Request 10

Furnish Ford's assessment of the alleged defect in the subject 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;
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

The alleged defect in the subject vehicles (malfunctions resulting in unexpected transmission downshift events) are due to degradation of electrical connections due to thermal cycling and vibration over extended time in service. These issues are generally occurring as the subject vehicles approach the end of their useful life.[1] High mileage vehicle transmissions can experience a wide range of issues with different failure modes and performance consequences due to wear and aging of subcomponents. Ford has identified two specific sensor outputs that are affected by this degradation in the subject vehicles: 1) Output Shaft Speed Sensor (OSS) faults; and 2) Transmission Range Sensor (TRS) faults.

As explained in detail below, and in contrast to the model year (MY) 2011-2014 vehicles subject to prior 6R80 recalls, OSS faults on the subject MY 2015-2017 vehicles will not result in a downshift of more than one gear position. Likewise, TRS signal faults on the subject MY 2015-2017 vehicles may result in worst-case downshifts of 6th to 2nd or 6th to 3rd gear depending on vehicle speed, but not a shift from 6th to 1st at highway speeds, which was the specific failure mode and safety consequence that was the subject of prior recalls on earlier MY vehicles.

1. Output Shaft Speed Sensor Faults Do Not Result in Unexpected Downshifts

The subject vehicles' Powertrain Control Module (PCM) commands gear-state changes based on vehicle speed data and the driver's accelerator pedal position inputs. During normal operation, the PCM determines vehicle speed based on data from the transmission's OSS sensor. Degradation of the OSS electrical connection can lead to permanent or intermittent signal interruption. On the subject vehicles, neither type of OSS signal interruption can lead to an unexpected downshift of more than one gear, or rapid deceleration. The subject vehicles

[1] The past 6R80 transmission recalls on MY 2011-2014 F150s (16V-248, 19V-075, 19V-433, and 24V-444) ("6R80 recalls") were also related to sensor connectivity issues, but those recalls were traceable to specific manufacturing quality issues at the supplier that created specifically identified connector integrity issues from day-one in those vehicles (e.g., OSS connector solder cracks in MY 2011-2012 F150s, and insufficient quality controls and solder process parameters on MY 2013-2014 F150s). These supplier production quality issues were addressed with targeted improvements to the supplier's manufacturing processes prior to Job One for the subject MY 2015-2017 vehicles.

were built with the plausibility check function that was the software-remedy employed on MY 2011-2014 vehicles as a part of earlier safety recalls.[2]

In vehicles like the subject vehicles that have the plausibility check software function, in the event of an intermittent interruption of the OSS sensor signal, the PCM will perform a secondary speed check using data from the wheel-speed sensors that are part of the anti-lock braking system. The wheel speed sensor data will be substituted for erratic or intermittent OSS speed signals. There are no known issues with speed values transmitted by the wheel speed sensors, and when that speed data is substituted, there will typically be no gear change from a fixed speed/pedal position. In cases where vehicle speed is changing during the intermittency, normal shift behavior will continue in response to accelerator position changes and accurate vehicle speed inferred from the wheel speed sensors.

In the event of permanent OSS signal loss, or signal losses lasting more than 250 milliseconds, where the PCM's diagnostic routine has time to complete, the PCM will shift to a default position of 3rd or 5th gear, depending on vehicle speed and the gear position when the code sets. The transmission will remain in that gear until the circuit resets and normal shift function resumes, with a MIL illuminated and diagnostic codes set. Specifically, if the vehicle is in 6th, 5th or 4th gear at the time of permanent OSS signal loss, the control logic defaults to 5th gear. If the vehicle is in 1st, 2nd or 3rd gear, the control logic defaults to 3rd gear. In no case will there be a downshift of more than one gear position, and there is no unexpected or rapid deceleration with these OSS sensor faults. Ford has completed additional vehicle simulations and track testing which confirmed that the plausibility check is performing properly and prevents unintended aggressive downshifts and decelerations. For example, see slides 4 through 7 of "24-869 TRG Summary" which is provided as part of Part 2, Request #1.

