YANMAR

SERVICE MANUAL

SAIL DRIVE

SD60

California
Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, and other reproductive harm.

California
Proposition 65 Warning

Battery posts, terminals, and related accessories contain lead and lead compounds, chemicals known to the state of California to cause cancer and reproductive harm.
Wash hands after handling.

Foreword:

This Service Manual has been developed for the exclusive use of service and repair professionals such as YANMAR authorized distributors and YANMAR authorized dealers. It is written with these professionals in mind and may not contain the necessary detail or safety statements that may be required for a non-professional to perform the service or repair properly and/or safely. Please contact an authorized YANMAR repair or service professional before working on your YANMAR product.

Disclaimers:

All information, illustrations and specifications in this manual are based on the latest information available at the time of publishing. The illustrations used in this manual are intended as representative reference views only. Moreover, because of our continuous product improvement policy, we may modify information, illustrations and/or specifications to explain and/or exemplify a product, service or maintenance improvement. We reserve the right to make any change at any time without notice. YANMAR and **YANMAR** are registered trademarks of YANMAR CO., LTD. in Japan, the United States and/or other countries.

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SERVICE MANUAL	MODEL	SD60
	CODE	0BSDM-EN0020

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Section 1

INTRODUCTION

This manual gives specific instructions for the proper repair of Yanmar SD60 series marine sail drive units.

Please follow the procedures carefully to ensure quality service.

Yanmar recommends that you read this *Service Manual* completely before starting repairs.

Along with standard tools, Yanmar recommends the use of special tools necessary to perform repairs correctly.

Yanmar products are continuously undergoing improvement. This *Service Manual* has been checked carefully in order to avoid errors. However, Yanmar is not liable for any misrepresentations, errors of description or omissions. Contact the regional headquarters for any questions you have regarding this *Service Manual.*

REVISION HISTORY

This manual is a living document. Periodic manual revisions are published to document product improvements and changes. This practice ensures the manual has the most current information.

As manual revisions become necessary, individual pages are prepared and sent to those who need the information. If a page, or number of pages should be replaced, the replacement information is sent along with a revised Revision Control Table. Discard the older, obsolete information.

At times, the revision involves inserting additional pages in one or more sections. Replace the Revision Control Table and insert the new pages.

This method of revision control represents the most cost-effective solution to providing current, updated information as needed.

Revision Control Table

Revision Date Revision Number	New Page Numbers Involved	Remarks	Initiating Dept.
September 2014	All	Initial release	Marine Operations Business

Section 2

SAFETY

Yanmar is concerned for your safety and the condition of your marine sail drive. Safety statements are one of the primary ways to call your attention to the potential hazards associated with Yanmar Marine sail drive. Follow the precautions listed throughout the manual before operation, during operation and during periodic maintenance procedures for your safety, the safety of others and to protect the performance of your marine sail drive. Keep the decals from becoming dirty or torn and replace them if they are lost or damaged. Also, if a part needs to be replaced that has a decal attached to it, make sure to order the new part and decal at the same time.

This safety alert symbol appears with most safety statements. It means attention, become alert, your safety is involved! Please read and abide by the message that follows the safety alert symbol.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, *will* result in death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, *could* result in death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, *could* result in minor or moderate injury.

NOTICE

NOTICE indicates a situation which can cause damage to the machine, personal property and/or the environment or cause the equipment to operate improperly.

SAFETY PRECAUTIONS

There is no substitute for common sense and careful practices. Improper practices or carelessness can cause burns, cuts, mutilation, asphyxiation, other bodily injury or death. This information contains general safety precautions and guidelines that must be followed to reduce risk to personal safety. Special safety precautions are listed in specific procedures. Read and understand all of the safety precautions before operating or performing repairs or maintenance.

⚠ DANGER

Never permit anyone to install or operate the sail drive without proper training.

- **Read and understand this *Service Manual* before operating or servicing the sail drive to ensure that safe operating practices and maintenance procedures are followed.**
- **Safety signs and decals are additional reminders for safe operating and maintenance techniques.**
- **Contact your Yanmar RHQ for additional training.**

Crush Hazard

- **When attaching a sail drive to a repair stand, be sure to use a stand of adequate capacity to safely support the sail drive to be repaired, and that it is securely attached to the sail drive.**
- **Never stand under a hoisted sail drive. If the hoist mechanism fails, the sail drive will fall on you.**
- **Always secure the sail drive solidly to prevent the sail drive from falling during maintenance.**
- **Always use lifting equipment with sufficient capacity to lift the sail drive.**
- **Never support the sail drive with equipment not designed to support the weight of the sail drive such as wooden pieces, blocks or by only using a jack.**

⚠ WARNING

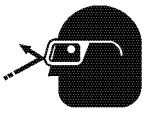
Fire and Explosion Hazard

- **While the engine is running or the battery is charging, hydrogen gas is being produced and can be easily ignited. Keep the area around the battery well-ventilated and keep sparks, open flame and any other form of ignition out of the area.**
- **Wipe up all spills immediately.**
- **Have appropriate safety equipment available. Have all fire extinguishers checked periodically for proper operation and/or readiness.**
- **Always read and follow safety-related precautions found on containers of hazardous substances like parts cleaners, primers, sealants and sealant removers.**

Entanglement Hazard

- **Never leave the key in the key switch when servicing the sail drive. Attach a "Do Not Operate" tag near the key switch while performing maintenance on the equipment.**
- **Always stop the engine before beginning service.**

Flying Object Hazard



Always wear eye protection when servicing the sail drive or when using compressed air or high-pressure water. Dust, flying debris, compressed air, pressurized water or steam may injure your eyes.

⚠ WARNING

Sever Hazard

Never wear jewelry, unbuttoned cuffs, ties or loose-fitting clothing and always tie long hair back when working near moving/rotating parts. Keep hands, feet and tools away from all moving parts.

Electrical Hazard

Make welding repairs safely.

- Always turn off the battery switch (if equipped) or disconnect the negative (–) battery cable and the leads to the alternator when welding on the equipment.
- Remove the multi-pin connector to the engine control unit. Connect the weld clamp to the component to be welded and as close as possible to the welding point.
- Never connect the weld clamp to the sail drive or in a manner which would allow current to pass through a mounting bracket.
- When welding is complete, reconnect the leads to the alternator and engine control unit prior to reconnecting the batteries.
- Never turn off the battery switch (if equipped) or short the battery cables during operation. Damage to the electrical system will result.
- Always keep the electrical connectors and terminals clean. Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors.

⚠ WARNING

Exhaust Hazard

All internal combustion engines create carbon monoxide gas during operation and special precautions are required to avoid carbon monoxide poisoning.

- Never block windows, vents or other means of ventilation if the engine is operating in an enclosed area.
- Always ensure that all connections are tightened to specifications after repair is made to the exhaust system.

Burn Hazard

Some of the engine and sail drive surfaces become very hot during operation and shortly after shutdown.

- Keep hands and other body parts away from hot surfaces.
- Handle hot components with heat-resistant gloves.

Lifting Hazard

- Additional equipment is necessary to lift the sail drive. Always use lifting equipment with sufficient capacity to lift the sail drive.
- If transport is needed for sail drive repair, have a helper assist in attaching it to a hoist or stand and loading it onto a truck.

Alcohol and Drug Hazard

Never operate the engine or sail drive while under the influence of alcohol, drugs or when ill.

⚠ WARNING

Exposure Hazard

Always wear personal protective equipment including appropriate clothing, gloves, work shoes and eye and hearing protection as required by the task at hand.

Tool Hazard

Always remove any tools or shop rags used during maintenance from the area before operation.

Sudden Movement Hazard

To prevent accidental startup, complete the following before installing or removing the propeller:

- Put the remote control in the NEUTRAL position.
- Put the main battery switch in the OFF position and remove the ignition key.
- To prevent accidental equipment movement, Never start the engine in gear.
- Always turn off the battery switch (if equipped) or disconnect the negative (–) battery cable before servicing the equipment.

⚠ CAUTION

Poor Lighting Hazard

Ensure that the work area is adequately illuminated. Always install wire cages on portable safety lamps.

Tool Hazard

Always use tools appropriate for the task at hand and use the correct size tool for loosening or tightening machine parts.

Slipping and Tripping Hazard

Ensure that adequate floor space is set aside for servicing the sail drive. The floor space must be flat and free of holes. Keep the floor free of dust, mud, spilled liquids and parts to help prevent slipping and tripping.

Loss of Control Hazard

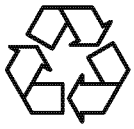
Never grease the steering cable while extended. Hydraulic lock could occur and cause loss of steering control.

NOTICE

Any part which is found defective as a result of inspection or any part whose measured value does not satisfy the standard or limit must be replaced.

Always tighten components to the specified torque. Loose parts can cause equipment damage or cause it to operate improperly.

Only use replacement parts specified. Other replacement parts may affect warranty coverage.



Follow the guidelines of the EPA or other governmental agencies for the proper disposal of hazardous materials such as gear oil, engine oil, diesel fuel and engine coolant. Consult the local authorities or reclamation facility.

- Never dispose of hazardous materials by dumping them into a sewer, on the ground, or into groundwater or waterways.

If any indicator illuminates during engine operation, stop the engine immediately. Determine the cause and repair the problem before continuing to operate the engine.

Only use the sail drive oil specified. Other gear oils may affect warranty coverage, cause internal components to seize and/or shorten sail drive life.

Never mix different types of sail drive oil. This may adversely affect the lubricating properties of the oil.

Never attempt to modify the sail drive's design or safety features. Failure to comply may impair the sail drive's safety and performance characteristics and shorten the sail drive's life. Any alterations to this sail drive may affect the warranty coverage of the sail drive.

NOTICE

The anode of the sail drive is only calculated for the sail drive. Changing the material of the propeller may require additional anodes to be installed on the sail drive.

Never attempt to change propellers until after determining the average load and individual requirements.

Never paint the anodes. Painting these components will render them ineffective as galvanic corrosion inhibitors.

If the AC shore power ground is not isolated from the boat ground, the anodes may be unable to neutralize the increased galvanic potential. Corrosion damage that results from the improper system design or application is not covered by the Yanmar Limited Warranty.

Galvanic corrosion damage, normal maintenance and consumable parts are not covered by the Yanmar Limited Warranty.

Replace anodes if eroded 50 percent or more.

If any water drains from the oil fill/drain hole, or if it appears milky, the sail drive may be leaking and should be checked immediately.

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Section 3

GENERAL SERVICE INFORMATION

SAFETY PRECAUTIONS

Before performing any service procedures within this section, read the following safety information and review the *Safety section on page 2-1*.

