

S E R V I C E M A N U A L

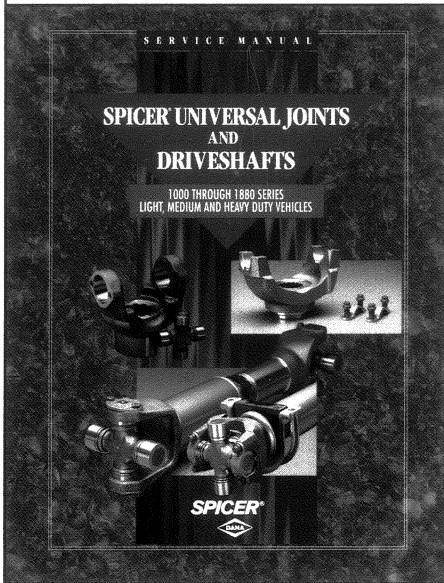
# SPICER<sup>®</sup> UNIVERSAL JOINTS AND DRIVESHAFTS

1000 THROUGH 1880 SERIES  
LIGHT, MEDIUM AND HEAVY DUTY VEHICLES



**SPICER<sup>®</sup>**





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## ABOUT THIS MANUAL...

Because of the many similarities between light, medium and heavy duty drivelines, this manual will present information as it relates to all three types. However, there are some basic differences among the three. Where this occurs it will be clearly noted.

**Failure to follow procedures, recommendations and caution statements outlined in this manual may void the product warranty and could result in serious personal injury.**

## SAFETY PRECAUTIONS

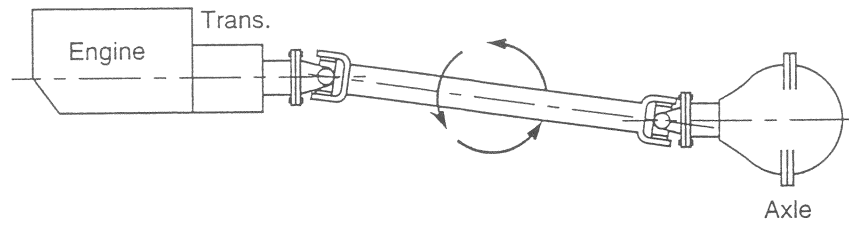
-  Rotating shafts can be dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death.
  -  Do not go under the vehicle when the engine is running.
  -  Do not work on the shaft (with or without a guard) when the engine is running.
  -  Do not engage or disengage driven equipment by hand from under the vehicle when the engine is running.
  -  In order to avoid becoming entangled, install the power take-off and/or shaft behind the frame rail, tanks, battery box, etc.
  -  If power take-off and/or shaft are still exposed after installation, install guard.
  -  Install a support strap when servicing a driveshaft to prevent personal injury. See pages 9, 13, 15, & 17.
  -  A serious or fatal injury can occur...
    - ▲ if you lack proper training
    - ▲ if you fail to follow proper procedures
    - ▲ if you do not use proper tools and safety equipment
- 
  - ▲ if you assemble driveline components improperly
  - ▲ if you use incompatible driveline components
  - ▲ if you use worn-out or damaged driveline components
  - ▲ if you use driveline components in a non-approved application
-  This manual contains detailed safety instructions. Read, understand and follow this manual.
    - ▲ Get proper training
    - ▲ Learn and follow safe operating procedures
    - ▲ Use proper tools and safety equipment
    - ▲ Use proper components in good condition
  -  Refer to the pages listed for more detailed instructions.
    - ▲ Inspection and Lubrication – See pages 4 - 8
    - ▲ Servicing the Driveshaft
      - heavy duty – pages 8 - 15
      - light and medium duty – pages 15 - 17
      - double cardan driveshafts – pages 18 - 21
    - ▲ Straightening and Balancing – See page 24

 This symbol warns of possible personal injury.

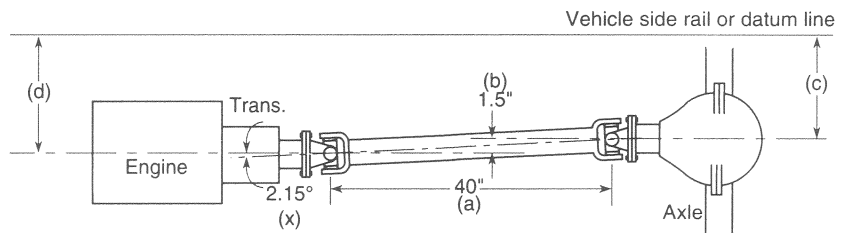
# THE FUNCTION OF A DRIVESHAFT

The basic function of a driveshaft is to transmit power from one point to another in a smooth and continuous action. In automobiles, trucks and construction equipment, the drivetrain is designed to send torque through an angle from the transmission to the axle (or auxiliary transmission).

The driveshaft must operate through constantly changing relative angles between the transmission and axle. It must also be capable of changing length while transmitting torque. The axle of a vehicle is not attached directly to the frame, but rides suspended by springs in an irregular, floating motion.



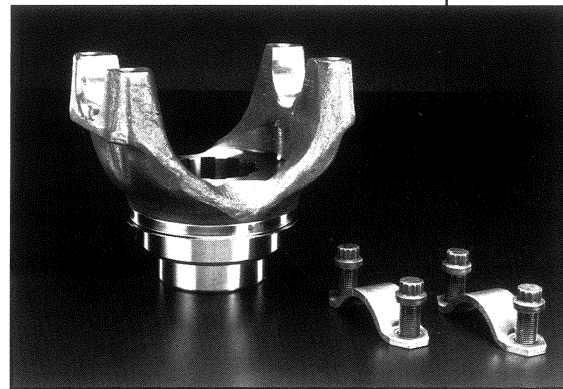
*The geometry of a driveshaft in side view – vertical offset*



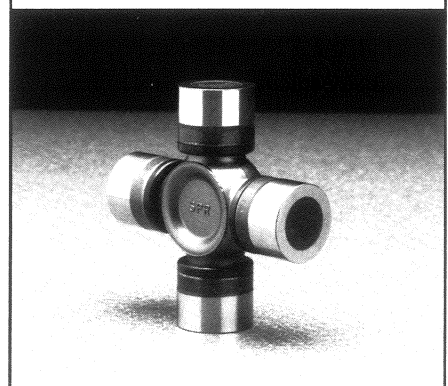
*The geometry of a driveshaft in plan view – horizontal offset*

## CONSTRUCTION OF A DRIVESHAFT (ALL TYPES)

To transmit required torque loads, the driveshaft must be durable and strong. Forged steel and high strength cast yokes, including the Spicer Quick Disconnect™ end yoke for heavy duty vehicles, are used to provide the necessary rigidity required to maintain bearing alignment under torque loads. Spicer heavy-duty u-joint kits and Low Effort™ light-duty u-joint kits are designed to give extended driveshaft life.

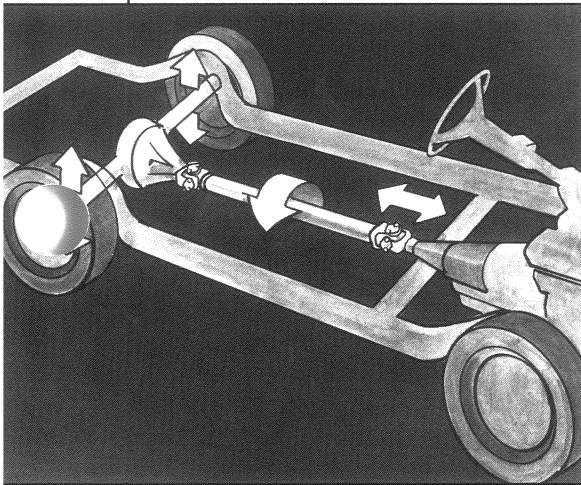


*Spicer Quick Disconnect™ End Yoke*



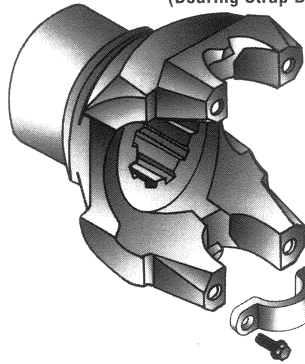
*Spicer Low Effort™ U-Joint Kit*

This means the driveshaft must be able to contract, expand and change operating angles when going over bumps or depressions. This is accomplished through universal joints, which permit the driveshaft to operate at different angles, and slip joints, which permit contraction or expansion to take place.

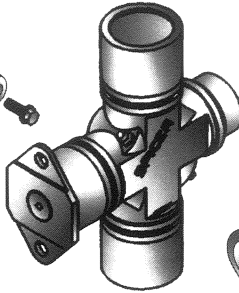


# DRIVESHAFT PARTS LISTING

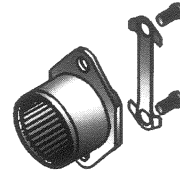
Quick Disconnect™ Half Round End Yoke  
(Bearing Strap Design)



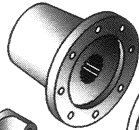
Quick Disconnect™ Half Round  
Cross & Bearing Kit



Tube Yoke



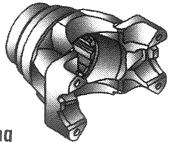
Companion Flange



Flange Yoke



Bearing  
Strap Design  
End Yoke



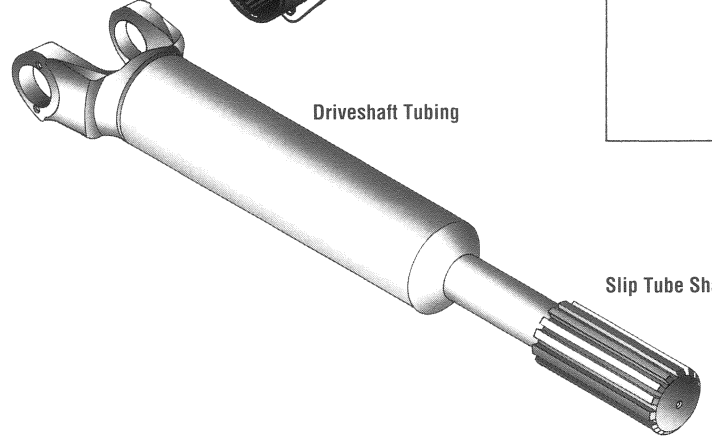
Cross & Bearing Kit



Tube Yoke



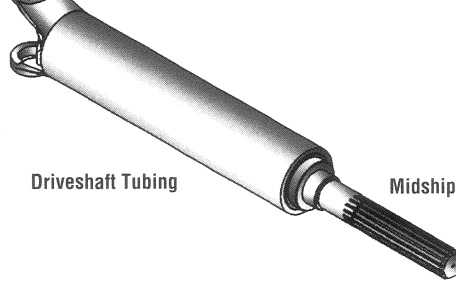
Driveshaft Tubing



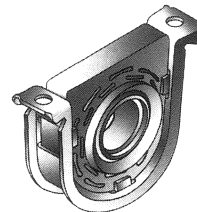
Slip Tube Shaft

Driveshaft Tubing

Midship Tube Shaft



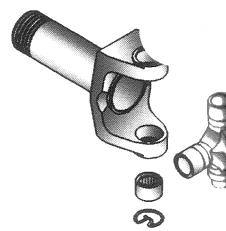
## 3 JOINT ASSEMBLY DRIVESHAFT



Dustcap & Washer Kit

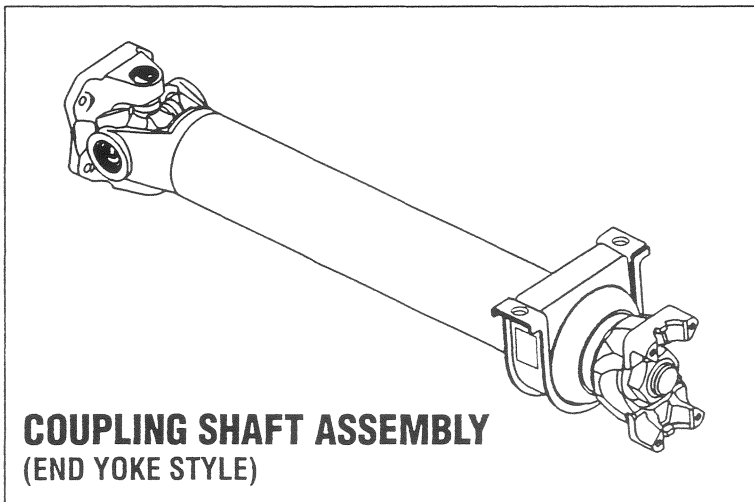


Slip Yoke Assembly

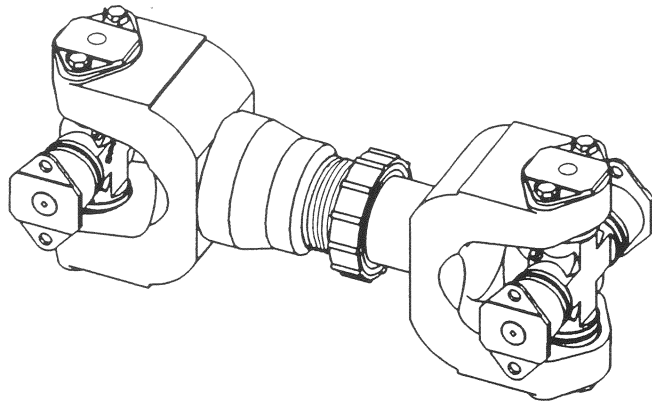
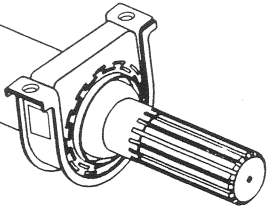


Cross & Bearing Kit

**COUPLING SHAFT ASSEMBLY**  
(END YOKE STYLE)



**COUPLING SHAFT ASSEMBLY  
(SLIP YOKE STYLE)**

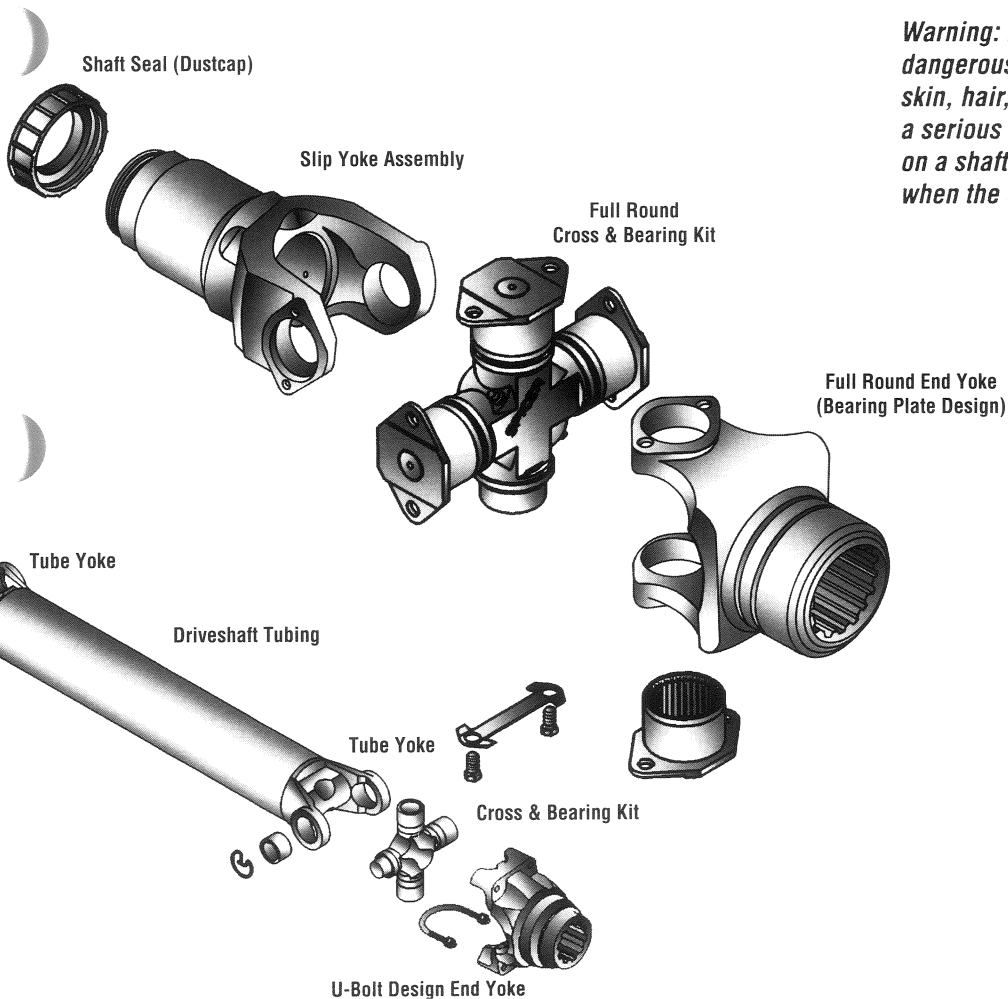


**SHORT COUPLED DRIVESHAFT**

**2 JOINT ASSEMBLY DRIVESHAFT**



**Warning:** Rotating shafts can be dangerous. You can snag clothes, skin, hair, hands, etc. This can cause a serious injury or death. Do not work on a shaft (with or without a guard) when the engine is running.



