SECTION C

43-44-45-46-48000 PROPELLER SHAFT

CONTENTS

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 on Special Series. On all 44-45-46 and 48000 Series with automatic transmission lubrication is achieved by inserting grease in the yoke seal which is positioned on the transmission output shaft. In all cases an oil seal "O" ring in the transmission extension housing prevents loss of lubricant and the entry of foreign material.

NOTE: On the above cars with automatic transmission the propeller shaft slip yoke is provided with a very small vent hole to prevent "blowing" the seal during installation. These slip yokes should be inspected to be sure the vent hole is clear and present if required. See Figure 40-46.

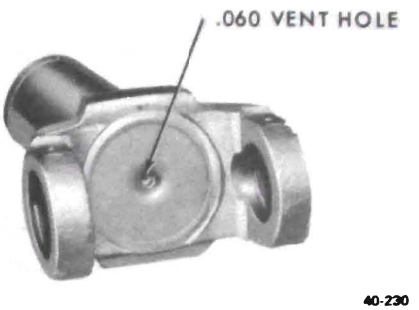

Figure 40-46 - Slip Yoke With Vent Hole

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

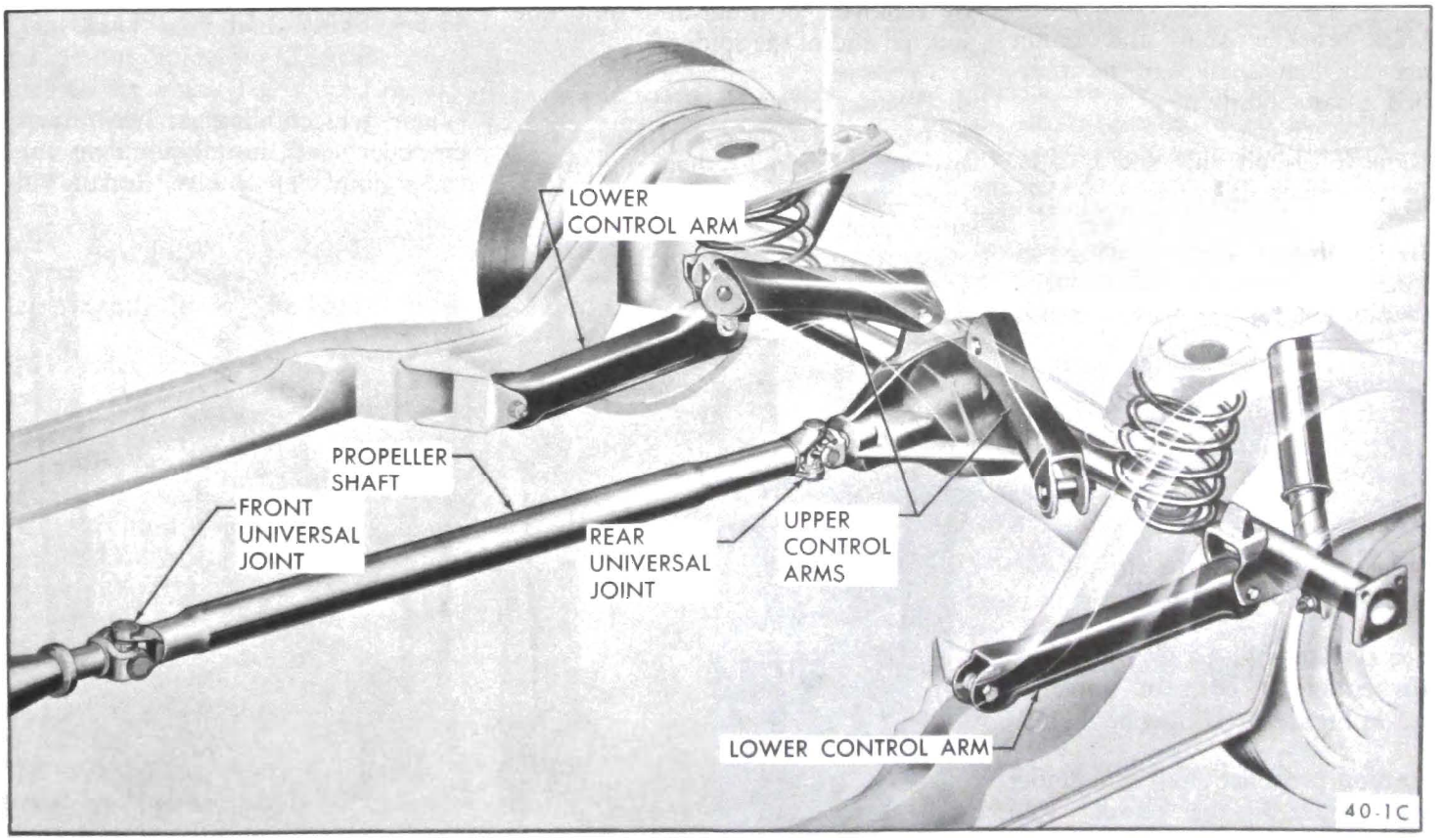

Figure 40-45 - Propeller Shaft Assembly

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.

Production universal joint bearing caps are now retained by a nylon injection ring instead of the conventional snap ring. Service universal joints however, will still use snap rings.

