Why fit a dedicated air tank for a semi-trailer airbag suspension?

An extra semi-trailer air tank dedicated to the airbag suspension can prevent expensive suspension damage, for a marginal increase in installation cost and small increase in tare weight.

All trailer airbag suspensions rely on one or two height control valves to maintain the suspension ride height to a predetermined level, regardless of load. Most modern airbag suspension systems use only one height control valve.

Figure 1 shows a typical airbag suspension piping layout for a single height control valve tri-axle system.

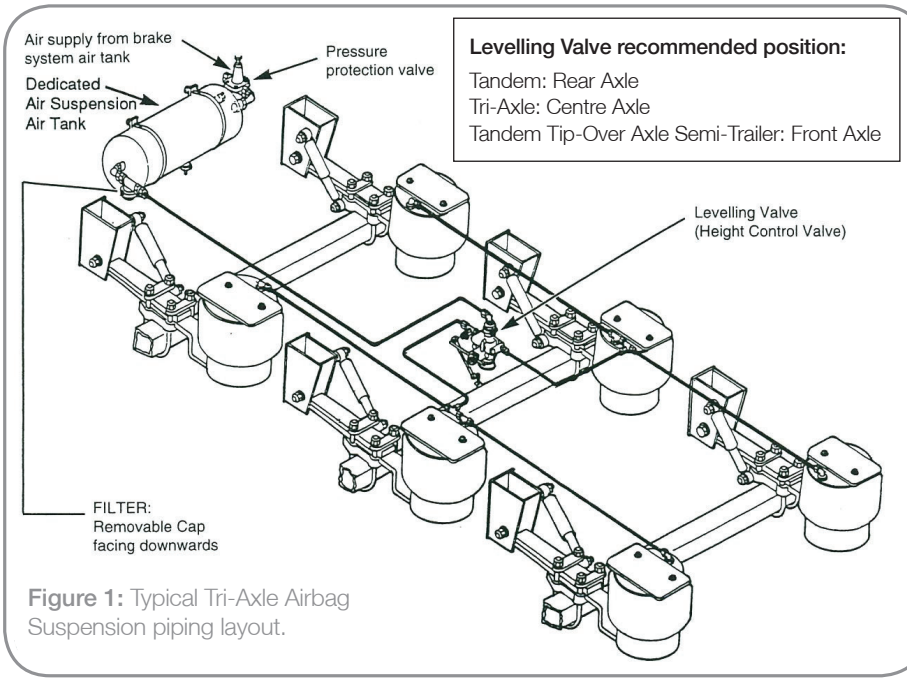

Figure 1: Typical Tri-Axle Airbag Suspension piping layout.

Figures 2, 3 and 4 show the operation of the height control valve. Notice the height control valve is bolted to the trailer, and is connected to the axle via pushrods. The height control valve is basically a position sensitive valve that always tries to keep the valve lever level.

Figure 2 shows the level position, which corresponds to the ride height position. The valve has all ports closed, with no air flowing to or from the airbags.

Figure 3 shows the axle moving towards the trailer frame. In this case, the height control valve feeds air to the airbags. This happens when loading a trailer. As more weight is put onto a trailer, the trailer frame lowers and the height control valve compensates by feeding air to the airbags, thereby increasing airbag pressure to keep the trailer at ride height. A laden tri-axle will have anywhere between 265kPa (38psi) to 470kPa (70psi) air pressure in the airbags, depending on suspension type.

Figure 4 shows the axle moving down, away from the trailer frame. The height control valve is exhausting air from the airbags. This occurs when the trailer is being unloaded. In this case the height control valve is compensating for trailer load by reducing the airbag pressure. An unladen trailer will typically have around 50kPa (7psi) air pressure in the airbags, depending on suspension type and trailer tare weight.

Air will also feed to the airbags and exhaust from the airbags when the axle moves up and down relative to the trailer frame due to road surface unevenness and trailer body up and down oscillation.

The air supplied to the air suspension must be via the brake system and through a pressure protection valve. When a dedicated airbag suspension air tank is fitted, then supply to this air tank must be also through a pressure protection valve. This valve is required by the Australian Design Rules (ADR 38/04). Its function is to protect the brake system from air loss through the airbag suspension. So if there is a severe leak or rupture of an airbag suspension air line, or an airbag, to the point where the air suspension completely runs out of air, the brake system will lose air until the brake system air pressure reaches a minimum of 450 kPa (65psi), by which time the pressure protection valve closes. This ensures there is protection of the brake system to prevent total loss of brakes.

Air suspension systems, which do not have dedicated air tanks will deplete air from the brake system as the axles move up and down in normal operation. Even as the trailer frame oscillates up and down the height control valve consumes air.

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After applying the brakes a few times, the brake system air pressure can be reduced to a level close or below the pressure protection valve cut off pressure, so not allowing any air to be fed to the height control valve. In this condition, the suspension ride height will reduce because the height control valve can only exhaust air as the axles move up and down. No air is available to feed to the airbags, increasing the frequency of the airbag bottoming out on its top plate. This reduces the service life of the airbag dramatically. In severe cases, especially on B-doubles and roadtrains, the airbag suspension can be exhausted to the point of actually enabling the suspension to ride on the airbag stops.

