

OPERATION MANUAL

MARINE GEAR

KMH

KMH40A

KMH41A

KMH50A

KMH51A

YANMAR

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OPERATION MANUAL	MODEL	KMH40A, KMH41A, KMH50A, KMH51A
	CODE	OAKMH-M00014

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Welcome to the world of YANMAR Marine! YANMAR Marine offers engines, drive systems and accessories for all types of boats, from runabouts to sailboats, and from cruisers to mega yachts. In marine leisure boating, the worldwide reputation of YANMAR Marine is second to none.

YANMAR Marine gears are designed for a wide range of applications. Our parallel, down angle, saildrive and V-drive marine gears are designed to reduce the vibration and make your cruising more pleasurable.

To help you enjoy your YANMAR Marine products for many years to come, please follow these recommendations:

- Read and understand this *Operation Manual* before you operate your boat to ensure that you follow safe operating practices and maintenance procedures.
- Keep this *Operation Manual* in a convenient place for easy access.
- If this *Operation Manual* is lost or damaged, order a new one from your authorized YANMAR Marine dealer or distributor.
- Make sure this manual is transferred to subsequent owners. This manual should be considered a permanent part of the boat and remain with it.
- Constant efforts are made to improve the quality and performance of YANMAR products, so some details included in this *Operation Manual* may differ slightly from your marine gear. If you have any questions about these differences, please contact your authorized YANMAR Marine dealer or distributor.

00	INTRODUCTION RECORD OF OWNERSHIP	No. 00-02-00	Page 1/1
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Take a few moments to record the information you need when you contact YANMAR for service, parts or literature.

Marine Gear Model: _____

Marine Gear Serial No.: _____

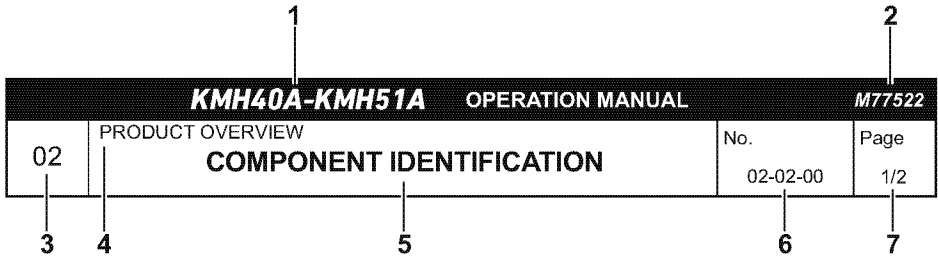
Date Purchased: _____

Dealer: _____

Dealer Phone: _____

KMH40A-KMH51A		OPERATION MANUAL		M77522
00	INTRODUCTION HOW TO READ THE MANUAL	No. 00-03-00	Page 1/1	

Read this manual referring to the following descriptions. This manual is composed according to the list of the "CONTENTS" page. Each chapter has each page number and is arranged to match each user's specifications.



121433-00EN00

Figure 1

The remarked items are the following explanations.

1. Model name of marine gear
2. Model No. of marine gear
3. Chapter code
4. Group name
5. Title of the chapter
6. Document No.
The number composition: (chapter code)-(partial code)-(revision code)
The page number is written putting the model No. ahead. (Ex. M77522-02-02-00)
7. Serial pane No. of the chapter

01	SAFETY SAFETY	No. 01-01-00	Page 1/1
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YANMAR considers safety of great importance and recommends that anyone that comes into close contact with its products, such as those who install, operate, maintain or service YANMAR products, exercise care, common sense and comply with the safety information in this manual and on the machine's safety labels. Keep the labels from becoming dirty or torn and replace them if they are lost or damaged. Also, if you need to replace a part that has a label attached to it, make sure you order the new part and label 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.

01	SAFETY SAFETY PRECATIONS	No. 01-02-00	Page 1/6
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General Information

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 operation or performing repairs or maintenance.

Before You Operate

⚠ WARNING



- Never permit anyone to install or operate the engine or marine gear without proper training.
- Read and understand this *Operation Manual* before you operate or service the engine or marine gear to ensure that you follow safe operating practices and maintenance procedures.
- Safety signs and labels are additional reminders for safe operating and maintenance techniques.
- See your authorized YANMAR Marine dealer or distributor for additional training.

During Operation and Maintenance

⚠ DANGER

FIRE HAZARD



- Keep fire extinguishers handy in case of fire. Clearly indicate the location of the fire extinguishers with a safety sign.
- Ensure that the type of fire extinguishers are appropriate for material that might catch fire. Check with local authorities.
- Have all fire extinguishers checked periodically for proper operation and/or readiness.
- Post evacuation routes prominently. Periodically conduct fire drills.
- Ensure that appropriate fire detection and extinguishing equipment are installed and checked periodically for proper operation. Check with local authorities.

CRUSH HAZARD



- Always use lifting equipment with sufficient capacity to lift marine gear.
- Never stand under hoisted marine gear. If the hoist mechanism fails, the marine gear will fall on you, causing serious injury or death.
- Never support marine gear with equipment not designed to support the weight of the marine gear such as wooden pieces, blocks or by only using a jack.

01	SAFETY SAFETY PRECATIONS	No. 01-02-00	Page 2/6
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⚠ WARNING

EXPLOSION HAZARD



- Avoid serious personal injury or equipment damage. 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.
- Diesel fuel is flammable and explosive under certain conditions.
- Never use a shop rag to catch the fuel.
- Wipe up all spills immediately.

FIRE HAZARD



- Avoid injury or equipment damage from fire. Undersized wiring systems can cause an electrical fire.

ALCOHOL AND DRUG HAZARD



- Never operate the engine while under the influence of alcohol or drugs or when feeling ill.

⚠ WARNING

EXPOSURE HAZARD



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

ENTANGLEMENT HAZARD



- Never leave the key in the key switch when you are servicing the engine or marine gear. Someone may accidentally start the engine and not realize you are servicing it.
- Avoid personal injury. Never operate the engine while wearing a headset to listen to music or radio because it will be difficult to hear the warning signals.
- If the vessel has more than one engine, Never service a marine gear if either of the engines are running. In multi-engine configurations, the propeller for an engine that is shut down may rotate if any of the other engines are running.
- Avoid unexpected equipment movement. Shift the marine gear into the NEUTRAL position any time the engine is at idle.

01	SAFETY SAFETY PRECATIONS	No. 01-02-00	Page 3/6
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⚠ WARNING

SEVER HAZARD



- Never service the marine gear while under tow or if the engine is running at idle speed. The propeller may rotate under these circumstances.
- Rotating parts can cause severe injury or death. Never wear jewelry, unbuttoned cuffs, ties or loose fitting clothing and Always tie long hair back when working near moving/rotating parts such as the flywheel or PTO shaft. Keep hands, feet and tools away from all moving parts.
- If the vessel has more than one engine, Never service a marine gear if either of the engines are running. In multi-engine configurations the propeller for an engine that is shut down may rotate if any of the other engines are running.
- Shift the marine gear into the NEUTRAL position any time the engine is at idle.
- To prevent accidental equipment movement, Never start the engine in gear.
- Before starting the engine, Always make sure that all bystanders are clear of the area. Keep children and pets away while the engine is operating.
- Avoid personal injury or equipment damage. Always remove any tools or shop rags used during maintenance from the area before operation.
- Stop the engine before you begin to service the marine gear and secure the propeller so it will not turn.

⚠ WARNING

BURN HAZARD



- Avoid serious injury. Some of the engine and marine gear surfaces become very hot during operation and shortly after shut-down. Keep hands and other body parts away from hot surfaces.

SUDDEN MOVEMENT HAZARD

- Avoid personal injury. Always stop the engine before beginning service.
- When you install the “emergency nut” the boat will move as soon as you start the engine! Make sure the area is clear before you start the engine.

EXHAUST HAZARD



- Avoid serious injury or death. Never block windows, vents, or other means of ventilation if the engine is operating in an enclosed area. All internal combustion engines create carbon monoxide gas during operation and special precautions are required to avoid carbon monoxide poisoning.

01	SAFETY SAFETY PRECATIONS	No. 01-02-00	Page 4/6
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⚠ WARNING

ELECTRICAL SHOCK HAZARD



- Avoid serious personal injury or equipment damage. Always turn off the battery switch (if equipped) or disconnect the negative battery cable before servicing the equipment.
- Avoid personal injury or equipment damage. Always keep the electrical connectors and terminals clean. Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors.

⚠ CAUTION

POOR LIGHTING HAZARD

- Avoid personal injury or equipment damage. Ensure that the work area is adequately illuminated. Always install wire cages on portable safety lamps.

TOOL HAZARD

- Avoid personal injury or equipment damage. Always use tools appropriate for the task at hand and use the correct size tool for loosening or tightening machine parts.