SPECIFICATIONS

		SD60-5 Standard, Extension		SD60-4 Standard, Extension	
Reduction gear system		Multiple friction disc			
Direction of rotation	Input shaft	Counter-clockwise viewed from stern			
	Propeller shaft	Counter-clockwise or clockwise viewed from stern			
Reduction ratio	Ahead	2.23	2.49	2.23	2.49
	Astern	2.23	2.49	2.23	2.49
Propeller speed (min^{-1})		1345	1205	1435	1285
Lubrication oil		15W-40			
Lubrication oil capacity (liter)	Standard (S)	2.8			
	With extension (L)	3.0			
Dry weight (kg)	Standard (S)	44		45	
	With extension (L)	48		49	
Applicable engine model		3JH5CE (28.7 kW / 3000 min^{-1})		4JH4-TCE (55.2 kW / 3200 min^{-1})	
		4JH5CE (39.6 kW / 3000 min^{-1})			
		4JH45 (33.1 kW / 3000 min^{-1})		4JH80 (58.8 kW / 3200 min^{-1})	
		4JH57 (41.9 kW / 3000 min^{-1})			

CORROSION

Corrosion Protection

These power packages are equipped with sacrificial anodes installed on foot and special surface treatments of components underneath the boat in order to help protect them from galvanic corrosion under moderate conditions.

Electrical Connections and Regulations According to International Rules ISO 60092-507 IEC:2008

It is recommended to perform the boat electric system in conformity with the regulation ISO 60092-507 IEC 2008, or equal local and international rules or laws.

To protect the boat from galvanic current when it is connected to the power source located on the dry land (wharf), it is recommended to install on the boat a galvanic isolator on the ground conductor of the AC power line.

This will prevent the flow of galvanic current with low voltage but will allow a normal supply.

For more information about or to find different solutions of the power system from the dry land, refer to the instructions of ABYC (American Boat and Yacht Council) in chapter E-11 or ISO 60092-507 IEC 2008.

At the same purpose can also be used an isolating transformer with the relevant characteristics of the circuit. Even in this case, refer to the applicable ABYC E-11 or ISO 60092-507 IEC 2008 for more information and suggestions.

Note: We advise you to install an isolating transformer for the electrical power supply from dry land (wharf).

Connecting of the Under-Water Metallic Parts

It is recommended to electrically connect all metallic parts overhanging from the hull (or installed through the hull) below the sea level so that all have the same electrical potential.

This will prevent the tension flow among them, creating corrosion.

For more information, refer to the tips and recommendations of ABYC in chapter E-11.

NOTICE

Observe directives, rules or local instructions.

PAINTING THE BOAT

When painting the boat hull below waterline with anti-fouling paint, observe the following rules:

- Use high-quality, anti-fouling paint designed for marine use.
- Avoid using anti-fouling paint that contains copper material, which could conduct electrical current.
- Avoid using anti-fouling paint that contains copper material on the sail-drive leg in any case.
- If using copper-based or tin-based paints is necessary, ensure that they comply with all local and federal laws prohibiting their use.
- Do not paint drain holes or items as specified by the boat manufacturer.
- Do not paint any anodes.

CHECK UNDER-WATER METALLIC PARTS

Check the status of corrosion protection (boat dry) of the hull below waterline before that the boat enters in the water.

Make sure all metallic parts over-hanging from the hull underneath the seawater line have to have the same potential.

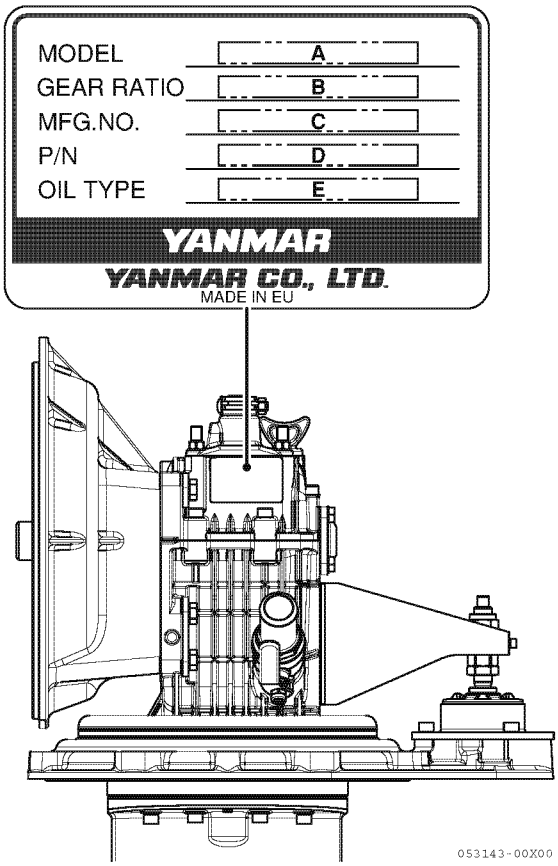
Consult your Yanmar marine RHQ for advice.

This way will assure:

- All metallic parts will have same potential and will avoid having current/tension circulation when the boat is in the water. This creates corrosion.
- All metallic parts are properly connected to the ground of the boat and they are, therefore, having the same potential.

GEAR IDENTIFICATION

Name Plate:
The name plate is fixed onto the sail drive



A – Sail drive type
B – Sail drive ratio
C – Sail drive serial number
D – Sail drive part number
E – Lubricating oil specifications

Figure 3-1

LUBRICATING OIL

The selection of lubricating oil is very important. If an inappropriate oil is used, or an oil change is neglected, it may result in damage and reduce the life of the Sail Drive. When selecting a lubricating oil, use one of the following:

1. Lubricating oil type: API Service Categories CD or higher Multigrade, SAE Viscosity 15W-40
2. Lubricating oil quantity:

	Quantity (ℓ)
Standard (S)	2.8
with extension (L)	3

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Section 4

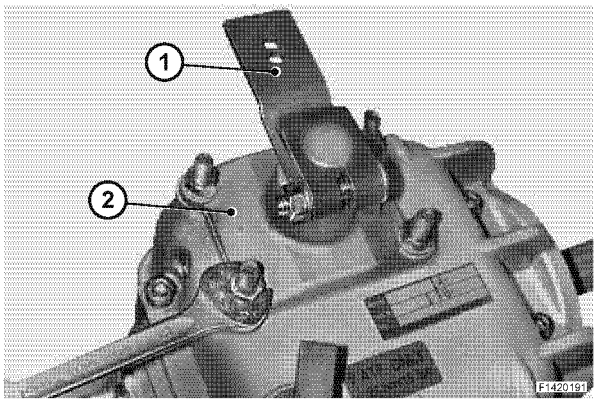
DISASSEMBLY AND REASSEMBLY

Before servicing the sail drive, review the *Safety* section on page *2-1*.

This section of the Service Manual describes the procedures necessary to disassemble and reassemble the sail drive.

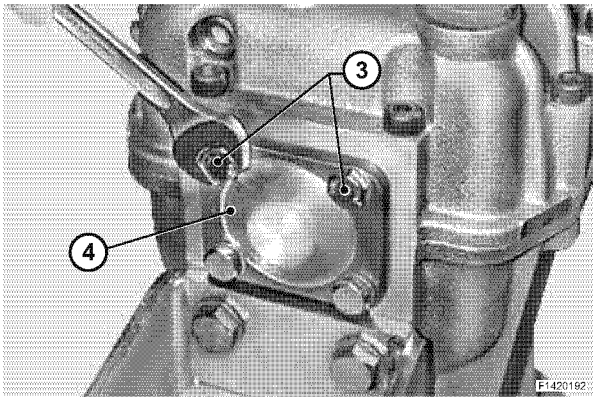
DISASSEMBLY

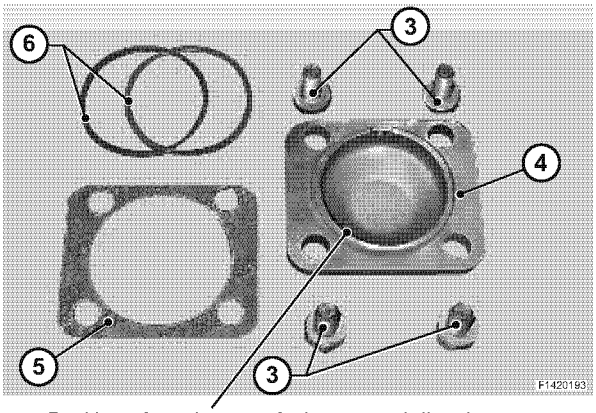
1. Put the shifting lever (1) in neutral
2. Remove the shifting lever cover assy (2).



3. Unscrew the 4 bolts (3), remove the cover (4), paper gasket (5) and the shims (6).

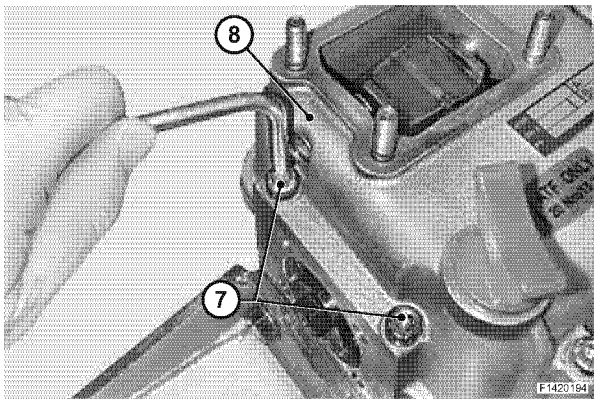
Note: Take note of the total thickness of shims (6) because during the reassembly they have to be mounted in the original position.



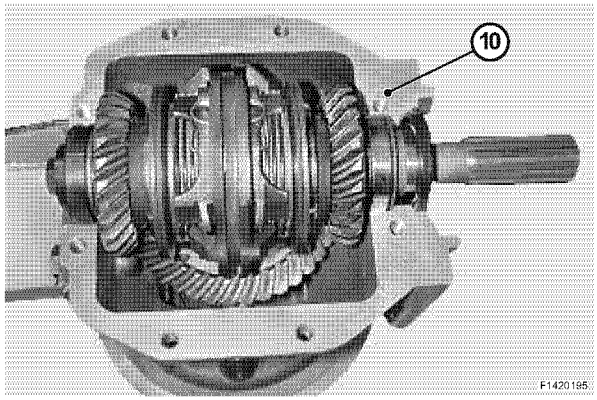


Position of gap in cover facing upward direction.

