

Request 13

Furnish Ford's assessment of the alleged defect in the subject and peer vehicles, including:

- a. The causal or contributory factor(s);
- b. The failure mechanism(s);
- c. The failure mode(s);
- d. The risk to motor vehicle safety that it poses; and
- e. What warnings, if any, the operator and the other persons both inside and outside the vehicle would have that the alleged defect was occurring, or subject component was malfunctioning; and
- f. The reports included with this inquiry.

Answer

Ford's current and ongoing assessment is that there is a lack of material evidence indicating that unresolved defect(s) with the subject and peer vehicles currently exist. As indicated in this response, Ford has considered and evaluated multiple variables to meaningfully assess field concerns and take appropriate actions where necessary. Such actions included added part performance and serviceability robustness, added quality control processes, corrective actions including a recall for a specific safety concern, and updated maintenance guidelines. Ford has continuously worked with NHTSA while it took these actions, providing regular updates as issues were being evaluated. Additionally, Ford respectfully disagrees with the description of the investigation opening resume indicating that the subject component was tested at an inadequate pressure and provides a further explanation of the 7-bar leak test below.

6.7L Diesel Fuel System Description-Role of Engine Mounted Secondary Fuel Filter

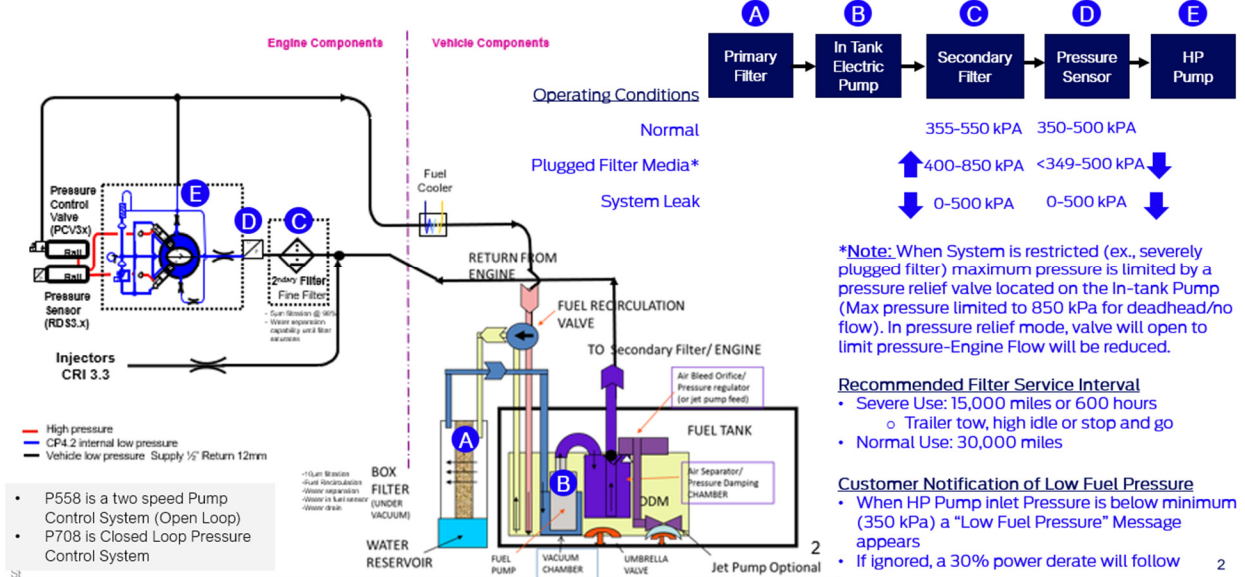
The 6.7L Diesel Fuel Delivery System uses a "clean side" constant displacement peristaltic pump, commonly known as a roller cell pump to improve fuel efficiency and reduce CO2.

The nominal system pressure is 4.5 bar relative. The fuel pump has an integral pressure relief valve that limits the pressure to a maximum of 8.5 bar in the event the system is dead headed (kink or restriction cause near zero flow) and decreases when restriction is reduced. The HP pump inlet / secondary fuel filter outlet pressure and temperature is monitored by a sensor mounted on a line between the secondary filter outlet and HPCR pump inlet. When fuel pressure is below the HPCR pump requirements (3.5 – 3.7 bar) a "Low Fuel Pressure" message is displayed and a low fuel pressure code is recorded (P008A). If the message is ignored, the engine power will be derated by 30% and eventually by 50%. The derate was progressively increased to 50% in 23MY. When filters age, the restriction will increase proportional to their pressure drop. The pump will have to work harder to meet the required flow/pressure. The system is designed for an end-of-life condition of 10% pump deterioration and primary filter pressure drop of 30 kPa and secondary filter pressure drop of 50 kPa. At this point, the pump flow will be at its capability limit due to the increase in outlet pressure and the engine requirements will not be met. The lower flow results in the pressure decreasing below the threshold (3.5 – 3.7 bar). As a result, a "Low Fuel Pressure" warning will be displayed and a Diagnostic Trouble Code, or P code (P008A), is set signaling the need to replace the filters.