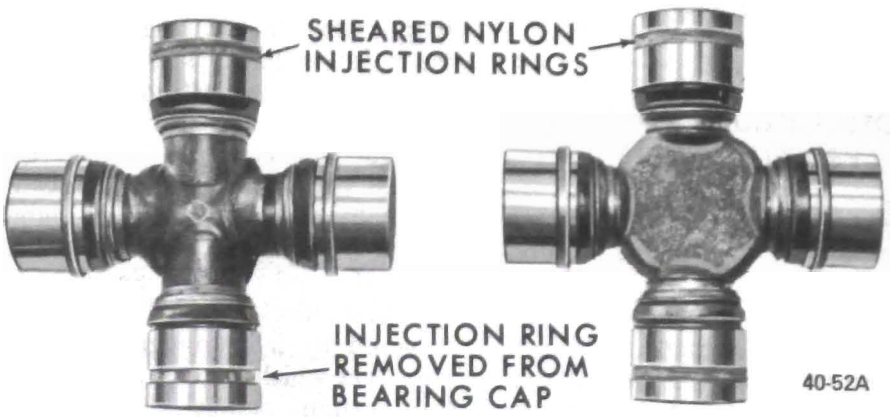

Figure 40-47 - 1969 Production Universal Joints

DIVISION III

SERVICE PROCEDURES

41-3 REMOVAL OF PROPELLER SHAFT

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

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 disengage splines on transmission main shaft.

41-4 DISASSEMBLY OF PROPELLER SHAFT

When disassembling a 1969 propeller shaft, either or both of universal joints in Figure 40-47 may be found.

1. Position propeller shaft and spider press J-9522-3 in power ram equipped with base plate J-8853 and ram screw adapter J-9522-2. See Figure 40-48.

2. Actuate the pump to force the spider and bearing to shear the nylon retaining ring and remove the bearing.

3. Release pump valve, rotate propeller shaft 1/2 revolution and install spider guide J-9522-7 into yoke bore of removed bearing and onto the journal end of the spider.

4. Position propeller shaft as before and use spider press and power ram hydraulic pump to shear the nylon injection ring and remove the opposite bearing. See Figure 40-49.

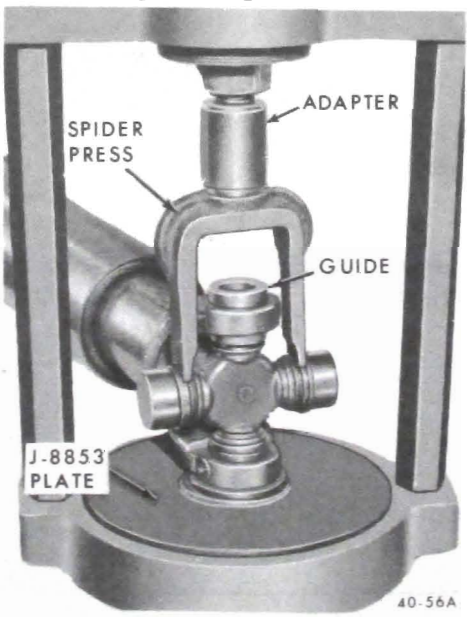

Figure 40-48 - Pressing Out U-Joint Bearing

NOTE: The above procedures should also be used to disassemble the front universal joint.

NOTE: Once a production universal joint is disassembled, it cannot be reassembled as there are no snap ring grooves provided in the bearing cap.

41-5 ASSEMBLY OF PROPELLER SHAFT

When reassembling a 1969 Buick propeller shaft, install complete universal joint repair kits. Repair kits

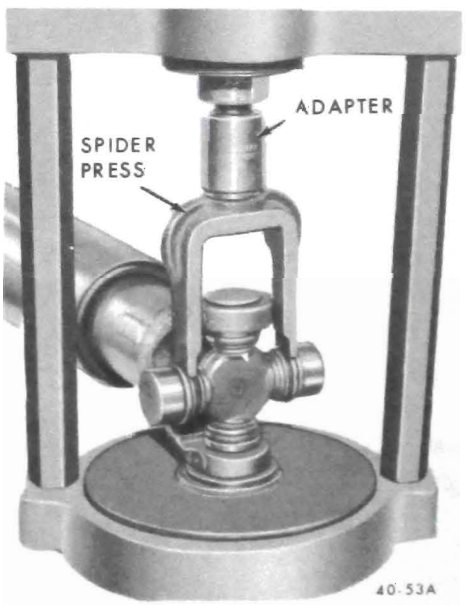

Figure 40-49 - Pressing Out U-Joint Bearing With Guide Installed

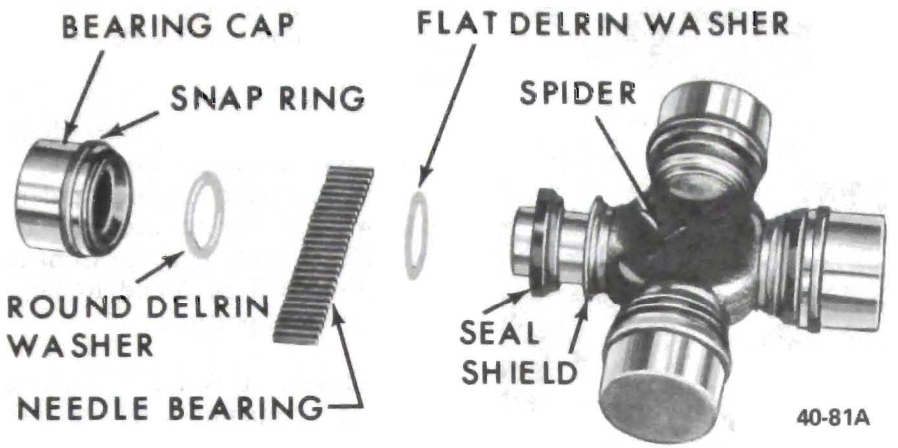

Figure 40-50 - 1969 Service Universal Joint

are listed in the Buick Master Parts Catalog under Group 5.442 and include a spider, four bearing assemblies, four delrin spacers, four seals and four shields. The four bearings come equipped with snap rings. See Figure 40-50.