FLYING OBJECT HAZARD



- Avoid personal injury. Always wear eye protection when servicing the engine or when using compressed air or high-pressure water. Dust, flying debris, compressed air, pressurized water or steam may injure your eyes.
- Periodic maintenance prevents unexpected downtime, reduces the number of accidents due to poor machine performance and helps extend the life of the marine gear.

If any problem is noted during the visual check, the necessary corrective action should be taken before you operate the marine gear.

01	SAFETY SAFETY PRECATIONS	No. 01-02-00	Page 5/6
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⚠ CAUTION

SLIPPING AND TRIPPING HAZARD

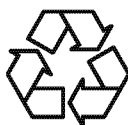


- Ensure that adequate floor space is set aside for servicing marine gear. The floor space must be flat and free of holes.
- Keep floor free of dust, mud, spilled liquids and parts to help prevent slipping and tripping.

NOTICE

It is important to perform daily checks as listed in this *Operation Manual*.

Periodic maintenance prevents unexpected downtime, reduces the number of accidents due to poor engine or marine gear performance and can help extend the life of the engine and marine gear.



Always be environmentally responsible.

Follow the guidelines of the EPA or other governmental agencies for the proper disposal of hazardous materials such as lubrication 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 ground water or waterways.

Before operating the engine, check marine gear oil level.

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

01	SAFETY SAFETY PRECATIONS	No. 01-02-00	Page 6/6
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NOTICE

Observe the following environmental operating conditions to maintain marine gear performance and avoid premature marine gear wear:

- Never run the marine gear if the ambient temperature is above +45 °C (+113 °F) or below -15 °C (+5 °F).
- If the ambient temperature exceeds +45 °C (+113 °F) the marine gear may overheat and cause the marine gear oil to break down.
- If the ambient temperature falls below -15 °C (+5 °F) rubber components such as gaskets and seals will harden causing premature marine gear wear and damage.
- Contact your authorized YANMAR Marine dealer or distributor if the marine gear will be operated in either temperature extreme.

Observe the following environmental operating conditions to maintain marine gear performance and avoid premature marine gear wear:

- Avoid operating in the presence of chemical gases or fumes.
- Avoid operating in extremely dusty conditions.

Never attempt to modify the marine gear's design or safety features.

NOTICE

Failure to comply may impair the marine gear's safety and performance characteristics and shorten the marine gear's life. Any alterations to this marine gear may affect the warranty coverage of your marine gear.

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

If the marine gear oil temperature is too high, stop engine immediately and check the marine gear oil level and check the oil cooler for proper coolant and water flow.

New Marine Gear Break-In:

On the initial engine start-up, allow the engine to idle for approximately 15 minutes while you check for proper marine gear function and marine gear oil leaks.

During the break-in period, carefully observe marine gear indicators (if any) for proper marine gear function.

During the break-in period, check the marine gear oil levels frequently.

Never use the marine gear lifting eye to lift the engine and marine gear as an assembly. Use the engine lifting eyes to lift the engine and marine gear. Only use the marine gear lifting eye to lift the marine gear as a separate component.

02	PRODUCT OVERVIEW OVERVIEW	No. 02-01-00	Page 1/1
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The KMH marine gear is a hydraulically-activated helical gear unit, developed for use in pleasure craft.

The marine gear is equipped with a disk-type reversing clutch mounted on the input shaft and the support shaft and supplied with hydraulic pressure from an oil pump.

Operation of the oil pump is dependent on the engine speed.

The marine gear is lubricated by splash and force-feed lubrication.

02	PRODUCT OVERVIEW	No.	Page
	COMPONENT IDENTIFICATION	02-02-00	1/1

Note: KMH41A shown. Other models are similar.

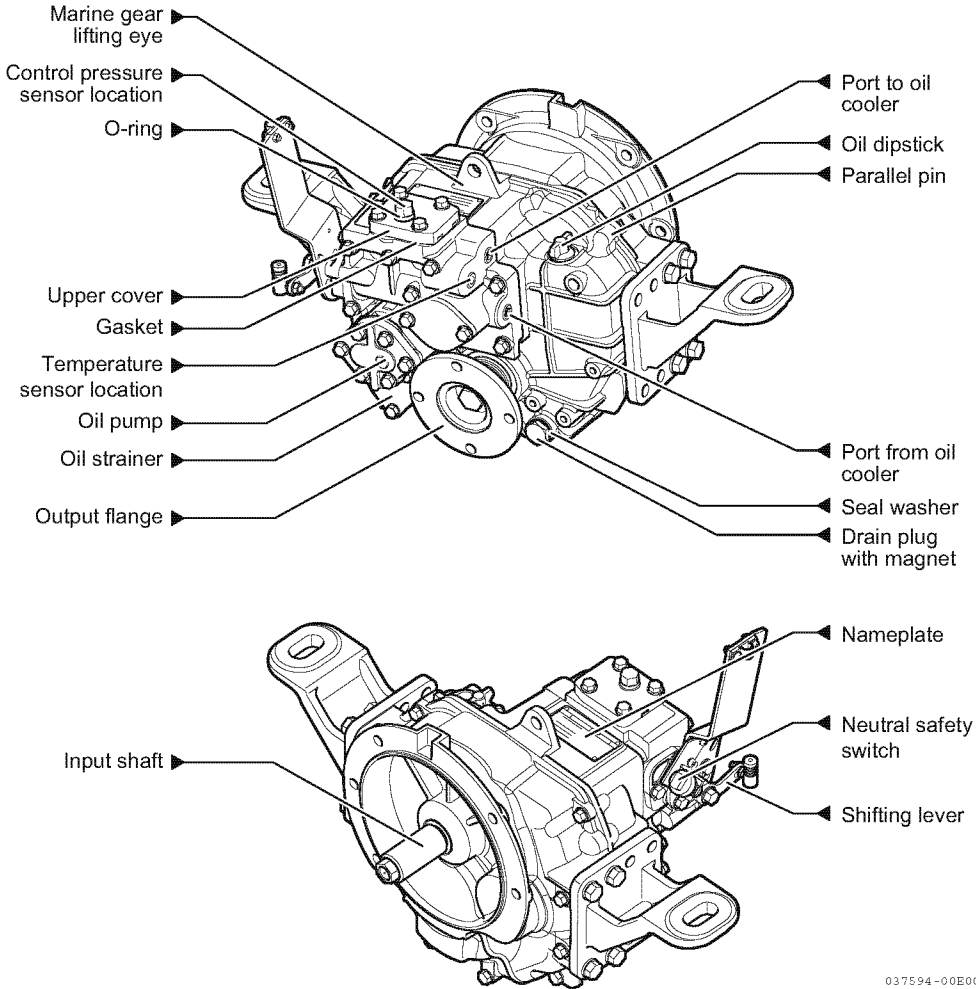


Figure 1

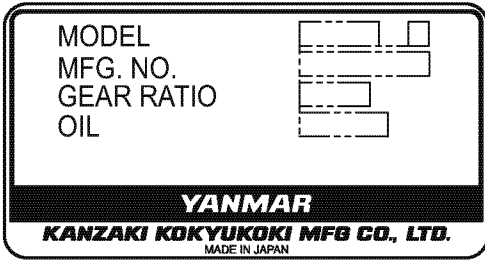
037594-00E00

NOTICE

Never use the marine gear lifting eye to lift the engine and marine gear as an assembly. Use the engine lifting eyes to lift the engine and marine gear. Only use the marine gear lifting eye to lift the marine gear as a separate component.

02	PRODUCT OVERVIEW NAMEPLATE	No. 02-03-00	Page 1/1
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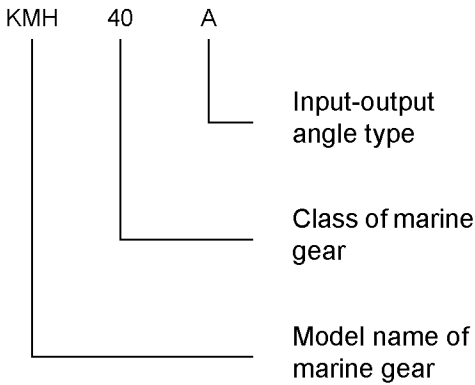
The nameplate is installed on the marine gear.



066651-00X00

Figure 1

Significance of Marine Gear Designations



02	PRODUCT OVERVIEW TECHNICAL DATA	No. 02-05-00	Page 1/1
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When installing the KMH marine gears, the following items should be specially noted:

- Installation should be done by a specialist only.
- Align and install the marine gear and engine correctly.
- Align correctly with engine and propeller shaft.
- Select a suitable damping coupling between the engine and the marine gear. Contact your authorized YANMAR dealer or distributor for assistance.
- Choose an adequate heat exchanger.
- Mount the marine gear correctly in the boat.