If the warning is ignored, the engine torque will be derated by 30% (2010-2022MY) and 50% progressively (2023MY and later).

If the fuel temperature exceeds 80°C, the engine will derate proportional to temperature and will only allow idle once the temperature reaches 90°C.

P558 Dual Filter System Architecture



Descriptions of Known Failure Modes and Robustness Actions Taken

Fuel filters can crack and leak for a variety of reasons. Ford has conducted investigations into a number of potential failure modes described in more detail below. From January 2014 through March 2024, Ford has also taken actions for new vehicle production to include added part performance and serviceability robustness, added quality control processes, and updated maintenance guidance. Ford has previously discussed these actions with NHTSA. These discussions included, but are not limited to, discussion which occurred in March 2019 (N18-1002-04), September 2021 to January 2022 (21-643), and April 2023 to May 2023 (23-249) [details of relevant investigations provided on slide 6 of presentation shared with NHTSA on May 5, 2023].

Supplier Quality

Ford previously investigated some filter housing parts that were found molded with a presence of injection mold purge material (investigation N17-0525-04). While no safety defect was found, the presence of ABS purge material within the final molded parts of the housing can result in a weaker than intended weld between the cap and the bowl. Tier 1 and Tier 2 suppliers took a series of preventative actions to strengthen the weld between the cap and the bowl. The supplier increased the number of parts purged after injection mold start-up from two to three parts and automated the process for selecting these purged parts to ensure that no parts contain ABS purge material contamination. Additionally, laboratory testing was added to ensure the final purged part is free of the ABS purge material. Finally, the leak test check run

on 100% of parts at the Tier 1 supplier was increased from 4 bar to 7 bar, to increase the likelihood of identifying any parts that have a leak due to a manufacturing issue.

Service Events and Education

Ford has also investigated reports of under hood fires as part of N18-1002-04 and N19-0509-01, identifying that about half of the under-hood fire reports occurred shortly after a fuel filter service event (See N18-1002-04). As part of these investigations, Ford reviewed available warranty reports and determined that in some circumstances, the fuel lines/connectors at the secondary fuel filter had been damaged during fuel filter replacements prior to the fire. Ford also uncovered some reports of fuel lines “popping off” the secondary fuel filter following fuel filter service. While Ford had not determined that a safety defect existed, Ford decided to implement a series of actions to improve service parts and created enhanced communications to reduce the likelihood of future failures caused by fuel filter service events. Ford discussed this approach with NHTSA and incorporated NHTSA’s feedback into the communications. A new fuel supply line quick connect connector was released into production for additional robustness. Ford also released a Special Service Message (SSM) with a video to show technicians the proper technique for reinstalling the quick connectors on the secondary fuel filter. Ford released a clamshell into production to protect the injector leak-off return line from becoming damaged during service. This collar was also released for service as part of the revised fuel filter maintenance kit. Ford issued a technical service bulletin (TSB) that showed repairing technicians how to install the new collar. Additionally, a YouTube video was released for the general public, who may perform their own service, to show customers how to install the collar and check that the fuel lines are properly installed on the secondary fuel filter. Finally, Ford released a new injector leak-off return line connector, designed to resist fuel line breakage during fuel filter replacement.

Extended Filter Usage

Ford’s CCRG also investigated some fuel filter caps that cracked just forward of the center of the outlet port (CCRG investigation 21-089). These filters tended to have evidence of high time in service, such as deformation in the internal filter medium. Further, the investigation determined that there were more reports of this crack condition in cavity-1 than in cavity-2 in the two-cavity tool. Evidence of tool wear was found. Both cap tools were refurbished, and maintenance frequency was updated to 20,000 cycles from 80,000 cycles. Additionally, the packing pressure was increased to 854 psi, automatic start-up scrap parts were increased from three to five, and measures were taken to ensure the mold and the plastic are at the correct temperature.

Supplier Quality – Field Service Action

As part of the 21-089 investigation, another investigation was initiated (21-346). This investigation found contamination in the supplier’s injection molding tool that resulted in a void in the cap at the center of the outlet port. The Tier-2 supplier made updates to their control plan, incorporated regular and more frequent cleaning of the magnet system used to eliminate ferrous material from the raw material, and the raw material supplier eliminated the use of staples in the raw material packaging. Additionally, the Tier-1 supplier instituted a revised reaction plan to an internal leak test failure, which included troubleshooting root cause for any failures. This investigation resulted in Ford recall 22S01 / NHTSA recall 22V013.

