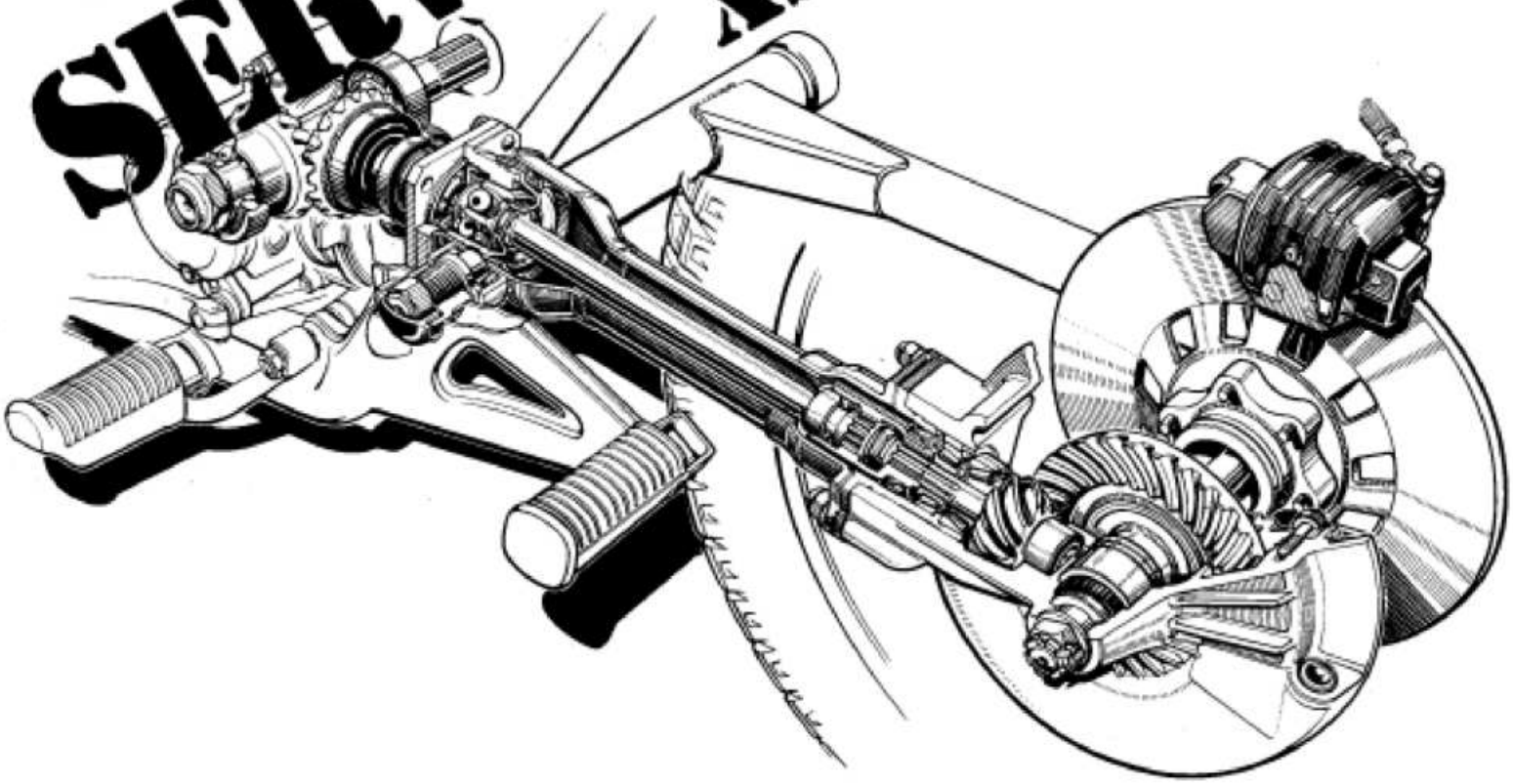
YAMAHA SHAFT DRIVE SERVICE MANUAL

XS750 MODELS

SCANNED BY 750E BUCKET



1J7-28197-19

NOTICE

The Yamaha Shaft Drive Service Manual is designed to be used as a guide for the qualified Yamaha service technician who must inspect, adjust, or repair the shaft drive mechanism. The Yamaha shaft drive mechanism is unique and special training, tools, and materials are required to properly inspect, adjust, and assemble the component assemblies. Anyone who does not possess the necessary training and materials should refrain from any sort of tampering with the shaft drive mechanism. Please rely upon a qualified Yamaha service person for any shaft drive component adjustment.

INTRODUCTION

To the Service Technician:
The Yamaha shaft drive mechanism is extremely durable and will rarely require any sort of adjustment. However, this manual will help you better understand the nature of the mechanism, even though adjustment may not be necessary. Please read this manual thoroughly before attempting any repairs or adjustments to the mechanism. If any difficulty is encountered in either the understanding of these procedures or the actual work involved, please contact the service department of your distributor or the appropriate regional representative. Please bear in mind that Yamaha products undergo continual improvement and that while the information in this manual is current at the writing date, notices of significant changes may be provided to Yamaha dealers in the future.

Particularly important information is distinguished in this manual by the following notations:

NOTE: A NOTE provides key information to make procedures easier or clearer.

CAUTION: A CAUTION indicates special procedures that must be followed to avoid damage to the machine.

WARNING: A WARNING indicates special procedures that must be followed to avoid injury to a machine operator or person inspecting or repairing the machine.

SHAFT DRIVE SERVICE MANUAL
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CHAPTER 1. THE BASIC MECHANISM

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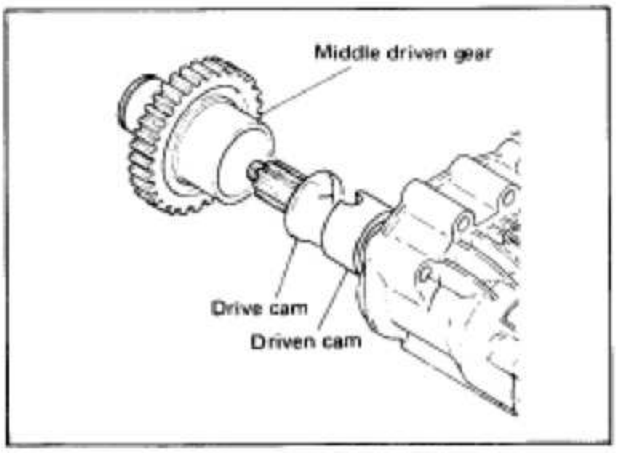
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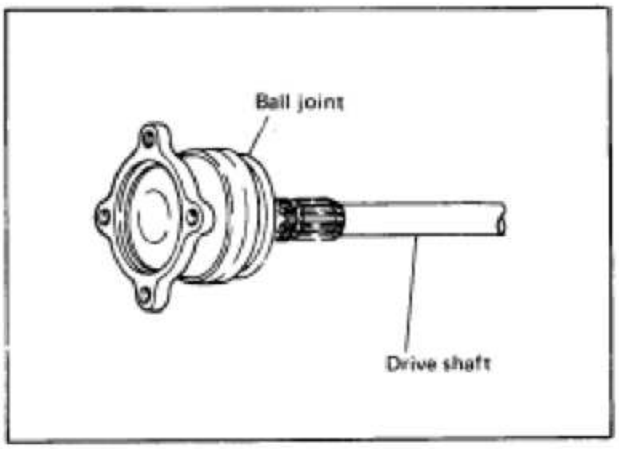
CHAPTER 1.
THE BASIC MECHANISM

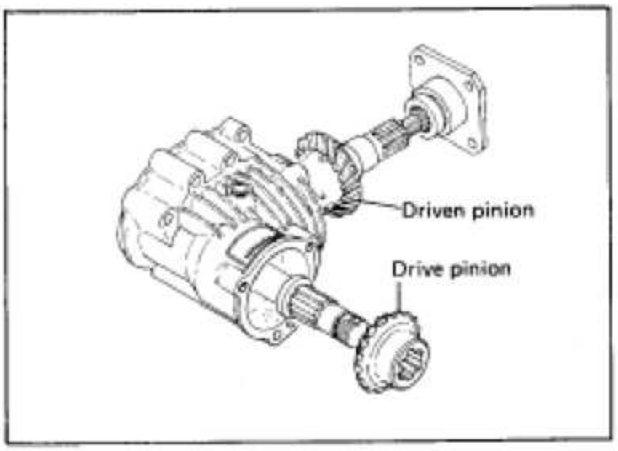
1-1. An Introduction to the Mechanism

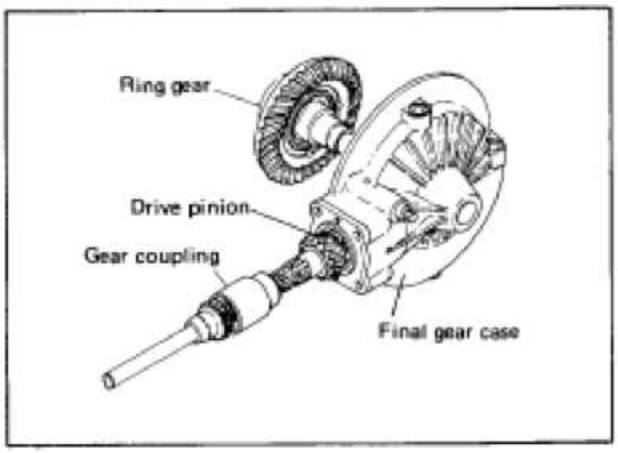
Power is transmitted from the crankshaft through the clutch and two transmission shafts to a third shaft, called the **middle driven gear.** A splined **drive cam** fits inside the middle driven gear and transmits power to the **driven cam,** which is located on the middle gear shaft. The drive and driven cams act as a shock damper in the drive line. These cams remain in the same position relative to each other; that is, they do not "ratchet" or slip over when under heavy load. The middle gear case contains two geared shats; the **drive pinion** (shaft and gear) and the **driven pinion** (gear). A **flange** rides on the driven pinion spline and is bolted to the **ball joint.** The ball joint acts like the universal joints in an automobile drive shaft. The ball joint is permanently lubricated and rarely requires replacement. The swing arm (rear arm) serves as both a suspension component and a housing for the drive shaft. Power is transmitted through the ball joint to the **drive shaft,** and to the splined **gear coupling** in the **final gear case.** In the Final Gear Case, the power is transmitted to the **Drive Pinion,** through the **Ring Gear,** and finally to the rear wheel.

NOTE:
The following illustrations represent only selected components and not the actual complete assembly.









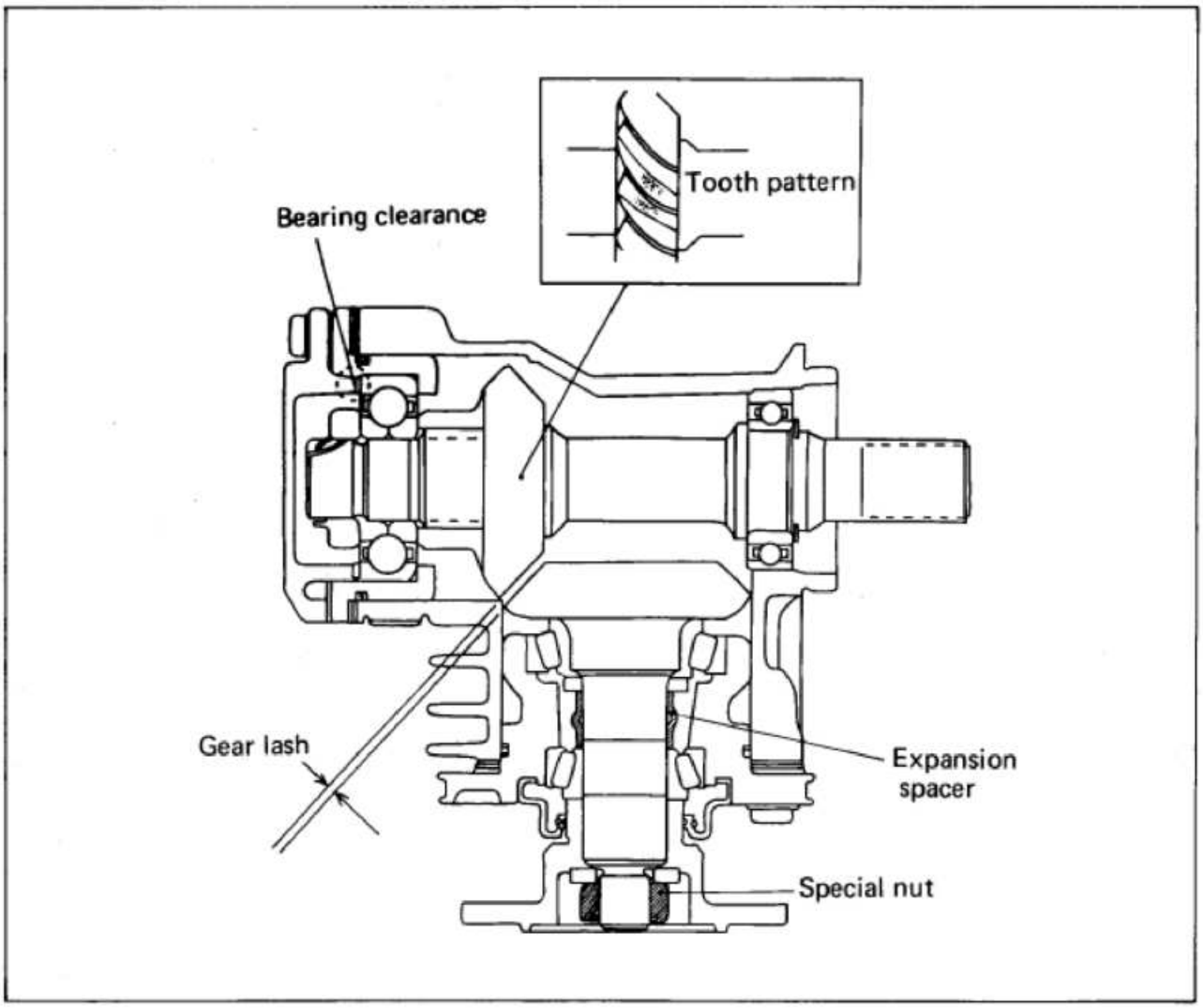
The main service concerns of the Middle Gear Case assembly are:

(1) Gear Lash: The play between the gear teeth. This can be adjusted by shimming.

(2) Tooth Patterns: The locations and patterns of contact that are made on the gear teeth. This can be adjusted by shimming.

(3) Bearing Clearance: The distance between a bearing and its bearing housing cap. This is an extremely small clearance that must be carefully adjusted by shimming.

(4) Bearing Preload: The set load forcing tapered roller bearings against their races. In this case it is measured as the torsional resistance of the driven pinion bearings. It is usually adjusted by replacing the **Expansion Spacer** and very carefully adjusting the torque on the special nut.

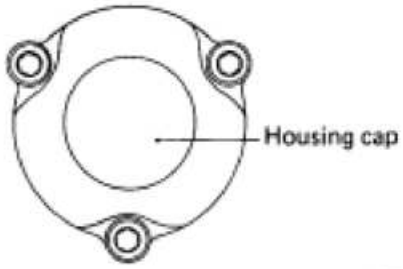
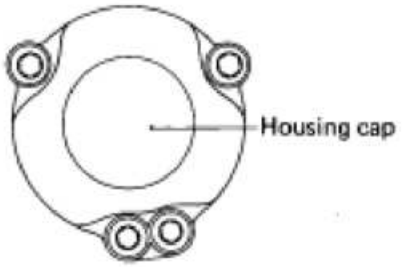
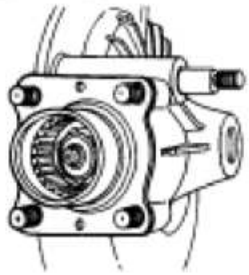
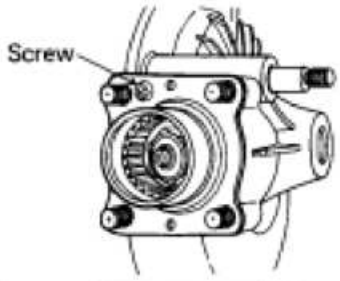


1-2. Lubrication

The maintenance of proper lubrication is the most important consideration that can be given to the shaft drive system by the owner or service person. Almost any significant wear or failure can usually be traced to low lubricant level, contaminated lubricant, or the wrong choice of gear oil. See Chapter 3 for specific gear oil recommendations and checking procedures.

