

WHEELS AND TIRES 2H

INDEX

	Page		Page
Abnormal Tire Wear	2H-3	Tire Rotation	2H-5
General	2H-1	Tire Roughness	2H-8
Polyspare Tire	2H-5	Tire Size and Load Rating	2H-2
Radial, Wide Tread and Snow Tire Applications	2H-5	Vibration	2H-10
Specifications	2H-12	Wheels	2H-5
Tire Construction	2H-1	Wheel Balancing	2H-6
Tire Inflation Pressure and Capacity	2H-2	Wheel Bearing Adjustment	2H-6
Tire Maintenance and Condition	2H-4	Wheel Maintenance and Condition	2H-5
Tire Repair	2H-4		

GENERAL

Jeep vehicles are equipped with American and metric size, tubeless-type, pneumatic tires available in load ranges SL, B, C, and D. Standard equipment tires are of bias-ply or bias-belted construction. Radial-ply tires are available as an option on most models.

Standard equipment wheels are safety rim, drop center-types constructed entirely of steel. Optional wheels, which are available on most models, consist of forged aluminum wheels, wide rim spoke-type sport wheels, and chrome plated styled steel wheels.

Original equipment wheels and tires are tested and selected to provide the best all around performance for normal operation. To obtain optimum wheel/tire performance, tire inflation pressures must be maintained at recommended levels and wheel/tire condition should be checked regularly. This is especially important on vehicles equipped with the Quadra-Trac full-time four wheel drive transfer case.

TIRE CONSTRUCTION

Three types of tire construction are currently in use. They are referred to as bias-ply, bias-belted, and radial-ply construction. The description for each construction-type is derived from the method used to position the tire cord plies in relation to the tread centerline.

Bias-Ply Construction

Bias-ply tires are constructed with the body cord plies extending from bead-to-bead and at an angle to the tread centerline (fig. 2H-1). Alternate plies overlap one another at opposing angles.

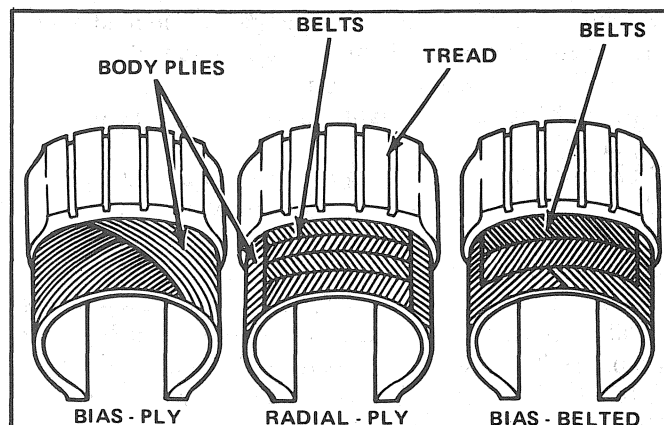


Fig. 2H-1 Types of Tire Construction

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Bias-Belted Construction

Bias-belted tires are constructed basically the same as bias-ply tires. However, in addition to the angled body cord plies, they also have belts that encircle the tire. These belts are located under the tire tread and extend from tread shoulder to tread shoulder (fig. 2H-1).

Radial-Ply Construction

Radial-ply tires, like bias-belted tires, also have belts under the tread which encircle the tire and extend from tread shoulder to tread shoulder. However, these tires are constructed with the body cord plies at right angles to the tread centerline. The plies cross the tread centerline at an angle of approximately 90 degrees (fig. 2H-1). Because the body cord plies radiate from the tread centerline, this type of construction is designated radial-ply.

Identifying Tire-Types

Radial tires are identified by the code letter R which appears in the size description imprinted on the tire sidewall. Bias-ply and bias-belted tires do not have such a code letter. For example, P225/75R-15 or HR78-15 for radial tires as compared to H78-15 for similar size bias-ply or bias-belted tires.

NOTE: As a result of their unique construction, radial tires have a highly flexible sidewall. This flexibility is responsible for the characteristic sidewall "bulge" which makes the tire appear to be underinflated. This is a normal condition for radial tires. Do not attempt to reduce this bulge by overinflating the tire. The only way to be sure a tire is properly inflated is to use an accurate and reliable tire pressure gauge. Check and adjust inflation pressures in accordance with the information provided in the Tire Inflation Pressure Chart at the end of this chapter.

TIRE SIZE AND LOAD RATING

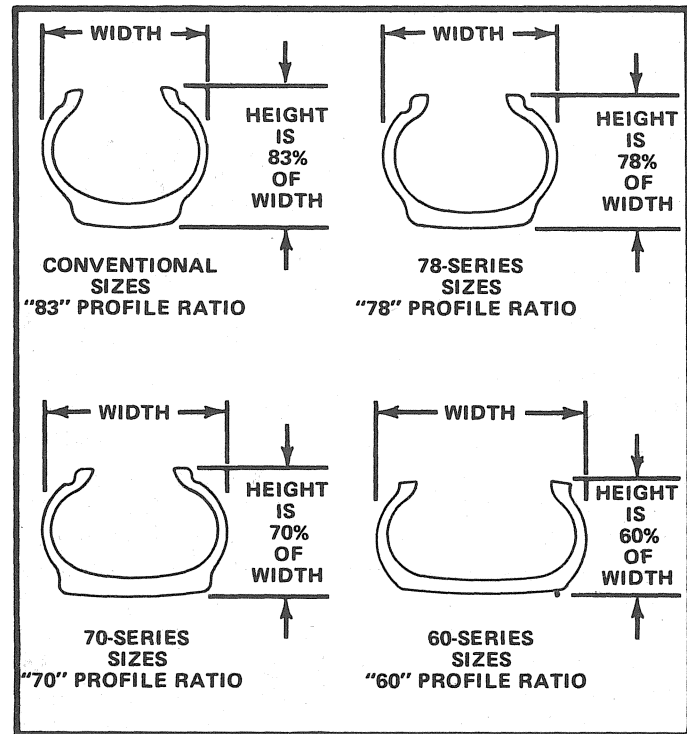
American and metric tire sizes and tire load range ratings are indicated in the combination of letters and numbers imprinted on the tire sidewall such as: P225/75R-15 load range SL, H78-15 load range B, G78-15 load range D and 9.50-16.5 load range D. The load range rating replaces the ply rating system formerly used to denote tire load capacity. Original equipment tires used on Jeep vehicles are available in load range ratings SL, B, C, and D.

NOTE: The SL load range rating applied to the P225/75R-15 metric tire is equivalent to the current load range B rating.

Conventional size American tires are identified with numbers only such as 9.50-16.5. These numbers indicate approximate tire width and rim diameter in inches. For example, 9.50 represents tire sidewall-to-side-wall width and 16.5 the nominal wheel rim diameter required.

The newer American tire sizes are based on tire profile ratio and use letter-number combinations such as H78-15. In this case, letter H represents tire industry specifications for the load and inflation schedule for tires in this letter classification. The number 78 indicates tire section height as determined by the ratio of section height to sidewall-to-side-wall width. Or, height divided by width equals size or profile ratio. In this case, the height of an H78 tire is equal to 78 percent of the width. This formula applies to all profile series tires (fig. 2H-2). The number 15 denotes the wheel rim diameter required.

