

Request 9

Furnish Ford's assessment of the alleged defect in the subject vehicle, 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. The threshold to trigger a MIL or other warning lamp due to the alleged defect;
- f. 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;
- g. The sequence of events, including durations of each, from first warning to alleged defect
- h. Explain the performance of all occupant protection systems in a subject vehicle that contains an already deployed subject component. This should include, but is not limited to, any element of the occupant protection system that is rendered to have a diminished functionality after the alleged defect has occurred; and
- i. The reports included with this inquiry.

Answer

NHTSA's Office of Defects Investigation (ODI) opened this Preliminary Evaluation based on ten [10] Vehicle Owner Questionnaire (VOQ) reports of inadvertent deployment of the seatbelt pretensioner in model year (MY) 2019 Ford Expedition vehicles. Ford has conducted an investigation associated with this subject, including the cause of these reports, the circumstances under which they occurred, and the anticipated performance of these products.

(a) The Causal or Contributory Factor(s)- Engineering evaluation of field returned retractor pretensioners found corrosion on the pretensioner squib pins where the bridge wire (heating element of pyro-technic device) is welded, as the cause. Further testing and analysis of the field returned seatbelts and new seatbelts found that the main causal factors were likely (1) a byproduct of corrosion which requires a high moisture/water content sealed in the squibs and (2) partial separation at the weld between the inner pin and platinum bridge wire, whereby the Restraint Control Module (RCM) diagnostic signal could trigger an inadvertent deployment. To address the question on how moisture could arrive in the squibs of the pretensioner, Ford analyzed vehicle environment factors and found the drain seal change that occurred at the start of production in 2019. Although unproven, Ford theorizes that a water leak related to a drain seal on the right front floor related to air-conditioning usage may increase humidity when Max air-conditioning (A/C) is used for extended periods and contribute to pretensioner squib pin corrosion.

(b) and (c) The Failure Mechanism(s) and the Failure Mode(s)- Certain seatbelt retractor pretensioners may develop corroded squib pins caused by an undefined supplier manufacturing issue. After extended corrosion and with a partial separation at the weld between the squib pin and the bridge-wire (heating element of a pyrotechnic device), high resistance or open circuit may occur, and, if not resolved, may result in a retractor pretensioner inadvertent deployment. Increased humidity inside the cab, caused by water leakage after customer air-conditioning (A/C) usage in hot temperature areas, may potentially contribute to the development of corrosion on top of the squib pins.

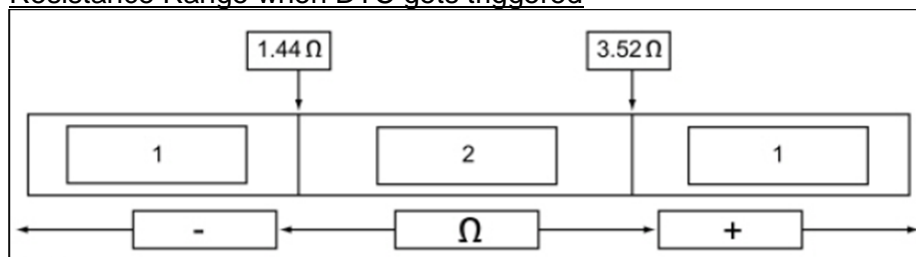
(d) The risk to motor vehicle safety that it poses- Inadvertent deployment of the retractor pretensioner will result in the seatbelt being locked in position and will not retract or extend, which is noticeable to the occupant. A seatbelt that does not retract or extend may result in injury in the event of a crash.

(e) The threshold to trigger a MIL or other warning lamp due to the alleged defect- When the vehicle key is turned ON, the Restraints Control Module (RCM) sends the diagnostic check signal to the squib pin of the seatbelt pretensioner at a frequency of 500 milliseconds. This signal is a 40 milli-ampere current that lasts for 2 milliseconds. If the RCM encounters high resistance or open circuit in the seatbelt pretensioner, the diagnostic signals increase the current within the pre-defined range in response, which illuminates the airbag warning light. The threshold to trigger the airbag warning light is based on the resistance values given in the table below.

DTC Fault Trigger Conditions-

DTC	Description	Fault Trigger Conditions
B007E:11	Driver Seatbelt Pretensioner "C" Deployment Control: Circuit Short to Ground	A fault is indicated when the RCM senses a short to ground on either driver seatbelt retractor pretensioner circuit for more than 6 seconds.
B007E:12	Driver Seatbelt Pretensioner "C" Deployment Control: Circuit Short to Battery	A fault is indicated when the RCM senses a short to voltage on either driver seatbelt retractor pretensioner circuit for more than 6 seconds.
B007E:13	Driver Seatbelt Pretensioner "C" Deployment Control: Circuit Open	A fault is indicated when the RCM measures more than the desired resistance between the driver seatbelt retractor pretensioner circuits for more than 6 seconds.
B007E:1A	Driver Seatbelt Pretensioner "C" Deployment Control: Circuit Resistance Below Threshold	A fault is indicated when the RCM measures less than the desired resistance between the driver seatbelt retractor pretensioner circuits for more than 6 seconds.