1-3. Identification

Some component assemblies, such as the Middle Gear Case assembly, may contain components of more than one type. These different types will be identified in the text as Type 1 or Type 2. Precise serial number identification of applicable machines is not available.

	Type	Identifying Feature
Middle Gear Case	Type 1	
	Type 2	
Final Gear Case	Type 1	
	Type 2	

The application of parts of the individual types will be discussed in the appropriate section of this manual.

NOTE:

Type 1 Final Gear.....See Type 1 preload specification (spacer type).
Type 2 Final Gear.....See Type 2 preload specification (expansion spacer type).

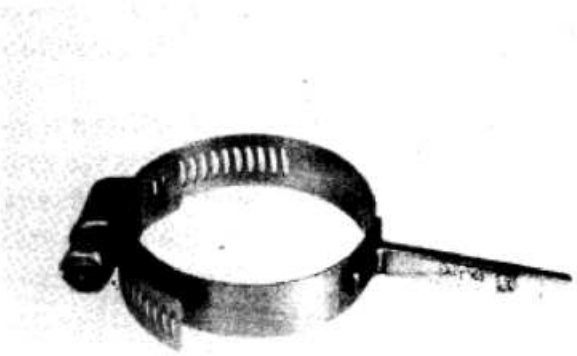
CHAPTER 2. SPECIAL TOOLS

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CHAPTER 2. SPECIAL TOOLS

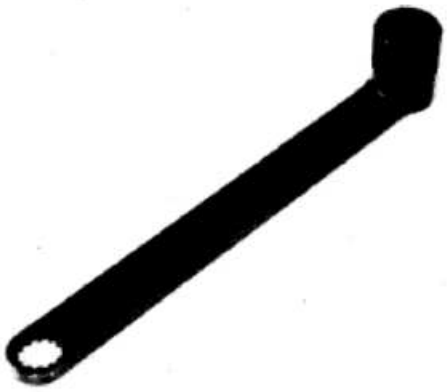
The following special tools are necessary for complete servicing of shaft drive components.



Gear lash measurement tool (final gear)
P.No. 90890–01231



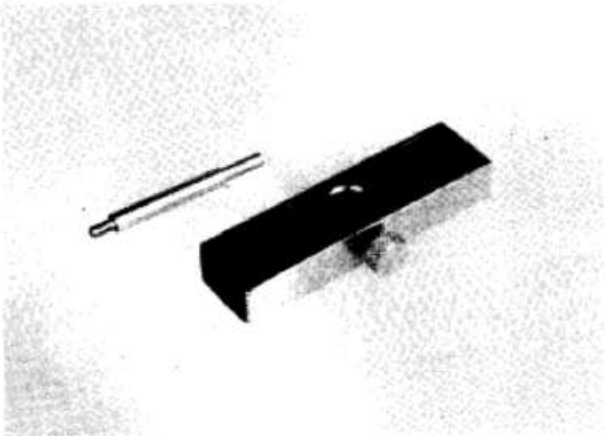
Gear lash measurement tool (middle gear)
P.No. 90890–01230



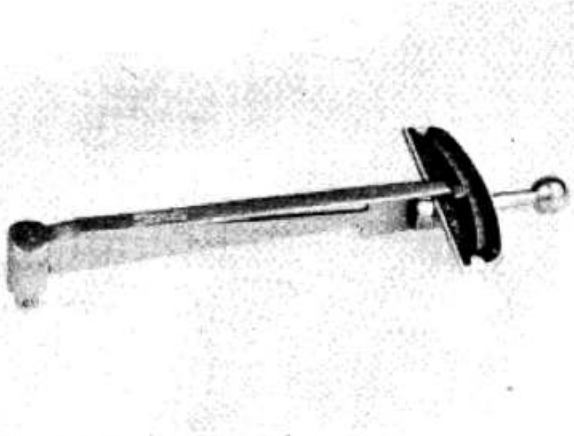
Middle and final gear holding tool
P.No. 90890–01229



Ring gear holding tool
P.No. 90890–01254



Dial gauge stand
P.No. 90890–01232



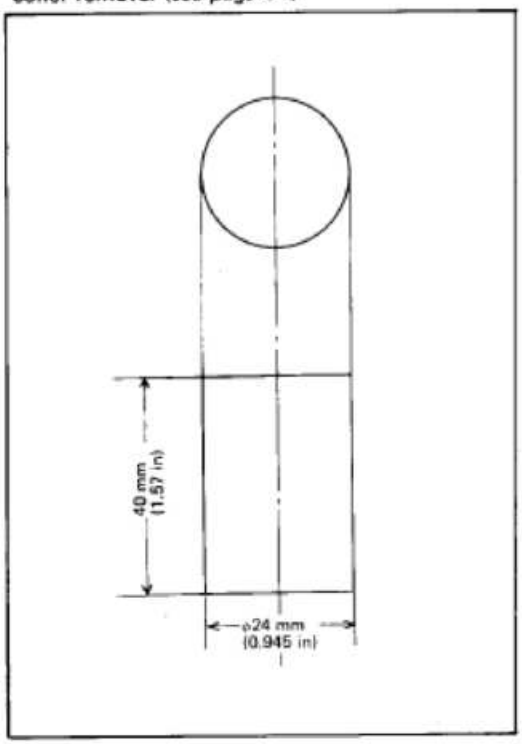
Torque wrench (0 – 30 cm-kg)
P.No. 90890–05147

In addition to these tools and common hand tools, the following are required:

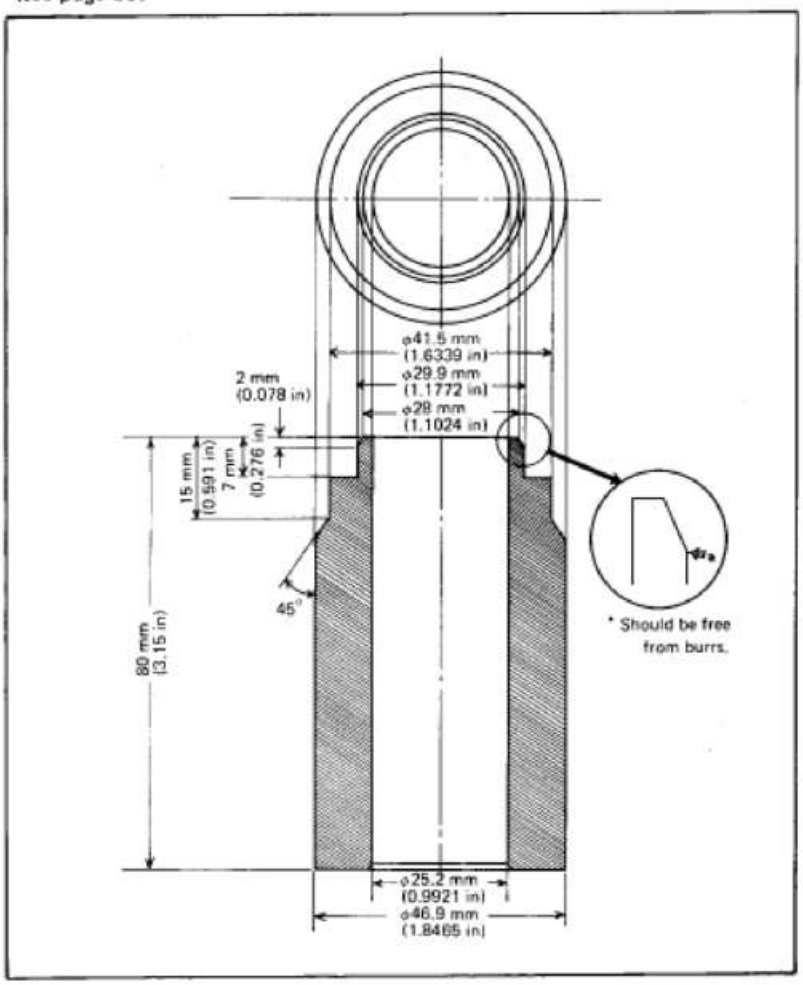
1 - ton press
Universal bearing puller
Feeler gauges
Loctite or similar thread sealant
Contact pattern paint (See Section 6–2)
Bearing installation collars
Torque wrench 0 - 10 m-kg (0 - 70 ft-lb)
Dial gauge

The following special tools are not available but can be constructed for shaft drive component disassembly and assembly:

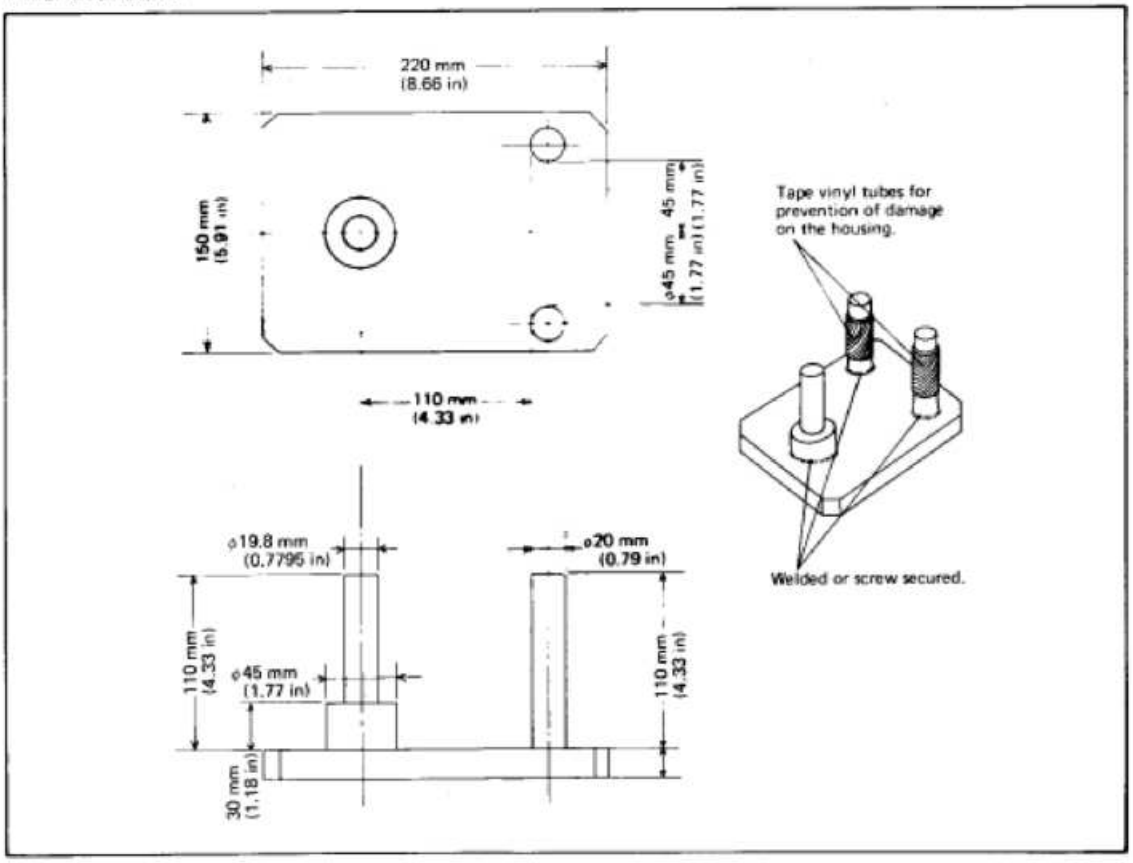
Press Tool No. 1 For final gear guide coller removal (see page 31)



Press Tool No. 2 For final gear roller bearing and oil seal installation (see page 35)



Final Gear Stand



CHAPTER 3. ROUTINE MAINTENANCE AND INSPECTION

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3-2. OIL LEVEL MEASUREMENT 9
3-3. GEAR OIL REPLACEMENT 10

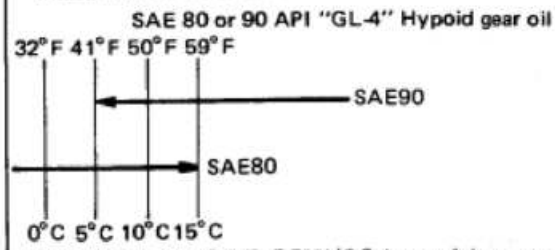
3

CHAPTER 3. ROUTINE MAINTENANCE AND INSPECTION

3-1. GEAR OIL TYPE AND QUANTITY

Middle Gear Oil Capacity: 375 cc (13.0 U.S. fluid oz)
Final Gear Oil Capacity: 300 cc (10.0 U.S. fluid oz)

Recommended oil:

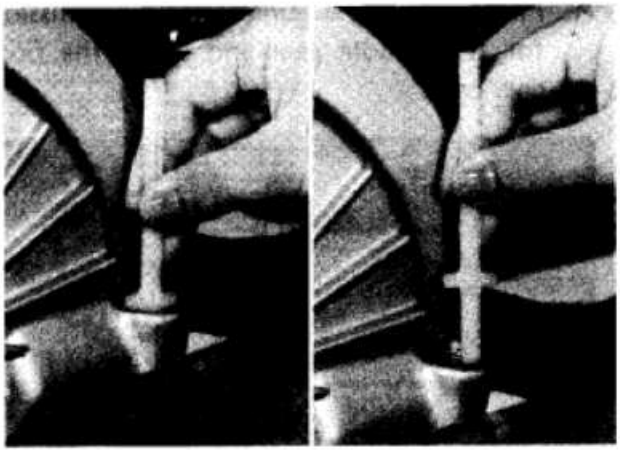


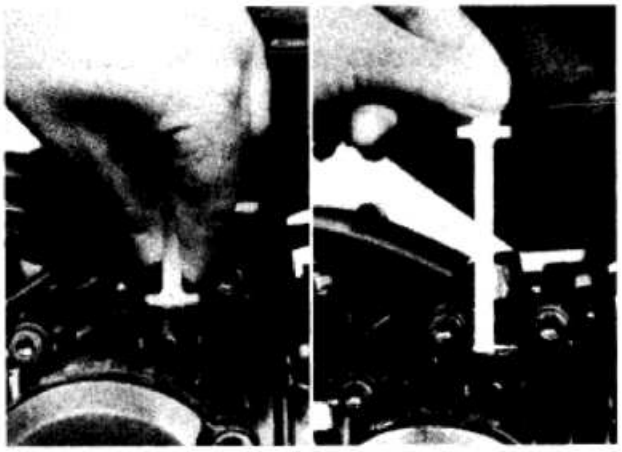
If desired, an SAE 80W/90 hypoid gear oil may be used for all conditions.

NOTE:
"GL-4" is a gear oil quality and additive rating. "GL-5" or "GL-6" designated gear oils of the proper weight may also be used.

Lubrication Intervals
Initial Gear Oil Change: 400 km (250 mi)
Routine Gear Oil Change: every 9,600 km (6,000 mi)

NOTE:
Middle gear and final gear oil can be checked with same level gauge, which is in the owners tool kit.





3-2. OIL LEVEL MEASUREMENT

A. Place the machine on a level surface and place it on the center stand. The engine should be cool (at atmospheric temperature). Allow 2 minutes for oil to drain to bottom of cases.