# CONSTRUCTION OF A DRIVESHAFT

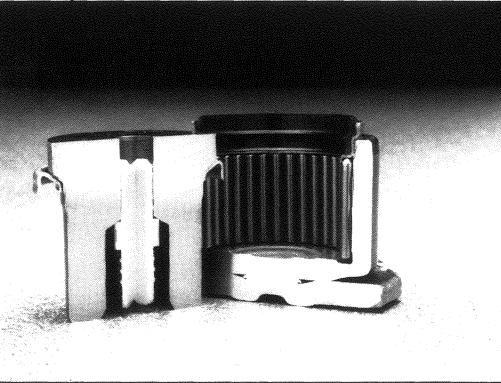
Anti-friction bearings are used to withstand required oscillating loads while the driveshaft is rotating at high speeds. The needle roller bearings on the trunnions of the cross carry large loads and are used because of their high capacity in a limited space.

composite (aluminum wrapped in graphite) driveshafts have been developed to meet the vehicular industry needs.

## INSPECTING AND LUBRICATING THE DRIVESHAFT (All Types)



**WARNING:** Rotating shafts can be dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death. Do not work on a shaft (with or without a guard) when the engine is running.



*Spicer Positive Purging valve and exclusive crowned bearing race inside diameter.*

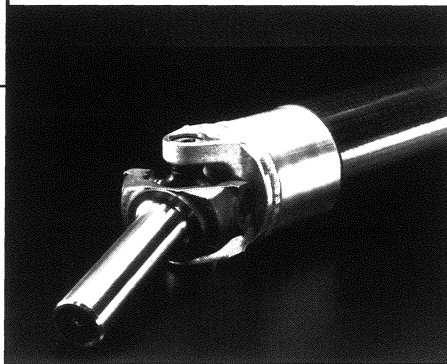
Spicer's exclusive bearing assembly inside diameter crowning and tapered thrust pads distribute loads more evenly on needle roller bearings and cross trunnion ends to significantly reduce end galling. Bearing assemblies are individually sealed to provide retention of lubricants and prevent the entry of foreign material. If lubricants become contaminated with water or abrasive matter, needle roller bearing life is seriously affected.

Abrasive material is a major problem when a vehicle operates under conditions of extreme moisture and dirt. To combat this problem, synthetic rubber seals were developed and resulted in increased life, ability to withstand high temperature and a less critical relubrication cycle for driveshafts.

Special high-strength tubing is used to provide maximum torque carrying capacity at minimum practical weight. In addition to steel tubing in use for many years now, Spicer Lite™ aluminum and Graph-Lite™



*Spicer Lite™ Aluminum Driveshaft*

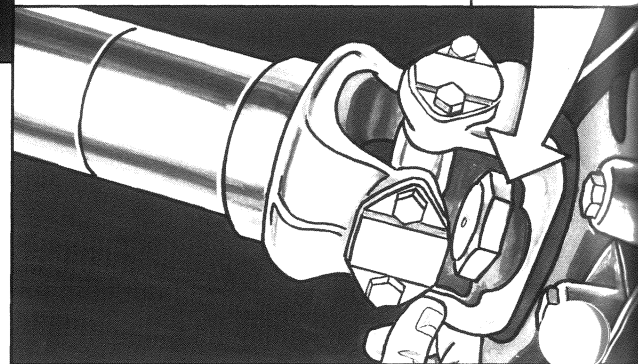


*Spicer Graph Lite™ Driveshaft*

The sliding splines between slip joint and permanent joint must support the driveshaft and be capable of sliding under full torque loads. To aid in this axial or slip movement, Spicer Glidecote™ was developed to reduce sliding friction thereby reducing thrust loads under high torque. This non-metallic coating also prevents spline galling and extends spline life.

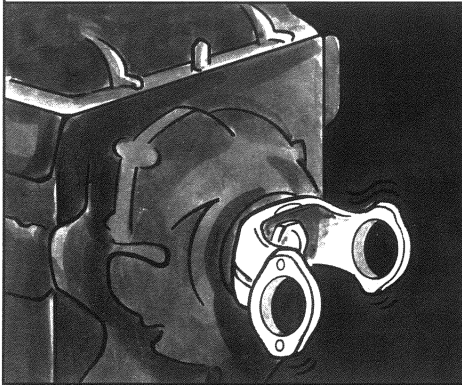
## INSPECTION

To keep a vehicle operating smoothly and economically the driveshaft must be carefully inspected at regular intervals. Vibrations and u-joint and shaft support (center) bearing problems are caused by such things as loose end yokes, excessive radial (side to side or up and down) looseness, slip spline radial looseness, bent shaft tubing, or missing plugs in the slip yoke.

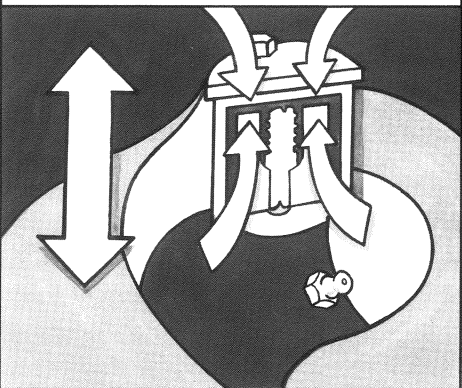


1. Check the output and input end yokes on both the transmission and axle, or axles, for looseness. If loose, disconnect the driveshaft and retorque the end yoke retaining nut to specification. If yoke replacement is required, check for manufacturer's recommendation regarding replacement frequency of the end yoke retaining nut.

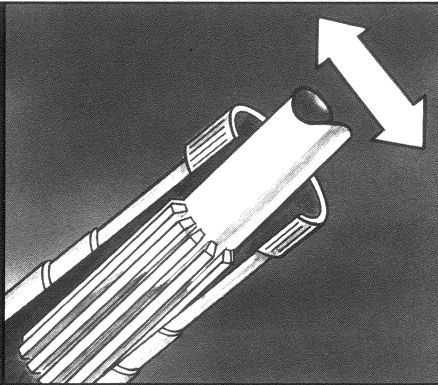
# INSPECTING AND LUBRICATING THE DRIVESHAFT (ALL TYPES)



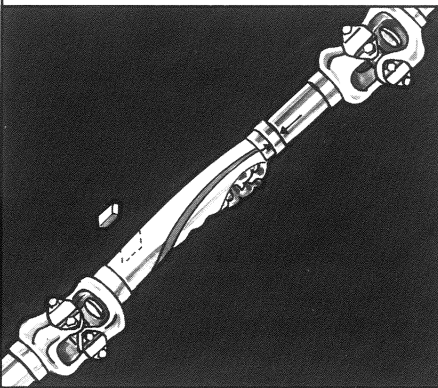
2. If the end yokes are tight, check for excessive radial looseness of the transmission output shaft and axle input and output shafts in their respective bearings. Consult transmission and axle manufacturer's specifications for acceptable radial looseness limits and method of checking.



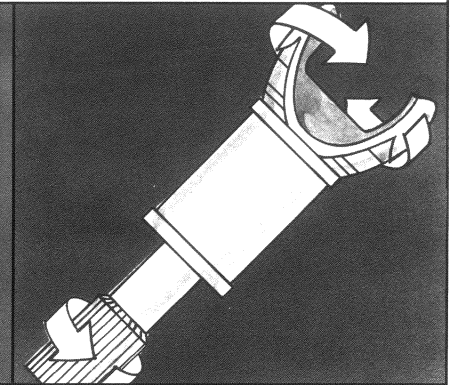
3. Check for excessive looseness across the ends of the bearing assemblies and trunnions. This looseness should not exceed .006 inches maximum.



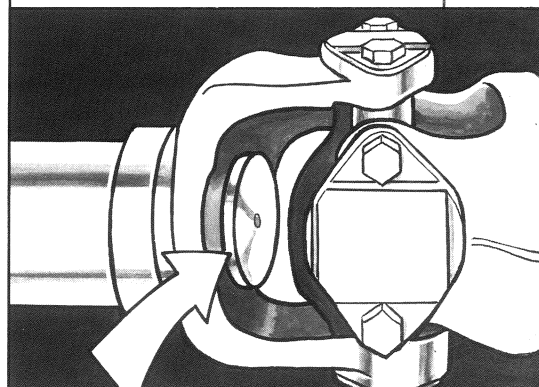
4. Check the slip spline for excessive radial movement. Radial looseness between the slip yoke and the tube shaft should not exceed .007 inches.



5. Check the shaft for damaged, bent tubing or missing balance weights. Make certain there is no build up of foreign material on the shaft, such as undercoat or concrete. If found, they should be removed carefully to avoid damage to the driveshaft.



6. If runout readings are required, they should be taken with the driveshaft mounted in the vehicle, with the transmission in neutral and the axle shafts pulled, or by jacking rear wheels off the ground and placing axles on jack stands. This will allow rotating the driveshaft by hand to check indicator readings. The runout readings taken at the various locations should not exceed an additional 0.010 T.I.R. over the manufacturer's specified runout. (See page 24)



7. For an inboard and outboard slip yoke assembly design, check to be sure the plug is not loose or missing ... if it is, repair or replace it. Loose or missing plugs are commonly caused by not enough driveshaft slip capability.

# INSPECTING AND LUBRICATING

## LUBRICATION

Among the most common causes of joint and slip problems is lack of proper lubrication. Properly sized Spicer U-joints that are adequately relubricated at recommended intervals will normally meet or exceed vehicle operation requirements. Relubrication flushes the joints thus removing abrasive contaminants from the bearings.

## LUBRICANTS FOR UNIVERSAL JOINTS

For a standard application, use a good quality E.P. (extreme pressure) grease (Timkin Test Load 45 lbs. min) meeting \*N.L.G.I. Grade 2 specifications.

Grease must have an operating range of +325°F/+163°C to -10°F/-23°C and be compatible with commonly used multi-purpose greases such as Lithium Soap Types.

For driveshaft applications involving shaft speeds below 500 RPM, a mineral oil in the SAE 140 to 250 viscosity range should be used.

Consult your local lubricant source for greases that meet these specifications.

## N.L.G.I. \*E.P. Grade 2 Lubricating Grease

\*National Lubricating Grease Institute

## INITIAL LUBRICATION AND RELUBE CYCLES

Spicer replacement universal joint kits contain only enough grease to provide needle roller bearing protection during storage. It is therefore necessary to completely lubricate each replacement kit prior to assembly into the yokes. Each cross lube reservoir should be fully packed with a recommended grease and each bearing assembly should also be wiped with the same grease, filling all the cavities between the needle rollers and applying a liberal grease coating on the bottom of each bearing assembly. Too much grease may cause hydraulic "lock-up", making installation difficult. After the kits are installed into the yokes and prior to placing into service, they should be relubed, through the lube fitting, using the same grease.



Relubrication cycles vary depending on the service requirements and operating conditions of the vehicle. A recommended relube cycle for various types of service is shown below.

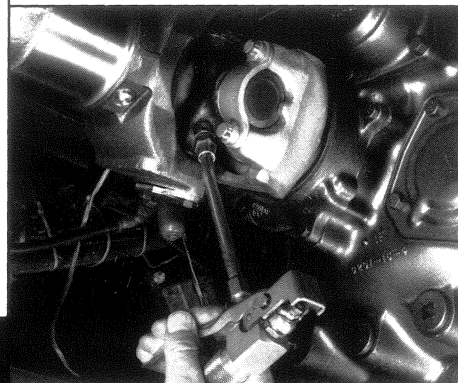
*NOTE: On-highway is defined as all applications requiring less than 10% of operating time on gravel, dirt or unimproved roads. If longer than 10% operating time off-highway, use off-highway recommendations.*

TYPE OF SERVICE	MILES	or	TIME
CITY	5000/8000		3 MONTHS
ON HIGHWAY (MID-RANGE)	10,000/15,000		3 MONTHS
ON HIGHWAY (LINE-HAUL)	10,000/15,000		30 DAYS
ON/OFF HIGHWAY	5,000/8,000		3 MONTHS
OFF HIGHWAY/ INDUSTRIAL			500/200 HRS.*

\*Relubrication cycles for off highway and industrial use vary depending on the application and operating conditions. In general, to obtain maximum life, relubrication should occur every 500 hours for normal service and every 200 hours for continuous service or severe environmental conditions.

## LUBRICATION PROCEDURE FOR U-JOINTS

(Except Constant Velocity Type Joints)



**WARNING:** Rotating shafts can be dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death.

Do not work on a shaft (with or without a guard) when the engine is running.

Do not go under the vehicle when the engine is running.

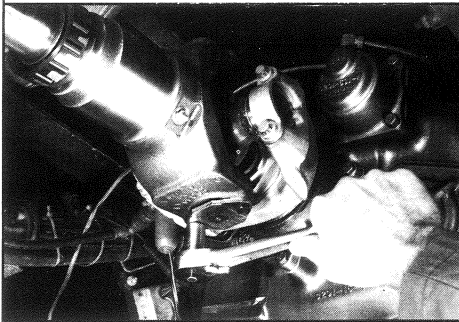
In order to avoid becoming entangled install power take-off and/or shaft behind the frame rail, tanks, battery box, etc.

If power take-off and/or shaft are still exposed after installation, install a guard.



# INSPECTING AND LUBRICATING

1. Use the proper lubricant to purge all four seals of each u-joint. This flushes abrasive contaminants from each bearing assembly and assures all four are filled. Pop the seals. Spicer seals are made to be popped.
2. On center twin zerk design or single zerk kits, if any of the seals fail to purge, move the driveshaft from side to side and then apply gun pressure. This allows greater clearance on the thrust end of the bearing assembly that is not purging. On two-zerk kits, try greasing from the opposite lube fitting. For light-duty kits, check for a fully seated snap ring or burrs on the snap ring or snap ring groove.
3. Because of the superior sealing capability of the Spicer Seal design on the 1610, 1710, 1760, 1810 and 1880 Series, there will occasionally be one or more bearing assembly seals that will not purge.



Release seal tension by loosening the bolts holding the bearing assembly that doesn't purge. It may be necessary to loosen the bearing assembly approximately 1/16 inch minimum. If loosening it does not cause purging, remove the bearing assembly to determine cause of blockage.

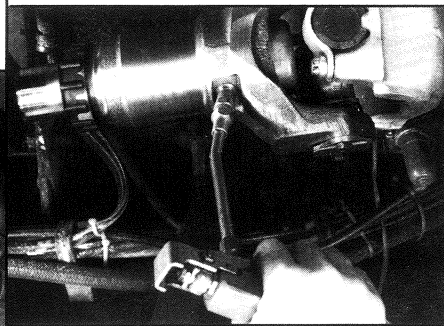
4. Install new bolts and torque to specifications.

**CAUTION:** Retaining bolts should not be reused. If loosening or removal of bolts is necessary, install new bolts and torque to specification.

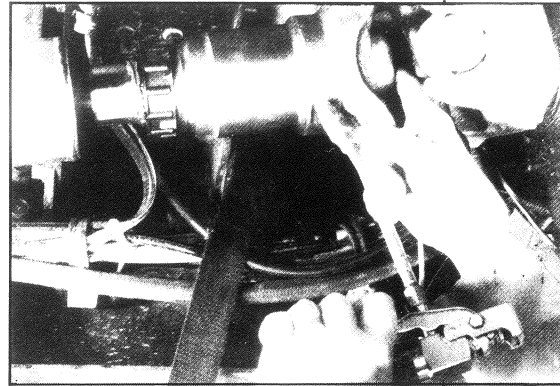
## LUBRICATION FOR SLIP SPLINES

The lubricant used for u-joints is satisfactory for slip splines. Glidecote™ and steel splines both use a good E.P. grease meeting N.L.G.I. Grade 2 specifications.

Relube splines at the intervals recommended in the chart for u-joints.



1. Apply grease gun pressure to the lube fitting until lubricant appears at the pressure relief hole in the plug at the slip yoke end of the spline.



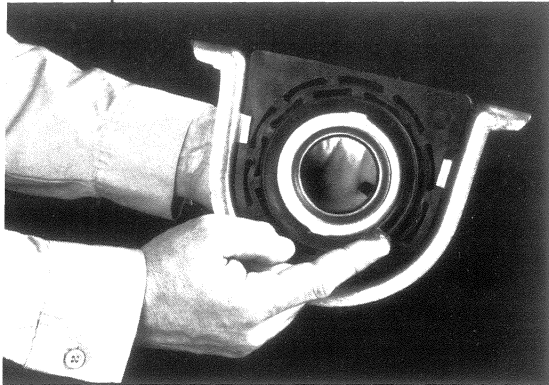
2. Now cover the pressure relief hole with your finger and continue to apply pressure until grease appears at the slip yoke seal.

**CAUTION:** In cold temperatures be sure to drive the vehicle immediately after lubricating. This activates the slip spline and removes the excessive lubricant. Failure to do so could cause the excess lubricant to stiffen in the cold weather and force the plug out. The end of the spline would then be open to collect contaminants and cause the spline to wear and/or seize.

