Request 14

Furnish Ford's assessment of the alleged defect in the subject vehicles, including:
a. The causal or contributory factor(s); including technical analysis resulting in the high confidence rate of vehicles' excluded from the scope of 24V-097.
b. The failure mechanism(s);
c. The failure mode(s);
d. The risk to motor vehicle safety that it poses;
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

It is Ford's current and best understanding that the failure mechanism is and remains to as identified in recall 22V-089. The power steering pressure line in affected vehicles may be inadequately connected to the brake Hydroboost unit, which may result in a leak or sudden loss of power steering fluid. During Ford's internal investigation that led to safety recall 24V-097, Ford reviewed warranty claims for vehicles that passed the safety recall 22V-089 inspection. Ford found that the probability of a failure of the subject component after the 22V-089 inspection is influenced by how much time has passed since the recall inspection. A parametric analysis is provided in the file "Conf Bus Info - RQ24-003 Response 14 – Analysis."

To answer questions (b)-(e) above, the answers would be the same as described in the 22S08 recall. The 7.3L engine was new for 2021 Model Year (MY) E-Series and required a change in routing of Power Steering Pressure Lines for the 90° angle quick connect joint between the power steering pump and the Hydroboost unit. Production assembly of this design can be difficult due to poor visibility, accessibility, and orientation. The line routing may also introduce a high side load force into the joint, which contributes to high installation efforts. These factors may result in an incomplete connection of the snap-ring in the retention groove of the quick connect fitting during assembly. An incorrectly assembled quick connect joint with a high amount of side loading may not immediately become detectable at the assembly plant and may become dislodged during service life.

The failure modes are a leak or disconnect at the quick-connect fitting between the high-pressure power steering line and the jumper line, which may result in the customer experiencing loss of power steering and brake assist. The figure below shows a Computer Aided Drawing (CAD) view of the quick-connect fitting, the high-pressure power steering line and the jumper line. Although the high-pressure power steering line is unique between the chassis cab and cutaway vehicle types, the section of the line of interest for the failure mode, which is shown in the figure below, is the same for both E-Series vehicle types. The differences in the high-pressure power steering lines used in the chassis cab and cutaway vehicle types is immaterial for the failure mode and the alleged defect.

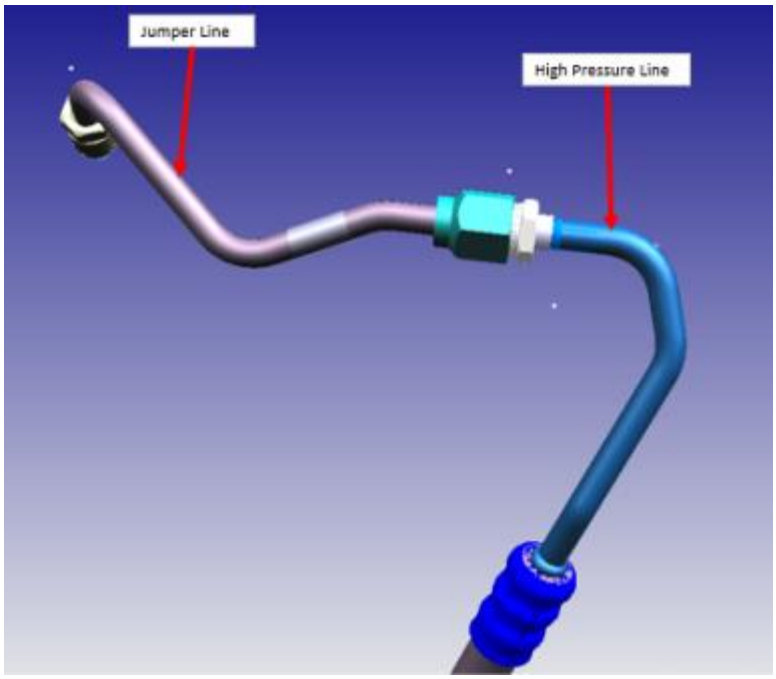

Figure 1: Isolated CAD Image Showing the High Pressure Power Steering Line to Jumper Line Connection Area

Sudden loss of power steering fluid may result in a loss of power steering assist, requiring increased steering effort, and loss of power brake assist, requiring increased force on the pedal to brake, potentially resulting in increased stopping distance. Mechanical braking and steering will still function. A sudden loss of power steering assist and power brake assist increases the risk of a crash.

