



TechnicalBase

A Web Site for Carrier's Distributor Service Managers

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Technical Alert

06D Oil Pressure/Level Problems

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A common problem with 06D compressors is the problem of oil leaving the crankcase. The typical call from a technician will usually begin with a complaint that the compressor will pump out the oil in the crankcase as quick as he can put it in, or within a few minutes.

You will find in most cases the problem is caused by a bad main bearing. The main bearing is exposed to both the crankcase and the motor barrel. Even on compressors with a good main bearing, there is a small amount of oil that flows out of each side of the main bearing. On the bearing side that faces the crankcase the oil simply falls into the crankcase with the rest of the oil. On the bearing side that faces the motor barrel, the oil will usually fall to the bottom of the motor barrel and return to the crankcase through the check valve. As this bearing wears, greater quantities of oil flows pass the increased clearances between the main bearing and crankshaft. At some point more oil is passing into the motor barrel than can be returned into the crankcase. The oil takes up space in the motor barrel which increases the velocity of the refrigerant passing through the motor barrel. At some point the increased velocity of the refrigerant will begin to sweep along the oil and carry it up the cylinders.

You may think that this increased clearance between the main bearing and crankshaft would result in a decrease in oil pressure. Until the oil regulator can no longer compensate for the increased clearances, you may not have a decrease in oil pressure.

Below are some normal symptoms of a 06D compressor with a worn main bearing:

1. Oil leaves the crankcase and does not return.
2. Oil pressure is normal until the compressor has been running for a period of time.
3. Compressor circuit breaker trips occasionally.
4. Compressor appears to be flooding, but the suction line superheat seems to be normal or slightly higher than normal.
5. Noise and vibration levels appear to be normal.

Each of the above need some explaining:

1. The normal question to ask when the oil leaves the compressor crankcase is, "Where does the oil go?". The simple truth is that most of the oil is in circulation. If the components of the air conditioning system were transparent, what you would see is that there is excess oil every where - coating the tubing and the surfaces of the compressor. Press any schrader core on the system and you will find that more oil seems to come out than refrigerant. Depending upon how much oil has been added to the system by the technician, an incredible amount of oil may be going around in circle within the system (with very little making its way back to the compressor crankcase).

2. This one stumps everyone. The technician will get to the job site, finds the oil pressure safety switch

tripped. He restarts the unit and find the oil pressure seems normal but the oil level is low in the compressor sight glass. He may add a small amount of oil and everything seems to be running normal. Several hours later is gets another call that the unit is off again. Upon his return to the job site he finds the unit off again on the oil pressure switch. The situation here is that the oil may be at a higher viscosity when the unit is first turned on, but as the compressor runs and the oil heats up, the viscosity drops and a greater amount of oil escapes from the excessive clearance between the main bearing and the crankshaft. The oil pressure regulator can no longer maintain the oil pressure and the oil pressure safety switch trips.

3. As the main bearing wears, the metal shavings that are generated will flow out with the oil into the compressor crankcase and motor housing. Some of this metal may find its way into the slots of the stator and short out the windings. Another source of metal particles is that as the main bearings deteriorates, the clearance between the rotor and stator will decrease until they come in contact with one another. Metal will be shaved off the laminated plates of the stator and off the rotor. This metal too will find it way to the stator slots and short out the windings. The contact between the rotor and stator will also increase the compressor running amps and may produce excessive temperatures of the motor barrel.

4. This one confuses many people until they remember that compressor oil is an insulator. The excessive oil in the system will be traveling along the walls of the tubing - insulating the tubing walls from the refrigerant that is flowing down the center of the tubing, This not only happens on the suction and liquid lines, but also the tubing that makes up the indoor and outdoor coils. Condensing coils and evaporator coils become less effective in rejecting and absorbing heat. Worse, the TXV bulb can no longer detect the temperature of the refrigerant which will cause refrigerant flooding (which dilutes the oil in the compressor that will cause even faster deterioration of the main bearing).

5. Until the rotor and stator come in contact with one another, the noise and vibration levels of 06D compressor with a defective main bearing will be quite normal. Which is unlike the problem of a rod having been broken off the crankshaft, which almost always results in low oil pressure and vibration.

Fortunately, we don't have to completely tear down the compressor to confirm our diagnosis of a failed main bearing. If the oil pressure is low enough to trip the oil pressure safety switch, then remove the compressor end bell (after pumping down the low side and isolating the compressor) from the compressor and observe the clearance between the rotor and stator. If the main bearing is worn, then there will usually be a greater clearance somewhere in the 10 to 2 o'clock region as compared with the 4 to 8 o'clock region. In severe cases, the clearance somewhere in the 4 to 8 o'clock region will have been reduced to zero.

Note: use a flashlight but watch out for shadows as they can be deceiving.

As the technician keeps adding oil to the system, the oil pressure problem, and the loss of oil from the crankcase, become worse and worse.

After the compressor has been replaced, unless the excess oil is removed from the system, the replacement compressor is destined to fail in the same manner (remember the flooding that will take place because the evaporator can not absorb heat and the TXV can not sense the line temperature). To remove all the excess oil from the system, the technician must keep reducing the oil level in the crankcase sight glass to less than 1/3 during the first few hours after the new compressor is installed and is operating. As the oil level reaches 1/2 up the sight glass, the level must be reduced back to less than 1/3 until it stays at there. The compressor should be run in the fully loaded condition during this oil removal process.

The system that suffer from oil/compressor problems most often is the 15 and 10-ton split heat pump.

When confronted with a complaint of oil pressure or compressor problems, please check the following:

1. When a replacement compressor is installed, be sure the compressor is run long enough to return all the excess oil from the system. Keep draining the compressor oil until the oil level in the sight glass is about 1/2. There should only be a thin layer of foam sitting on top of the oil. If the entire sight glass is foamy, then there is too much oil in the system - keep draining, keep draining, keep draining. Leaving excess oil in the system will only insure another compressor failure.
2. Measure the refrigerant line length. On the 15 and 10-ton heat pump, 100 linear feet is the maximum. Not 120 feet, not 150 feet - the max is 100 feet. Measure the lines yourself as you will probably find them to be much longer than what you are told.
3. Check the size of the refrigerant lines. The liquid line size is important because an oversize liquid line will contribute greatly to an overcharge condition. These units have a maximum refrigerant charge - do not exceed this maximum. The vapor line size is important because it determines gas velocity. If the vapor line is too large, then the oil may not be able to return. Follow the piping guidelines in the product literature, not the System Design Books or the refrigerant piping software.
4. Whether or not the indoor air handler was installed at the same time as the outdoor section, the TXVs may not be operating properly. What is the superheat setting for each valve? Are the TXV bulbs installed on the correct suction lines? Are the TXV bulbs tight? It is surprising how many times there are problems with the TXVs and the unit has lost multiple compressors?
5. Check valves leaking? There are check valves in the outdoor indoor sections. If in the cooling mode, and the indoor check valve is leaking, then the liquid refrigerant may be bypassing the TXV! Use a strong magnet to see if the check valve ball is free. An indication that the indoor check valve might be a problem is if the compressor is flooding, the suction pressure is low, and there is very little temperature drop across the indoor coil.

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