



U.S. Department  
of Transportation

**National Highway  
Traffic Safety  
Administration**

# ODI RESUME

**Investigation:** PE 18-003  
**Date Opened:** 03/16/2018  
**Investigator:** Nathan Ong  
**Approver:** Stephen Ridella  
**Subject:** Air bags may be disabled during crash  
**Date Closed:** 08/30/2019  
**Reviewer:** Paul Simmons

## MANUFACTURER & PRODUCT INFORMATION

**Manufacturer:** Kia Motors America, Hyundai Motor America  
**Products:** 2012-2013 Kia Forte and 2011 Hyundai Sonata  
**Population:** 1,087,000  
**Problem Description:** Failure of the air bag control unit may prevent the frontal air bags/Seat Belt Pretensioners from deploying in the event of a crash.

## FAILURE REPORT SUMMARY

	ODI	Manufacturer	Total
<b>Complaints:</b>	4	8	8**
<b>Crashes/Fires:</b>	4	8	8**
<b>Injury Incidents:</b>	2	6	6**
<b>Number of Injuries:</b>	2	6	6**
<b>Fatality Incidents:</b>	3	4	4**
<b>Number of Fatalities:</b>	4	4	4**

\*\* Total eliminates duplicates received by ODI and manufacturer.

## ACTION / SUMMARY INFORMATION

**Action:** This Preliminary Evaluation has been upgraded to an Engineering Analysis (EA19-001). Additionally, this Preliminary Evaluation has resulted in Hyundai Recall No. 18V-137 and Kia Recall No. 18V-363.

### Summary:

The Office of Defects Investigation (ODI) opened PE18-003 on 3/16/18 to investigate incidents involving crashes, resulting in significant collision related damage, where the frontal airbags failed to deploy. ODI reviewed complaint data, available design, test, and field data on the model year (MY) 2011 Hyundai Sonata, MY 2012-2013 Kia Forte and Forte Koup vehicles. ODI also evaluated data from the automotive air bag system supplier, ZF-TRW (ZF), to review vehicles that may contain the same air bag control unit (ACU) used in the subject vehicles.

Hyundai Motor America (HMA) issued recall No. 18V-137 for MY 2011-2013 Sonata and MY 2012 Sonata Hybrid vehicles. Kia Motors America (KMA) issued recall No. 18V-363 for MY 2010-2013 Kia Forte and Forte Koup, MY 2011-2013 Optima, MY 2011-2012 Optima Hybrid, and MY2011-2012 Sedona vehicles. The two recalls address vehicles containing ACUs manufactured without adequate circuit protection by installing a wire harness filter kit to prevent internal damage to the ACU. In the event of a crash, ACU damage may result in the disablement of the vehicle's airbags. Each respective manufacturer has mailed letters to affected vehicle owners informing them of the remedy and its availability.

ODI plans to evaluate the susceptibility of the subject ACU to electrical signals, as well as other vehicle factors that can either lead to, or reduce the likelihood of, an electrical overstress event in other vehicles manufactured with the subject ZF ACU. Accordingly, this Preliminary Evaluation has been upgraded to an Engineering Analysis (EA19-001), to expand the scope of the investigation to include the Tier-one supplier and any manufacturers who installed the subject ACU in production vehicles.

Additional information is available with the closing resume available at [NHTSA.gov](http://NHTSA.gov) (see Associated Documents).

The ODI complaints cited above can be viewed at [www.NHTSA.gov](http://www.NHTSA.gov) under the following ODI identification numbers: 10781050, 10849839, 11099038, 11080341.

## **PE18-003 Additional Information**

In November 2017, the Office of Defects Investigation (ODI) followed up on a vehicle owner questionnaire (VOQ) alleging that a MY 2011 Hyundai Sonata's frontal air bags failed to deploy during a crash, resulting in significant-collision related damage that would be expected to result in air bag deployment. However, in this case, the frontal air bags failed to deploy. ODI requested similar high-severity non-deployment allegations from HMA and KMA. By the end of 2017, ODI became aware of six total crashes involving Hyundai and Kia models where the air bags failed to deploy in frontal crashes. Four crashes involved MY 2011 Hyundai Sonata vehicles and two others involved MY 2012 and MY 2013 Kia Forte vehicles. The MY 2013 Forte crash occurred in Canada and the Forte was a vehicle from the Canadian market. In total, the crashes resulted in four fatalities and six injuries. The vehicles involved in these crashes had air bag control units (ACUs), which did not have protecting diodes, intended to block electrical transients, on one or both of the ACUs' communication lines to the front satellite crash sensors. These ACUs were supplied by ZF, a supplier of automotive air bag systems.