The customer may notice a power steering fluid leak on the ground underneath the vehicle. Some drivers report hearing an audible “pop” noise if the quick connect joint becomes disconnected while driving.

Summary

For RQ24-003, NHTSA is investigating claims of loss of power brake assist or power steering after a safety inspection was completed as part of Ford Recall 22S08 (NHTSA Recall 22V-089). As described elsewhere in this response, the identified defect in 22S08 was "[T]he power steering pressure line in affected vehicles may be inadequately connected to the brake Hydroboost unit, which may result in a leak or sudden loss of power steering fluid." This was due to "[T]he fitting between the power steering pressure line and the brake Hydroboost unit may not have been adequately connected during the assembly process." A more detailed description of root cause is provided in Response #11 of this IR. This background is important because the vehicles subject to this RQ have already been subject to a previous safety recall. Technicians inspected the 24,623 subject vehicles as part of 22S08 recall and determined that they "passed" the inspection. If they did not pass the inspection, the vehicles received new Hydroboost lines.

As part of the inspection process in 22S08, technicians performing the inspection were to first determine whether the vehicle has the "old" or "new" level Hydromax pressure line design and

hydraulic booster jumper line. If both lines were old, the technician was instructed to insert a 0.25 inch flat blade screwdriver bit between the space in the Hydromax pressure line to hydraulic booster line at a 90 degree angle to the connection and apply 12 Nm of torque to attempt to separate the line connection. Then, the technician was to use a brake lining thickness gauge and measure the space. If there is a gap of 3mm or greater, the technician would conduct the replacement procedure. If it was less than 3mm, the vehicle would be considered a "pass" and no further action was required.

At the time Ford developed this inspection procedure, the company believed it to be a robust way of assessing vehicles for this potential condition. After release to the field, Ford collected subject parts, some of which indicated that certain inspection events may not have been properly performed. As described in the chronology for Ford Recall 24S07 (NHTSA Recall 24V-097), Ford's CCRG:

> "determined that the inspection procedure was not effective to ensure detection of an incomplete connection of the snap-ring in the retention groove of the quick-connect joint at the Hydroboost unit. Evidence of returned lines showed some lines were under-inspected with inadequate torque applied or inspected and repaired improperly with the lines not replaced. Further, some defective connections were not properly identified as being defective by the dealer technicians."

Based on this new understanding, Ford reviewed the data on post-inspection repairs and conducted projections. For vehicles that had not been inspected as part of 22S08, the remedy was revised to replace the power steering pressure line and hydroboost jumper line. After conducting an analysis of the post-inspection repairs, Ford found that the probability of failure after inspection decreases as the age of the vehicle at the time of the inspection increases.

Based on the understanding of the underlying defect described in 22S08 and the inspection techniques in that recall, an improper inspection of the lines is most likely to fail shortly after the inspection. For the vehicles previously inspected under 22S08, Ford is estimating that over 99% of the subject vehicles were inspected correctly under 22S08. To address the expenses related to the limited number of expected repairs that may occur, Ford also approved 22N03, which provides for a one-time repair of the power steering pressure line and hydroboost jumper line within 10 years or 150,000 miles. Ford believes this approach is an effective way to deal with this situation and in line with previous actions.

Ford is actively assessing the scope and remedy effectiveness of recall 24V-097 and will continue to actively monitor this subject through our internal processes. Given the focus of vehicles that passed inspection more than twelve months ago, Ford intends to brief the agency as part of this response on its most up to date findings.