

# SECTION C

## 43-44000 PROPELLER SHAFT

### CONTENTS

Division	Paragraph	Subject	Page
I	41-1	SPECIFICATIONS AND ADJUSTMENTS: Propeller Shaft Specifications . . . . .	40-32
II	41-2	DESCRIPTION AND OPERATION: Description of Propeller Shaft . . . . .	40-33
III	41-3 41-4 41-5 41-6 41-7 41-8 41-9	SERVICE PROCEDURES: Removal of Propeller Shaft . . . . . Disassembly of Propeller Shaft . . . . . Assembly of Propeller Shaft . . . . . Installation of Propeller Shaft . . . . . Checking Rear Universal Joint Angle (2 Methods) . . . . . Checking Propeller Shaft Run-Out . . . . . Propeller Shaft Balancing Procedure . . . . .	40-33 40-34 40-35 40-35 40-38 40-40 40-40
IV	41-10	TROUBLE DIAGNOSIS: Propeller Shaft Trouble Diagnosis . . . . .	40-41

## DIVISION I SPECIFICATIONS AND ADJUSTMENTS

### 41-1 PROPELLER SHAFT SPECIFICATIONS

#### a. Tightening Specifications

Use a reliable torque wrench to tighten the parts listed, to insure proper tightening without straining or distorting parts. These specifications are for clean and lightly lubricated threads only; dry or dirty threads produce increased friction which prevents accurate measurement of tightness.

Part	Location	Thread Size	Torque Lbs. Ft.
Nut	Rear Universal Joint to Pinion Flange (U-Bolt) . . . . .	5/16-18	12

#### b. General Specifications

Propeller Shaft . . . . .	1 Piece - Open Drive Line
Universal Joints . . . . .	2 Single

## DIVISION II

### DESCRIPTION AND OPERATION

#### 41-2 DESCRIPTION OF PROPELLER SHAFT

Power is transmitted from the transmission output shaft to the differential by either one of two type propeller shaft assemblies: One type, used on all cars, except Sportwagon, equipped with manual transmission, consists of a solid piece of tubular steel; the other type, used on all cars equipped with automatic and Sportwagon equipped with manual transmission, incorporates a combination steel and rubber shaft assembly. On either type, a universal joint and splined slip yoke are located at the transmission end and a second universal joint is used at the differential end. See Figure 40-45.

Two U-bolt type clamps are used to attach the rear universal joint to the pinion flange at the differential. The front universal joint attaches to the output shaft of the transmission by means of a splined slip yoke which permits fore and aft movement of the propeller shaft as the differential assembly moves up and down. This splined yoke connection is lubricated internally with transmission lubricant except on the Sportwagon 400 and the GS 400 when equipped with a Super Turbine 400 transmission. An oil seal at the transmission prevents loss of lubricant and protects the splined yoke from harmful foreign material.

The propeller shaft assembly requires very little periodic service. The universal joints are lubricated for life and cannot be lubricated while on the car. A service kit which consists of a spider with bearing assemblies and snap rings must be installed

on the car if a universal joint becomes worn or noisy. If it becomes necessary to repair a universal joint, the entire propeller shaft must be removed from the car. Care should be taken to avoid jamming or bending of any parts of the assembly.

If a car is to be undercoated, the propeller shaft must be kept completely free of undercoating material. Undercoating material or any other foreign material could upset the propeller shaft balance and produce serious vibration.