	KMH40A, 41A	KMH50A, 51A
Shifting Pressure (Changes in oil temperature or input speed will affect shifting pressure.)	3.67 - 3.77 MPa (532 - 547 psi)	3.68 - 3.78 MPa (534 - 548 psi)
Maximum Input Speed	5500 min ⁻¹ (rpm)	4225 min ⁻¹ (rpm)
Oil Capacity without Heat Exchanger		
Available	1.7 L (1.8 qt)	2.0 L (2.1 qt)
Effective	0.4 L (0.4 qt)	0.4 L (0.4 qt)

03	MARINE GEAR OPERATION DAILY CHECKS	No. 03-01-00	Page 1/2
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This section of the *Operation Manual* describes the procedure for performing daily checks, checking the marine gear oil level and shifting the marine gear.

Before performing any operations within this section, *review the Safety section on M77522-01-01-00.*

All marine gears have been submitted to a test run before shipment.

Visual checks for leakage should be made from time to time.

Before operating the marine gear, make sure it is in good operating condition. Make sure you check the following items and have any repairs completed before you operate the marine gear.

Visual Checks



If any problem is noted during the visual check, the necessary corrective action should be taken before you operate the marine gear.

1. Check for oil leaks.
2. Check for damaged or missing parts.
3. Check for loose, missing or damaged fasteners.
4. Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors.

Checking Oil Level

KMH41A

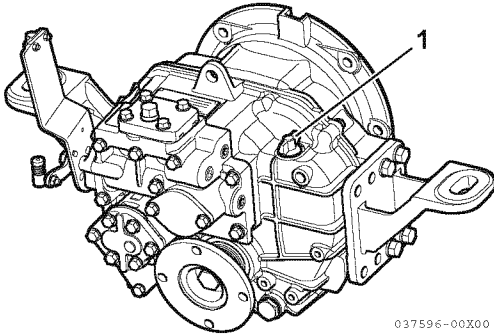


Figure 1

1. Remove dipstick (1, **Figure 1**) and wipe with clean cloth.

NOTICE

Prevent dirt and debris from contaminating marine gear oil. Carefully clean the dipstick and surrounding area before you remove it.

2. Reinsert the dipstick but do not thread it into place.

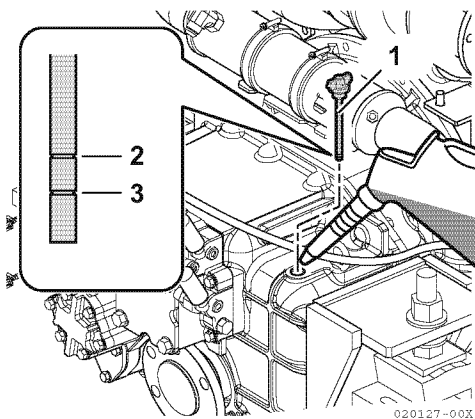


Figure 2

3. Remove the dipstick. The oil level should be between the upper (2, **Figure 2**) and lower (3, **Figure 2**) lines on dipstick.
4. Insert dipstick and tighten securely.
5. Ensure the shift lever is in NEUTRAL.
6. Start the engine. Let the engine run at idle with the shift lever in the NEUTRAL position for several minutes. This will ensure the oil is distributed to all pipelines, oil cooler and marine gear oil passages.
7. Stop the engine. Wait at least 10 minutes for the oil to drain back into the sump.
8. Check the oil level. If necessary, add oil until the level reaches the upper mark on the dipstick. Check the oil level again after operating the marine gear for a short period of time.

NOTICE

Never overfill. The oil level must be between the upper and lower level marks.

Recommended Oil (Type of Oil)

- **API (American Petroleum Institute) service grade:** Class CF or higher
- **Viscosity:** SAE 30
- **Recommended oil:** YANMAR Marine Super Oil SAE 30

NOTICE

Always use the specified SAE 30 oil. Never use gear oil or ATF in KMH marine gears. Never use multi-grade oil or mix oil types.

03	MARINE GEAR OPERATION	No.	Page
	SHIFTING THE MARINE GEAR	03-02-00	1/4

NOTICE

During normal operation, the marine gear should only be shifted with the engine at idle. Shifting at higher engine speed will damage the marine gear.

Mechanical Shift

The marine gear is shifted by moving the shifting lever.

Shifting Positions:

- A = Propeller rotation opposite of engine rotation.
- N = NEUTRAL position
- B = Propeller rotation same as engine rotation.

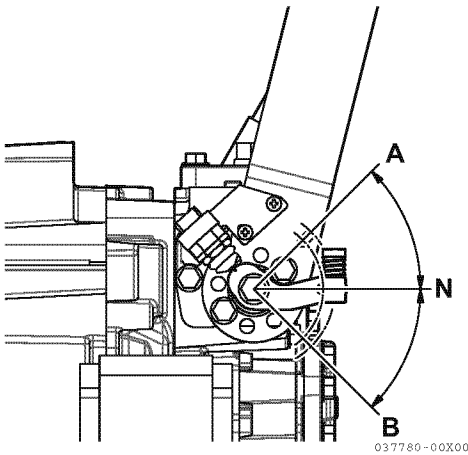


Figure 1

Operating temperature of the marine gear: 50° to 80 °C (122° to 176 °F).

A connection port for a temperature sensor has been provided. (See *Component Identification on page M77522-02-02-00*).

Electric Shift

Propeller direction

CW: Propeller rotation opposite of engine rotation.

CCW: Propeller rotation same as engine rotation.

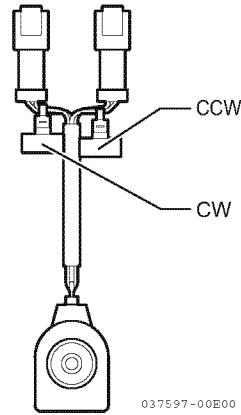


Figure 2

Viewed from Propeller Side

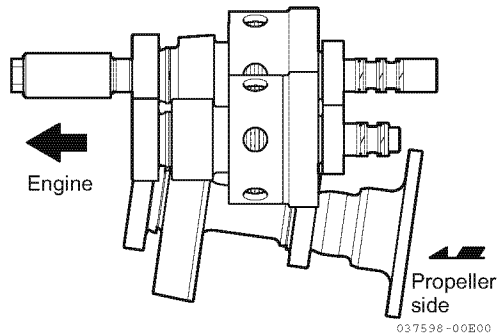
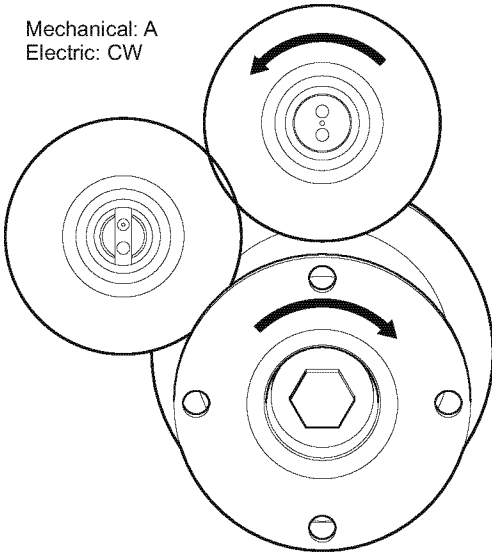


Figure 3

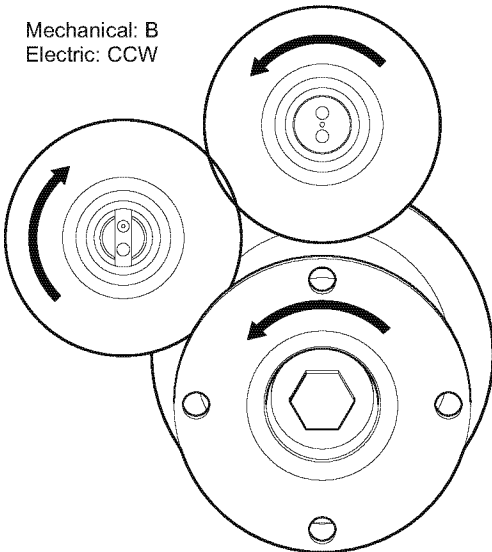
Mechanical: A
Electric: CW



Viewed from propeller side 037599-00200

Figure 4

Mechanical: B
Electric: CCW



Viewed from propeller side 037600-00EN01

Figure 5

Emergency Operation of Electric Valve

If the electric valve stops operating with the engine(s) not running, do the following:

Current Production Models

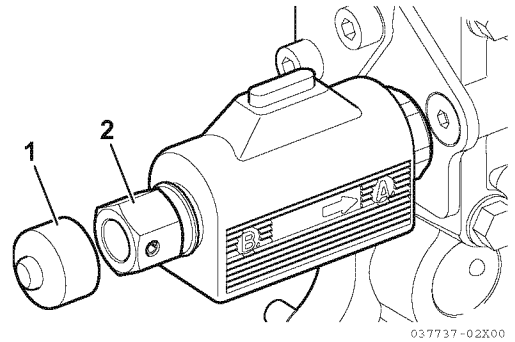


Figure 6

1. With the engine(s) not running, remove cap (1, Figure 6), and emergency nut (2, Figure 6).

CAUTION

If you have more than one engine, you cannot shift the marine gear into the "B" position after you install the "emergency nut".