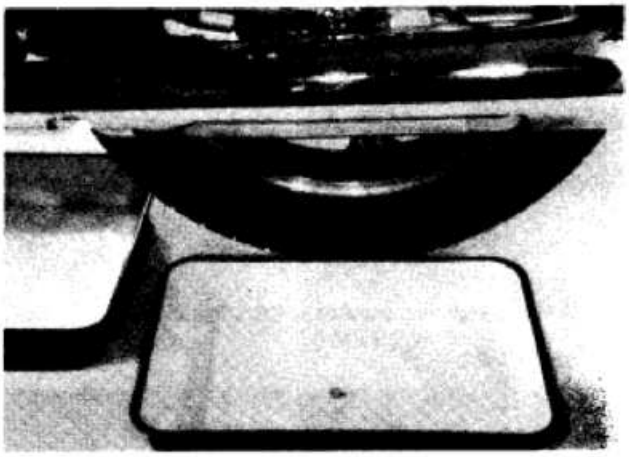
B. Remove the oil filler cap. Check the oil level with level gauge (from tool kit) as shown. The correct oil level is between the two marks on each end of the level gauge. Use end of gauge marked "REAR" for measuring the rear (final) gear case. Use the end marked "MIDDLE" for measuring the middle gear case.

CAUTION:
Take care not to allow foreign material to enter the middle and/or final gear case.

3-3. GEAR OIL REPLACEMENT

NOTE:
See Chapter 4 regarding the inspection of drained oil.

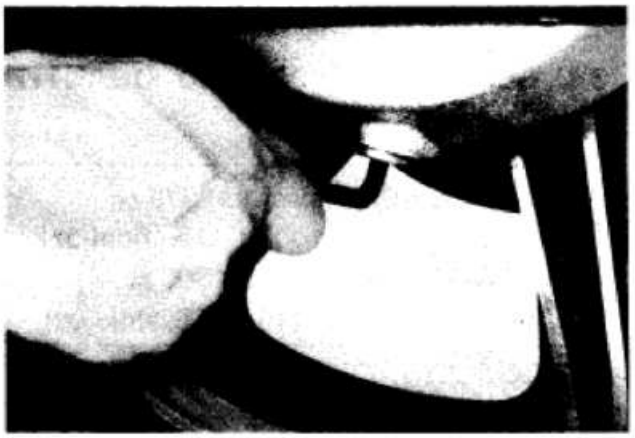
A. Place an oil pan under the transmission for the middle gear and under the final gear case.



B. Remove the middle and/or final gear oil filler cap(s) and the drain plug(s), and drain the oil.

WARNING:
When draining or filling, take care not to allow foreign material to enter the middle and/or final gear case. Do not allow the gear oil to contact the tire and wheel.





C. Reinstall the middle and/or final drain plug(s).

MIDDLE GEAR DRAIN BOLT TORQUE: 4.3 m-kg (31 ft-lb) FINAL GEAR DRAIN BOLT TORQUE: 2.3 m-kg (17 ft-lb)

D. Fill the gear case(s) up to specified level.

Oil Capacity:	
Middle Gear Case:	375 cc (13.0 U.S. fl. oz)
Final Gear Case:	300 cc (10.0 U.S. fl. oz)
Recommended oil:	(See page 9)

E. Reinstall the filler cap(s) securely.

NOTE:
After initial 400 km (250 mi) oil change, it is normally not necessary to change middle and final gear oil more frequently than the indicated service interval of 9,600 km (6,000 mi).

CHAPTER 4. TROUBLESHOOTING

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A. The following conditions may indicate damaged shaft drive components 12
B. Consider the following 13
C. Troubleshooting Chart 13
D. Oil Leak Inspection 14
E. Checking Drained Oil 14

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CHAPTER 4. TROUBLESHOOTING

4-1. TROUBLESHOOTING CONDITIONS

A. The following conditions may indicate damaged shaft drive components:

Basic conditions	Possible damaged areas
1. A pronounced hesitation or "jerky" movement during acceleration, deceleration, or sustained speed. (This must not be confused with engine surging or transmission characteries). 2. A "rolling rumble" noticeable at low speed; a high-pitched whine; a "clunk" from a shaft drive component or area.	A. Damage to bearings. B. Improper gear lash; improper gear tooth contact. C. Gear tooth damage. D. Drive flange/ball joint bolts loose.
3. A locked-up condition of the shaft drive mechanism; no power transmitted from engine to rear wheel.	E. Broken drive shaft. F. Disconnected flange/ball joint connection. G. Driven cam seized to middle gear drive pinion shaft. H. Broken gear teeth. I. Seizure due to lack of lubrication. J. Small foreign object lodged between moving parts.

NOTE:

Damage areas A, B and C above may be extremely difficult to diagnose. The symptoms are quite subtle and difficult to distinguish from normal machine operating noise. If there is reason to believe component (s) are damaged, remove component (s) for specific inspection.

B. Consider the following

Inspection Notes:

(1) During coasting, accelerating or decelerating, the "rolling rumble" will increase with rear wheel speed, not engine or transmission gear speeds. However, such noise may also be due to wheel bearings.

(2) Noise that varies with acceleration and deceleration: Following incorrect reassembly, a condition of too-little gear lash may produce a whine during deceleration.

> **CAUTION:**
> **Too-little gear lash is extremely destructive to gear teeth. If a test ride following reassembly indicates this condition, stop riding immediately to minimize damage to gears.**

(3) A slight "thunk" must be distinguished from normal machine operation. It will be most noticeable at low speed and could indicate broken gear teeth.

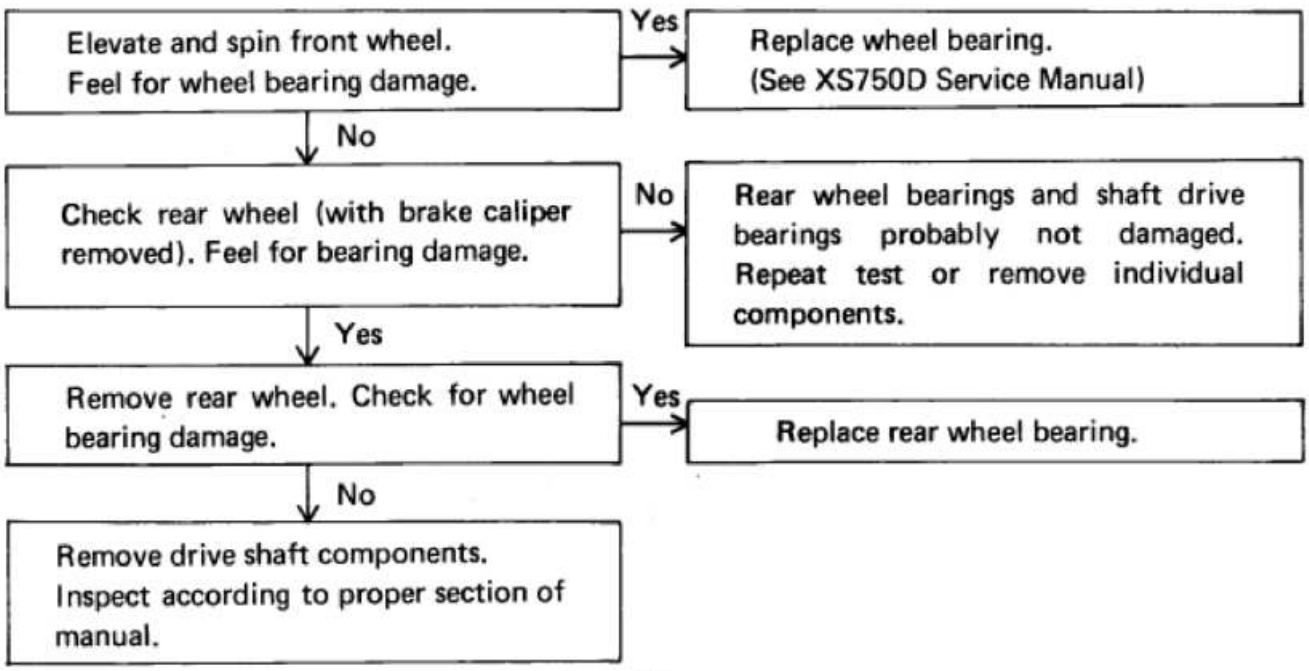
> **WARNING:**
> **If broken gear teeth are suspected, stop riding immediately. This condition could lead to locking-up of the shaft drive assembly and result in harm to a rider.**

(4) If the drive flange/ball joint bolts a slightly loose, a "clunk" may be felt when slowly taking off, or when changing from slow acceleration to slow deceleration. At high speed this will result in vibration.

> **WARNING:**
> **Do not continue riding a machine suspected of having loose flange/ball joint bolts. The components may break, causing injury to a rider.**

C. Troubleshooting Chart

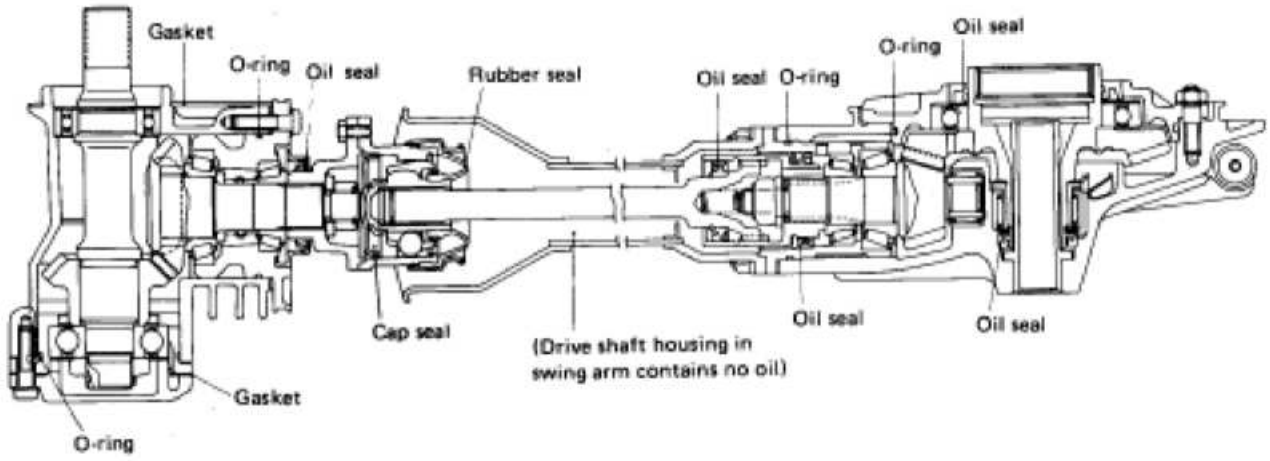
Where Basic Conditions (1) and (2) above exist, consider the following Chart:



D. Oil Leak Inspection

If a shaft drive component is suspected of leaking oil, first thoroughly clean the entire machine. The apparent location of an oil leak on a dusty machine may be misleading. Dry the machine and apply a leak-localizing compound or a dry-powder spray deodorant that will limit the flow of any leaking oil. Operate the machine prepared in this way for the distance necessary to percisely locate the leak. There are the possibilities that a component housing may have been damaged by road debris or an accident, or a gasket or seal may be cracked or broken. However, on new or nearly new machines an apparent oil leak may be the result of a rust-preventive coating or excess assembly lubrication of seals. Always clean the machine and recheck the suspected location of any apparent leakage.

Oil Seals and Gaskets



E. Checking Drained Oil

Whenever a problem is suspected in either the middle or final gear assemblies, drain and inspect the oil. Metal particles on the drain plug or in the oil could indicate a bearing seizure or other problem in the component. However, a small amount of metal particles in the oil is normal.

CHAPTER 5. REMOVAL OF COMPONENTS

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C. Middle Gear Removal 16
D. Drive Shaft 16
5-2. CHECKING GEAR LASH 17
A. Check final drive gear lash as follows: 17
B. Check middle gear lash as follows: 18

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CHAPTER 5. REMOVAL OF COMPONENTS

5-1. Removal of Components

It is normally not necessary to remove the engine to remove the Middle Gear Case.

A. Drive Shaft Joint

(1) Pull rubber boot from drive shaft coupling to expose four (4) bolts.
(2) Remove 4 coupling bolts.

NOTE:
Use the rear brake to lock the drive shaft.



B. Final Gear Removal

(1) Remove rear axle and left shock absorber. Remove rear wheel. See XS750D Service Manual for procedures.

(2) Remove 4 nuts holding Final Drive unit to swing arm.

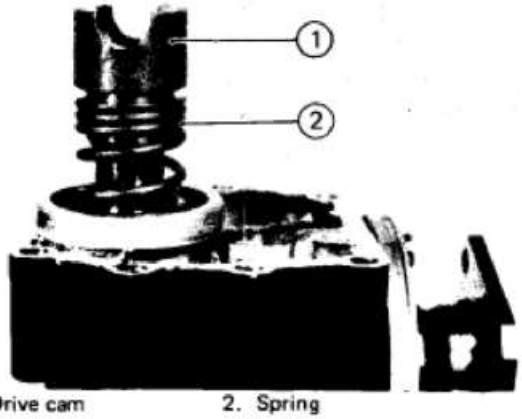
NOTE:
Keep the Final Drive pinion bearing housing attached to the Final Drive assembly. It may tend to separate from the Final Gear (for Type 1 Final Gear only).

(3) Remove the Final Drive Gear assembly.



C. Middle Gear Removal

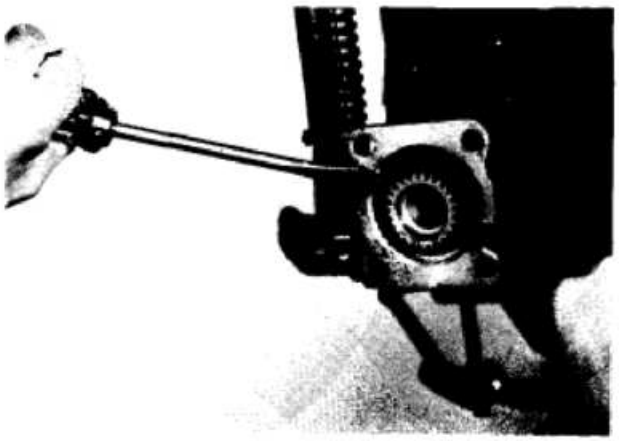
Remove seven (7) middle gear case securing bolts. Remove the meddle gear case, drive cam and spring.



1. Drive cam 2. Spring

D. Drive Shaft

Remove drive shaft as shown.

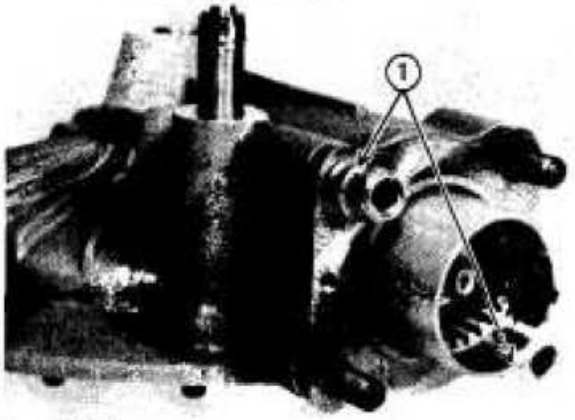


5-2. Checking Gear Lash

A. Check final drive gear lash as follows

(1) Remove final drive gear case.

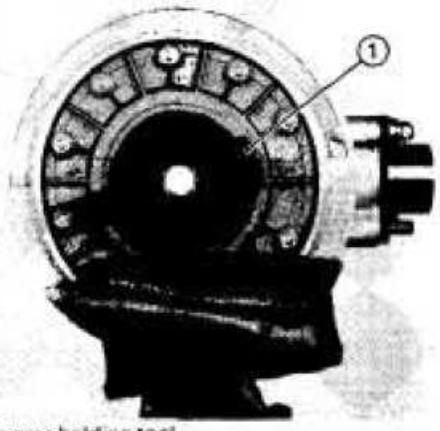
(2) Temporarily secure bearing housing as follows (Type 1 and Type 2):
Place a thickness of washer (about 1/4 inch thick) over 2 opposite bearing housing studs. Install 2 nuts on these studs and temporarily tighten the bearing housing to the final drive housing.



