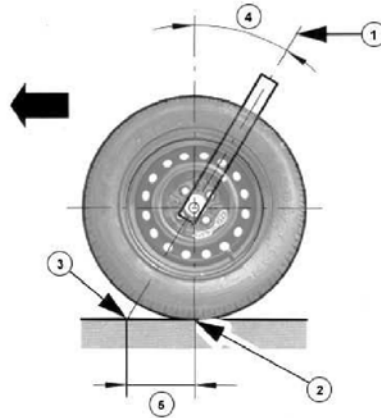


LV04 Vehicle Chassis Units

Steering

a. The action and purpose of steering geometry:

i. Castor angle (4)



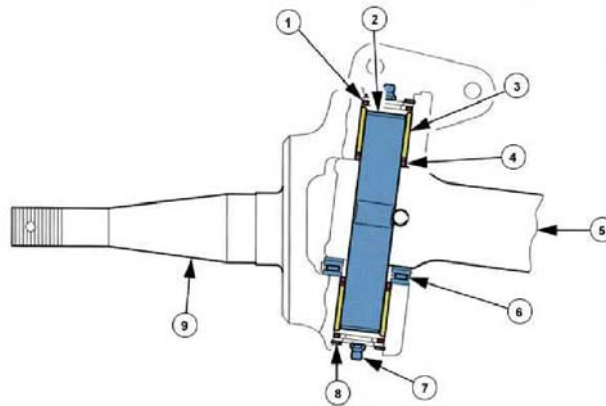
- More stable and good at changing direction due to increased negative camber when steering.
- Makes the steering heavy so often zero castor in FWD cars.

ii. Camber angle



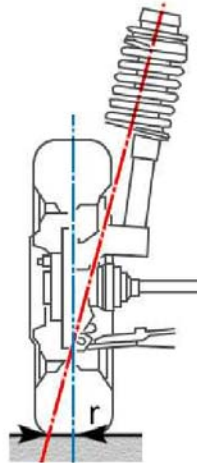
- Increases grip in corners
- Can lead to uneven tyre wear

iii. Kingpin or swivel pin inclination

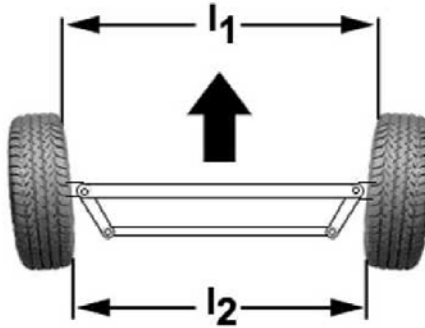


iv. negative offset (scrub radius)

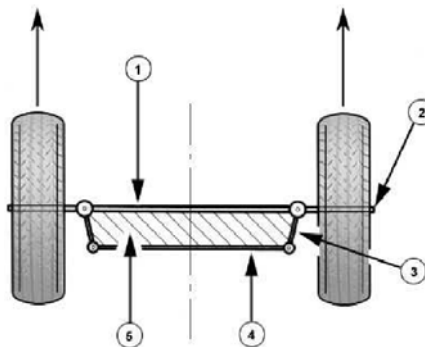
LV04 Vehicle Chassis Units



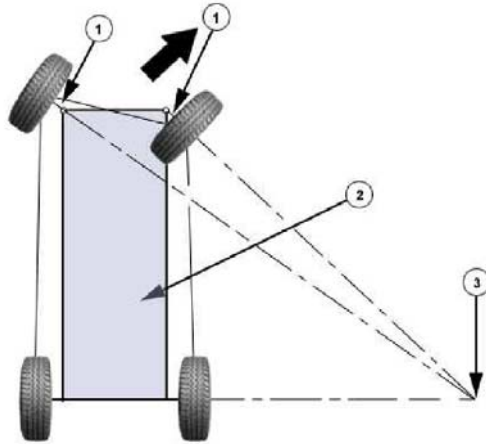
- Negative offset is stable but leads to understeer.
 - Positive offset is good at changing direction, but very twitchy.
- v. Wheel alignment (tracking) (toe in and toe out)



