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## Level Control Systems

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## **Model: Level Control Systems**

**Production: E 32 750L 88-94 (Hydro-Pneumatic)**

**E 32 740L 93-94**

**E 38 750L 95-01**

**E 38 740L 95-01**

**E 34 Touring 525T, 530T**

**E 39 Touring 528T, 540T, 525T (EHC I)**

**E 53 X530, X5 4.4i and X5 4.6s (EHC I)**

**E 53 X5 3.0, X5 4.4 (EHCII)**

**E 66 745Li, 760Li from 03EHC**

### **Objectives:**

After completion of this module you should be able to:

- Identify BMW Level Control Systems

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## Level Control Systems

### Purpose of the System

The primary function of Level Control Systems is to maintain the height of the vehicle as closely as possible to a predetermined level under all load conditions.

This constant level allows the suspension system to maintain the alignment geometry. Camber and Toe in are minimally affected when the ride height is consistent. In addition, the headlight range stays consistent throughout the various operating conditions.

The Level Control System is designed to operate in the event of static changes such as when passengers are entering or exiting the vehicle or quasi-static such as when the fuel tank is emptying while driving.

The Level Control System come in various configurations such as hydraulic (hydropneumatic) or pneumatic only systems.

Hydropneumatic systems use high pressure hydraulic fluid which is dampened by a gas cushion from a nitrogen charged accumulator. These system use and electro-hydraulic pump or an engine driven piston pump. These systems are installed as follows:

- **Hydropneumatic Level Control System with electro-hydraulic pump** - This type of system is used on the early 5 Series vehicles (E12 and E28), the 6 Series (E24) and the early 7 Series (E23). This system uses an electric motor, pump and an expansion tank which is connected by hydraulic lines to the rear spring struts. The rear spring struts are also connected to a pair of pressure accumulators which are "Nitrogen Charged". There is a control switch which mounted on the rear axle which monitors the position of the stabilizer bar. Changes in ride height are detected and the system is regulated to maintain the correct level. During prolonged dynamic movements during acceleration and braking, the level control system is disabled by an acceleration sensor (mercury switch) and brake light input to the hydraulic control unit.
- **Hydropneumatic Level Control System with engine driven piston pump** - This system can be found on the 7 Series (E32 and E38) and the 5 Series Touring (E34). This configuration is similar in operation to the previous system with a few changes. There hydraulic pressure now comes from an engine driven piston pump. This pump is mounted in tandem with the power steering (radial type) pump. The pressurized fluid is sent to a control valve which distributes the fluid to the rear spring struts and pressure accumulators. The control valve is attached to the rear sway bar by a lever, changes in ride height will move the lever which will influence fluid flow to the spring struts.

The next generation of BMW Level Control Systems evolved into pneumatic only systems which are referred to as EHC. EHC will be discussed later in this module.

## Hydropneumatic Rear Leveling System

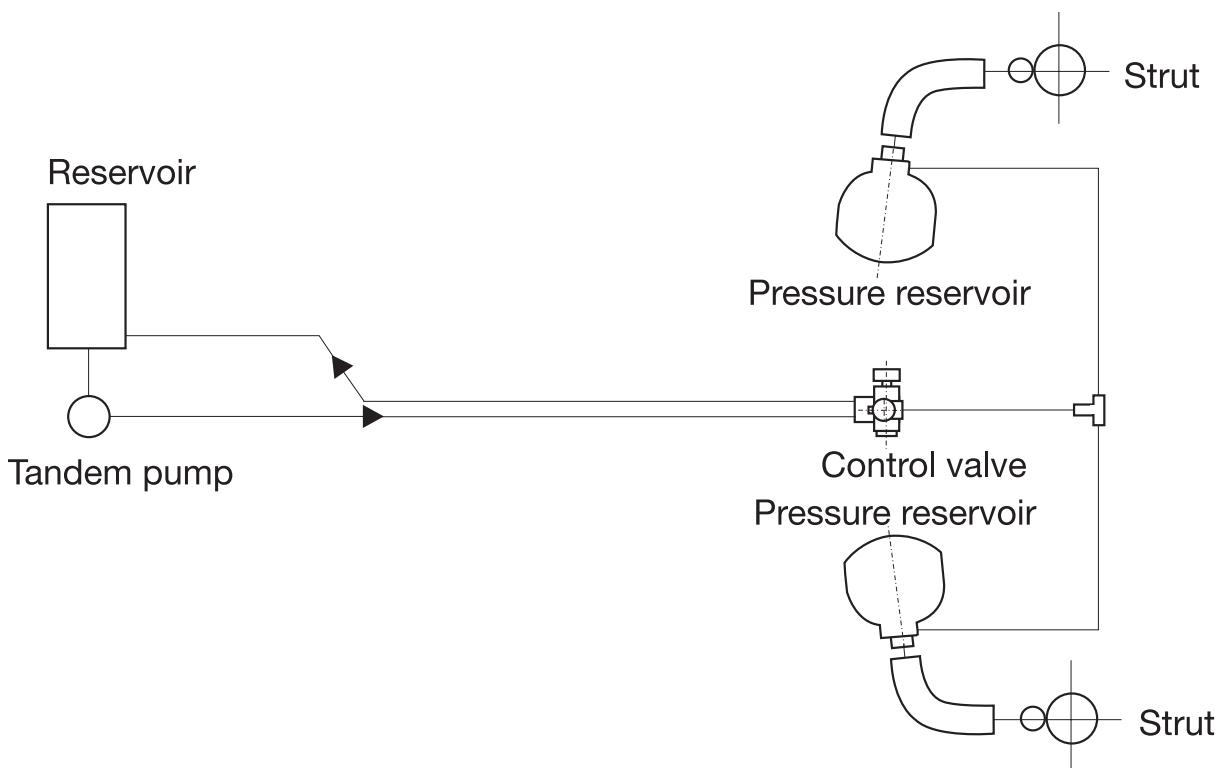
This module pertains to the hydropneumatic rear suspension system with the engine driven piston pump. The earlier system using the electro-hydraulic pump will not be discussed.