1. Washers

(3) Place gear case in a vice or other support.

(4) Remove one nut from a final drive case stud bolt. Place gear holder (Special Tool) over ring gear surface and stud bolt. Tighten holder to stud bolt with nut.



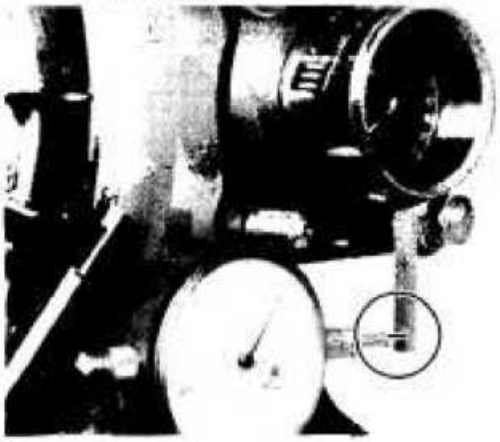
1. Ring gear holding tool

(5) Install final gear lash measurement tool on gear coupling (input side).



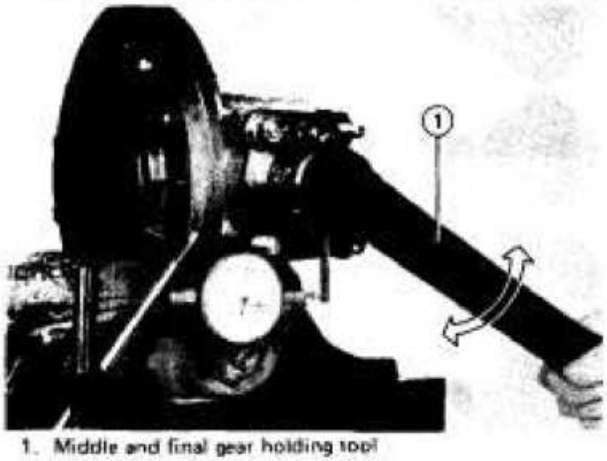
1. Gear lash measurement tool

(6) Mount a dial gauge against the lash measurement tool at the scribed mark (60 mm (2.36 in) from the center of the shaft).



(7) Use special wrench to gently rotate gear coupling back and forth. Note the lash measurement on the dial gauge.

FINAL GEAR LASH
0.25 – 0.50 mm (0.010 – 0.020 in): When using the measurment tool.
0.1 – 0.2 mm (0.004–0.008 in): Actual gear lash on the final gear teeth.



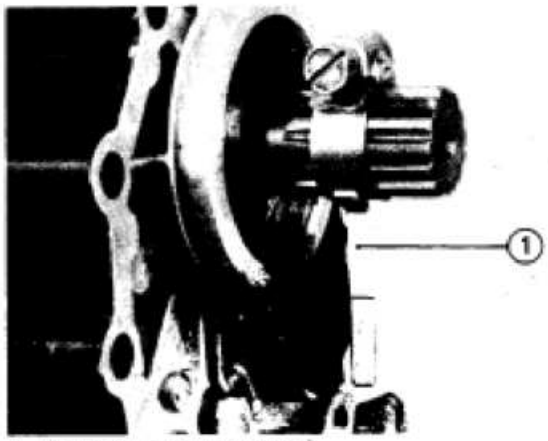
1. Middle and final gear holding tool

(8) Check this engagement at 4 positions. Rotate the shaft 90° each time and repeat the gear lash check.

MIDDLE GEAR CASE LASH
0.1 – 0.2 mm (0.004 – 0.008 in):
Measured value and actual gear lash are the same.

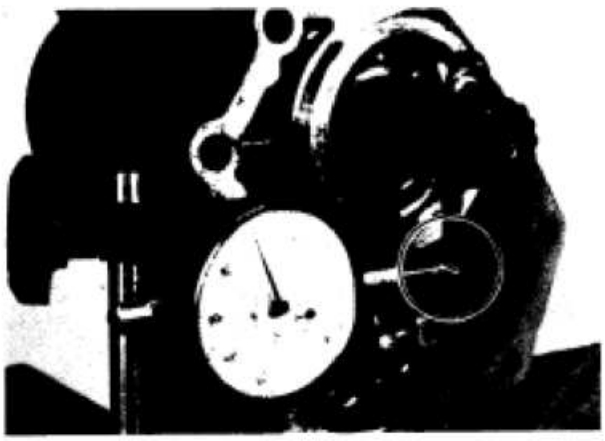
B. Check middle gear lash as follows

(1) Support gear case in a vise by the output shaft flange. Install the lash measurement tool on the input shaft as shown.

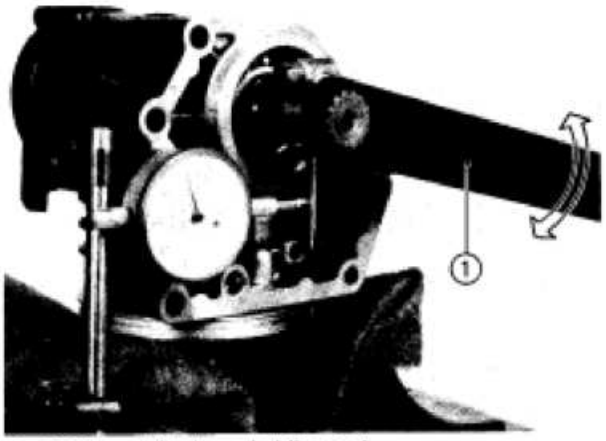


1. Gear lash measurement tool

(2) Mount a dial gauge against the lash measurement tool at the scribed mark (34 mm (1.34 in) from the center of the shaft).



(3) Hold the gear case and rotate the input shaft back and forth using the special wrench. Read the gear lash on the dial gauge.



1. Middle and final gear holding tool

(4) Check this engagement at 4 positions. Rotate the driven pinion shaft 90° each time and repeat the gear lash check.

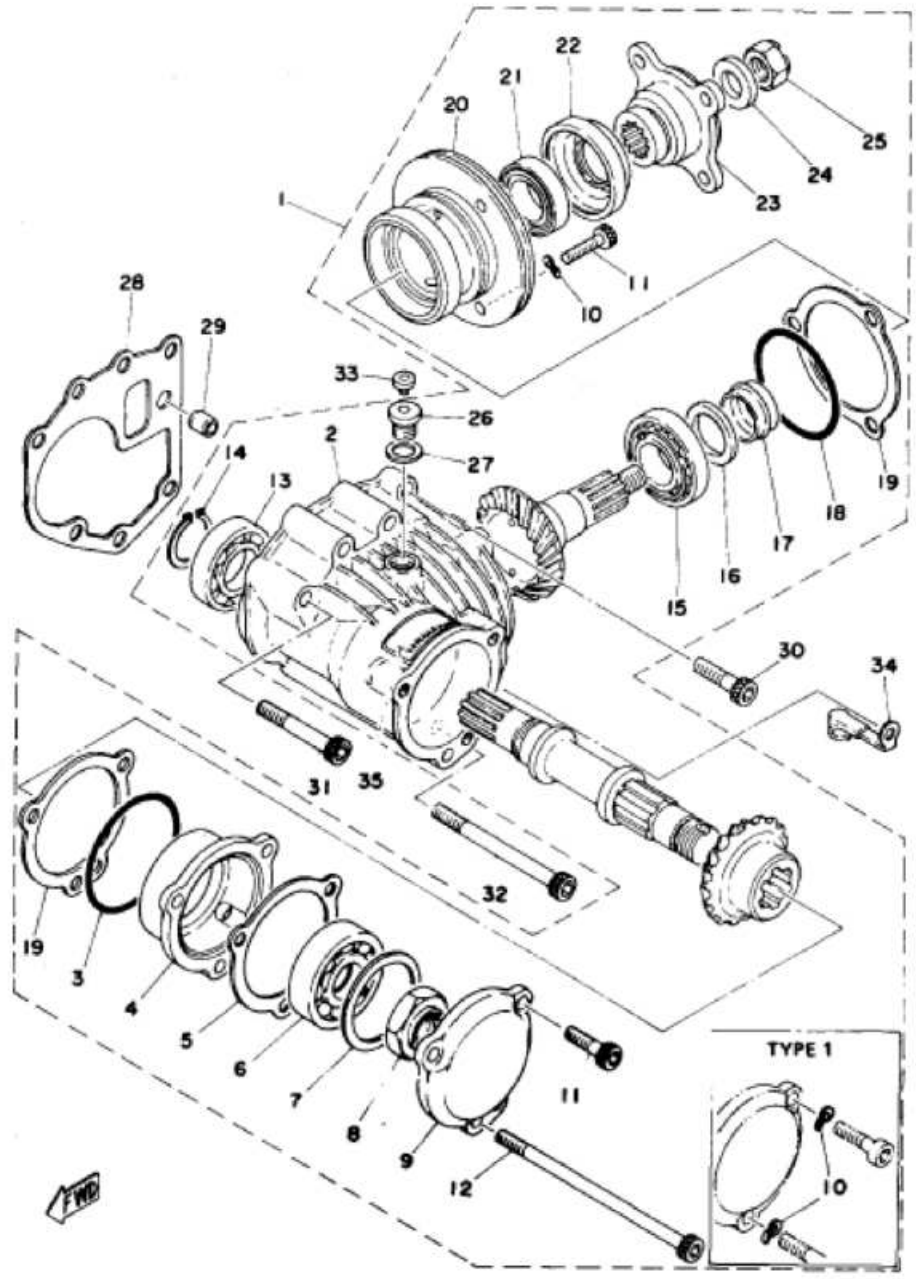
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6

CHAPTER 6. MIDDLE GEAR

6-1. Disassmebly and Inspection



1. Middle gear case ass'y
2. Middle gear housing
3. "O". ring
4. Bearing housing
5. Housing cap gasket
6. Bearing (6305 special)
7. Thrust shim (0.15, 0.3, 0.4, 0.5 mm)
8. Nut
9. Housing cap
10. Wave washer
11. Hexagon socket head bolt
12. Hexagon socket head bolt
13. Bearing (6006C3)
14. Circlip (S-30)
15. Tapered roller bearing
16. Plate washer (25.4-37-6)
17. Expansion spacer
18. "O" ring
19. Pinion shim (0.10, 0.15, 0.30)
20. Bearing housing
21. Tapered roller bearing
22. Oil seal (S-35-63-16.5)
23. Middle gear flange
24. Plate washer (14.1-32-5)
25. Self locking nut
26. Oil inlet plug
27. Gasket
28. Middle gear case gasket
29. Dowel pin (6.4-10-15)
30. Hexagon socket head bolt
31. Hexagon socket head bolt
32. Hexagon socket head bolt
33. Plug cap
34. Harness clamp
35. Oil caution label

NOTE:

If either the drive pinion or driven pinion gears are damaged, both must be replaced as a set. Please note also that all bearings that are removed in the following operations must be replaced during reassembly. By removing only the drive pinion it is possible to perform a thorough inspection of the middle gear assembly.

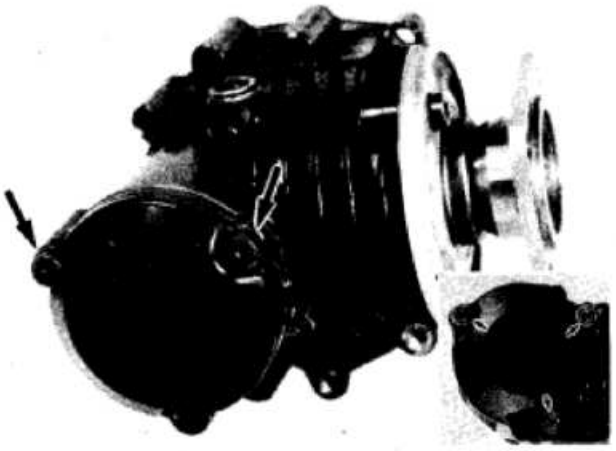
A. Purpose of Drive Pinion Removal

By removing the drive pinion shaft only, the following can be inspected:

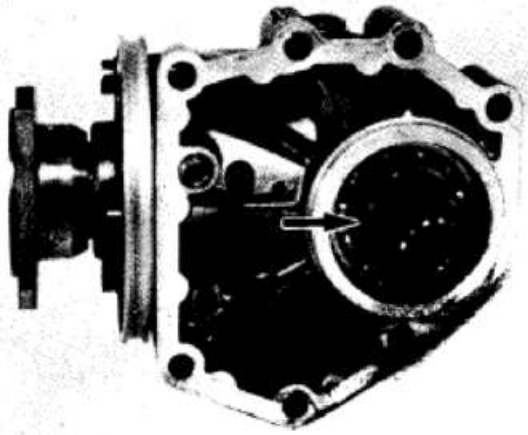
(1) Drive Pinion Bearing (page 21 ~ 22)
(2) Driven Pinion Bearings (page 22 ~ 23)
(3) Drive Pinion Bearing Housing Cap clearance (page 24)
(4) Condition of gear teeth (page 21)
(5) Tooth contact pattern (page 25)
(6) Driven pinion bearing preload (page 26 ~ 27)

B. Disassembly (Initial)

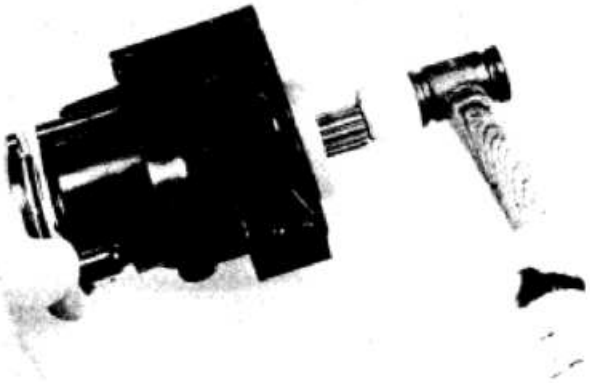
(1) Remove bearing housing cap.



(2) Remove drive pinion circlip.



(3) Tap on splined end of drive pinion shaft with a soft hammer. Remove the drive pinion assembly.



C. Drive Pinion Assembly Inspection

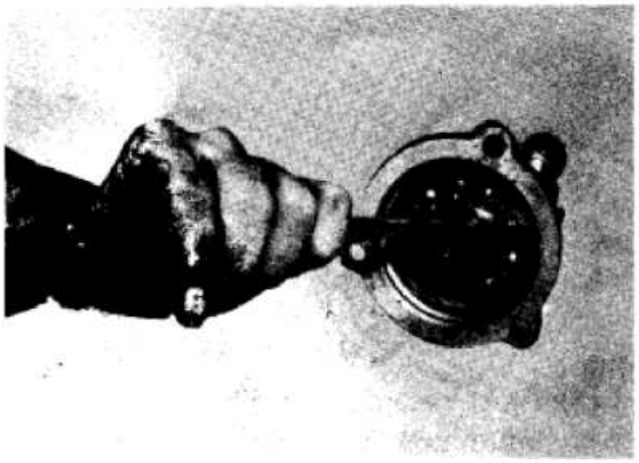
Check bearing movement for damage to balls, rough spots, bearing looseness. Inspect gear teeth. If any gear tooth is damaged, the gear set must be replaced.