Resistance Range when DTC gets triggered-



Range	Description
1	May set Diagnostic Trouble Code
2	Desired range

(f) and (g) Warnings, Detectability, Sequence of Events and Durations from first warning to alleged defect- An airbag malfunction light illuminates on the cluster preceding an inadvertent deployment of the seatbelt retractor pretensioner. Ford conducted a study on connected vehicles that experienced inadvertent deployment and found that the airbag warning light was ON for an average period of 5.5 weeks prior to an inadvertent deployment.

(h) Performance of all occupant protection systems that contains already deployed subject component- The driver and front passenger seatbelts on subject vehicles are equipped with

dual pretensioners – the retractor pretensioner and an anchor pretensioner – along with primary seatbelt locking functions. In the event of a high resistance or open circuit in the retractor pretensioner, or inadvertent deployment of the retractor pretensioner, the primary seatbelt locking functions and the anchor pretensioner will continue to function properly, as per the design intent. The intent of the retractor pretensioner is to remove any residual slack in the seatbelt in the upper body region of an occupant, as the occupant upper body region tends to move relative to the seat during the crash event. Similarly, the anchor pretensioner removes any residual slack in the seatbelt in the lower body region of an occupant, as the occupant lower body region moves relative to the seat during the crash event. Below are Ford's assessments of subject vehicle for various scenarios that the occupant may encounter.

Scenario-1: Ford conducted computer-aided-engineering (CAE) analysis and concluded that the system would continue to meet regulatory requirements in the event the driver and/or front passenger seatbelt retractor pretensioners have an open circuit diagnostic trouble code and the retractor pretensioner did not correctly deploy. This computer crash simulation was conducted considering an absence of retractor pretensioner during crash event to simulate non-deployment of retractor pretensioner. Also, Ford has not found any evidence in the field that an open circuit diagnostic trouble code would adversely affect the commanded deployment of seatbelt retractor pretensioner.

Scenario-2: Ford believes that when the same occupant is occupying the seat position when the inadvertent deployment occurred, the seatbelt would provide the necessary fit to the occupant in any drive cycle and provide the necessary protection during crash. Once the inadvertent deployment occurs, the slack in the seatbelt is already removed and it is locked on the retractor end of the seatbelt. Hence, the same occupant occupying the same seat position after the inadvertent deployment should get the protection in the crash event as the primary seatbelt locking functions and the anchor pretensioner function, as per the design intent.

Scenario-3: If the size of the occupant changes, for example, inadvertent deployment occurred when 95th percentile occupant was occupying the seat and later in different drive cycle, the 5th percentile occupant occupies the same seat, the belt will not fit properly i.e., there will be slack in the seatbelt. During crash event with this 5th percentile occupant, the primary seatbelt locking functions and the anchor pretensioner function, as per the design intent.

Scenario-4: If the size of the occupant changes conversely, i.e., the inadvertent deployment occurred when 5th percentile occupant was occupying the seat and later in the different drive cycle, the 95th percentile occupant occupies the same seat, the belt would be too tight for this 95th percentile occupant and they may not be able to buckle the seatbelt.

Analyzing Customer Verbatims- The current overall rate of reports relating to inadvertent deployment in subject vehicles manufactured from October 2018 through June 2019 is 1.2 R/1000 (71 reports/ 57,031 units). Ford identified two owner reports and three legal claims alleging injury and one owner report of property damage potentially pertaining to the alleged defect in subject vehicles. Additionally, five VOQs allege injury related to the alleged defect in subject vehicles. Ford identified no reports of accident or fatality pertaining to the alleged defect in subject vehicles. Deployment of the seatbelt retractor pretensioner may result in smoke and an odor observable by the vehicle occupants. Although such reports are included in the "fire" incident category, Ford notes that there are no reports of flame and the reports are limited to smoke due to the deployment of the pretensioner. A few customer reports alleged

that the inadvertent deployment felt like pressure on the chest, but they did not seek medical attention.

(i) US Field Data on Subject Component- As of January 12, 2024, Ford is aware of 71 reports of inadvertent retractor pretensioner deployment on subject vehicles in the US, received from July 05, 2021, to December 30, 2023, primarily in warm-weather regions. The incidents corresponded to a clearly defined window of vehicle production from October 2018 through June 2019, indicating there could be a supplier quality concern. Additionally, most of the inadvertent deployments occurred during the summer months. The projected lifetime risk using field data indicated a 10 years/150k miles failure rate of 2.8% for inadvertent deployment and 5.2% for diagnostic trouble codes that result in an airbag warning light illumination for Ford Expedition and Lincoln Navigator vehicles produced from October 2018 through June 2019.

Summary- Ford acknowledges that a seatbelt that does not retract or extend may result in injury in the event of a crash. On February 02, 2024, Ford's Field Review Committee reviewed the concern and approved field action 24S06 (NHTSA Campaign Number 24V-099). To address the undefined manufacturing issues at the supplier, Ford recommends replacing both front seatbelt retractor pretensioners on the vehicles built within the suspect time window. As a robustness action, Ford also recommends implementing an existing TSB to install a revised Heating Ventilating and Air Conditioning (HVAC) drain tube to address humidity inside the cab.