4. Unscrew the 8 screws (7).
5. Remove the upper housing (8).



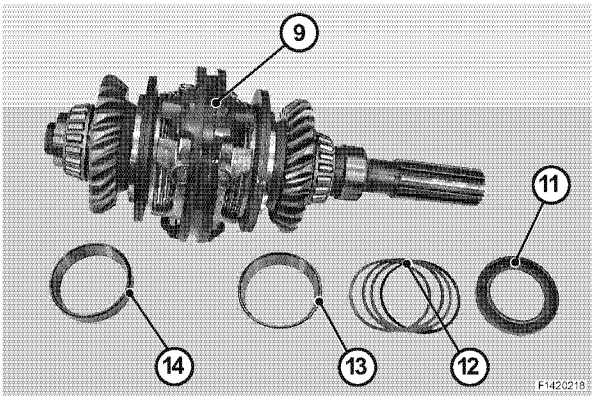
6. Remove the input shaft assembly (9) from the lower housing (10).



7. Remove from the input shaft assembly (9) the input shaft seal (11), the shims (12) and the taper roller bearing outer races (13) and (14).

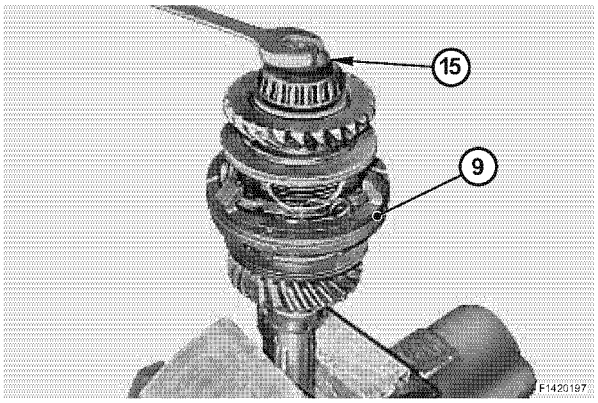
Note:

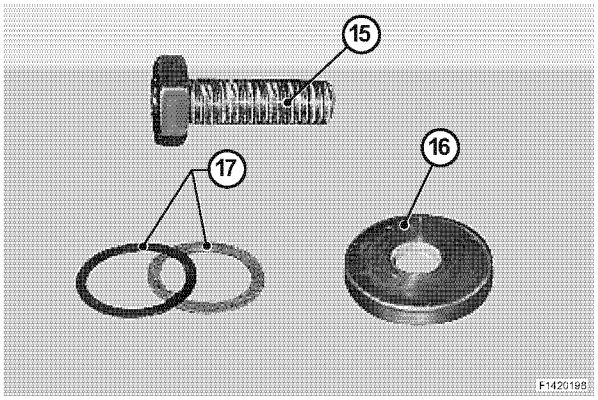
- *Take note of the original shims (12) because during the reassembly they have to put in the original position.*
- *Mark the input shaft side taper roller bearing outer race (13) to prevent exchange of position on reassembly.*



8. Put the input shaft assembly (9) in a vice, unscrew the hex head bolt (15) and remove the washer (16) and the shims (17). Take notice not to damage the splines.

Note: Take note of the total thickness of the original shims (17) because during the reassembly they have to be mounted in the original position.

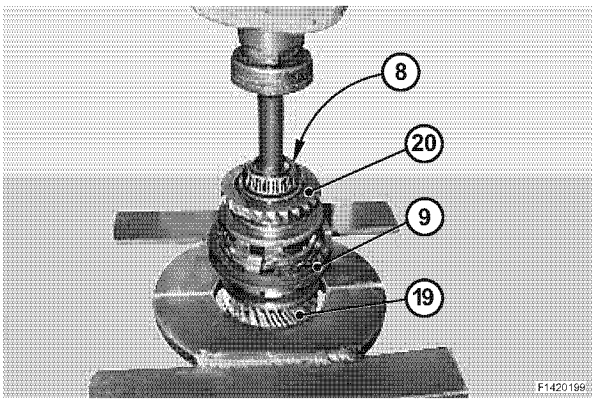




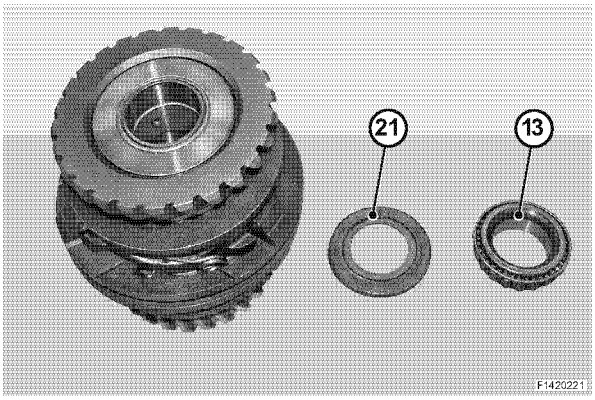
9. Put the input shaft assembly (9) below a press (spline facing down) and remove the input shaft (8).

Note:

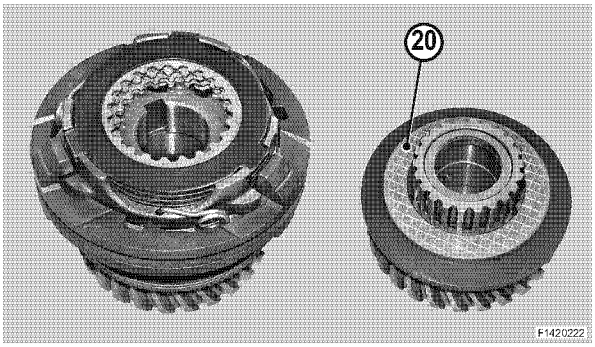
- *Half rings have to be positioned only below the gear Z = 26 (19).*
- *Mark gear (19) and (20) to prevent errors in reassembly.*



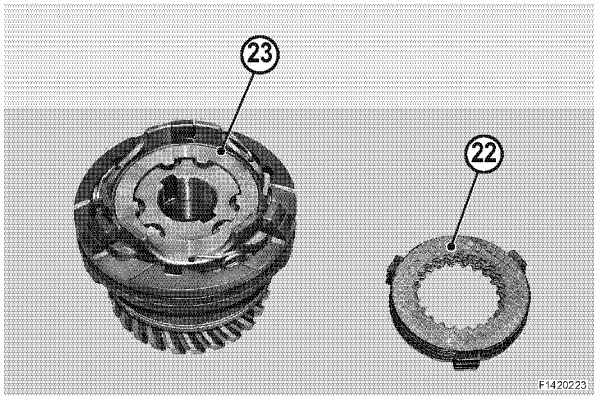
10. Remove the tapered roller bearing inner race (13), and the butting ring (21).



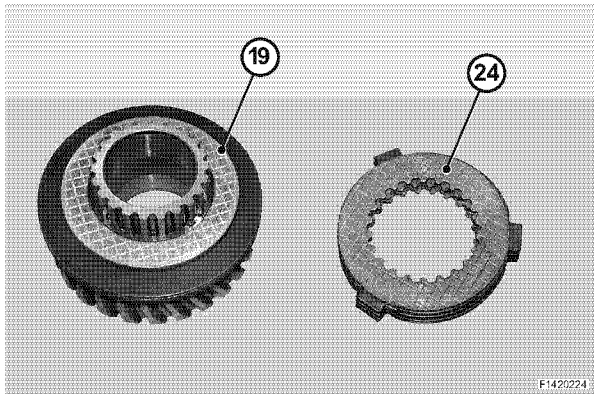
11. Remove the gear (20).



12. Remove the clutch pack (22) and the actuating sleeve (23).

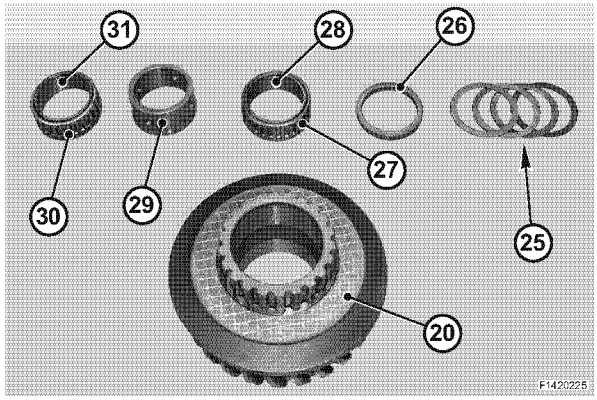


13. Remove from the gear (19) the clutch pack (24).



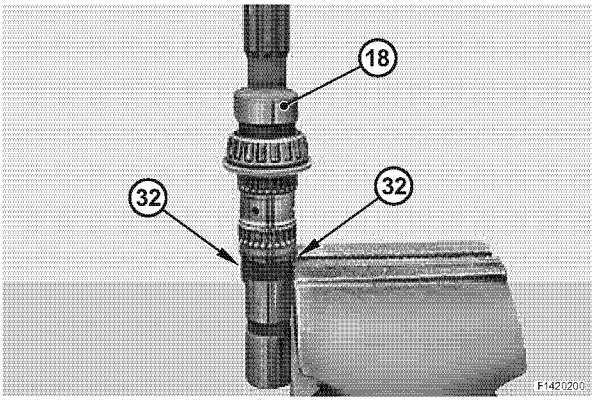
14. Remove from the gear (20) the shims (25), the spacer (26), the needle roller bearing (27) and its inner race (28), the spacer (29) and the needle roller bearing (30) and its inner race (31).

Note: Do not separate the needle roller bearings (27) and (30) from their related inner races (28) and (31).



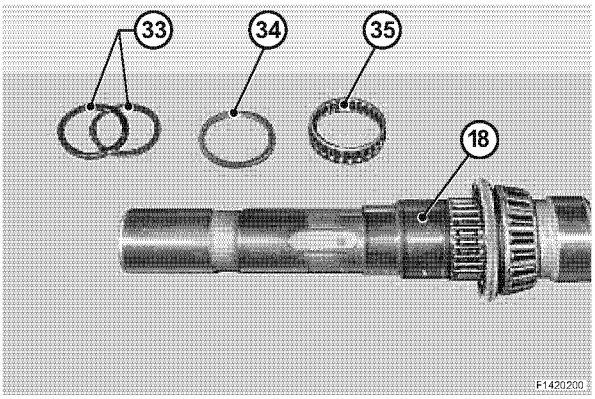
15. Remove the 2 keys (32) from the input shaft (18).

Note: During removal the keys can be damaged and therefore they have to be replaced every time.

