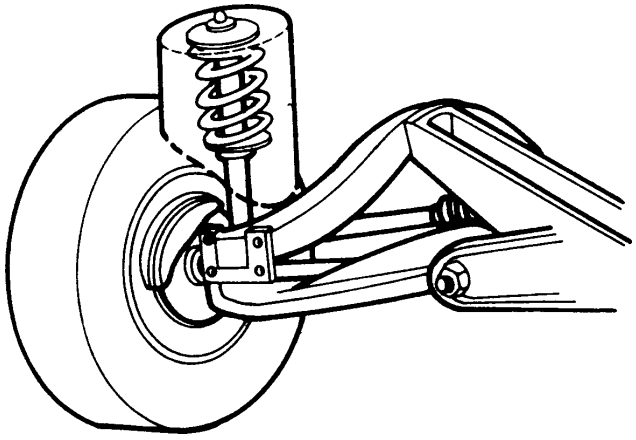
HOW - TO
MAC-PHERSON STRUTS



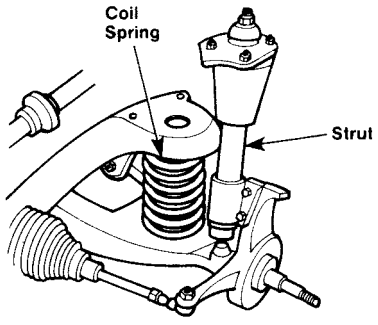
Tool And Material Checklist

- ☐ Jack Stands or Hoist
- ☐ Lug Wrench
- ☐ Workbench
- ☐ Spanner or Pipe Wrench
- ☐ Torque Wrench
- ☐ Vise
- ☐ Vise-holding Tool
- ☐ Spring Compressor
- ☐ Oil
- ☐ Service Manual
- ☐ Screwdrivers
- ☐ Safety Glasses or Googles

Once found almost exclusively on foreign cars, the MacPherson strut suspension system is now used on a large (and growing) number of American models. And while it is dramatically different in appearance from the traditional independent front suspension system, its components work in basically the same manner. This booklet provides an overview of MacPherson strut suspension, including inspection and service procedures.

OPERATION AND COMPONENTS

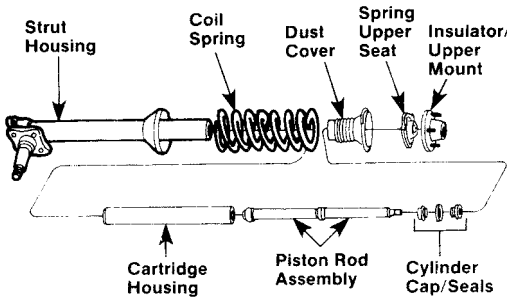
The most unique feature of a MacPherson strut suspension is that all of the components are contained in a single assembly. Based on a triangle design, a typical MacPherson strut assembly includes a coil spring, upper suspension locator, and shock absorber and is mounted between the top arm of the steering knuckle and the inner fender panel. When the spring is not on the strut itself, but is instead located between the lower control arm and the frame, this is known as a Chapman strut and a modified MacPherson suspension; the advantage is that minor road vibrations are absorbed through the chassis rather than being fed to the driver through the steering system. Following is a closer look at MacPherson strut components.



A modified MacPherson suspension

STRUTS

The strut is the heart of the MacPherson suspension system. Not only do struts look like conventional shock absorbers, they also perform the same shock-dampening function. They reduce suspension space and weight requirements as well; by mounting the strut assembly to the steering knuckle, the need for an upper control arm and ball joint is eliminated. The upper mount is the load-carrying component on MacPherson suspensions.



Exploded view of typical strut

There are two types of struts: serviceable and sealed. Serviceable struts are designed with a threaded body nut, thus enabling the shock-absorbing cartridge to be replaced. Sealed struts, on the other hand, permanently retain the cartridge by means of a cap. Since there is no way of replacing the cartridge on a sealed strut, the entire strut unit must be replaced. The majority of original equipment domestic struts are sealed.

NOTE: It is recommended that struts always be rebuilt or replaced in pairs.

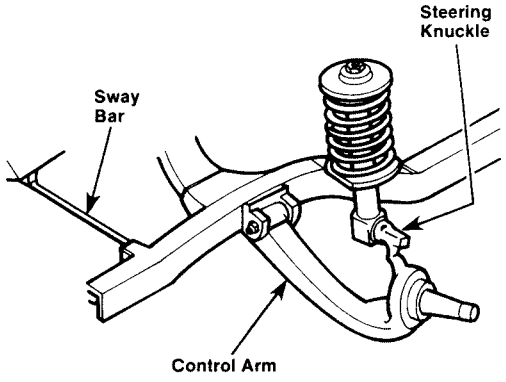
COIL SPRINGS

Coil springs are found on all MacPherson strut suspensions. A mounting plate welded to the strut acts as the lower spring seat, while the upper seat is bolted to the strut piston rod. The coil spring and strut turn with the motion of the steering wheel by means of a bearing or rubber bushing in the upper mount. As mentioned earlier, modified MacPherson suspensions do not have the coil spring mounted on the strut. While this feature does provide a smoother ride under normal driving conditions, the regular MacPherson suspension (in which the spring is positioned on the strut) provides a smoother, more responsive ride over a wide range of driving conditions. The higher and wider spring placement also provides superior roll resistance.

