

Notes about AHC operating heights and cross levelling and 'lean'

For a stationary vehicle on a level surface, front wheels straight ahead, fuel full, no persons nor freight on board, no other causes of unequal load distribution, then:

Weight of the vehicle must be supported by an equal and opposite force.

This force comes in 2 parts on an AHC-equipped vehicle, described here as "Part 1" and "Part 2".

If the weight of the vehicle remains unchanged, the total of the two supporting forces remains unchanged.

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Part 1: Upward force at front is partially provided by torsion bars.

This force varies with the tightening of the torsion bars.

If there is no AHC fitted, then the height of the vehicle would increase when torsion bars are tightened.

NOTE: Much heavier torsion bars are required in a non-AHC vehicle because they must carry 100% of the front weight at all times. No AHC contribution, no "Part 2".

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Part 2: Upward force at front is partially provided by AHC pressure.

This force is regulated by the AHC Electronic Control Unit and is determined by the settings of the Height Control Sensors (two in front and one at the rear), and, the position of the height control switch in the cabin centre console. The "N" position is used for measurement and test purposes.

If the torsion bars are tightened in an AHC-equipped vehicle, then the torsion bar force increases (which would tend to increase height)

BUT

at the same time the front AHC system reduces pressure and the AHC carries a reduced share of the vehicle front weight.

This means more weight is transferred to the torsion bars (which tends to reduce height).

Regulation by the ECU and the settings of the Height Control Sensors balances these two effects to 'self-level' Front and Rear so that height does not change at "N"

No vertical movement takes place and front height of the remains unchanged at "N" – unless the adjustment of the Height Control Sensors is changed, or, unless AHC capability is exceeded (drops to "LO"), or, unless there is an unusual fault condition.

These principles are used to adjust AHC pressures by cranking torsion bar adjusters without causing 'ride' or 'operating' height change.

About 'cross levelling' – done per FSM with engine/AHC "OFF":

The aim of front 'cross levelling' on a vehicle equipped with AHC has nothing to do with setting the front 'operating height'. That is set by the Height Control Sensor adjusters. The purpose of 'cross levelling' is to eliminate 'lean' and ensure that Left and Right torsion bars are each carrying the same load. This is important to ensure that the Right and Left sides of the vehicle are balanced and react to road conditions and steer Right and Left in the same way (provided front wheel alignment and steering sensor also are correct). In setting up the AHC system, 'cross levelling' is done first, using the torsion bar adjusters. Engine/AHC are "OFF" per FSM.

There are two assumptions:

1. torsion bars of the same type, of good quality and in good condition and can be assumed to give the same deflection (movement) as each other when under the same load, and,
2. the load (weight) on the Left side and the Right side of the vehicle are the same and the vehicle is on a level surface, fully loaded with fuel, no people nor freight are on board nor any other unevenly distributed weight.

If these assumptions are true and if front hub-to-fender heights are equal by tape-measure, then the Left torsion bar and Right torsion bar are carrying equal loads. This principle is used in 'cross levelling' adjustments per FSM to equalise torsion bar loads.

NOTE: The AHC system DOES NOT regulate heights individually at each wheel nor side-to-side heights**. AHC only regulates front and rear heights using the average of the front Height Control Sensors positions and the position of Rear Height Control Sensor.

**** On the road travelling in a turn greater than ~35 degrees, the system uses Height Sensor differentials, wheel speeds, steering wheel angle to hydraulically isolate and maintain pressure at the outside wheel to reduce lean (body roll).**