SUSPENSION SYSTEMS–OBJECTIVES WORKSHEET
Module 1–Basic Front Suspension Designs

A-2

Five commonly referenced front steering angles on a vehicle include:

- camber.
- _____.
- toe.
- steering axis inclination (SAI).
- _____ angle.

A-3

_____ caster is when the upper pivot point (ball joint/strut mount) is positioned rearward of the lower ball joint.

_____ caster is when the upper pivot point (ball joint/strut mount) is positioned forward of the lower ball joint.

Caster does not affect tire wear when driving straight ahead.

Notes

Please refer to the Student CD-ROM for a copy of the:

- *Textbook.*
- *Video Scripts.*
- *Self-Study Narration Scripts.*
- *Student Handouts (if applicable).*

© 2003–2008 Inter-Industry Conference On Auto Collision Repair

A-4

_____ is the inward or outward tilt of the top of a tire compared to true vertical when viewed from the front of the vehicle.

_____ camber is the top of the tire leaning away from the vehicle centerline, and _____ camber is the top of the tire leaning towards the vehicle centerline.

Camber that is too positive or negative will cause excessive wear on the shoulder of a tire.

A-6

If the _____ angle is incorrect, one or both of the pivot points is out of place. This may be caused by chassis damage, suspension part damage, or improperly aligned parts.

A-10

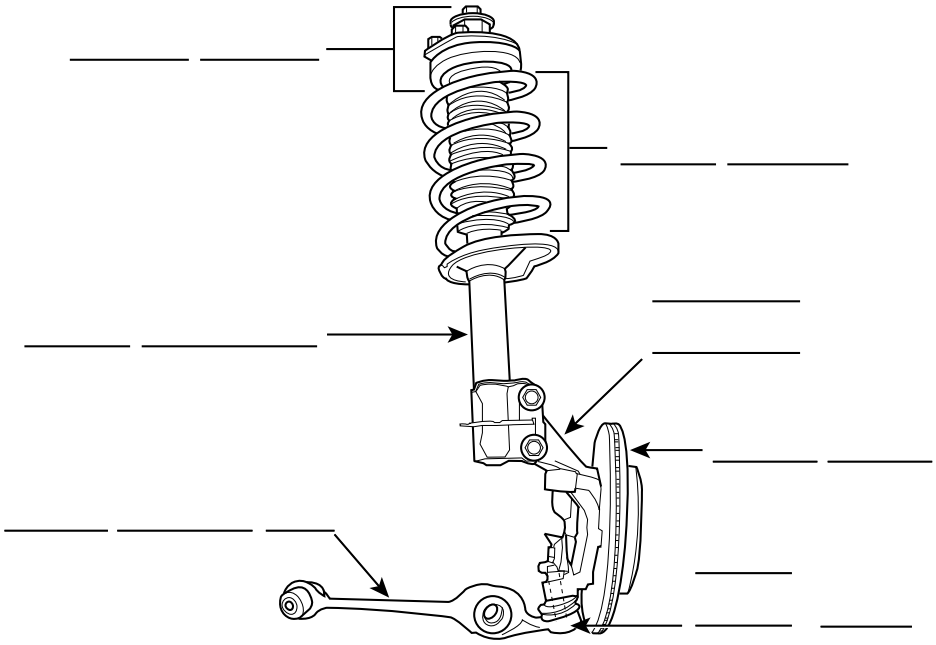
Do NOT install suspension parts that show signs of previous repairs or housing leaks.

Use _____ _____ to check for cracks on recycled replacement parts.

Notes

© 2003–2008 Inter-Industry Conference On Auto Collision Repair

A-11



A-12

The strut mount:

- contains the upper _____ assembly of the strut.
- is fastened to the _____ rod.
- secures the coil spring to the strut.
- attaches to the strut tower by threaded studs.

Notes

© 2003–2008 Inter-Industry Conference On Auto Collision Repair

A-13

When inspecting a strut for damage, check for:

- clunking noises while driving.
- binding spots or difficulty when turning the wheels left and right.
- excessive movement. This is done by raising the vehicle off the ground, unloading the suspension, and trying to move the strut assembly (pushing and pulling on the strut) in and out of the wheelhouse area.
- deterioration or tears in the rubber strut mount.
- inconsistent _____ readings during an alignment.

A-15

_____ springs:

- are used by various vehicle makers on both front and rear suspensions.
- surround the upper portion of the strut assembly.
- are designed to maintain proper ride height.
- support a portion of the vehicle weight and its contents.
- must be _____ before they can be removed or installed.

A-17

All coil springs are generally inspected the same. This includes coil springs used on the front and rear of a vehicle.

Coil springs that are broken may cause:

- a portion of a vehicle to _____.
- a _____ reading to be incorrect.
- tire damage from the broken spring.

Notes

© 2003–2008 Inter-Industry Conference On Auto Collision Repair

A-28

_____ _____ should be inspected for:

- noise when driving over rough surfaces.
- limited rotation or binding.
- torn dust boots.