The airbag suspension needs an air reservoir to give the truck air compressor time to build up the system air pressure to a level above the pressure protection valve setting after severe braking. This is particularly the case on units travelling on rough roads (where the height control valve will consume more air since the axles move a greater amount and since there is a greater likelihood in any case of the airbags bottoming out on the top plate), and on long combination vehicles such as B-doubles and roadtrains.

An alternative solution is to fit a very slow acting height control valve which consumes less air when the axle moves up and down. Although simple, it is not the best solution, since the trailer will take a long time to reach ride height after loading and after unloading. After loading, if the operator does not wait for the suspension to reach ride height the upward travel of the axle is reduced and the airbags will bottom out more frequently, which is undesirable. After unloading, if the operator does not wait for the suspension to go down to ride height, the shock absorbers and/or the axle retainers will be called upon to limit the axle's downward travel and can be damaged as they absorb dynamic road loads.

The ideal all-round solution is to fit a fast-acting height control valve onto the airbag suspension system with a dedicated air tank, to ensure maximum service life from all suspension components.

A dedicated airbag suspension air tank is essential is a raise/lower or dump valve system is fitted to the airbag suspension.

Please note: We suggest our clients do not act only on the basis of the material contained in this bulletin because the items contained herein are of a nature of general comment only, and may be liable to misinterpretation in a particular circumstance. Also, changes to legislation occur quickly, we therefore recommend you contact your local BPW Transpec branch before acting on any of this information.

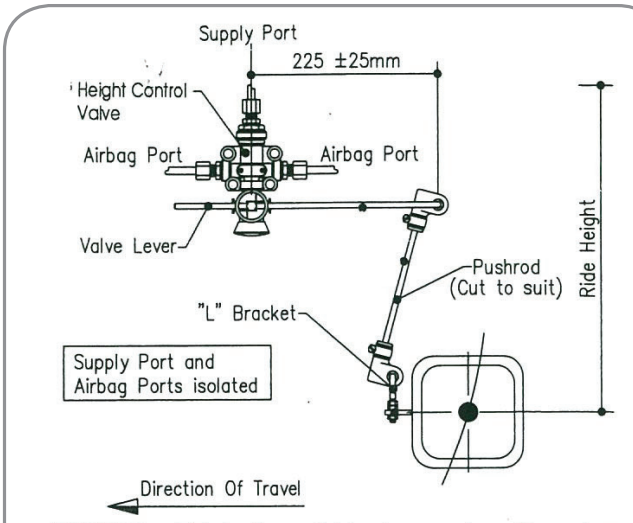

Figure 2: Height Control Valve in neutral position when suspension is set at ride height.

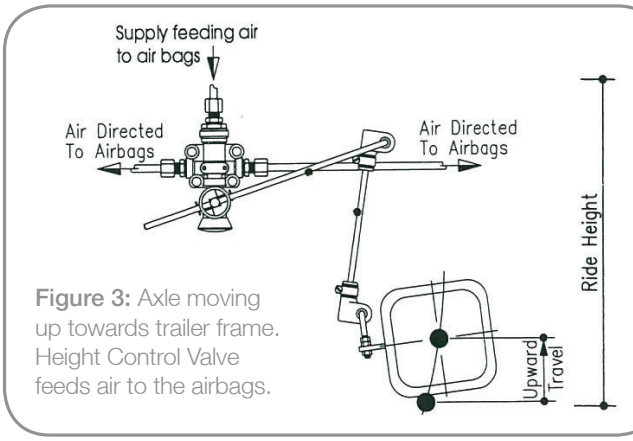

Figure 3: Axle moving up towards trailer frame. Height Control Valve feeds air to the airbags.

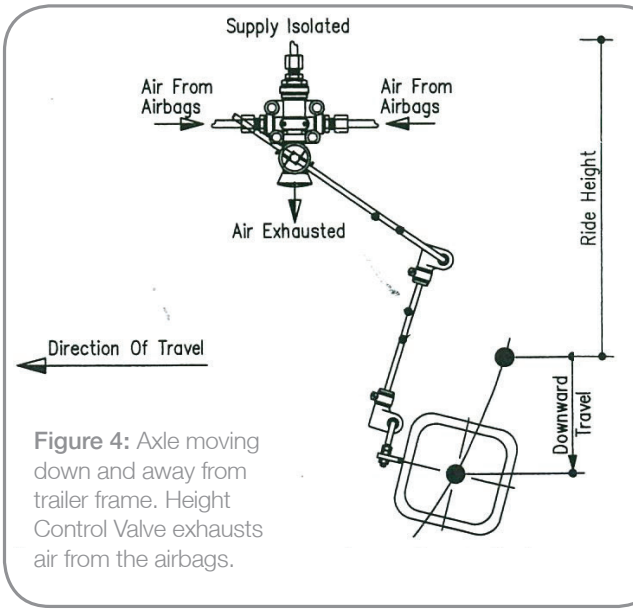

Figure 4: Axle moving down and away from trailer frame. Height Control Valve exhausts air from the airbags.

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