

## Chronology of Defect / Noncompliance Determination

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Describe the chronology of events leading up to the defect decision or test data for the noncompliance decision\*: (2000)

During the summer of 2018, Isuzu received reports of loose main power wire bolts, and/or melted wiring inside the external relay box, on N-gas trucks. Parts were requested from the field and were then sent to the harness supplier for analysis. An internal investigation was opened under the U.S. field investigation process. As of that time, Isuzu had received a total of nine reports.

In October, 2018, the supplier identified pinched insulation as being the likely cause of damage to the wiring harnesses. The investigation found that, in June, 2017, the supplier had changed the insulator tube heating process from individual heat lamps to a conveyor belt heat lamp system. In January, 2018, the supplier changed back to the individual heat lamp process because workers found that maintaining the proper insulator position was difficult with the conveyor belt heater lamp system.

Consistent with the supplier's analysis, Isuzu contained the parts at the vehicle assembly plant in Charlotte, and the supplier and Isuzu jointly audited the part inventory at the plant to check for excessive insulation. As part of that inspection, any bolts found with pinched or excessive insulation were removed and reattached once the insulation was trimmed. In November, Isuzu and the supplier jointly inspected completed trucks at the Charlotte assembly plant and trimmed insulation when found out of specification. During this inspection, all relay box main power supply bolts were torqued to the proper specification.

In December, based on additional testing, the supplier determined that the pinched insulation was not causing the bolts to loosen. The investigation began to focus on finding the root cause of the loose bolts. Upon review, Isuzu Motors Limited also confirmed that, while the insulation will become hot and may melt the wiring, the thermal event is self-extinguishing and would not result in smoke or open flame. The loose bolts could result in a no-start condition or an intermittent loss of power. Isuzu opened an internal investigation in Japan corollary to the investigation in the U.S. to determine the root cause of the concern.

Between January and April, 2019, the supplier conducted extensive testing and evaluation, including a process history review, duplication analysis, a process comparison of the supplier's different plants, as well as additional wire melting duplication tests. In May, the supplier provided Isuzu with its final report, which concluded that notwithstanding the potential for excessive insulation, the root cause of the issue was the supplier's random failure to torque the bolt appropriately during initial harness production.

Upon reviewing the matter, Isuzu determined that a campaign to inspect the bolts was warranted. As of May/June, Isuzu had received 15 reports of loose bolts and/or melted wires with regard to the N-gas trucks, and none with regard to the more limited population of FTR trucks or Chevrolet badged trucks. Nine of the 15 reported a no-start condition. Others described intermittent loss of power, mostly with the ability to restart the vehicle and drive to a service station. One report alleged that the vehicle lost power while being driven but was able safely to reach the roadside. Most of the reports were early in the life of the vehicles both in terms of mileage and time-in-service. The last report had been received in March, 2019 and all of the vehicle's production dates pre-dated the Charlotte plant inspection. This led to the likelihood of an early life condition that had already been fully identified in the field.

After discussion with the agency, Isuzu initiated a service campaign/survey of vehicles in dealer inventory. Isuzu discussed with the agency that if Isuzu found no loose bolts in the survey, Isuzu would expand the service campaign to the remaining vehicles in the field. If loose bolts were found, Isuzu would conduct a safety recall to inspect the remaining vehicles in the field and to complete the campaign with regard to trucks still remaining in dealer inventory. While 391 vehicles were inspected, Isuzu received the survey reports with regard to 292 of those vehicles, with none indicating loose bolts when the inspection process was properly followed.

However, in late July/early August, Isuzu received two additional reports of relay box failures in N-Gas vehicles in the field. These two vehicles experienced the relay box failures later in their "vehicle life" (more mileage and/or more months in service) than prior vehicles. The parts were collected and sent to the supplier for analysis. The supplier confirmed that on these two vehicles the relay box bolt had not been properly torqued during production.

Isuzu informed the agency of the results of the dealer survey as well as the new reports from the field. On August 30, 2019, Isuzu decided to conduct a safety recall to ensure the bolts are appropriately torqued.