1. Make certain the shields and seals are in firm position and not damaged on the spider and install the spider in the yoke. The spider may face in either direction.

2. Install spider guide J-9522-7 into one yoke bore and position spider journal into the guide. Push guide in far enough for opposite journal to extend slightly above yoke bore.

NOTE: Spider journals and bearings must be free of dirt or foreign material.

3. Place the propeller shaft and yoke assembly in position with the Power Ram and Pump. Inspect bearing cap to see that all needle bearings are in place and lubricated. Make certain the Delrin Washer is in place against the needle bearings. Position bearing straight over yoke bore and onto spider journal.

NOTE: Failure to pilot the spider journal into the bearing could cause the bearing needles to become dislodged during installation of the bearing cap.

With the pump, force the bearing into the yoke. As the bearing nears the end of its required travel, it will cause the spider to push the guide outward without damage to the seal or shield. The bearing cap is properly positioned in the yoke when the snap ring groove is exposed enough to install the snap ring. When the bearing is correctly positioned in the yoke, turn the assembly over, remove the guide J-9522-7 and again place bearing over the bore in the yoke.

Carefully slide the spider partially out of the previously seated bearing

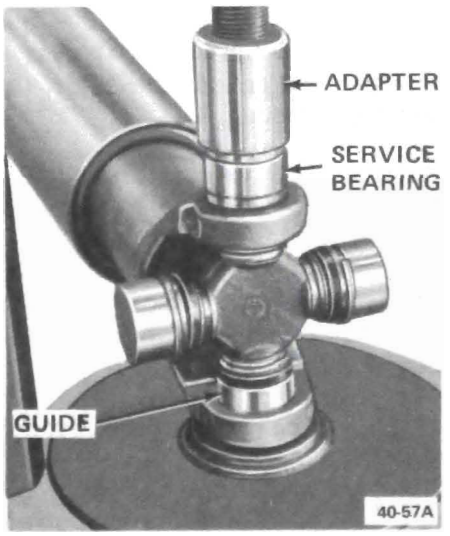

Figure 40-51 - Installing U-Joint Bearing With Guide in Place.

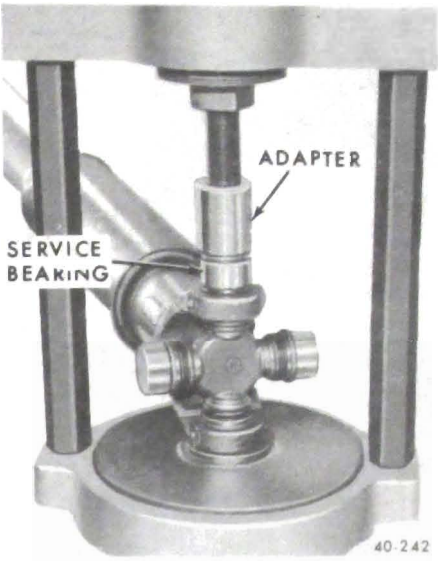

Figure 40-52 - Installing U-Joint Bearing

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

NOTE: If excessive resistance is encountered, the bearings should be removed as this is an indication that one or more of the needles are out of place.

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 firmly with a hammer to fully seat the snap rings against the yoke. Turn the spider to make certain that it is free. See Figure 40-53.

Figure 40-53 Seating U-joint Snap Rings

41-6 INSTALLATION OF PROPELLER SHAFT ASSEMBLY

1. Apply engine oil to splined propeller shaft yoke on manual transmission cars, then slide yoke and propeller shaft assembly onto transmission output shaft. On cars with automatic transmission, apply grease (EP #1 grade) to internal splined area of slip spline and slide the splined yoke onto the transmission output shaft.

NOTE: On splined yoke for automatic transmission cars, be sure the vent hole in the yoke is not plugged. See Figure 40-46.

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

2. Position rear universal joint to differential pinion flange. Make certain spider bearings are properly aligned in pinion flange yoke. Use marks made prior to shaft removal to align shaft with companion flange.

3. Install U-bolts and nuts; torque nuts evenly to 12 lb. ft. See Figure 40-54. Avoid excessive torque on these U-bolts since car noise and joint durability problems may result if torque is too high.

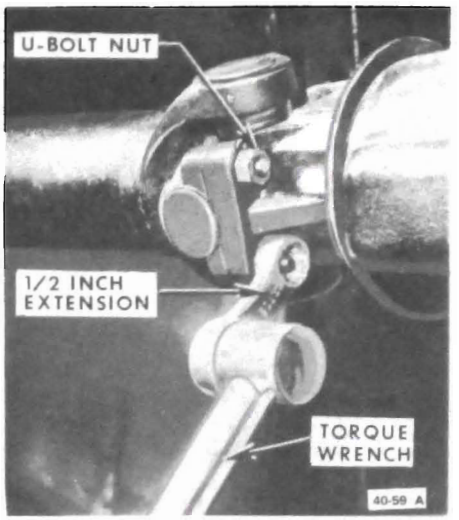

Figure 40-54 Using Extension to Torque U-Bolt Nuts.