LOWER SUSPENSION COMPONENTS

As on conventional suspensions, the lower mounting position is the frame. The lower control arm and ball joint are retained on MacPherson suspensions, as is the sway, or stabilizer, bar. The lower ball joint stabilizes the steering and helps prevent shimmy. The only exception to this is on modified MacPherson suspensions, where the ball joint is the load bearer and the upper mount is responsible for steering.

On today's uni-body cars, the weight of the vehicle is carried by a coil spring located between the inner fender skirt and upper control arm. An upper ball joint is also included on uni-body designs. This is a compression-type ball joint, meaning that when the weight of the car is on the ball joint, it is tight; when the weight is removed from the ball joint, it loosens up.



Lower suspension components

INSPECTION

The strut shaft on a MacPherson suspension system receives a tremendous amount of force, both vertically and horizontally, even during normal driving conditions. For this reason, the assembly must be inspected periodically for signs of leakage, poor dampening, or shaft bending. The rest of the system should also be checked carefully, particularly the ball joints, control arm bushings, strut rod bushings, and sway bar bushings.

NOTE: The MacPherson strut components on front wheel drive vehicles are subjected to even greater wear due to the force of front-drive axles.

	Replaceability	
Component	Individual Part	In Assembly Only
Struts		X
Strut upper mounts	X	
Coil springs	X	
Ball joints		X
Control arm inner pivot bushing	X	
Steering knuckle	X	
Stabilizer bar*		X
Stabilizer bar-to-arm insulator	X	
Stabilizer bar-to-body bushing	X	
Control arm**		X
Stabilizer bar brackets	X	
Stabilizer bar-to-bracket clamp	X	

*Rubber insulators are mounted on the bar as an assembly.

**Assembly includes ball joint, inner bushing, stabilizer bar-to-arm insulators.

When trouble is suspected with your car's Mac-Pherson strut suspension, always begin with a road test. Note the handling and overall ride quality, as well as any vibration during acceleration, braking, or cornering. Measure the ride height (from the suspension to the frame) and compare it to the specifications in your service manual. If the height is below the recommended minimum—or if you are not satisfied with the ride quality—the coil springs might need replacing.

Another good check is to bounce the car—first the front end and then the rear. Note any binding that could indicate a bent strut shaft. Poor dampening usually means worn valving in the strut. Also, the top mount assembly bearing should be checked for binding or roughness when steering with the tires on the ground. If any of these problems are present, the strut must be disassembled and serviced. Consult the table to see which components can be replaced individually and which must be replaced as part of a larger assembly.

If the struts on your car are serviceable, the shock absorbing device inside them is "wet." This means that oil is sealed inside the strut by means of a body nut, O-ring, and piston rod seal. Servicing a "wet" strut means a thorough cleaning of the inside of the strut body and very careful reassembly.

NOTE: Whenever work is being done under the vehicle, always wear safety glasses or goggles.

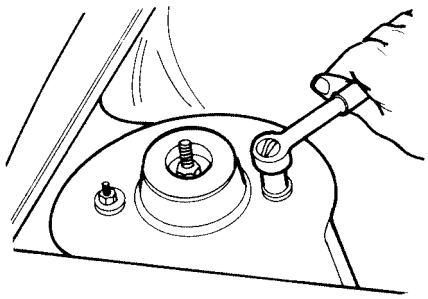
STRUT REMOVAL

To remove a regular MacPherson strut, proceed as follows:

1. Remove the wheel covers and loosen the lug nuts one full turn. After making sure that the steering wheel is unlocked, raise the car on jack stands or a hoist.

2. Remove the wheel. Mark the location of the upper bearing plate camber bolt on the steering knuckle so that you'll be able to replace it easily.

3. If the strut provides for camber adjustments, mark the position of the attachment.

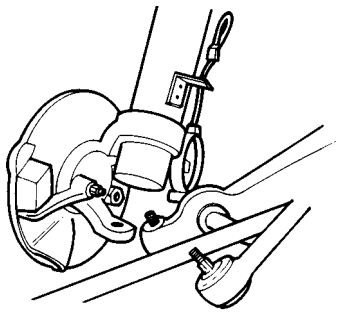


Removing the nuts that secure the upper mount

4. Remove all but one of the nuts securing the upper mount to the car body. The remaining nut should be left on finger-tight.