Metric size tires also use letter-number combinations to indicate size and type. For example, with the P225/75R-15 tire, letter P indicates tire use is for passenger vehicle applications, 225 is the sidewall-to-side-wall width in millimeters, 75 is the profile ratio (height equals 75% of width), R indicates radial-ply construction and 15 the wheel rim diameter required stated in inches.



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Fig. 2H-2 Tire Size and Profile Ratio

TIRE INFLATION PRESSURE AND CAPACITY

Original equipment tires used on Jeep vehicles are selected and tested to meet operating requirements within tire capacity. The recommended load capacities and inflation pressures for full or reduced load operation are listed in the Tire Inflation Pressure Chart at the end of this chapter. This information is also provided in the owners manual and on a label attached to the interior surface of the glove box door.

Tire inflation pressures are selected to be compatible with the load capacity, ride, and handling characteristics of a specific vehicle. In cases where a slightly softer ride is preferred, the driver may use reduced load pressures but must not exceed 55 mph (88 km/h) or reduced load vehicle capacity.

When sustained high speed operation is anticipated, tires may be inflated to recommended full load inflation pressures plus an additional 2 psi (14 kPa). However, inflation pressures must not exceed maximum recommended pressures.

Tire pressures should be checked and adjusted to recommended levels on a weekly basis. This is especially important when extreme changes of 20 degrees or more in average seasonal temperatures occur and is especially important on vehicles with Quadra-Trac.

Adjusting Inflation Pressures

Check and adjust inflation pressures only when the tires are cold, or driven for less than two miles at speeds below 40 mph (64 km/h), or after the vehicle has been parked for three hours or more.

Do not reduce inflation pressures if the tires are hot, or driven over two miles at speeds above 40 mph (64 km/h). At this stage, tire pressures may increase as much as 6 psi over cold inflation pressures due to air expansion caused by heat buildup in the tire.

When checking and adjusting inflation pressures, always use a reliable and accurate gauge to ensure proper inflation levels.

ABNORMAL TIRE WEAR

Abnormal tire wear may be caused by incorrect inflation pressures, tire-wheel unbalance, worn suspension components, improper brake operation, bent wheels, front wheel alignment, or excessive speed on turns.

In most cases, inspection of tire wear patterns will reveal the cause of abnormal wear. The various types of wear patterns and necessary corrective action are illustrated in figure 2H-3.

Rapid wear of the tread shoulders is usually caused by underinflation or lack of rotation or a combination of both. If this type of wear occurs and the tires are serviceable, rotate the tires and inflate them to recommended levels when they are cool.

Rapid wear at the tread center is usually caused by overinflation or lack of rotation or a combination of both. If this type of wear occurs and the tires are still serviceable, rotate the tires and inflate them to recommended levels when they are cool.

Cracked treads are usually caused by underinflation or excessive high speed operation or a combination of both. Tires with cracked treads should be replaced and the replacement tires properly maintained to avoid a recurrence.

Excessive wear of one tread shoulder may be caused by excessive speed on turns or by incorrect camber. Incorrect negative camber will wear the inboard tire shoulder while incorrect positive camber will wear the outboard shoulder. If this type of wear occurs, check camber. If camber is incorrect, the front axle housing may need to be replaced. If camber is within specified limits, caution the owner about excessive speed on turns. If the tires are serviceable, rotate them and adjust inflation pressures to recommended levels.

Incorrect toe-in will cause the tire tread surface to develop a feathered edge. One side of the tread will be rounded while the opposite side develops a feathered edge. This type of wear indicates that the tire is side slipping and scuffing as it moves over the road surface.

A feathered edge that faces toward the vehicle indicates excessive toe-in. A feathered edge that faces away from the vehicle indicates excessive toe-out. The direction in which a feathered edge has developed can be determined by passing a hand over the tire tread surface. Bent steering knuckle arms can also cause this type of wear.

If a feathered edge develops, check and correct toe-in as necessary and rotate the tires if they are serviceable.

Wide Tread Bias-Bolted Tire Wear

Bias-belted wide tread tires have an initial wear characteristic that is unique to this type of tire. It occurs as a fairly rapid but even wear of the second and sixth tread ribs (fig. 2H-4). Wear may occur at only one of the ribs or at both ribs simultaneously. In some cases, a slight cupping of these ribs may also develop in addition to wear. Although wear develops rapidly, the degree of wear is relatively light.

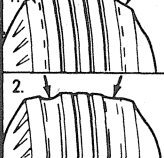
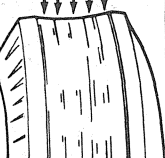

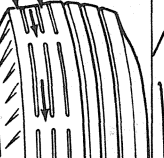
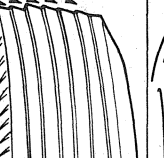
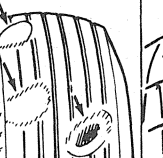
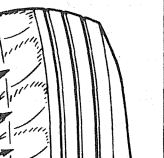
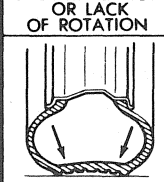
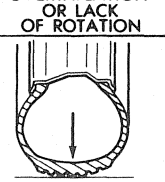
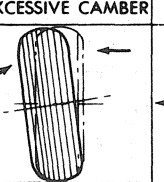
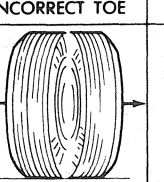
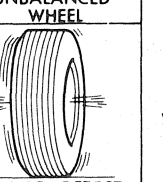
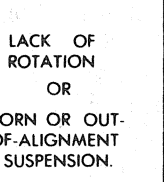
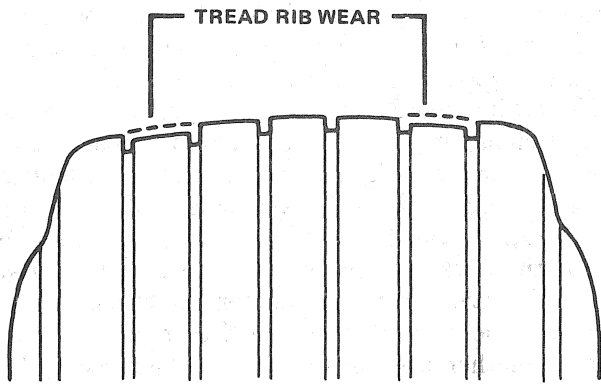
	RAPID WEAR AT SHOULDERS	RAPID WEAR AT CENTER	CRACKED TREADS	WEAR ON ONE SIDE	FEATHERED EDGE	BALD SPOTS	SCALLOPED WEAR
CONDITION							
CAUSE	UNDERINFLATION OR LACK OF ROTATION 	OVERINFLATION OR LACK OF ROTATION 	UNDERINFLATION OR EXCESSIVE SPEED	EXCESSIVE CAMBER 	INCORRECT TOE 	UNBALANCED WHEEL OR TIRE DEFECT 	LACK OF ROTATION OR WORN OR OUT-OF-ALIGNMENT SUSPENSION. 
CORRECTION	ADJUST PRESSURE TO SPECIFICATIONS WHEN TIRES ARE COOL ROTATE TIRES		REPLACE TIRES	REPLACE FRONT AXLE HOUSING IF NECESSARY	ADJUST TOE-IN TO SPECIFICATIONS	DYNAMIC OR STATIC BALANCE WHEELS	ROTATE TIRES AND INSPECT SUSPENSION

Fig. 2H-3 Tire Wear Patterns



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Fig. 2H-4 Wide Tread Bias-Belted Tire Wear

This wear characteristic is a normal condition with wide tread bias-belted tires and is related to the tread deflection properties of these tires. When the tread is pressed against the road surface, all tread ribs do not support equal portions of weight. The outer and center ribs support the most weight while the second and sixth ribs support the least. Because of the lighter load on the second and sixth ribs, they are able to deflect more and tend to slip and scrub slightly as the tire rotates. This action causes more wear on these ribs.

