| 講演番号 | 397 |
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# Power Tailgate Economical Type Optimization Development

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**KEY WORDS: Gas Spring, Spindle Motor Driver, Reaction Force, Power Tailgate, Safety Strategy [B1]**

To enhance profitability through securing cost competitiveness, an economical power tailgate (PTG) was developed. The proposed economical type consists of a spindle drive and a gas lifter, aiming to reduce component count and system cost while preserving essential functional performance.

As the application of PTG systems expands toward cost-sensitive vehicle segments, maintaining consistent functionality under unfavorable operating conditions becomes increasingly important. In this development, major functional and performance requirements were treated as mandatory constraints, and the system was designed to satisfy these constraints across a wide range of operating environments.

In the economical configuration, the contribution of the gas lifter to the overall reaction force becomes more significant compared to conventional systems. Degradation of the gas lifter may therefore result in unexpected tailgate behavior after open completion, which can potentially affect user safety. This characteristic highlights the need for an enhanced safety concept specifically tailored to economical PTG architectures.

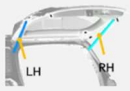
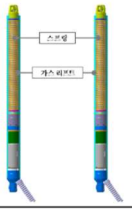
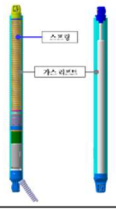
| Type | | A Type | This Type |
|---|---|---|---|
| Components |   |  |  |
| Part Name | LH | Spindle Drive | Spindle Drive |
| | RH | Spindle Drive | Gas Lifter |

Fig.1 Comparison of PTG Configurations

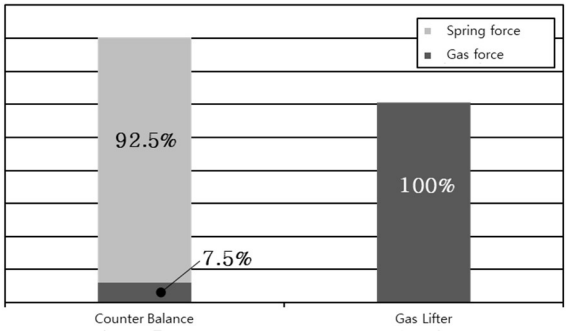



Fig.2 Reaction Force Contribution

Conventional control approaches, while effective in improving safety robustness, may introduce limitations in terms of user operability under certain conditions. To address this challenge, a new safety strategy was introduced to improve robustness while minimizing negative impact on usability. The proposed concept focuses on resolving inconsistencies observed in conventional approaches rather than adding complexity to the system.

The safety strategy is structured around a staged concept that combines early identification of abnormal system behavior with mitigation measures that are applied only when abnormality is confirmed. This approach enables effective risk reduction while avoiding unnecessary intervention during normal operation.

Vehicle-level evaluations were conducted under diverse operating conditions to verify that the proposed concept maintains required performance and improves safety robustness of the economical PTG. The results demonstrate that the proposed approach supports broader application of economical PTG systems to future vehicle models while maintaining an appropriate balance between safety and usability.