5. Disconnect the brake hose and line from the strut assembly (if applicable).

NOTE: If working on a front-wheel drive car, place a plastic or metal shield over the CV hub joint temporarily to protect it from accidental damage.



Freeing the strut

6. Remove the bolts connecting the strut assembly to the steering knuckle.

7. If the steering knuckle is part of the strut assembly, separate the ball joint taper and pry down on the control arm to free the strut.

8. Lift the strut assembly from the car and set it on a clean workbench.

SERVICE

Whenever you are servicing struts, a vise-holding tool is a must. Never secure a strut directly in a vise because the force necessary to hold it could easily damage the cylinder. Use the following service procedure:

1. Mount the strut in a vise using a vise-holding tool.

2. Attach a spring compressor to the coils; tighten until the pressure on the upper mount has been removed.

3. Mark the position of the coil spring and upper mount so that they can be reassembled easily.

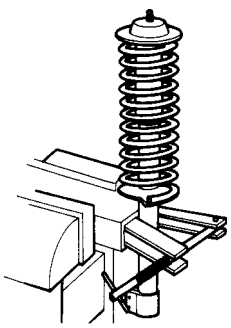
4. Remove the plastic dust cap and strut-retaining nut from the upper mount.

5. Disassemble the remaining components and lay them out in order on the workbench. Do not remove the spring from the compressor.

6. If the strut is serviceable, remove the spanner nut using a spanner or pipe wrench.

7. If the strut is sealed and therefore non-serviceable, discard the old strut, place the new strut in the vise, and proceed to the section "Strut Installation."

8. Remove the rubber O-ring from the cylinder. Slowly pull out the piston rod and cartridge to prevent oil spillage. Discard all the internal parts.



Using a vise-holding tool

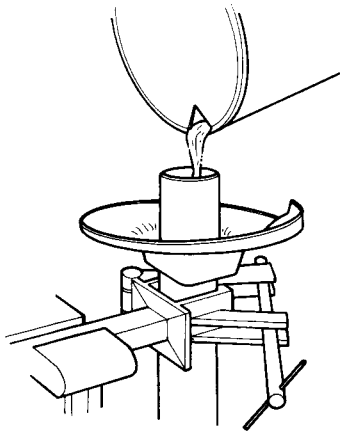
9. Remove the strut from the vise and discard any oil that might be left inside the cylinder.

10. Clean and inspect the cylinder, particularly the threads.

11. Replace the cylinder in the vise. Before installing the new cartridge, pour a little oil into it; this will help dissipate heat before assembly.

12. Install the new cartridge according to the manufacturer's directions, then install and tighten the new spanner nut.

STRUT INSTALLATION

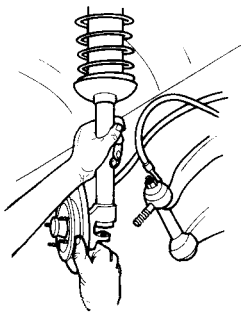


Pouring oil into the new cartridge

To replace a strut back into the MacPherson suspension, proceed as follows:

1. Extend the piston rod on the new strut (or cartridge) to its full length.

2. Reinstall the coil spring and other components in the reverse order that they were removed. Make sure the spring is positioned properly on the lower spring seat.



Installing the strut

3. Install the new strut retaining nut and tighten it to the specified torque.

4. Remove the spring compressor, then remove the entire assembly from the vise. Reinstall it on the car.

5. Check to make sure that the upper bearing plate and stud nuts are properly aligned with the marks you made earlier, then tighten them.

6. Tighten the steering knuckle mounting bolts or ball joint nut to the manufacturer's specifications.

7. Reattach the brake hose, as well as any other parts that were removed.

MODIFIED MACPHERSON STRUTS

To replace a strut on a modified MacPherson suspension, proceed as follows:

1. Raise the car and support the lower control arms with a jack or jack stands.

2. Remove the upper shaft nut, but not the upper strut mount retaining bolts. If a mount rivet is used, do not remove it either.

3. Remove the brake caliper. If necessary, unbolt the strut from the spindle.

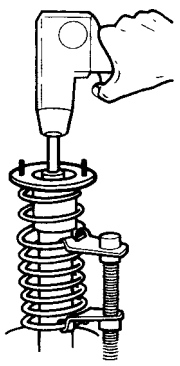
4. Remove the strut assembly and upper mount. Discard the strut assembly.

5. If the upper mount has a rubber jounce bumper inside the dust shield, inspect it and replace if damaged.

6. Prime and slightly expand the new strut assembly. Insert it through the dust shield, jounce the bumper, and start threading the upper shaft nut.

7. Extend the cartridge and bolt the lower strut mount to the spindle using the supplied hardware. Torque to specifications.

8. Torque the upper shaft nut and mounting nuts to specifications.



Tightening the strut retaining nut