The self-leveling suspension system is designed to maintain vehicle ride height under loaded conditions.

The system is fully hydraulic, utilizing a tandem oil pump to supply pressure to both the suspension system and power steering system.

The system is installed on:

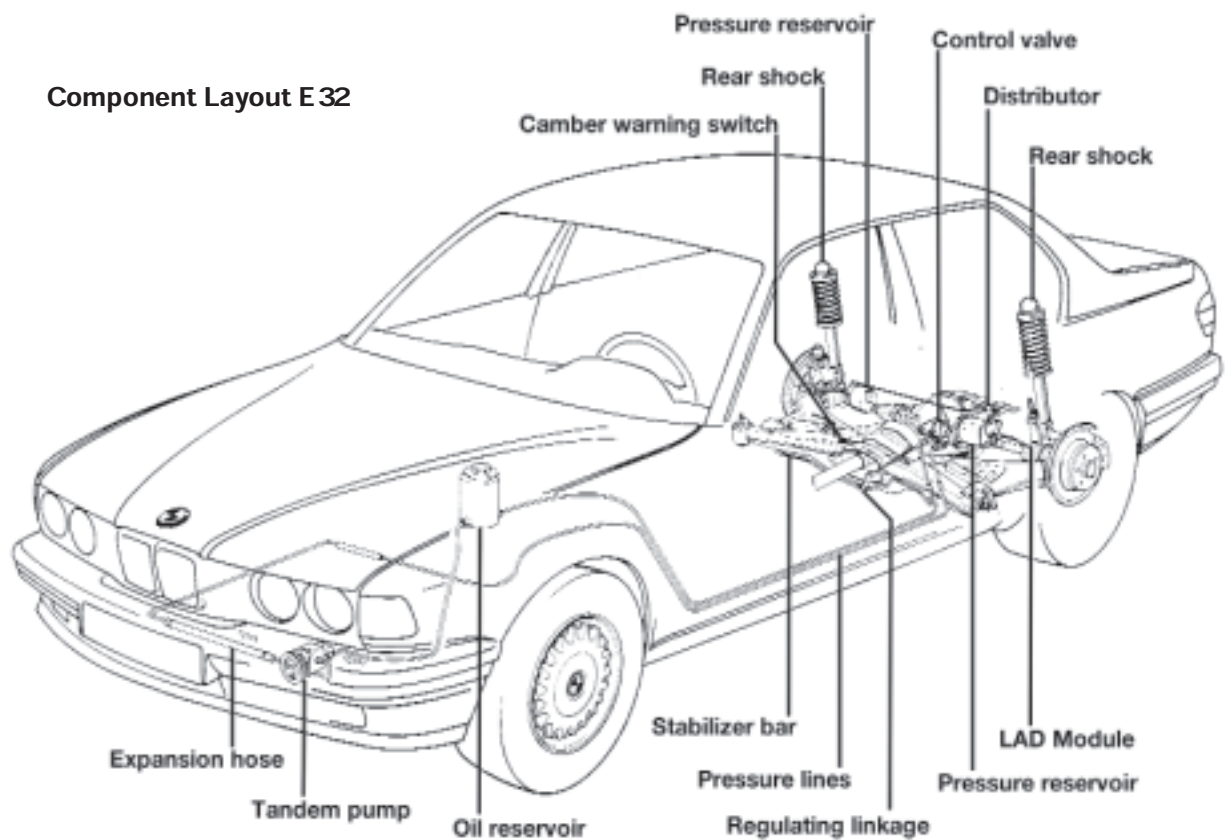
- E 32 - 735 iL, 740iL and 750iL
- E 34 - Touring 525i and 530i
- E 38 - 740 iL and 750iL