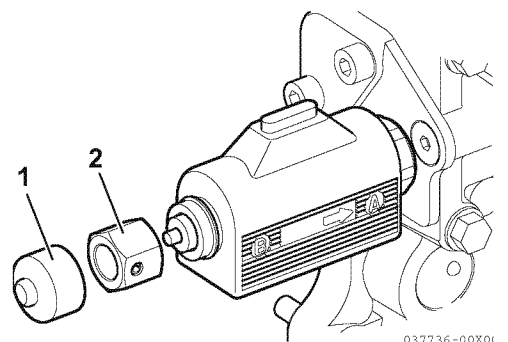


Figure 7

- Reverse the emergency nut (2, Figure 7) and thread it onto electric valve.

▲ WARNING

When you reverse the “emergency nut” the transmission is locked in gear and the boat will move as soon as you start the engine! There is no neutral safety protection in this mode. Make sure the area is clear before you start the engine.

- In this condition, the propeller rotates in the CW direction of Figure 4 at the engine start.

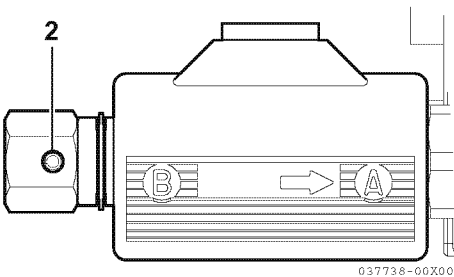
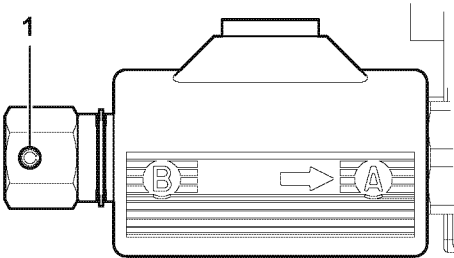


Figure 8

Note the orientation of the spring pin in the emergency nut.

- Normal operation (1, Figure 8)
- Emergency operation (2, Figure 8)

Past Production Models

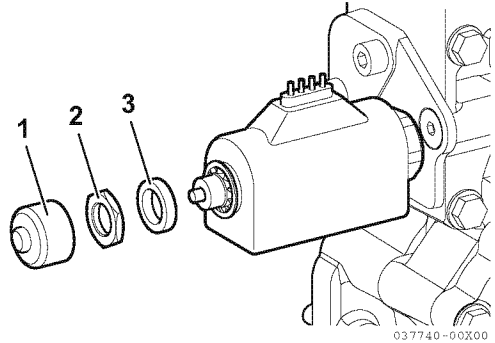


Figure 9

- With the engine(s) off, remove cap (1, Figure 9), nut (2, Figure 9) and collar (3, Figure 9).

▲ CAUTION

If you have more than one engine, you cannot shift the marine gear into the “B” position after you install the “emergency nut”.

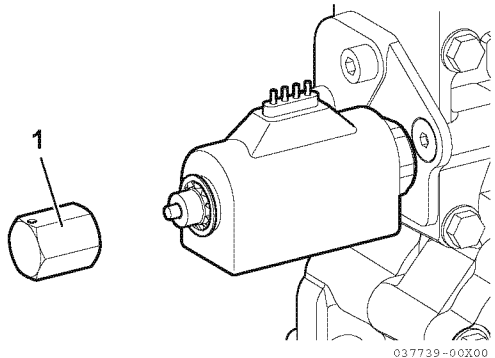


Figure 10

- Thread the emergency nut (1, Figure 10) onto electric valve.

⚠ WARNING

When you reverse the “emergency nut” the transmission is locked in gear and the boat will move as soon as you start the engine! There is no neutral safety protection in this mode. Make sure the area is clear before you start the engine.

3. In this condition, the propeller rotates in the CW direction of **Figure 4** at the engine start.

03	MARINE GEAR OPERATION TOWING OR ANCHORING	No. 03-03-00	Page 1/1
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When a boat is being towed or is anchored, water current will cause the propeller to turn (when the engine is off, the position of the shifting lever is irrelevant). The propeller must be fixed to prevent from damage, when the propeller is turned by towing or single engine running (in the twin engine boat) for 1 hour or more.

04	MAINTENANCE TIGHTENING FASTENER	No. 04-01-00	Page 1/1
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This section of the *Operation Manual* describes the procedures for proper care and maintenance of the marine gear.

Before performing any operations within this section, *review the Safety section on page M77522-01-01-00.*

Use the correct amount of torque when tightening fasteners. Applying excessive torque may damage the fastener or component and too little torque may cause a leak or component failure.

NOTICE



The tightening torque in the Standard Torque Chart should be applied only to the bolts with a “7” head. (JIS strength classification: 7T).

Apply 60% torque to bolts that do not have the indication of “7”.

Apply 80% torque of the Cast Iron or Steel when tightened to aluminum alloy.

04	MAINTENANCE	No.	Page
	TORQUE CHARTS	04-02-00	1/1

Standard Torque Values

	M6 × 1.0	M8 × 1.25	M10 × 1.25 or 1.5	M12 × 1.25 or 1.5	M14 × 1.5	M16 × 1.5
Cast Iron or Steel	10.8 ± 1.0 N·m	25.5 ± 2.0 N·m	49.1 ± 4.9 N·m	88.3 ± 10.0 N·m	137.2 ± 4.9 N·m	225.4 ± 10.0 N·m
	8.0 ± 0.8 ft-lb	18.8 ± 1.5 ft-lb	36.2 ± 3.6 ft-lb	65.1 ± 7.4 ft-lb	101.2 ± 3.6 ft-lb	166.2 ± 7.4 ft-lb
Aluminum	8.8 ± 1.0 N·m	20.6 ± 2.0 N·m	39.2 ± 2.0 N·m	70.6 ± 4.9 N·m	109.8 ± 4.9 N·m	180.3 ± 10.0 N·m
	6.5 ± 0.8 ft-lb	15.2 ± 1.5 ft-lb	28.9 ± 1.5 ft-lb	52.1 ± 3.6 ft-lb	81.0 ± 3.6 ft-lb	133.0 ± 7.4 ft-lb

Torque Specifications

Item	Size	Torque		Comments
		N·m	ft-lb	
Shifting Lever Bolt	M10 × 1.5	39.2 ± 2.0 (347 ± 18 in.-lb)	28.9 ± 1.5	
Tapered Plugs	NPTF 3/8	39.2 ± 2.0 (347 ± 18 in.-lb)	28.9 ± 1.5	
Drain Plugs	M16 × 1.5	29.4 ± 2.0 (260 ± 18 in.-lb)	21.7 ± 1.5	
Neutral Safety Switch	M12 × 1.25	3.2 ± 2.0 (28 ± 2.2 in.-lb)	2.4 ± 1.5	
Hose Clamps for Cooler	-	2.5 - 3.4 (22 ± 30 in.-lb)	1.8 - 2.5	
Hose for Cooler	3/4 - 16	49 ± 0.49 (434 ± 43 in.-lb)	36.1 ± 0.36	
Transmission Assembly Bolts	M8	18.6 - 22.6 (165 ± 200 in.-lb)	13.7 - 16.7	
	M10	37.2 - 41.2 (329 ± 365 in.-lb)	27.5 - 30.4	
	M12	65.7 - 75.5 (582 ± 668 in.-lb)	48.5 - 55.7	
Oil Dipstick		Hand-Tighten		

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⚠ CAUTION

Establish a periodic maintenance plan according to the marine gear application and make sure you perform the required periodic maintenance at intervals indicated. Failure to follow these guidelines will impair the marine gear’s safety and performance characteristics, shorten the marine gear’s life and may affect the warranty coverage on your marine gear. See your authorized YANMAR Marine dealer or distributor for assistance when checking items marked with a ●.

The Importance of Periodic Maintenance

Marine gear deterioration and wear occur in proportion to the length of time the marine gear has been in service and the conditions it is subjected to during operation. Periodic maintenance prevents unexpected downtime, reduces the number of accidents due to poor machine performance and helps extend the life of the marine gear.

The Importance of Daily Checks

The Periodic Maintenance Schedule assumes that the daily checks are performed on a regular basis. Make it a habit of performing daily checks before the start of each operating day. See *Daily Checks on page M77522-03-01-00* and refer to the *Operation Manual* for your engine.

Keep a Log of Engine Hours and Daily Checks

Keep a log of the number of hours the engine is run each day and a log of the daily checks performed. Also note the date, type of repair (e.g., replaced bearings), and parts used for any service needed between the periodic maintenance intervals. Periodic maintenance intervals are every 250 engine hours. Failure to perform periodic maintenance will shorten the life of the marine gear.

YANMAR Replacement Parts

YANMAR recommends that you use genuine YANMAR parts when replacement parts are needed. Genuine replacement parts help ensure long engine life.