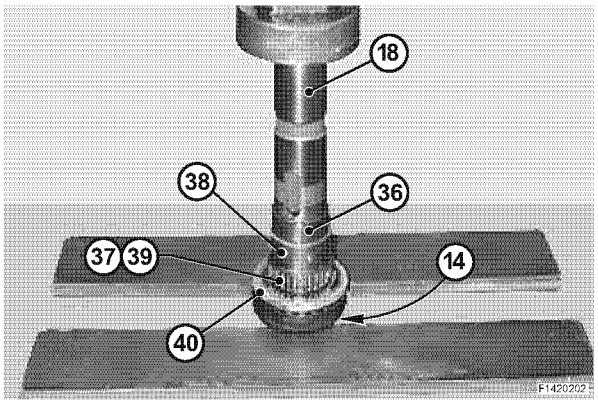


16. Remove from the input shaft (18) the shims (33), the spacer (34) and the needle roller bearings (35).

Note: Take note of the total thickness of the original shims (33) because during the reassembly they have to be mounted in the original position.

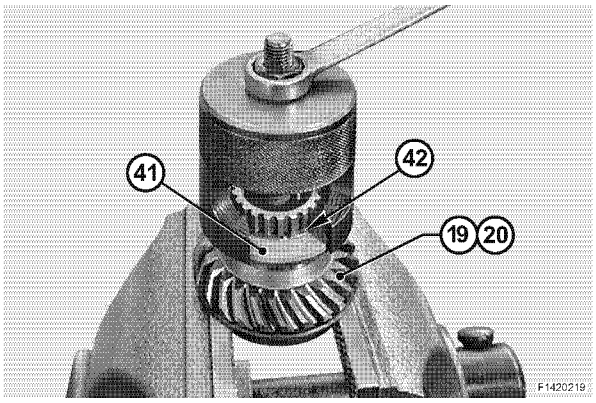


17. Temporarily mount the taper roller bearing outer race (14) and, using half rings below the taper roller bearing outer race (14), remove from the shaft (18) the inner bearing inner races (36) and (37), the spacer (38), the needle bearing (39), the butting ring (40) and the taper roller bearing (14).

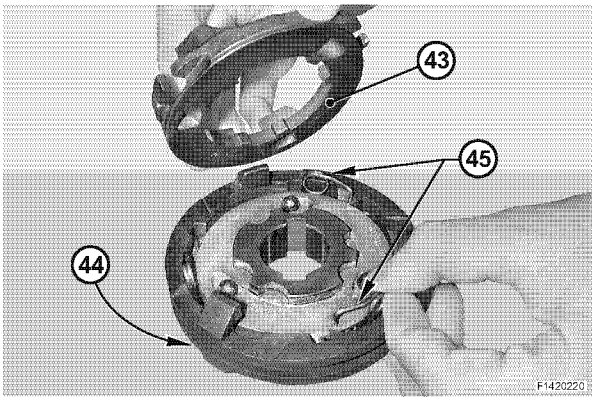


18. Using a proper tool press the end disc (41) and remove from gears (19) and (20) the snap ring (42) and the end disc (41).

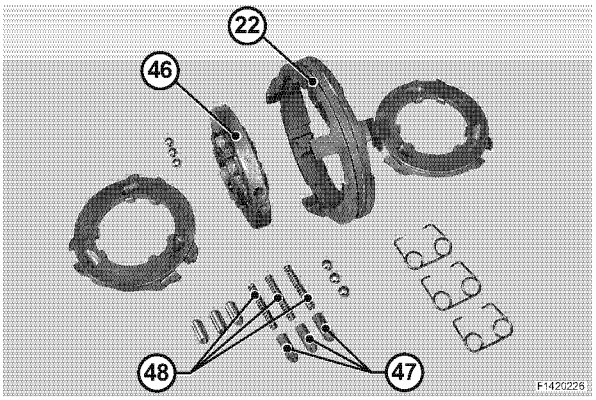
Note: Replace the end discs (41) each time the clutch discs are changed.



19. Disconnect from the disc carrier (43) and (44) the springs (45) and remove them.



20. Place actuating sleeve (22) on a plane surface and press out guide sleeve (46).
21. Watch for detent pins (47) and springs (48) a jumping off the guide sleeve. It will be advisable to wrap a rag around the actuating sleeve and the guide sleeve to catch any parts that might jump off.



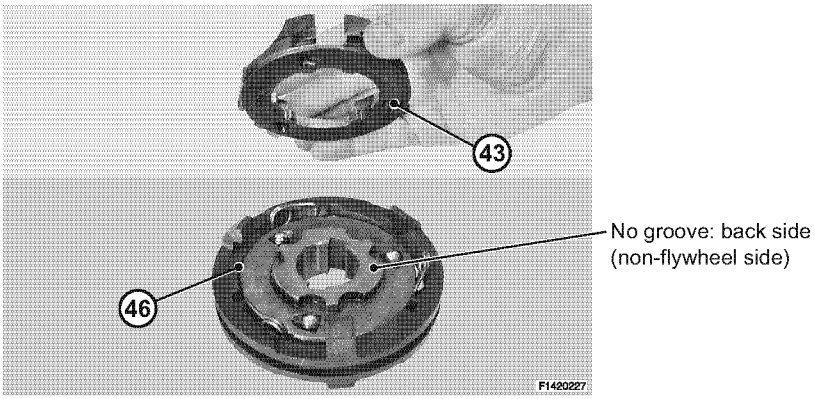
REASSEMBLY

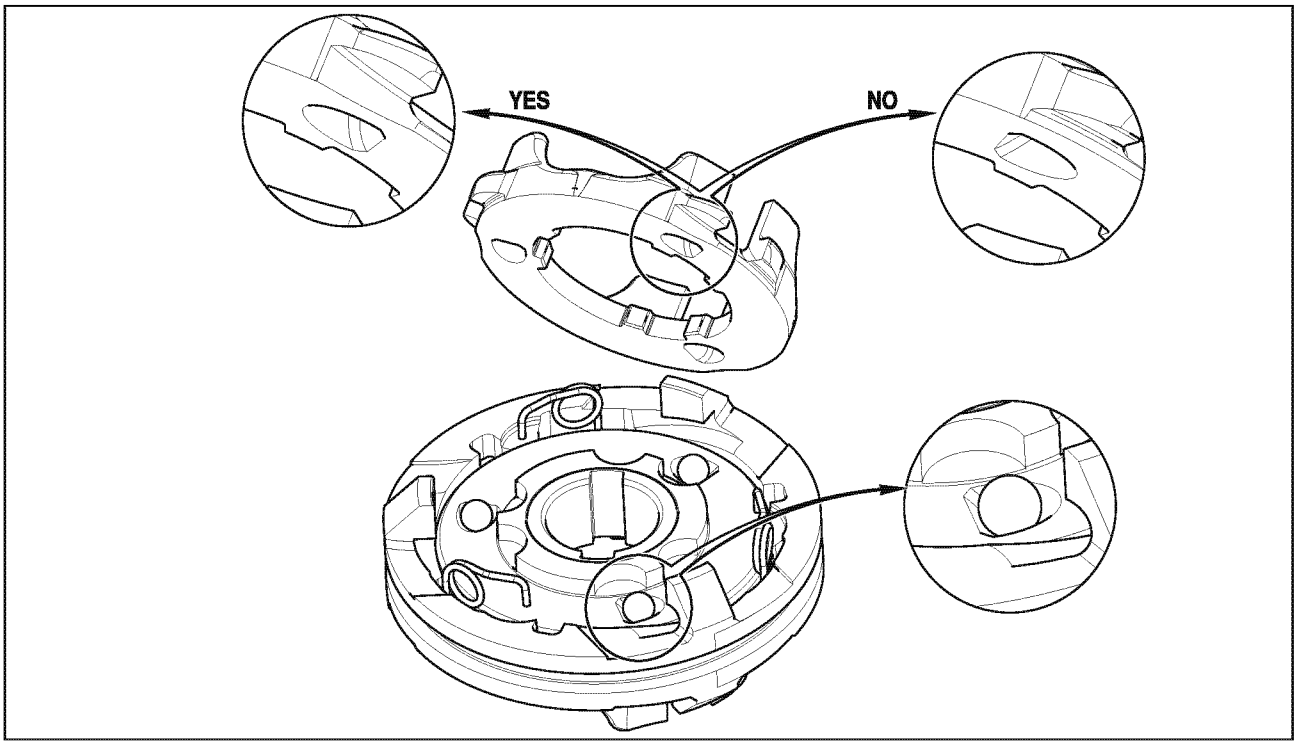
Correct way to assemble the disc carrier

1. Reassemble the actuating parts taking care that the groove on the disc carrier (43) and (44) and the guide sleeve (46) are facing each other and directed in opposite direction.

⚠ CAUTION

The grooves must be positioned in the opposite way.

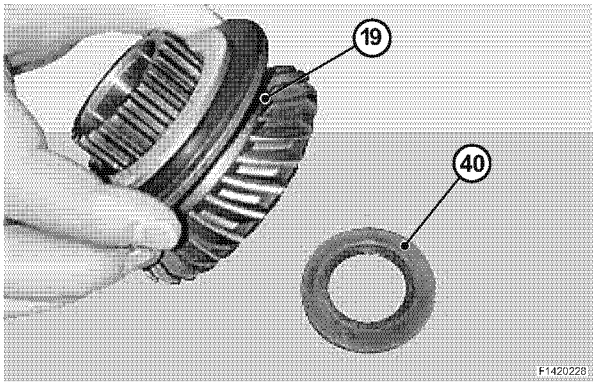




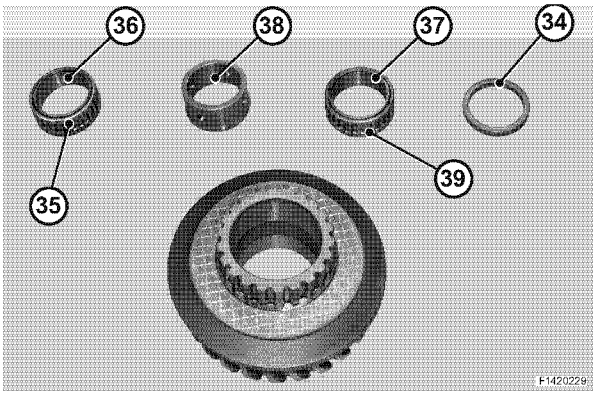
Note: If no parts had to be replaced, the previously disassembled shims can be re-used in their former arrangement and positions without any measuring operation. If measuring is required, proceed as follows.

1. Place pre-assembled gear (19) on butting ring (40).

Note: Mount the bronze side of the butting ring (40) facing against the gear (19).