2. Transmission Range Sensor Faults Can Lead to a Worst-case 6-2 Downshift in Some but Not All Cases

Ford's review of warranty claim fault codes has identified an additional and separate type of signal fault in the subject vehicles that was not present in the earlier recalled vehicle populations. These fault codes (P0706, P0707, P1706, etc.) are uniquely linked to faulty signals from the Transmission Range Sensor (TRS). The TRS is responsible for monitoring the gear shifter position, and feeds this information to both the PCM, and gear selection display or "PRNDL." These types of faults also appear to be associated with high time in service vehicles and appear to be related to degradation of the electrical connections in the leadframe due to thermal cycling and vibration. Short-duration TRS intermittency results in a momentary detection of incorrect TRS signal positions by the PCM. This can cause the gear selection indicator (or "PRNDL") to flash momentarily, and in some cases indicate the selection of a gear position that is not actually shifted to by the PCM. This is why some customers report a shift from 6-1 from highway speeds, when that is not actually occurring. In a rare worst-case scenario, TRS sensor faults can cause an unexpected downshift from 6th -2nd gear.

[2] When the OSS signal was intermittent on previously recalled vehicles prior to installation of the software update, the PCM could infer vehicle speeds lower than the actual speed which could result in an unintended downshift from 6-1 from highway speeds. Prior to the software remedy on those vehicles, the shift map would not prevent such downshifts because it requires accurate speed data inputs to function as designed.

A faulty TRS signal can lead to a range of possible PCM reactions and gear selector indications. Specifically, it can lead to an unintended shift to neutral, unintended upshifts or downshifts to allowable gear positions that are regulated by the shift map for a given speed, and the momentary display of a gear position that has not actually been shifted to. These faults will also trigger a MIL on the instrument cluster and set a fault code in the PCM that will typically lead to vehicle repair and minimize the chances of re-occurrence.

The maximum gear change that can be triggered by a TRS fault is limited by the normal operation of the shift map. The "shift map" is a graphical representation of the vehicle speeds at which any given up-shift or down-shift will be allowed by the PCM's control logic. In other words, the shift map creates a limited band of vehicle speeds at which a given up-shift or down-shift will be executed in response to throttle position changes or manual gear shift commands, including erroneous gear change commands initiated by faulty TRS signals. As described in the table below, the shift map for the subject vehicles will not allow a downshift from 6th to –1st at speeds above 35 MPH. At speeds between 35-64 MPH, the maximum allowable downshift under the shift map is to 2nd gear. At speeds between 65 -90 MPH, the maximum allowable downshift is to 3rd gear.

	Downshift Speed Limits by Gear				
Downshift Gear	1	2	3	4	5
Max-Vehicle Speed (MPH)	35	64	90	112	112

The prior safety recalls on MY 2011-2014 vehicles were conducted because intermittent OSS signal faults on those vehicles could cause a downshift from 6th to 1st gear (without regulation by the shift map), which, depending on the actual vehicle speed at the time of the downshift, could result in temporary rear wheel lock-up, significant and rapid vehicle deceleration, and the potential for loss of control due to the severity and duration of the deceleration. Without the plausibility check, downshifts beyond the speeds allowed under the shift map could occur because the shift map functionality requires the presence of accurate vehicle speed inputs to limit overly aggressive downshifts. In the case of TRS signal faults on the subject vehicles, the PCM will always continue to get accurate speed information from either the OSS or wheel speed sensors. Accordingly, even when there is a TRS fault, the shift map will continue to limit the maximum downshifts, as designed, based on the predetermined maximum speeds that were calibrated into the shift map during the development of the 6R80 transmission.

At highway speeds between 35-64 MPH, the maximum potential downshift that can result from a faulty TRS under the shift map is a downshift to 2nd gear. The maximum allowable downshifts for each speed band were determined based on the needs of both safety and vehicle control, and protection of the engine and transmission hardware. In the process of evaluating the subject vehicles for PE25-002, Ford has conducted two rounds of track testing to confirm that the shift map calibration is effectively limiting excessively aggressive downshifts (like downshifts from 6th to –1st at highway speeds).