Wear on the second and sixth ribs cannot be reduced by over or underinflating the tires. Maximum benefit in minimizing wear is obtained only by adhering to the specifications recommended for tire inflation pressures, tire rotation, and front wheel alignment.

TIRE MAINTENANCE AND CONDITION

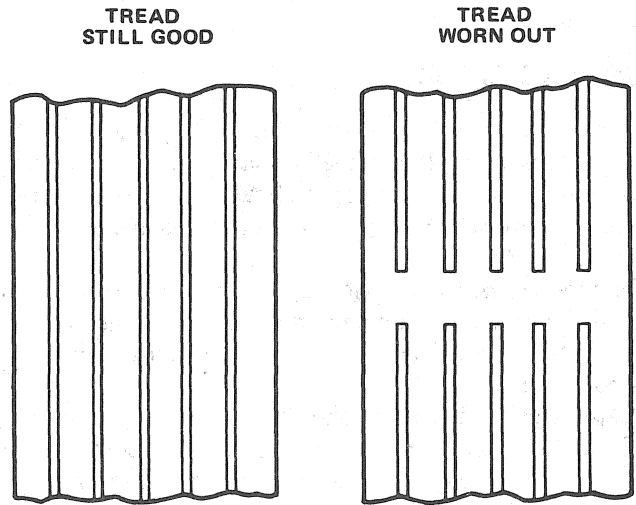
To maximize tire performance, inspect tires frequently for signs of incorrect inflation and uneven wear which may indicate a need for balancing, rotation, or alignment. Tires should also be inspected frequently for cuts, abrasions, stone bruises, blisters, or for objects imbedded in the tire. Weekly inspection intervals are recommended as a minimum. More frequent inspections are recommended when extreme temperature changes occur or where road surfaces are rough or occasionally littered with debris.

As a further check of tire condition, tread wear indicators are molded into the bottom of the tread grooves. These indicators appear in the form of 1/2 inch (13 mm) wide bands across the tread when it has worn to a thickness of 1/16 inch (1.58 mm) or less (fig. 2H-5). The tire should be replaced when these bands become visible.

A number of states have statutes concerning minimum permissible tread depths and use these indicators as the tire wear limit.

Clean tires using a mild soap and water solution only and rinse thoroughly with water. Do not use caustic solutions or abrasive materials. To clean white sidewalls

and raised letters and numbers, use an approved white-wall cleaner only. Do not use steel wool, wire brushes, or materials having a mineral oil base such as gasoline, paint thinner, or turpentine. These materials are harmful to the tires and will also discolor the white sidewalls and raised figures.



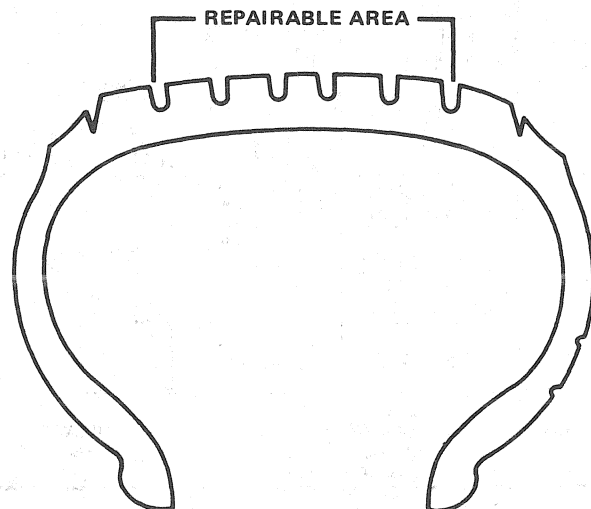
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Fig. 2H-5 Tread Wear Indicators

TIRE REPAIR

Punctured tires should be removed from the wheel and permanently repaired from the inside using a combination repair plug and vulcanized patch. When repairing punctures, always follow the manufacturers instructions for repair kit installation.

Punctures in the tread area only are repairable (fig. 2H-6). Never attempt to repair punctures in the tire



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Fig. 2H-6 Tire Repair Area

shoulders or sidewalls. In addition, never attempt to repair any tire that has sustained the following damage:

- Bulges or blisters
- Ply separations
- Broken, cut, or cracked beads
- Fabric cracks or cuts
- Tires worn to the fabric or if wear indicators are visible
- Punctures larger than 1/4 inch (6 mm) in diameter

Externally applied repair plugs, blowout patches, and aerosol sealants should be considered as emergency-type repairs only. Tires repaired in this fashion should not be driven at speeds over 40 mph (64 km/h) or for more than 75 miles (121 kilometers) before permanent repair is made.

TIRE ROTATION

To equalize wear, tires should be rotated at the intervals specified in the Mechanical Maintenance Schedule. The first rotation is the most important in setting the stage for even tread wear. After rotation, adjust tire inflation pressures to the levels recommended in the Tire Inflation Pressure Chart.

Radial tires are not rotated in the same manner as conventional tires. Conventional tires are rotated in a crossing pattern. Radial tires are rotated on the same side; front-to-rear (fig. 2H-7).

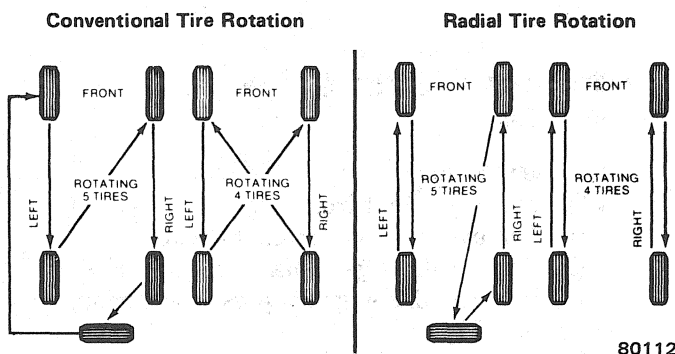


Fig. 2H-7 Tire Rotation

RADIAL, WIDE TREAD AND SNOW TIRE APPLICATIONS

Radial, wide tread, mud and snow, or conventional tires must be installed in **complete sets** only. This is especially important on vehicles with Quadra-Trac. Different tire types must not be intermixed at any time.

CAUTION: *Tires installed on Jeep four-wheel drive vehicles must all be of equal circumference to maintain satisfactory operation. They must also be the same size, tread pattern, make, construction, and inflation pressure. Intermixing tires of different size or construction will cause unusual handling, noisy operation, and accelerated wear of driveline components.*

Wide tread tires must be installed in complete sets and only when there is adequate clearance for the tire in the wheel well. Refer to the Tire Inflation Pressure Chart for tire sizes allowable on each model.