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 accleration 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 and may be altered by adding or removing shims between transmission rear bearing retainer and the transmission mount.

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

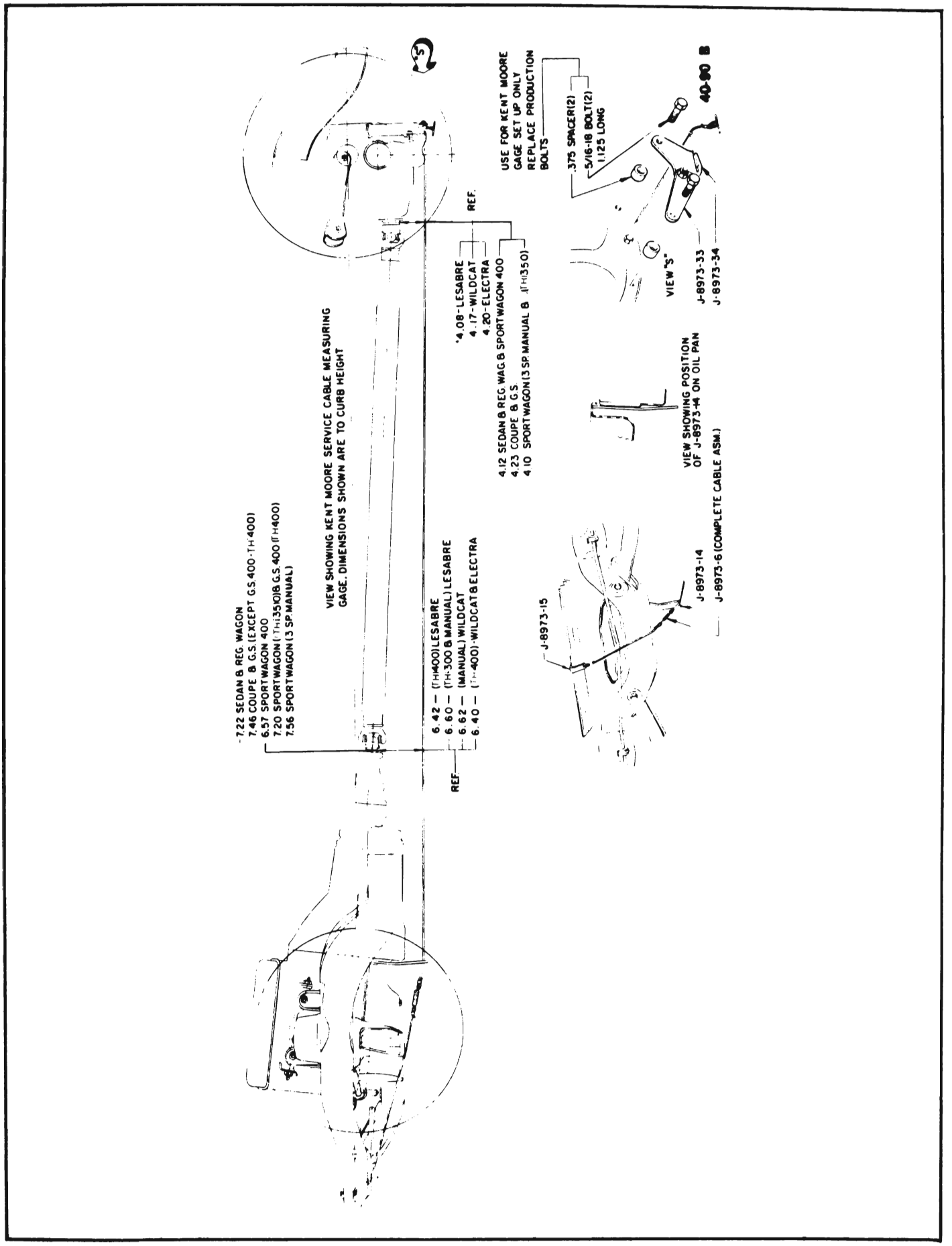

Figure 40-55 - Checking Universal Joint Angle

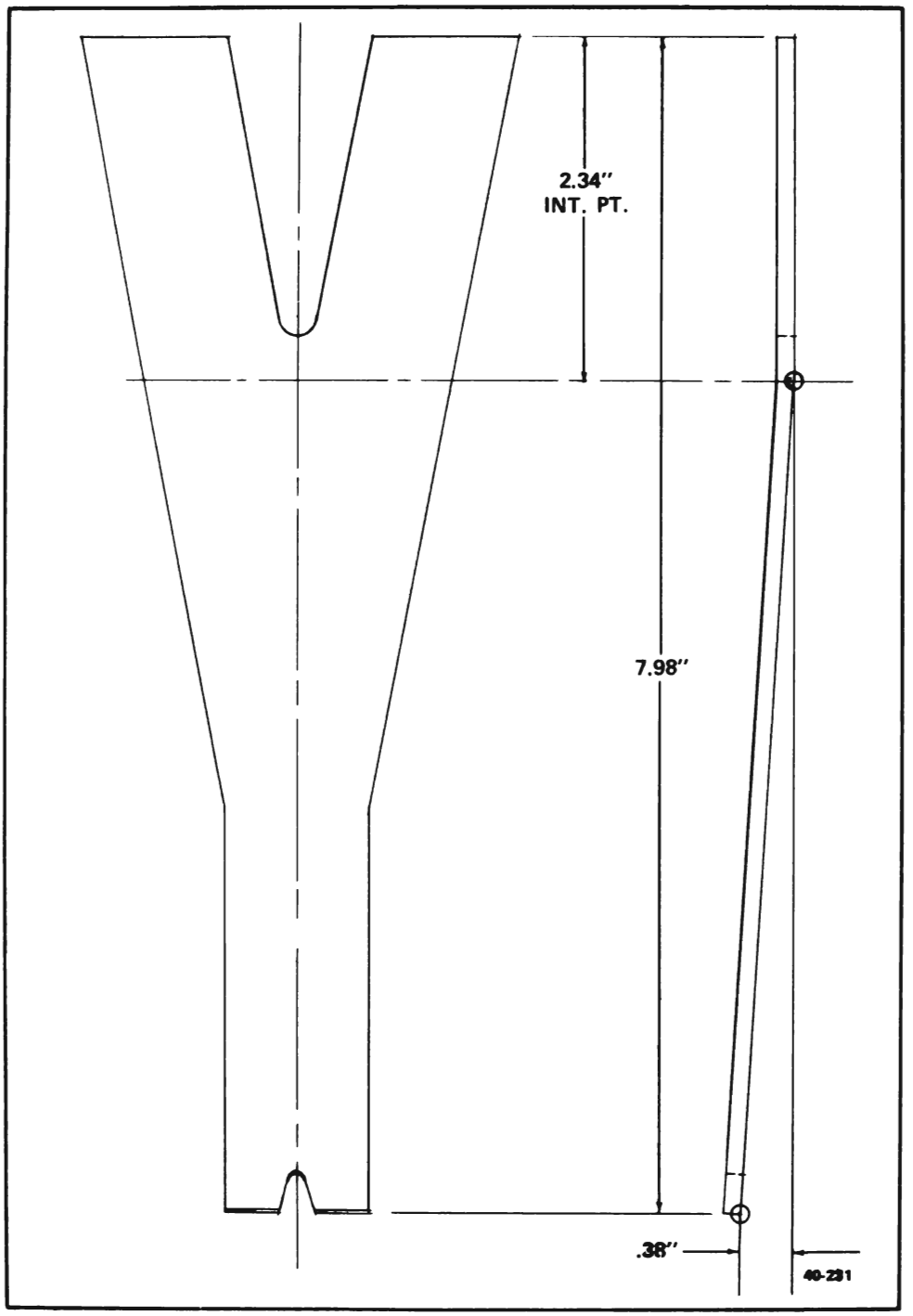

Figure 40-56 - Rework Instructions of Plate J-8973-14

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 1969 Buicks.

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 tubes contact blocks.

NOTE: Use same blocks for Station Wagons and Sedans. See Figure 40-55.