## DIVISION III

### SERVICE PROCEDURES

#### 41-3 REMOVAL OF PROPELLER SHAFT

1. Mark propeller shaft and companion flange so that shaft can be reinstalled in same position.

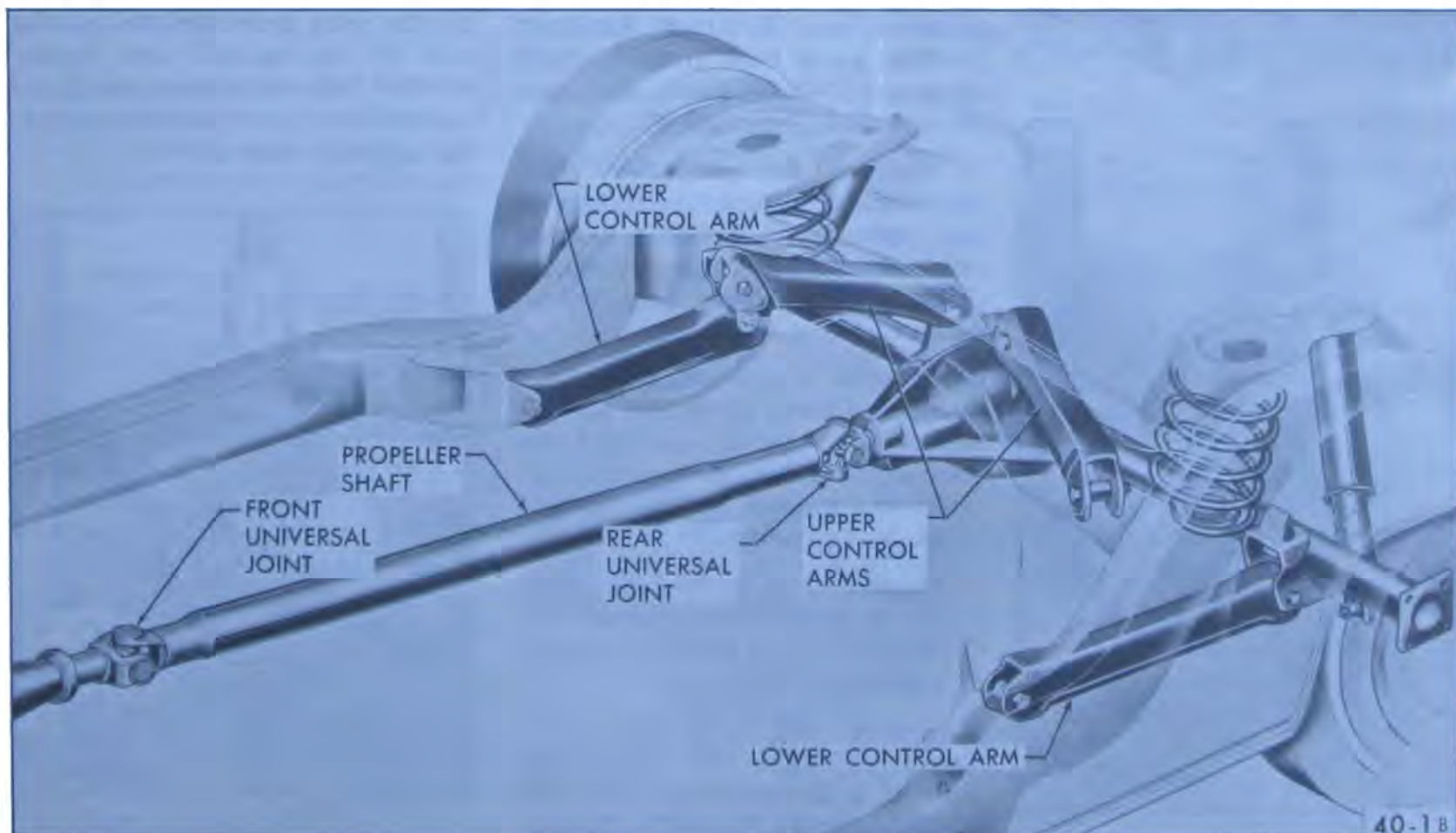


Figure 40-45—Propeller Shaft Assembly



Figure 40-46—Removing Snap Rings from Propeller Shaft

2. Remove U-bolt nuts and U-bolts from rear pinion flange.

**NOTE:** If universal spider bearings are not retained on spider with connecting strap, use tape or wire to retain bearings.

3. Remove entire propeller shaft assembly by sliding rearward to



Figure 40-48—Installing Spacer

disengage splines on transmission main shaft.

#### 41-4 DISASSEMBLY OF PROPELLER SHAFT

1. Remove snap rings from the bearings. The snap rings are on the inside of the yoke and can be removed with the aid of Tool J-9522-1. See Figure 40-46.

2. Set up Power Ram and Hydraulic Pump in preparation for removing the propeller shaft bearings. With this, use Axle Bearing and Retainer Replacer J-8853 as a base plate. Attach Adapter J-9522-2 to the ram screw. See Figure 40-47.

3. Position the propeller shaft universal joint into the fixture as set up in Step 2 with a bearing over the hole in Replacer J-8853. Install Spider Press J-9522-3 on spider.

With tools in position, actuate the pump and force the spider against the lower bearing, pushing the bearing as far out of the universal joint and through the hole in Tool J-8853 as possible.

**NOTE:** Care should be taken not to damage dust shield in the event that joint does not require replacement.

4. Release the pump and install Spacer J-9522-5 over the spider journal at the space provided with bearing forced partially through the yoke. See Figure 40-48. Re-position the propeller shaft in the