Radial tires must never be intermixed with bias-ply or bias-belted tires on any vehicle. Intermixing these tires will produce an adverse effect on vehicle handling and cornering stability. In an emergency situation, tires may be intermixed but only for the duration of the emergency and only if vehicle speed is kept below 40 mph (64 km/h).

Mud and snow tires must not be intermixed with conventional tread tires on any vehicle. These tires must also be of the same size, tread pattern, make, construction, and inflation pressure. In addition, never mix bias-ply or bias-belted snow tires with radial-ply mud or snow tires.

POLYSPARE TIRE

The Polyspare lightweight spare tire furnished with Cherokee and Wagoneer models and J-10 trucks is designed for emergency use only. Operation of the tire at speeds over 50 mph (80 km/h) and travel in excess of 100 continuous miles (160 km) is not recommended.

The Polyspare tire is mounted on a standard type 15 x 6-inch steel wheel. Correct inflation pressure is 32 psi (221 kPa) and the tire can be inflated with conventional inflation equipment. Installation and removal of Polyspare does not require special tools and the anticipated tread life is approximately 3,000 miles (4 800 km).

WHEELS

The standard equipment wheels used on Jeep vehicles are safety rim, drop center, J-type wheels of all-steel construction. Optional wheels include chrome-plated styled steel wheels, wide rim spoke-type steel wheels, and forged aluminum wheels.

Steel wheels are of two-piece construction consisting of a rim and center section (spider). The two sections are welded together to form a seamless, air-tight assembly.

WHEEL MAINTENANCE AND CONDITION

Wheel condition should be checked frequently. Replace any wheel that is cracked, bent, severely dented, has excessive runout, or has broken welds. The tire inflation valve should also be inspected frequently for wear, leaks, cuts, or looseness and should be replaced if damaged or worn.

Clean all wheels with a mild soap and water solution only and rinse thoroughly with water. Never use abrasive or caustic materials, especially on aluminum or chrome plated wheels as the surface will be etched or the plating severely damaged. After cleaning aluminum or chrome plated wheels, apply a coating of protective wax to preserve the finish and lustre.

WHEEL BALANCING

Wheel balancing may be performed using on or off-vehicle equipment. However, when using on-vehicle balancing equipment, observe the following precautions:

- On vehicles with a Trac-Lok rear axle, do not use on-vehicle equipment to balance the rear wheels. Instead, remove the wheels and balance them off the vehicle using a two-plane, dynamic balancer.
- On vehicles with front hubs, place the hubs in the 4 x 2 or Free position before balancing front wheels.
- Before balancing wheels on a vehicle equipped with a Model 208 or 300 transfer case, shift the transmission and transfer case into neutral.
- Before balancing wheels on a vehicle equipped with a Quadra-Trac Model 219 transfer case, disconnect the front or rear propeller shafts as required.

Because of their unique construction, radial tires are sometimes less responsive to certain balancing techniques. In some cases, dynamic two-plane, off-vehicle type balancing equipment will provide the most satisfactory results with radial tires.

When balancing aluminum or chrome plated wheels, take care to avoid damaging the wheel surface when installing balance weights. Use self-adhering type weights on aluminum wheels only and install them on the back side of the wheel whenever possible.

WHEEL BEARING ADJUSTMENT

Wheel bearing adjustment is very important because it establishes the operating clearance of the wheel bearings. A tight adjustment preloads the bearings excessively causing them to overheat. A loose adjustment allows the hub to shift position as bearing load varies during acceleration, braking, and cornering. A loose bearing adjustment can produce shimmy, vibration, and low brake pedal heights as a result of disc brakeshoe knock back caused by rotor wobble.

Front Wheel Bearing Adjustment—CJ Models

- (1) Raise vehicle.
- (2) Remove bolts attaching front hub to rotor hub and remove hub body and gasket.
- (3) Remove snap ring from axle shaft and remove hub clutch assembly.
- (4) Straighten lip of outer locknut tabbed washer (fig. 2H-8).
- (5) Remove outer locknut and tabbed washer.
- (6) Loosen, then tighten inner locknut to 50 foot-pounds (68 N•m) torque using tool J-25103. Rotate wheel while tightening nut to seat bearing properly.
- (7) Back off inner locknut 1/6 turn (45°-65°) while rotating wheel. Wheel must rotate freely and not display any lateral movement.
- (8) Install tabbed washer and outer locknut.

(9) Tighten outer locknut to 50 foot-pounds (68 N•m) torque using tool J-25103 and bend lip of tabbed washer over locknut.

(10) Recheck bearing adjustment. Wheel must rotate freely and not display any lateral movement.

(11) Install hub clutch assembly on axle shaft.

(12) Install snap ring on axle shaft.

(13) Install gasket and hub body. Tighten hub bolts to 30 foot-pounds (41 N•m) torque.

(14) Lower vehicle.

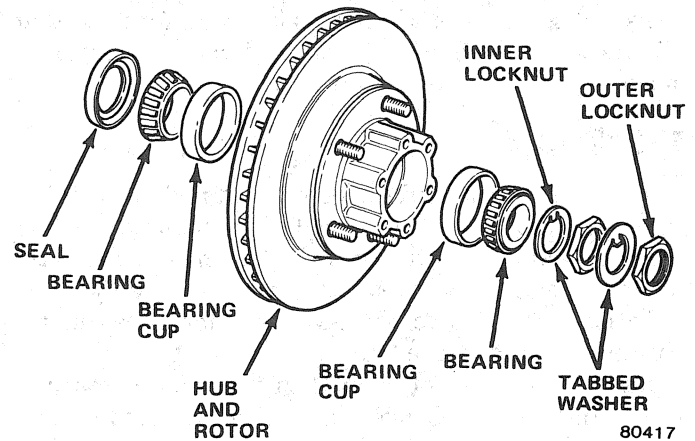
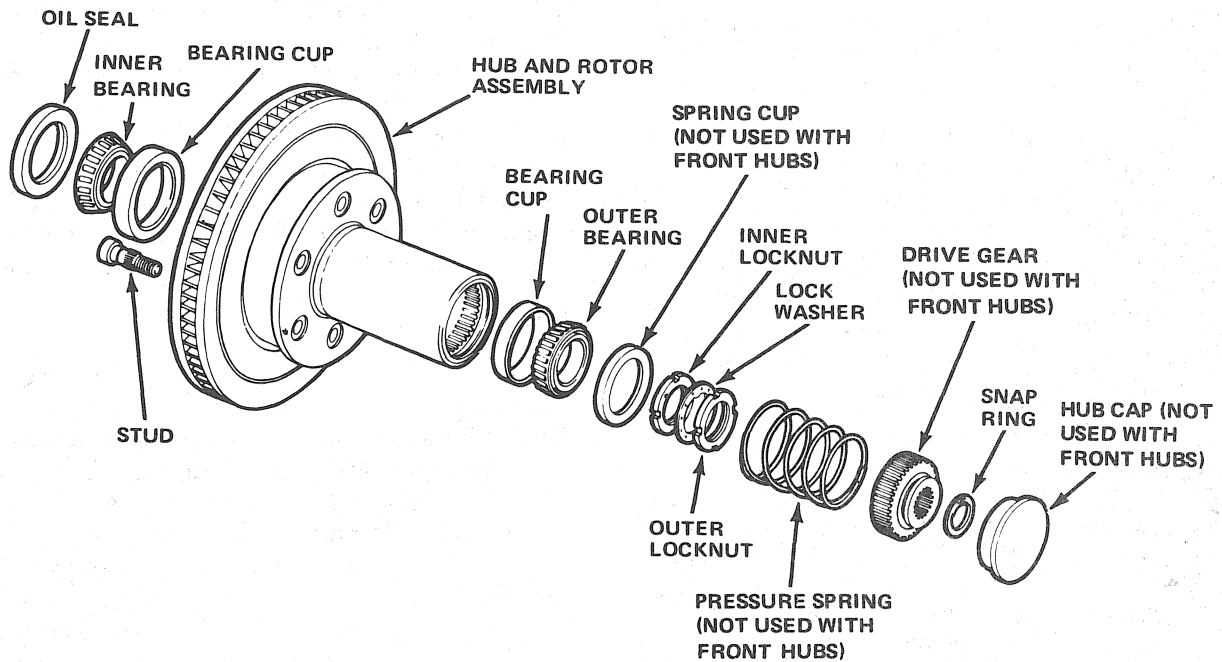