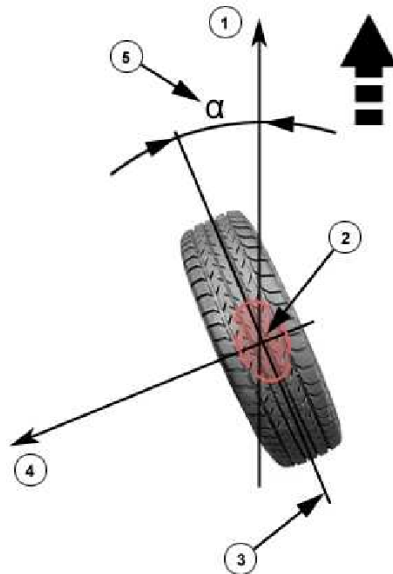
- Toe out is good for changing direction
 - Toe in is stable in a straight line, but leads to understeer
 - Most cars are zero toe for better tyre wear
 - Incorrect wheel alignment leads to feathering
- vi. toe out on turns
vii. steered wheel geometry
- b. The following terms associated with steering:
- i. Ackerman principle



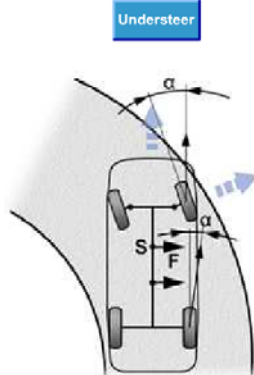
LV04 Vehicle Chassis Units



ii. slip angles

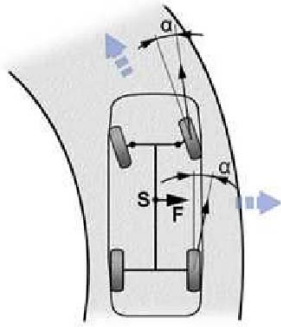


iii. self-aligning torque oversteer and understeer

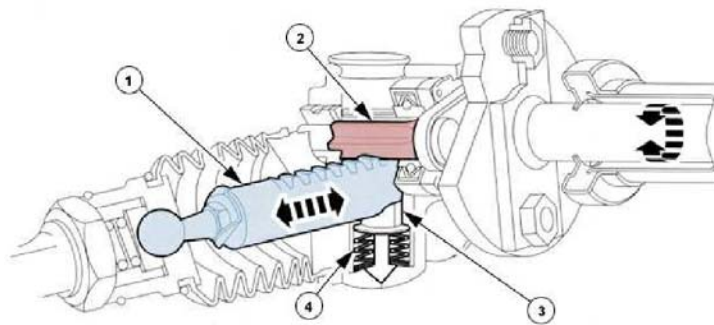
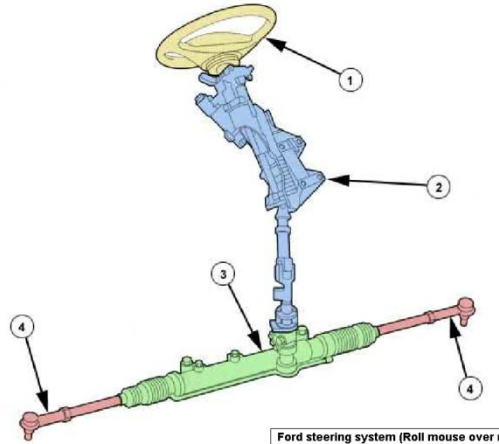


