

Hyundai Recall Campaign 272/025G (AMENDED 2024-12-05)

Attachment A: Requested Chronology of Events Leading Up to Decision

❖ October 2022 – March 2023

- Beginning in October 2022, HMC began examining ICCU warranty returns from various markets and noted heat damage on the low-voltage converter field effect transistor(s) (“FET”) of the ICCU assemblies equipped in certain Hyundai and Genesis electric vehicles.
- In January 2023, HMC began evaluating potential overcurrent modes in the ICCU in an attempt to replicate the FET failure(s) observed in examined warranty part returns.

❖ April – September 2023

- On April 24, 2023, NHTSA’s Office of Defects Investigation (“ODI”) notified NASO of certain VOQ’s received alleging a loss of motive power in a Hyundai IONIQ 5 vehicle located in the U.S. NASO held multiple discussions from April to May informing ODI of its analysis of field information and the findings of HMC’s investigation and ongoing replication testing.
- On May 17, 2023, HMC conducted vehicle driving tests to study the potential loss of power following failure of the ICCU, specifically regarding the effects of low-voltage convertor fault(s) on vehicle mobility, warning signs that precede an ICCU fault, and driving time and range following an ICCU fault. These tests were performed with the Korea Automobile Testing and Research Institute (“KATRI”). The testing results indicated that the vehicle remains operational following a low-voltage convertor fault, resulting in multiple audible and visual warnings to the driver. The results confirmed that if the vehicle continues to be driven while ignoring the warning symptoms, the vehicle will eventually lose all motive power. The test results also confirmed that the onset of the fail-safe mode includes full motive power during the initial 22 minutes after ICCU fault detection, followed by five (5) stages of progressive warnings and gradual motive power limitations, providing a total cumulative drive time of up to 45 minutes in fail-safe mode. Further examination of the test results confirmed that total drive time with access to motive power is dependent on several factors such as powered vehicle accessories, ambient conditions such as temperature and humidity, and road driving conditions such as curvatures and inclines.
- On May 24, 2023, NASO held a video conference meeting with NHTSA to discuss updates to its investigation, including the results of HMC’s joint testing with KATRI.
- On June 23, 2023, NHTSA issued an opening resume letter stating that formal investigation PE23-011 had been opened to investigate ICCU failures in certain model year 2022-2023 Hyundai IONIQ 5 vehicles manufactured by HMC for sale in the U.S.
- On July 17, 2023, Hyundai launched service campaign SC997 to address the subject condition in affected Hyundai electric vehicles in the U.S. market.
- On July 28, 2024, HMC performed a second test at the Hyundai-Kia Namyang Centre High-Speed Proving Ground using a Hyundai production test vehicle with multiple accessories activated. The results indicated 11 minutes of full motive power and 33 minutes of total vehicle operation following a low-voltage convertor fault, with multiple visual warnings and an audible chime, leading up to a complete vehicle stall condition.
- On August 10, 2023, NASO submitted its first response to PE23-011 to the agency.
- On September 21, 2023, Genesis launched service campaign SC907G to address the subject condition in affected Genesis electric vehicles in the U.S. market.

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- On September 26, 2023, NASO held a joint vehicle demonstration with HMC and members from NHTSA's Vehicle Research and Testing Center ("VRTC") at Hyundai's Safety Test and Inspection Laboratory (STIL) in Michigan. The results confirmed 10 minutes of full motive power and approximately 21 to 26 minutes of total vehicle operation leading up to a complete vehicle stall. The test was performed with conditions representative of a "harsh" or "worst-case" scenario, including multiple vehicle accessories powered on and use of a test-track containing turns and inclines requiring driving maneuvers typically demanding increased 12-volt auxiliary power draw. NASO and HMC also noted that test trials performed in advance of the joint session yielded results consistent with prior findings.
- On September 27, 2023, NASO submitted its final response to PE23-011 to the agency, including its final assessment of the subject condition.