## SHAFT SUPPORT BEARING ASSEMBLIES

Bearing manufacturers do the initial lubrication and all Spicer shaft support (center) bearings are lubed for life. When replacing a shaft support bearing assembly, be sure to fill the entire cavity around the bearing with waterproof grease to shield the bearing from water and contaminants. Enough grease must be put in to fill the cavity to the extreme edge of the slinger surrounding the bearing. Lubricants must be waterproof. The following chart lists recommended waterproof lubricants for use with center bearings.

# SERVICING THE DRIVESHAFT

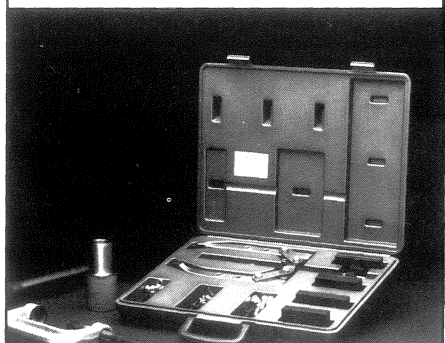


**NOTE:** There are numerous instances when special lubrication is required by vehicle specification or customer request. The lubrication recommendations listed in this manual are what Spicer U-Joint engineers suggest. Any alternate lubricants, or lubrication procedures, are the responsibility of the user.

## Recommended Lubricants

### - Source

- Rykon Premium No. 3
  - Amoco Oil Company
- Sun C-34 Grease (Cup No. 4)
  - Sun Oil Company
- Amolith 8516
  - Amoco Oil Company
- Van Talgar No. 4
  - Exxon Company



## SERVICING THE DRIVESHAFT

### Heavy Duty Application

Cross and Bearing Kit Replacement  
Bearing Plate Design

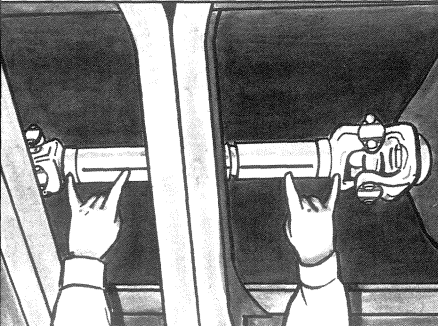
Full Round and Quick Disconnect End Yoke Designs

## Special Tools:

- Torque wrench (125 lb./ft.)
- Journal locator
- U-joint press
- V-block
- \* Alignment bar/No Go wear gauge
- Common hand tools

One of the following is recommended:  
Owatonna tool kit (#7057)  
(Two-jaw puller)  
Tiger tool kit  
JJAG tool kit  
J & J tool kit

\*Available only from Dana Corporation Spicer Service Representatives.



**NOTE:** Before removal of the driveshaft set the brakes, block the wheels, and mark the slip yoke assembly and tube shaft with a marking stick or paint to assure proper alignment when reassembled. This is known as keeping the driveshaft yokes "In Phase."

**CAUTION:** Never heat components or use sledge hammers and floor jacks to disassemble driveshafts. This can result in damaged, weakened or bent components.

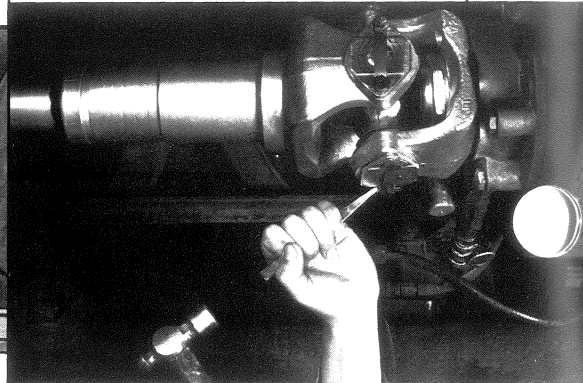


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## REMOVAL

### (Full Round End Yoke Style)

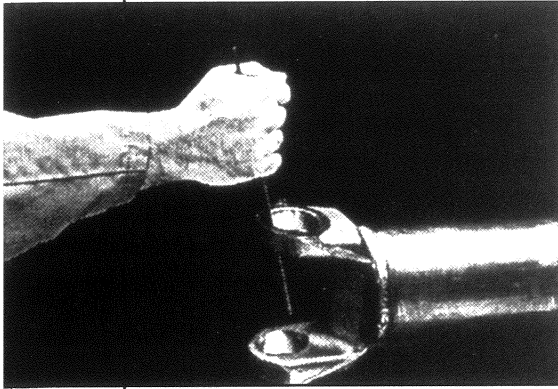
1. The method of driveshaft removal should be one that assures safety and ease of removal to the mechanic without damage to the driveshaft, transmission or axle components. Suggested method is use of a u-joint puller:  
Owatonna tool kit #7057, Tiger tool kit, JJAG tool kit, or J&J tool kit.



2. Bend tabs of lock straps away from bolt heads with a chisel.

**NOTE:** The self-locking bolt design for full-round end yokes uses serrated bolts with lock patch and DOES NOT require a lock strap.

# SERVICING THE DRIVESHAFT



If after proper cleaning of the cross holes the alignment bar will not pass through simultaneously, the yoke lugs are distorted and the yoke or yokes should be replaced.

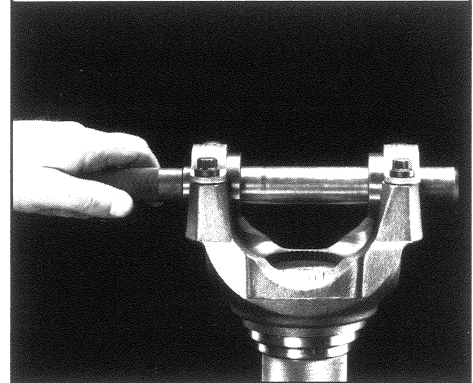
**CAUTION:** Use a journal locator to avoid nicking journal cross trunnions or damaging oil seal slingers.

## DISASSEMBLY (Quick Disconnect™ Half Round End Yoke Style)

1. Place the driveshaft in v-blocks to remove the cross and bearing assemblies.
  2. Completely remove the cross and bearings from both ends of the driveshaft by removing the bolts and bearing straps.
  3. Remove the end yoke from the driveshaft and place in a soft jawed vise to inspect the crosshole surfaces. Raised metal can be removed with a rat tail or half round file. Emery cloth should be used to remove all rust and corrosion from crosshole bores.
  4. Check the yoke for crosshole alignment using the Spicer Alignment gauge. Place the correct bushing in each lug ear allowing a .03 to .06 clearance between the tang and the bushing.
3. After removing the cross and bearings, both ends, inspect the cross hole surfaces for damage or raised metal. Raised metal can be removed with a rat tail or half round file and emery cloth. Check the yoke lug crossholes with a No-Go Wear Gauge and then use a Spicer Alignment Bar to inspect for damage by sliding through both cross holes simultaneously. The alignment bar will identify yoke lugs that have taken a set because of excessive torque. The raised metal or distorted lugs can be a cause of premature cross and bearing problems.

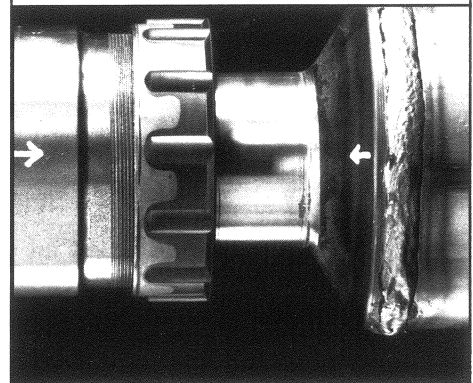
At this time, clean the cross holes of the yokes on the transmission and axle and inspect with an alignment bar gauge as described above.

Assemble bearing straps and bolts, tightening bolts a minimum of 30 ft. lbs. Insert the alignment gauge into one crosshole. If the gauge enters and passes through the opposite crosshole, alignment is correct. If the alignment gauge will not enter the opposite crosshole, reinspect for burrs.

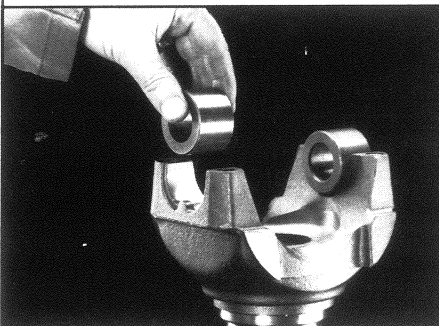


If, after proper cleaning, the alignment gauge still does not pass through both crossholes, the yoke lugs are distorted and the yoke should be replaced.

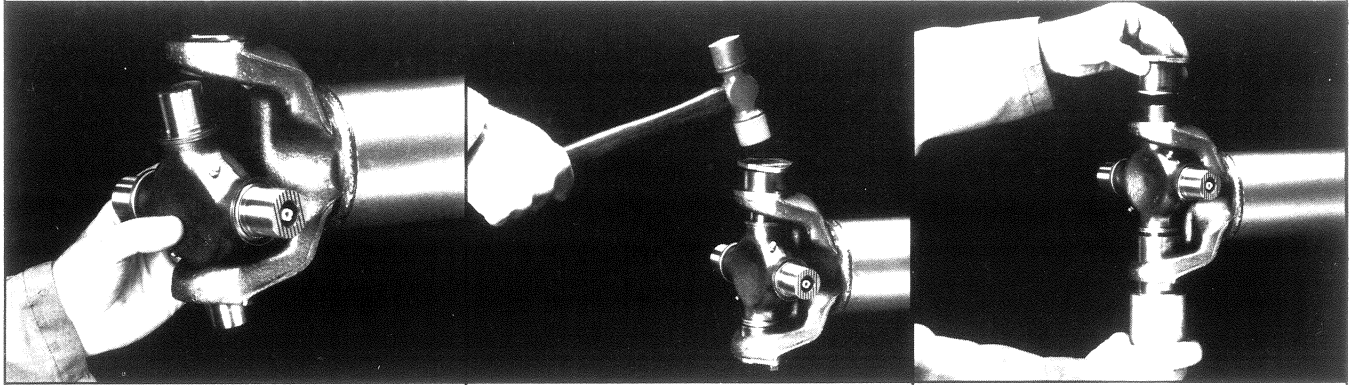
## REASSEMBLY



1. Place each end of the driveshaft, less cross and bearing kits, on v-blocks. Check the paint marking placed on the tube and slip yoke assembly prior to removing from the vehicle to be sure they are lined up or "in phase."

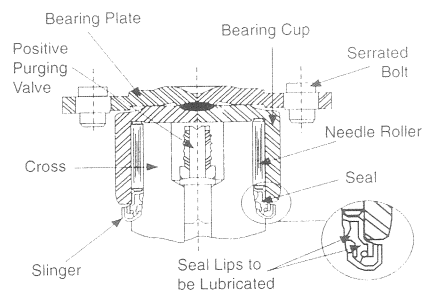


# SERVICING THE DRIVESHAFT



2. Remove the cross and bearings from the box and remove all four bearing assemblies.

Rotate the cross to inspect for presence of the positive purging valve in each lube hole of all four trunnions. Then position the cross into the end yoke with its lube fitting in line as near as possible with the slip spline lube fitting. Keep the lube fitting on the inboard side.



3. The lips of the seal on the u-joint **must** be lubricated with a light weight oil to prevent the seal from turning inside out upon installation. Also, each cross reservoir must be packed with grease and **each** cap bearing wiped with grease prior to assembly.
4. Move one end of the cross to cause a trunnion to project through the cross hole beyond the outer machined face of the

yoke lug. Place a bearing assembly over the trunnion diameter and align it to the cross hole.

Holding the trunnion in alignment with the cross hole, using the journal locator, press bearing assembly flush to face of end yoke by hand.

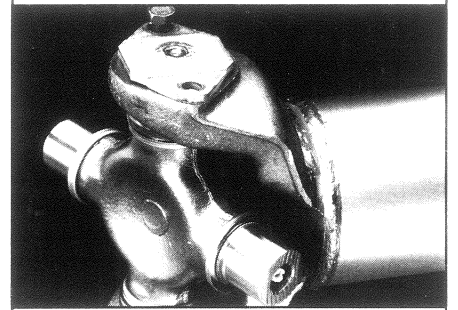
A journal locator should be used to prevent damage to the u-joint trunnions and slingers. If the u-joint bearing cap is pressed into place, the bearings and bearing surfaces could be damaged.

If bearing assembly binds in cross hole, tap with soft hammer directly in center of bearing assembly plate. Do not tap outer edges of bearing plate.

Exact fit of all driveline components is extremely important. The correct parts and clean mating surfaces are essential for safe operation and good repair.

5. When the bearing assembly is completely seated, put the lock plate tab in place and use the "Grade Eight" cap screws that are furnished with the kit and insert them through the cap screw holes in both

the lock strap and bearing assembly. Thread with hand or wrench into tapped holes in yoke. Do not torque down bolts.



**NOTE:** The self-locking bolt design for full-round yokes uses serrated bolts with lock patch and **DOES NOT** require a lock strap. **DO NOT** reuse **ANY** retaining bolt. If loosening or removal of a bolt is necessary, replace with a new one.

6. Move the cross laterally to the opposite side and through the cross hole beyond the machined surface of the yoke lug. Place a bearing assembly over the cross trunnion and slide it into the cross hole, seating the plate to the face of the lug. Put the lock plate tab in place and thread the bolts with hand or wrench into tapped holes in yoke.

# SERVICING THE DRIVESHAFT

**NOTE:** Projecting the trunnion through a cross hole beyond the machined surface of the lug will provide a surface to help align the bearing assembly with the cross hole. This method should also be followed when assembling driveshaft to yokes of vehicle at transmission and axle or axles.

7. Repeat process of installation of cross and bearing kit at opposite end of the driveshaft. Make sure to position the cross in the yoke so that the lube fitting is in line with the lube fitting at the other end.
8. For flange yoke applications, install the flange yoke, bearing assemblies and bolts at this time.

**CAUTION:** Worn bearing assemblies used with a new cross or new bearing assemblies used with a worn cross will wear rapidly making another replacement necessary in a short time.

**Always Replace the Cross, Four Bearing Assemblies and Bolts as a Unit.**

## INSTALLATION IN VEHICLE

The installation of a driveshaft does not present any unusual mechanical difficulties. Before actual installation the driveshaft should be checked for the following items:

- ✓ Damage or dents on the driveshaft tubing.
- ✓ Splines should slide freely with slight drag from slip shaft seal.
- ✓ Cross should flex and be free from excessive bind. A slight drag is the most desirable condition on a new cross and bearing kit. Excessive looseness is not desirable and will

result in an unbalanced driveshaft.

- ✓ Mounting flanges and pilots should be free from burrs, paint and foreign substances which would not allow proper seating at assembly.

When servicing system balanced assemblies it is imperative that the following rules be strictly adhered to:

1. Sleeve yokes to midship shafts, end yokes, companion flanges, etc. must not be rotated from their original position during reassembly.
2. It is strongly recommended that an indexing mark or line be painted down the entire length of all assemblies prior to removal from the vehicle.
3. Upon reassembly, all components must be reinstalled exactly as removed. Do not turn yokes or sleeves from their original position.

For Spicer slip yoke interaxle applications, the slip yoke should be installed with the yoke ears "up hill" from the seal. In main driveshaft applications, the slip yoke seal should be up hill or with the slip yoke at the transmission in transmission-to-axle applications.

4. If at all possible, do not remove boots or dust caps from sleeve assemblies.
5. Inspect boots for any damage (rips or holes). If boot is damaged, it must be discarded. Do not reuse clamps.
6. Push on dust caps are not serviceable. If dust cap must be removed, replace it with a new one.

7. If a boot must be disconnected, remove the clamp at the sleeve end and leave the other end attached. Do not reuse clamp.
8. **IMPORTANT:** If any major component is replaced on any of the assemblies (any component other than boots, dust caps, or u-joints), the entire system balanced assembly must be rebalanced by a competent driveshaft repair facility capable of system balancing.

Failure to adhere to these recommendations can cause excessive driveline vibration and/or premature component failure.

**NOTE:** The unitized one piece seal now used on Spicer driveshafts is not intended to be removed in service. When servicing driveshafts with the pop on seal, DO NOT remove the seal from the slip yoke. Pull the tube shaft out of the slip yoke and carefully realign the splines on the tube shaft with the slip yoke upon reassembly. To separate the tube shaft from the slip yoke, pull the tube out of the slip yoke, leaving the seal in place. A significant amount of force will be required to remove as well as reinstall the tube shaft through the seal. Removal of the unitized seal causes damage to the seal lip where it contacts the slip yoke. If removal of the seal is absolutely necessary, it should be replaced with a new unit.

To remove the old seal, hold the yoke assembly firmly in a vise. Using a large chisel, drive the seal off of the yoke. To install a new seal, generously lubricate the seal lip and press the new seal into place using a small arbor press or equivalent.



