

TECHNICAL MANUAL

**ORGANIZATIONAL, DIRECT SUPPORT, AND
GENERAL SUPPORT MAINTENANCE MANUAL**

**(INCLUDING REPAIR PARTS AND
SPECIAL TOOLS LIST)**

FOR

85' AERIAL LADDER

FIRE FIGHTING TRUCK

NSN 4210-00-965-1254

HEADQUARTERS, DEPARTMENT OF THE ARMY

5 NOVEMBER 1986

Section I
DRIVE LINES

SERVICE MANUAL

SPICER UNIVERSAL JOINTS AND DRIVESHAFTS

1330 THROUGH 1850 SERIES
MEDIUM AND HEAVY DUTY VEHICLES



DANA CORPORATION
UNIVERSAL JOINT DIVISION



FOREWORD

This manual is presented as a guide in solving problems associated with drive shafts. No attempt has been made to discuss technical consideration of design or theory of vibrating systems.

In discussing installation of drive shafts, no hard and fast rule or fine dividing line has been drawn between satisfactory and unsatisfactory operation.

The limits set forth in this manual correspond with our own standards. Our long experience in the manufacture and installation of drive shafts has proven these standards to be accurate.

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FUNCTION

In examining the automotive drive line, it would be well to start with a review of drive shaft operation. A critical examination of why it is there and what it must do may be helpful in analyzing its effect on the entire drive line system. A drive shaft's functions can be briefly described as follows:

1. It must transmit torque from the transmission to the axle. This requirement makes it necessary that the drive shaft be capable of transmitting the maximum low gear torque developed by the engine and transmission ratio and any shock loads which may develop. It must also be capable of rotating at the maximum speed required for vehicle operation. This speed is often engine speed increased by an overdrive ratio in the transmission.
2. The drive shaft must operate through constantly changing relative angles between transmission drive shaft and axle.
3. The length of the drive shaft must be capable of changing while transmitting torque. Length changes are caused by necessary axle movement due to torque reaction, road deflections, braking loads, etc.

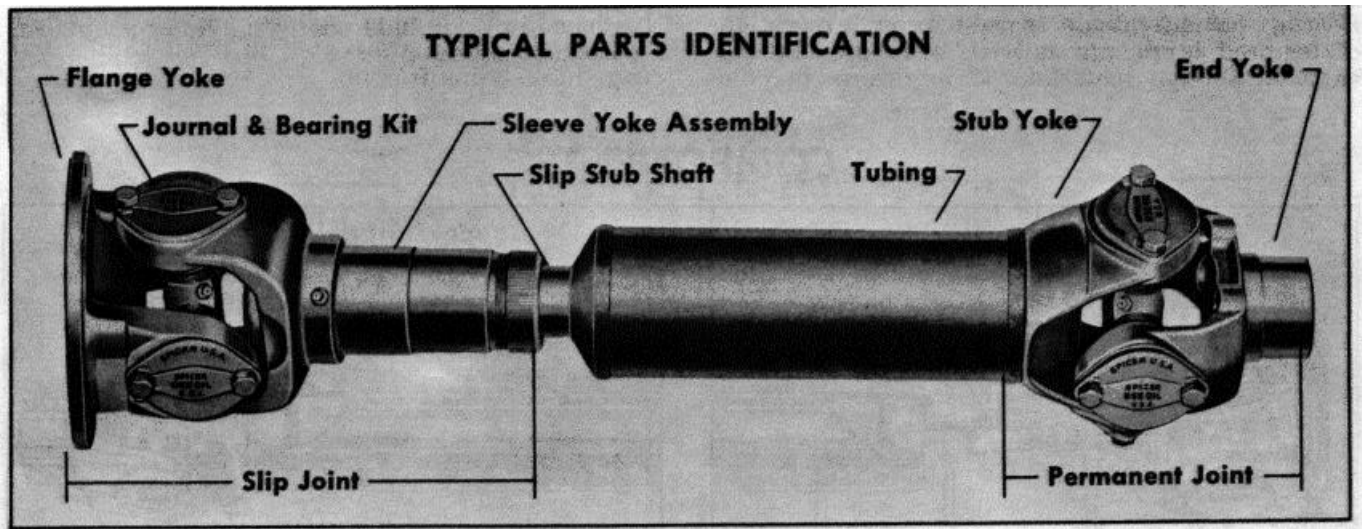


FIGURE 1

CONSTRUCTION

The basic functions having been designated, let's look at conventional universal joint and drive shaft construction.