Fig. 2H-8 Rotor and Wheel Bearings—CJ Models

Front Wheel Bearing Adjustment—Cherokee-Wagoneer-Truck

- (1) Raise vehicle.
- (2) On models without front hubs:
 - (a) Remove wheel cover and hubcap.
 - (b) Remove drive gear snap ring (fig. 2H-9).
 - (c) Remove drive gear, pressure spring, and spring cup (fig. 2H-9).
- (3) On models with front hubs:
 - (a) Remove socket head screws from hub body and remove body from hub clutch assembly.
 - (b) Remove large retaining ring from hub. Remove small retaining ring from axle shaft.
 - (c) Remove hub clutch assembly.
- (4) Remove outer locknut and lockwasher (fig. 2H-9).
- (5) Seat bearings by loosening, then tightening inner locknut to 50 foot-pounds (68 N•m) torque using tool J-6893. Rotate wheel while tightening locknut to seat bearings uniformly.
- (6) Back off inner locknut 1/6 turn (45°-65°) while rotating wheel.
- (7) Install lockwasher. Align one of lockwasher holes with peg on inner locknut and install washer on nut.



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Fig. 2H-9 Rotor and Wheel Bearings—Cherokee-Wagoneer-Truck

(8) Install outer locknut. Tighten outer locknut to minimum of 50 foot-pounds (68 N•m) torque using tool J-6893.

(9) Recheck bearing adjustment. Wheel must rotate freely and not display any lateral movement.

(10) On models without front hubs:

(a) Install spring cup and pressure spring.

CAUTION: The spring cup must be installed so the recessed side faces the bearing and the flat side faces the pressure spring. The pressure spring should contact the flat side of the cup only.

(b) Install drive gear and drive gear snap ring.

(c) Coat hubcap rim with Permatex Form-A-Gasket No. 3 or equivalent and install hubcap.

(11) On models with front hubs:

(a) Install hub clutch assembly.

(b) Install small retaining ring on axle shaft.

Install large retaining ring on hub.

(c) Install hub body on hub clutch.

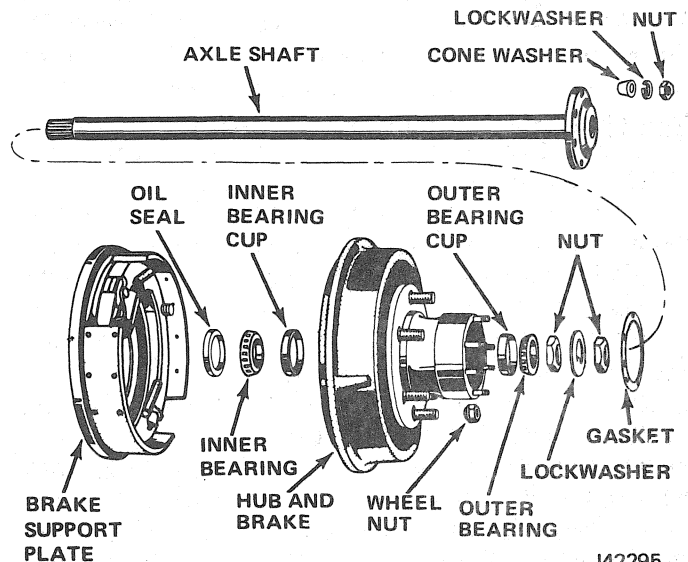
(d) Install socket head screws in hub. Tighten screws to 30 inch-pounds (3 N•m) torque.

(12) Lower vehicle.

thrust in either direction. However, the tapered axle shafts used in CJ models (AMC/Jeep axle) do require correct axle shaft end play to maintain proper bearing operating clearances. Refer to Chapter 2F—Axles for end play measurement and adjustment procedures.

Model 60 Full-Floating Rear Axle

(1) Remove axle shaft attaching bolts, lockwashers, and cone washers (fig. 2H-10).



J42295

Fig. 2H-10 Model 60 Rear Axle Hub and Bearings

Rear Wheel Bearing Adjustment

AMC/Jeep Rear Axle

The wheel bearings used in Cherokee, Wagoneer and J-10 Truck models do not require adjustment. The shafts used in these axle models are equipped with tapered roller bearings which are capable of accepting lateral

- (2) Remove axle shaft and shaft gasket. Discard gasket.
- (3) Straighten lip of lockwasher and remove locknut and lockwasher.
- (4) Raise vehicle.
- (5) Rotate wheel and tighten adjusting nut to 50 foot-pounds (68 N•m) torque using tool J-25106.
- (6) Back off adjusting nut about 1/6-turn or until wheel rotates freely without lateral movement.
- (7) Install and tighten locknut to 50 foot-pounds (68 N•m) torque and bend lockwasher lip over locknut.
- (8) Check adjustment and correct if necessary.
- (9) Install replacement axle shaft gasket and axle shaft. Install cone washers, lockwashers, and bolts.
- (10) Lower vehicle.

TIRE ROUGHNESS

Roughness, vibration, tramp, shimmy, and thump are usually caused by excessive wheel or tire runout, cupped tires, or wheel/tire unbalance. These problem conditions may also be caused by operation over rough or undulating road surfaces. Driving the vehicle on different road surfaces will usually help determine if the road surfaces or tires are causing the problem.

Always road test the vehicle to determine the exact nature of the problem. Drive the vehicle for at least seven miles (11 km) to warm the tires and remove temporary flat spots that may have formed while the vehicle was parked. Note tire condition and wear and check and adjust inflation pressures to recommended levels before road testing.

Radial Tire Performance Characteristics

As a result of their unique construction, radial tires produce ride, handling, and appearance characteristics that are noticeably different from conventional tires.

The low speed ride quality or feel of radial tires may seem harsh when compared to conventional tires. This is a normal characteristic and is due to the stiff belts used in radial tire construction. Harshness often leads to the assumption that the tires are overinflated. Do not underinflate radial tires in an attempt to correct this condition. Inflate radial tires to recommended levels only.