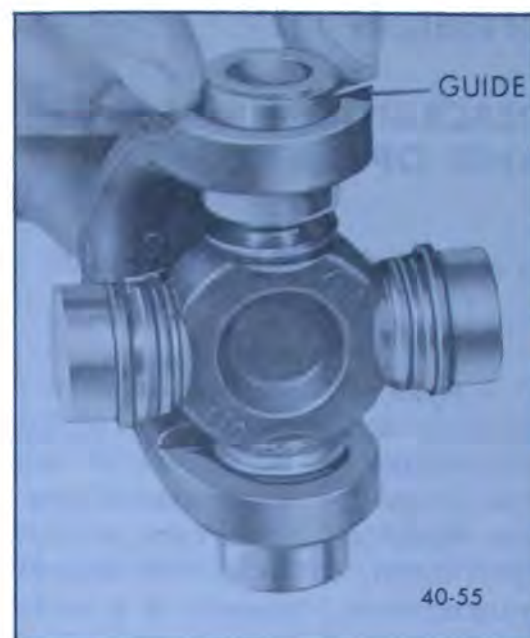


Figure 40-49—Installing Guide on U-Joint

fixture as before and force the bearing completely out of the yoke with the added assistance of the spacer.

5. Release pump and turn over propeller shaft. Install Guide J-9522-8 through the bearing hole in the yoke and over the journal end of the spider. See Figure 40-49. This guide assures alignment of the spider while removing the opposite bearing.



Figure 40-47—Pressing Out U-Joint Bearings

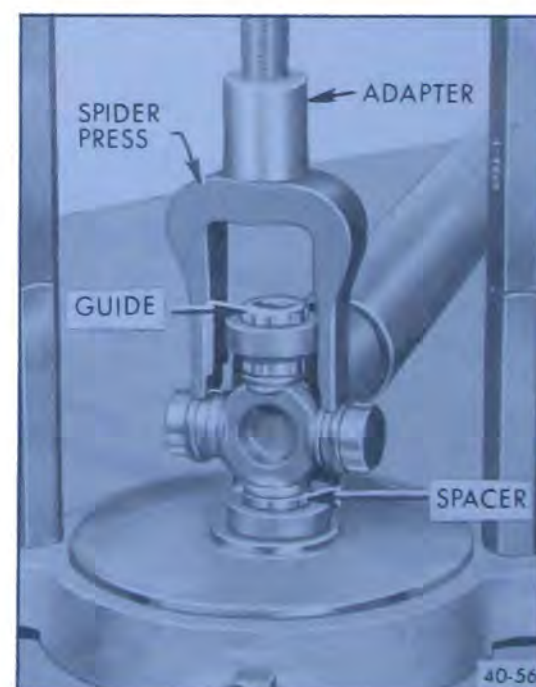


Figure 40-50—Removing Bearing with Guide and Spacer in Place



Figure 40-51—Pressing Bearing into Place

6. Install Spacer J-9522-5 adjacent to the bearing as in Step 4 and remove the bearing. See Figure 40-50.

7. Repeat Steps 3, 4, 5 and 6 to remove other bearings until the propeller shaft is disassembled to the point desired.

8. Wipe spider bearing surfaces clean and inspect for damage or wear. Inspect splined slip yoke for damage or wear. Replace any damaged parts.

#### 41-5 ASSEMBLY OF PROPELLER SHAFT

When inspection indicates any worn or damaged universal joint parts, always install a complete universal joint repair kit. Repair kits are listed in the Buick Master Parts Catalog under Group 5.442 and include a spider, four bearings and four snap rings.

1. Position the spider inside the yoke; it may face either direction. Make certain that the spider dust shields are not damaged upon installation.

2. Make certain that the bearings have a full set of rollers, are packed with lubricant and that the

seals are in position. Multi-purpose Universal Joint bearing grease #2 grade should be added to bearings if they are dry, although new bearings are normally pre-lubricated as received from the source.

Place the assembly in position with Power Ram and Pump as shown in Figure 40-51. Position the bearing straight over the hole in the yoke. Carefully pull up the spider so that the spider journal enters the loose bearing. With the pump, force the bearing into the yoke continuing to hold the spider up in this bearing. Failure to do this could cause the bearing needles to become dislodged if the journal is engaged incorrectly.

When the bearing is correctly positioned in the yoke, turn the assembly over. Again place the bearing over the hole in the yoke. Carefully slide the spider partially out of the previously seated bearing and start it carefully into the bearing being installed. This prevents the bearing needles from burring the edge of the spider journal if forced over journal other than straight. Even slight burring of the journal can cause premature failure.

While pressing bearings into position, move the spider back and forth to make certain that the spider journals engage the bearings squarely to avoid damage and binding. If binding exists,

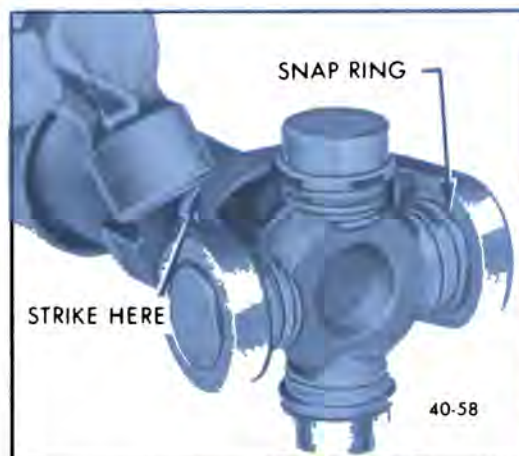


Figure 40-52—Seating U-Joint Snap Rings



Figure 40-53—Using Extension to Torque U-Bolt Nuts

remove the bearings and spider and examine for dislodged rollers or damaged journals.