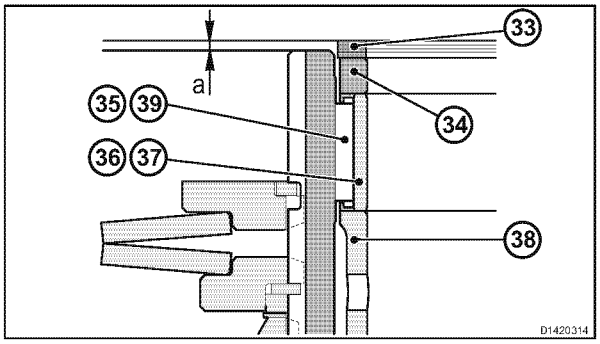


2. Insert needle bearings (35) and (39), needle bearing inner races (36) and (37), spacer (38) and spacer (34) into bore of gear.



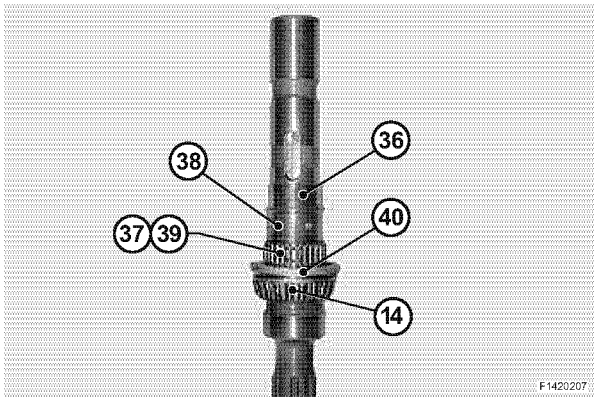
3. a Fit shims (33) as required until prescribed setting value “a” (distance between the last shim and spline surface) is 0.4 - 0.45 mm.

Note: Repeat the procedure above for the other gear (20).

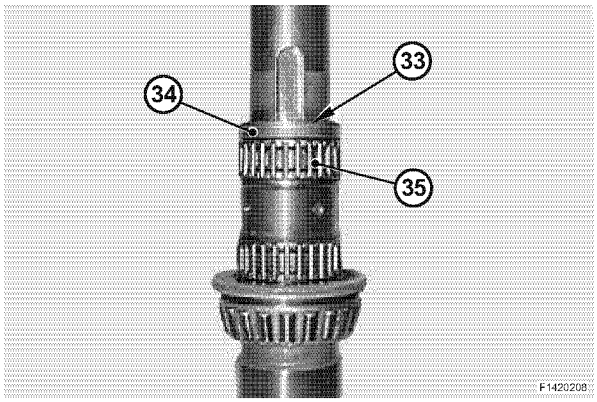


b Remove parts 33-40 from gear. Besure to keep each set with it's gear.

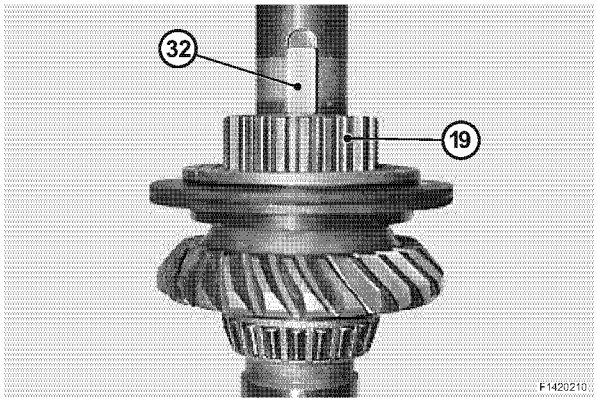
4. Put some engine oil on the shaft.
Press the tapered roller bearing inner race (14), the butting ring (40), the needle bearing inner race (37), the needle bearing (39), the spacer (38) and the needle bearing inner race (36).



5. Fit the needle bearing (35), spacer (34) and the shims (33).

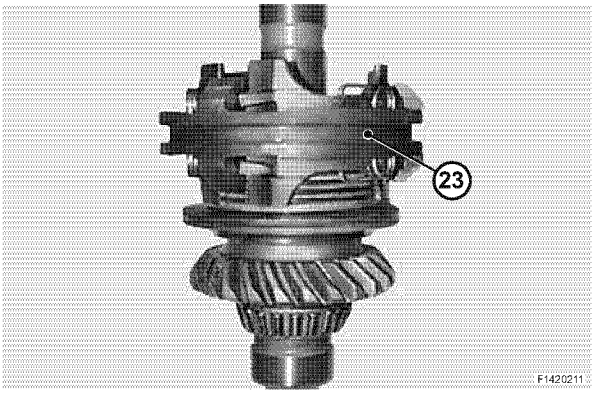


6. Fit gear assembly (19) and keys (32) on the shaft.



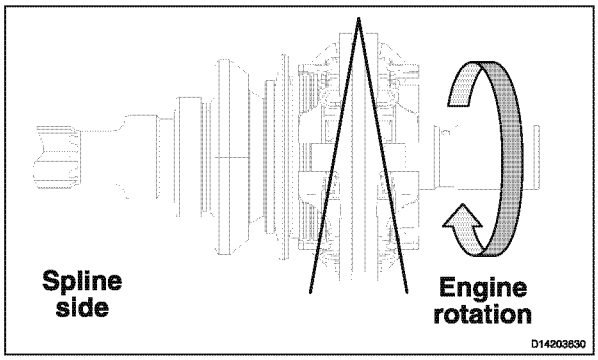
7. Install the clutch pack (24) and fit the actuating sleeve assembly (23) through the keys taking care to align the actuating parts in relation to the engine rotation (see sketch).

Note: Lubricate the friction discs with engine oil.

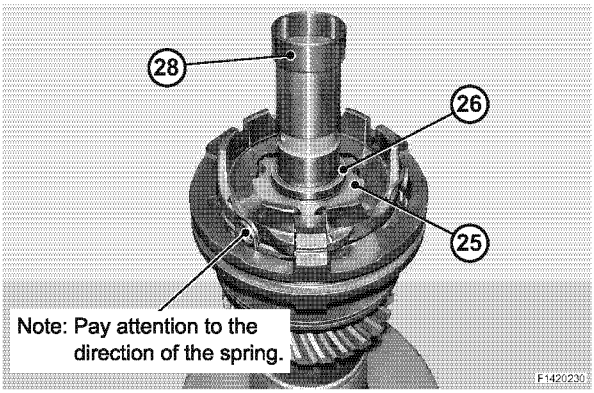


⚠ CAUTION

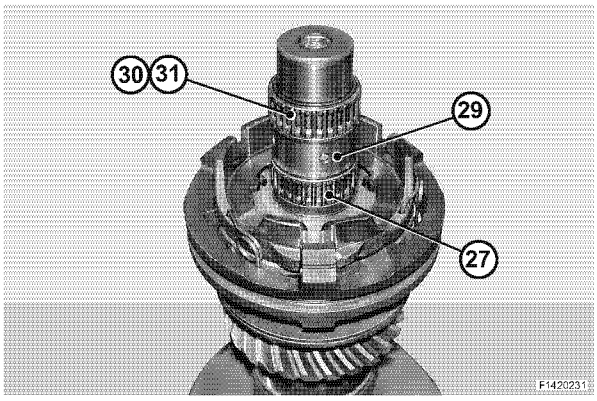
Align the actuating parts in relation to the engine rotation.



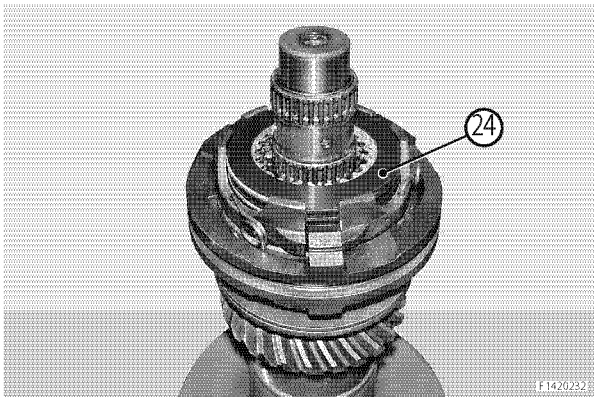
8. Install the shim (25), the spacer (26) and the needle bearing inner race (28).



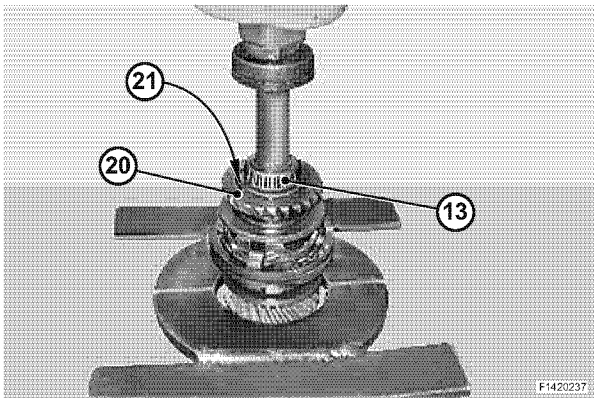
9. Install the needle bearing (27), the spacer (29), the needle bearing (30) and the needle bearing inner race (31).



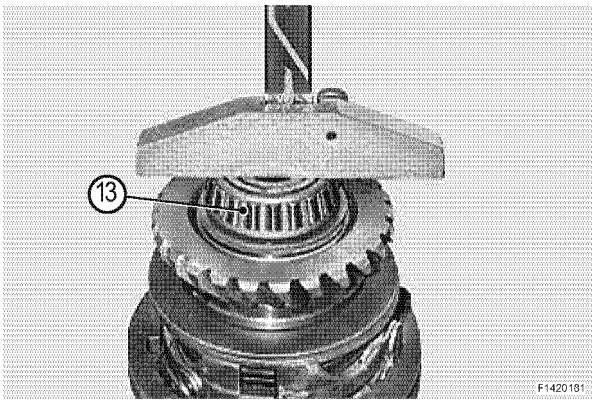
10. Install the clutch pack (24).