## System Components

The system consists of the following components:

- Tandem Hydraulic Pump
- Oil Reservoir
- Pressure Reservoir (2)
- Control Valve with Regulating Linkage
- Camber Warning Switch (E 32 and E 34)
- Rear Shock with LAD Module
- Expansion Hose, Pressure Lines and Distribution block.

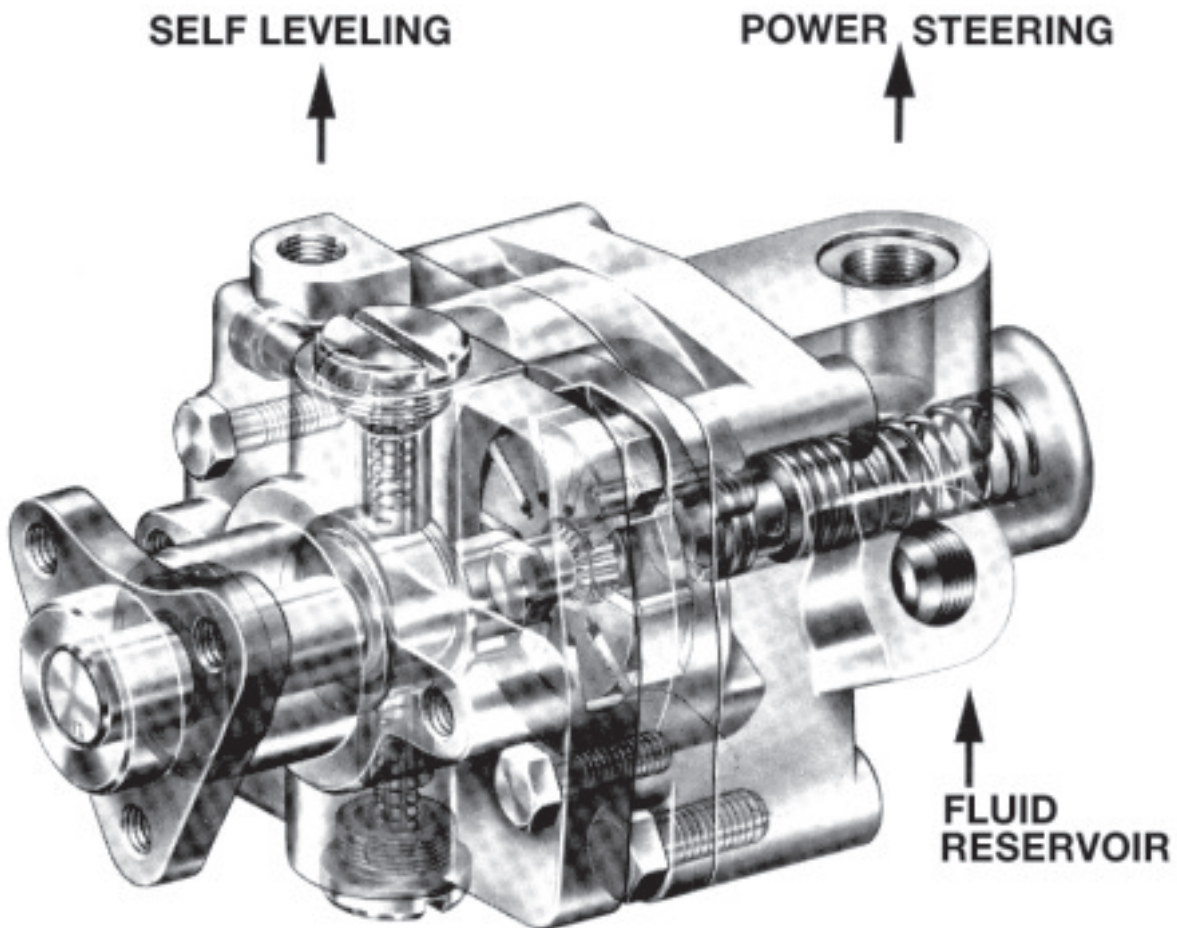


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## Tandem Pump

The tandem pump consists of a vane pump for power steering and a radial pump for self-leveling suspension. Both pumps are driven by the same shaft and have separate oil feeds for each system.

