

Refrigeration System - Proper Low Ambient Charging

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When trying to determine the proper low ambient charge for a refrigeration system, several factors should be taken into account: what type of head pressure regulating device is being used, and if there is sufficient receiver capacity for year round operation. It is critical to proper system operation to have a sufficient pressure differential across the TXV. Most manufacturers give low ambient charging instructions for a brand new system at startup but leave you "out in the cold" when trying to determine how much to add back into the system after a leak or some type of system maintenance.

Here are a few pointers that will help out next time you are trying to figure out if your refrigerant charge is sufficient for low ambient conditions.

On a smaller system that has a single fan with fan cycling it is relatively simple: make sure your system is delivering a solid column of liquid to the TXV at the proper liquid pressure. To do this you must first set the fan cycling control to maintain the recommended head pressure (somewhere around 100 degree condensing temp or approximately 195psig for R22 and around 230 psig for R404a). These numbers should be used as a midpoint for the fan cut in vs. fan cut out settings. Then charge the system to a clear sight glass with an occasional bubble in the glass when the fan is running. These systems usually have small receivers so this is where you should stop adding refrigerant. At this point you should be supplying your TXV with very close to a 100% column of liquid at a pressure very close to what the system was designed to operate.

On larger systems with multiple fans and 3 way head pressure/condenser flooding control valves, it becomes very complicated to determine the proper low ambient charge and a clear sight glass can be deceiving. If a system is low on charge the 3 way head pressure control valve won't bypass properly to pressurize the receiver and the sight glass may still be clear - giving the impression that the charge is okay. Many times this low charge condition is not found until a gauge is placed on the high side of the system only to find an abnormally low discharge pressure. What a lot of technicians don't realize is that these systems are designed to flood a percentage of the condenser coil in the winter time to build head pressure. No matter what manufacturer the head pressure valve is, it will be marked with a pressure setting. This is what the system is designed to maintain. Before you add refrigerant, you must disable any compressor capacity control and allow only the header fan to run (the other fans should already be off on low ambient stats). If your head pressure is still too low, add refrigerant until you start to see the head pressure rise. As the pressure approaches the setting on the head pressure control valve, slow down your flow of refrigerant into the system. As soon as you reach this setting you will be close to the proper charge. You must then determine if your receiver is large enough to accommodate this "winter" charge. You can do this by simply closing the outlet of the receiver to pump the system down. If it pumps down properly and stores the entire refrigerant charge in the condenser and receiver without building excessive head pressure, your charge is okay. If the system builds head pressure and won't pump down, you may have an undersized receiver or just a longer piping run than the system was designed.

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