Tools Required

Before you start any periodic maintenance procedure, make sure you have the tools you need to perform all of the required tasks.

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Ask Your Authorized YANMAR Marine Dealer or Distributor For Help

Our professional service technicians have the expertise and skills to help you with any maintenance or service related procedures.

Daily and periodic maintenance is important to keep the marine gear in good operating condition. The following is a summary of maintenance items by periodic maintenance intervals. Periodic maintenance intervals vary depending on marine gear application and are hard to establish definitively. The following should be treated only as a general guideline.

Note: These procedures are considered normal maintenance and are performed at the owner's expense.

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Periodic Maintenance Schedule

○: Check or Clean ◇: Replace ●: Contact your authorized YANMAR Marine dealer or distributor

System	Item	Periodic Maintenance Interval			
		Daily	At 50 hours (1 st period)	Every 250 hours or one year whichever comes first	Every 500 hours or 2 years whichever comes first
Whole	Visual inspection of engine exterior	○ Before starting			
Lubricating System	Check the lubricating oil level and refill if necessary	○ Before starting			
	Replace the lubricating oil		◇	◇	
	Clean oil strainer		○	○	
	Replace oil filter of the electric trolling valve		◇	◇	
	Check and Clean oil cooler			●	
Electrical System	Check the wiring connectors			○	
Miscellaneous Items	Check friction/steel plates, bearings and gears, Replace them if necessary				●
	Check the damper, Replace it if necessary				●

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After Initial 50 Hours of Operation

Perform the following maintenance after the initial 50 hours of operation.

- **Changing the Marine Gear Oil and Cleaning the Marine Gear Oil Strainer**
- **Changing the Electric Trolling Valve Oil Filter Element (If Equipped)**

Changing the Marine Gear Oil and Strainer

Optimum effectiveness of oil can only be assured if the marine gear oil is changed and the oil strainer is washed with clean oil regularly, according to the maintenance schedule.

1. Position a container under the marine gear to collect the waste oil.

KMH41A

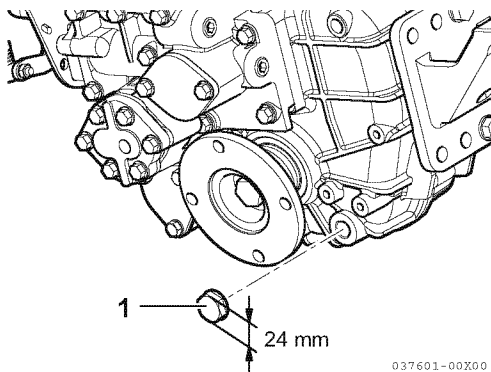


Figure 1

2. Use a 24 mm wrench to remove the M16 drain plug (1, **Figure 1**).

Note: Clean any metal particles from the drain plug with magnet before installing in housing.

3. Check the seal washer for damage. Replace if necessary.

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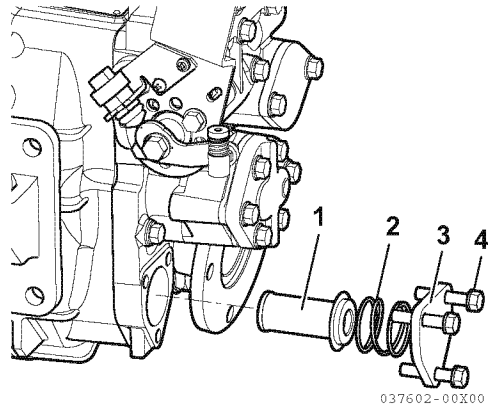


Figure 2

4. Remove three M8 × 40 bolts (4, **Figure 2**) and washers.
5. Remove the cover (3, **Figure 2**), spring (2, **Figure 2**) and oil strainer (1, **Figure 2**).
6. Check the cover gasket for damage. Replace if necessary.

*Note: The oil strainer (1, **Figure 2**) must be washed with clean oil whenever the oil is changed.*

7. Install the oil strainer, spring, gasket and cover.
8. Tighten the cover bolts to 18.6 - 20.6 N·m (13.7 - 15.2 ft-lb).

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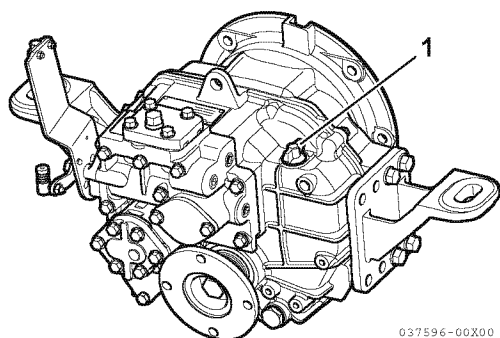


Figure 3

9. Remove the dipstick (1, **Figure 3**). Fill with the following quantities of oil, and add the amount required for oil cooler and pipelines.

NOTICE

Avoid engine damage. Never overfill the marine gear. The oil level must be between the upper and lower level marks on the dipstick.

- Quantities of oil: See *Technical Data* on page M77522-02-05-00.
 - Type of oil: See *Recommended Oil (Type of Oil)* on page M77522-03-01-00.
10. After filling the marine gear with oil, reinstall the dipstick and hand-tighten. Over-tightening may damage the cap.
 11. Perform a trial run after the oil change.
 12. Ensure the shift lever is in the NEUTRAL position.

13. Start the engine. Let the engine idle with the shift lever in the NEUTRAL position for several minutes. This will ensure the oil is distributed to all pipelines and the oil cooler.
14. Stop the engine. Wait at least 10 minutes for the oil to drain back into the sump.
15. Check oil level. See *Checking Oil Level on page M77522-03-01-00*. If necessary, add oil until the level reaches the upper mark on the dipstick. Check the oil level again after operating the marine gear for a short period of time.

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Changing the Electric Trolling Valve Oil Filter Element (If Equipped)

1. Remove four mounting bolts (1, **Figure 4**) from electric trolling valve (2, **Figure 4**).

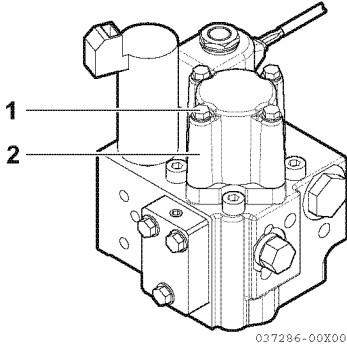


Figure 4

2. Remove filter element housing (3, **Figure 5**).

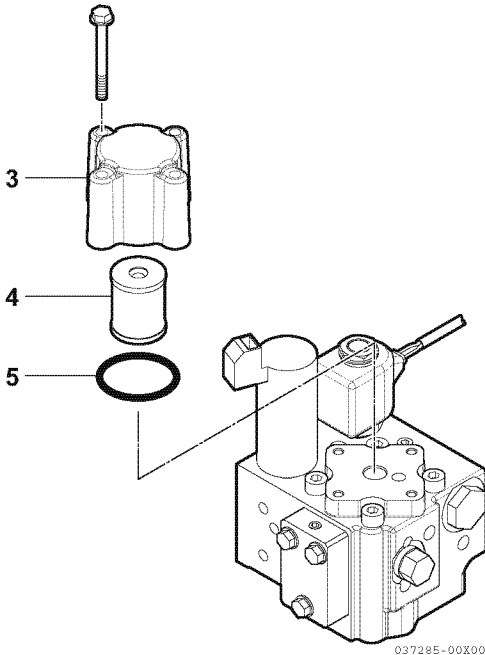


Figure 5

3. Remove filter element (4, **Figure 5**).
4. Remove and replace O-ring (5, **Figure 5**).
5. Install new filter element.
6. Installing filter element housing.
7. Install four mounting bolts.

Every 250 Hours of Operation

Perform the following maintenance every 250 hours of operation or yearly, whichever comes first.

- **Changing the Marine Gear Oil and Cleaning the Marine Gear Oil Strainer**
- **Changing the Electric Trolling Valve Oil Filter Element (If Equipped)**

Changing the Marine Gear Oil and Cleaning Strainer

See *Changing the Marine Gear Oil and Strainer*.

Changing the Electric Trolling Valve Oil Filter Element (If Equipped)

See *Changing the Electric Trolling Valve Oil Filter Element (If Equipped)*.

04	MAINTENANCE LONG-TERM STORAGE	No. 04-05-00	Page 1/1
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If the marine gear is stored for six months or longer, oil should be added through the dipstick hole to full mark to protect the unit from corrosion.

Drain seawater from the cooling system, including the gear oil cooler.

Before operating the marine gear after a long-term storage, the marine gear oil must be changed. See *Changing the Marine Gear Oil and Strainer* on page M77522-04-04-00.

05	TROUBLESHHTING	No. 05-01-00	Page 1/3
	TROUBLESHOOTING CHART		

In case of trouble, first check if all items of the mounting and operating instructions have been completed.

The subsequent tables will assist you in troubleshooting.