To transmit required loads, the drive shaft must possess high strength. Forged steel, or high strength cast yokes are generally used to provide necessary strength and the rigidity required to maintain bearing alignment under torque loads and during high speed operation. Special high strength tubing is used to provide maximum torque carrying capacity at minimum practical weight. This tubing must be securely welded to its end members, to provide the necessary torque capacity.

High quality anti-friction bearings are used to withstand required loads while oscillating at high speeds. These bearings on the journal cross carry very high loads for their size. The full complement, roller-type (needle) bearings are generally used because of their high capacity in a limited space. Bearings are individually sealed to provide retention of required lubricants as well as to prevent the entry of foreign material. If lubricants become contaminated with water

or abrasive material, needle bearing life is seriously affected.

Abrasive material is a major problem where a vehicle operates under conditions of extreme moisture and dirt. Off-highway installations are especially critical in this respect. Military trucks represent the extreme in this direction and were the first to show the shortcomings in the conventional cork seals used in universal joint bearings. It was found that an improved seal was required for this type of operation. Synthetic rubber-type seals were developed for these installations. These seals have been in use for many years on military vehicles and are now used in most commercial installations. The improved sealing shows increased life and a less critical re-lubrication cycle.

The sliding splines between slip joint and permanent joint must support the drive shaft and be capable of sliding under full torque loads. To provide adequate strength and wear resistance, hardened and ground splines are used. These splines are phosphate coated to resist galling and to reduce sliding friction.

COMPONENTS

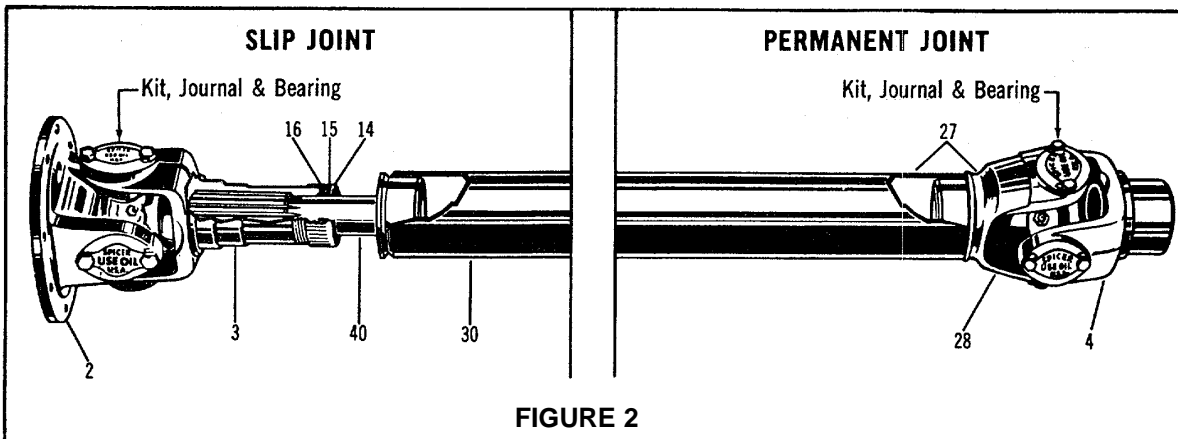


FIGURE 2

TABLE OF NOMENCLATURE

Symbol	Part Name	Symbol	Part Name
2	FLANGE YOKE	27	STUB YOKE & TUBE ASSEMBLY
3	SLEEVE YOKE ASSEMBLY	28	STUB YOKE
4	END YOKE	30	TUBING
5	JOURNAL ASSEMBLY	40	SLIP STUB SHAFT, Welded Tube
6	BEARING ASSEMBLY	53	MIDSHIP STUB SHAFT, Center Bearing
7	SNAP RING	70	CAP & BOLT ASSEMBLY
14	DUST CAP	82	YOKE SHAFT
15	STEEL WASHER	94	U-BOLT ASSEMBLY
16	CORK WASHER		

