전남 개조전기차 규제자유특구

고전압 와이어 하네스의 압착표준 개발

이강령*

Development of High Voltage Wire Harness Crimping Standard

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Key Words : High Voltage Wire Harness(고전압 와이어 하네스), Crimping Standard(압착표준)

ABSTRACT

As the spread of electric vehicles expands, safety issues related to electric vehicle fires are emerging. The wire harness itself cannot ignite, but if high voltage is applied, there would be a risk of fire due to sparks caused by air gaps and corrosion depending on the crimping state. If the air gaps in the clamping area are minimized, it is possible to prevent sparks caused by the applied voltage and progressive corrosion.

The crimping standards of low voltage wire harness are well organized, such as ES specification, Uscar21 specification and the other specifications provided by parts manufacturers. However, as the standards for high voltage wire harnesses have not been established, production is in progress based on past experiences.

So we are trying to solve this problem by developing crimping standards for high voltage wire harness by changing crimping method from the conventional hydraulic press to using a servo motor. And also we changed the crimping shape to hexagonal.

The experimental method is to cut the crimping part and measure the cross section with a cross-sectional camera to find the crimping specification of high voltage wire by each SQ with charging the optimal crimping ratio.

We plan to commission a test to an authorized research institute in order to test whether ES specification is satisfied or not through a complex environmental test.

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개조 전기차 제작기술 개발과 중량이 증가된 개조 전기자동차의 주행 안전성 실증

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Developing Technology for Modified Electric Vehicles and Demonstrating Driving Safety in Overweight EVs

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Key Words : Modified electric vehicle (개조전기차), Regulation-free special zone (규제자유특구)

ABSTRACT

The Modified Electric Vehicle Special Zone, designated as Regulation-Free Special Zone No. 7 in August 2022, has the purpose of converting internal combustion engine vehicles into eco-friendly electric vehicles. This research primarily focuses on the driving safety of modified electric vehicles and, in particular, addresses the development of technologies to address safety issues caused by the increased weight that arises during the conversion process. Mokpo Hyundai Commercial Services, a key participant, is collaborating with the Korean Auto-vehicle Safety Association and the Korea Automotive Technology Institute to develop technologies for the production of modified electric vehicles. In particular, we are conducting research to improve the driving safety of modified electric vehicles like the Kia Bongo Ⅲ when their weight increases by up to 450 kg. These efforts, which support the eco-friendly conversion of old cars and the growth of the domestic car tuning industry, play a role in protecting the environment and strengthening the sustainability of the automotive industry.

The purpose of this study is to conduct tests and evaluations in the weight increase range (150~450kg) through comparative demonstration to assess driving safety, and to propose standards for driving safety of modified electric vehicles.

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화재 전이 방지 시스템을 적용한 리튬 이온 Module Battery Pack

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Lithium-ion Module Battery Pack with Fire Transfer Prevention System

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Key Words : Fire transfer prevention system(화재 전이 방지 시스템), Module battery pack(모듈 배터리팩), Cylindrical lithium-ion cell(원통 리튬이온 셀),

ABSTRACT

As the global market paradigm changes, the production and distribution of electric vehicles is expanding. However, the fire problem of electric vehicles is threatening not only consumer demand but also driver safety. Causes of fire include overcharging, overdischarging, or aging of cells due to cell imbalance within the battery pack. Suppressing these causes is also important, but if you suppress the transition phenomenon that occurs between cells, you will be able to prevent the spread of fire in electric vehicles in the early stages.

The lithium-ion module battery consists of a cell holder, nickel plate, and copper bus-bar. The production of the cell holder uses materials with a flame retardant rating (PA6+G30%+IM) so that in the event of a fire, the fire can be easily extinguished.

The gap between the cells is set to 2mm, and the height difference between the cells and the cell holder is set to 1.5mm. The reason for this configuration is to send the flame generated from the single cell spreading left and right upwards. The thickness of the nickel play is 0.2mm and the thickness of the bus-bar is 0.5mm, laser welded, and then spot welded to the battery. The shape of the nickel plate is smaller than the plus and minus areas of the battery, and the shape of the bus-bar is made so that the plus and minus areas are not differentiated, allowing the spark to go to the top. By reducing the width of the nickel plate shape, it was designed and manufactured to create a fuse structure that short-circuits when the temperature rises. Future tests will be conducted with the Korea Electrotechnology Research Institute, and a film heater will be attached to one battery to force thermal runaway to determine whether it will spread.