3. While observing the previous precautions, install the balance of the bearings necessary to complete the assembly and install snap rings.

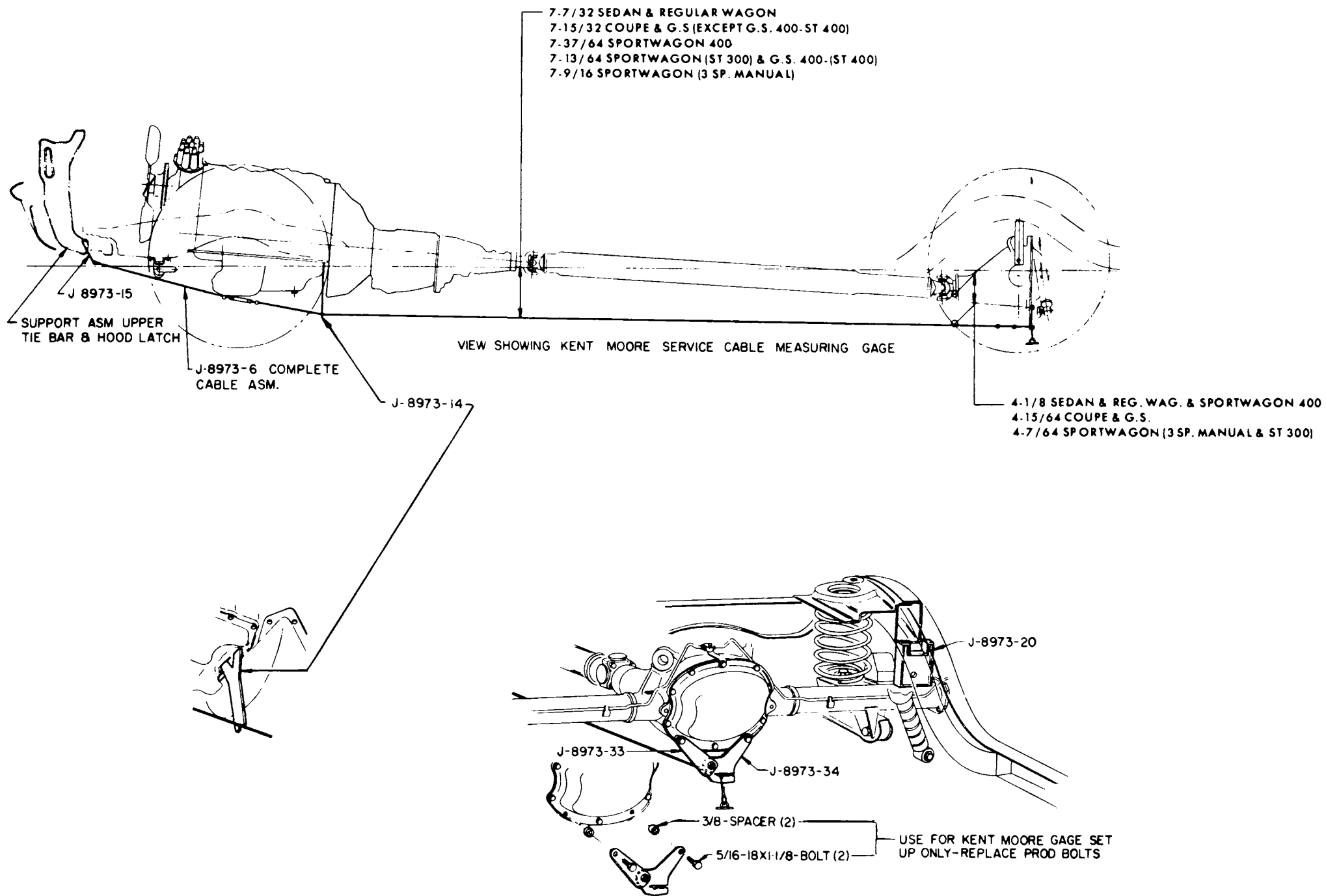
4. Strike the yoke with a hammer to fully seat the snap rings against the yoke. Turn the spider to make certain that it is free. See Figure 40-52.