COMPONENTS

PERMANENT JOINT

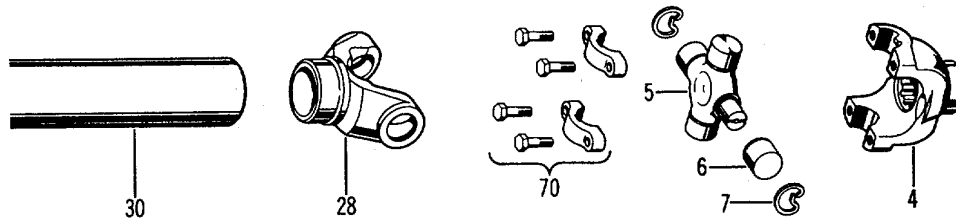


FIGURE 3

CENTER BEARING ASSEMBLY

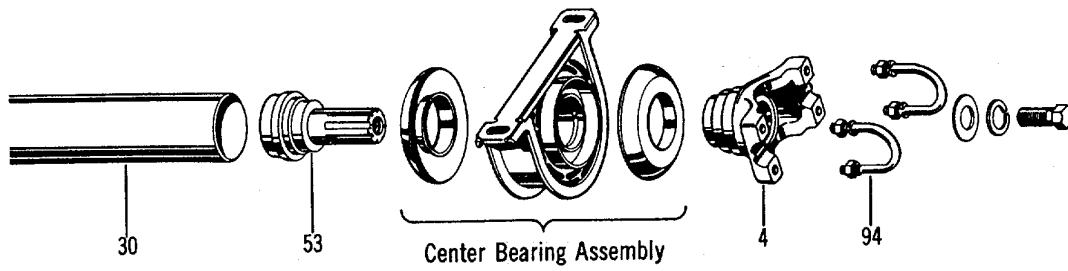


FIGURE 4

SLIP JOINT