The radial pump has the capacity to pump 102 liters of oil per minute. The maximum pressure is limited to 1900 Psi (130bar) by the pressure regulator located on the control valve.



## Oil Reservoir

The single reservoir stores fluid for both the self-leveling and power steering systems. Incorporated in the reservoir, is a reed type level warning switch. If the fluid level drops and the contact closes, a signal is sent to the check control module and a warning will be displayed in the instrument cluster matrix display.

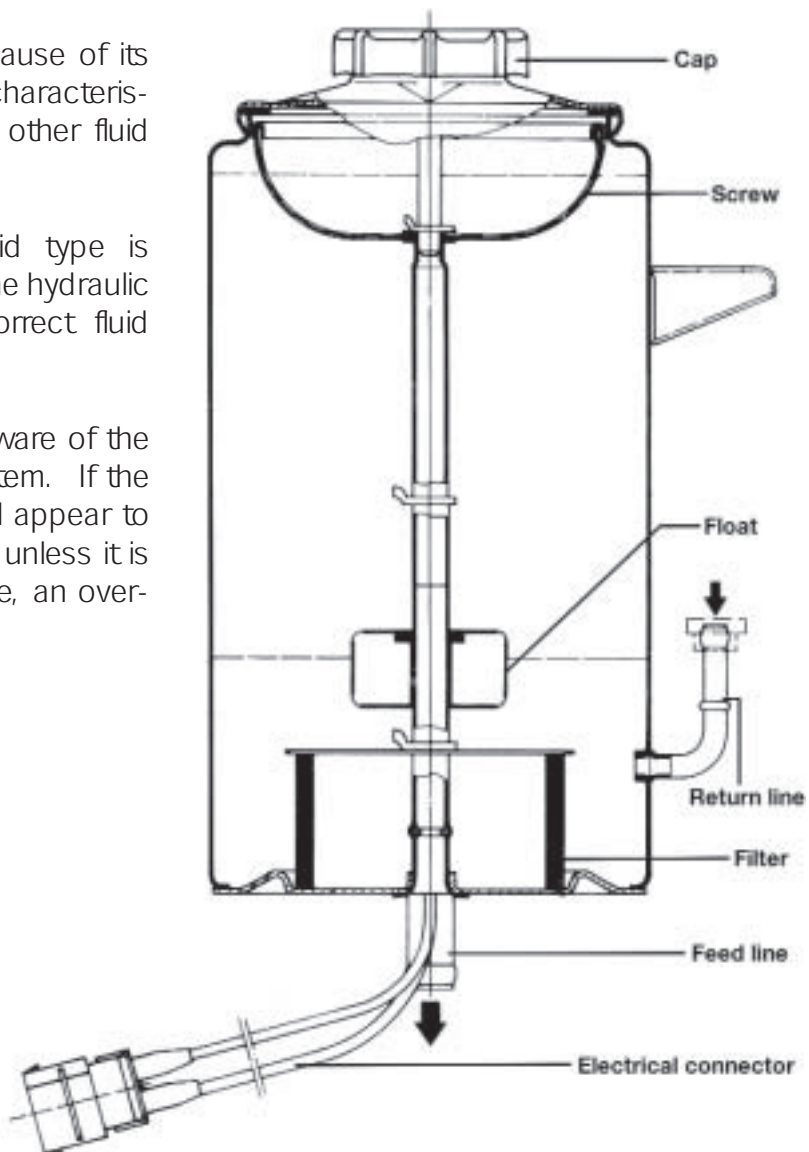
The hydraulic fluid required for the self-leveling suspension system varies between models and installed equipment. The following fluid is used:

- Pentosin CHF 7.1
- Pentosin CHF 11S
- Power Steering Fluid (BMW)

This type of fluid is used because of its low viscosity and low noise characteristics. It cannot be mixed with other fluid types.

The self-leveling system fluid type is always marked on the top of the hydraulic reservoir. Always use the correct fluid never mix with another fluid.