iv. neutral steer

LV04 Vehicle Chassis Units

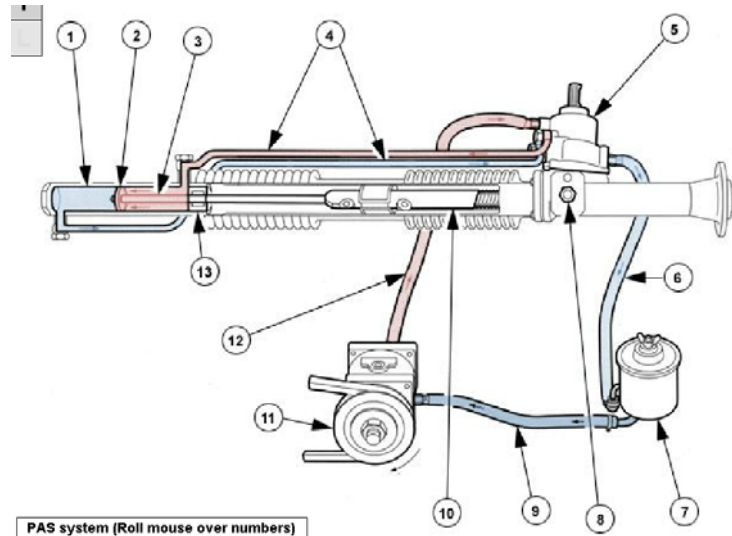


c. The components and layout of hydraulic power steering systems:

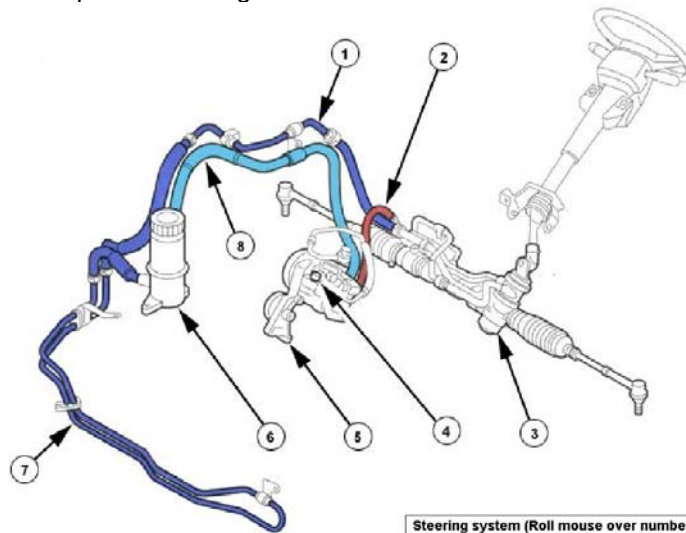


i. piston and power cylinders

LV04 Vehicle Chassis Units



- ii. drive belts and pumps
 - iii. hydraulic valve (rotary, spool and flapper type)
 - iv. hydraulic fluid
- d. The advantages of power assisted steering.
- e. The operation of hydraulic power steering.

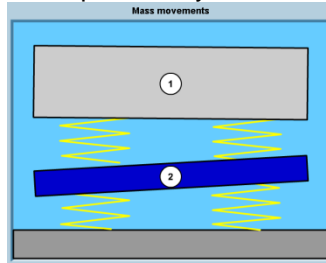


- f. The principles of electronic power steering systems.
- Electric pump with hydraulic system.
 - Direct acting electronic power steering.
- g. The procedures used for inspecting the serviceability and condition of:
- i. manual steering (check gaiters, damage on track rod, free play)
 - ii. power steering (same as manual, plus check for power steering fluid leaks)
- h. Steering system defects to include:
- i. uneven tyre wear (vi, vii, viii, ix)
 - ii. wear on outer edge of tyre (viii, toe in)
 - iii. wear on inner edge of tyre (viii, toe out)
 - iv. flats on tread (vi)
 - v. steering vibrations (unbalanced wheels)
 - vi. wear in linkage
 - vii. damage linkage
 - viii. incorrect wheel alignment
 - ix. incorrect steering geometry