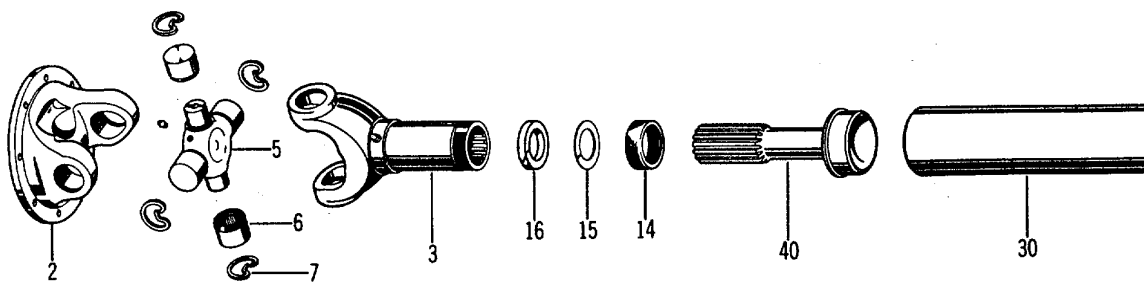
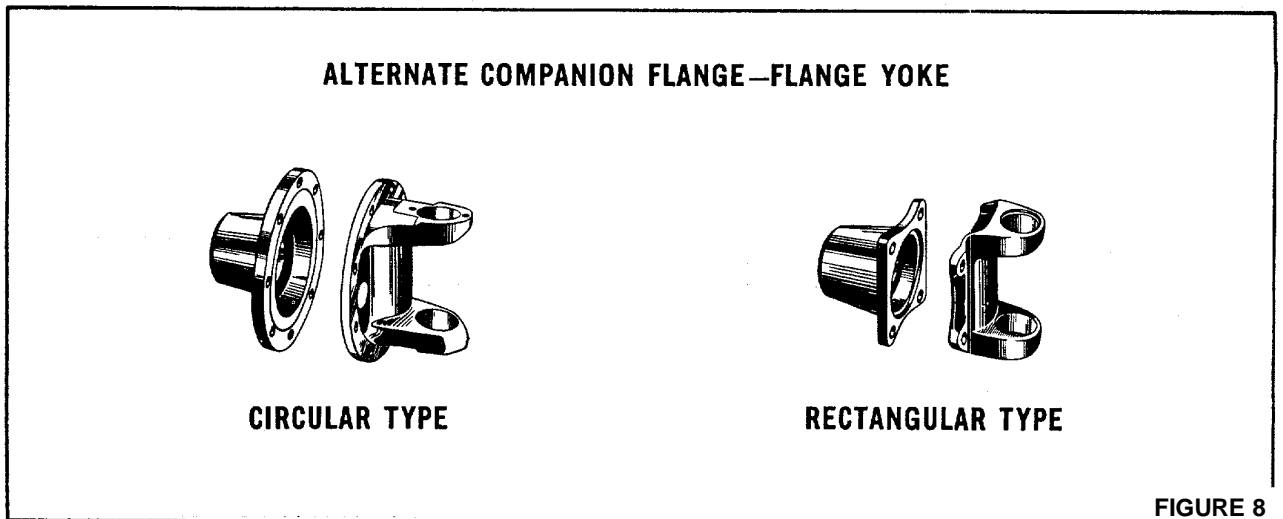
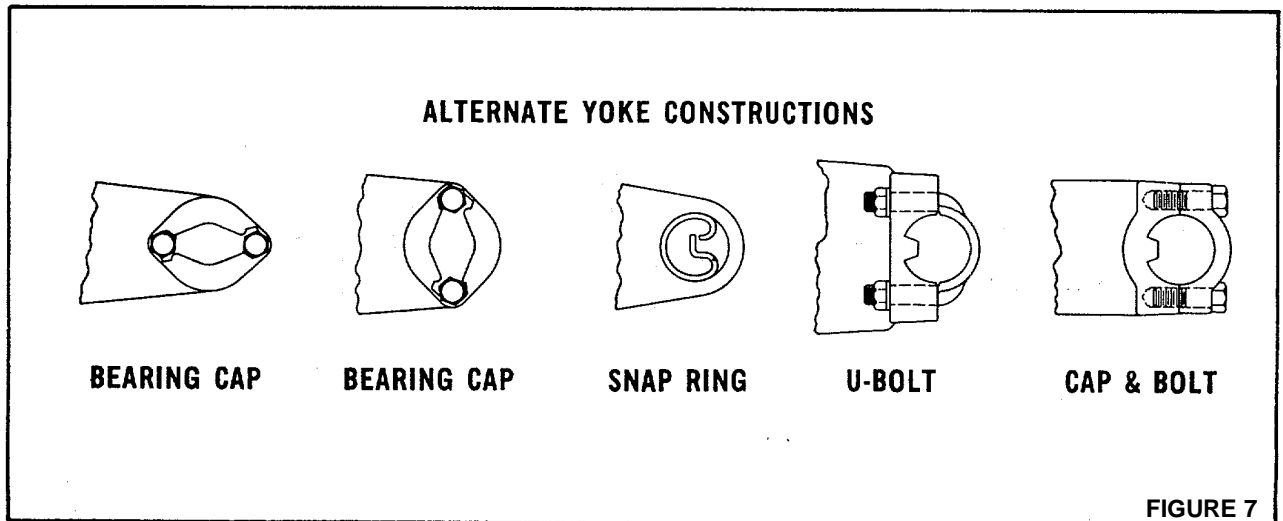
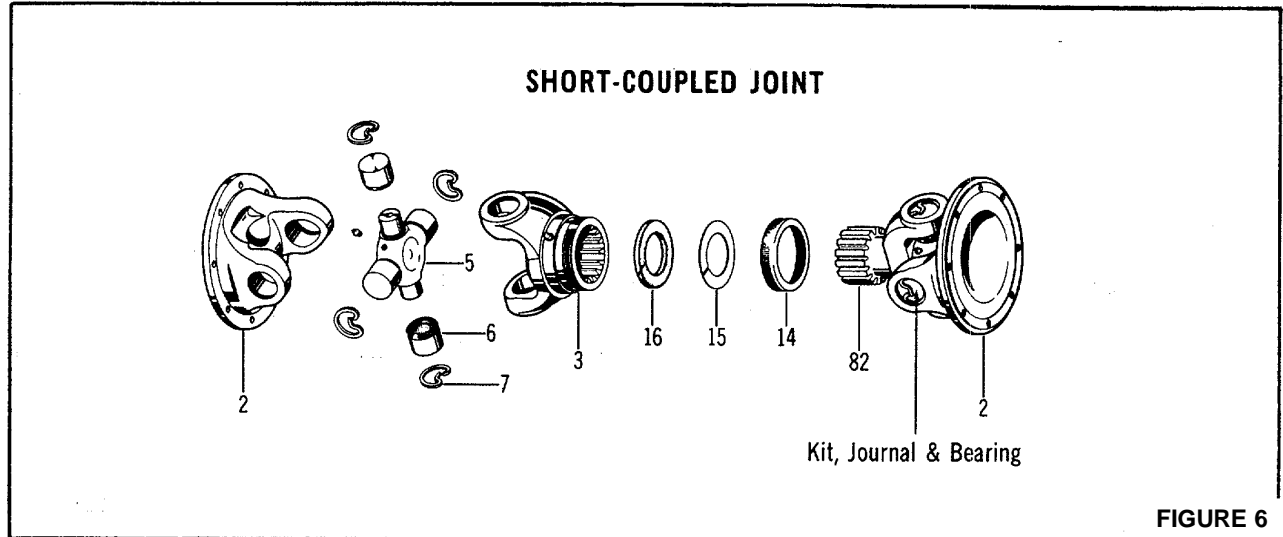
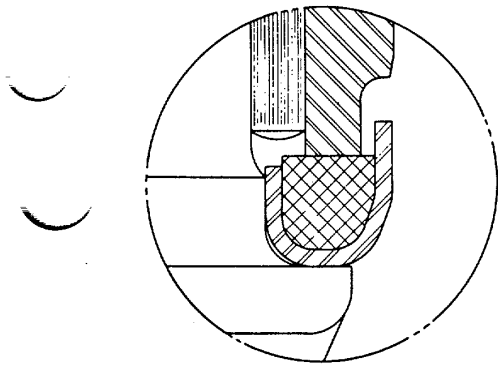