Because radial tire body plies are positioned at a 90 degree angle to the tread centerline, they have highly flexible sidewalls. It is this flexibility which produces a characteristic sidewall bulge making the tire appear underinflated. This is a normal condition. Do not attempt to reduce this bulge by overinflating the tire. Check inflation pressure using an accurate gauge and inflate radial tires to recommended levels only.

At speeds of 15 mph (24 km/h) or less, radial tires may generate a side-to-side or waddle motion. This motion is a normal radial tire characteristic and is due to the highly flexible sidewall. An objectionable waddle condition can be reduced only by rotating the tires. Wheel balancing will not alleviate this condition.

Proper mounting of radial tires is very important. Incomplete seating of the tire bead can produce a high frequency vibration at speeds above 45 mph (72 km/h). Improper bead seating can be checked by visually inspecting the tire. Correction involves removing and re-seating the tire on the wheel.

Because of their construction, radial tires are sometimes less responsive to certain methods of wheel balancing. Radial tire balancing is best accomplished using dynamic, two-plane, off-vehicle balance equipment.

Tire Thump

Thump noise is caused by the tire moving over irregularities in the road or by irregularities in the tire itself. The sound coincides with each wheel revolution.

To determine which tire is causing thump, inflate all tires to 45 psi (310 kPa) temporarily and drive over the same roads. If thump stops, reduce the pressure in one tire at a time and repeat the road test. Perform this procedure until all tires have been tested and each test is made with three tires at high pressure and one tire at recommended pressure. When thump develops again, the tire just reduced to normal inflation pressure is the problem tire.

NOTE: Although the procedure for diagnosing thump is usually effective with conventional tires, it is considerably less effective with radial tires.

Tire Tramp

Tramp is caused by wheel/tire static unbalance or by excessive lateral runout of the tire or wheel.

The most effective method for checking static balance is by using off-vehicle balancing equipment.

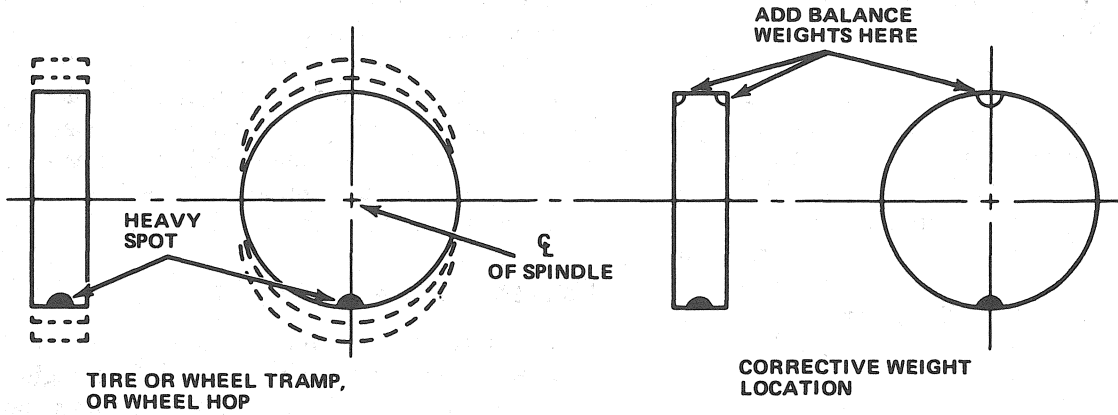
Static balance is the result of an equal distribution of wheel and tire weight about the circumference of the tire. In this case, weight is distributed about the spindle in such a manner that the assembly lacks the tendency to rotate by itself when mounted on the arbor of a balancing machine.

Static unbalance occurs when an unequal portion of weight is concentrated at one point on the tire and wheel (fig. 2H-11). It causes a vibratory-type pounding action which is referred to as tramp or hop.

Dynamic balance is the result of an equal distribution of wheel/tire weight around the plane of rotation (fig. 2H-12). This causes the wheel to rotate smoothly about the axis that bisects the wheel and tire centerline.

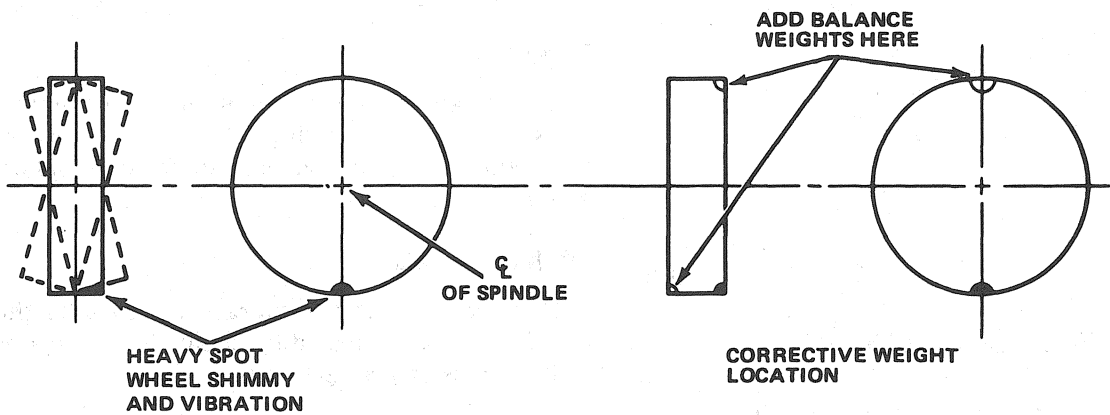
Dynamic unbalance occurs when unequal forces are concentrated at opposing points on the tire circumference. It will cause shimmy and vibration at medium and high speeds (fig. 2H-12).

The most effective method for balancing wheels and tires is by using equipment that will correct both static and dynamic balance. Dynamic, two-plane balancing equipment is preferable.



70227

Fig. 2H-11 Static Unbalance



70226

Fig. 2H-12 Dynamic Unbalance

Since procedures vary with different machines, follow the equipment manufacturers operating instructions explicitly to obtain satisfactory results.

WARNING: On-vehicle type wheel balancers may be used on the rear wheels of vehicles equipped with a Trac-Lok differential, but only after raising the rear end and removing the wheel opposite the one being balanced. In addition, do not exceed 35 mph (56 km/h) on the speedometer when spinning wheels. As a result of differential action, actual wheel speed is double the speed indicated on the vehicle speedometer. The centrifugal force generated by a tire spinning at high speed could cause damage and personal injury.

Wheel and Tire Runout

Excessive radial or lateral runout of a wheel or tire can cause roughness, vibration, tramp, tire wear, and steering wheel tremor.

Before checking runout, drive the vehicle for at least seven miles to remove temporary flat spots that may have formed in the tires. Flat spots must be removed to avoid false readings when measuring runout.

Measure runout using a dial indicator. All measurements should be made on the vehicle with the tires

inflated to recommended levels and with the wheel bearings adjusted to specifications.

Measure radial runout at the center and outside ribs of the tread face (fig. 2H-13). Measure lateral runout at the tire sidewall just above the buffing rib on the sidewall (fig. 2H-13).

On conventional tires, radial runout should not exceed 0.105 inch (2.66 mm) and lateral runout should not exceed 0.080 inch (2.03 mm). Mark the high points of lateral or radial runout for reference.