2. Remove differential cover bolt on either side of lowest cover bolt. Using two 5/16-18xl-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 40-55.

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 40-55. 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

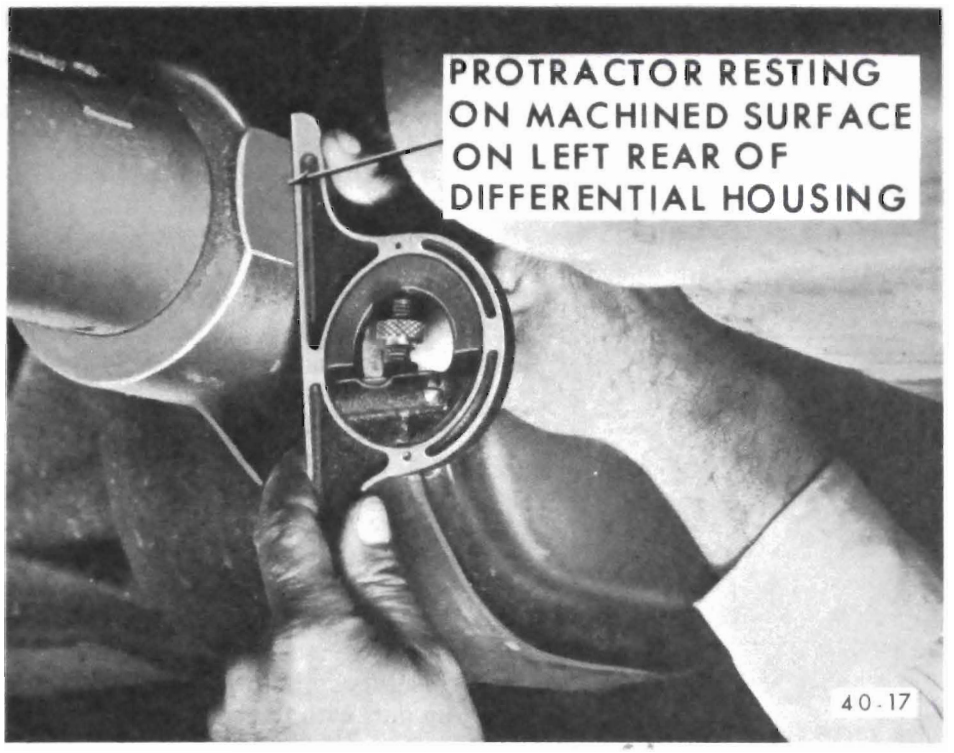

Figure 40-57 - Measuring Differential Assembly Angle

the bracket slot. It is important that the cable is fully in the slot and is taut and free of kinks.

NOTE: On older or existing versions of J-8973-14 Plate, it will be necessary to rework as per Figure 40-56. This rework will not affect the accuracy of the plate when used to check older models.

5. Measure perpendicular distance from cable to surface immediately in front of slinger on rear pinion flange. The correct dimension is given in Figure 40-55.