Improper wheel position may be caused by a bent ball joint stud. A ball joint stud that is bent may have incorrect camber or a wheel not positioned correctly in the wheelhouse.

A-29

Some conditions that indicate a worn ball joint include:

- grease _____ movement.
- _____ wheel movement.
- rotating the ball stud by hand.
- removing the ball joint from the steering knuckle, and rotating the ball stud to determine if the stud is straight. Bent ball joints, when rotated, will rotate in an off-center motion.

A-30

Depending on the type of front suspension, ball joints may require different inspection techniques. Suspension systems such as:

- _____, four-link, and double wishbone-type require the wheel to be unloaded.
- _____-type, which require the suspension to be unloaded, the ball joint is removed from the knuckle and inspected for damage or excessive wear within the joint.

Notes

© 2003–2008 Inter-Industry Conference On Auto Collision Repair

A-31

Depending on the vehicle maker's design, ball joints may be:

- _____ into the control arm.
- _____ into the control arm.
- pressed into the control arm.

A-37

Do NOT _____ damaged control arms.

When replacing a lower control arm, the ball joint may have to be _____ or replaced into the replacement control arm.

A-38

When replacing a lower control arm, unbolt the lower:

- ball joint and separate it from the _____ _____.
- control arm from the chassis and remove the damaged part.

Reinstall the replacement lower control arm in reverse order.

Do NOT torque lower control arms until the vehicle suspension is loaded.

Once a replacement lower control arm is installed, the vehicle will require an alignment.

Notes

© 2003–2008 Inter-Industry Conference On Auto Collision Repair

A-40

Strut cartridges:

- contain high pressure gas inside the cartridge.
- use a strut rod to maintain proper wheel position and allow vertical suspension travel.
- must NOT be heated.
- should be _____ before being discarded. To depressurize a strut, fully extend the strut rod and drill a hole in the center of the strut assembly.
- affect the ride quality of a vehicle.
- may affect the ride height of a vehicle if damaged.
- may have replaceable _____.

A-42

Struts should be inspected for:

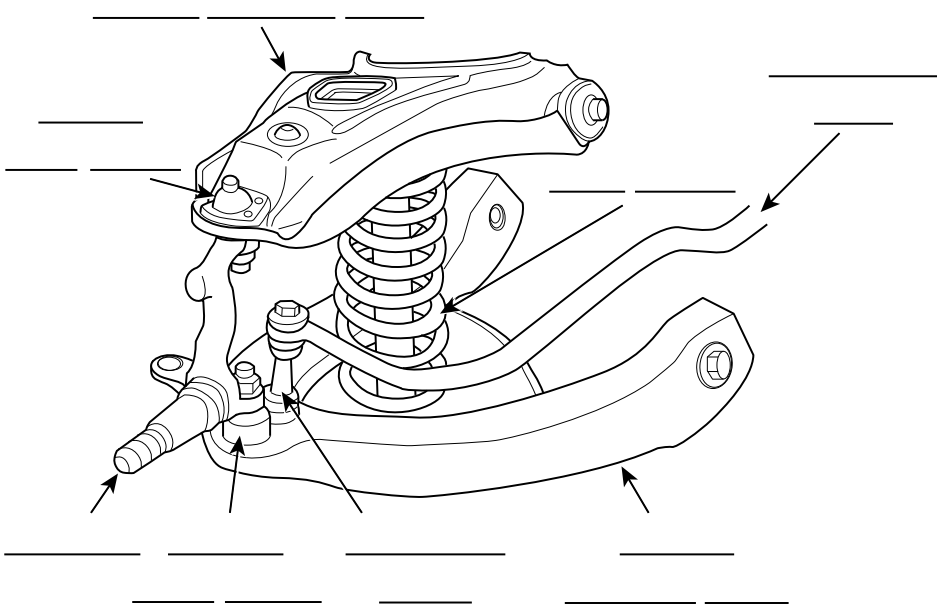
- seeping or leaking _____ from the area where the strut rod enters the strut cylinder. Struts with oil seepage require replacement.
- damaged attachment points. This damage may be the result of a collision or a loose part.

Struts should be replaced in _____. Struts affect the ride and handling of a vehicle, therefore they should react the same. Using a new and used strut may cause the vehicle to react in a manner not intended by the vehicle maker.

Notes

© 2003–2008 Inter-Industry Conference On Auto Collision Repair

B-1



B-3

When replacing an upper control arm:

- unload the spring pressure.
- unbolt the upper shock mount.
- unbolt and separate the upper ball joint.
- remove the upper control arm from the attachment point on the frame.
- remove the upper control arm from the vehicle.
- reassemble the replacement upper control arm in reverse order.

Do not _____ an upper control arm with rubber bushings until the vehicle suspension is _____.

Once the upper control arm is removed, the vehicle will require an alignment.

