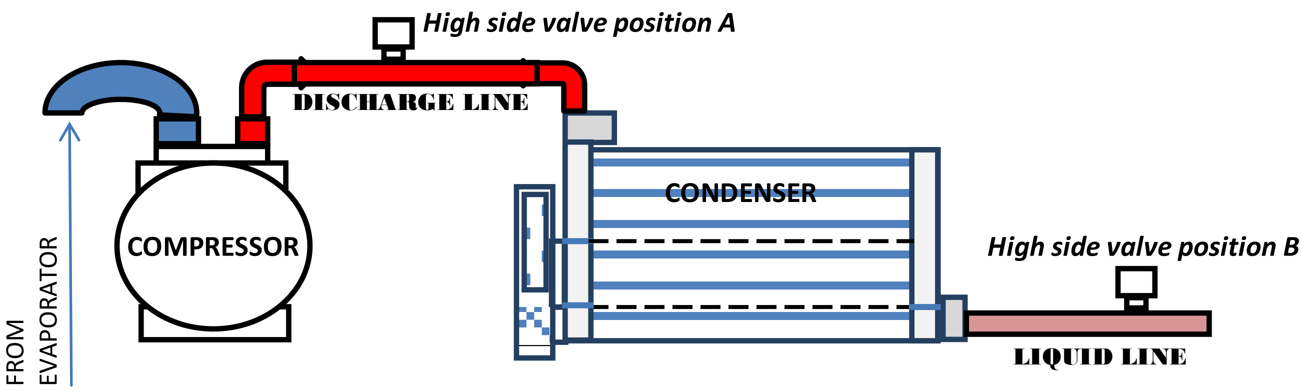
Automotive Air Conditioning Analysis: Phantom Head Pressure



Welcome back to another episode of AC Tech Talks. In this issue I will be discussingerrors in AC system designs that cause inaccurate gauge readings and allow for hidden head pressure problems to occur.

Above is a basic schematic of the two different locations that high side pressure ports can be located. Diagram A has the port in the discharge line, between the compressor and the condenser. Diagram B has the port located in the liquid line between the condenser or receiver drier and the TX valve. The two locations that these ports exist can greatly alter the effectiveness of your diagnostic procedures.

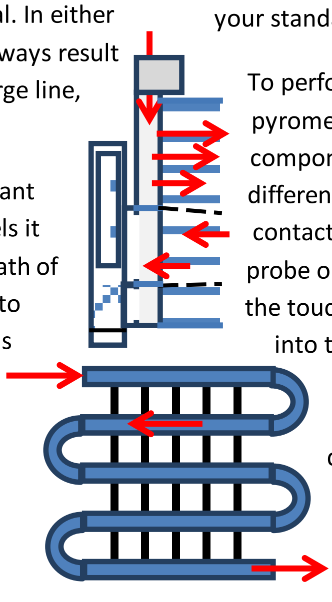
Let's take a step back and discuss the common results of high head pressure. In many situations a fan will stop working or a condenser will become blocked with road grime, reducing the cooling efficiency of the condenser. The result is excess system pressure and temperature, ultimately causing a compressor failure by either internal break down or a failed seal. In either situation a compressor failure will almost always result in aluminium debris flow on into the discharge line, condenser and the filter drier.

This is where the problem starts! As refrigerant enters the condenser it has multiple channels it can flow through and will always take the path of least resistance. The same principal applies to flush, meaning that even after a condenser is flushed partial blockages can still exist. This is why all OE dealers will replace the condenser when system contamination occurs from a failed compressor. Further partial restrictions can occur when large chunks of debris become logged in the elbows of discharge lines or when incorrect and oversized desiccant bags are used.

So how do we identify these blockages? In the case of diagram A at the top of the page, head pressure problems caused by restrictions in the discharge line, condenser or drier will be easily identified on the gauge set. However when the high side port is placed in the liquid line, after the points of restriction at question, the high side pressure will appear to be normal and you will assume that your system is operating perfectly, while in fact your compressor is pumping against a restriction, causing pressures of 350+psi.

Temperature V'S Gauge pressure:

As shown in the situation above, a high side valve located in the liquid line can easily hide partial blockages.If a system reflects that of diagram B, I recommend temperature testing as an addition to your standard diagnostic procedures.



To perform these tests you will need a digital pyrometer to read the temperatures of components at different locations. There are two different types of pyrometers available, an infrared contactless or a contact style using either a touch probe or a clamp. Both styles have their strengths, the touch probe is very accurate but hard to get into tight places, and the infrared is easy to use. Considering that you will be looking for differences in temperature of only 5 degrees, I recommended using the touch probe for its accuracy.

When using your Pyrometer to test temperatures at different locations, make sure to always sample from pipe surfaces of the same style and environment. For example, comparing a bare alloy pipe at a bend to a straight painted pipe will be inaccurate as the painted pipe will shield the true heat reading. Secondly perform these tests on a cold engine. Some pipes at the condenser will be cooled by air drawn from the fans, while the pipes at the compressors will absorb heat from the engine, again effecting true system temperatures.

When a blockage in a high side component is present, the pressure on one side will be much higher than the other. Considering pressure is directly related to temperature, we can identify a block by locating a sudden, large drop in temperature, almost like a TX in operation.

Using a pressure relation chart convert your high side gauge pressure into degrees. Now probe the pipe at the high side port to check you have correct calibration. Working backwards towards the compressor, measure the temperature along the pipes for any sudden increases in temperature. For example if you have more than a 5 degree increase across the discharge than a blockage exists in the line. In the same manner a large increase in temperature between the outlet and inlet of a dryer would suggest a restriction. Condensers are a difficult component to assess as their job is to remove heat. However, an efficient condenser will evenly distribute the heat reduction across the entire unit, so by measuring along the flow of refrigerant through the condenser, a sudden 'hot spot' would suggest a blockage.

Temperature analysis is a great method for identifying blockages in a system, however it can be wildly inaccurate if your tools are not working well or measurements are not taken from the same environment as explained earlier. If you are ever in doubt, use the touch technique! Simply run your hand over the pipe or condenser at question, and if there is a rapid change in temperature, or any pipe is extremely hot to touch, assume a blockage and investigate further.

This Tec Article has been bought to you by CoolCompressors Pty Ltd and MrCool Automotive. Written by Ben Perry, technician and marketing manager. Please forward any questions to ben@mrcool.com.au.