No.	Problem	Possible Cause	Solution
1	Transmission cannot be shifted	Shifting lever is loose.	Tighten clamping bolt on shifting lever.
		Remote control does not permit lever travel required for testing.	Remove remote control. If gears can be shifted by hand, repair remote control.
		Remote control faulty.	Repair remote control.
		No shifting pressure available.	Refer to No.7.
2	Delayed shift time	Shift linkage misadjusted; not allowing full engagement.	Remove remote control. If gears can be shifted by hand, repair remote control. If the transmission cannot be shifted correctly by hand, replace the control block.
3	Clutch is slipping, i.e. propeller speed too low for engine speed	Incorrect oil used.	Drain oil, refill with specified oil, flush transmission while engine runs in NEUTRAL position, drain oil and refill transmission.
		Oil contains water.	Refer to No. 9.
		Shifting pressure too low.	Refer to No. 6.
		Wear on clutch disks.	Disassemble transmission, replace clutch disks.
		Piston rings in clutch are damaged.	Disassemble transmission, replace clutch.
4	Transmission locked in gear	Seal ring on input shaft or support shaft in case plate is faulty.	Remove case plate, replace seal ring. If case plate is worn, replace.
		Warped disks due to overheating of slipping clutch.	Refer to No.3.
		Plain bearings on input or support shaft have failed.	Disassemble transmission, repair if possible or replace transmission.
5	Output shaft turns in NEUTRAL position	Rotary valve in casing is worn.	Replace rotary valve.
		Faulty plain bearing on input or support shaft.	Disassemble transmission and input or support shaft, replace bearing and other damaged parts.
		Warped disks due to overheating of slipping clutch.	Refer to No. 3.

05
TROUBLESHOOTING
TROUBLESHOOTING CHART

No.

05-01-00

Page

2/3

No.	Problem	Possible Cause	Solution
6	Shifting pressure too low	Oil strainer clogged.	Wash strainer or replace.
		Oil level in transmission too low.	Fill with oil. In case of oil loss, check transmission, cooler and pipelines for leakage and repair. Refer to No. 10 through No. 13.
		Oil pump is worn out.	Replace oil pump.
		Spring in shifting pressure relief valve is broken.	Replace spring.
		Seal rings on input shaft or support shaft are faulty.	Remove case plate, replace seal ring. If case plate is worn, replace.
		Throttle valve for shifting pressure is broken.	Replace throttle valve.
		Piston rings in clutch are faulty.	Disassemble transmission. Replace clutch.
		Choke port at modulator valve obstructed.	Wash the modulator valve.
7	No shifting pressure available	Direction of engine rotation does not agree with arrow on transmission.	Replace with engine that has correct rotation.
		No oil in the transmission.	Refill with oil.
		Strainer is dirty.	Clean or replace oil strainer.
		Oil level in transmission is too low.	Fill with oil. In case of oil loss, check transmission, cooler and pipelines for leakage and repair. Refer to No. 10 through No. 13.
		Oil pump is worn out.	Replace oil pump.
		Spring in shifting pressure relief valve is broken.	Replace spring.
		Throttle valve for shifting pressure is broken.	Replace throttle valve.
8	Excessive oil temperature	Excessive oil in transmission.	Remove excess oil with commercial suction pump.
		Oil cooler is dirty on water side.	Clean oil cooler on water side.
		Worn oil pump.	Replace oil pump.
		Seal rings on input shaft or support shaft are faulty.	Remove case plate, replace seal ring. If case plate is worn, replace.
		Clutch is slipping.	Refer to No.3.
		Clutch does not open completely due to worn disc support.	Separate transmission and coupling. Replace inner disc support and / or clutch.

05	TROUBLESHHTING TROUBLESHOOTING CHART	No. 05-01-00	Page 3/3
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No.	Problem	Possible Cause	Solution
9	Water in the oil, oil looks milky	Oil cooler faulty.	Repair leakage at cooler or replace cooler.
		High water level in engine compartment, water entering through output shaft seal.	Investigate cause for water level in engine compartment. Repair cause. Replace transmission.
10	Oil leakage at output shaft	Breather clogged.	Remove contamination from breather.
		Shaft seal faulty.	Disassemble transmission. Replace seal. If seal location on output shaft is worn, seal lip should be mounted offset.
11	Oil leakage at breather	Excessive oil in transmission.	Remove excess oil with commercial suction pump.
12	Oil leakage at joints	Bolts are loose.	Tighten bolts to specified torque.
		Seals on bolts have been damaged.	Replace seals, tighten used bolts to specified torque.
		Mating faces are contaminated, no surface seal applied.	Unscrew case halves, finish mating surfaces with oilstone or finishing file, apply surface seal. Assemble transmission, tighten bolts to specified torque.
13	Transmission noise becomes louder	Oil level too low - pump sucks in air.	Fill with oil to marking on dipstick.
		Damage to flexible coupling due to misalignment between engine and transmission.	Replace flexible coupling. Check alignment between engine and transmission.
		Bearing damage in transmission, e.g. due to torsional vibrations, running without oil, overload, wrong alignment of transmission, excessive engine output.	Disassemble transmission, replace bearings if damaged and other faulty parts. Find causes and repair.
		Gear damage, e.g. due to torsional vibrations, running without oil, overload.	Disassemble transmission, remove faulty parts.
		Oil suction cover in transmission is loose.	Disassemble transmission, tighten oil suction cover.
14	Chattering transmission noise mainly at low engine speed	Misaligned jack shaft on input or output.	Mount and align jack shaft strictly according to instructions issued by jack shaft manufacturer.

06	SPECIFICATIONS GENERAL SPECIFICATIONS	No. 06-01-00	Page 1/1
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Item		Specification				
		KMH40A	KMH41A	KMH50A	KMH50A-3	KMH51A
Type		Down angle hydraulic				
Angle		8°				
Maximum Input Torque		457 N·m (337 ft·lb)	316 N·m (233 ft·lb)	684 N·m (505 ft·lb)	684 N·m (505 ft·lb)	457 N·m (337 ft·lb)
Maximum Input Speed		5500 min ⁻¹		4225 min ⁻¹		
Reduction Ratio (F/R)		-	2.62/2.62	-	-	2.60/2.6
		2.45/2.45	2.45/2.45	2.43/2.43	2.43/2.43	2.43/2.43
		2.04/2.04	2.04/2.04	2.13/2.13	2.13/2.13	2.13/2.13
		1.53/1.53	1.53/1.53	1.67/1.67	1.67/1.67	1.67/1.67
		1.24/1.24	1.24/1.24	-	-	-
Direction of Rotation	Input	Counterclockwise viewed from stern				
	Output	Clockwise or counterclockwise viewed from stern				
Lubrication		Forced lubrication				
Oil Capacity		1.7 L (1.8 qt)		2.0 L (2.1 qt)		
Input Speed While Shifting the Clutch	Ahead/Astern Shift	1000 or less min ⁻¹				
Mechanical-Type (A2) Trolling (Option)	Max Input Speed While Trolling	850 or less min ⁻¹ (Continuation time ≤30 min)				
	Controllable Output Range	0 min ⁻¹ , 50 min ⁻¹ to slip ratio 50% *1				
C-Type Trolling (Option) (For VCS Type Engine)	Max Input Speed While Trolling	-	850 or less min ⁻¹ (Continuation time ≤30 min)		-	
	Controllable Output Range	-	0 min ⁻¹ , 50 min ⁻¹ to slip ratio 20% *1		-	
PTO (Option)	Flange Size	SAE#A				
	Permissible Torque	120 N·m				
	Permissible Weight	2.5 kg				
	Permissible Length	110 mm				
Shift	Mechanical	49 N or less (Cable direction)				
	Electrical (Option)	Solenoid voltage: DC12				
Bellhousing Size		Borg warner or SAE #4 Size	Borg warner Size	Borg warner or SAE #4 Size	Borg warner Size	Borg warner Size
Dry Weight		29.5 kg (65 lb) without oil cooler, damper or feet		41 kg (90 lb) without oil cooler, damper or feet		

*1: This value is target value based on the load of propeller law calculated by multiplier of three. Therefore this value may be changed due to the hull, shipment and weather condition.