FIGURE 5

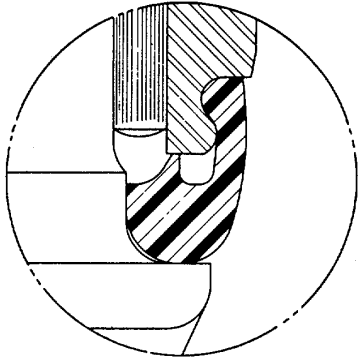
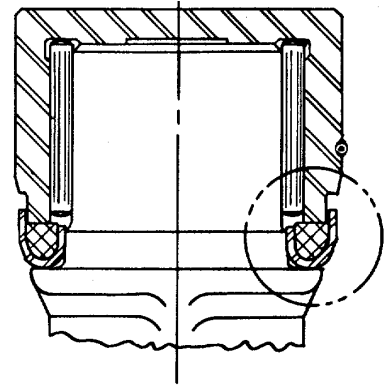
COMPONENTS



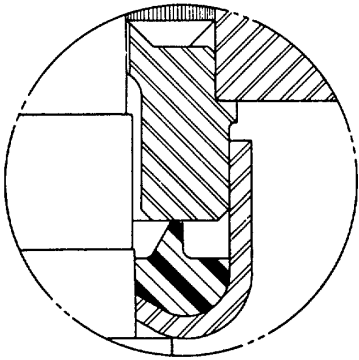
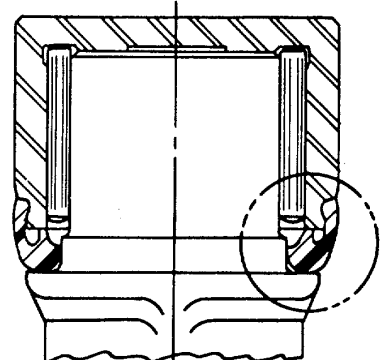
UNIVERSAL JOINT SEALS