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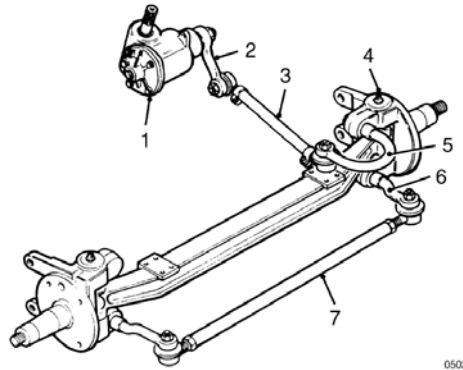
Suspension

a. The layout and components of suspension systems:



(1. Sprung 2. Unsprung)

i. non-independent suspensions



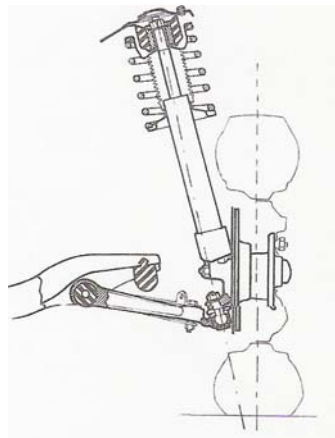
non-independent front suspension



non-independent rear suspension

- suspension travel on one wheel affects the other wheel
- takes up a lot of space, not as comfortable, less grip
- cost effective

ii. independent front suspension (IFS)



MacPherson Strut

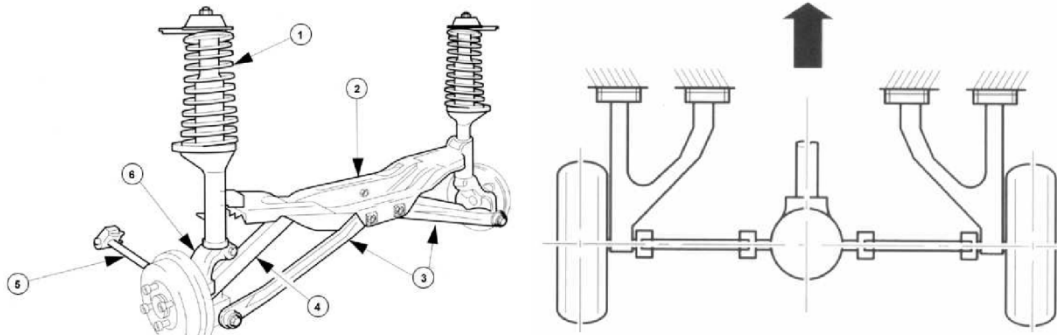


LV04 Vehicle Chassis Units

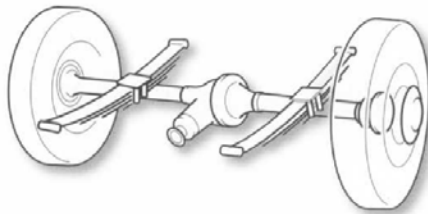


double wishbone

iii. independent rear suspension (IRS)

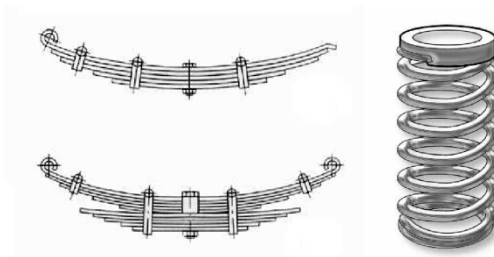


- iv. hydraulic
- v. hydro-pneumatic
- vi. rigid axle types

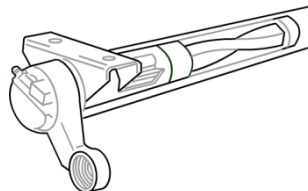


i. The operation of suspension systems and components:

i. leaf and coil springs

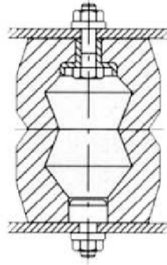


ii. torsion bar

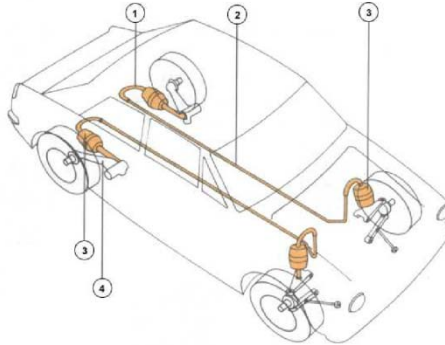


LV04 Vehicle Chassis Units

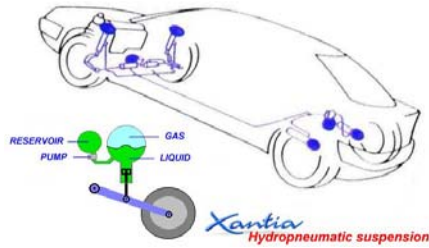
iii. rubber springs



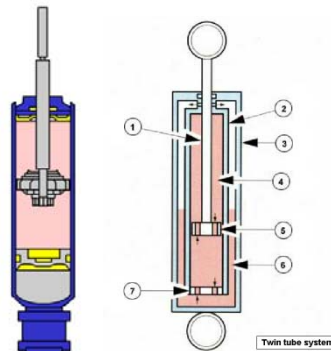
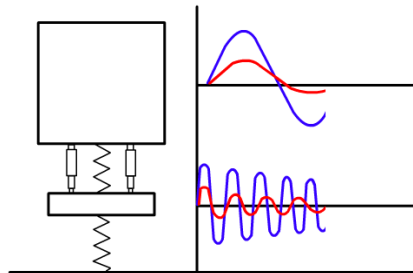
iv. hydraulic



v. hydro-pneumatic

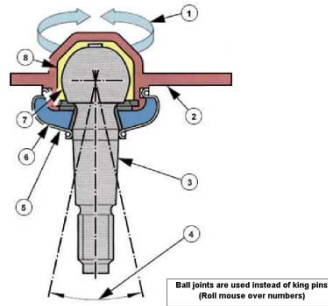


vi. hydraulic dampers

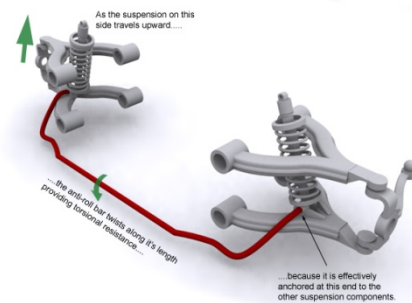


LV04 Vehicle Chassis Units

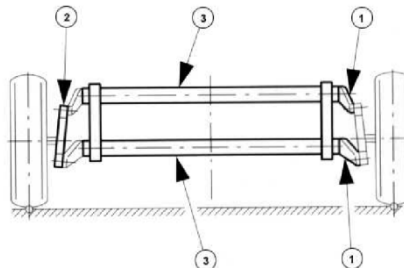
- vii. trailing arms
- viii. wish bones
- ix. ball joints



- x. track control arms
- xi. bump stops
- xii. anti-roll bars (stabiliser bars)



- xiii. parallel link



- xiv. swinging half-axes
- xv. transverse link
- xvi. semi-swinging arms

b. The advantages of different systems including:

- i. non-independent; strong and cheap
- ii. independent suspension; better ride, compact
- iii. hydraulic; self levelling, comfortable
- iv. hydro-pneumatic; same as hydraulic plus adjust ride height
- v. rigid axle; very strong

c. The principles of electronic suspensions systems.

d. The forces acting on suspension systems during braking, driving and cornering.