In February 2018, HMA filed a defect information report (DIR) leading to NHTSA Recall No. 18V-137 for the MY 2011 Hyundai Sonata. The scope of that recall was based on the production dates of the four known incidents and encompassed 154,000 total vehicles. HMA indicated that the DIR stemmed from post-collision inspections of the ACUs in the four crashes discussed in the preceding paragraph. HMA's inspections showed that an electrical overstress (EOS) condition of an electrical component internal to the ACUs occurred in three of the four crashes. HMA also indicated that the fourth ACU was under evaluation for the same concern.

For further evaluation of the subject defect condition and scope, ODI opened PE18-003 in March 2018 on the MY 2011 Hyundai Sonata, MY 2012-2013 Kia Forte and Forte Koup vehicles. ODI requested and reviewed information provided by Hyundai, Kia, and ZF. Hyundai's response to ODI's request included the original four incidents that Hyundai acknowledged in its DIR filing. Kia's response to ODI's request identified four potential incidents, including one of the vehicles that ODI identified in late 2017. All of the Kia incidents included air bag non-deployments during high-severity frontal crashes where occupants sustained moderate injuries or death. Two of the three available ACUs from the incidents, which were provided by Kia, were determined to be non-communicative with the manufacturer's Event Data Recorder (EDR) tools (the EDR data was not able to be downloaded from the ACU), which is a condition consistent with EOS/internal electrical damage. The remaining ACUs were either not available for analysis or, despite communication with the download tool, showed evidence of EOS; Kia's provided analysis stated that the cause of these non-deployment was inconclusive.

During the course of PE18-003, NHTSA attended vehicle crash tests designed and conducted by HMA that replicated air bag non-deployments/EOS circuit damage to the ACU in original recall scope and non-recalled vehicles, with the same level of EOS protection, during certain crash test scenarios. In April 2018, HMA amended 18V-137 to include an additional 429,000 vehicles—consisting of the remaining MY 2011 Sonata population, newer MY 2012-2013 Sonatas, and MY 2011-2012 Sonata Hybrids. HMA vehicles produced subsequently were manufactured with ACUs containing improved circuit protection.

In May 2018, subsequent to HMA tests, ODI located two potential frontal collision non-deployment Kia Forte subject vehicles in salvage yards, to be inspected and evaluated by NHTSA representatives, KMA,

and KMA's consultants. Subsequently, both of the vehicles' ACUs were taken to ZF for further analysis. One ACU showed characteristics of EOS damage, while the other ACU's EDR showed a functional "below threshold" non-deployment event. In June 2018, Kia filed a defect information report leading to NHTSA Recall No. 18V-363, involving just over 507,000 vehicles that included the MY 2010-2013 Forte and Forte Koup vehicles (original investigation scope MY 2012-2013), MY 2011-2013 Optima, MY 2011-2012 Optima Hybrid, and MY 2011-2012 Sedona vehicles. Subsequent to the recall, ODI became aware of a fatal VOQ report involving a Kia subject vehicle, which is also included in this closing resume. KMA vehicles produced subsequently were manufactured with ACUs containing improved circuit protection.

Additionally, ODI requested and obtained information provided by ZF to determine if other model vehicles used the same ACU. As a result, additional Make-Model-Model Year products were added to the scope of the PE18-003 subject vehicles. ODI learned that the ZF ACU design was licensed to another supplier, MOBIS. These vehicles are also included in the scope and covered in the recalls mentioned. In summary, in addition to the 150K vehicles recalled in the original Hyundai recall No. 18V-137, a further 900,000 vehicles were recalled (by the amendment to the original HMA recall and the new KMA recall No. 18V-363), totaling just over 1 million vehicles. The two recalls address vehicles containing ZF ACUs with inadequate circuit protection by installing a wire harness filter kit, as a recall remedy to prevent internal damage to the ACU in the event of a crash where electrical transients are generated.

This investigation revealed that the subject ACU, without circuit-protecting diodes on communication lines, may be susceptible to damage, during a crash. Failure of the ACU may prevent airbag deployment during crashes where deployments may be necessary. Preliminary Evaluation 18-003 has been upgraded to Engineering Analysis (EA) 19-001 which will investigate similarly designed ACUs manufactured by ZF that were used by other vehicle manufacturers.