Further Robustness for Extended Filter Usage

Finally, the cap design was modified to provide more robustness to the pressure cycle fatigue crack found in CCRG investigation 21-089 and both the cap and bowl injection molding operation was brought in house to the Tier-1 supplier from the Tier-2 supplier.

Explanation of 7-bar Leak Test

The opening resume of this Information Request states that the fuel filters are only tested to 7 bar during the manufacturing process and that the maximum operating pressure is 8.5 bar. While the stated maximum operating pressure is correct, there appears to be a misunderstanding about the types of testing conducted. There are two tests that are run to qualify parts. First, the Supplier performs a leak test, which is run at 7 bar on every secondary fuel filter it manufactures. This test is intended to ensure proper assembly and sealing of the filter and intentionally run within the design operating limits. A separate test, called a burst test, is run to validate the integrity of the parts in a given batch. These tests are destructive and the pressure is increased until failure. The minimum accepted burst pressure for a given batch had been 14 bar and was increased to 17 bar in the first quarter of 2024. One part per weld machine is subjected to a burst test at the beginning and the middle of each shift. The burst test is intended to qualify each batch of parts to ensure they would be able to withstand internal pressures in excess of what they could be subjected to in a vehicle.

Volume and Rates Discussion

From 15 MY through 21 MY Ford produced 1.28 million trucks with the 6.7L diesel engine, which is the subject of this preliminary evaluation. From 22 MY through 24 MY Ford produced an additional 0.55 million trucks with the 6.7L diesel engine. Additionally, Ford's records indicate approximately 7.7 million secondary fuel filters were produced for service / maintenance. In total, 9.53 million parts were produced in this timeframe.

Because Ford does not often have access to records which indicate when a vehicle owner last replaced their secondary fuel filter or how often it had been replaced, it can be difficult to assess for potentially related claims. The secondary fuel filter is designed as a maintenance part and is intended to be replaced at a regular interval (30,000 miles for normal operation, 15,000 miles or 600 engine hours or 6 months for severe operating conditions, or 15,000 miles or 300 engine hours or 6 months for biodiesel use). Additionally, aftermarket parts exist in the market which are not produced by the Tier-1 supplier, so it is often unclear what vintage, condition or quality of filter was installed in a vehicle at the time of a reported event or from warranty returns.

The rate of reported leaks from the secondary fuel filter and the rate of under hood fires has remained low over the past eight years for the vehicles that are the subject of this investigation. Ford notes that the current level secondary fuel filter part went into production this year and is currently used for peer vehicles (22-24MY), as well as being available for maintenance replacement on 2017 – 2021 MY vehicles. The rate of reported leaks for the new secondary fuel filter on these peer vehicles is only 0.12 R/1000. Ford also notes that the rate of reported fires is low for subject and peer vehicles. The rate of reported fires is 0.11 R/1000 in the subject vehicles and 0 R/1000 (no reported fires) in the peer vehicles. Furthermore, the rate of reported leaks for the secondary fuel filter on subject vehicles (1.83

R/1000) is likely inflated. It is important to emphasize that because this involves a service part, each vehicle has likely been serviced and likely had this secondary fuel filter replaced multiple times over the life of the vehicle. The subject vehicles likely experience more replacements compared to the peer vehicles due to more time and miles travelled. Furthermore, considering maintenance part sales, the R/1000 calculations per part produced would be even lower. Greater fidelity of part sales figures should be provided to NHTSA by Sogefi in response to Request 6 of the Supplier IR. Ford's work is ongoing and Ford will supplement these estimates if necessary.

VOQ Response

The agency provided 27 Vehicle Owner Questionnaire (VOQ) reports along with this inquiry. Ford's review of these reports determined that 16 reports are most closely classified as a category A (allegation of fuel leak from the secondary fuel filter) of which one report was a duplicate of another one, two reports were determined to be classified as category A1 (under hood fire with potential or alleged secondary fuel filter leak), six reports were determined to be classified as B (under hood fire with unknown cause), two reports were determined to be classified as B1 (under hood fire with ambiguous fuel leak allegation), and one report was determined to be classified as C (ambiguous fuel leak allegation).

Of the 27 VOQs provided, 21 of them occurred prior to Ford's most recent discussion with the agency in May 2023. Six reports occurred after these latest discussions. Of these six most recent reports, three were secondary fuel filter leak allegations (two of which are duplicates as they describe the same event on the same day in the same vehicle), two were ambiguous under hood fire allegations, and one was an under-hood fire alleged to have been caused by a fuel leak from the secondary fuel filter area.

Conclusion

For all of these reasons, Ford's current and ongoing assessment is that there is no material evidence indicating that unresolved safety defect(s) with the subject and peer vehicles currently exist.