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자동차 및 배터리 모니터링 플랫폼 구축

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Establishment of Automobile and Battery Monitoring Platform

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Key Words : Battery(배터리), Vehicles(자동차), Cloud-based data managemnet(클라우드 기반 데이터 관리), Platform (플랫폼)

ABSTRACT

Electric vehicles equipped with batteries as an alternative to environmental issues are replacing internal combustion engine vehicles. A major obstacle to the spread of electric vehicles is the sustainability of the driving range on a single charge and the uncertainty of fire. Since the battery's charging capacity depends on the driver's driving habits, the remaining lifespan of the battery installed in an electric vehicle would be different decades later. Identifying the correlation between vehicle speed and battery capacity is possible by applying a real-time data transmission system. Cloud-based data management that ensures real-time can prevent fires by delivering vehicle and battery information to drivers to recognize problems early, also it could be used as data to develop a prediction model for the remaining life of the battery. Consequently building a real-time monitoring platform contribute to the spread of electric vehicles along with verification and improvement of technical defects. Through this study, we aim to establish a real-time transmission system for vehicle and battery data and build a user-friendly monitoring platform.

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개조전기차 서스펜션의 구조 안전성에 대한 연구

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A Study on Structural Safety for Suspension of Modified Electric Vehicles

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Key Words : Modified electric vehicle(개조전기차), Finite element analysis(유한요소해석), Suspension(서스펜션), Special zone for regulatory freedom(규제자유특구)

ABSTRACT

The domestic market for modified electric vehicles(mEVs) in South Korea is estimated to be around 56,000 units annually. However, the existing regulations regarding safety tests for these mEVs are inadequate, posing challenges to market activation. To address this issue, Jeollanam-do is undertaking a practical project to establish safety standards related to driving safety based on weight increase through the conversion of various internal combustion engine vehicles, such as compact and mid-sized cars, into electric cars. It is expected that this practical project will help shape the ecosystem of the mEV industry, contributing to the widespread adoption and carbon reduction through electric vehicle promotion. Particularly, Jeollanam-do is expected to create an eco-friendly automobile industry valley by leveraging local infrastructure such as the KIC and the KATECH.

The mEVs face a challenge of increased vehicle weight due to the removal of powertrain components and the addition of motors and battery packs. This weight increase directly affects the vehicle's safety, including its driving performance and durability. However, there are currently no safety standards specifically for mEVs both domestically and internationally, highlighting the urgent need to establish them. Therefore, research is required to create safety standards for mEVs based on the weight increase issue.

In this study, finite element analysis will be used to analyze the safety of the suspension structure of representative vehicle models among the target vehicles for mEVs. Additionally, a comparative analysis of the safety of the suspension structure of internal combustion engine vehicles will be conducted. This approach will allow for consideration of whether to use the suspension from conventional internal combustion engine vehicles during modification or opt for better suspension systems. Ultimately, this research can serve as reference material for establishing safety standards for mEVs in the future.

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개조전기차 안전성 검증을 위한 실험실 평가 프로세스 검토

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Review of Laboratory Evaluation Processes for the Safety Verification of Modified Electric Vehicles

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Key Words : Modified electric vehicle(개조전기차), Driving stability(주행 안전성), Special zone for regulatory Freedom (규제자유특구), Carbon neutrality(탄소중립)

ABSTRACT

With an increasing number of countries worldwide committing to achieving carbon neutrality, the necessity of modified electric vehicles as an alternative has become even more pronounced. In response to this, regulatory-free zones have been established in the areas of Mokpo, Yeongam, and Haenam, creating an environment conducive to conducting safety validation research for modified electric vehicles.

Modified electric vehicles involve converting conventional internal combustion engine cars into electric vehicles by removing powertrains and adding components such as motors and battery packs. This process leads to an increase in the vehicle's weight, which directly impacts factors like driving performance and durability, thus affecting overall safety. However, both domestically and internationally, there are currently no safety standards in place for modified electric vehicles, making it imperative to establish them.

To establish safety validation standards for modified electric vehicles, practical road tests in the designated regulatory-free zones in Jeollanam-do, along with laboratory-based assessments and computational safety evaluations, are planned. Modified electric vehicles will undergo chassis diagnostics and computational stability assessments to identify and reinforce vulnerable areas. Once reinforcement is completed, laboratory-based evaluations will be conducted, taking into account real-world road load data, including significant load distribution points and road load data for vulnerable areas resulting from the increased weight.

Finally, after completing laboratory-based evaluations, real-road driving validation will be conducted to establish safety standards. Demonstrating the safety of modified electric vehicles is expected to play a significant role in achieving carbon neutrality, and the safety validation research is anticipated to greatly support the proliferation and activation of modified electric vehicles.

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