- Pitch
 - Braking; dive (front end dips)
 - Acceleration; squat (back end drops)
- Roll; if you turn left, the right hand side of the car drops....

e. The methods of locating the road wheels against braking, driving and cornering forces.

f. Suspension terms:

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- i. Rebound; suspension moves down
- ii. Bump; suspension moves up (compression)
- iii. float
- iv. dive
- v. pitch
- vi. roll
- vii. compliance

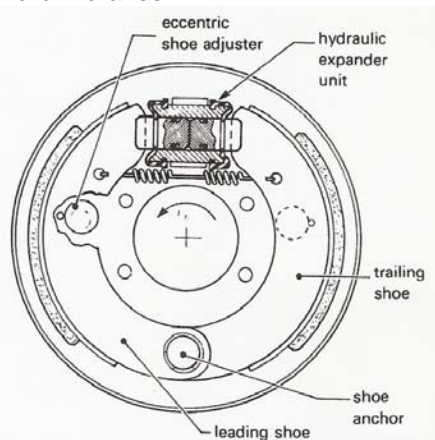
The procedures used for inspecting the serviceability and condition of the suspension system

g. Suspension system defects:

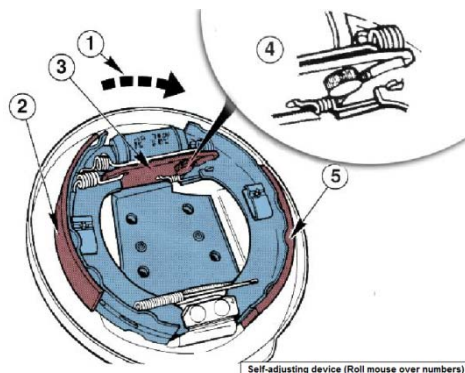
- i. wheel hop
- ii. ride height (unequal and low)
- iii. wear
- iv. noises under operation
- v. fluid leakage
- vi. excessive travel
- vii. excessive tyre wear
- viii. bounce
- ix. poor vehicle handling
- x. worn dampers
- xi. worn joints
- xii. damaged linkages

Brakes

a. The construction and operation of drum brakes:



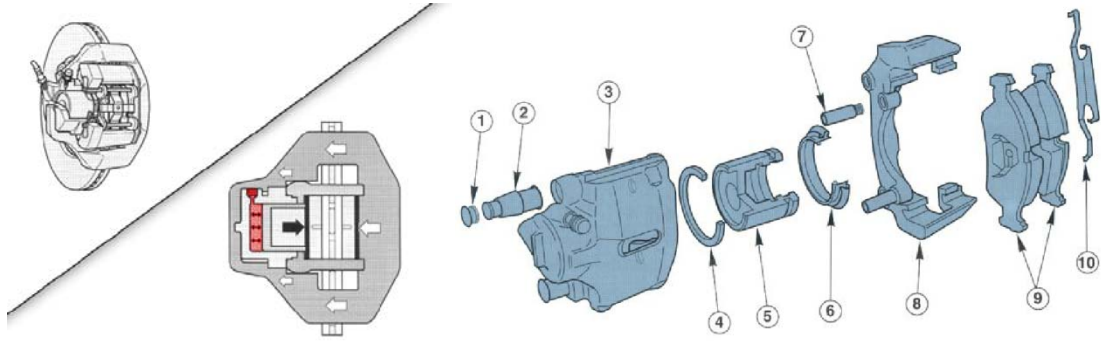
- i. leading and trailing shoe construction
- ii. self-servo action
- iii. automatic adjusters