06	SPECIFICATIONS OUTLINE DRAWINGS	No. 06-02-00	Page 1/13
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KMH40A for 4LHA with Mechanical Shift

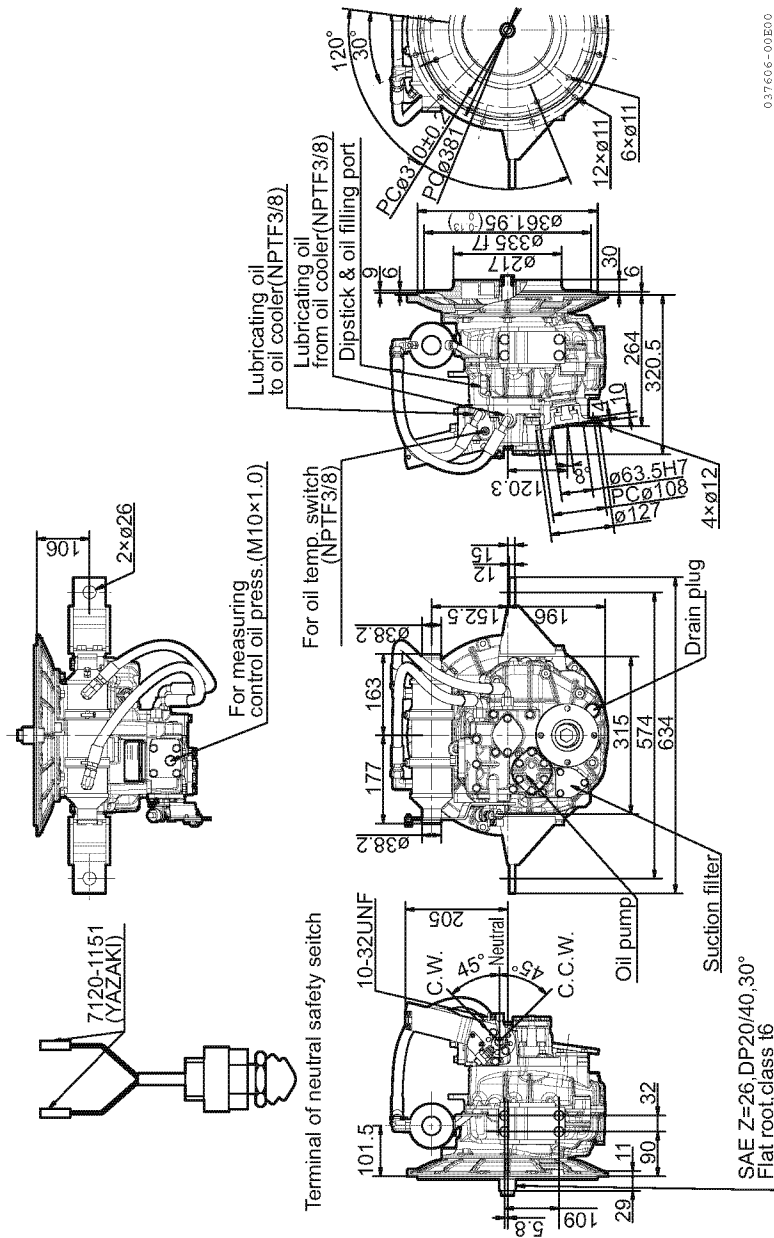


Figure 1

KMH40A for 4LHA with Electric Shift

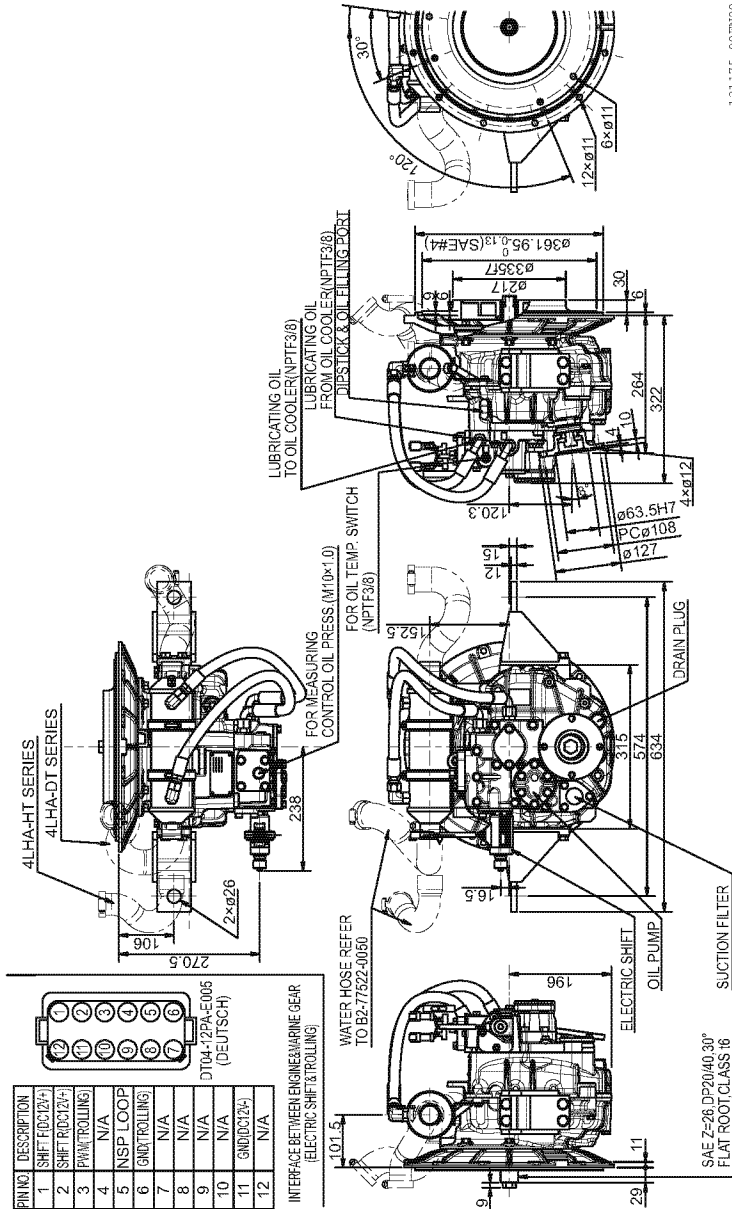
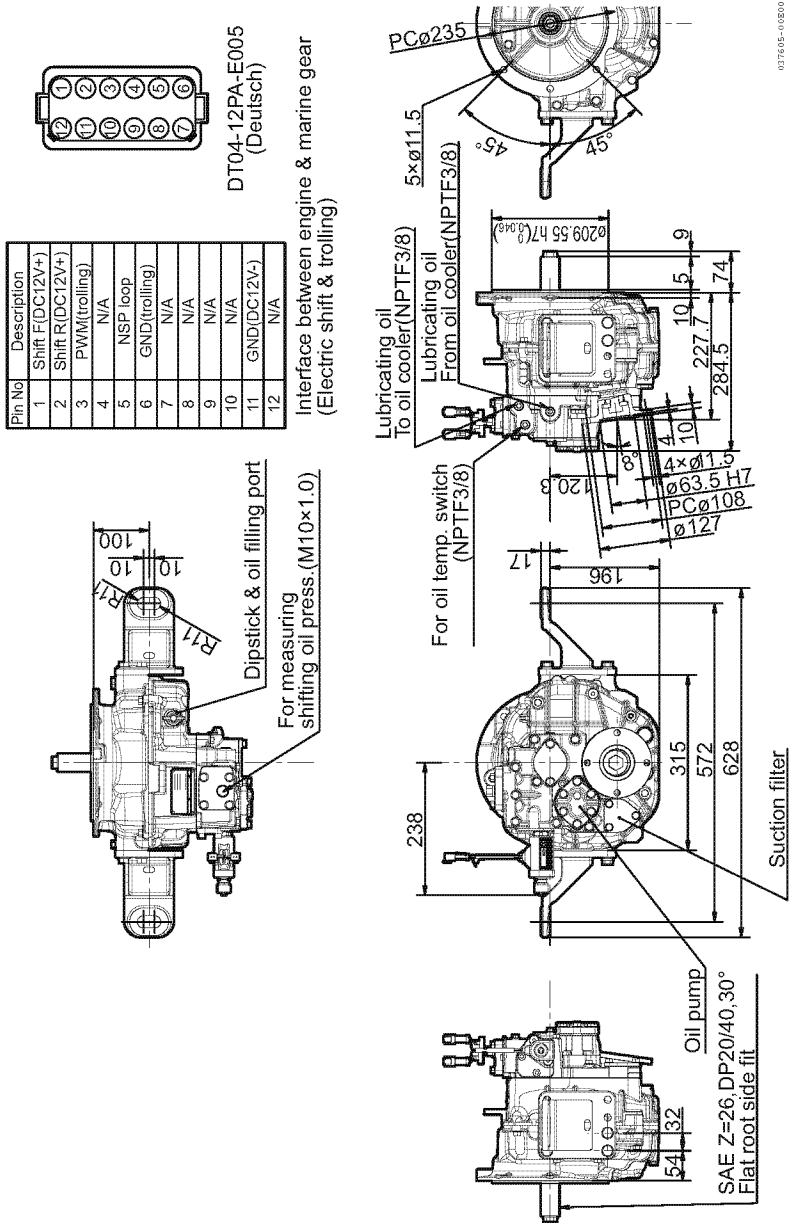


Figure 2

KMH41A for 4BY3 with Electric Shift



037605-00000

Figure 4

06	SPECIFICATIONS OUTLINE DRAWINGS	No. 06-02-00	Page 6/13
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KMH50A for 8LV with Electric Shift