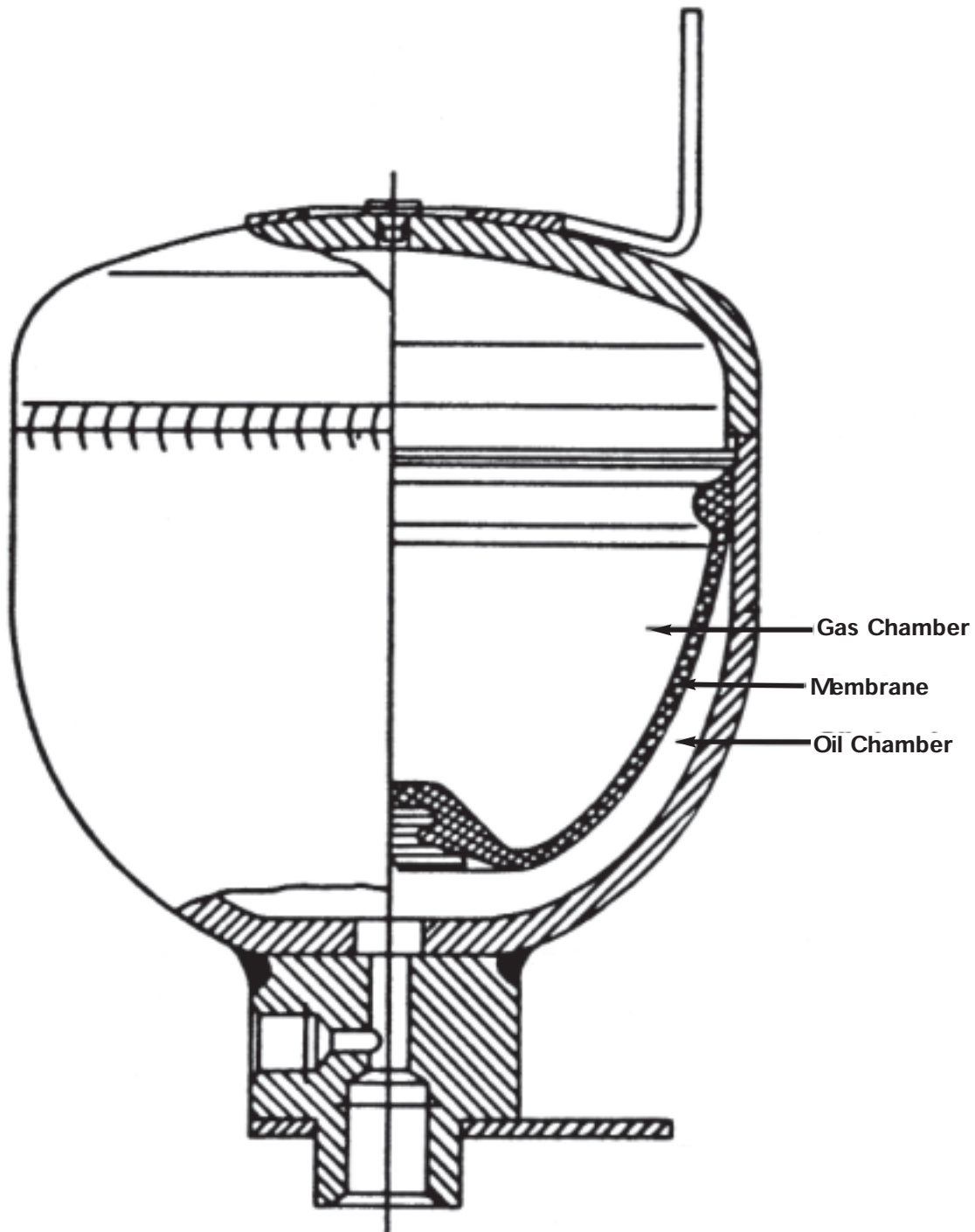
When filling the system, be aware of the status of the level control system. If the vehicle is loaded, the level will appear to be low. Do not fill the system unless it is in the resting state. Otherwise, an overflow situation could result.



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## Pressure Reservoirs

The oil pressure reservoirs (2) on each strut incorporate a membrane and are nitrogen gas filled. They are designed to absorb the oil which is expelled from the struts during downward movement, the gas in the reservoirs is compressed and pushes the oil back into the struts during upward movement.