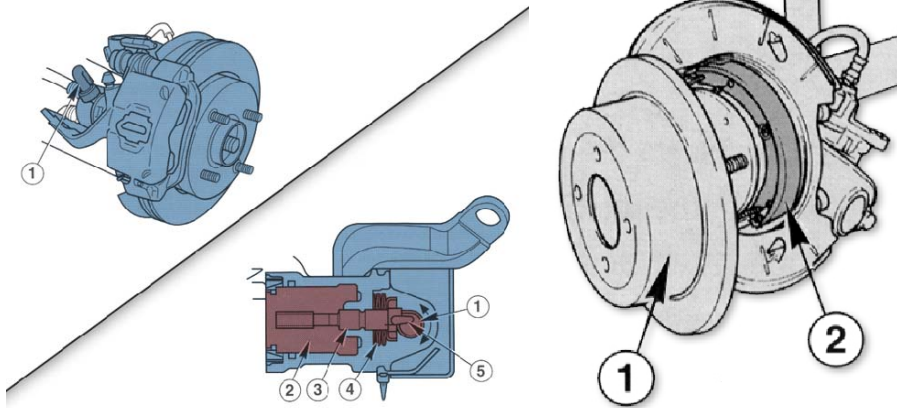
- iv. backing plates
- v. parking brake system

b. The construction and operation of disc brakes:

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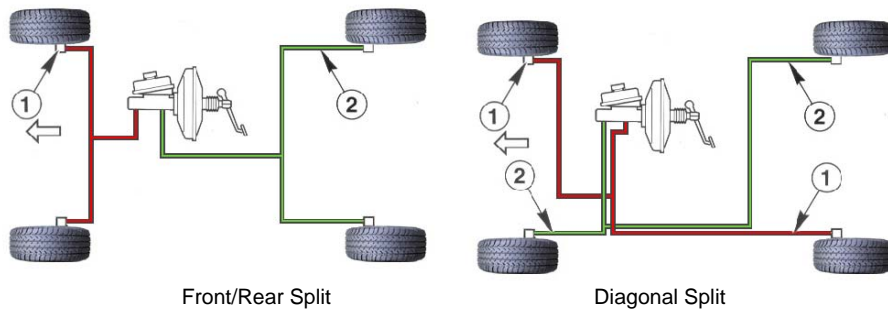
- i. disc pads
- ii. calliper
- iii. brake disc
- iv. ventilated disc
- v. disc pad retraction
- vi. parking brake system



- vii. electrical and electronic components
- viii. wear indicators and warning lamps

c. The construction and operation of the hydraulic braking system:

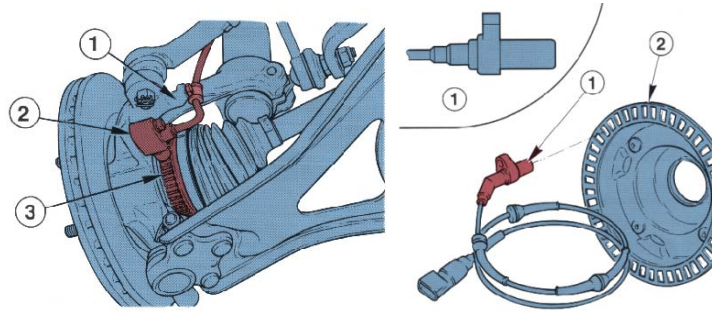
- i. single and dual line layout



- ii. master cylinders
- iii. wheel cylinders
- iv. disc brake calliper & pistons
- v. brake pipe
- vi. brake servo
- vii. warning lights
- viii. parking brakes
- ix. equalising valves

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- d. The principles and components of electronic ABS systems, electrical and electronic components.

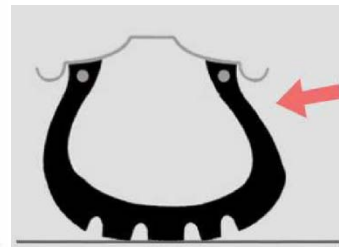
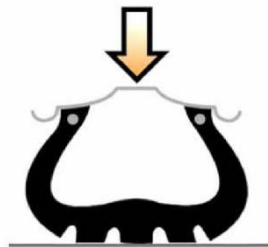