D. Driven Pinion Assembly Inspection

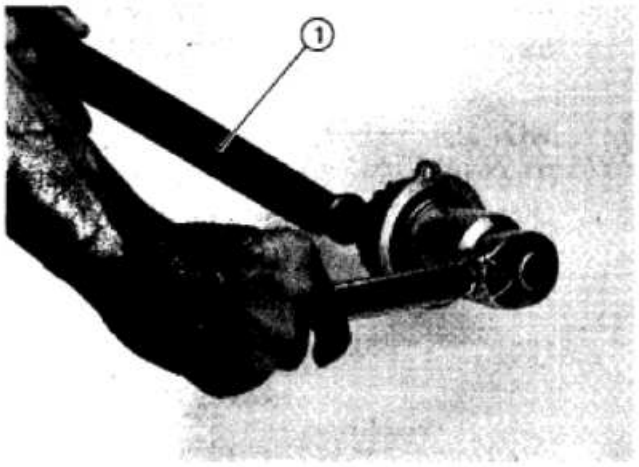
Leave driven pinion installed. Spin the shaft to check for bearing damage. Inspect gear teeth.

E. Drive Pinion Bearing Removal (for replacement only)

(1) Bend down locking collar of the nut.



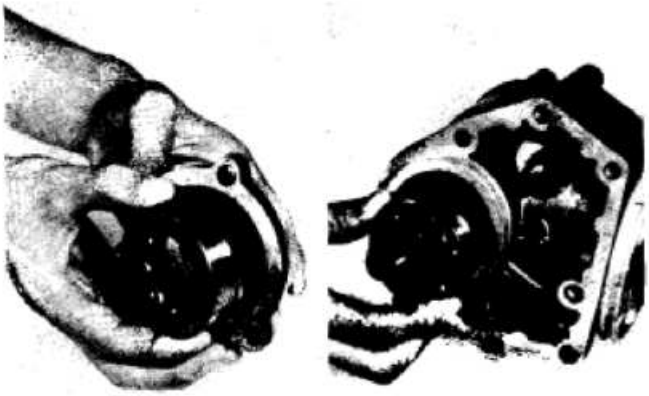
(2) Use special tool to hold splined end of shaft and remove the nut.



1. Middle and final gear holdint tool

(3) Remove housing with bearing. Remove bearing from case.

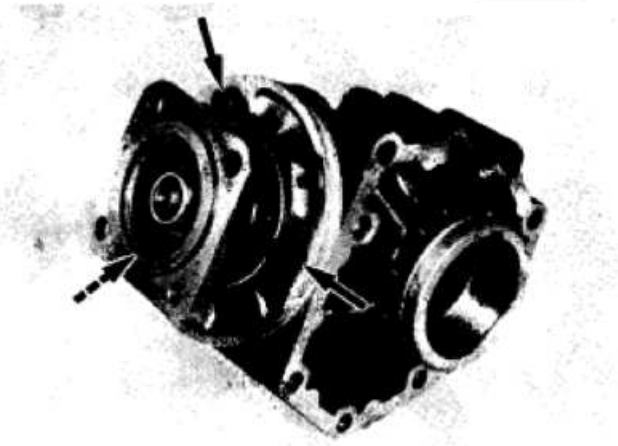




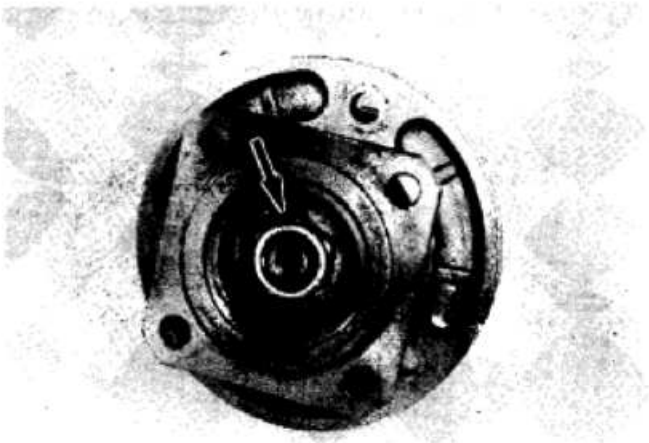
F. Driven Pinion Disassembly (for replacement only)

NOTE:
The following driven pinion disassembly should be performed only if the bearings are to be replaced. Do not re-use bearings or races that have been installed and removed.

(1) Remove bearing housing screws. Remove bearing housing from case.



(2) Hold flange in a vise. Remove self-locking nut.



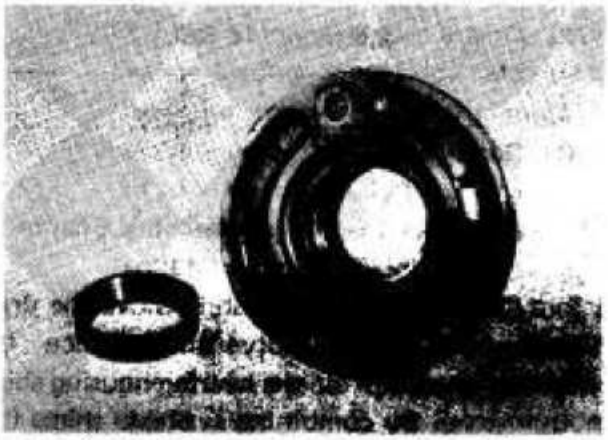
(3) Tap driven pinion with a soft hammer. Remove pinion from bearing housing.



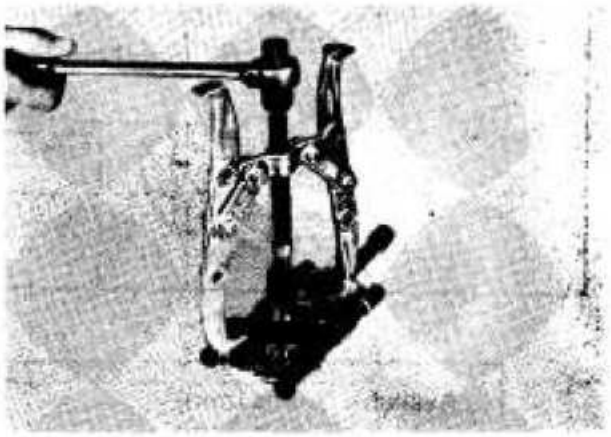
(4) Small bearing (rear): Remove bearing housing oil seal and bearing inner race.



(5) Bearing housing outer race removal requires an oven. Heat bearing housing to 100°C (212°F). If necessary, tap the races out with a punch.



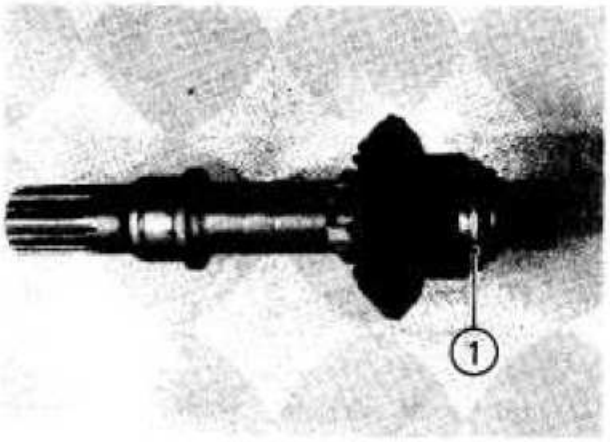
(6) Large bearing (front):
Use a universal-type bearing puller to remove the bearing from the driven pinion.



6-2. Reassembly and Adjustment

A. Drive Pinion Assembly

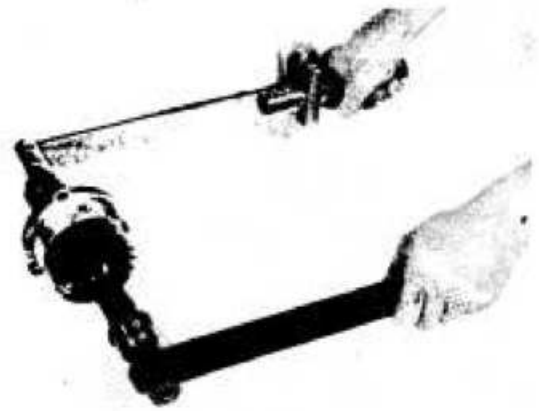
(1) Install bearing into middle gear case.
(2) Install bearing into bearing housing.
(3) Install bearing inner race half onto drive pinion shaft.



(4) Install bearing housing onto drive pinion. Install remaining bearing inner race half.

(5) Use middle gear holding tool to lock drive pinion shaft and install nut. Tighten to specified torque.

Drive Pinion Nut Torque:
11 m-kg (80 ft-lb)



(6) Stake the locking collar of the nut to the slot on the drive pinion shaft.



(7) Install a new O-ring on the bearing housing.

(8) Install original shim on bearing housing assembly and install drive pinion assembly into middle gear case.

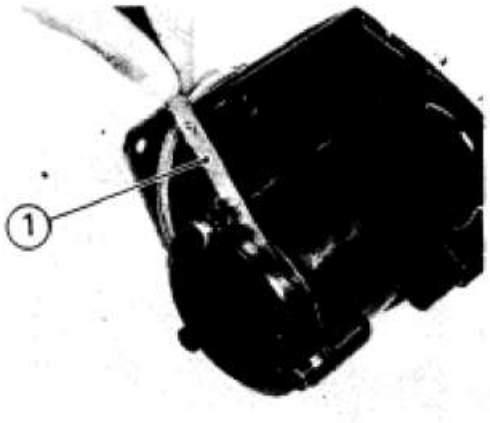
NOTE:
It may be helpful to temporarily install the long mounting screw through the bearing housing and shim.

B. Bearing Housing Cap Clearance

(1) Install the original thrust shim. Install the housing cap without a gasket. The sealing surfaces must be clean to obtain an accurate measurement.

(2) Hold the housing cap in position. Insert a feeler gauge between the cap and the case. If necessary, select an appropriate thrust shim to achieve specified gap.

Cap to housing gap (no gasket):
0.2 – 0.25 mm (0.0079 – 0.0098 in)
New gasket thickness:
0.3 mm (0.012 in)



1. Feeler gauge

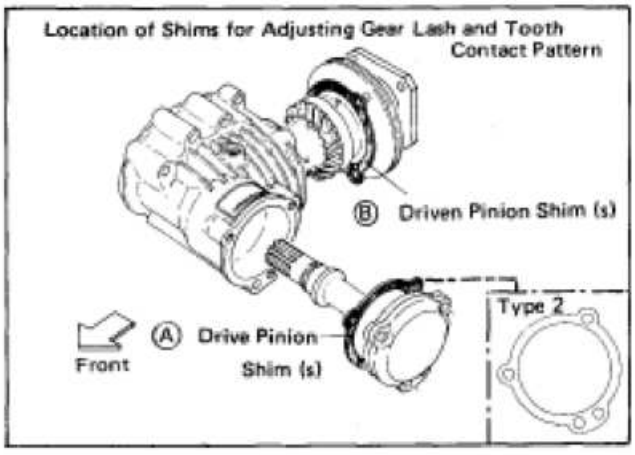
(3) When gap is adjusted properly, remove cap. Install new housing cap gasket. Reinstall cap and tighten screws to specified torque.

Housing Cap Screw Torque:
2.5 m-kg (18 ft-lb)

C. Gear Lash

(1) Check middle gear lash. See Chapter 5, Section 5 – 2.

(2) To reduce gear lash, remove the drive pinion assembly and reduce the thickness of the bearing housing shim-(s). By combining available shims it is possible to decrease total shim thickness in 0.05 mm steps.



Available Shims (mm):
0.10, 0.15, 0.30

To increase gear lash, use a thicker shim. Gear lash can also be adjusted by changing the driven pinion bearing housing shim(s) in the same way.

CAUTION:
Too little gear lash is extremely destructive to gears. Always recheck an assembled component for specified gear lash.

D. Tooth Pattern Inspection and Adjustment

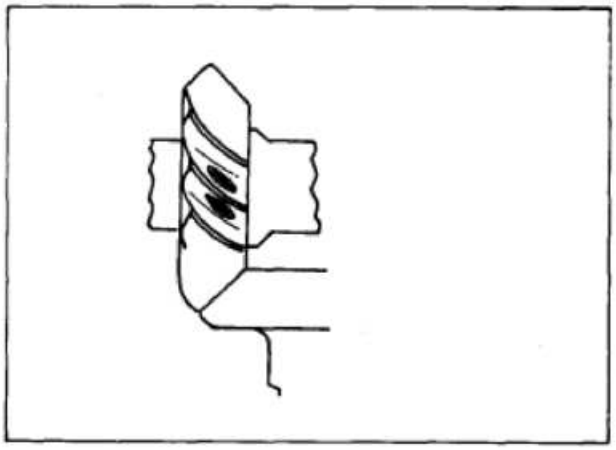
(1) The middle gear case must be relatively free of oil, with only enough to protect the bearings. Clean the gear teeth with spray solvent.

(2) To mark the gears, use a white paint. White lead or artist's oil zinc white may be used. The paint must be smooth and firm, with the consistency of toothpaste. Apply this paint to 3 or 4 driven pinion teeth. Cover the contact faces of the teeth.

(3) Use the middle gear holding tool to turn the pinion shaft while holding the driven pinion flange to simulate a load. Turn for 2 or 3 revolutions. Then reverse the rotation and load for 2 or 3 revolutions.

(4) Remove the bearing housing cap and tap out the drive pinion shaft. Inspect the gear tooth patterns.

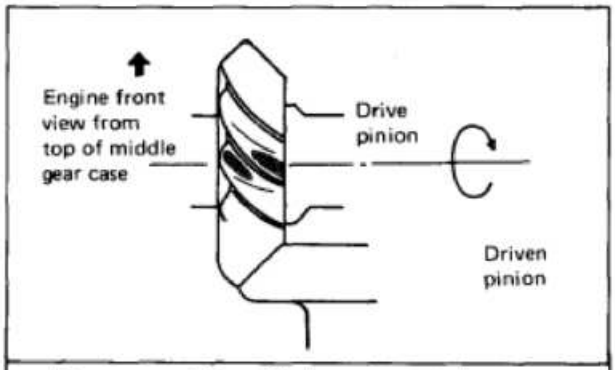
Example 1. Correct pattern



NOTE:
The pattern should be centered in the tooth drive surface. However, wear and drive forces tend to move the contact area to the out side. Therefore the correct pattern can be slightly toward the inside, or heel, of the gear tooth.

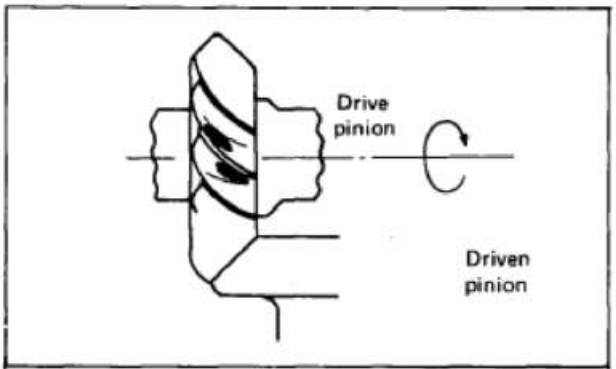
(5) To correct an incorrect tooth pattern, change the total shim thickness at each location (A and B) an equal amount. The shims must be changed an equal amount or gear lash will be affected. Use the following guide:

Example 2. Incorrect pattern



Decrease shim thickness at A increase shim thickness at B an equal amount.

Example 3. Incorrect pattern



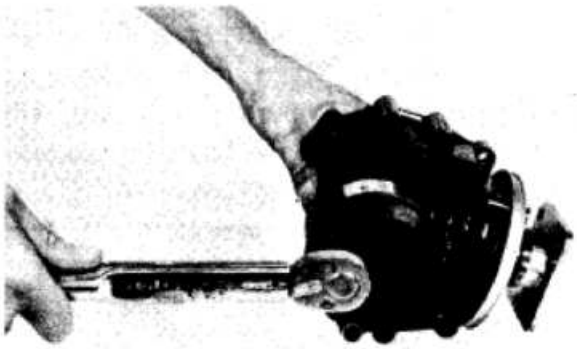
Increase shim thickness at A decrease shim thickness at B an equal amount.