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## Control Valve

The rotary control valve located on the rear suspension has three positions:

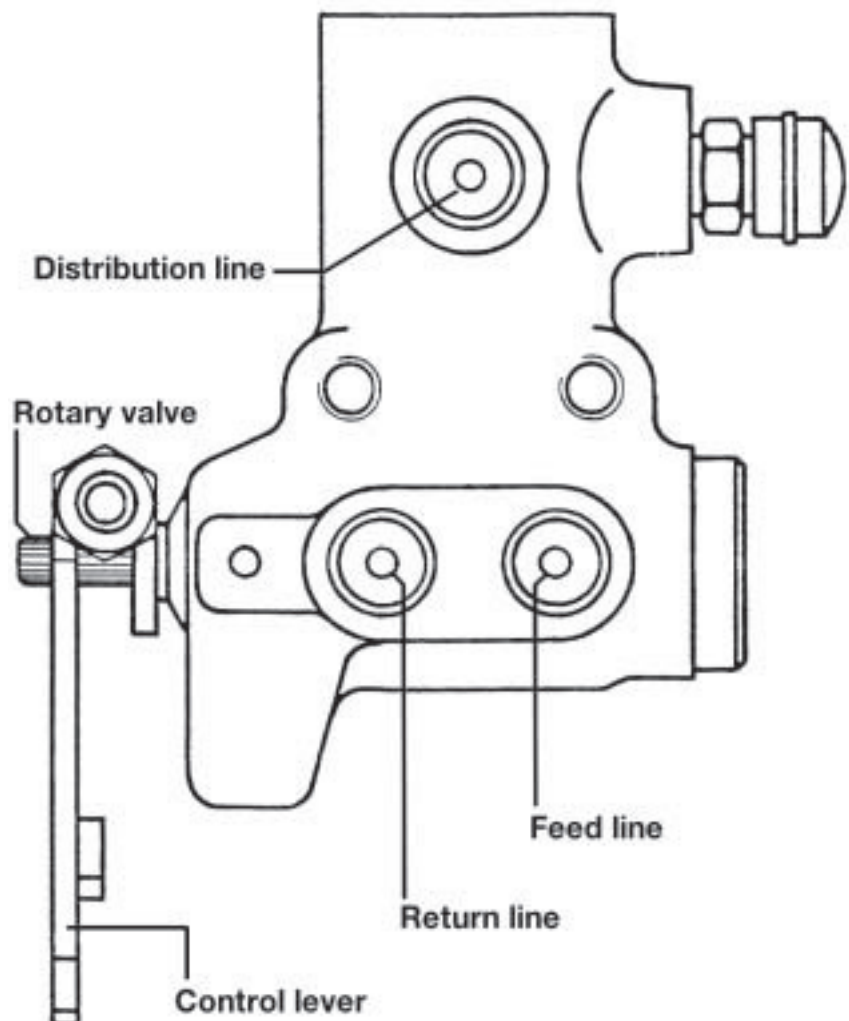
- Raise
- Level
- Lower

The control lever is attached to the rear stabilizer bar to sense vehicle loading. When the vehicle is loaded (passenger or luggage) the suspension drops and the stabilizer bar twists. The control lever is moved in the "raise" direction.

With the engine running, oil flows from the pump to the bottom of the rear struts. The body of the car is lifted and the control lever returns to the level position.