**WARNING:** Rotating shafts can be dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death.

# SERVICING THE DRIVESHAFT

Do not go under the vehicle when the engine is running.

Do not work on a shaft (with or without a guard) when the engine is running.

Do not engage or disengage driven equipment by hand from under the vehicle when the engine is running.

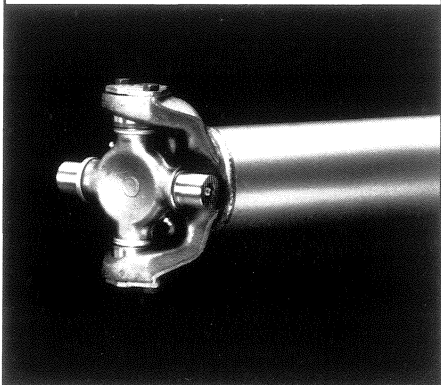
In order to avoid becoming entangled, install the power take-off and/or shaft behind the frame rail, tanks, battery box, etc.

If power take-off and/or shaft are still exposed after installation, install a guard.

Install a support strap when servicing a driveshaft to prevent personal injury.

## FULL ROUND END YOKE STYLE

1. Rotate the transmission end yoke by putting the transmission in neutral and the axle end yoke by jacking up one rear wheel, so the cross holes are in a horizontal position.



2. Tilt the cross trunnions of the driveshaft, both ends, with trunnions pointing toward each other from end to end, one side. Install with the slip joint nearest the source of power. Use a nylon support strap to aid in handling the driveshaft.

**CAUTION:** Use a journal cross locator to avoid nicking journal cross trunnions or damaging oil seal slingers.

3. Holding the driveshaft firmly, project a trunnion in an outward position

between the lugs of either the axle or the transmission end yoke and through a cross hole. Repeat at opposite end. The driveshaft is being supported at each end by one trunnion surface in a cross hole and the nylon support strap.

Tilt a cross trunnion until the opposite side can be inserted through a cross hole. Repeat at opposite end. The driveshaft is now being supported at each end by two trunnion surfaces in the cross holes and the nylon support strap.

4. Move one end of the shaft to cause a trunnion to project through the cross hole beyond the outer machined face of the yoke lug. Place a bearing assembly over the trunnion diameter and align it to the cross hole.

Holding the trunnion in alignment with the cross hole, press bearing assembly flush to face of end yoke by hand.

If bearing assembly binds in cross hole, tap with soft hammer **directly in center** of bearing assembly plate. Do not tap outer edges of bearing plate.

5. Slide the shaft to project an opposite trunnion through the cross hole beyond the face of the end yoke. Again, place a bearing assembly over the trunnion, align and place hands on opposite bearing assembly, and press both inward flush to yoke faces. If assembly binds, tap with soft hammer as outlined above. Put the lock plate tab in place and insert the "Grade Eight" cap screws through the holes in the lock plates and bearing assemblies. Thread cap screws into end yokes. Tighten with wrench until plates are flush against end yoke faces.

6. Lubricate the cross and bearing assembly until lube appears at all four seals. If any seal fails to purge, see "Lubrication Procedure for U-Joints." Also check slip yoke lubrication.

7. Torque all eight bolts to specification (see chart below). Bend lock plate tabs to flat of cap screwheads to lock in place.

**NOTE:** The self-locking bolt design for full-round yokes uses serrated bolts with lock patch and **DOES NOT** require a lock strap. **DO NOT** reuse ANY retaining bolts.

8. Repeat at opposite end. Remove nylon support strap.

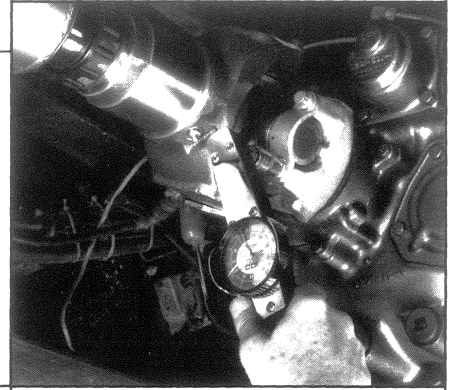
## FULL ROUND END YOKE

SERIES	THREAD SIZE	TORQUE					
		LOCK STRAP DESIGN			SERRATED BOLT w/LOCK PATCH		
		(Lb./Ft.)	(NM)	Bolt P/N	(Lb./Ft.)	(NM)	Bolt P/N
1610	.312-24	26-35	35-48	5-73-109	26-35	35-48	5-73-709
1710	.375-24	38-48	52-65	6-73-109	38-48	52-65	6-73-209
1760	.375-24	38-48	52-65	6-73-109	38-48	52-65	6-73-209
1810	.375-24	38-48	52-65	6-73-109	38-48	52-65	6-73-209
1880	.438-20	60-70	81-95	7-73-115	60-70	81-95	7-73-315

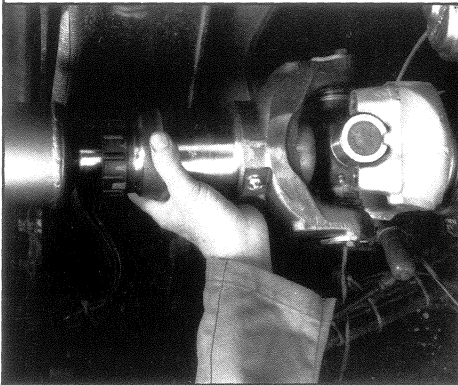
# SERVICING THE DRIVESHAFT

## QUICK DISCONNECT™ HALF ROUND END YOKE

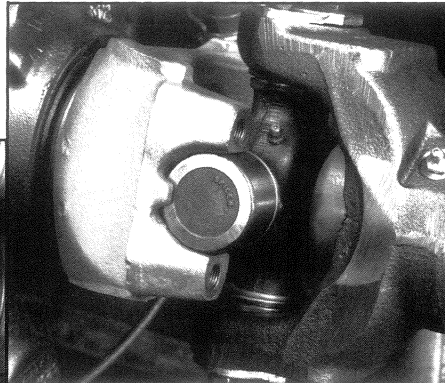
SERIES	THREAD SIZE	BOLT P/N	BOLT TORQUE	
			(Lb/Ft.)	(NM)
SPL90	.375-24	6-73-412	45-60	61-81
1610	.375-24	6-73-412	45-60	61-81
1710	.500-20	8-73-316	115-135	156-183
1760	.500-20	8-73-316	115-135	156-183
1810	.500-20	8-73-316	115-135	156-183



On Quick Disconnect applications, the bearing saddles of the end yoke must be clean and free of any contaminants.

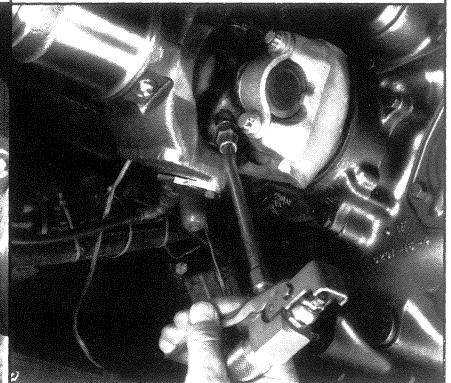


Using a soft hammer, tap the bearing assemblies until they are fully seated into the end yoke. Check to be sure the cups are fully seated in the bearing saddles of the yoke behind the yoke tabs as shown below.



Install the bearing straps and bolts and torque all eight bolts to the proper specification. Bend lock plate tabs to flat of cap screwheads to lock in place.

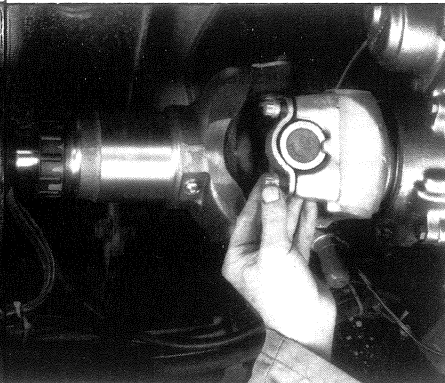
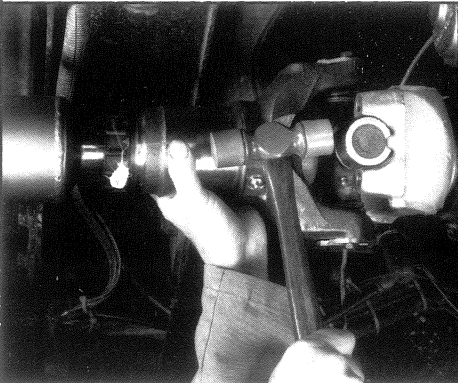
**NOTE:** The self-locking bolt design for full-round yokes uses serrated bolts with lock patch and DOES NOT require a lock strap. DO NOT reuse ANY retaining bolts.



**CAUTION:** Excessive bearing rotation could cause premature wear of components involved. The causes of rotation are:

1. Use of non-Spicer parts with Genuine Spicer components.
2. Improper torque on retaining strap bolts.
3. Failure to firmly seat both bearing assemblies in the end yoke saddles before the strap bolts are tightened.
4. Dirty bearing saddles.

**CAUTION:** Half Round self-locking retaining bolts should not be reused. Follow instructions implicitly to prevent danger of serious personal injury or death from loss of driveshaft function.



Lubricate the cross and bearing assembly until lube appears at all four seals. If any seal fails to purge, see "Lubrication Procedure for U-Joints." Also check slip yoke lubrication.

# SERVICING THE DRIVESHAFT

## FLANGE YOKE

SERIES	THREAD SIZE	BOLT TORQUE	
		(Lb./Ft.)	(NM)
SPL90	.375-24	40-48	54-65
1610	.375-24	40-48	54-65
1710	.375-24	40-48	54-65
1760	.438-20	63-75	85-102
1810	.438-20	63-75	85-102
1880	.625-18	194-232	263-315

## FLANGE YOKE STYLE

With nylon support strap in place and holding the driveshaft firmly, align the (permanent end) flange pilots of the driveshaft flange yoke and axle companion flange with each other. Align bolt holes and install bolts, lock washers and nuts to temporarily secure driveshaft to axle. Compress the slip assembly to position the opposite end of the driveshaft to the transmission companion flange. Align bolt holes and install bolts, lock washers, and nuts. Torque to specifications, both ends.

**NOTE:** 1650 Series Bearing Assemblies with Locking Flats.

When installing new bearing assemblies into cross holes, the locking flat on the bearing assembly must be aligned with the locking flat in the yoke cross hole. Proper location of locking flats will assure that the bearing assembly will not rotate.

## LIGHT AND MEDIUM DUTY APPLICATION

Cross and Bearing Kit Replacement

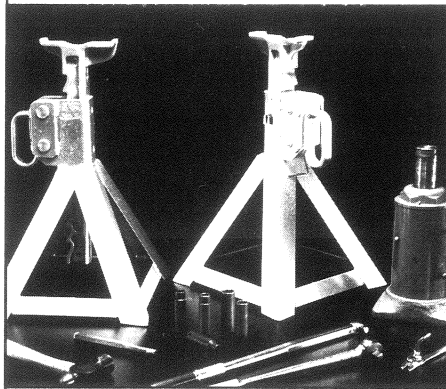
Inside and Outside Snap Ring, U-Bolt and Bearing Strap Design



**WARNING:** Rotating shafts can be dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death. Do not go under the vehicle when the engine is running.

## TOOLS (1000 - 1500 SERIES):

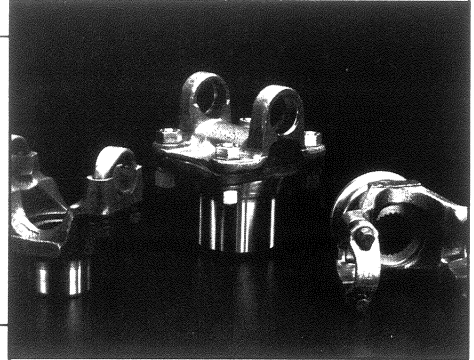
Common Hand Tools  
Soft Hammer



## REMOVAL

Procedures for removing the driveshaft from light and medium duty vehicles are nearly the same as for heavy duty applications. One difference is that the cross and bearings vary in the method of attaching to the vehicle. Methods of attachment include u-bolt, bearing strap and flange yoke design.

For heavy driveshafts, support with a nylon support strap. Remove the u-bolts or strap cap screws from the end yoke. Slide the slip yoke toward the shaft to free the bearings from their seats between the yoke tabs in the end yokes. Care should be taken to avoid dropping the bearing assemblies. Repeat at opposite end.



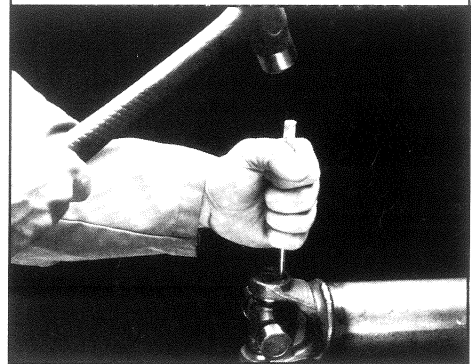
For double flange applications, disassemble as a complete assembly by removing the companion flange bolts.

For flange yoke and end yoke combination-type driveshafts, remove as described above for whatever design applies.

## OUTSIDE SNAP RING DESIGN (RELUBABLE)

### Disassembly

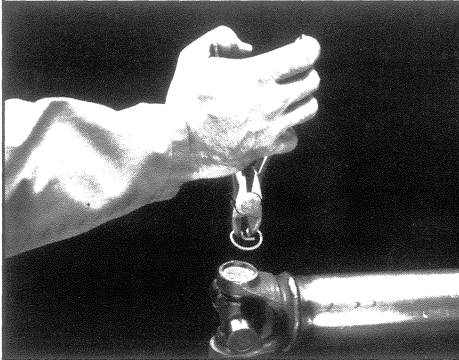
With the shaft removed, the following procedure should be followed:



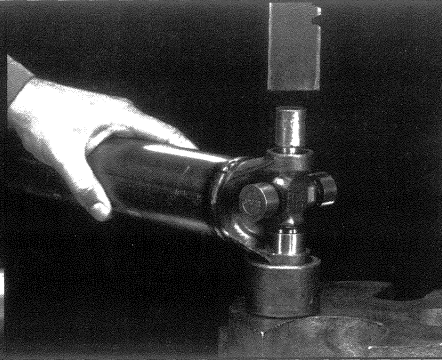
1. Using a soft drift, tap the outside of the bearing assembly to loosen snap ring. Tap bearing only hard enough to break assembly away from snap ring.



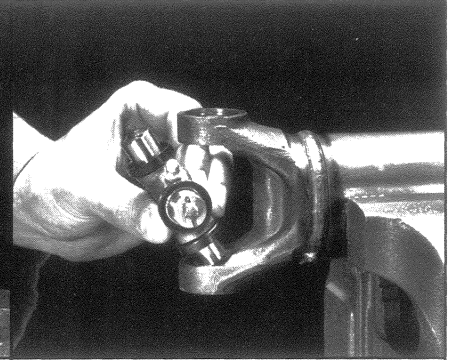
# SERVICING THE DRIVESHAFT



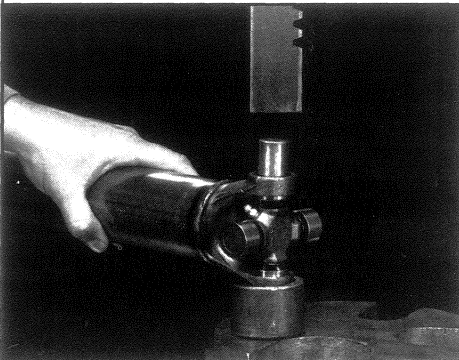
2. Remove snap ring from yoke. Turn joint over, tap bearing away from snap ring, then remove opposite snap ring.



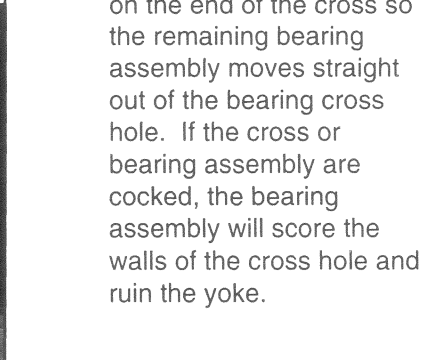
5. To remove the opposite bearing assembly, turn the yoke over and straighten the cross in the open cross hole. Then carefully press on the end of the cross so the remaining bearing assembly moves straight out of the bearing cross hole. If the cross or bearing assembly are cocked, the bearing assembly will score the walls of the cross hole and ruin the yoke.



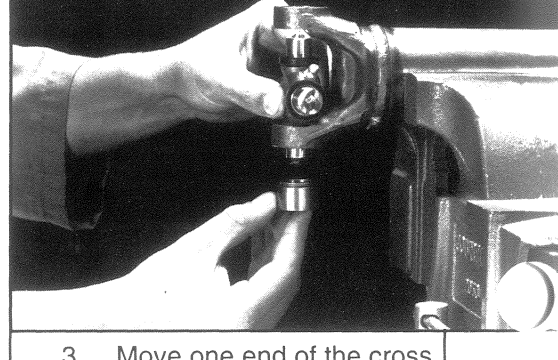
2. Position the cross in the yoke with its lube fitting on the inboard side (toward driveshaft).