Remove original contact pattern and recheck with fresh paint. If the new pattern is correct, thoroughly clean all paint from the teeth and flush the case several times with solvent to remove all traces of paint. Immediately oil all bearings with gear oil. Recheck gear lash.

(6) Final assembly

a. Install circlip on drive pinion shaft.

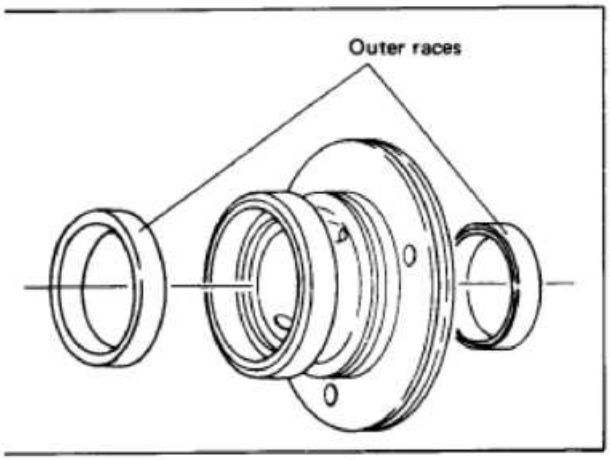
b. Remove housing cap screws. Clean threads and apply thread sealant such as "Loctite", and reinstall. Remove driven pinion bearing housing screws, clean threads and apply thread sealant. Tighten all screws to specified torque.



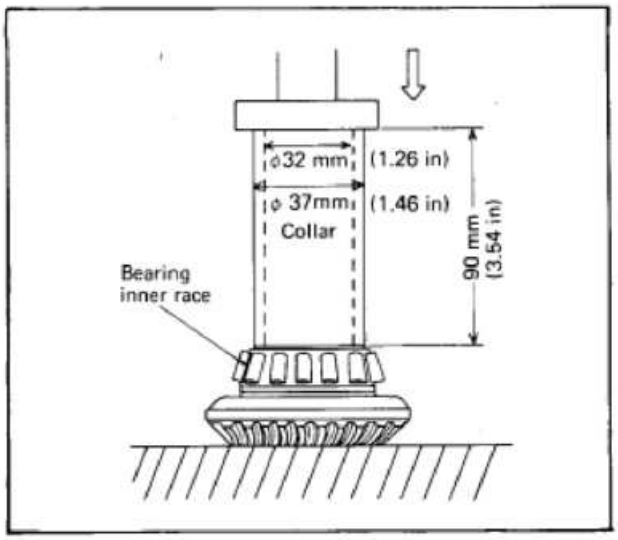
Bearing Housing Screw Torque (drive and driven pinion bearing housings): 2.5 m-kg (18 ft-lb)

. **Driven Pinion Reassembly**

(1) Heat driven pinion bearing housing to 100°C (212°F). Install new bearing outer races.



(2) Install the larger bearing on driven shaft using a press and a collar of the proper size. Oil the bearing.



(3) Install smaller bearing inner race into bearing housing. Oil the bearing.

(4) Install a new oil seal into the bearing housing. Use a press if necessary.

(5) Install the washer and a new expansion spacer on the driven pinion shaft.

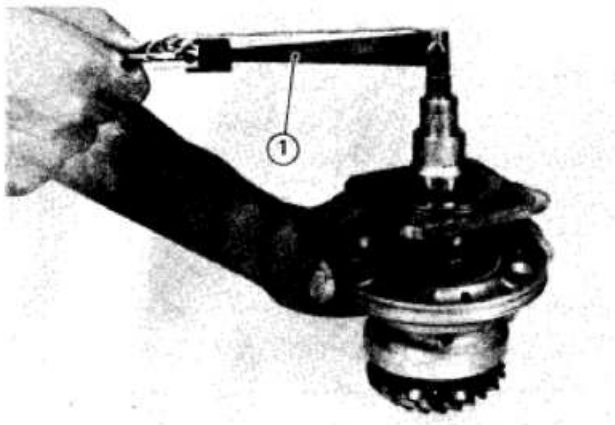
(6) Install the driven pinion assembly into the bearing housing assembly.

(7) Grease the inside surface of the bearing housing oil seal and install the flange.

(8) Install plate washer and nut. Gradually tighten nut to proper pre-load as follows:

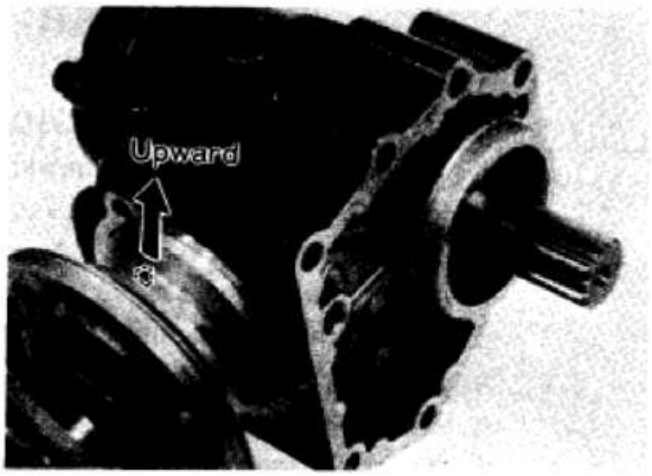
a. Use a 0–30 cm-kg torque wrench.

b. Hold flange and tighten nut slightly. **Avoid obertightening.** Overtightening will require disassembly and replacement of the expansion spacer.



1. Torque wrench

c. Hold bearing housing and check preload. This preload is determined by turning the shaft with a torque wrench and measuring the resistance of the bearings to the rotation of the shaft.



CAUTION:
Do not hold the bearing housing in a vise.

Preload Specification:
4 – 5 cm-kg (3.4 – 4.3 in-lb)
Nut tightening torque (for reference):
10 ~ 15 m-kg (72 ~ 108 ft-lb)

d. Repeat steps (a), (b) and (c) until proper preload is reached.

NOTE:
Early type 1 units used a slightly greater preload, however, use the above specification for all types.

(9) Apply tooth pattern checking paint to drive pinion gear. Check pattern and adjust if necessary. Use procedure for checking drive pinion.

(10) Install driven pinion assembly into middle gear case as shown. Clean bearing housing screws and apply thread sealant. Tighten to specified torque.

Driven Pinion Bearing Housing Screw
Torque: 2.5 m-kg (18 ft-lb)

CHAPTER 7. FINAL GEAR

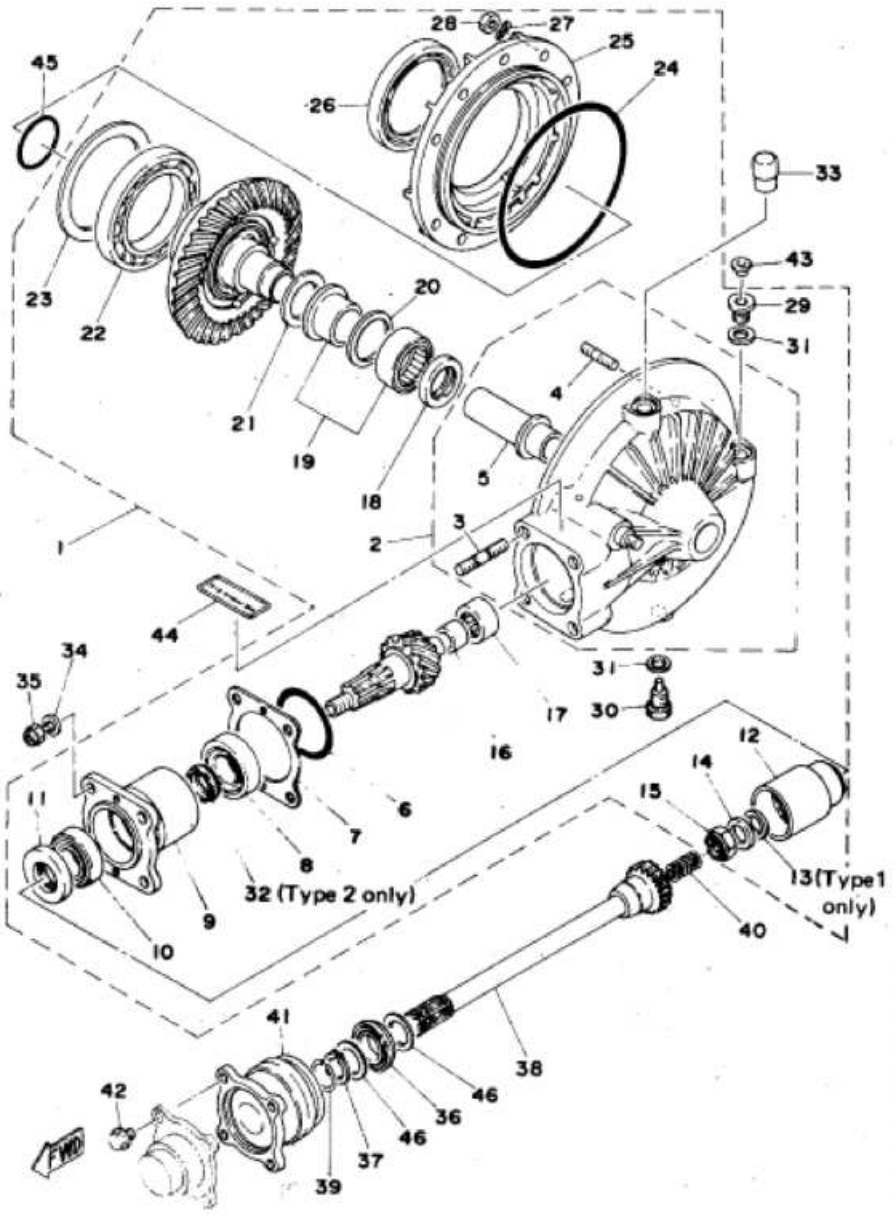
7-1. DISASSEMBLY AND INSPECTION 29
- A. Purpose of Ring Gear Removal 29
- B. Ring Gear Removal 30
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- D. Drive Pinion Removal 30
- E. Drive Pinion Disassembly (replacement only) 30

7-2. REASSEMBLY AND ADJUSTMENT 31
- A. Drive Pinion Assembly 31
- B. Tooth Contact Pattern and Gear Lash 33
- C. Ring Gear Assembly 35

7

CHAPTER 7. FINAL GEAR

7-1. Disassembly and Inspection



1. Rear axle gear case ass'y (Final gear case ass'y)
2. Drive shaft housing comp.
3. Stud bolt
4. Stud bolt
5. Guide collar
6. "O" ring
7. Drive pinion shim (0.30, 0.35, 0.40, 0.45, 0.50, 0.55)
8. Tapered roller bearing
9. Bearing housing
10. Tapered roller bearing
11. Oil seal (S-38-50-7)
12. Gear coupling
13. Bearing spacer (1.00, 1.52, 1.54, 1.56, 1.58, 1.60, 1.70, 1.80, 1.90)Type 1 only
14. Plate washer (14-26-4)
15. Self locking nut
16. Inner race
17. Bearing
18. Oil seal (S-30-42-7)
19. Bearing
20. Thrust washer (1.8, 1.9, 2.0, 2.1)
21. Thrust shim (0.1, 0.2)
22. Bearing (16014)
23. Ring gear shim (0.25, 0.3, 0.35, 0.4, 0.45, 0.5)
24. "O" ring
25. Bearing housing
26. Oil seal (SD-70-90-10)
27. Wave washer
28. Nut
29. Oil inlet plug
30. Oil drain plug
31. Gasket
32. Expansion spacer (Type 2 only)
33. Breather comp.
34. Spring washer
35. "U"nut
36. Oil seal (OS0-37-43.6-7)
37. Circlip (S-26)
38. Drive shaft
39. Clip
40. Compression spring
41. Ball joint comp.
42. Washer based bolt
43. Bolt cap
44. Oil caution label
45. "O" ring (4-54.5)
46. Plate washer

A. Purpose of Ring Gear Removal

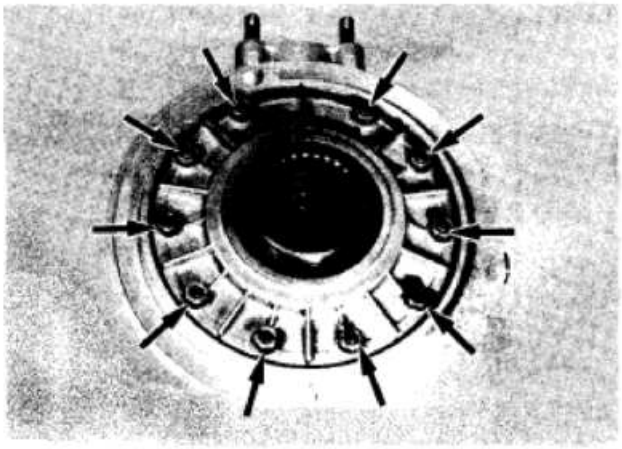
By removing the ring gear assembly only, the following inspections can be made.

(1) Drive pinion bearings (page 21 ~ 22, 30)
(2) Ring gear bearings
(3) Gear teeth condition
(4) Tooth contact pattern (page 25, 33 ~ 34)
(5) Drive pinion bearing preload (page 31 ~ 33)

B. Ring Gear Removal

(1) Remove the nuts (10) holding the bearing housing.

(2) Remove the ring gear assembly and thrust washer from final gear case.



C. Inspection

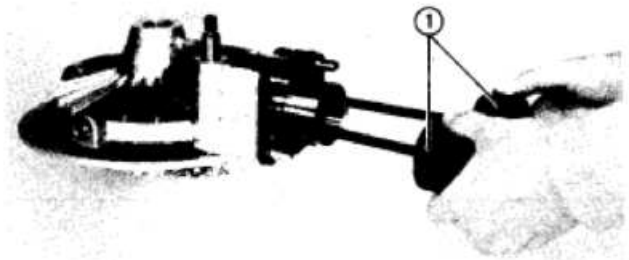
Inspect bearings and gear teeth as in Middle Gear procedure. If necessary, check tooth contact pattern. See page 33 for basic procedure.

D. Drive Pinion Removal

Use two slied weights and 6 mm shafts to remove bearing housing.

NOTE:

On Type 2 Final Gear assemblies, remove bearing housing securing screw before removing bearing housing.



1. Slide weights

E. Drive Pinion Disassembly (replacement only)

NOTE:

The following drive pinion disassembly should be performed only if gearing replacement is necessary. Do not re-use bearings or races after removal.

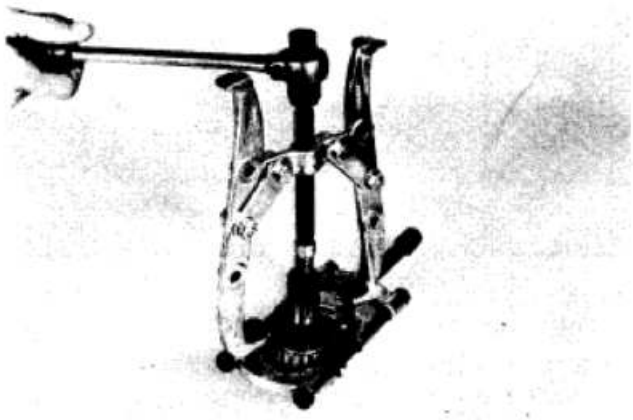
(1) Hold gear coupling with special tool. Remove self-locking nut from drive pinion. Tap lightly with a soft hammer to remove drive pinion from coupling.