Notes

© 2003–2008 Inter-Industry Conference On Auto Collision Repair

B-11

Stabilizer bars:

- are made of _____ steel, which is designed to flex and not retain memory.
- may be a one- or two-piece assembly.
- connect to a stabilizer _____ fastened to the vehicle chassis.

C-4

When replacing a solid _____ _____, lift the axle housing and support the housing with jack stands and remove:

- the axle arms.
- the springs.
- the shocks.
- any attaching accessories that are fastened to the axle housing.

D-1

Double _____ suspensions:

- are a combination of _____ suspension with a strut used in the design.
- position the damper fork around the axle shaft.
- have an upper control arm that attaches inside the vehicle strut tower.
- attach the strut cartridge inside a pocket in the upper portion of the damper fork.

Notes

© 2003–2008 Inter-Industry Conference On Auto Collision Repair

Parts used on a double wishbone suspension that are different than a MacPherson strut suspension include:

- an _____ control arm.
- a _____ arm that helps keep the wheel in the correct position while driving.
- a _____ fork that connects to the lower part of the strut cartridge, and bolts to the lower control arm.

D-3

When inspecting a double wishbone suspension:

- an out-of-position wheel will not be caused by a damaged _____.
- the _____ control arm, lower control arm, and steering knuckle affect wheel position. Damage to any of these parts will affect camber, caster, or toe.

Notes

© 2003–2008 Inter-Industry Conference On Auto Collision Repair

F-1

Specific twin _____ suspension parts include:

- the left and right axle arm.
- replaceable _____ upper ball joint camber and caster bushings.
- radius arms to maintain proper wheel position.
- a leaf or coil spring on the front suspension, depending on vehicle application.

F-2

Twin I-beam front suspensions have:

- _____ front camber.
- different _____ points for each axle located under the front of the vehicle.

Notes

© 2003–2008 Inter-Industry Conference On Auto Collision Repair

SUSPENSION SYSTEMS–OBJECTIVES WORKSHEET
Module 2–Rear Suspensions

Notes

A-2

The rear suspension used on a vehicle may be:

- _____ axle.
- trailing arm.
- _____.

A-4

When inspecting a rear straight axle:

- incorrect alignment angles such as toe, camber, caster, or thrust angle may indicate a damaged axle housing assembly.
- doing a ____-point, ____-position axle check may not be possible if the axle has alignment _____ under the rear spindle. Typically solid drive axles can be checked using the 2-point, 3-position method.
- comparative measurements may be possible, but may have to be compared to a known undamaged vehicle. Comparative measurements may be referenced from an area on the axle housing center carrier and out to the end of the axle housing. Measurements taken 180° apart will help identify damaged axle housings.
- any lubricants used in the axle should be inspected for contamination. If any fluid contamination is found, inspect and clean the affected parts.
- check mounting bushings or isolators for damage or wear.

© 2003–2008 Inter-Industry Conference On Auto Collision Repair

A-8

When inspecting a rear SLA suspension:

- composite springs should be inspected and replaced if damaged.
- inspect the coil spring of a coil-over-shock absorber.
- rear SLA suspension inspection is similar to front SLA suspensions.
- shock absorbers should be inspected and replaced if leaking. If a rear shock absorber requires replacement, do not install a recycled shock.

Notes

© 2003–2008 Inter-Industry Conference On Auto Collision Repair

SUSPENSION SYSTEMS–OBJECTIVES WORKSHEET
Module 3–Ride Dampeners

Notes

A-2

Shock absorbers used on the front and rear of a vehicle:

- may contain _____ springs around the shock assembly.
- may be controlled by changing _____ pressure.
- do not affect ride height if they are hydraulic.
- limit _____-travel of the vehicle suspension.
- are inspected the same as strut assemblies.

A-4

When replacing _____ _____:

- support the axle and suspension.
- unbolt the damaged shock absorber.
- install the replacement shock absorber.
- they should be replaced in pairs.

B-2

When replacing a _____ _____:

- mark the location of the spring at the control arm and at the splines of the crossmember adjuster arm.
- unload the spring tension from the control arm by loosening the adjuster arm bolt.
- slide the torsion bar forward.
- remove the adjuster arm from the crossmember.
- slide the spring backwards out of the control arm, and then forwards out of the vehicle crossmember.

When replacing or reinstalling torsion springs, they are marked for either the left or right side of the vehicle.

© 2003–2008 Inter-Industry Conference On Auto Collision Repair

B-6

Leaf spring assemblies vary. The differences include:

- _____.
- width.
- thickness.
- number of _____ in a _____.
- weight capacity.
- compression rate.

The number of leafs in a spring pack does NOT represent weight capacity of the spring assembly.

B-13

When inspecting _____ shocks, an improperly operating system may be indicated by:

- a vehicle that _____ while parked.
- an air _____ that runs constantly.
- incorrect ride height of a vehicle.
- a ride characteristic that is too soft or firm.

Notes

© 2003–2008 Inter-Industry Conference On Auto Collision Repair