The first rounds of track testing were conducted in December 2024 and February 2025 and were intended to compare the relative deceleration and impact on vehicle control of the 6-1 downshifts that were the subject of the earlier 6R80 recalls to the 6-2 downshifts that are the worst-case failure mode for TRS signal faults in the subject vehicles. This testing confirmed that the decelerations associated with 6-2 downshifts are substantially less aggressive than 6-1

downshifts from the same initial speeds. Summaries of this first round of testing are found in "24-869 TRG Summary" on slides 4 through 7.

For example, Ford simulated a downshift from 6-1 in a test with a starting speed of 59.7 MPH and observed a rapid deceleration to 42.6 MPH, a reduction of approximately 17 MPH with a deceleration of approximately -7.61 m/s squared. Ford observed that the engine speed peaked at 8,486 RPM (above the redline) and the vehicle experienced a wheel drag duration of 1.4 seconds. Ford concluded that the driver could experience wheel skidding and a potential loss of control under certain conditions in the period before the vehicle reaches 43 MPH and the skidding stops.

In contrast, Ford simulated a downshift from 6-2 from a similar starting speed of 58.9 MPH and observed a much less aggressive deceleration to 52.4 MPH. This was a speed reduction of only 6.4 MPH with a deceleration rate of – 4.74 m/s squared. The engine speed peaked at a much lower 5,946 RPM (below redline) and the vehicle experienced a wheel drag duration of only 0.48 seconds. Ford concluded that no steering input was needed by the driver to maintain control and the potential for loss of control with this level of deceleration is materially lower than a 6-1 shift. Additional tests were run at different speeds with similar results varying slightly based on vehicle speed at the time of simulated fault. Video files "Vehicle Demo 1 TRS 6-1" and "Vehicle Demo 1 TRS 6-2" provided as part of the response to Part 2, Request #1 contain video recordings from these tests done on a subject vehicle at Ford's Non-Destructive Evaluation test track and show a momentary 6-1 "PRNDL" flash and a 6-2 downshift respectively.

A second round of testing was completed on May 23, 2025, with additional vehicle instrumentation to more fully capture the driving experience associated with a 6-2 downshift (worst case for a TRS fault). Video file "Vehicle Demo 2 - Four Views" provided as part of Part 2, Request #1, contains video recordings from these tests done on a subject vehicle at Ford's Driving Dynamics Laboratory test track. The vehicle was instrumented with four cameras that recorded: 1) the driver and the steering wheel; 2) the driver's view of the road; 3) the instrument cluster (including the speedometer); and 4) the right rear wheel. The vehicle in the video had a controller installed that could simulate a worst-case TRS fault at highway speed. The attached video shows 4 tests (time stamps 10:15, 11:21, 11:31, and 13:43) simulating TRS signal interruptions that would command maximum downshifts at approximately 64 MPH, which is just below the threshold in the shift map that would limit downshifts to 3rd gear. Downshifts to 3rd gear are generally less common and less aggressive due to the gear ratios. In each case, the vehicle decelerates between 5-8 MPH. In no case was there any unexpected feedback in the steering wheel, and the driver maintains control with one hand on the wheel. In some cases, there is no audible sound from the rear wheels, and in one simulation there is a momentary chirp indicating a brief and transient skid of one of the rear wheels lasting less than one second. This 6-2 vehicle performance is similar to the previous simulations run that compared 6-1 downshifts to 6-2 downshifts. The attached video also includes 2 tests (time stamps 3:48 and 4:48) showing momentary 6-1 "PRNDL" flashes.

In addition to being less severe than the downshifts associated with prior recalls, the TRS fault downshifts are less common, and are not experienced by customers as having the same level of severity.

Out of the total of 1,270,970 subject vehicles, there have only been 18 customer complaints and field reports to Ford alleging temporary rear wheel lock-up due to an unexpected downshift. Warranty claims, which overlap with customer complaints and field reports, include 20

allegations of wheel lock-up. That represents an unverified alleged temporary wheel lock-up rate of 0.0028%.

