Suction / Vacuum Side Fuel Filters

Suction-side fuel filters are located upstream from the pump. The fuel flows by vacuum through the filter as opposed to those located downstream from the pump where the fuel is forced, under pressure, through the filter.

Problems associated with suction/vacuum side fuel filters are usually not obvious. The most serious problem to consider is loss of vacuum. Vacuum loss caused by air leaks will result in loss of engine performance.

Air being sucked into the fuel system could result in lower fuel delivery. Power and performance will be affected by these conditions. Locating the air leaks in the fuel system is normally very difficult. The common conclusion is that there is a suction leak around the fuel filter.

One observation made in the field is the fact that during servicing of a suction-side fuel filter it is only partially full when removed.

Most suction-side fuel filters will be partially filled with fuel when removed from an engine. It may also seem that full utilization of the media is not being obtained. The air-vapor cavity or air entrapment is caused by the surface tension of the fuel. It can also be referred to as the passage resistance of wetted filter media to allow air or vapor to pass through. The magnitude of this resistance to vapor passage is related to paper pore size and fuel surface tension. By decreasing the pore size, one will increase resistance to vapor passage. An increase in surface tension will also result in an increase in resistance to vapor passage. Once the media pores are wetted with fuel, these pores will not allow the passage of air until the vacuum on the clean side is sufficiently greater than the vacuum on the dirty side of the filter. This vacuum differential increase will break the surface tension of the fluid bridging the pores.

The only time that the air will pass through the media is when a differential vacuum across the filter overcomes the surface tension. In actual engine installations of suction-side filters, when the primer or transfer pump is activated, a differential vacuum across the media is created. The differential vacuum is large enough to overcome the surface tension and allow the passage of air and/or fuel through the media. As the media is wetted, the air-vapor barrier is formed and so any new air vapor generated will be blocked from passing through the media.

With the fuel system completely sealed and assumed leak proof, then one may ask, how is the air generated and where does it come from? The source of air

vapor is the diesel fuel itself. Similar to water, diesel fuel contains a certain amount of dissolved air, depending upon the fuel temperature, pressure on the fuel, specific gravity and the amount of aeration to which the fuel has been subjected.

Increasing the fuel temperature or a fuel pressure reduction will release the air. The amount of air released is dependent upon the degree of the air saturation of the fuel and the magnitude of temperature increase and pressure reduction.

In actual laboratory experiments duplicating a filter as installed on an engine, it has been proven that the filter will always be full on the clean side and air-vapor is present on the dirty side only. Therefore, there is always sufficient amounts of fuel leaving the filter. The reason that the filter appears partially full when removed from the engine is because as the seal between the filter and the mounting base is broken, the vacuum differential across the cartridge is also broken and the fuel level on the clean side and the dirty side of the cartridge are instantly equalized, thus resulting in a filter that appears to have had the same fuel level on both sides of the cartridge when under operation.

There are, however, instances that some filters upon removal from the engine do appear to be full of fuel. The reasons could be any of the following:

1. There are voids in the seal between the element and the end caps.
2. The element does not seal properly in the filter or housing.

When these conditions exist, a filter bypass condition exists and a filter may then be full of fuel when it is removed.

Remember that the air passage resistance is related to paper pore size. Therefore, a bypass in a filter will represent a large pore size. Hence, easier vapor passage.

Note of Caution: If a suction-side fuel filter is full of fuel, do not automatically assume that the filter is of an inferior quality. There are other reasons beyond the scope of this publication that contribute to this effect and may not necessarily mean filter bypass.

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