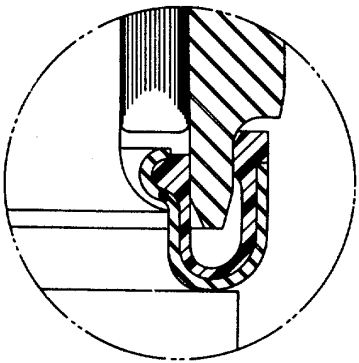
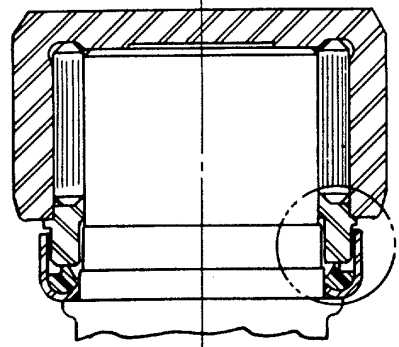
CORK SEAL



RUBBER SEAL



RUBBER SEAL



EXTENDED LIFE SEAL

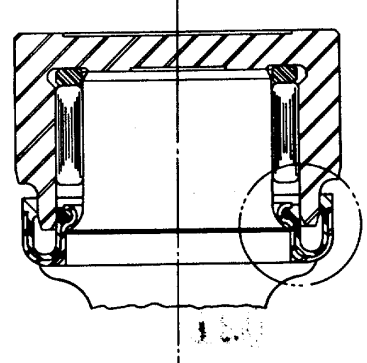


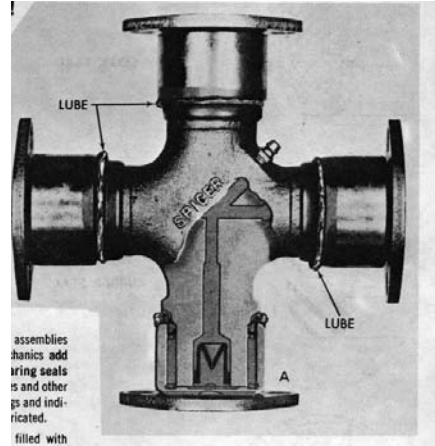
Figure 9

LUBE SPECS

Don't Neglect Spicer Drive Shaft Lubrication!

Lack of adequate or proper lubrication is among the most common causes of U-Joint and drive shaft failure

Proper servicing of the drive shaft is an essential part of vehicle maintenance and should not be overlooked in routine shop procedure.



Universal Joints

In the Vehicle or Application

To insure proper lubrication of all four bearing assemblies on Spicer universal joints, it is essential that mechanics **add lubricant until it appears at all journal cross bearing seals** (Illustration A). This assures removal of dirt particles and other contaminants that may find their way into the bearings and indicates to the mechanic that the bearings are fully lubricated.

Do not assume that bearing cavities have been filled with new lubricant unless flow is noticed around all four bearing seals!

Spicer journal cross seals are designed to relieve. However, if all the seals do not "pop" when being lubed, move the driveshaft laterally in all four directions and pull or push on the drive shaft in the direction opposite to the journal cross seal not relieving while lube gun pressure is being applied to the alemite fitting. An increase in line pressure may also be necessary.

Drive Shaft Assembly

Spicer factory assembled drive shafts are lubricated at the plant prior to shipment. However, shipping, handling and installation of the drive shaft assembly into the vehicle usually results in some loss of lube. Therefore, it is recommended that all universal joints be relubricated after installation of the drive shaft prior to putting vehicle in service

Journal and Bearing Kits

Spicer replacement universal joint kits contain only enough grease to provide needle bearing protection during storage.

It is therefore necessary to completely lubricate each replacement kit prior to assembly into the drive shaft yokes. Each journal 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 rollers and applying a liberal grease coating on the bottom of each race. After the kits are installed into the driveshaft yokes and prior to placing into service, they should be relubed, through the zerks, using the same grease.

LUBE SPECS

Lubricants

For driveshaft applications involving shaft speeds over 500 RPM, a high quality extreme pressure (EP) grease recommended by lubricant manufacturers for universal joints should be used. Lithium soap base greases meeting *NLGI Grade 1 and Grade 2 specifications are preferred. The use of greases that tend to separate and cake should be avoided.

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

*National Lubricating Grease Institute

Relube Cycles

Relubrication cycles for drive shaft universal joints and slip splines will vary with service requirements and operating conditions. The following re-lubrication schedule has been used successfully.

