 2009

Cold W·A·R·

Whether it's Air Conditioning or Refrigeration
SERVICING KNOW-HOW

SPORLAN



Most of What You Need to Know About Flooded Head Pressure Control

by: Andy Schoen
Senior Application Engineer

PHASE II 24

Cold W.A.R. Phase II, Issue 24

Most of What You Need to Know About Flooded Head Pressure Control

Below are six questions that will help you learn most of what you need to know about flooded head pressure control.

1. Why do you need a receiver?

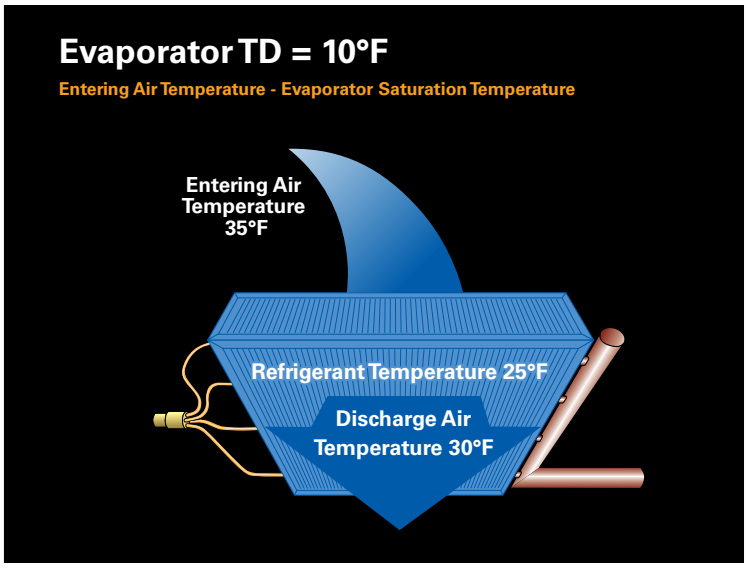
The flooded head pressure control valve maintains head pressure by backing up liquid refrigerant into the condenser, and in doing so reduces condenser capacity. This function requires the system to have additional refrigerant available that it won't need during summertime operation when head pressure will be above the valve's control setting.

This additional refrigerant must be stored in the receiver when it is not needed by the head pressure control valve.

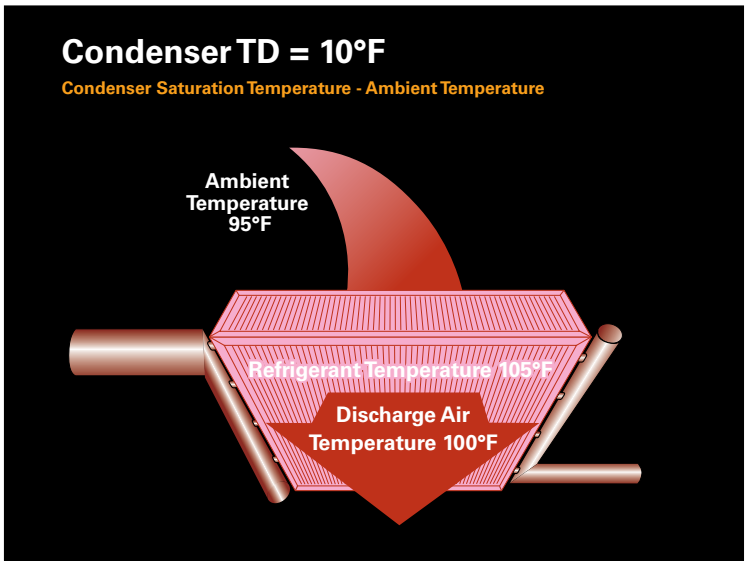
2. What is Temperature Difference (TD)?

Air cooled condensers and air cooling evaporators are sized on the basis of temperature difference (TD). They are calculated as follows:

Evaporator TD: Entering Air Temperature - Evaporator Temperature



Condenser TD: Condenser Temperature - Ambient Temperature



Most of What You Need to Know About Flooded Head Pressure Control

Evaporator and condenser capacity vary proportionately to TD. For example, if we were to double the TD, we would double the coil capacity. Below is a ratings table for an 18,000 Btu/h medium temperature coil rated at 15°F TD.