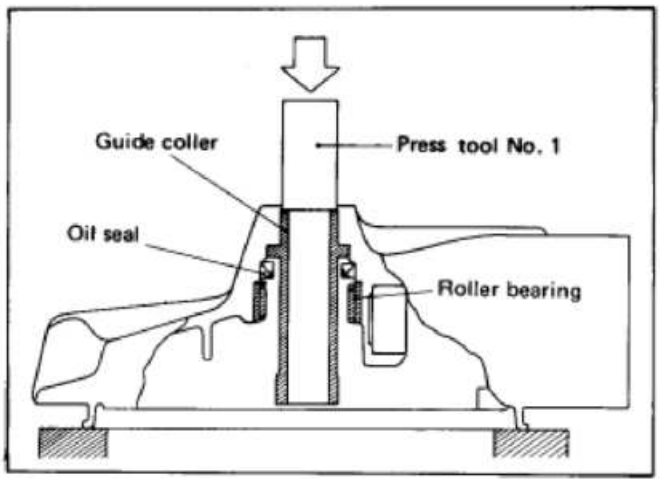
(2) Small bearing (front): Remove oil seal from bearing housing. Remove outer races. Use drift punch to remove outer race. Do not re-use bearing.



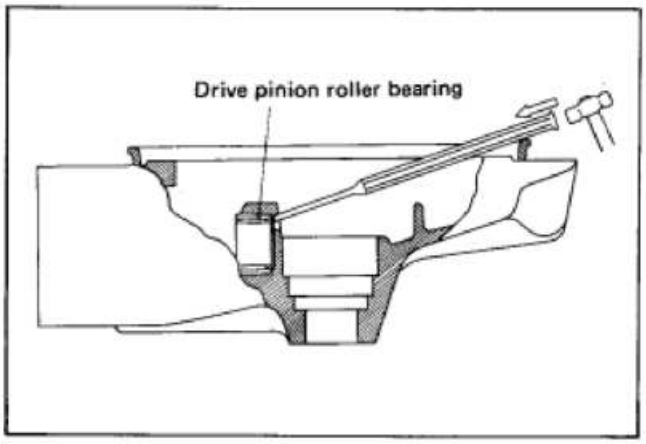
(3) Large bearing (rear): Use a universal-type bearing puller to remove inner race of large bearing from the drive pinion.



(4) Use a press and the press tool No. 1 (Special Tool) to push the guide coller, oil seal, and roller bearing from the main housing. Use appropriate supports for the main housing during this operation. If undamaged, the roller bearing may be re-used. Do not re-use oil seal.



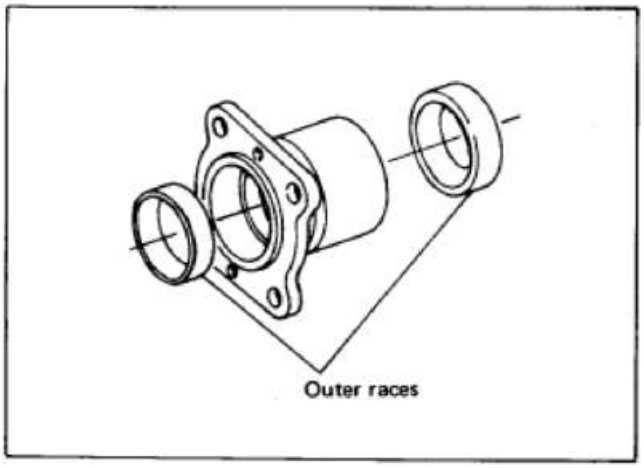
(5) Rear drive pinion roller bearing: Removal of this bearing is difficult and seldom necessary. Heat the bare housing to 150°C (302°F). Use appropriately shaped punch to remove the roller bearing outer race. Remove inner race from the drive pinion.



7-2. Reassembly and Adjustment

A. Drive Pinion Assembly

(1) Install 2 new bearing outer races into the drive pinion bearing housing.



(2) Install the inner race of the smaller bearing to drive pinion shaft. Oil the bearing.

(3) Install the inner race of the smaller bearing into the bearing housing. Oil the bearing.

(4) Grease a new oil seal and install it into the bearing housing.

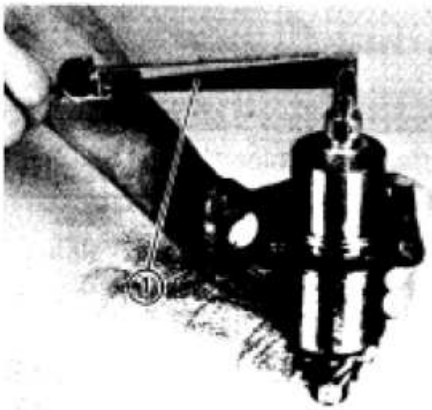
(5) Type 2 only: Install new expansion spacer on the drive pinion shaft.

(6) Install the drive pinion into the driven pinion bearing housing according to the following types and procedures.

Type 1:

a. Install the gear coupling, plate washer, and self-locking nut. **Do not install spacers yet.** Tighten nut gradually until proper bearing preload is reached. Overtightening will damage the bearings.

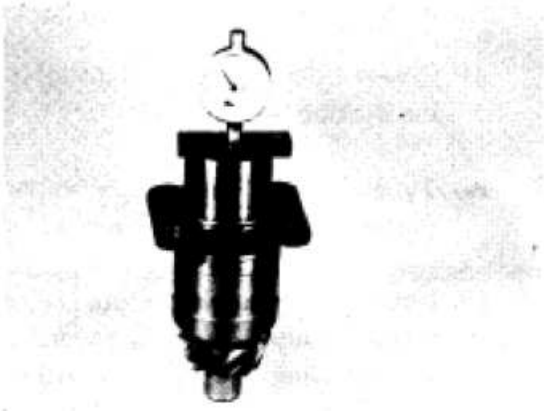
NOTE:
This preload is determined by turning the shaft with a torque wrench and measuring the resistance of the bearings to the rotation of the shaft.

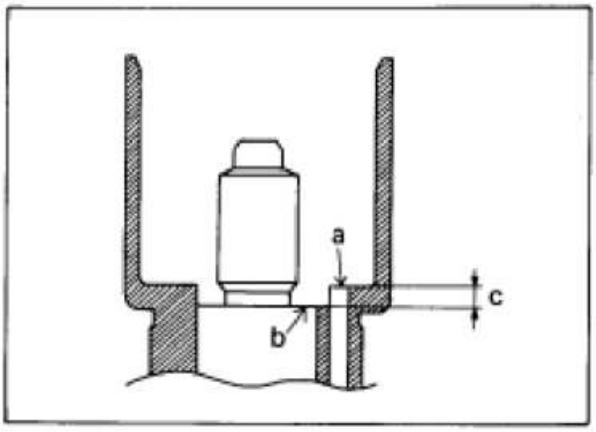


Torque wrench

Type 1 Bearing Preload:
10 – 12 cm-kg (9 – 10 in-lb)

b. Remove the nut and washer. Use a dial indicator and dial gauge stand (Special Tool) to measure the distance from the coupling shoulder ("a" in illustration) to drive pinion shoulder ("b").

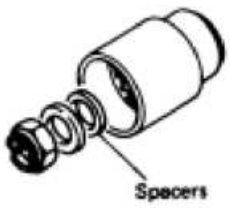




c. Choose spacers that will reduce clearance at "c" in the illustration to 0.02 mm (.0008 in) that is, the thickness of the spacers must be 0.02 mm less than the "c" dimension.

d. Install the spacers, plate washer, and nut. Tighten nut to specified torque and check preload.

Specified torque:	7.5 – 8.5 m-kg (54 – 61 ft-lb)
Preload:	10 – 12 cm-kg (9 – 10 in-lb)



e. If the preload is less than specified, reduce the spacer thickness by 0.02 mm (.0008 in) more (total gap to 0.04 mm). If preload is still not to specification, reduce gap in 0.02 mm steps until the preload is correct. Check for correct assembly of parts.

f. If the preload is over specification, increase the spacer thickness by 0.02 mm (.0008 in) and recheck preload.

Type 2: Follow the same procedure described for the Middle Gear driven pinion.

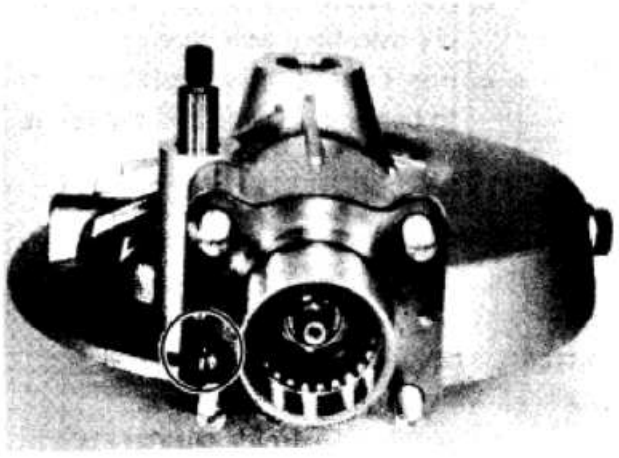
Type 2 Bearing Preload: 4 – 5 cm-kg (3.4 – 4.3 in-lb) Nut tightening torque (for reference): 10 ~ 15 m-kg (72 ~ 108 ft-lb)

(7) Install new O-ring on drive pinion bearing housing (all types).

(8) Install original shim on bearing housing. Align and install bearing housing assembly.
Alignment:
Type 1: The oil hole in the bottom of the bearing housing must align with the slot in the bottom of the final drive housing.



Type 2: Align the bearing housing securing screw hole with the corresponding hole in the final drive housing.



(9) Check gear lash as described in Chapter 5, Section 5–2. Adjust as necessary by the following procedure:

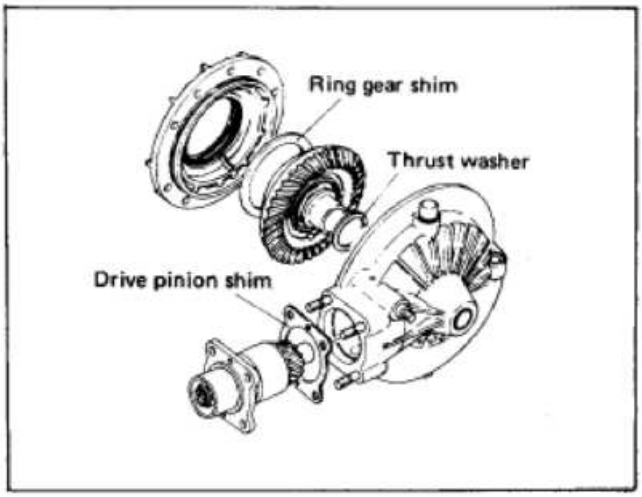
a. Lash too large: Install one-size smaller ring gear shim.
b. Lash too small: Install one-size larger ring gear shim. Recheck gearlash.

B. Tooth Contact pattern and Gear Lash

(1) Remove drive pinion assembly from final gear housing. The ring gear must be assembled for this check.

(2) Apply contact pattern checking paint to ring gear. (See Section 6–2 D for basic contact pattern checking procedure.)

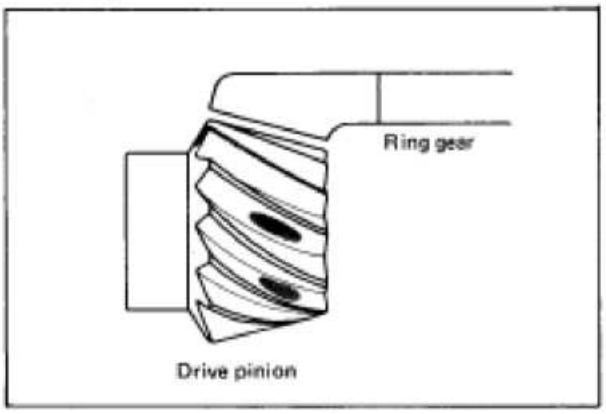
(3) Observe the locations of the following components.



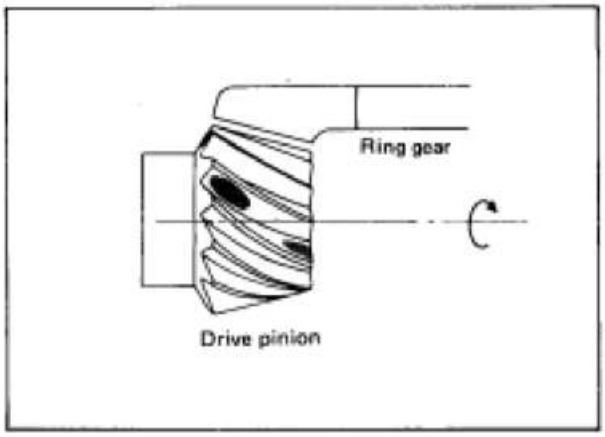
NOTE:

In the following pattern adjustment procedures, always increase or decrease the drive pinion shim for adjusting the tooth contact and increase or decrease the ring gear shim for adjusting the gear lash.

Correct pattern



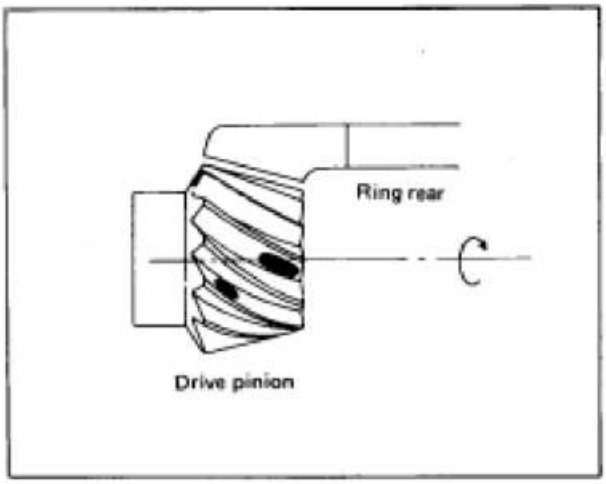
Incorrect Pattern



Correction Procedure:

a. Reduce drive pinion shim 0.05 mm.
b. Recheck tooth pattern.
c. If necessary, repeat step "a" in 0.05 mm steps.

Incorrect pattern



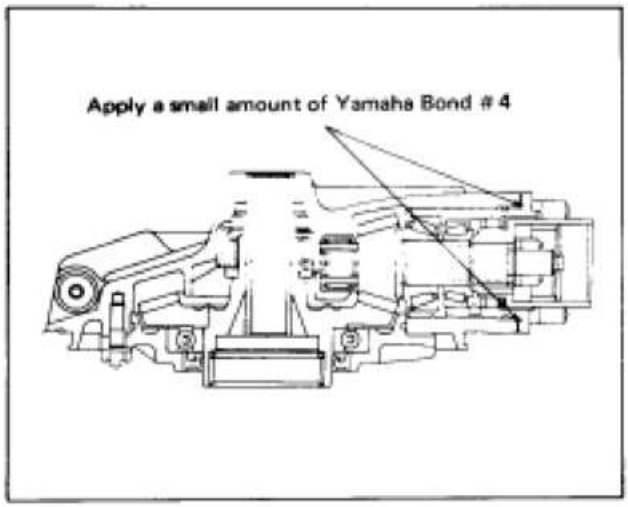
Correct Procedure:

a. Increase drive pinion shim 0.05 mm.
b. Recheck tooth pattern.
c. If necessary, repeat step "a" in 0.05 mm steps.

(4) Check and adjust gear lash. (See Chapter 5, Section 5-2)
To reduce gear lash, increase ring gear shim. To increase gear lash, reduce ring gear shim. If it is necessary to increase ring gear shim by more than 0.1 mm reduce the thrust washer thickness by 0.1 mm for each 0.1 mm of ring gear shim increase and if it is necessary to reduce shim by more than 0.1 mm, reverse above procedure.