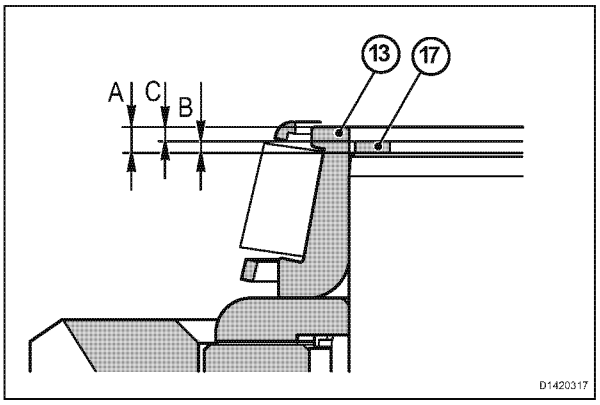


11. Install the gear (20), the butting ring (21) and press the taper roller bearing inner race (13).

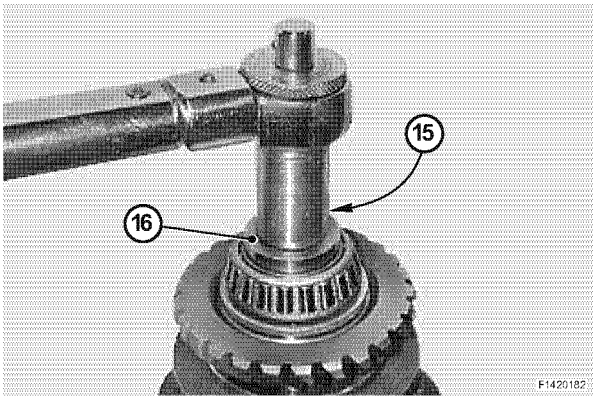


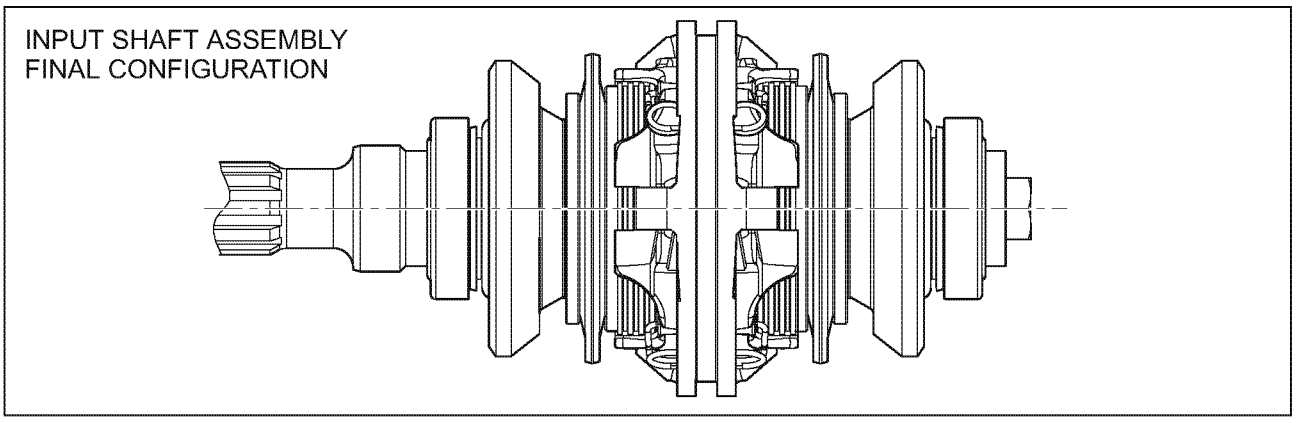
12. Calculate the thickness (B) of shims (17) using the formula below:
    B = A–C
    where:
    B= thickness of shims (17)
    A= measured distance between shaft and inner race of bearing (13).
    C= end clearance, from 0.1 mm to 0.15 mm.



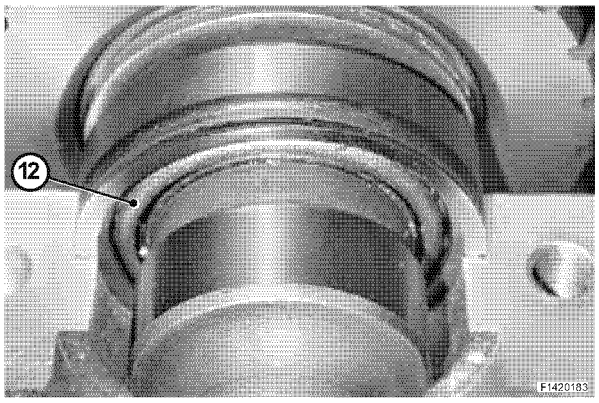


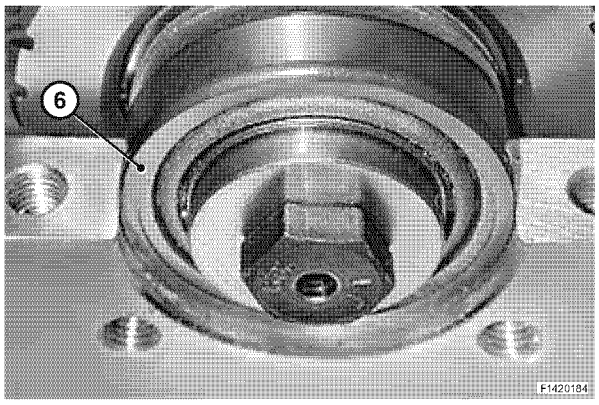
13. Replace the bolt (15) (M10x30).
    Install the washer (16) and tighten the new bolt to 50 Nm.
    Do not overtighten.



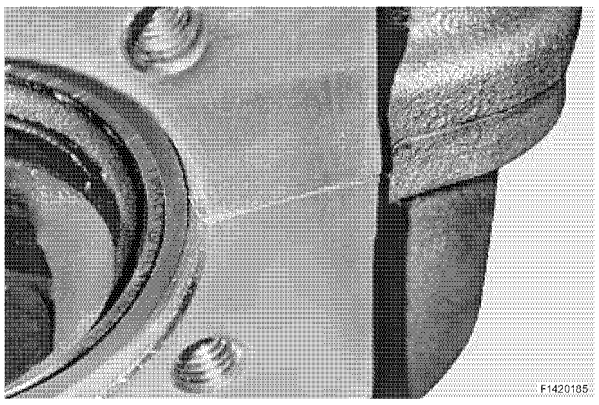


14. Fit the input shaft assembly in the housing and install the shims (12) and (6) in the original position.



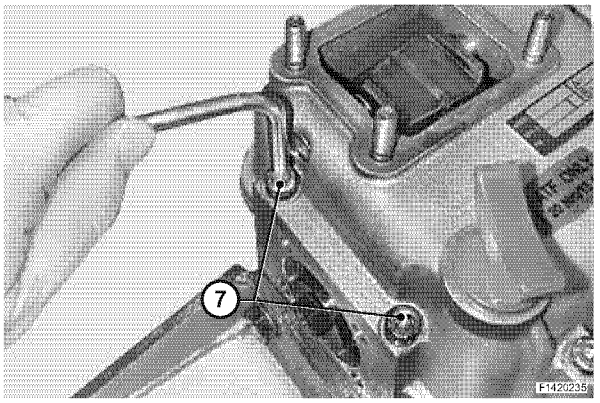


15. a Clean the housing surfaces and seal with Loctite 518.
Align the two housing in order to eliminate the step between them.

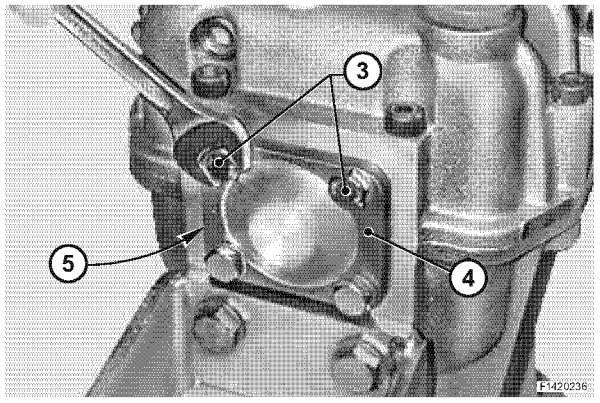


b Temporarily fit the cover (handtight) to align housing surface.

16. Tighten the screws (7) to 22 Nm.

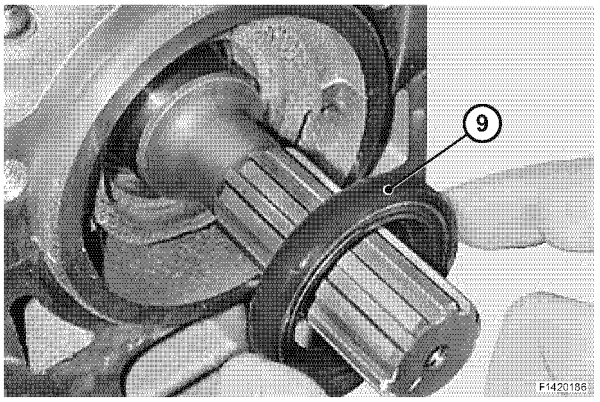


17. Replace the paper gasket (5) fit the cover (4) and tighten the 4 bolts (3) to 14 Nm.



18. Replace the input shaft seal (9) and put some Loctite 574 on the external diameter before putting it into place.
Adjust the shifting lever cover assembly following this procedure.

Note: Always fit the shifting lever cover using the procedure described in the next chapter.

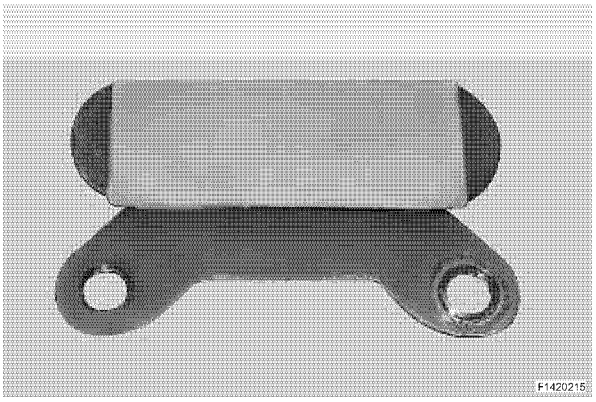


PROCEDURE TO ADJUST THE SHIFTING LEVER COVER

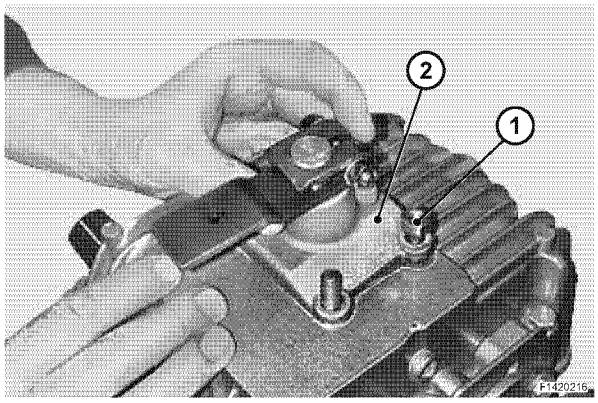
New bracket (p/n 196460-34010) to adjust the shifting lever cover.