- e. The requirements and hazards of brake fluid:
- boiling point
 - hygroscopic action
 - manufacturer's change periods (every three years).
 - fluid classification and rating (DoT4, DoT5)
 - potential to damage paint surfaces
- f. Terms associated with mechanical and hydraulic braking systems:
- braking efficiency; The required braking efficiency is 50% for the first line brakes, 25% for the second and 16% for the parking brake. It is calculated by $(\text{Total brake effort} / \text{Vehicle weight}) \times 100$
 - brake fade
 - brake balance
 - ABS
- g. The procedures used for inspecting the serviceability and condition of the braking system
- h. Braking system defects:
- worn shoes or pads
 - worn or scored brake surfaces
 - abnormal brake noises
 - brake judder (more than 0.15mm on dial gauge)
 - fluid contamination of brake surfaces
 - fluid leaks
 - pulling to one side
 - poor braking efficiency
 - lack of servo assistance
 - brake drag
 - brake grab
 - brake fade

Wheel and Tyres

- a. The construction of different types of tyre:

- Radial



- cross ply

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- iii. bias belted
- iv. tread patterns



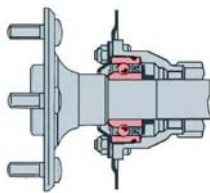
- v. tyre mixing regulations
 - vi. tyre applications
- b. Tyre markings:
- i. tyre and wheel size markings

205	/	65	R	15	94	H
Width of the tyre (mm) "Section Width"		Aspect Ratio (%)	Tyre Construction (Radial)	Rim Diameter (Inch)	Load Index	Speed Symbol

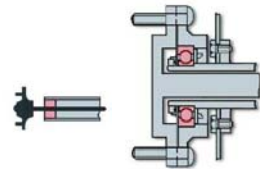
- ii. speed rating
- iii. direction of rotation
- iv. profile (aspect ratio)
- v. load rating
- vi. ply rating
- vii. tread-wear indicators



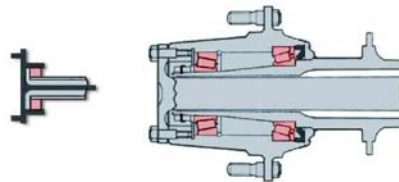
- c. Wheel construction:
- i. light alloy
 - ii. pressed steel and wire wheels
 - iii. flat-edge and double hump rims
- d. Types of wheel bearing arrangements:
- i. non-driving
 - ii. driving



Wheel bearing - Semi floating



Wheel bearing - Three-quarter floating



Wheel bearing - Fully floating

- e. Types of bearing used for wheel bearing arrangements:
- i. Roller

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- ii. taper roller



- iii. needle



- iv. ball and plain



- f. The procedures used for inspecting the serviceability and condition of:
 - iii. tyres & wheels
 - iv. bearings
- g. The defects associated with tyres and wheels:
 - i. abnormal tyre wear
 - ii. cuts
 - iii. side wall damage
 - iv. wheel vibrations
 - v. tyre noise (squeal during cornering)
 - vi. tyre over heating (low pressure)
 - vii. tread separation

General

The procedures for dismantling, removal and replacement of chassis system components

- a. The preparation:
 - i. testing and use of tools and equipment
 - ii. electrical meters and equipment used for dismantling
 - iii. removing and replacing chassis systems and components
- b. Appropriate safety precautions:
 - i. PPE
 - ii. vehicle protection when dismantling
 - iii. removing and replacing chassis systems and components
- c. The important of logical and systematic processes.
- d. The inspection and testing of chassis systems and components.
- e. The preparation of replacement units for re-fitting or replacement of chassis systems or components.
- f. Identify the reasons why replacement components and units must meet the original specifications (OES):
 - i. warranty requirements
 - ii. to maintain performance

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- iii. safety requirements
- g. Refitting procedures.
- h. The inspection and testing of units and systems to ensure compliance with manufacturer's, legal and performance requirements.
- i. The inspection and re-instatement of the vehicle following repair to ensure customer satisfaction:
 - i. cleanliness of vehicle interior and exterior
 - ii. security of components and fittings
 - iii. re-instatement of components and fittings