3. Set the yoke in the arbor press with a piece of tube stock beneath it. Position the yoke with the lube fitting pointing up to prevent interference during disassembly. Place a solid plug on the upper bearing assembly and press it through to release the lower bearing assembly.

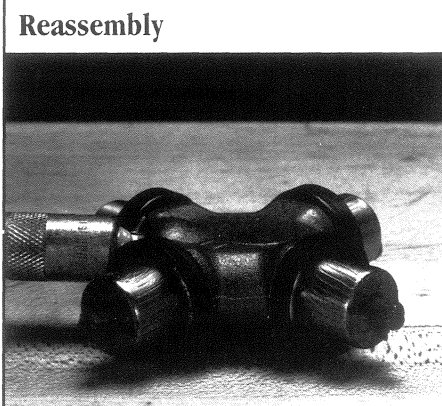


6. Repeat this procedure on the remaining bearing assemblies to remove the cross from the yoke.



3. Move one end of the cross to cause a trunnion to project through the cross hole beyond the outer machined face of the yoke lug. Place a bearing assembly over the trunnion diameter and align it to the cross hole. Using an arbor press, hold the trunnion in alignment with the cross hole and place a solid plug on the upper bearing assembly. Press the bearing assembly into the cross hole enough to install a snap ring.

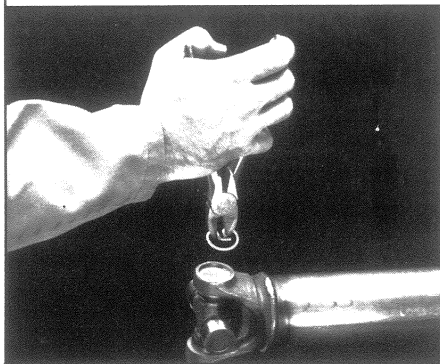
4. If the bearing assembly will not pull out by hand after pressing, tap the base of the lug near the bearing assembly to dislodge it.



## Reassembly

1. Pack the four grease cavities of the cross with a high quality extreme pressure N.L.G.I. Grade 2 grease (refer to page 6). Also pack each bearing assembly approximately 1/4 full with this grease.

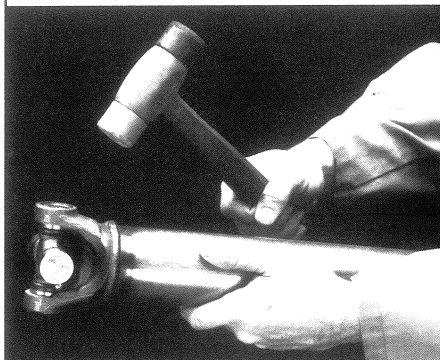
# SERVICING THE DRIVESHAFT



4. Install a snap ring.



5. Repeat steps 3 and 4 to install the opposite bearing assembly. If the joint is stiff, strike the yoke ears with a soft hammer to seat the needle bearings.



**CAUTION:** Be sure snap rings are properly seated in grooves.

6. Repeat steps 2 - 5 at the opposite end of the driveshaft if installing a second kit. Make sure to keep lube fittings at each end of the driveshaft in line.

7. Install the reassembled driveshaft in the vehicle. If bearing straps or u-bolts hold the shaft in vehicle, be certain the bearing assemblies are fully seated between bearing locating shoulders.

8. Torque bolts to specification.

**CAUTION:** Self-locking bolts used with bearing straps should not be reused. Follow instructions implicitly to prevent danger of serious personal injury or death from loss of driveshaft function.

9. Apply more grease through the lube fitting until grease appears at all four bearing seals.

## INSIDE SNAP RING DESIGN (RELUBABLE)

### Disassembly



Removing an inside snap ring.

Repeat outside snap ring design disassembly instructions.

### Reassembly

Repeat outside snap ring design reassembly instructions.



**WARNING:** Rotating shafts can be dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death. Do not go under the vehicle when the engine is running.

In order to avoid becoming entangled install power take-off and/or shaft behind the frame rail, tanks, battery box, etc.

If power take-off and/or shaft are still exposed after installation, install a guard.

## PRELUBE OR LUBE-FOR-LIFE™ DESIGNS



Spicer Prelube or Lube-for-Life™ U-joint Kit

Some Spicer crosses and bearings are prelube or lube-for-life designs and have no lube fittings. Since lubrication is critical, special seals are used to contain the lubricant in the cross/bearings in this design.

Service instructions are nearly the same for relubable and prelube or lube-for-life design, whether it is inside or outside snap ring, u-bolt or bearing strap design.

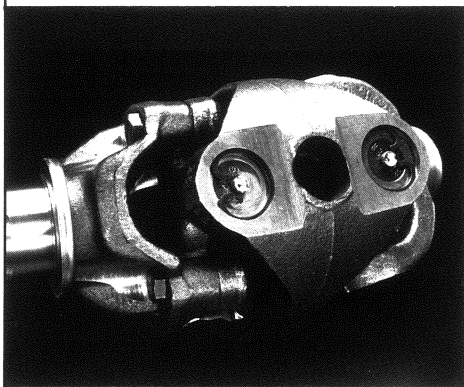
The difference is that lifetime lubrication is done by Spicer at the time of manufacture and relubrication should not be necessary. Replacement of the cross and bearing kit rather than relubrication is recommended.

# SERVICING THE DRIVESHAFT

## TORQUE SPECS FOR LIGHT AND MEDIUM DUTY

POSITION	BOLT SIZE	TORQUE	
		(Lb./Ft.)	(NM)
U-Bolts	(5/16) .312-24	14-17	19-23
	(3/8) .375-24	20-24	27-33
	(7/16) .438-20	32-37	43-50
Bearing Strap	(1/4) .250-28	13-18	18-24
	(5/16) .312-24	25-30	34-41
	(3/8) .375-24	45-60	61-81
Flange Bolts	(5/16) .312-24	22-26	16-35
	(3/8) .375-24	40-48	54-65
	(7/16) .438-20	63-75	85-102
	(1/2) .500-20	97-116	132-157

## DOUBLE-CARDAN CONSTANT VELOCITY TYPE JOINT (Light Duty)



The double-cardan constant velocity (CV) type u-joint is a special design to accommodate necessary installation angles not compatible with single-cardan u-joints. The CV joint also requires special attention. Neglect is its main enemy.

The CV joints need lubrication to live. Some of the older assemblies using flush-type fittings require special lube gun fittings, such as a needle nose attachment. The crosses may or may not have lube fittings.

The centering socket and ball is critical to proper function of the CV joint and smooth operation. Without lubrication it will wear out, causing vibration and serious damage. Rebuilding the CV joint will be necessary.

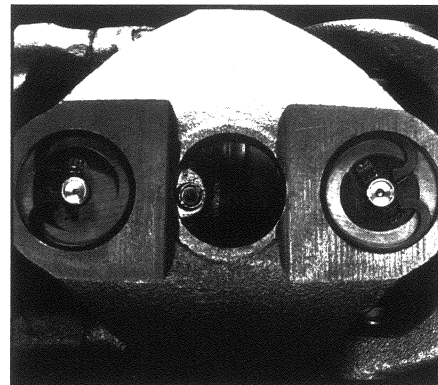
## LUBRICATION

The lube fitting for the centering socket in the CV joint can be difficult to reach and requires a special lube technique. It is necessary to rotate the driveshaft to a position with the flush type lube fitting in the centering socket up toward the floor board. The yokes spread or open in this position to allow access with the needle nose tip. It is still an awkward and blind procedure. That explains why neglect is so common.



**WARNING:** Rotating shafts can be dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death. Do not work on a shaft (with or without a guard) when the engine is running.

A more positive, less frustrating approach is to disconnect the driveshaft. The lube fitting will come into view but it may be necessary to jack one front wheel and rotate the driveshaft. This can be done to all 4WD vehicles with the double-cardan u-joint.



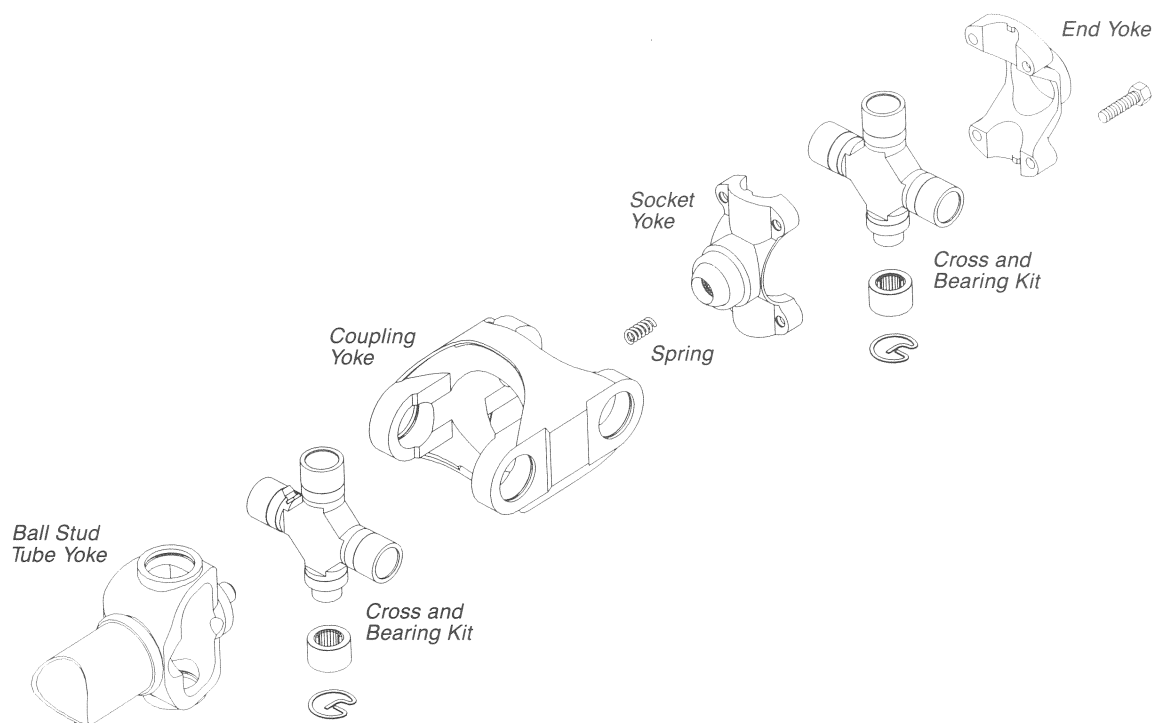
*Lubrication access hole in late-design Spicer Double Cardan Joints*

The later-design Spicer CV joints simplify lubrication by making easy access to the lube fittings. Service replacement kits have been modified with a lube fitting in one or more bearing assemblies to aid in lubrication access. Also, an access hole has been provided in the center yoke for easy lubrication of the centering ball. This new design eliminates the need to disconnect the shaft and puts the fittings in plain view.

Look for signs of u-joint trouble when lubricating u-joints:

- ✓ Lube spray from a leaky seal indicates need for u-joint replacement.
- ✓ Any looseness or noticeable "slop" at a u-joint in the driveshaft calls for immediate replacement of the u-joint, assuming the snap rings or bolts are already in place or torqued down.

# SERVICING THE DRIVESHAFT



Spicer Double Cardan Constant Velocity Type Joint

## SPICER STYLE REPAIR KIT

The Spicer style double cardan CV joint has outside snap rings. CV joint repairs should be made whenever inspections show any noticeable sign of loose fit, corrosion or loss/lack of lube at u-joint or centering ball.

Centering socket/ball repair kits are available from Spicer with installation instructions for replacement. The correct repair kit depends on whether the CV joint is the older or newer type. The advantage of easy access lube fittings for the new style center kit would be lost when installed in an old style u-joint. The centering kits have a different location for the lube fitting.

The disassembly and reassembly of both types is basically the same procedure. It is important that both styles be reassembled with all lube fittings aligned on the same side. This will make service lubrication more

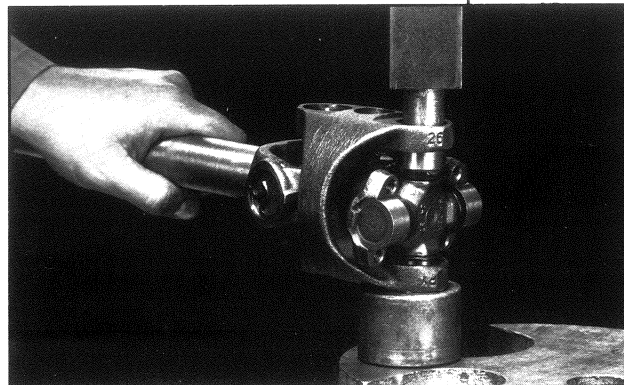
convenient and reduce the possibility of overlooking lube points.

## DISASSEMBLY

1. Disconnect u-bolts or bearing straps at the single-cardan end yoke position. Disconnect cap screws from the CV end yoke or flange bolts from the CV companion flange. This will allow driveshaft removal from the vehicle.



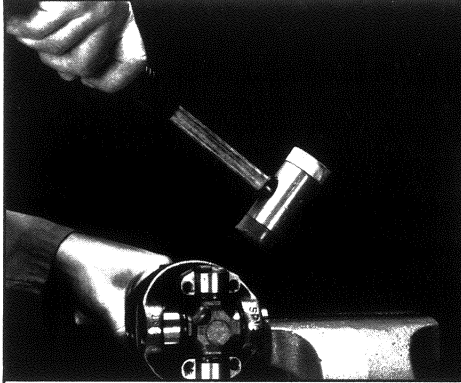
2. Remove all snap rings from the bearing assemblies.



3. Press the bearing assembly partially from the outboard side of the center yoke — enough to grasp by vise jaws. Do not press the bearing assembly completely through.

**NOTE:** Be sure to remove lube fitting if it interferes with bearing assembly press-out.

# SERVICING THE DRIVESHAFT

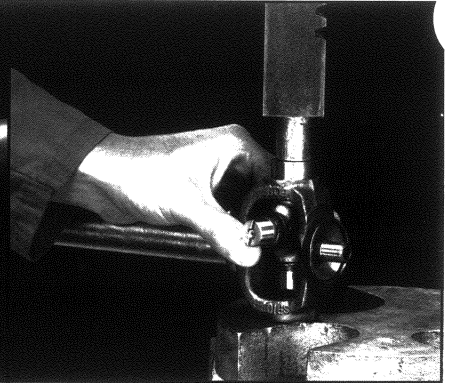


4. Grasp the protruding bearing assembly by vise jaws. Tap the tube yoke with a mallet and drift to dislodge the bearing assembly from the yoke hole.



## REASSEMBLY

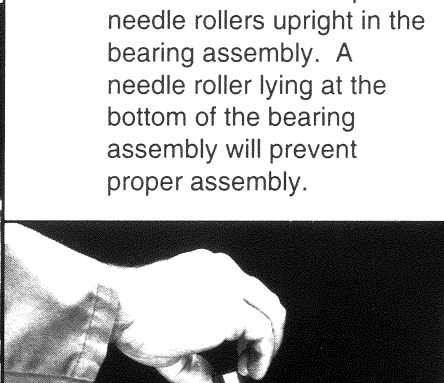
1. Fit a cross into the tube yoke.
2. Place a bearing assembly in a tube yoke hole and over a trunnion. Keep the needle rollers upright in the bearing assembly. A needle roller lying at the bottom of the bearing assembly will prevent proper assembly.



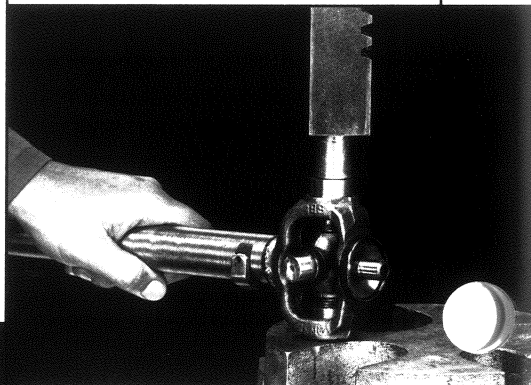
3. Press the bearing assembly in place and install a snap ring.



5. Flip the assembly and repeat steps 3 and 4 for removing the opposite side bearing assembly. This will then allow removal of the cross centering kit assembly and spring.
6. Press the remaining bearing assemblies out on the other cross as described above to complete disassembly.



**NOTE:** Be sure to remove the lube fitting if it interferes with bearing assembly press-up.



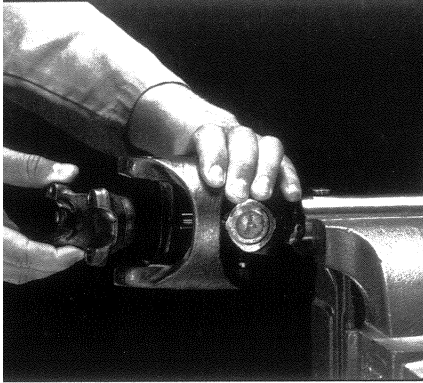
4. Flip the tube yoke and repeat bearing assembly installation on the opposite trunnion. Install a snap ring.