The earlier model years had specifically identified leadframe supplier production issues that have been addressed. The subject MY 2015-17 vehicles are not presenting those same supplier production issues. In contrast, for the subject MY 2015-2017 vehicles, the root cause appears to be aging of the connections due to thermal cycling and vibration over extended miles and time in service and therefore failure rates are significantly lower and are dependent on vehicle operating conditions over time in service. Specifically, the rate per-1000 (R/1000) for warranty, consumer complaints and field reports for wheel lock-up in MY 2014 F-150s subject to prior 6R80 recall 24V-444 was 0.07 at the time of Recall Query RQ24-005 response, which is more than double the R/1000 for the subject MY 2015-2017 vehicles, which is 0.03.

Ford has not been able to verify or repeat any of the allegations of significant wheel lock-up, or loss of control on customer vehicles. Only one of these allegations involved some claim of property damage and even that claim contains little beyond the customer's initial allegations in the verbatim. This legal claim involved a MY 2016 F150 (VIN 1FTFW1EG0GFD41569) with a property claim seeking compensation for damage to the side mirror and side of the truck due to the incident. There was no police report or report to an insurance company related to this claim. Ford has not been able to further verify this claim.

Ford reviewed the 138 VOQs provided by NHTSA and found that 24 claims alleged some kind of transmission related wheel lock-up, 89 claims alleged unexpected downshifts, and 2 claims alleged wheel lock up with unknown cause. Four claims were related to vehicles equipped with 10R80 transmissions and were not included in assessment totals. The remaining 19 VOQs were not considered responsive since either their symptoms did not match the focus of this investigation, or the root cause was related to a component(s) not included in the list of potential subject components. Ford's track testing has not been able to duplicate the allegations of significant or sustained wheel lock-up or loss of control alleged in certain VOQs.

Ford's review of the VOQs provided by NHTSA and the indicant data requested in Part 1, Request #2 confirms that customers are not experiencing the types of performance issues associated with the prior 6R80 recalls. The vast majority of consumer complaints, field reports and consumer survey data relate to concerns about shift quality, noise and unexpected down-shifts that do not impact vehicle control (such as downshifts while towing trailers up hill). Many customers complaints are connected to issues with the PRNDL display, which is consistent with TRS sensor faults.

There are a number of factors that complicate the evaluation of owner complaints, including the VOQs. For example, the past safety recalls of earlier model years with different failure modes and consequences have created a tendency for owners to assume that their vehicle has the same issue as earlier model years, which as explained above is not the case. Similarly, many owner concerns are associated with other annoying or unpleasant concerns about the transmission that have no safety consequences at all, like rough shifting or shifting that is not sufficiently responsive to changes in accelerator pedal position. These issues generate non-safety-related customer concerns.

The sensor faults described above will typically cause the vehicle to flash a malfunction indicator lamp (MIL) on the dashboard alerting the driver to the need for transmission service if the failure persists long enough for the diagnostics to take action. Specifically, this signal fault will cause illumination of the Wrench light, MIL, and flashing of specific fault codes P0720 and

P0722 to facilitate service of the specific OSS connection. A TRS signal fault will cause illumination of the Wrench light, MIL, and flashing of specific fault codes P0705, P0706, P0707, P0708, P0709, P1702 or P1706 to facilitate service of the specific TRS connection.
The presence of MIL illumination on the subject MY 2015-2017 in the event OSS and TRS faults notify the driver of the need for transmission service and reduces the likelihood of repeated occurrences after the initial fault.

The transmission faults described above create legitimate customer concerns about transmission quality and driving comfort, and in some cases the behavior may drive customer complaints. Furthermore, because this occurs late in the lifetime of a vehicle, customers are frequently out of warranty and may have to pay out of pocket for repair. Based on Ford's detailed analysis of the fault modes, analysis of owner complaints and field reports, and vehicle testing, we believe these faults are extremely unlikely to result in a loss of vehicle control, or any other unreasonable risk to motor vehicle safety based on the nature of the worst-case failure mode and its infrequency.