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. Record this height for possible future reference.

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 40-57. Center bubble in sight glass and record measurement from vertical in degrees.

NOTE: Measuring surfaces must be free of dirt or other foreign material.

2. Hold protractor firmly against rear end of propeller shaft. See Figure 40-58. Center bubble in sight glass and record measurement in degrees ( ).

3. Subtract smaller figure from larger figure to obtain existing rear universal joint angle ( ).

See Chart Figure 40-59.

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 straight down.

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

6. Subtract smaller figure from

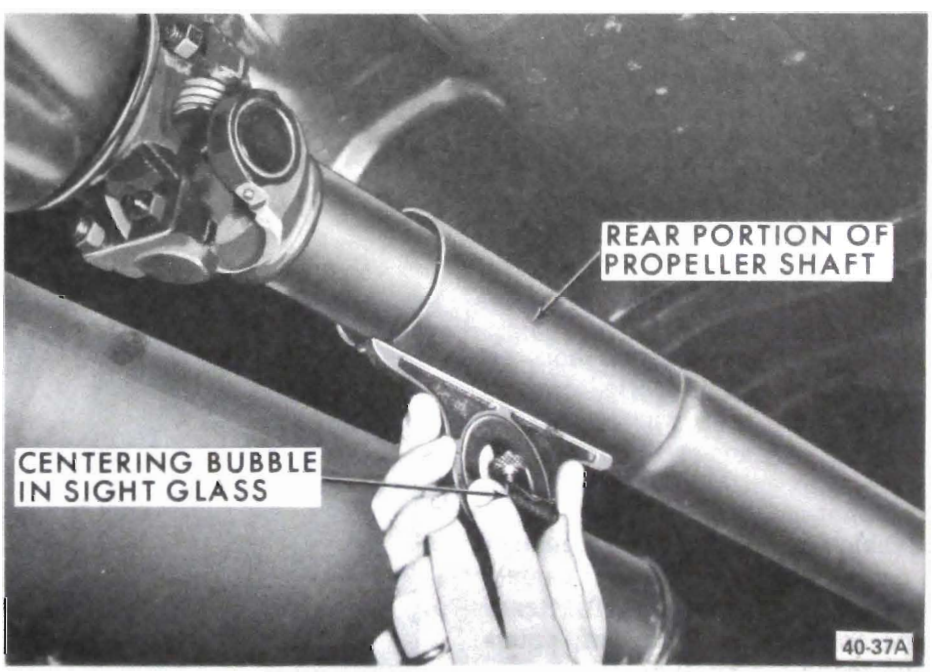

Figure 40-58 - Measuring Angle at Rear of Propeller Shaft

UNIVERSAL JOINT ANGLES		
	Front	Rear
43-44 Coupes and Sedans	3°	2°
43-44 Regular Wagon	2½°	2½°
GS 400	2¾°	2°
44 Sportwagon Man. Trans.	1½°	2¾°
44 Sportwagon TH350	1½°	2°
44 Sportwagon TH400	2½°	2¼°
Le Sabre	2¾°	2°
Wildcat	2½°	2°
Electra	2½°	2°
Riviera	1¼°	13½°
*The above angles may be ± ½°		

Figure 40-59 - Universal Joint Angles

larger figure to obtain existing front universal joint angle ( ).

CAUTION: Extreme care must be exercised when taking readings as very small variations (+ or -½) are allowed.

41-8 CHECKING PROPELLER SHAFT RUN-OUT

If there is noise or vibration at high speed which might be caused by a bent shaft 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 40-62.

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 reinstall wheel lug nuts with flat side next to drum.