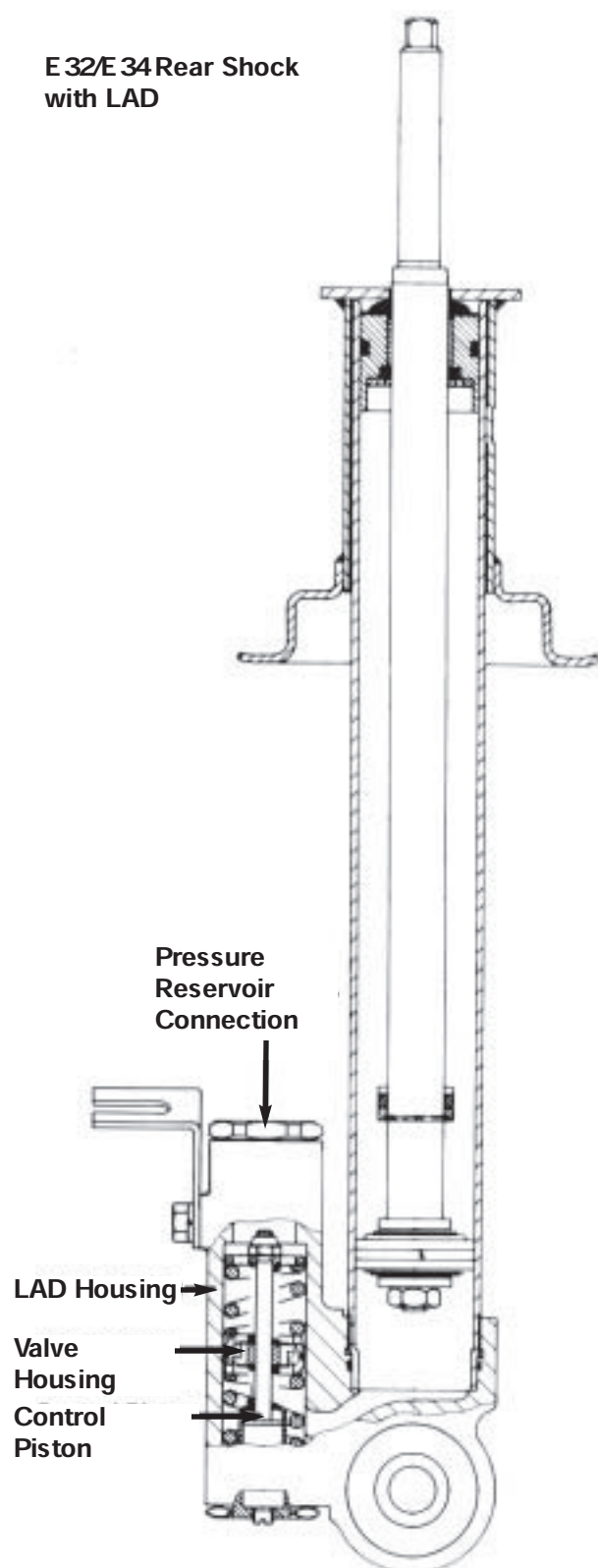
In the level position, the oil bypasses the valve and returns to the reservoir through the return line.

A minimum pressure of 440 Psi (30bar) is maintained at all times. If service is required, a bleed off valve is installed on the control valve to drain the systems pressure.