(5) Final assembly

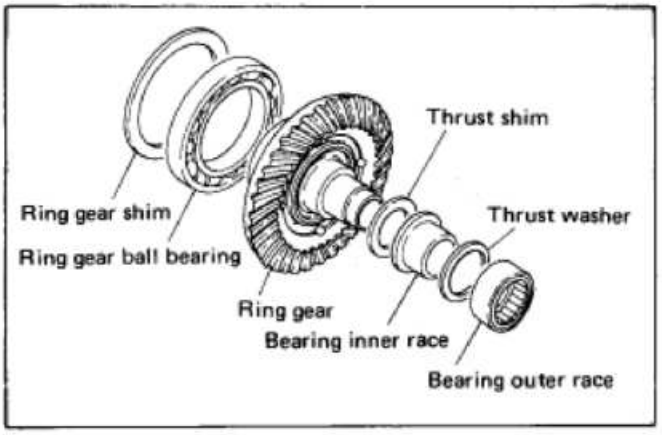
a. Remove drive pinion bearing housing assembly and apply a small amount of Yamaha Bond # 4 as shown.



b. Reinstall the bearing housing assembly into final gear case.
c. For Type 2 only: Install the screw to bearing housing and tighten it.

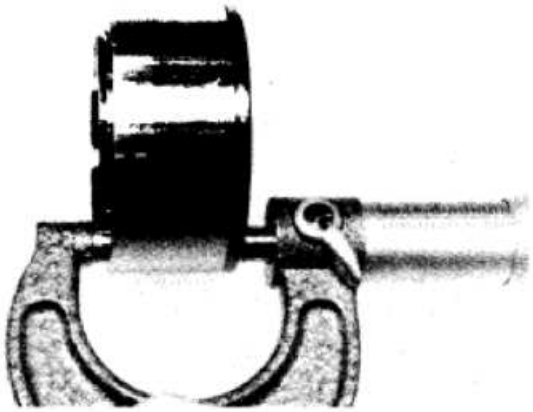
C. Ring Gear Assembly

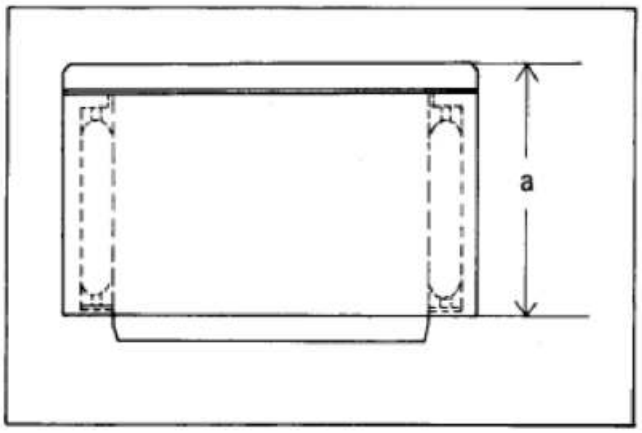
(1) Ring gear assembly components



(2) Roller bearing replacement

a. Remove original roller bearing assembly (2 pieces). Remove thrust washer and assmeble the inner and outer races of the bearing for measurement. Use a micrometer to measure the assembled size as shown.





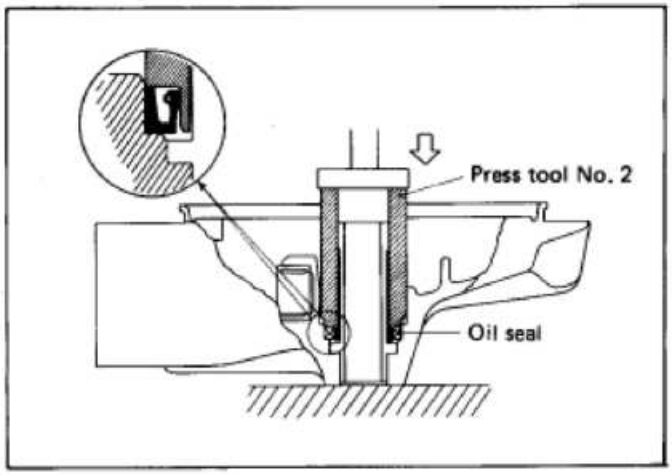
b. Measure the new roller bearing assembly the same way (without thrust shim).

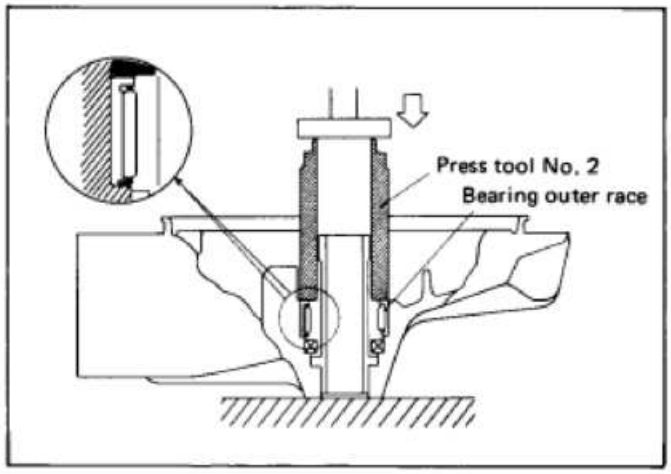
c. If the distance "a" of the old and new bearings in different, remove and measure the thrust shim (not the thrust washer).

d. Use a new thrust shim that is thicker or thinner to correspond to the difference between the old and new roller bearing assemblies. Install the new bearing and thrust shim.

Example: Old bearing. . . . . .a
New bearing . . . . . a + 0.1 mm
Old thrust shim . . . . . b
Choose: New thrust shim . . b – 0.1 mm

(3) If undamaged, reinstall ring gear ball bearing and original shim. If bearing is replaced, use a new shim of the same size. Continue reassembly in the reverse order of disassembly. Use press tool 2(Special Tool) to install oil seal and bearing.





CHAPTER 8. DRIVE SHAFT

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B. Inspection 37
8-2. BALL JOINT INSPECTION 37
A. Removal 37
B. Inspection 37

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CHAPTER 8. DRIVE SHAFT

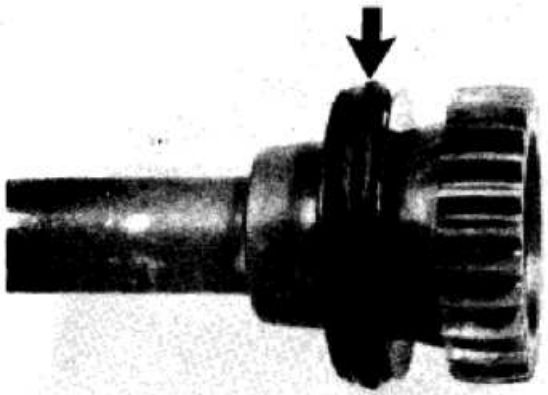
8-1. Drive Shaft Inspection

A. Removal

See Chapter 5, Section 5-1D for drive shaft removal.

B. Inspection

(1) Inspect oil seal for damage. If damaged, replace the oil seal.



(2) Inspect shaft splines have excessive wear and/or damaged, replace the drive shaft.

NOTE:
When installing the drive shaft, lubricate splines and oil seal with light coat of lithium soap base grease.



8-2. Ball Joint Inspection

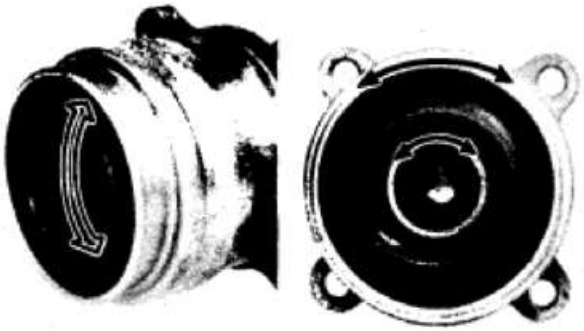
A. Removal

Remove middle gear and final gear cases. Remove drive shaft. The ball joint can now be easily removed from the swing arm cavity.

NOTE:
The ball joint cannot be disassembled. If damaged, it must be replaced.

B. Inspection

Inspect ball joint for leakage. The ball joint should move freely up and down, and from side to side. It should not move when twisted. See illustrations.



CHAPTER 9. CASE EXCHANGE

9-1. MIDDLE GEAR CASE REPLACEMENT 39
A. Selection of Drive Pinion Shim 39
B. Selection of Driven Pinion Shim 39
C. Final Inspection 39
9-2. FINAL GEAR CASE REPLACEMENT 39

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CHAPTER 9.
CASE EXCHANGE

When the exterior of the middle gear or final gear case is damaged and must be replaced, pay attention to the numbers scribed on the replacement cases. Follow assembly instructions in the appropriate section of this manual.

9-1. Middle Gear Case Replacement

A. Selection of Drive Pinion Shim

Note the number scribed on the middle gear cases (original and replacement). Note the original drive shim thickness:



Example: Replacement 79.73
Original 79.93
Original shim . . . . . .0.10 mm

Formula for determining new shim: Original shim – (new case number – original case number)

Example: 0.10–(79.73–79.93)
0.10–(–0.2.)
0.10 + 0.20
0.30 new shim

Notice that the subtraction of a negative number–(–0.20) is the same operation as adding that amount as a positive number. Use this shim and the normal instructions for installation of middle gear components described in Chapter 6, Section 6–2.

B. Selection of Driven Pinion Shim

Note the number scribed on the middle gear cases. Proceed as in above steps (Chapter 6, Section 6–2. E).

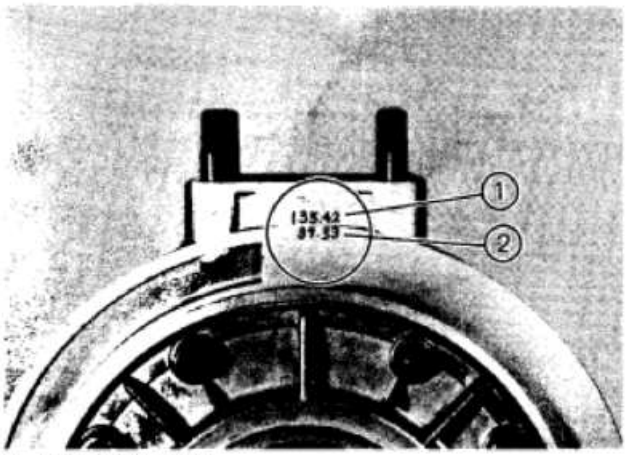


C. Final Inspection

Install gear assemblies according of appropriate sections of this manual. Check tooth contact patterns and gear lash before mounting new assembly on machine. Refer to Chapter 6, Section 6–2D for tooth contact pattern inspection.

9-2. Final Gear Case Replacement

Selection of new drive pinion shim(s) and thrust shim(s) is similar to middle gear drive pinion shim determination.



1. Drive pinion side
2. Ring gear side

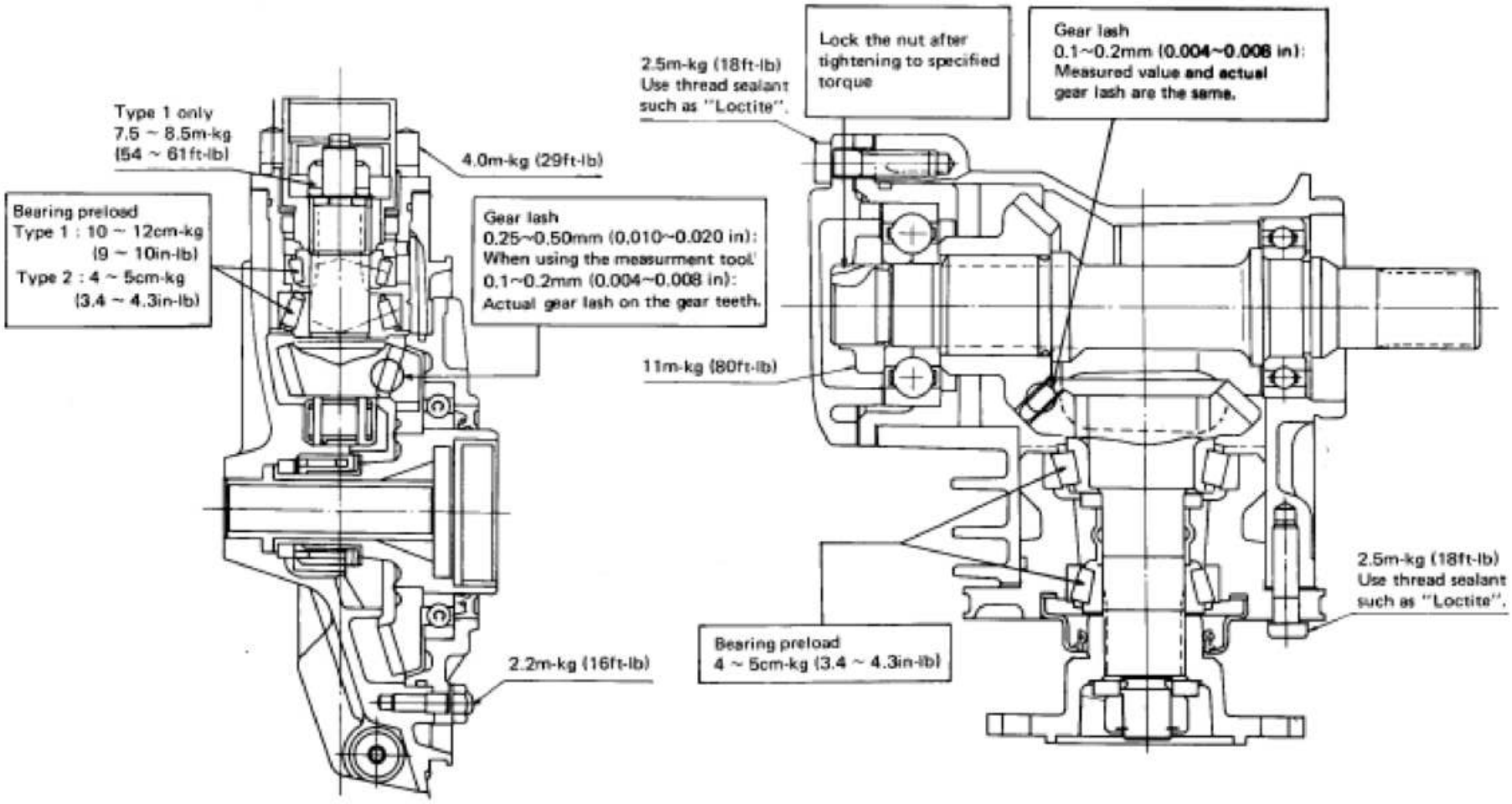
APPENDICES

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APPENDICES

1. Tightening Torque, Gear Lash and Bearing Preload Chart



2. Interchangeability of Parts for Type 1 and Type 2

NOTE:

All the parts except the following parts are interchangeable for both Type 1 and Type 2. These items can be used, however, on both Type 1 and Type 2 provided they are used for replacement in a set.

A. Middle Gear

Parts Name	Parts No.	
	Type 1	Type 2
Middle gear housing	YG4–11011–00–1G	1J7–17511–Y0
Bearing housing	YG4–11011–10–0G	1J7–17521–Y0
Pinion shim	YG4–11710–70–0G	1J7–17531–Y0
Housing cap gasket	YG4–11005–40–0G	1J7–17519–Y0
Housing cap	1J7–17538–01	1J7–17538–Y1

B. Final Gear

Parts Name	Parts No.	
	Type 1	Type 2
Drive shaft housing comp.	YG4–11011–50–0G	1J7–46150–Y0
Bearing housing	YG4–11006–90–1G	1J7–46124–Y0
Gear coupling	YG4–11707–11–0G	1J7–46123–Y0
Expansion spacer	————	1J7–46129–Y0

XS750 SHAFT DRIVE MANUAL
1976-1980

COVERS TYPE 1 AND TYPE 2
DRIVE TRAINS

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