#### 41-6 INSTALLATION OF PROPELLER SHAFT ASSEMBLY

1. Apply engine oil to splined propeller shaft yoke, then slide yoke and propeller shaft assembly onto transmission output shaft. (Sportwagon and G.S. 400 equipped with Super Turbine 400 Transmission) Apply sufficient grease (EP #1 grade) to internal splined area of slip spline so that depth of spline is completely filled.

**CAUTION:** Do not drive propeller shaft in place with hammer. Check for burrs on transmission output shaft spline or possibly the wrong U-joint yoke.

2. Position rear universal joint to differential pinion flange. Make certain spider bearings are properly aligned in pinion flange yoke.



40-90A

Figure 40-54—Checking Universal Joint Angle

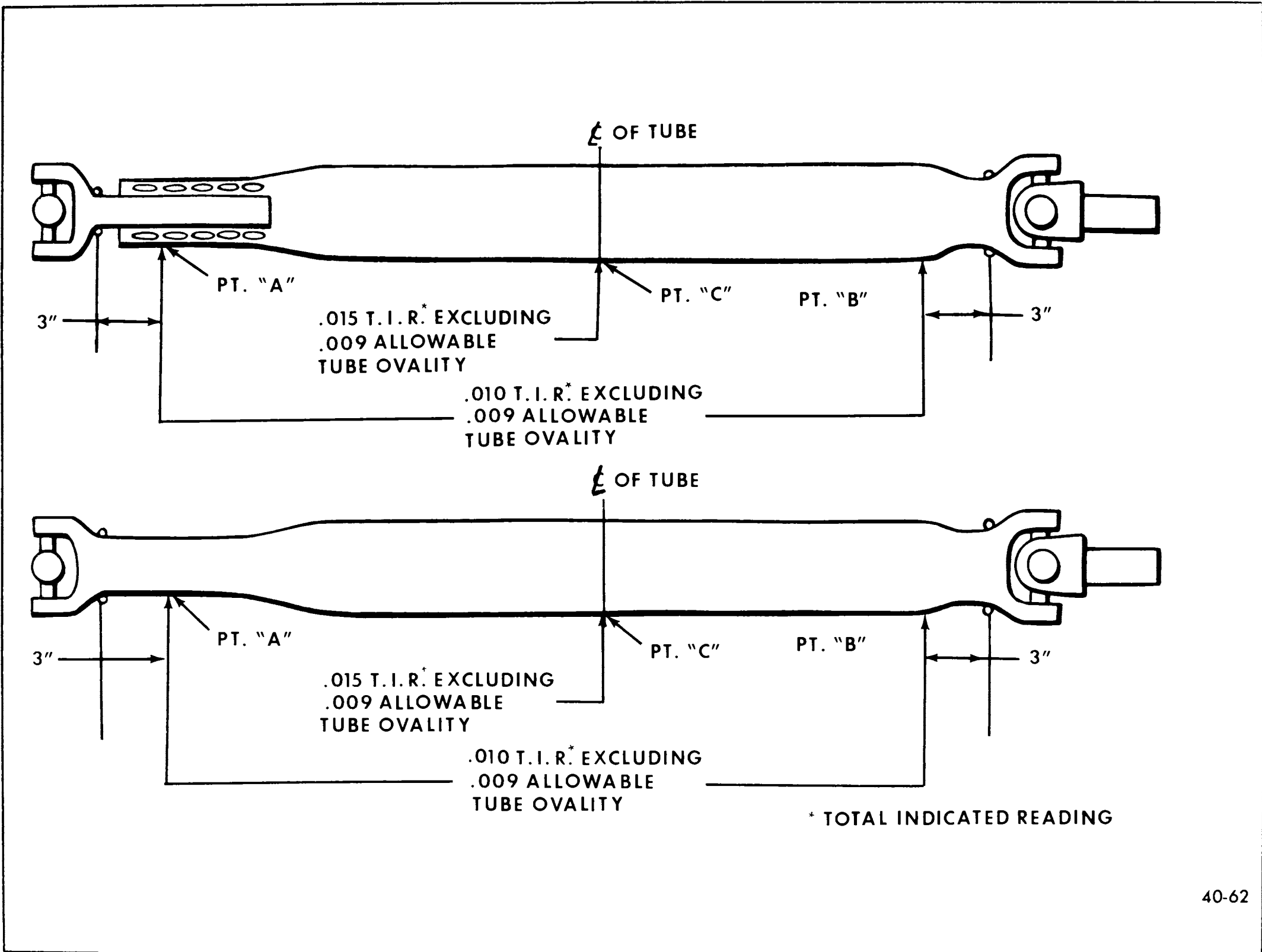


Figure 40-55—Checking Propeller Shaft Run-Out

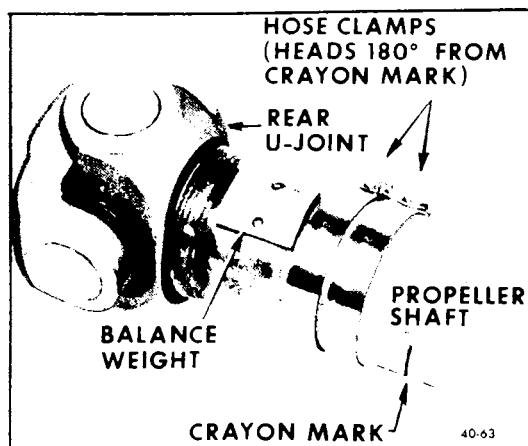


Figure 40-56—Balance Hose Clamps in Place

Use marks made prior to shaft removal to align shaft with companion flange.

3. Install U-bolts, lock washers and nuts; torque nuts evenly to 12 lb. ft. See Figure 40-53.

#### 41-7 CHECKING REAR UNIVERSAL JOINT ANGLE

##### a. Kent-Moore Gage Method

When torque is transmitted through any ordinary universal joint, the driven yoke fluctuates slightly in speed. In other words, although the driving yoke rotates at a constant speed, the driven yoke speeds up and slows down twice per revolution. This fluctuation of the driven yoke is in direct proportion to the angle through which the universal joint

is operating; the greater the angle, the greater the fluctuation.

Whenever two universal joints are used, this fluctuation effect can be eliminated by staggering the joints so that the two driving yokes are 90° apart provided the two joints are transmitting torque through the same angle.

Therefore, when two universal joints are used, the angles through which they operate must be very nearly the same. This allows the alternate acceleration and deceleration of one joint to be offset by the alternate deceleration and acceleration of the second joint. When the two joints do not run at approximately the same angle, operation is rough and an objectionable vibration is produced.

The actual optimum angles desired must also consider the effects of various passenger loadings and rear axle windup during acceleration so that it is unlikely that the front and rear joints will be found to be the same in actual practice.