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

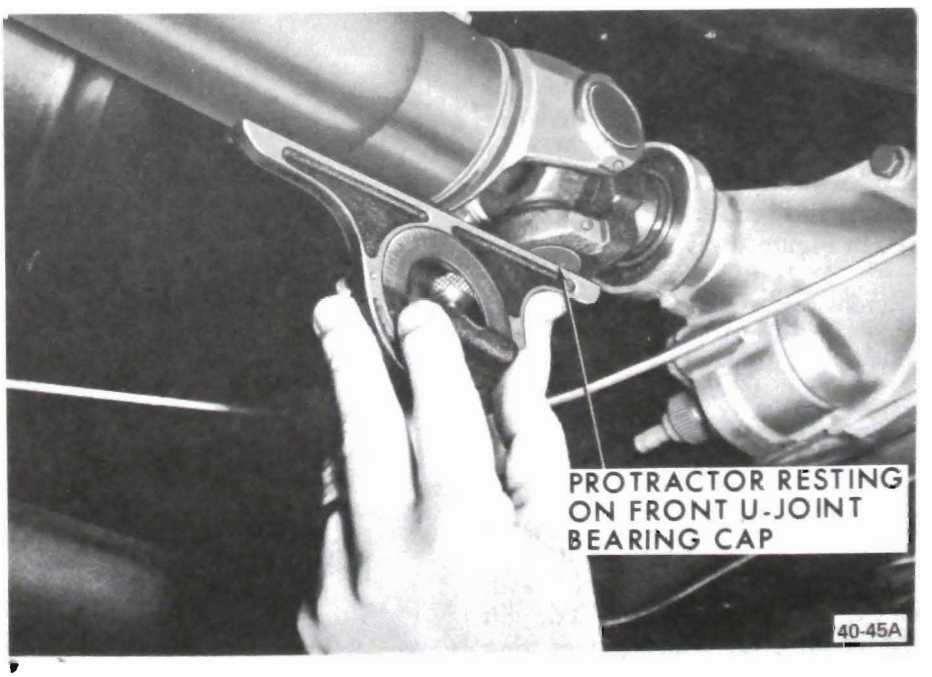

Figure 40-60 - Measuring Transmission Angle

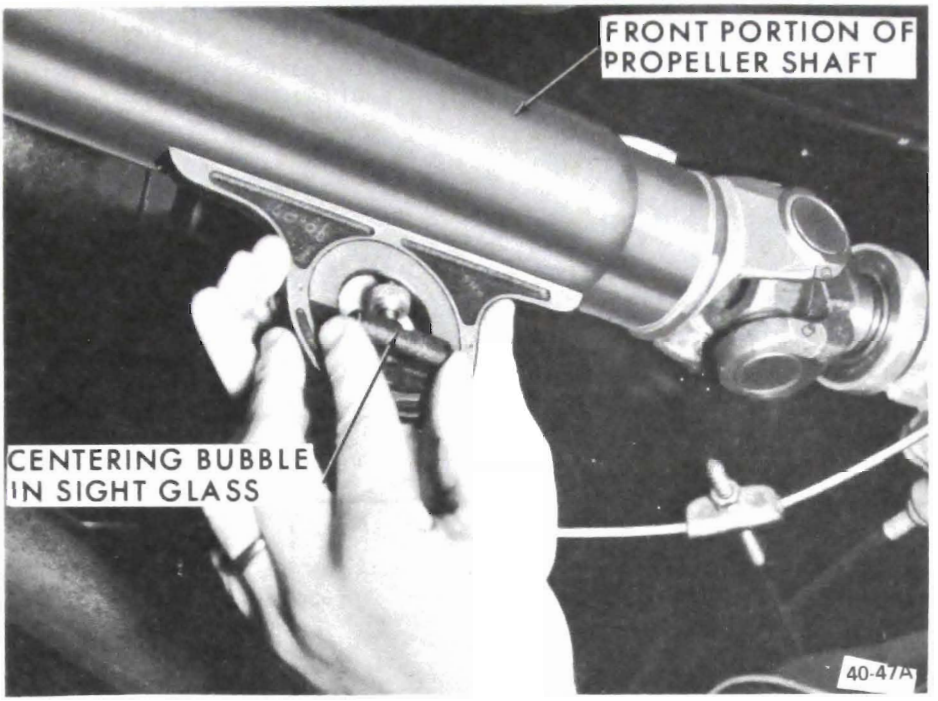

Figure 40-61 - Measuring Angle at Front of Propeller Shaft

marks made on shaft in Step 2. Tighten the clamps. See Figure 40-63.

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 40-64.

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

a. Body Boom Noise or Vibration

Objectional "body boom" noise or vibration at 55-65 MPH can be caused by an unbalanced propeller shaft. Excessive looseness at the spline can contribute to this unbalance.

Other items that may also contribute to the noise problem are as follows:

1. Undercoating or mud on the shaft causing unbalance.

2. Shaft balance weights missing.

3. Shaft damage such as bending, dents or nicks.

4. Tire-type roughness. Switch tires from a known good car to determine tire fault.

b. Check for Propeller Shaft Vibration

Objectionable vibrations at high speed (65 MPH or higher) may be caused by a propeller shaft that is out of balance. Out of balance may be due to a bent shaft.

To determine whether propeller shaft is causing vibration, drive car through speed range and note speed at which vibration is most pronounced. Shift transmission into lower gear range and drive car at same engine speed as when vibration was most pronounced in direct drive. Note effect on vibration.

To determine engine speed, divide vehicle speed by the transmission gear ratio in which the vibration occurs.