OPERATING CONDITION	RE-LUBE CYCLE	
	Miles	Hours
Normal	6000-8000	150-200
*Severe	2000-3000	50-75

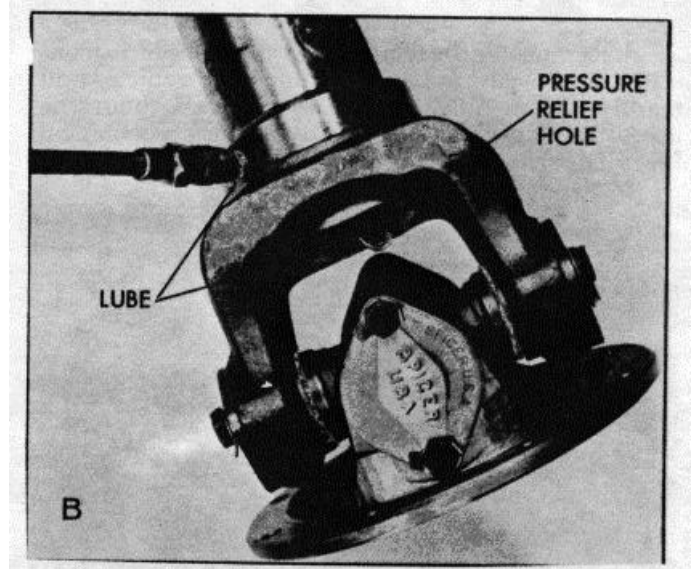
* For applications where conditions such as high speeds, high ambient temperatures or high angles are present.

Sliding Spline Sections

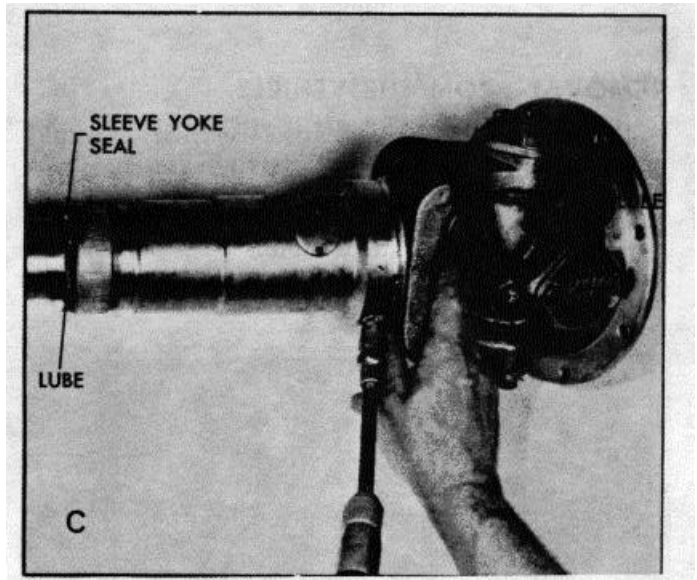
Lubricants

Steel Splines: Driveshaft steel splines should be lubricated with a good extreme pressure grease as recommended by lubricant manufacturers. Extreme pressure grease satisfying NLGI Grade 1 has been adopted as the standard by our factories.

Glidecote TM Splines: Any high grade multi-purpose grease can be used. Greases-recommended by lubricant manufacturers for universal joints have been found satisfactory for Glidecote splines.



Relube spline at the intervals prescribed above. Apply grease gun pressure to lubrication zerk **until lubricant appears at pressure relief hole in welch plug** at sleeve yoke end of spline. (Illustration B). At this point, cover pressure relief hole with finger and continue to apply pressure **until grease appears at sleeve yoke seal**. (Illustration C). This will insure complete lubrication of spline.



Center Bearings

Initial lubrication is done by the bearing manufacturers. **No attempt is made to add or change grease within the commercial bearing itself.** However, when servicing a driveshaft in the field with a new center bearing, it is necessary to fill the entire cavity around the bearing with waterproof grease to shield the bearing from water and contaminants. The quantity should be sufficient to fill the cavity to the extreme edge of the slinger surrounding the bearing.

Lubricants used must be waterproof. Consult your grease supplier for recommendation.