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Heavy-Duty Diesel Engine Air Filter Collapse

Most reputable filter manufacturers design their air filters to operate well beyond recommended engine intake restriction service points. In fact, there is usually a safety factor of at least 2-3 times over the stated service point. However, there are circumstances when filter collapse can take place. When an engine is operated with a filter that's collapsed, there is a good chance that unfiltered air is getting to it, which could result in costly repairs. Most of the time poor maintenance is the cause, but there are some operating conditions to consider as well.

Collapse of a heavy-duty air filter is defined as a permanent deformation of the unit after airflow is removed. This occurs when the pressure drop across the filter exceeds the design limit of the device. Because of the safety factors built-in when the filter is engineered, this is an unusual event and is normally preventable.

A common cause of filter collapse is not paying attention to the service point recommended by the engine manufacturer. Diesel engines typically have an intake element service point of 20-30" H₂O (5-7.5 kPa), depending on the manufacturer. As stated above, exceeding this by an incremental amount won't cause the filter to collapse, as they are designed to withstand a much higher level of restriction. However, because filters tend to load very quickly after a certain point, not servicing them soon after the maximum allowable restriction is reached (as recommended by the engine manufacturer) can end up causing a very high level of pressure drop across the filter, and may result in a collapse condition. The best way to avoid this is to install and monitor a restriction measuring device (gauge, pop-up indicator, dash light, etc.) and replace the element when it indicates the service point has been reached.

Another possibility of filter collapse is sub-standard element construction or remanufacture. Generally, obtaining air filters from a reputable manufacturer will avoid this issue. Quality heavy-duty air filters are made with materials that can withstand high levels of pressure drop and resist collapse, while sub-standard elements may not.

It is also important to inspect all filters before installation. Dented liners or end caps may result in a loss of structural integrity and filter collapse.

Damage may be present but not very visible. If the filter shows any sign of damage, don't use it. This is especially critical when using cleaned elements (refer to TSB 89-4R2). Couple the possibility of damaged filters with weakened media (if it were washed or cleaned with too high of a pressure) and the filter may have a much lower resistance to collapse.

Operating conditions should be considered as well. For example, high levels of soot (generally from diesel engine exhaust) can plug an air filter rapidly. This may shorten the life of a filter dramatically, and if a restriction indicating device isn't monitored closely, can result in extremely high pressure drop across the filter that may cause it to collapse. If high levels of soot are experienced, the cause of the ingestion should be investigated and, if possible, corrected. These include (but are not limited to) proximity of the intake to the exhaust, exhaust leaks near the air intake, vehicles operating or idling in close quarters and operating in certain areas where exhaust concentrations are high can result in high levels of soot.

Extremely high levels of water ingestion can be a concern, too. Although most filters can take a certain amount of moisture with no problems, large amounts of water can weaken and plug the filter media long enough to cause collapse. However, this is an unusual situation because most vehicles that are likely to be used in these types of conditions have a water separation device installed. One possibility of excessive water ingestion often not accounted for is the introduction of high levels of moisture during washing of the vehicle. The best practice is to ensure the engine is not operating during washing and water is not sprayed directly into the engine air intake.

In summary, following the engine manufacturer's service recommendations, using quality undamaged products and using a restriction indicating device are the best practices to prevent air filter collapse. If element collapse occurs, it is important to ascertain whether lack of maintenance caused the problem or if the vehicle is used in conditions that dramatically shorten filter life, and then take corrective action to keep it from happening again. For additional information about servicing heavy duty air filters refer to TSB 89-3R3.

For additional information, contact:

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