EXAMPLE: With the S.T. 400 in low range, divide by 1.50. If vibration is

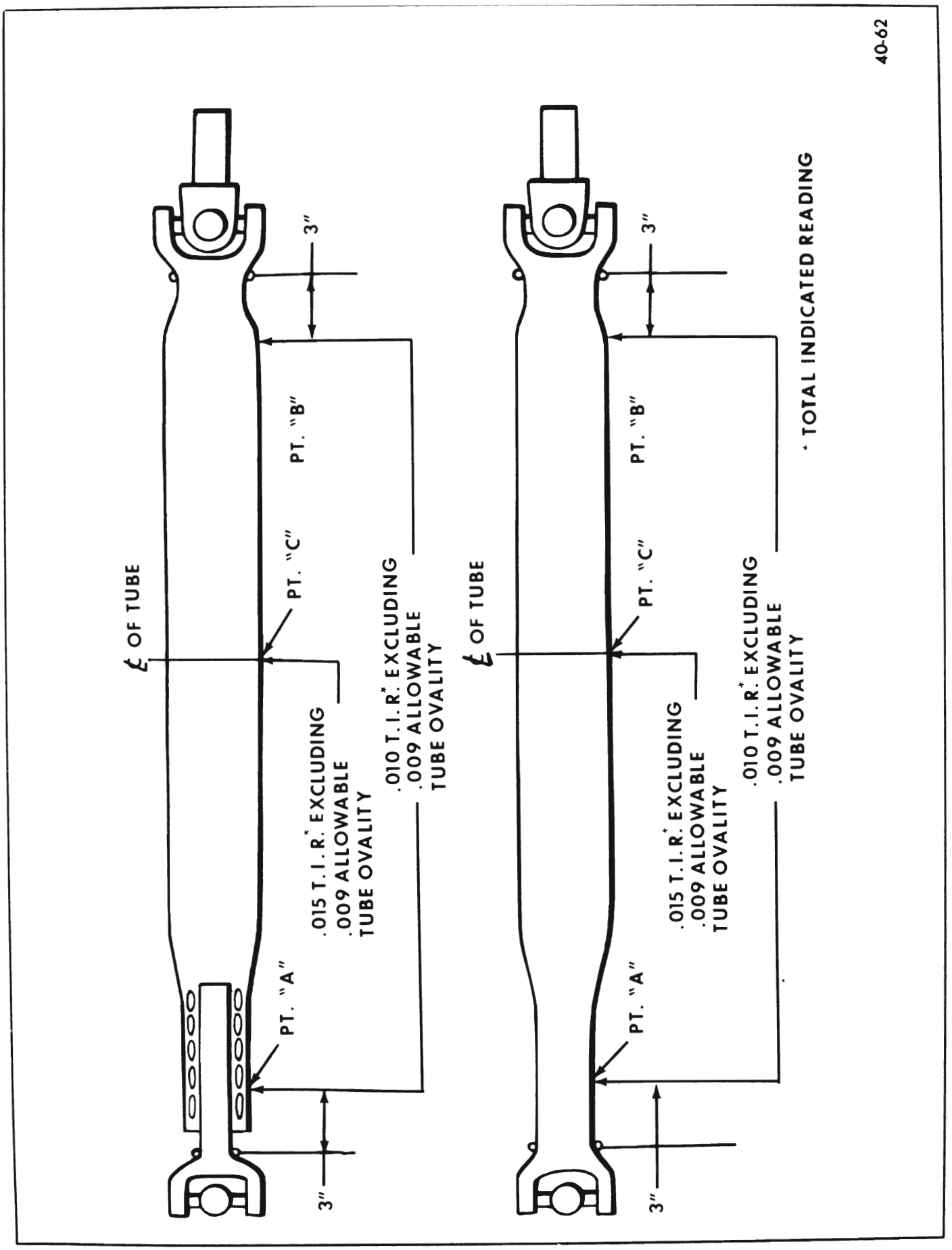

Figure 40-62 - Checking Propeller Shaft Run-Out

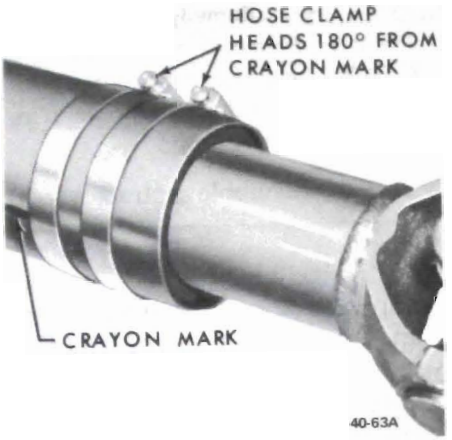

Figure 40-63 - Balance Hose Clamps in Place

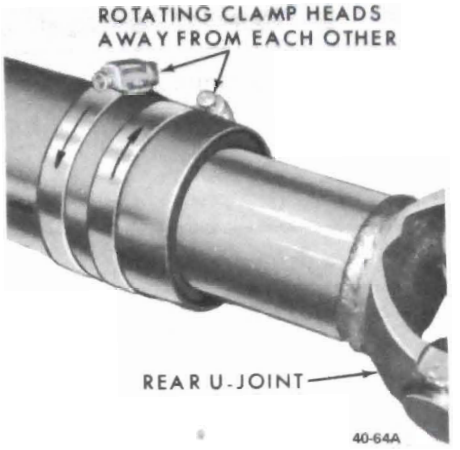

Figure 40-64 - Rotating Balance Hose Clamps

most pronounced in direct drive at 65 MPH, the same engine speed would be produced in low range (S.T. 400) at 65/1.50 # 43 MPH.

If the vibration is still present at the same engine speed whether in direct drive or in the lower gear, since the propeller shaft speed varies, this cannot be the fault. If the vibration decreases or is eliminated in the lower gear, then the propeller shaft is out of balance and should be rebalanced.

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.
Roughness or vibration any speed.	Bent or dented shaft.	Replace
	Tight universal joints.	Impact yokes with hammer to free up. Replace joint if unable to free up or if joint feels rough when rotated by hand.
	Worn universal joints.	Replace.
	U-Joint retainer bent against bearing cup.	Replace.
	Undercoating on shaft.	Clean up shaft.
	Excessive U-bolt torque.	Check and correct (12 lb. ft.)
	Burrs or gouges on companion flange snap ring location surfaces.	Replace companion flange if it can't be reworked.
	Incorrect rear joint angle (usually too large an angle).	Check using Kent-Moore alignment gage or bubble protractor method. Also check trim height at curb weight.
	Tire unbalance.	Balance wheel and tire assembly or replace from known good car.
	Shaft or companion flange unbalance combination.	1. Check for missing balance weights. 2. Remove and reassemble shaft to companion flange 180° from initial location. 3. Rebalance in car using (2) hose clamp method.
Roughness usually at low speeds, light load, 15-35 MPH.	Improper joint angles usually rear joint angle is too large.	Check rear joint angle using Kent-Moore alignment gage or bubble protractor. Check rear trim height at curb weight.
	U-bolt clamp nuts excessively tight.	Check and correct torque (12 lb. ft.) if torque was too excessive or if brinnelled pattern is evident, replace joint.
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.