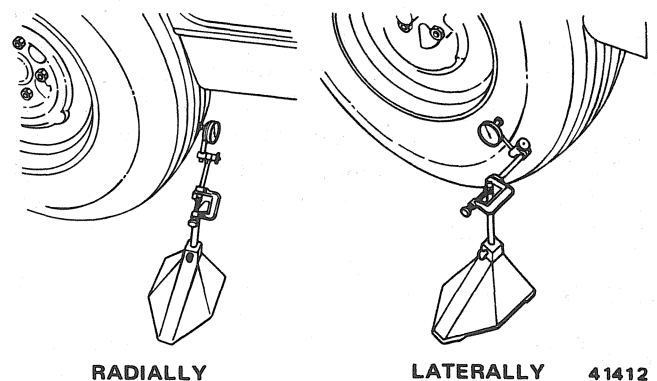


Fig. 2H-13 Measuring Tire Runout

On radial tires, radial runout should not exceed 0.080 inch (2.03 mm) and lateral runout should not exceed 0.100 inch (2.54 mm).

If the tire radial or lateral runout exceeds specified limits, it will be necessary to check wheel runout to determine whether the wheel or tire is at fault.

Wheel radial runout is measured at the wheel rim just inside of the wheel cover retaining nibs (fig. 2H-14). Wheel lateral runout is measured at the wheel rim bead flange just inside the curved lip of the flange (fig. 2H-14). Mark the high points of radial or lateral runout for reference.

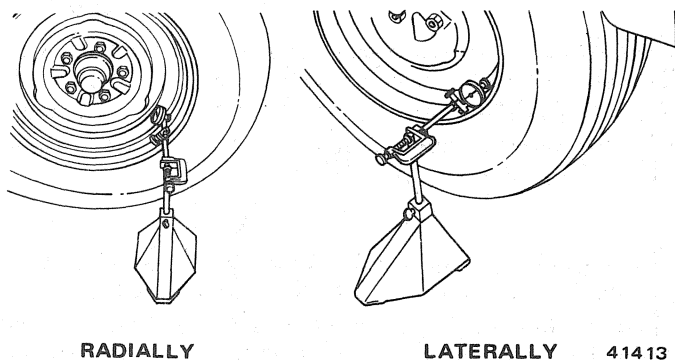


Fig. 2H-14 Measuring Wheel Runout

Wheel radial runout should not exceed 0.035 inch (0.88 mm). Wheel lateral runout should not exceed 0.045 inch (1.14 mm).

If tire runout exceeds specified limits but wheel runout is within limits, runout may be reduced to an acceptable level by changing tire position on the wheel so that the previously marked high points are 180 degrees apart.

NOTE: On vehicles with disc brakes, excessive wheel lateral runout may be caused by excessive rotor hub-to-bore runout. Refer to the Rotor Inspection procedure in Chapter 2G.

VIBRATION

Vibration may be caused by tire and wheel unbalance or runout, incorrect wheel bearing adjustment, loose or worn suspension or steering components, worn or defective tires, certain tire tread patterns, incorrect universal joint angles, worn universal joints, excessive propeller shaft runout or yoke runout, rotor or brakedrum runout, loose engine or transmission supports, or by engine operated accessories.

Vibration Types

There are two types of vibration which are referred to as mechanical and audible.

Mechanical vibrations are felt through the seats, floorpan, or steering wheel and usually produce some

visible motion in the rear view mirror, fenders, dash panel, or steering wheel.

Audible vibrations are heard or sensed above normal background noise and may or may not be accompanied by a mechanical vibration. In some cases, they occur as a droning or drumming noise while in other cases they produce a buffeting sensation that is felt or sensed by the driver rather than heard.

Vibration Sensitivity

Mechanical and audible vibrations are sensitive to changes in engine torque, vehicle speed, or engine speed. They usually occur within one, or sometimes two well-defined ranges in terms of vehicle speed, engine rpm, and torque application.

Torque Sensitive

This means that the condition can be improved or worsened by accelerating, decelerating, coasting, or maintaining a steady vehicle speed and application of engine torque.

Vehicle Speed Sensitive

This means that the vibration occurs at the same speed and is not affected by engine torque, engine rpm, or transmission gear selected.

Engine Speed Sensitive

This means that the vibration occurs at varying vehicle speeds when a different transmission gear is selected. It can sometimes be isolated by increasing or decreasing engine speed with the transmission in neutral.

Vibration Diagnosis

A proper vibration diagnosis should always begin with a road test. Corrective measures should not be attempted until the vibration type, magnitude, and speed range have been established by a road test.

Road Test

During the road test, drive the vehicle on a road that is smooth and free of undulations. If vibration is apparent, note and record the following:

- The speed range in which vibration occurs
- The type of vibration—mechanical or audible
- If the vibration is affected by changes in vehicle speed, engine rpm, or engine torque
- Determine the vibration sensitivity—torque sensitive, engine speed sensitive, or vehicle speed sensitive

Diagnosis Procedure

When the vibration type, sensitivity, and range has been determined, refer to the Vibration Diagnosis Chart for probable causes.

Consider correcting only those items coded on the charts that are related to the problem condition.

Refer to the following correction codes for a description of the various corrective procedures.

Vibration Diagnosis Chart Codes

TRR—Tire and Wheel Radial Runout. Vehicle speed sensitive mechanical vibration. Not a cause of vibration below 20 mph. Speed required to cause vibration increases as runout decreases.

WH—Wheel Hop. Vehicle speed sensitive mechanical vibration. Not a cause of vibration below 20 mph (32 km/h). Generates rapid up-down movement in steering wheel and dash panel. Most noticeable in 20-40 mph (32-64 km/h) speed range. Caused by tires having radial runout of more than 0.045 inch (1.14 mm). Balancing ineffective, faulty tire should be replaced.

TB—Tire Balance. Vehicle speed sensitive mechanical vibration. Static unbalance not a cause of vibration below 30 mph (46 km/h). Dynamic unbalance not a cause of vibration below 40 mph (64 km/h).

TLR—Tire and Wheel Lateral Runout. Vehicle speed sensitive mechanical vibration. Not a cause of vibration below 50-55 mph (80-88 km/h) unless runout is extreme. Generates front end shimmy if extreme.

TW—Tire Wear. Vehicle speed sensitive mechanical vibration. Abnormal wear causes vibration in 30-55 mph (50-88 km/h) range and may generate whine noise at high speed changing to growl noise at low speed.

W—Radial Tire Waddle. Normal condition with radial tires. Construction causes side-to-side motion at speeds up to 15 mph. Rotate tires to reduce condition. Replace tires if condition is extremely severe.

UJA—Universal Joint Angles. Incorrect angles cause mechanical vibration below 20 mph (32 km/h) changing to mechanical and/or audible vibration at 35 to 55 mph (56 to 88 km/h). Torque sensitive vibration.

UJ—Universal Joints. If needle bearings, bearing cups, or bearing ends of spiders are worn, damaged, overtightened, or loose, they will cause mechanical vibration at almost any speed. Torque and vehicle speed sensitive vibration.

PSY—Propeller Shaft and Yokes. Not a cause of vibration below 35 mph (56 km/h). Excessive runout, unbalance, missing balance weights, undercoating on shaft tube, dents or bends in tube will cause mechanical vibration at 35 mph (56 km/h) and above. Torque and vehicle speed sensitive vibration.