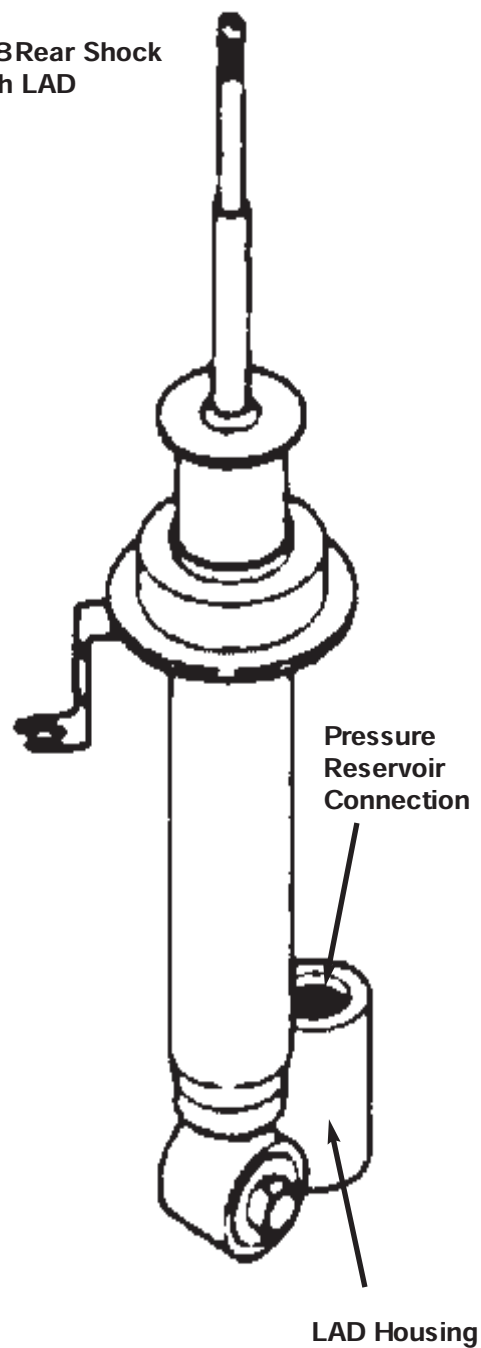


## Rear Shocks With Load Dependent Module (LAD)

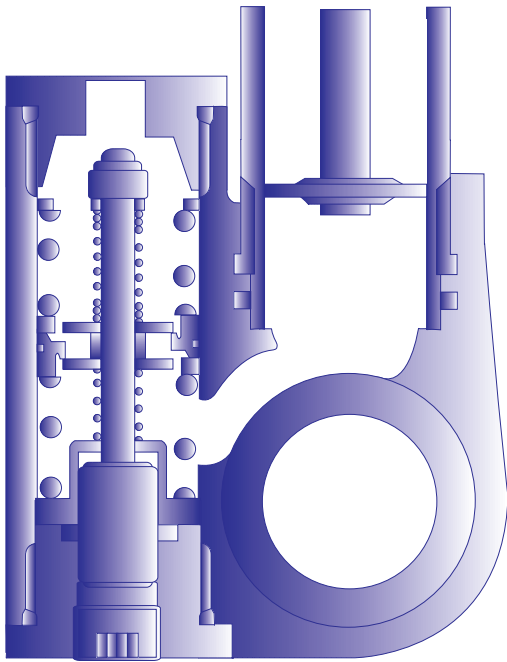
E 32/E 34 Rear Shock  
with LAD



E 38 Rear Shock  
with LAD



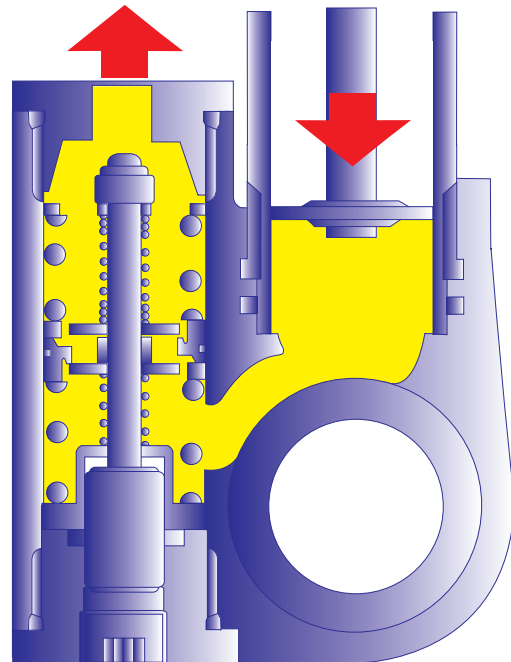
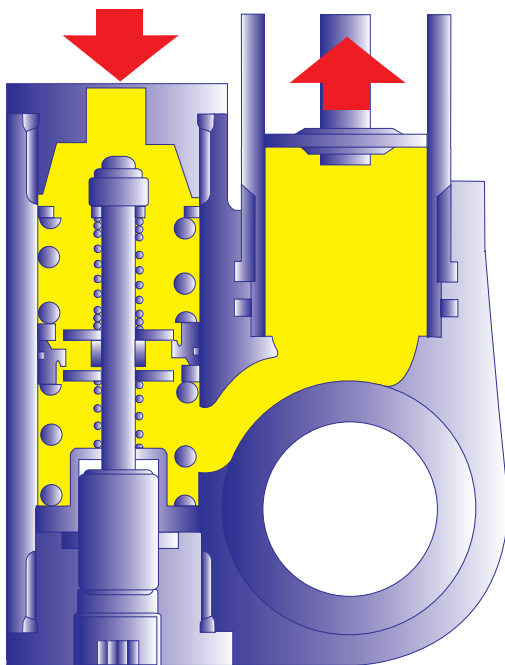
## LAD Module



The load dependent module is a control valve that regulates the flow of oil between the strut and the pressure reservoir.

The control piston in the (LAD) moves in relation to the pressure applied from the pump. This movement will regulate the tension on the inner spring of the module. With only a low pressure applied, a small amount of tension will be applied to the spring. Little flow resistance will be developed between the strut and pressure reservoir. The damping force is soft.

With a high pressure applied to the control piston, the flow resistance is high and the damping force will be stiff.



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## Camber Warning Switch (E 32 AND E 34 Touring)

The self-leveling suspension systems used in the E 32 and the E 34 Touring are equipped with a camber warning switch. The switch is mounted on the right rear axle support and connected through a rod to the semi-trailing arm.

The function of the switch is to warn the driver of an overload condition or an unsafe driving situation.

If the switch detects a rear wheel camber of -3.5 deg. A signal is sent to the check control module and displayed on the dash.

A time delay of 8 minutes is incorporated to prevent the warning from being displayed while driving through turns.

The E 38 does not use the camber warning switch due to the design of the rear suspension.

