Refined ride quality

A range of innovative hydraulic stops developed by **BWI Group** enable many benefits for vehicle ride refinement

The damper has a big part to play in the overall determination of suspension travel limits, as it must manage the loads associated with those limits in both the compression (or jounce) and rebound (or extension) directions. The effectiveness of the damper can be increased by installing BWI Group's Hydraulic Compression Stop (HCS) and Hydraulic Rebound Stop (HRS) systems, which develop additional damping forces over those provided by the standard piston and base valves within the damper. Both these systems offer efficient dissipation of energy, improved ride quality, enhanced vehicle roll and pitch control, and better levels of noise, vibration and harshness (NVH).

BWI's HCS damping feature was first applied to a serial production vehicle in 2018, and a Supplier Innovation Award nomination quickly followed from BMW, proving that this new hydraulic feature provides great value to vehicle engineers in their quest for increasingly refined ride quality.

Competing designs for end-of-stroke energy management are available on the market today, but the designs developed by BWI Group stand out due to the smoothness of their engagement and their tuning flexibility. These features go beyond the management of so-called 'spike' loads that normally occur at the limits of suspension travel, delivering additional rebound and compression damping forces that elevate ride quality to a higher level.

The HRS system is a well-established BWI Group design that has proven its efficiency on a variety of applications, and it is becoming a standard damping control feature with some OEMs. The modularity of the HRS design enables other features like internal rebound springs or rebound bumpers to be added, delivering options for further damper tuning refinements. Of key importance is that each feature can be tuned separately. Within HRS alone, damping force gains progressiveness, and the level of developed damping force can be tuned to match the vehicle's ride goals.

ABOVE: BWI Group's Hydraulic Compression Stop offers a cost-effective means to achieve a premium vehicle feel

The transposal of the HRS principle into HCS results in a device capable of delivering a very high level of compression damping ('HCS High Damping') without influencing the rest of the damping range, and for applications requiring lower levels of additional compression damping, an alternative design ('HCS Low Damping') uses a second position-sensitive valve. HCS Low Damping gives greater opportunity for tuning of both compression and rebound damping at the end of compression stroke to improve both comfort and handling.

The coupling of HRS with HCS enables vehicle engineers to deliver handling and comfort without compromising either factor. The additional damping provided by HRS and HCS not only reduces the noise transmitted from the suspension to the passenger compartment, but also improves the luxury feel of a car by managing the end-of-stroke energy, enabling lighter body structures.

While it was initially expected that the greatest demand for the systems would come from the heavy electric vehicle sector, the application of BWI Group's HRS and HCS has also been shown to improve the quality of vehicle tuning in premium passenger cars. HRS and HCS could be particularly helpful for hybrid or electric vehicles based on existing models, avoiding the need for major suspension design changes.

These end-of-travel load management technologies handle the additional weight of a large battery pack and will satisfy lower cabin noise level requirements for electric vehicles by reducing the road noise transmitted into the vehicle body. These devices could also improve the ride performance of vehicles whose gross weight varies significantly with payload, as the end of stroke of the loaded vehicle is better managed on bumpy or uneven roads.

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