In addition, universal joints are designed to operate safely and efficiently within certain angles. If the designed angle is exceeded, the joint may be broken or otherwise damaged.

The front universal joint angle is actually the angle between the engine-transmission centerline and the propeller shaft. This angle is determined by the design of the body assembly. Since this angle is not liable to change with use, no method has been established for adjusting this front joint angle.

Because sensitivity to pinion angle adjustment has been reduced, non-adjustable rear upper control arms are installed at the best pinion angle during factory installation.

All complaints of propeller vibration should be accompanied by

rear trim height measurements at curb weight. An incorrect trim height may cause some vibration. If vibration is severe enough, removal or installation of spring shims may be required. If any irregular roughness or vibration is detectable in the drive line, the rear universal joint angle should be checked. Also, if a car is involved in a severe rear end collision, or if the rear axle housing is replaced, the rear universal joint angle should be checked and arms replaced if necessary.

The Kent-Moore Gage Method of measuring universal joint angles utilizes a spring-loaded steel cable stretched between the front of the chassis and the differential carrier. When the rear universal joint angle is adjusted correctly, this steel cable will clear the underside of the pinion flange by a definite amount. Therefore, if this single direct measurement is within specified limits, the rear universal joint angle is correct; if this measurement is out of limits, the joint angle is not correct.

Rear universal joint angle is checked using Alignment Set J-8973 and Rear Universal Joint Angle Gage Rear Bracket J-8973-35.

The Spacer Blocks, J-8973-20, in the set are designed to raise the rear of the car above normal trim height. Use of these blocks makes certain that the rear universal joint angle will be checked at a predetermined trim height. These blocks must be used since rear universal joint reading varies at different trim heights and the only reference dimension given is for the particular height block supplied.

The front end of the cable is equipped with two attaching brackets so that the cable may be used on all series 1968 Buicks.

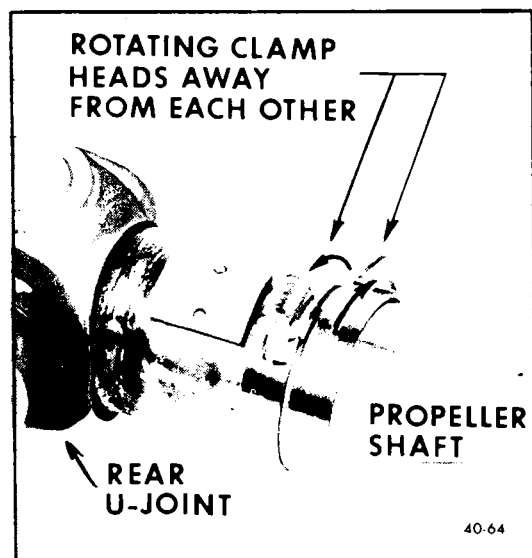


Figure 40-57—Rotating Balance Hose Clamps

The rear end of the cable has stops attached at various points to allow the cable to be placed in tension on all wheelbase Buicks.