WB—Wheel Bearings. Loose bearings cause shimmy-like vehicle speed sensitive mechanical vibration at 35 mph (56 km/h) and above. Rough or damaged bearings will also generate growl noise at low speed or whine noise at high speed.

AN—Axle Noise. Axle not a cause of vibration unless axle shaft is bent or front axle shaft U-Joint is damaged. Worn or damaged axle gears or bearings will cause noise in varying speed ranges in relation to amount of engine torque applied.

SSC—Suspension and Steering Components. Worn, damaged, or loose suspension components (steering damper, steering knuckles, pitman arm, springs, spring U-bolts or center bolts, shocks, tie rod ends, etc.) can cause mechanical or audible vibrations at many speeds. Can be torque and vehicle speed sensitive.

EA—Engine Driven Accessories. Loose or broken AC compressor, power steering pump, water pump, air pump, alternator, etc. can cause engine speed sensitive mechanical vibration. Usually apparent when transmission is shifted into neutral and engine rpm increased.

ADB—Accessory Drive Belts. Loose, worn belts can cause engine speed sensitive audible vibration that sounds like droning, fluttering, or rumbling noise.

DEM—Damaged Engine or Transmission Mounts. If loose, worn, or broken can allow engine, transmission, or engine accessories to contact body causing noise and vibration.

ES—Exhaust System. Loose or broken components may contact body causing noise. In addition, mispositioned components (e.g., muffler, converter, pipes, hangers) may also contact body or driveline components causing noise.

SPECIFICATIONS

Vibration Diagnosis Chart

Vibration Sensitivity	Correction Codes For Mechanical Vibrations Within Specific MPH (km/h) Ranges									
	10 (16 km)	20 (32 km)	30 (48 km)	40 (64 km)	50 (80 km)	60 (96 km)	70 (112 km)	80 (128 km)	90 (144 km)	
Vehicle Speed Sensitive		← W →								
Torque Sensitive										
Engine Speed Sensitive										

Vibration Sensitivity	Correction Codes For Audible Vibrations Within Specific MPH (km/h) Ranges									
	10 (16 km)	20 (32 km)	30 (48 km)	40 (64 km)	50 (80 km)	60 (96 km)	70 (112 km)	80 (128 km)	90 (144 km)	
Vehicle Speed Sensitive										
Torque Sensitive										
Engine Speed Sensitive										

Tire Inflation Pressure Chart

Model	GVW Rating		Tire Size	Load Range	Normal Load ①				Maximum Load ②				Wheel Size	
					Sustained Driving Over 65 mph (105 km/h) ③		Under 65 mph (105 km/h)		Sustained Driving Over 65 mph (105 km/h) ③		Under 65 mph (105 km/h)			
	lbs	kg			Front	Rear	Front	Rear	Front	Rear	Front	Rear		
CJ-5 & CJ-7	3750	1700	9-15LT	B	35	35	25	25	40	40	30	30	15 x 8 15 x 5.50 15 x 8	
	&	&	H78-15	B & D	24	24	20	20	28	28	24	24		
	4150	1882	L78-15	B & C	24	24	20	20	24	24	20	20		
Cherokee & Wagoneer	6200	2812	L78-15	B	24	24	20	20	32	32	28	28	15 x 8 15 x 7 15 x 7 15 x 8	Aluminum Wheel is 15 x 7
			P225/75R-15	SL ③	31	31	28	28	35*	35*	32	32		
			P235/75R-15	SL ③	31	31	28	28	35*	35*	32	32		
			10R-15LT	B	35	35	25	25	45*	45*	35	35		
J-10 Truck	6200	2812	H78-15	B	28	28	24	24	32*	32*	32	32	15 x 6 15 x 6 15 x 8 15 x 6 15 x 8	Aluminum Wheel is 15 x 7
			H78-15	D	28	28	24	24	36	36	32	32		
			L78-15	B	24	24	20	20	32	32	28	28		
			P225/75R-15	SL ③	31	31	28	28	35*	35*	32	32		
			10R-15LT	B	35	35	25	25	45*	45*	35	35		
J-20 Truck	6800	3084	8.75-16.5	C	40	40	30	30	50*	55*	40	45	16.5 x 6 16.5 x 6.75 16.5 x 6.75 16.5 x 6.75	
	7600	3447	9.50-16.5	D	45	45	35	35	55*	70*	45	60		
	8400	3810	9.50-16.5	D	45	45	35	35	55*	70*	45	60		
	8400	3810	9.50-16.5	D	45	45	35	35	55*	70*	45	60		
Cherokee & Wagoneer with Snow Plow Package	6200	2812	H78-15	D	28	28	24	24	40*	40*	38	38	15 x 6 15 x 7	Aluminum Wheel is 15 x 7
			H78-15	D	28	28	24	24	40*	40*	38	38		
J-10 Truck with Snow Plow Package	6200	2812	H78-15	D	28	28	24	24	40*	40*	38	38	15 x 6	Aluminum Wheel is 15 x 7

NOTE: Inflate tires while cold, before running. Do not reduce pressure if tires are warm.

*Speed limited to 74 mph (119 km/h).

① Normal Load: Frequently selected accessories plus driver and two passengers. For CJ models, driver and one passenger.

② Maximum Load: Gross Vehicle Weight Rating (GVWR).

③ SL is approximate metric tire equivalent of load range B.

④ Sustained driving over 74 mph (119 km/h) for Cherokee and Wagoneer except where indicated by asterisk (*).

Torque Specifications

Service Set-To Torques should be used when assembling components. Service In-Use Recheck Torques should be used for checking a pre-torqued item.

	USA (ft-lbs)		Metric (N·m)	
	Service Set-To Torque	Service In-Use Recheck Torque	Service Set-To Torque	Service In-Use Recheck Torque
Caliper Mounting Bolt (Cke-Wag-Trk)	35	30-40	47	41-54
Caliper Support Key Retaining Screw (CJ)	15	15-18	20	20-24
Wheel Retaining Nuts:				
CJ	75	65-80	102	88-108
Cke-Wag-J-10 Trk	75	65-90	102	88-122
J-20 Trk (8400 GVW)	130	110-150	176	149-203
Wheel Bearing Adjustment (CJ):				
Outer Locknut	50	50 min.	68	68 min.
Inner Locknut (Adjusting Nut)			Tighten to 50 foot-pounds (68 N·m) torque and back locknut off 1/6 turn (45°-65° while rotating wheel	
Wheel Bearing Adjustment (Cke-Wag-Trk):				
Outer Locknut	50	50 min.	68	68 min.
Inner Locknut			Tighten to 50 Foot-pounds (68 N·m), and back off locknut 1/6 turn (45°-65°) while rotating wheel	
Tire Radial Runout:				
Conventional Tire		0.105 inch		2.66 mm
Radial Tire		0.080 inch		2.03 mm
Tire Lateral Runout (All)		0.100 inch		2.54 mm
Wheel Radial Runout (All)		0.045 inch		1.14 mm
Wheel Lateral Runout (All)		0.045 inch		1.14 mm

All Torque values given in foot-pounds and newton-meters with dry fits unless otherwise specified.