**CAUTION:** Tap in the center of the "H" yoke. Never strike the yokes at the bearing assembly holes because the snap ring grooves may collapse and make reassembly impossible.

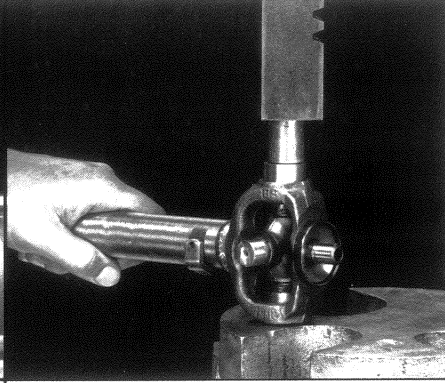


5. Fit the center yoke on the remaining two trunnions and press bearing assemblies in place, both sides. Install snap rings.

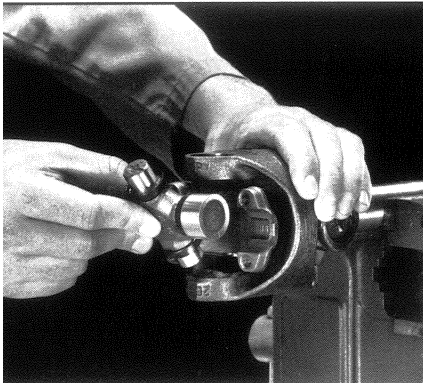
# SERVICING THE DRIVESHAFT



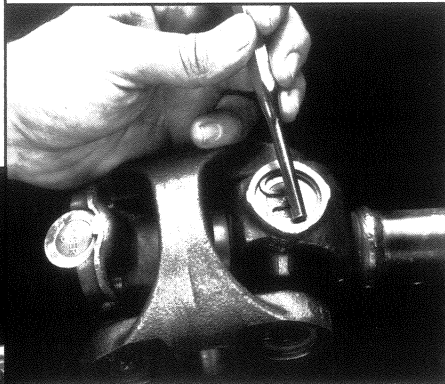
6. Next install the centering kit assembly inside the center yoke making sure the spring in the tube yoke is in place. Align the lube fitting on the centering kit assembly with the lube fitting on the installed cross.



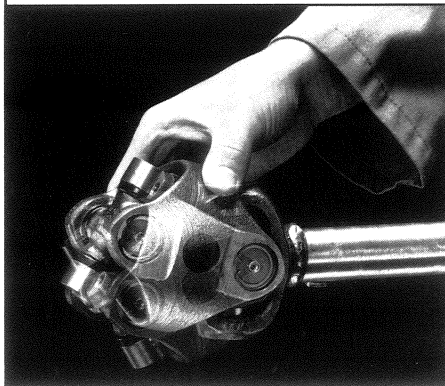
8. Press the remaining two bearing assemblies into place and install snap rings.



7. Place two bearing assemblies on the remaining cross (opposite sides). Fit the open trunnions into the center yoke holes and the bearing assemblies into the centering kit assembly. Make sure the lube fitting on the cross is in line with the other two lube fittings.



9. Tap the snap rings to allow them to set into the grooves. A bearing cup from a used u-joint works well for this.



10. Check for proper assembly. Flex the CV joint beyond center. It should snap "over center" in both directions when all needle rollers and components are correctly assembled.

11. Reinstall in the vehicle.
12. Torque all bolts and cap screws to specifications shown below.
13. Add grease to all three lube fittings.

## TORQUE SPECIFICATIONS FOR DOUBLE-CARDAN CONSTANT VELOCITY TYPE JOINTS

1210CV—Standard Grade Eight Bolts  
Bolt Torque – 13-18 lb./ft.  
(.250-28)

1310/1330CV—Standard Grade Eight Bolts  
Bolt Torque – 22-26 lb./ft.  
(.312-24)

**CAUTION:** Self-locking bolts used with bearing straps should not be reused. Follow instructions implicitly to prevent danger of serious personal injury or death from loss of driveshaft function.



**WARNING:** Rotating shafts can be dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death.

Do not go under the vehicle when the engine is running.

In order to avoid becoming entangled install power take-off and/or shaft behind the frame rail, tanks, battery box, etc.

If power take-off and/or shaft are still exposed after installation, install a guard.

# SERVICING THE ADVANCED MATERIALS DRIVESHAFT

## SERVICING THE DRIVESHAFT

Assembly and disassembly procedures for Spicer Lite™ aluminum and Spicer Graph-Lite™ driveshafts are similar to those of other driveshafts. However, some unique instructions **must be** followed to service advanced technology materials.

### SPICER LITE™ ALUMINUM DRIVESHAFT

#### Inspecting and Lubricating

- 1) Inspect Spicer Lite™ aluminum driveshafts following the same procedures for steel driveshafts as outlined on pages 4 - 7.
- 2) Inspect the aluminum tubing for surface scratches and dents. These scratches may **not** exceed 0.008 inches in depth.

- 3) Visually inspect the circle welds and end fittings for any signs of cracks or

signs of deterioration. If there are any cracks that exceed 0.008 inches in depth, the assembly must be replaced.

- 4) Check to be sure there are no missing balance weights. If balance weights are missing and a void has occurred in the aluminum tubing greater than 0.008 inches, the assembly must be replaced.

## SERVICING

- 1) Service Spicer-Lite™ aluminum driveshafts following the same procedure for steel driveshafts as outlined on pages 13 - 15.
- 2) After removing the cross and bearings from both ends of the driveshaft, inspect the cross hole surfaces for damaged or raised metal. Raised metal can be removed with an emery cloth. The raised metal can cause premature cross and bearing problems.

**CAUTION:** Aluminum is softer than steel. Care must be taken not to remove excessive material or damage cross holes.

- 3) If the universal joint kit is replaced, it must be

replaced with a kit designed specifically for use with aluminum. The use of non-endurion coated kits will result in damage to the driveshaft through galvanic corrosion.

**CAUTION:** When replacing universal joint kits in aluminum driveshafts, use kits designed specifically for aluminum to avoid galvanic corrosion.

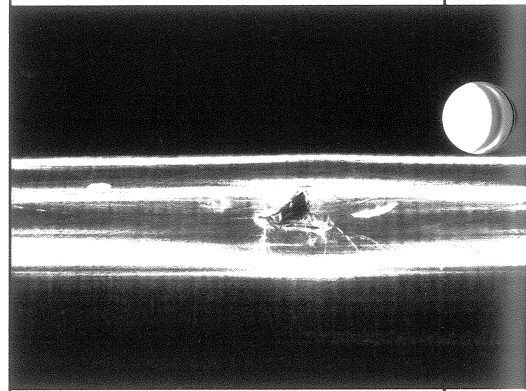
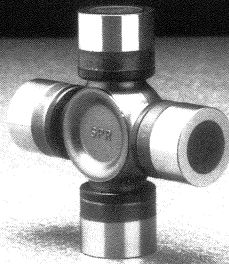
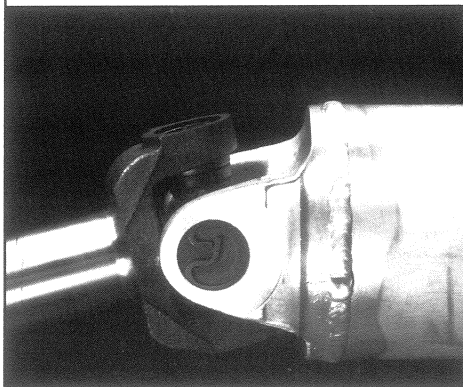
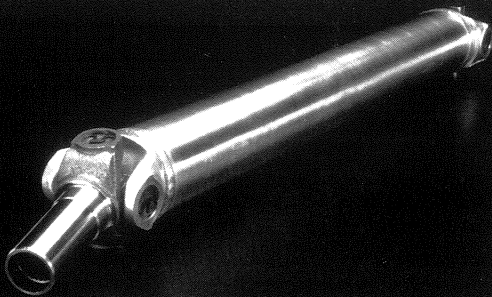
## Straightening and Balancing

- 1) Our Spicer Lite™ aluminum driveshaft can be straightened following the same procedure for steel driveshafts as outlined on page 24.

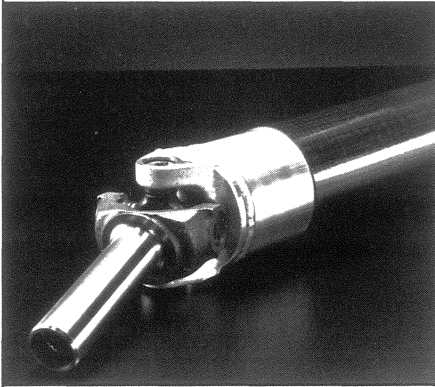
## GRAPH-LITE™ DRIVESHAFTS

### Inspecting and Lubricating

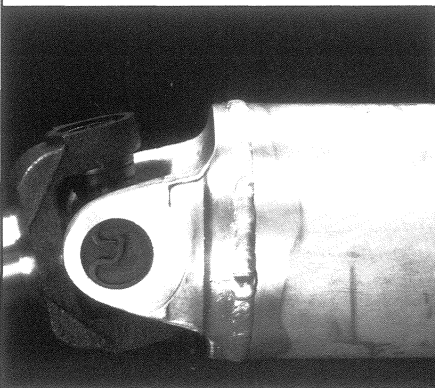
- 1) Inspect driveshaft for any surface imperfections in the black graphite covering. Look for torn graphite near the ends of the covering and surface scratches or cracks deeper than 0.008 inches along the length of the covering. If any imperfections such as these exist, the assembly must be replaced. The black graphite must be securely attached to the aluminum tubing in all areas. If there is any relative movement between the two materials (aluminum and carbon graphite), the assembly must be replaced.



# SERVICING THE ADVANCED MATERIALS DRIVESHAFT



- 2) Inspect the driveshaft following the same procedures for steel driveshafts as outlined on pages 4 - 7.
- 3) Inspect the aluminum tubing for surface scratches and dents deeper than 0.008 inches.



- 4) Visually inspect the circle welds and end fittings for any signs of cracks or deterioration. If there are any cracks that exceed 0.008 inches in depth, the assembly must be replaced.
- 5) Check for any missing balance weights. If balance weights are missing, and a void has occurred in the aluminum tubing greater than 0.008 inches, the assembly must be replaced.

## Servicing

- 1) Service Spicer Graph-Lite™ driveshafts following the same procedure for steel driveshafts outlined on pages 13 - 15.
- 2) After removing the cross and bearings from both ends of the driveshaft, inspect the cross hole surfaces for damaged or raised metal. Raised metal can be removed with an emery cloth. The raised metal can cause premature cross and bearing problems.

**CAUTION:** Aluminum is softer than steel. Care must be taken not to remove excessive material or damage cross holes.



- 3) If the universal joint kit is replaced, it must be replaced with a kit designed specifically for use with aluminum. The use of non-endurion coated kits will result in damage to the driveshaft through galvanic corrosion.

**CAUTION:** When replacing universal joint kits in Graph-Lite™ driveshafts, use kits designed specifically for aluminum to avoid galvanic corrosion.

## Straightening and Balancing

**DO NOT, UNDER ANY CIRCUMSTANCES, ATTEMPT TO STRAIGHTEN ALUMINUM GRAPHITE DRIVESHAFTS.** Any attempt to do this will cause damage to the carbon graphite covering resulting in decreased performance of the driveshaft. The entire driveshaft assembly must be replaced if the tubing is bent or twisted.



**WARNING:** Rotating shafts can be dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death.

Do not go under the vehicle when the engine is running.

Do not work on a shaft (with or without a guard) when the engine is running.

Do not engage or disengage driven equipment by hand from under the vehicle when the engine is running.

In order to avoid becoming entangled, install the power take-off and/or shaft behind the frame rail, tanks, battery box, etc.

If power take-off and/or shaft are still exposed after installation, install a guard.

Install a support strap when servicing a driveshaft to prevent personal injury.

A serious or fatal injury can occur ...

- ▲ if you lack proper training
- ▲ if you fail to follow proper procedures
- ▲ if you do not use proper tools and safety equipment
- ▲ if you assemble driveline components improperly
- ▲ if you use incompatible driveline components
- ▲ if you use worn-out or damaged driveline components
- ▲ if you use driveline components in a non-approved application

This manual contains detailed safety instructions. Read, understand and follow this manual.

- ▲ Get proper training
- ▲ Learn and follow safe operating procedures
- ▲ Use proper tools and safety equipment
- ▲ Use proper components in good condition



# STRAIGHTENING AND BALANCING ANGLES AND PHASING

## STRAIGHTENING AND BALANCING THE DRIVESHAFT

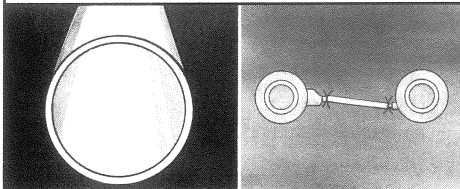
(Excluding Aluminum)

The rebuilding of a driveshaft assembly usually consists of replacing worn cross and bearing assemblies with a new kit. These kits replace the part of a driveshaft most subject to wear in operation. The potential off-center condition present in the cross and bearing assemblies makes it desirable to balance every assembly after installing new cross and bearing kits.

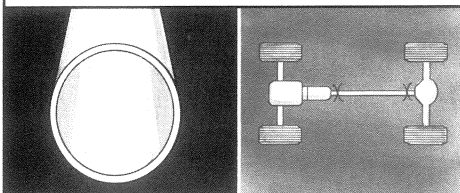
When the tubing is bent or twisted or the tube fittings are distorted, it will be necessary to replace the damaged parts.

Properly assemble the new components into the tube and straighten the shaft assembly before tack welding, to be sure the parts are on center. This can be done by mounting the complete assembly in the appropriate tooling and straightening until the ends of the tube run concentric within 0.005 T.I.R. Recheck for runout.

### RUNOUT VERSUS OVALITY



Runout-circular diameter, bent tubing

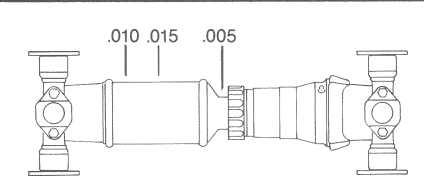


Ovality-oval diameter straight tubing

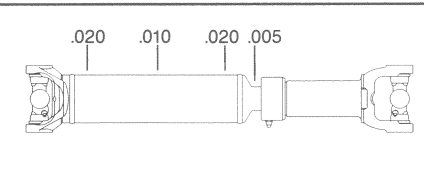
When checking for runout, it is important to distinguish between runout and ovality. Runout is when the tube is slightly bent but still maintains its circularity throughout the tube. During dynamic balancing, a dial indicator will show runout ONCE per revolution.

Ovality occurs when the tube is not circular but oval in shape. During dynamic balancing, a dial indicator will display ovality TWICE per revolution. Even though a tube may be straight, ovality will make it seem bent. A tube with ovality may be used up to a 0.010 T.I.R. runout reading. Beyond this limit the tube must be discarded for driveshaft purposes.

After welding, the entire driveshaft should be straightened to the following limits:



Heavy Duty Driveshaft Runout Limits



Light and Medium Duty Driveshaft Runout Limits for Unbalanced Driveshaft

### Heavy Duty

0.005 T.I.R. on the neck of the slip tube shaft  
0.010 T.I.R. on ends of tubing 3" from welds  
0.015 T.I.R. at linear center of the tube

### Light and Medium Duty

0.005 T.I.R. on the neck of the slip tube shaft  
0.010 T.I.R. on ends of tubing 3" from welds  
0.015 T.I.R. at linear center of the tube  
0.015 T.I.R. for full length of tube with 30" or less

(T.I.R. — Total Indicator Reading)

These runouts should be taken with entire driveshaft assembly mounted on master tooling which locates on the outboard bearing assemblies of the u-joint kit (light and medium duty), or the trunnions

of the outboard u-joint kit (heavy duty) or on selected flange yokes or yokes.

All flange yokes or yokes should be selected for dynamic balance to eliminate as much unbalance as possible. During balancing, the driveshaft again should be mounted on the same master tooling or selected flanges or yokes.

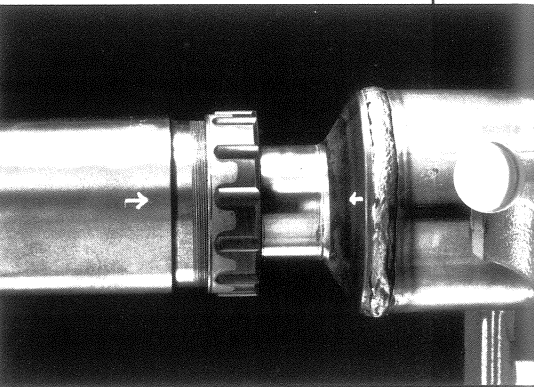
After straightening, balance the entire assembly to Original Equipment Manufacturer specifications.