Check rear universal joint angle using the following procedure: If the work is to be done with the aid of a hoist, a drive-on hoist is preferable. A frame contact lift hoist cannot be used because alignment spacers must be inserted between axle tubes and the frame.

1. With car on hoist, raise rear of car and position spacer blocks with tips up so that they contact frame directly above axle tube; bottom of block should be parallel to axle. Hold blocks up against frame and allow car to settle until axle housing contact block.

**NOTE:** Use same blocks for Station Wagons and Sedans. See Figure 40-54.

2. Remove differential cover bolt on either side of lowest cover bolt. Using two 5/16-18 x 1-1/8" bolts with 3/8" spacers, attach rear Bracket J-8973-35.

3. Engage front attaching Bracket J-8973-15 in lower opening of vertical center support assembly located at front of radiator. Hook bracket into bottom of opening. See Figure 40-54.

4. Place Engine Height Plate J-8973-14 so that the upper end bears against the engine oil pan between the two rear oil pan bolts. See Figure 40-54. Place the cable in notch of height plate, pull cable tight and hook into rear bracket so one of the stops on the cable is to the rear of the bracket slot. It is important that the cable is fully in the slot and is taut and free of kinks.

5. Measure perpendicular distance from cable to surface immediately in front of slinger on rear pinion flange. The correct dimension is given in Figure 40-54.



Figure 40-58—Measuring Differential Assembly Angle

6. Remove height rod, cable bracket and spacer blocks. Install differential cover bolts, torque to 30 lb. ft.

#### b. Bubble Protractor Method

An alternate method of checking universal joint angle is that of using a bubble protractor which reads 0° to 180°. This method can be used with the car over a pit, on an axle lift hoist or on a drive-on hoist as long as the car is at curb height with a full tank of gasoline.

**NOTE:** JOUNCE CAR UP AND DOWN TO ASSURE CURB HEIGHT.

Readings should be taken at the following locations in the following manner:

1. Hold protractor firmly against flat on left rear of differential. See Figure 40-58. Center bubble in sight glass and record measurement in degrees.

**NOTE:** Measuring surfaces

must be free of dirt or other foreign material.

2. Hold protractor firmly against rear portion of propeller shaft. See Figure 40-59. Center bubble in sight glass and record measurement in degrees\_\_\_\_\_.

3. Subtract smaller figure from larger figure to obtain existing rear universal joint angle\_\_\_\_\_.

4. Hold end of protractor firmly on front universal joint bearing cap. See Figure 40-60. Center bubble in sight glass and record measurement in degrees\_\_\_\_\_.

**NOTE:** Bearing cap face must be parallel to the ground.

5. Hold protractor firmly against front portion of propeller shaft. See Figure 40-61. Center bubble in sight glass and record measurement in degrees\_\_\_\_\_.

6. Subtract smaller figure from larger figure to obtain existing front universal joint angle\_\_\_\_\_.

**CAUTION:** Extreme care must





Figure 40-59—Measuring Angle at Rear of Propeller Shaft

be exercised when taking readings as very small variations ( $\pm 1/2^\circ$ ) are allowed.

Rear Universal Joint Angles		
Le Sabre	2-1/2°	$\pm 1/2^\circ$
Wildcat	3-1/2°	$\pm 1/2^\circ$
Electra	3-1/2°	$\pm 1/2^\circ$
Riviera	13-1/2°	
Front Universal Joint Angles		
Le Sabre	1°	$\pm 1/2^\circ$
Wildcat	1°	$\pm 1/2^\circ$
Electra	1°	$\pm 1/2^\circ$
Riviera	1-1/4°	$\pm 1/2^\circ$

#### 41-8 CHECKING PROPELLER SHAFT RUN-OUT

If there is noise or vibration at high speed which might be caused by a bent shaft (Division IV) or if shaft has been damaged through rough handling or a collision, it may be checked for straightness as follows:

1. Raise car on a twin post hoist so that rear of car is supported on rear axle housing with wheels free to rotate.

2. Mount a dial indicator on a

movable support that is high enough to permit contact of indicator contact button with propeller shaft. Readings are to be taken at points indicated in Figure 40-55.

3. With transmission in neutral, check for run-out by having a second person turn rear wheel so

that propeller shaft will rotate. At points "A" and "B" run-out should not exceed .010". At point "C" run-out should not exceed .015". Care must be taken not to include indicator variation caused by ridges, flat spots or other variations of the tube.