TD (°F)	Coil Rating (Btu/h)
10	12,000
15	**18,000**
20	24,000
30	36,000

3. How does one estimate the extra refrigerant charge necessary to flood the condenser?

If the condenser TD doubles, we must flood one-half of the condenser coil to maintain the same capacity. If our condenser TD triples, we must flood two-thirds of the condenser coil to maintain the same capacity. And so on. The formula to calculate the percentage of condenser to flood is as follows:

$$\left[1-\frac{\text{design TD}}{\text{actual TD}}\right]\cdot 100$$

Knowing the setting of the head pressure control valve, the minimum ambient at which the condenser will operate, and the TD at which the condenser was originally sized, you can estimate the percentage of the condenser coil that needs to be flooded to maintain head pressure control. For example:

Head pressure control setting: 90°F
Minimum ambient temperature: 0°F
Condenser TD at design conditions: 15°F

The percentage of condenser to flood is determined by the above equation:

$$\left[1-\frac{15}{(90-0)}\right]\cdot 100 = 83.3\%$$

If you do not know how the condenser was originally sized, you may use the following TDs listed in the table below as an estimate:

Application	TD (°F)
High Temp - A/C	20
Medium Temp	15
Low Temp	10

The amount of refrigerant necessary to completely flood a condenser coil requires one to determine the internal volume of the condenser coil and the liquid density of the refrigerant. Sporlan Bulletin 90-30-1 provides data to simplify this calculation. Knowing this value, and the percentage of the condenser to be flooded, allows one to determine the additional refrigerant required.

Most of What You Need to Know About Flooded Head Pressure Control

4. How does one select the receiver and head pressure control valve?

The receiver should be sized such that the required excess refrigerant charge takes up no more than 80% of its internal volume. If it is desired to pump down the system, the receiver should be sized such that the entire system charge takes up no more than 80% of the receiver's internal volume.

For summertime conditions, the head pressure control valve should be sized such that the pressure drop across the valve does not exceed the equivalent of 1 to 2°F, or a maximum of about 5 psi with R-404A.

Three types of head pressure control valves are shown below. If you are using and ORI and ORD-4 combination for head pressure control as shown in Fugure 1, check the ORD-4 capacity at the wintertime conditions. In some situations, it may be necessary to parallel two ORD-4 valves to obtain adequate bypass capacity.

How these valves operate and their ratings may be found in Sporlan Bulletin 90-30.

Figure 1

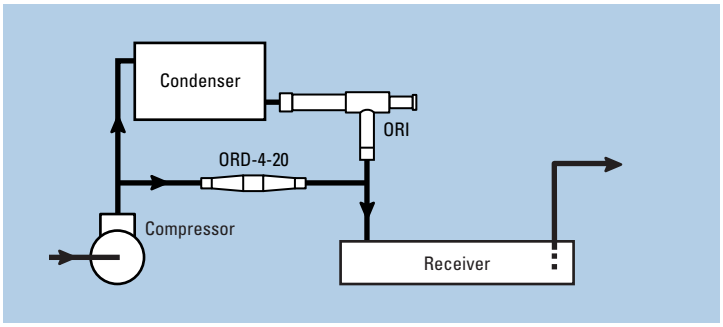


Figure 2

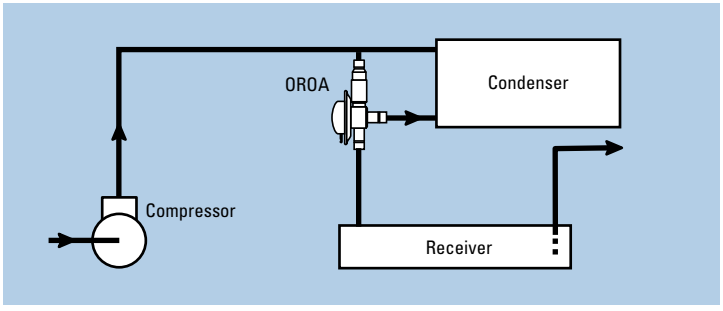
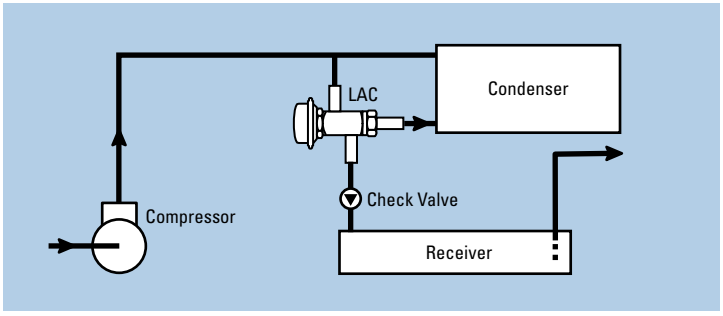


Figure 3



Most of What You Need to Know About Flooded Head Pressure Control

5.What if I'm servicing the equipment when the head pressure control valve is already backing up refrigerant into the condenser? How do I know if I have the correct charge?

Block the condenser air flow until head pressure is above the head pressure control valve setting. The refrigerant will return to the receiver. From here, one could remove refrigerant from the system until flashing occurs in the sight glass, and then add back the correct amount of refrigerant for proper head pressure control.

6. How can I figure out how much refrigerant I have in the receiver?

Using a torch (preferably a propane torch), GENTLY heat up the receiver while the system is running. Then run you hand from the bottom of the receiver to where you heated it. If the receiver is only warm, you have liquid present. If it is hot, you do not have liquid present. With a little practice, you should be able to accurately locate the refrigerant level using this technique.