## ANGLES AND PHASING

(All Types)

Proper driveshaft angles and correct phasing of the yokes are very important in maintaining long life and quiet running shafts.

When in phase, the slip yoke lugs (ears) and tube yoke lugs (ears) are in line. Normally, this is the ideal condition and gives the smoothest running shaft. There may be an alignment arrow stamped on the slip yoke and on the tube shaft to assure proper phasing when assembling these components. If there are no alignment marks, they should



An "In Phase" Driveshaft

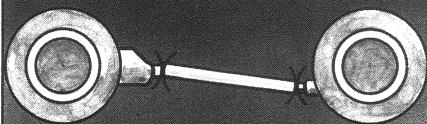
be added before disassembly of the shaft to assure proper reassembly.

Phasing is relatively simple on a two-joint set ... be sure that the slip yoke lugs and the tube yoke lugs are in line. Driveshaft angles are a little more complicated.

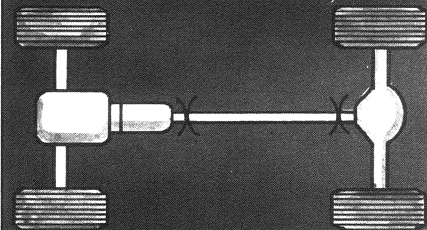
# ANGLES AND PHASING

The u-joint operating angle is the angle formed by two yokes connected by a cross and bearing kit. There are two kinds of u-joint angles.

The simple one plane angle found in most installations has all driveline slope confined to one plane, usually the vertical plane. The other type of driveline angle is the compound angle in two planes. This is found in driveline designs where offset exists in both the vertical and horizontal planes. For detailed information on troubleshooting compound angles, contact your Spicer Service Representative.



One Plane Angle Driveshafts, Side and Top View



Two Plane Angle Driveshaft, Side and Top View

High angles combined with high R.P.M. is the worst combination, resulting in reduced u-joint life. Too large and unequal u-joint angles can cause vibrations and contribute to u-joint, transmission and differential problems. The improper u-joint angles must be corrected.

Ideally, the operating angles on each end of the driveshaft should be equal to or within 1 degree of each other, have a 3 degree maximum operating angle and have at least 1/2 of a degree continuous operating angle.

R.P.M. is the main factor though in determining maximum allowable operating angles. As a guide to maximum normal operating angles, refer to the chart listed.

DRIVESHAFT RPM	MAX. NORMAL OPERATING ANGLES
5000	3.25°
4500	3.67°
4000	4.25°
3500	5.0°
3000	5.83°
2500	7.0°
2000	8.67°
1500	11.5°

Tube diameter and normal operating RPM determine maximum allowable tube length. If "critical length" is reached, a three-joint driveshaft with center support or a Spicer Graph-Lite™ driveshaft must be used. Refer to the Spicer "Driveshaft Speed Calculator" — Form M3-11 TRNG.

When the transmission output shaft centerline and axle input shaft centerline are parallel, the u-joint operating angle permissible is length of driveshaft divided by five. Example: A short coupled driveshaft with a 15" length would be limited to 3 degrees maximum operating angle. A 30" shaft would be limited to 6 degrees.

When the transmission output shaft centerline and axle input shaft centerline intersect midway of the driveshaft, the joint angles are equal. However, due to the change to unequal joint angles during up and down axle movement, this is a more undesirable condition than parallel centerlines.

In this case, the maximum u-joint operating angle is determined by dividing length of driveshaft by ten. Example: A 30" driveshaft with intersecting angles would have a 3 degree permissible operating angle.

## CHECKING DRIVESHAFT ANGLES IN THE VERTICAL OR HORIZONTAL PLANE

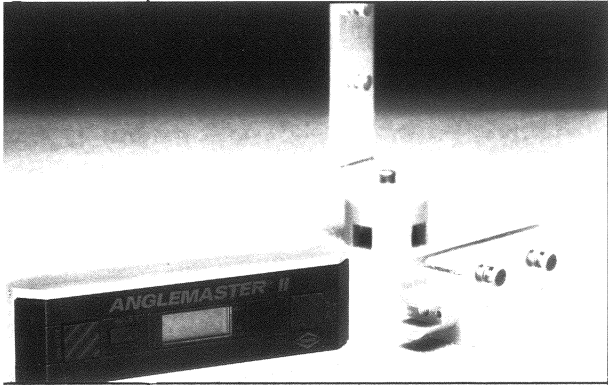


**WARNING:** Rotating shafts can be dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death. Do not work on a shaft (with or without a guard) when the engine is running.

Use the following procedure to check driveshaft angles for proper u-joint operating angles.

1. Inflate all tires to the pressure at which they are normally operated. Park the vehicle on a surface which is as level as possible both from front-to-rear and from side-to-side. Do not attempt to level the vehicle by jacking up the front or rear axles. Shift the transmission to neutral and block the front tires. Jack up a rear wheel.
2. Rotate the wheel by hand until the output yoke on the transmission is vertical, and lower the jack. This simplifies measurement later. Check driveshaft angles in the same loaded or unloaded condition as when the vibrations or noise occurred. Always try to check driveline angles in both loaded and unloaded conditions.

# ANGLES AND PHASING



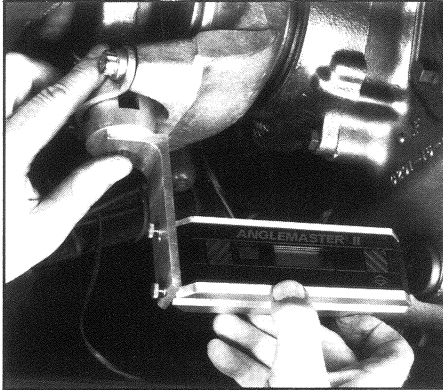
*Spicer "Anglemaster® II" Electronic Driveline Inclinometer with available attachments*

3. To determine driveshaft angles, a spirit level protractor or Spicer Anglemaster® II Electronic Driveline Inclinometer is required. On a protractor, when angles are read from the 0 degree mark (horizontally — on the driveshaft) record and use the angle shown. When angles are read from either of the 90 degree marks (vertically — on the flange) do not record the angle shown on the protractor since the 90 degree marks must be understood to be the same as 0 degrees on the horizontal plane. Thus, if a vertical reading is 85 degrees, the angle being measured is 5 degrees ( $90 - 85 = 5$  degrees).

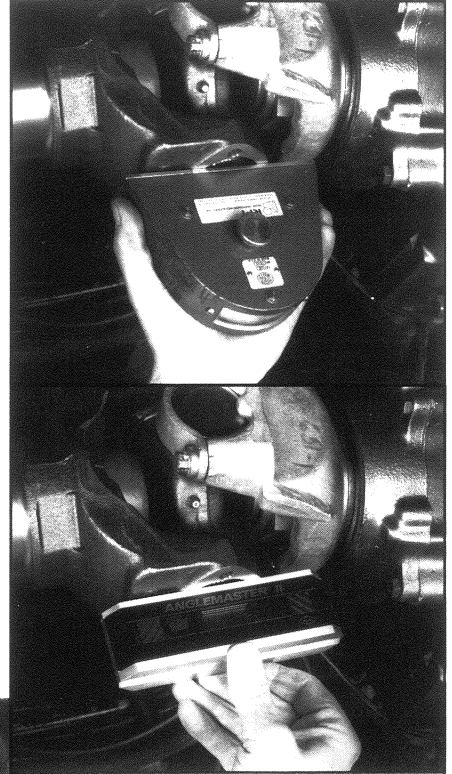
To use the Spicer Anglemaster® II Electronic Driveline Inclinometer, simply place the sensor on the component to be measured. A display module will show what the angle is and in which direction it slopes.

(Available only from Dana Corporation and your Spicer Service Representative.)

If using a protractor, all angles should be read within 0.25 degree and they should be measured with the protractor held plumb on a clean flat surface. The Spicer Anglemaster® II Electronic Driveline Inclinometer is automatically accurate to within 1/10 of 1 degree. Always measure the slope of the drivetrain going from front to rear. A component slopes downward if it is lower at the rear than the front. A component slopes upward when it is higher at the rear than it is in front.



4. Check and record the angle on the main transmission. This reading can be taken on the end yoke lug, with the bearing assembly removed or on a flat surface of the main transmission parallel or perpendicular to the output yoke lug plane. Record your readings on a sketch.

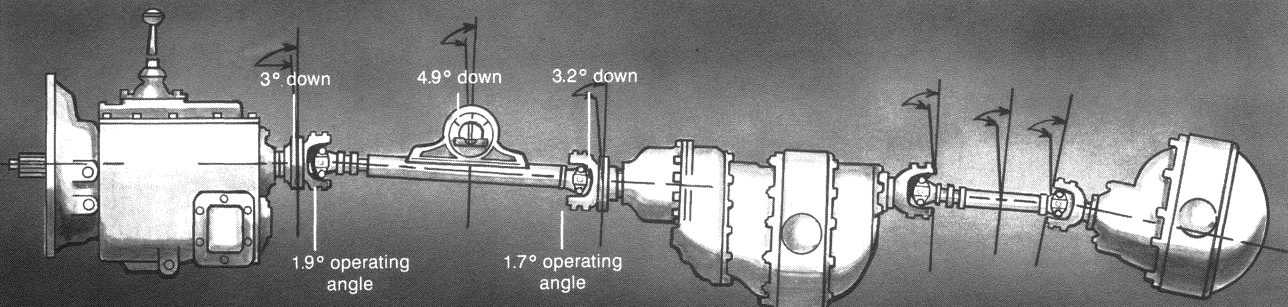


5. Now check the driveshaft angle between the transmission and axle or forward axle. On short tube length driveshafts, check the angle of the driveshaft on either the tube or slip yoke lug with the bearing assembly removed. On long tube length driveshafts, measure the angle on the tube at least 3" away from the circle welds or at least 1" away from any balance weights. Be sure to remove any rust, scale or sound deadening compounds from the tube to obtain an accurate measurement.

A 5 minute videotape that outlines instructions for "Measuring and Calculating Driveline Operating Angles" is available at \$60.00 from:

**Spicer Universal Joint Division  
Dana Corporation  
P. O. Box 955  
Toledo, Ohio 43695  
Attn: Advertising Department**

# ANGLES AND PHASING



Transmission output yoke =  $\downarrow 3^\circ$        $\begin{matrix} 4.9^\circ \\ -3.0^\circ \\ \hline 1.9^\circ \end{matrix}$   
 Forward driveshaft =  $\downarrow 4.9^\circ$  or

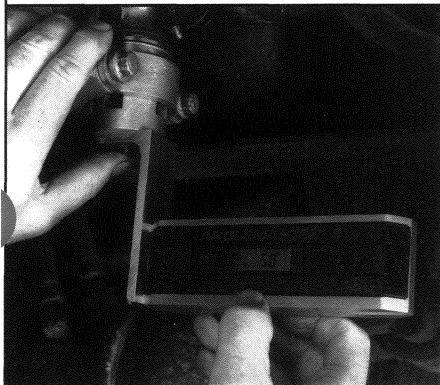
Transmission/  
 Driveshaft operating  
 angle

$\begin{matrix} 1.9^\circ \\ -1.7^\circ \\ \hline 0.2^\circ \end{matrix}$

- Good cancellation of u-joint operating angles (within  $1^\circ$ )
- Operating angles less than  $3^\circ$
- At least  $\frac{1}{2}$  of one degree continuous operating angle

Forward axle input yoke =  $\downarrow 3.2^\circ$        $\begin{matrix} 4.9^\circ \\ -3.2^\circ \\ \hline 1.7^\circ \end{matrix}$   
 Forward driveshaft =  $\downarrow 4.9^\circ$  or

Driveshaft/Forward  
 Axle operating angle



6. Check the forward axle input yoke angle by removing a bearing assembly and measuring the angle on the yoke lugs or on a flat surface of the angle housing parallel or perpendicular to the input yoke lug plane.

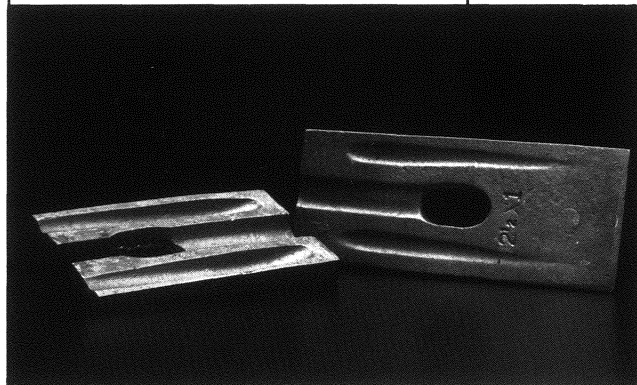
7. If applicable, measure the output yoke angle of the forward axle, the angle of the tandem driveshaft between the forward axle and the rear axle, and the rear axle input yoke angle.

With all of the angles recorded, complete a drawing as shown. There are no u-joint operating angles in your drawing at this time, just the slope of the components and their direction. To determine u-joint operating angles, simply find the difference in the slopes of the components.

When the slopes are in the **Same** direction on two connected components, **Subtract** the smaller number from the larger to find the u-joint operating angle. When the slopes are in the **Opposite** direction on two connected components, **Add** the measurements to find the u-joint operating angle.

Now compare the u-joint operating angles on your drawing to the rules for ideal operating angles mentioned above.

## Correcting U-Joint Operating Angles



*Axle Shims*

The recommended method for correcting severe u-joint operating angles depends on the vehicle suspension or driveline design.

On vehicles with leaf spring suspension, thin wedges called axle shims can be installed under the leaf springs of single axle vehicles to tilt the axle and correct u-joint operating angles. Wedges are available in a range of sizes to change pinion angles.

On vehicles with tandem axles, the torque rods can be shimmed. Torque rod shims rotate the axle pinion to change the u-joint operating angle. A longer or shorter torque rod may be available from the manufacturer if shimming is not practical. Some torque rods are adjustable.

# FIELD PROBLEM ANALYSIS

As a general rule, the addition or removal of a 1/4" shim from the rear torque arm will change the axle angle approximately 3/4 of a degree. A 3/4 of a degree change in the pinion angle will change the u-joint operating angle about 1/4 of a degree.

Always take the time to call the vehicle manufacturer if there are unusual u-joint operating angle problems. For detailed information on troubleshooting three u-joint or multiple-shaft driveline arrangements, contact your Spicer Service Representative.

## What Causes U-Joint Operating Angles To Change

- ✓ Suspension changes caused by:
  - worn bushings in the spring hangers
  - worn bushings in the torque rods
  - incorrect airbag height
- ✓ Revisions in components of the driveline
- ✓ Stretching or shortening the chassis
- ✓ Adding an auxiliary transmission or transfer case in the main driveline
- ✓ Worn engine mounts

## Driveshaft Brake

When a driveshaft brake is used, care must be taken to see that the brake drum is properly piloted, runs true and is in balance.

## FIELD PROBLEM ANALYSIS

(All Types)



**WARNING:** Rotating shafts can be dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death. Do not work on a shaft (with or without a guard) when the engine is running.

U-Joint problems, as a rule, are of a progressive nature. They generally accelerate rapidly and result in ruined components.

Some recognizable signs of u-joint deterioration are:

1. Vibration
2. U-joint looseness
3. U-joint discoloration due to excessive heat buildup
4. Inability to purge all four trunnion seals
5. An audible noise or squeal from the driveline

## Lubrication-Related Problems

The most common reasons for u-joint wear are lack of lubrication, inadequate lube quality, inadequate initial lubrication or failure to lubricate properly and often enough.

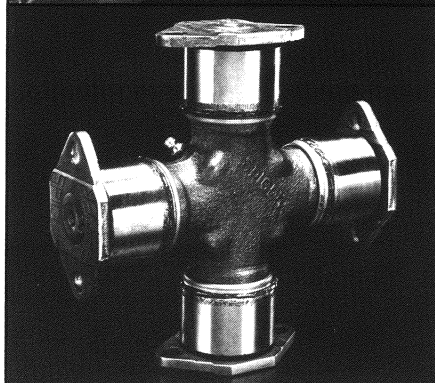
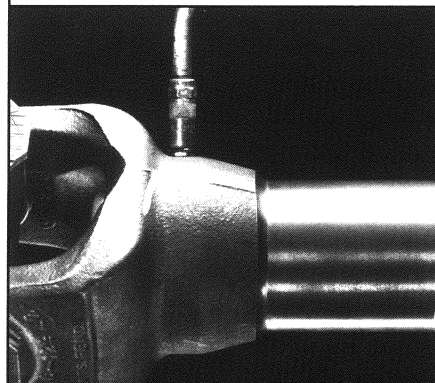
On Quick-Disconnect™ applications, excessive bearing rotation could cause premature wear of components involved.

The causes of rotation are:

1. Use of non-Spicer parts with Genuine Spicer components.
2. Improper torque on retaining strap bolts.
3. Failure to firmly seat both bearing assemblies in the end yoke saddles before the strap bolts are tightened.
4. Dirty bearing saddles.