4. If run-out exceeds specifications because the propeller shaft is bent, it is probably more economical to replace propeller shaft than to attempt straightening it. However, if run-out is within specifications and noise or vibration problem exists, see paragraph 41-9 for propeller shaft corrective balancing procedure.

#### 41-9 PROPELLER SHAFT BALANCING PROCEDURE

1. Place the car on a twin post hoist so that the rear of the car is supported on the rear axle housing and the rear wheels are free to rotate. Remove both rear tire and wheel assemblies and re-install wheel lug nuts with flat side next to drum.



Figure 40-60—Measuring Transmission Angle



Figure 40-61—Measuring Angle at Front of Propeller Shaft

2. Mark and number propeller shaft at four (4) points 90 degrees apart at rear of shaft just forward of balance weight.

3. Install two (2) Wittek type hose clamps on the rear propeller shaft and slide them rearward until the clamps stop at the nearest balance weight welded to the tube. Align both clamps to any one of the four marks made on shaft in Step 2. Tighten the clamps. See Figure 40-56.

**CAUTION:** Be sure sufficient clearance is maintained so that clamp heads do not contact floor pan of car when axle is in

contact with rebound bumper in frame. In order to gain sufficient clearance, it may be necessary to position the clamps over the balance weights.

4. Run the car through the speed range to 65-70 MPH. Note amount of unbalance.

5. Loosen clamps and rotate clamp heads 90 degrees to the next mark on shaft. Tighten clamps and repeat Step 4.

6. Repeat Step 5 until car has been run with clamp heads located at all four marks on shaft.

7. Position clamps at point of minimum unbalance. Rotate the clamp heads away from each other 45 degrees. (One each way from the point of minimum unbalance) Run the car and note if unbalance has improved. See Figure 40-57.

In some cases it may be necessary to use one clamp or possibly three clamps in order to obtain a good balance.

8. Continue to rotate the clamps apart in smaller angular increments until the car feel for unbalance is best.

**CAUTION:** Do not run car on hoist for extended periods due to danger of overheating the transmission or engine.

9. Reinstall tire and wheel assemblies and roadtest the car for final check of balance.

**NOTE:** Vibration felt in the car on the hoist may not show up in a roadtest which is, after all, the final determining factor.

If a wheel balancer of the type that is equipped with a strobe light is available, the use of such a unit will facilitate the balancing of the propeller shaft. The balance pick-up unit should be placed directly under the nose of the rear axle carrier and as far forward as possible.

## DIVISION IV—TROUBLE DIAGNOSIS

### 41-10 PROPELLER SHAFT TROUBLE DIAGNOSIS

COMPLAINT	POSSIBLE CAUSE	REMEDY
Shudder on acceleration low speed	Improper rear joint angle	Check using Kent-Moore alignment gage and check rear trim height at curb weight. Check with bubble protractor.

## 41-10 PROPELLER SHAFT TROUBLE DIAGNOSIS (Cont'd)

COMPLAINT	POSSIBLE CAUSE	REMEDY
Roughness or vibration any speed	<p>Bent or dented shaft</p> <p>Tight universal joints</p> <p>Worn universal joints</p> <p>U-Joint retainer bent against bearing cup</p> <p>Undercoating on shaft</p> <p>Excessive U-bolt torque</p> <p>Burrs or gouges on companion flange snap ring location surfaces</p> <p>Incorrect rear joint angle (usually too large an angle)</p> <p>Tire unbalance</p> <p>Shaft or companion flange unbalance combination</p>	<p>Replace</p> <p>Impact yokes with hammer to free up. Replace joint if unable to free up or if joint feels rough when rotated by hand.</p> <p>Replace</p> <p>Replace</p> <p>Clean up shaft</p> <p>Check and correct (12 lb. ft.)</p> <p>Replace companion flange if it can't be reworked.</p> <p>Check using Kent-Moore alignment gage or bubble protractor method. Also check trim height at curb weight.</p> <p>Balance wheel and tire assembly or replace from known good car.</p> <ol style="list-style-type: none"> <li>1. Check for missing balance weights.</li> <li>2. Remove and reassemble shaft to companion flange 180° from initial location.</li> <li>3. Rebalance in car using (2) hose clamp method.</li> </ol>
Roughness usually at low speeds, light load, 15-35 MPH	<p>Improper joint angles usually rear joint angle is too large.</p> <p>U-bolt clamp nuts excessively tight.</p>	<p>Check rear joint angle using Kent-Moore alignment gage or bubble protractor. Check rear trim height at curb weight.</p> <p>Check and correct torque (12 lb. ft.) if torque was too excessive replace joint.</p>
Knock or click	Loose upper or lower control arm bushing bolts	Tighten bolts.
Scraping noise	Slinger on companion flange rubbing on rear axle carrier	Straighten out slinger to remove interference.