Note:

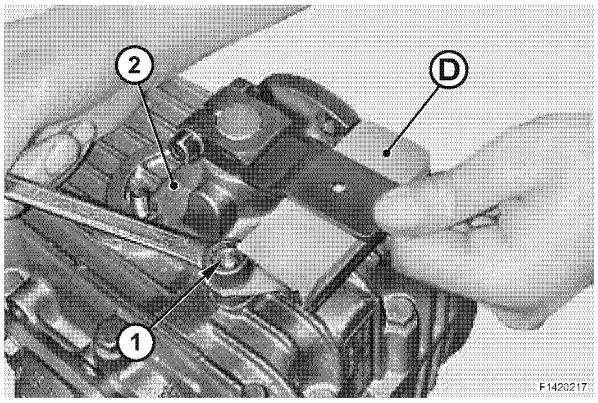
- *Before mounting the cover (2) clean the mating surfaces and adjust the shifting lever to the neutral position.*
- *Put Loctite 574 (or alternatively 518) on the cover (2) surface and position it with the lever in neutral.*



1. Lightly tighten two nuts (1).

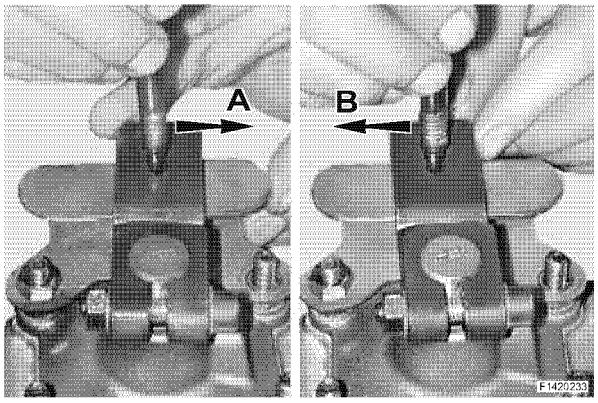


2. Adjust the cover (2) roughly in the middle.
3. Fit the adjusting bracket “D” (p/n 196460-34010) using only one nut (1) lightly tighten; the cover (2) must be free to move with light hammer tabs.

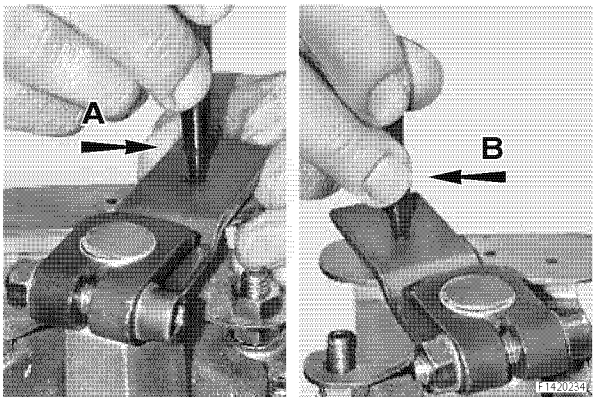


4. Move the lever toward the detent A without engaging the clutch and mark the position. Repeat the same for the detent B.

Note: If the shifting lever has two holes refer to the inner hole.



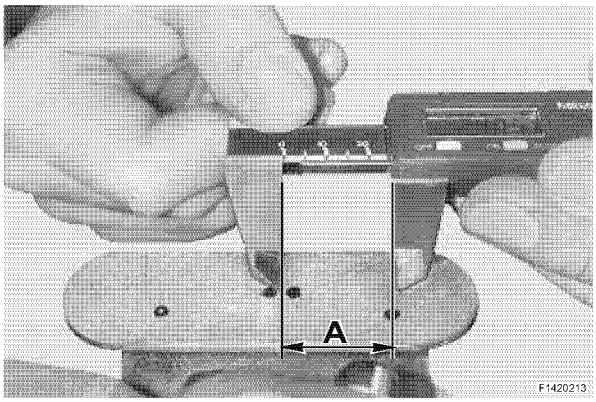
5. Engage the clutch in position “A”, turn back the lever to the engaging point and mark the position.
   Repeat the same procedure for position “B”.

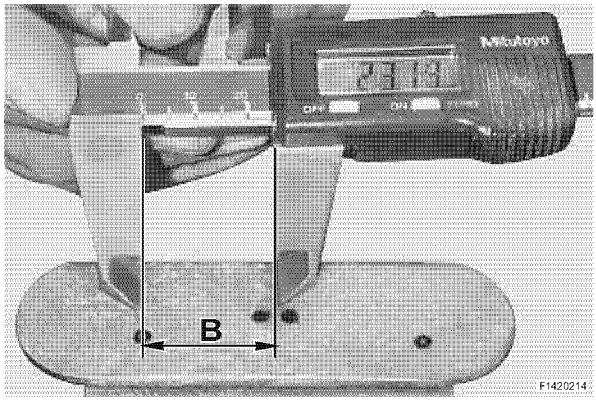


6. Consider the centre line between the internal marks and measure the distance from this line and the center of the external marks.
7. The maximum distance between the centre line and the external marks must be 24 mm.
   The maximum difference between the two measurements must be less than 3 mm.

Note: A must be always < 24
B must be always < 24
A – B < 3
Example:
A = 20; B = 24 –> A – B = 4 > 3 NO
A = 21; B = 23 –> A – B = 2 < 3 YES

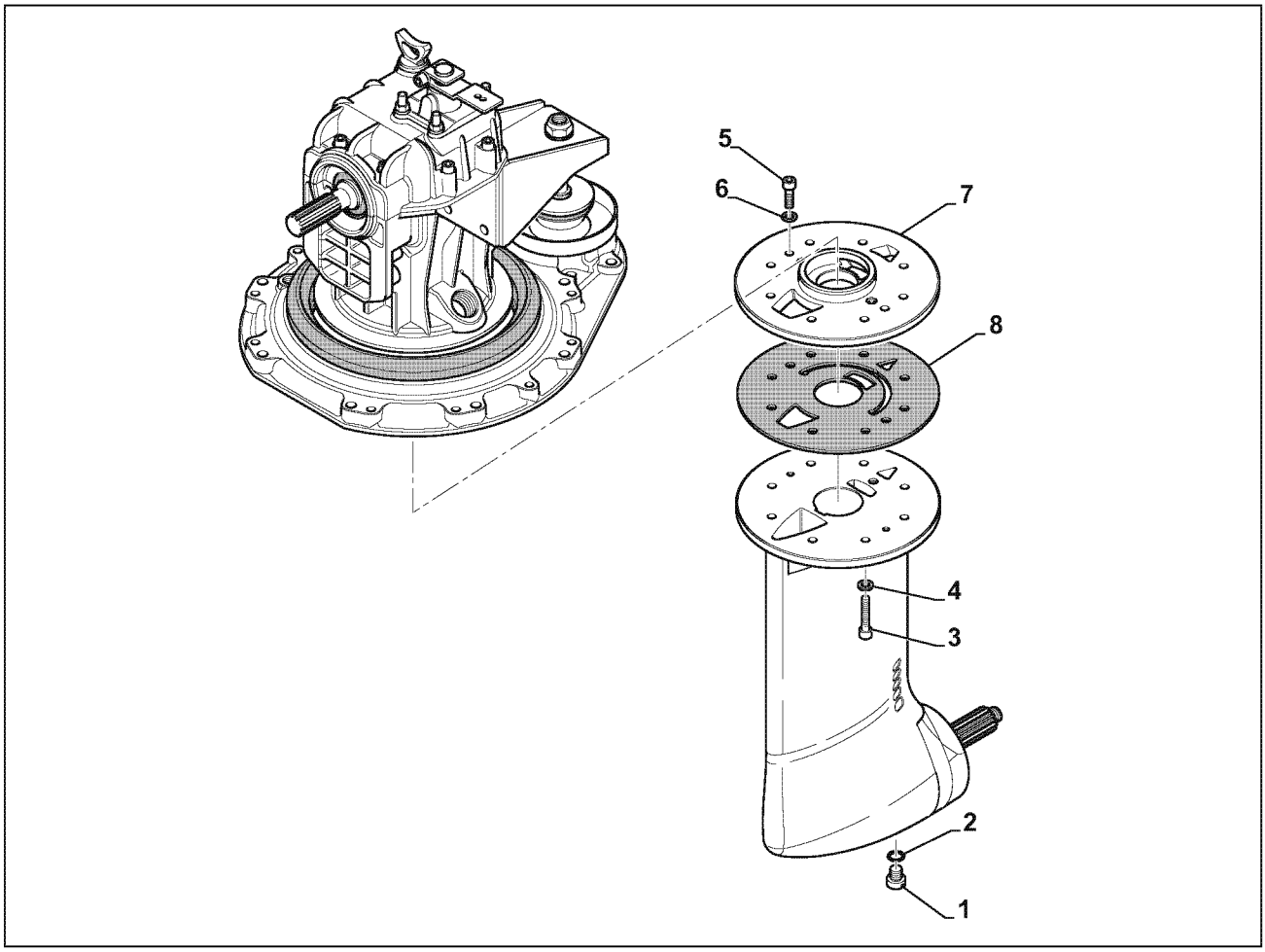
If the above conditions are not reached move the cover toward the opposite direction where the measurement is largest by light hammer pats and repeat the marking operation.
If it is not possible to adjust the cover to maximum 24 mm, the gearbox needs to be completely over hauled.





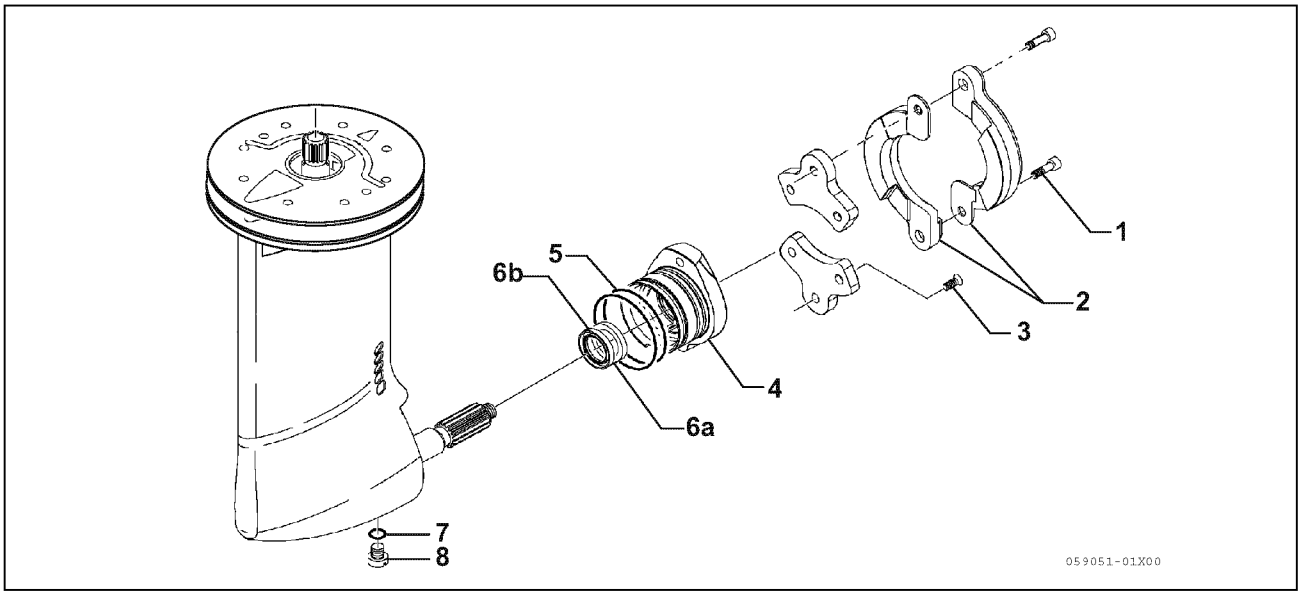
8. After the correct adjusting measurement is reached remove the adjusting bracket “D” tighten the four nuts with 22 Nm torque.