❖ January – February 2024

- On January 31, 2024, HMC informed NASO of its updated findings in its investigation. NASO's Data Analysis ("DA") team created a new case for reconsideration of the current service campaign and immediately escalated it to the Data Review Committee ("DRC") on January 31, 2024.
- On February 7, 2024, the DRC escalated the case to the Technical Review Committee ("TRC") based on its preliminary analysis of field information. NASO's TRC began analyzing and confirming field information, including an examination of the ongoing service campaign, related claim data, and accumulated results of prior testing performed by HMC.

❖ March 2024

- On March 8, 2024, HMA's NASO convened its North America Safety Decision Authority ("NASDA") for review of the TRC's findings and recommendation.
- In its review of the subject condition, the NASDA acknowledged that multiple, extensive operator warning(s) occur over an extended period of drive time, during which the vehicle initially retains full motive power before entering several stages of gradually reduced motive power, culminating in a loss of all motive power after a time period of 22-45 minutes. Although the NASDA concluded that the length of available drive time with sufficient mobility during fail-safe driving is reasonably sufficient for detection by vehicle occupants, and NASO's investigation did not identify related any crashes or injuries, the NASDA decided to conduct a safety recall of affected Hyundai and Genesis vehicles in the U.S. and Canada out of an abundance of caution.

❖ April – May 2024

- On April 29, 2024, HMNA's Warranty Department notified NASO of final confirmation of affected vehicles in the U.S. market. The final vehicle population includes 14 vehicles under evaluation by Motional as fully operable "robotaxis" retrofitted with proprietary ADS technology. Based on this information, NASO amended the affected population in the original 573 report on May 2, 2024.

❖ June – November 2024

- From June through July 2024, NASO continued to monitor internal field information, including new VOQ's, after deployment of recall 257/021G to the field. Upon confirmation of new reports alleging

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ICCU failure on vehicles that were remedied under the previous recall, NASO launched an investigation and began requesting warranty part returns from incidents occurring in the field. Eight (8) total ICCU returns were recovered in July and sent to both HMC and NASO's STIL in Michigan for analysis.

- On September 9, 2024, NASO was notified of a corporate fleet vehicle exhibiting symptoms of an ICCU failure. On September 12, 2024, NASO inspected the vehicle and confirmed an ICCU fuse open-circuit condition resulting in limited drivability under the vehicle's "fail-safe" drive mode. NASO noted that replacement of the ICCU and the associated fuse corrected the condition. The original ICCU parts were sent to the STIL for further analysis.
- On October 1, 2024, NASO met with HMC to provide an update on its internal investigation. NASO informed HMC that all part returns sent to the STIL were undergoing full CT scan to identify any irregularities and potential causes of failure. HMC shared updated information regarding affected vehicle populations in the U.S. and Canadian markets.
- On October 28, 2024, NASO received an update from the STIL regarding its part inspection results. Preliminary findings indicated damage to the ICCU's internal MOSFET. NASO informed HMC of the STIL's findings on October 31, 2024.
- On November 4, 2024, HMC provided NASO with an update to its investigation into global market impact and potential field correction. HMC informed NASO that the Korean market safety decision authority would convene soon to review KASO/NASO findings and decide on potential field action.
- Based on this information, NASO convened its North America Safety Decision Authority on November 13, 2024, and decided to conduct a new safety recall of all vehicles affected by the subject condition, including all vehicles involved in prior recalls 257 and 021G.

NASO has confirmed 57 unique incidents in the U.S. from reports received beginning March 25, 2024, through November 5, 2024. There are no crashes, injuries, or fatalities attributable to this condition in the U.S.



❖ November – December 2024

- **On November 27, 2024, NASO was informed of an additional 85 IONIQ 5 and 28 IONIQ 6 affected vehicles that were retailed and delivered in the U.S. on or around this recall's filing date. As such, NASO is amending the original recall report to reflect the updated affected vehicle population.**