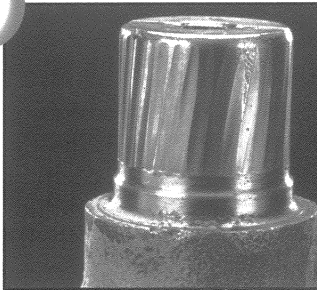
To avoid lubrication-related problems:

1. Lube all fittings including those that are often overlooked, out-of-sight, dirt-covered or difficult to reach.
2. Know how some lube fittings appear different from regular chassis lube fittings and require a needle nose attachment for the grease gun.
3. Don't overlook slip yoke lubrication.



4. Use correct lube technique. **New Lube Must Flow From All Four Bearing Seals.**
5. Use correct lubricant. It should be a recommended type, such as N.L.G.I. Grade 1 or 2 with E.P. additives and high temperature resistance.
6. New u-joints must be lubricated when assembled into the driveshaft yokes.
7. Observe recommended lubrication cycle. See chart on page 6.

# FIELD PROBLEM ANALYSIS

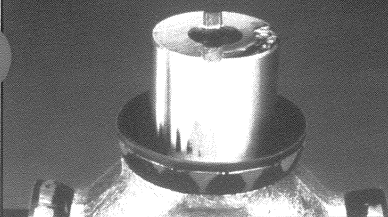


*Brinelling*

Generally, a lubrication problem is one of two types — brinelling or end galling. The grooves made by the needle roller bearings on the trunnion of the cross are known as brinelling. Brinelling can also be caused by too much torque for the capacity of the u-joint used. End galling is a displacement of metal at the end of the trunnion and can also be related to angularity problems. Both of these problems can be caused by lack of lubrication.

Problems which are not a result of lubrication are associated with the installation, angles and speed of the driveshaft. Fractured parts caused by torque, fatigue and bending are associated with overload, excessively high u-joint angles and driveshaft lengths exceeding critical speed limitations.

## End Galling

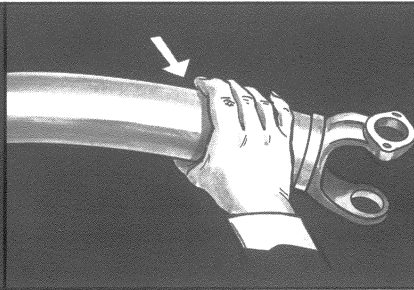


*End Galling*

## VIBRATION-RELATED PROBLEMS

Vibration is a driveshaft problem that can be either transverse or torsional.

Transverse vibration is the result of unbalance acting on the supporting shafts as the driveshaft rotates. When a part having an out-of-balance, or heavy side, is rotated an unbalanced force is



*Transverse Vibration*

created that increases with the square of the speed. The faster the shaft turns, the greater the unbalance force acting on the shaft.

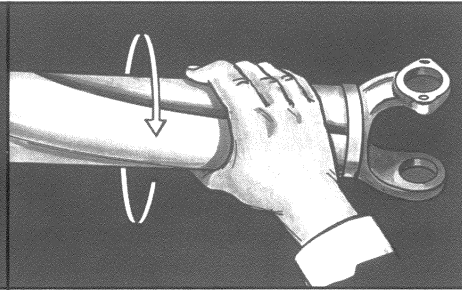
The force produced by this out-of-balance condition tends to bend the supporting members. As the supporting members have a natural frequency of vibration similar to a swinging pendulum, a violent vibration may exist at certain periods when the speed of rotation and the natural frequency of supports coincide.

Each end of the shaft must be balanced individually as each support is responsive to an out-of-balance condition in the portion of the shaft it supports. Out-of-balance affects operating conditions only when rotating.

Transverse vibration caused by a driveshaft out-of-balance will usually emit sound waves that you can hear and mechanical shaking that you can feel. The force from out-of-balance increases with speed, not torque load. The driveshaft speed is determined by vehicle speed and the vibration is demonstrated best by road testing the vehicle to operating speed, disengaging engine, and checking vibration while coasting with engine noises eliminated.

Torsional vibration, although similar in effect to transverse vibration, is an entirely different motion. The transverse vibration is a bending movement whereas torsional vibration is a twisting motion.

The energy to produce torsional vibration can occur from the



*Torsional Vibration*

power impulses of the engine or from improper u-joint angles. This type of vibration is difficult to identify in road testing but certain characteristics do exist. It causes a noticeable sound disturbance and can occasionally transmit mechanical shaking.

Torsional vibrations can exist at one or more periods any place in the operating range and tend to be more severe at lower speeds. Changes in torque load (part-to-full throttle) usually affect the vibration. The nonuniform velocity obtained when a u-joint operates at an angle produces torsional vibration. In a driveline having two or more joints in series, it is desirable to have the individual joint angles arranged such that the net result minimizes nonuniform velocity characteristics over the system.

It is practically impossible to maintain the desired joint angles throughout the operating range. Therefore, it is necessary to determine some maximum limit of torsional excitation which can be considered as generally acceptable.

The amount of torsional excitation which can be accepted without causing excessive disturbance depends upon operating speed and characteristics of supporting structures and other units in the driveline and drivetrain system.

Other vibrational problems in a driveshaft could be caused by worn or damaged u-joints. These joints must be constantly maintained according to manufacturer's lubrication specifications.

# TROUBLESHOOTING



**WARNING:** Rotating shafts can be dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death. Do not go under the vehicle when the engine is running.

## Complaints

### VIBRATION

Low gear shudder  
At certain speeds under full drive or full coast  
Under light loaded conditions

### Causes

Secondary couple load reaction at shaft support bearing  
Improper phasing  
Incompatible driveshaft  
Driveshaft weight not compatible with engine-transmission mounting  
Driveshaft too long for speed  
Loose outside diameter fit on slip spline  
Excessively loose u-joint for speed  
Driveshaft out of balance; not straight  
Unequal u-joint angles  
U-joint angle too large for continuous running  
Worn u-joint  
Inadequate torque on bearing plate cap screws  
Torsional and/or inertial excitation

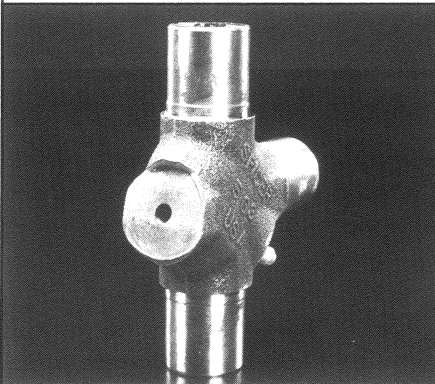
### Corrections

Reduce u-joint continuous running angle  
Replace u-joint  
Install two piece driveshaft with shaft support bearing  
Use larger diameter tube  
Shim drivetrain components to equalize u-joint angles  
Straighten and balance shaft  
Check with transmission or axle manufacturer — replace shaft bearing  
Inspect u-joint flex effort for looseness — torque to specification  
Check driveshaft for correct yoke phasing

## Complaints

### PREMATURE WEAR

Low mileage u-joint wear  
Repeat u-joint wear  
End galling of cross trunnion and bearing assembly  
Needle rollers brinelled into bearing cup and cross trunnion  
Broken cross and bearing assemblies



*Broken Cross*

### Causes

End yoke cross hole misalignment  
Excessive angularity  
Improper lubrication  
Excessive u-bolt torque on retaining nuts  
Excessive continuous running load  
Continuous operation at high angle/high speed  
Contamination and abrasion  
Worn or damaged seals  
Excessive torque load (shock loading) for u-joint and driveshaft size

### Corrections

Use Spicer alignment bar to check for end yoke cross hole misalignment, replace end yoke if misaligned  
Check u-joint operating angles with a spirit level protractor or Spicer Anglemaster® II Electronic Driveline Inclinator, reduce excessive u-joint operating angles  
Lubricate according to Spicer specifications  
Replace u-joint kit

Reduce u-joint continuous running angle  
Replace with higher capacity u-joint and driveshaft  
Check u-joint flex effort — replace joint or yoke if necessary  
Clean and relubricate u-joint  
Realign to proper running angle — minimum 1/2 degree  
Torque bearing retention method to specification

## Complaints

### SLIP SPLINE WEAR

Seizure  
Galling  
Outside diameter wear at extremities and at 180 degrees  
Spline shaft or tube broken in torsion

### Causes

Improper lubrication  
Worn or damaged part  
Tube size inadequate  
Excessive torque load for u-joints and driveshaft size  
Male spline head engagement length too short for application  
Excessive loose outside diameter fit  
Slip member working in extreme extended or fully collapsed position  
Contamination

### Corrections

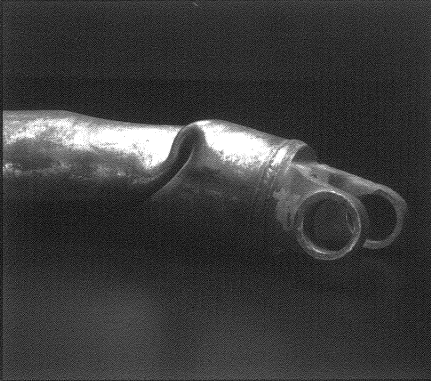
Lubricate slip spline according to Spicer specifications  
Replace with higher capacity u-joint and driveshaft  
Check u-joint flex effort — replace joint or yoke if necessary  
Clean and relubricate according to Spicer specification  
Replace spline — check design for application  
Use Spicer Glidecote™ slip spline  
Increase driveshaft assembly length to position slip spline head towards u-joint  
Check for male slip member with longer spline  
Use larger diameter tube

# TROUBLESHOOTING

## Complaints

### SHAFT AND/OR TUBE

Shaft support bearing wear or fracture  
Shaft support rubber insulator wear or fracture  
Tube circle weld fracture



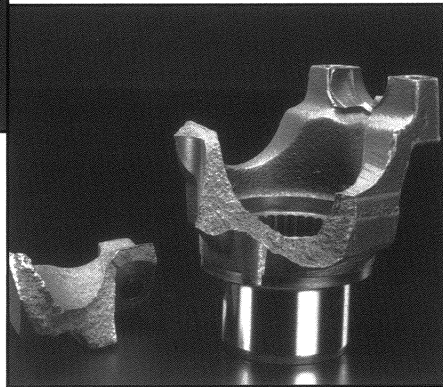
## Causes

Balance weight located in apex of weld yoke lug area  
Balance weight too close to circle weld  
Improper circle weld  
Bending fatigue due to secondary couple loads  
Driveshaft too long for operating speeds  
Worn or damaged parts  
Excessive torque load (shock loading) for u-joint and driveshaft size

Improper lubrication of bearings  
Shaft support bearing misaligned — interferes with slinger

## Corrections

Reduce u-joint continuous running angle  
Replace with higher capacity u-joint and driveshaft  
Install two piece driveshaft with shaft support bearing  
Use larger diameter tube  
Normal bearing wear — replace  
Realign mounting bracket to frame cross member to eliminate interference with slinger



## Complaints

### YOKE FRACTURE

Yoke broken in hub  
Yoke broken at ear tip

## Causes

Mating yoke lug interference at full jounce and rebound  
Excessive torque load for u-joint and driveshaft size  
Improper shaft length and slip  
Bending fatigue due to secondary couple loads

## Corrections

Reduce u-joint continuous running angles  
Replace with higher capacity u-joint and driveshaft  
Replace yoke — check design for application  
Use wide angle yokes  
Check installed lengths and adjust driveshaft length to provide proper slip conditions



**WARNING:** Rotating shafts can be dangerous. You can snag clothes, skin, hair, hands, etc. This can cause serious injury or death.

Refer to safety precaution section on inside front cover.



# GLOSSARY

**ALIGNMENT BAR** — a device (gauge) used to check yoke cross hole alignment.

**BEARING ASSEMBLY** — a hollow cup containing the needle roller bearings that ride on the cross trunnion.

**BRINELLING** — grooves from needle rollers marking and burning into trunnion. Usually caused by improper angles, lack of lubrication or too much load.

**CARDAN-TYPE U-JOINT** — a non-constant velocity u-joint which consists of two yokes connected by a cross through four bearings.

**COMPOUND ANGLE** — a driveline angle that is offset both vertically and horizontally.

**CONSTANT VELOCITY (CV) U-JOINT** — a u-joint which uniformly transmits motion at an angle without speed changes in the driven shaft.

**CONTINUOUS OPERATING TORQUE** — represents the constant torque load that a respective driveshaft or joint series will transmit over long periods of time, such as a direct drive installation.

**COUPLING SHAFTS** — are essentially extension members to the total drivetrain. In automotive applications these units are inserted ahead of the two joint assemblies and lead out of the power source, usually supported by a shaft support bearing. Used where one piece shafts would be too long.

**CRITICAL SPEED** — this is a phenomenon associated with any elastic shaft rotating at a high speed. At some specific speed the shaft will start to vibrate and, in some instances, the vibrations are so severe that the shaft will "whip" resulting in premature wear or fracture in the drivetrain system.

**CROSS** — the central component of the u-joint, connecting the input and output yokes.

**CROSS HOLE** — two parallel machined holes in the yoke lugs, which accept u-joint bearing assemblies.

**DOUBLE-CARDAN CV JOINT** — consists of two u-joints connected by a coupling yoke (double yoke) with internal supporting and centering means. The torsional vibrations of the two joints are cancelled so that power is transmitted smoothly.

**DRIFT** — a soft metal, usually brass, tool used to assist in removal of bearing assemblies from full round cross holes.

**GALLING** — a displacement of metal, usually caused by lack of lubrication, angularity problems, or over capacity loads.

**GLIDECOTE™** — Dana patented coating for slip splines that extends life through reduction of friction.

**HORSEPOWER** — a unit of measure that denotes the amount of work done in a given period of time. 1 H.P. = 550 lbs./ft. per second. The formula for horsepower is:  $H.P. = \text{Torque} \times R.P.M./5252$ .

**INCLINOMETER** — an instrument for indicating the inclination of a driveline from the horizontal.

**LUBE CYCLE** — recommended time period for relubrication.

**NEWTON-METERS (nm)** — a unit of measurement for torque, comparable to lb./ft. One (1) lb./ft. = 1.355818 nm. One (1) nm = .73756 lb./ft.

**PHASING (IN-LINE)** — a relationship that exists between the yokes when they are in-line from "ear-to-ear" and their centerlines are parallel.

**PHASING (OUT-OF-LINE)** — a relationship that exists between the yokes when they are not in-line from "ear-to-ear," but are rotated relative to one another.

**POSITIVE PURGING VALVE (PPV)** — a lube valve that is pressed into the cross assembly of Genuine Spicer U-Joints. The PPV provides ease of purging and eliminates inadvertent dislocation from the cross when assembling or disassembling.

**PURGE** — completely flush out the clean, fresh lube at all four seals.

**R.P.M.** — revolutions per minute.  $R.P.M. = H.P. \times 5252/\text{Torque}$ .

**RUNOUT** — applies to the allowable off-center limits of a driveshaft.

**SERRATED BOLT WITH LOCK PATCH** — a bolt, identified by the under-head serrations and the lock patch coating on the threads, that replaces the lock strap design.

**SHAFT SUPPORT (CENTER) BEARING ASSEMBLY** — a mounted bearing assembly

used when two or more driveshafts are required to reduce driveshaft length — supports the coupling shaft.

**SHORT COUPLED JOINT** — a driveline of yoke shaft and slip yoke construction similar to a two-joint assembly, used where space is restricted.

**SHORT DURATION TORQUE** — represents the u-joints capability to withstand momentary loading accompanying start-stop service.

**SLIP YOKE (ALSO SLEEVE YOKE)** — it is that component of the driveshaft that absorbs the axial movement of the vehicle thus allowing for length changes in the driveshaft.

**T.I.R.** — Total Indicator Reading, a measure of driveshaft runout.

**TORQUE** — twisting effort caused by the application of force. The formula for torque is:  $T = H.P. \times 5252/R.P.M.$

**TORSIONAL ELASTIC LIMIT** — represents the maximum torque load the u-joint or shaft will transmit instantaneously, without yield in any part.

**TRUNNION** — the four machined posts of the u-joint cross which serve as the inner bearing race.

**TUBE (WELD) YOKE** — permanent fitting at one or both ends of a driveshaft designed to fit a specific tube and u-joint assembly.

**TWO-JOINT ASSEMBLY** — these assemblies are in essence a complete driveshaft. The front end of the unit contains the slip joint while the rear is fitted with a permanent type joint.

**U-JOINT COUPLING** — consists of two yokes and a cross and bearing kit, a type of flexible coupling which can transmit torque and/or rotary motion from one shaft to another with fixed or changing angular misalignment.

**U-JOINT DRIVESHAFT** — a rotating shaft used for the transmission of torque and consisting of one or two u-joint couplings and a center section. It is capable of operating at an angle and usually with changes in length.

**YOKE AND TUBE ASSEMBLY** — a weld yoke and a piece of tubing attached at the factory available in various length and capacities suitable for field specialist tailoring.



*Spicer...The name that guarantees  
you're buying the best.*

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Dana Corporation  
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Toledo, Ohio 43697-0955