REPLACEMENT OF THE PAPER GASKET



1. Install drive on the fixture.
2. Clean the outside of the upper and lower gear housings.
3. Remove the drain plug (1) and let the oil flow the proper hole.
4. Scrap the oil drain plug O-Ring (2).
5. Remove all bolts M8x40, 8 pcs (3) together with the relative washers (4) below the division line of the drive.
6. Split the drive.
7. Remove the two bolts M8x25 (5) together with the relative washers (6) and remove the adapter plate (7).
8. Save the shims and note the thickness of the shims.
9. Scrap the gasket (8).
10. Apply engine oil to the new gasket (8).
11. Put the new gasket on the lower gear housing. Align the gasket in the correct way *(with the sign turned to the top)*.
12. Install the adapter plate (7) on the lower gear housing.
13. Tighten the two bolts M8x25 (5) together with the relative washers (6) to 20 Nm.
14. Put the lower leg and the upper gear housing together.
15. Apply MOLYCOTE G-n PLUS to the bolts M8x40, 8 pcs (3).
16. Tighten the bolts M8x40, 8 pcs (3) together with the relative washers (4) to 20 Nm.

REPLACEMENT OF THE ZINC ANODE, O-RINGS & SEAL RINGS



1. Install lower gear housing on fixture, if this has not been done previously.
2. Unscrew the four bolts M6x20 (1) and remove the zinc anode (2).
3. Scrap the zinc anode (2).
4. Unscrew the two bolts M10x25 (3). Remove carefully the propeller bearing support (4) using an appropriate tool.
5. Remove two O-Rings (5).
6. Scrap the O-Rings.
7. Remove the bearing race out using an appropriate tool.

Note: Take note of the original shims because during the reassembly they have to be mounted in the original position.

8. Tap the seal rings (6a - 6b) out of the propeller bearing support (4), using a screwdriver.
9. Install the outer seal ring (6a) in the propeller bearing support using an appropriate tool.

Note: Install the seal ring dry and aligned so that the spring comes outwards.

10. Install the inner seal ring (6b) in the propeller bearing support using an appropriate tool.

Note: Install the seal ring dry and aligned so that the spring comes inwards.

11. Place the original shims in the propeller bearing support.
12. Press the bearing race in with an appropriate tool.
13. Install new O-Rings (5) on the propeller bearing support (4).
14. Using a brush to lubricate the O-Rings (5) with engine oil.
15. Brush a thin layer of sealant, Permatex 80726 Loctite, on the lower housing surface.

⚠ CAUTION

We recommend to clean carefully the mating surface with Loctite 7063 cleaner before applying the Permatex 80726 Loctite.

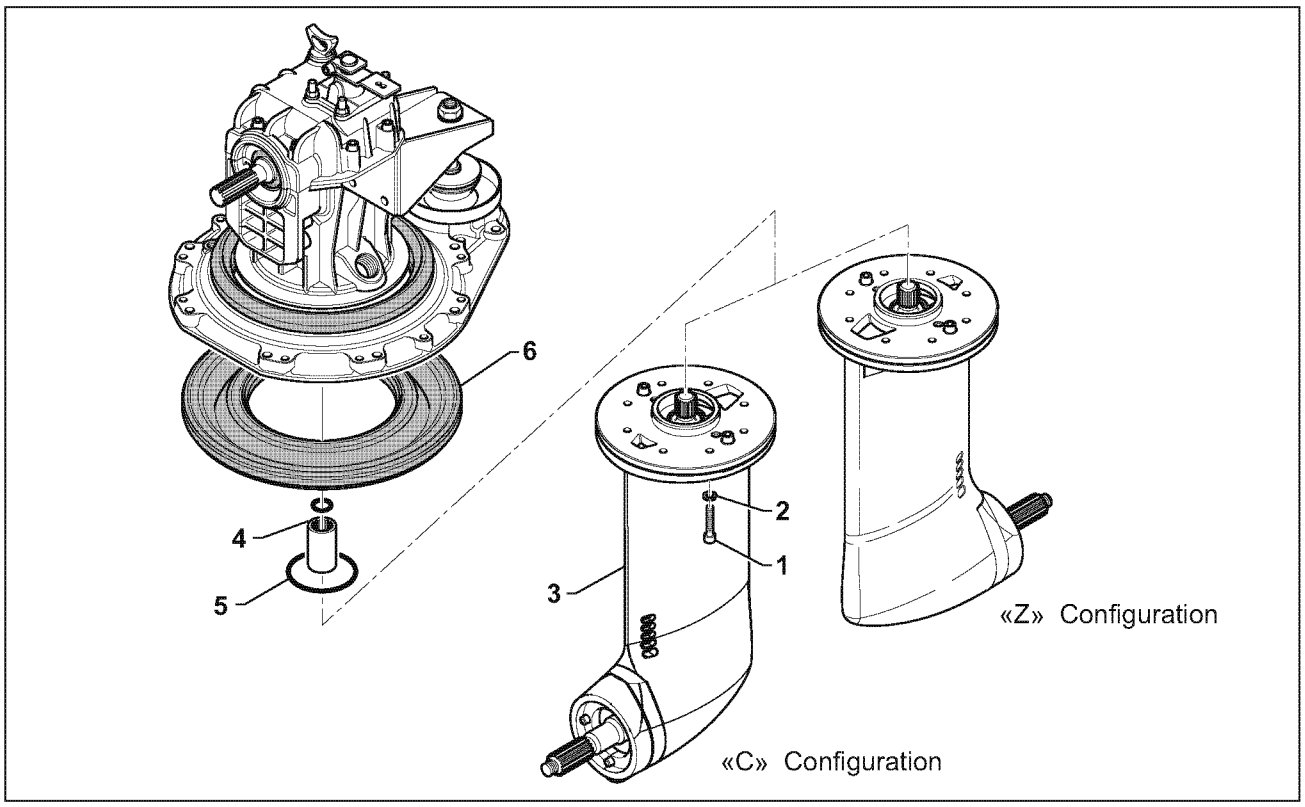
16. Apply thin coat of KLUEBER STABURAGS NBU 30 grease on internal periphery / lip of the seal rings (6a - 6b).
17. Put the propeller bearing support (4) in place.

⚠ CAUTION

Be careful to ensure that the splines do not scratch the seal rings (6a - 6b).

18. Tighten the two bolts M10x25 (3). Torque 40 Nm
19. Scrape the mating surface clean and install the zinc anode (2).
20. Tighten the four screws M6x20 (1). Torque 12 Nm.
21. Install new O-Ring (7) on the oil drain plug (8). Torque the oil drain plug (8) to 10 Nm.

ROTATION (180°) OF THE LOWER LEG ASSEMBLY, FROM "Z" TO "C" CONFIGURATION



The connection between the upper gear housing and the lower leg housing is made by means of eight bolts M8x40 (1).

The rotation of the lower leg housing is easily made:

1. Remove all the connection bolts M8x40, 8 pcs, (1) together with the relative washers (2) below the division line of the drive.
2. Split the drive.
3. Rotate the lower leg housing 180° (3).
4. Put the lower leg housing and the upper gear housing together.
5. Apply MOLYCOTE G-n PLUS to the bolts M8x40, 8 pcs (1).

⚠ CAUTION

In the reversing operation pay attention to four points:

6. The spline sleeve (4) is put in vertical position, thus it can fall down.
7. Be sure that the O-Ring (5) that seals the head with the leg stays attached to the leg when taking it out. Pay attention not to damage the O-Ring when putting the leg in the new position.
8. When extracting the leg, the rubber seal (6), of the entire Sail Drive, gets loose. Pay attention not to damage this rubber when put the leg back in position.
9. When putting the leg in the new position, be smooth and use manual adjustment of the propeller shaft in order to easily mate the teeth of the spline sleeve.

Section 5

TROUBLESHOOTING

Before performing any troubleshooting procedures within this section, review the *Safety* section on page *2-1*.

If a problem occurs, stop the engine immediately. Refer to the Symptom column in the Troubleshooting Chart to identify the problem.

TROUBLESHOOTING

First of all check, whether all items of operating instructions have been complied with.
The following assists you in troubleshooting.

Symptom	Possibly caused by	Remedy
1. High oil temperature	• Oil level high during operation • Oil level low • No water in cooling system • Unknown	• Pump out oil to max. mark on dipstick • Add oil • Check cooling system and repair • Consult Yanmar marine RHQ for additional training
2. Oil on sail drive housing	• Loose screws • Loose screw connections • Loose dipstick • Oil level high during operation • Unknown	• Tighten to specification • Tighten, replace • Tighten, replace • Pump out oil to max. mark on dipstick • Consult Yanmar marine RHQ for additional training
3. Shifts hard	• Selector control • Linkage • Unknown	• Consult Yanmar marine RHQ for additional training • Adjust • Consult Yanmar marine RHQ for additional training
4. Slow engagement	• Selector control • Linkage • Unknown	• Consult Yanmar marine RHQ for additional training • Adjust • Consult Yanmar marine RHQ for additional training
5. No movement of the boat	• Selector control • Improper selector position • Propeller missing • Propeller shaft broken • Sail drive malfunction • Engine malfunction	• Consult Yanmar marine RHQ for additional training • Adjust • Replace • Replace • Consult Yanmar marine RHQ for additional training • Consult Yanmar marine RHQ for additional training

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