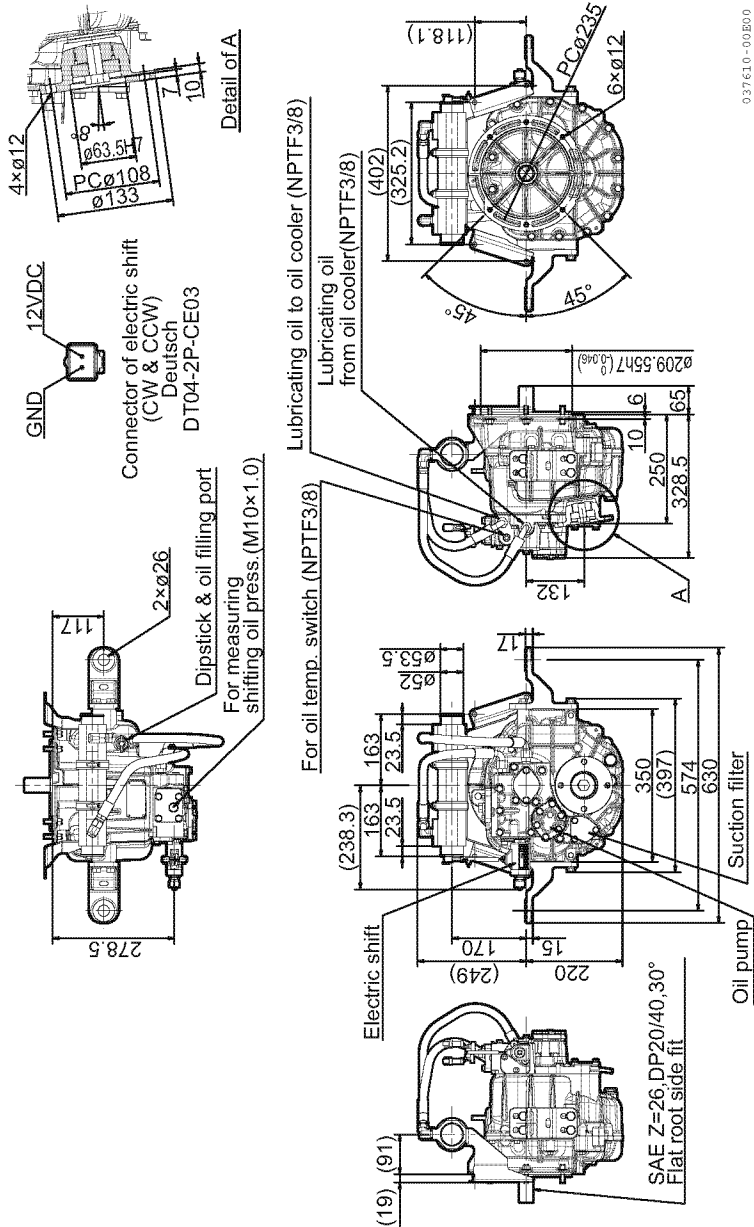


Figure 6

KMH50A for 6LPA with Mechanical Shift

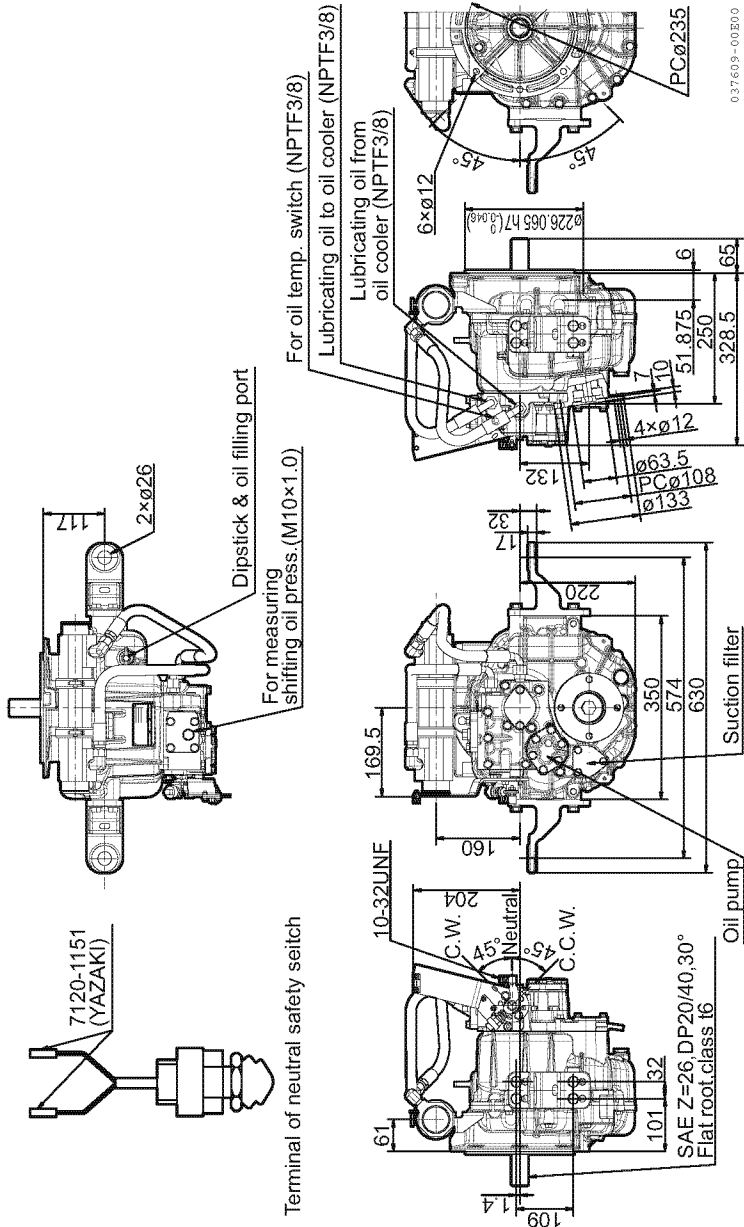


Figure 8

KMH50A-3 for 4LV with Mechanical Shift

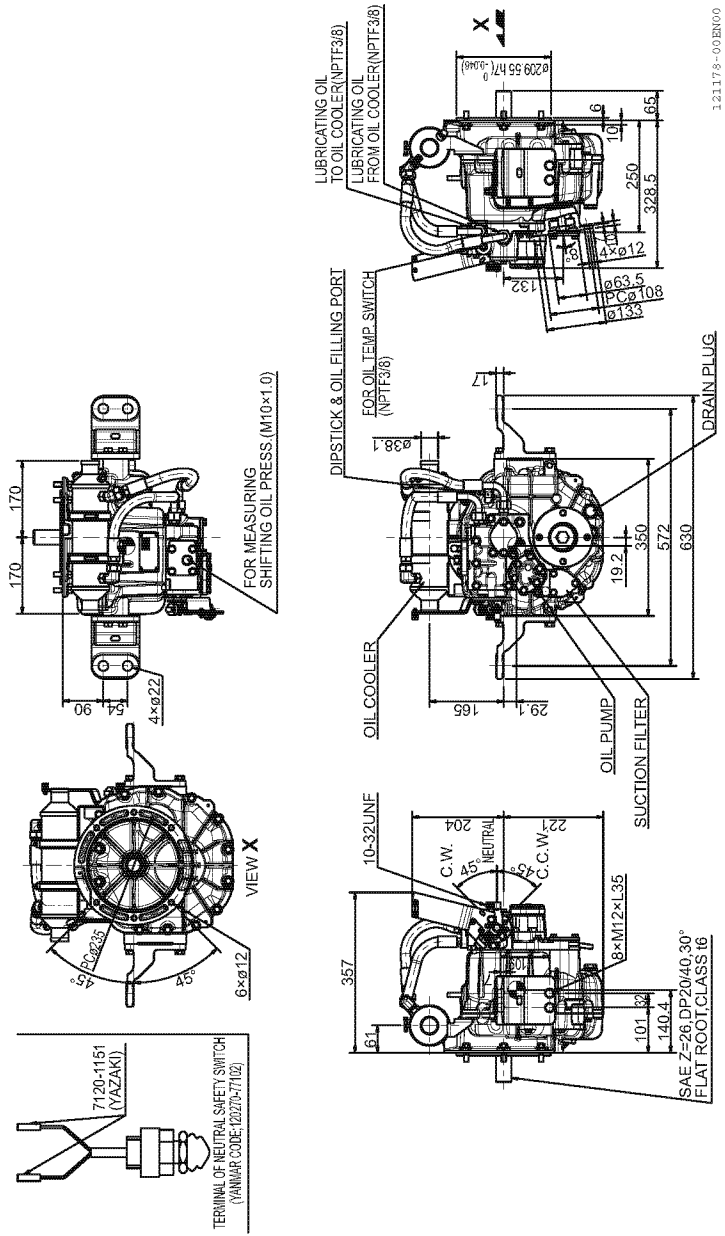


Figure 9

KMH50A-3 for 4LV with Electric Shift

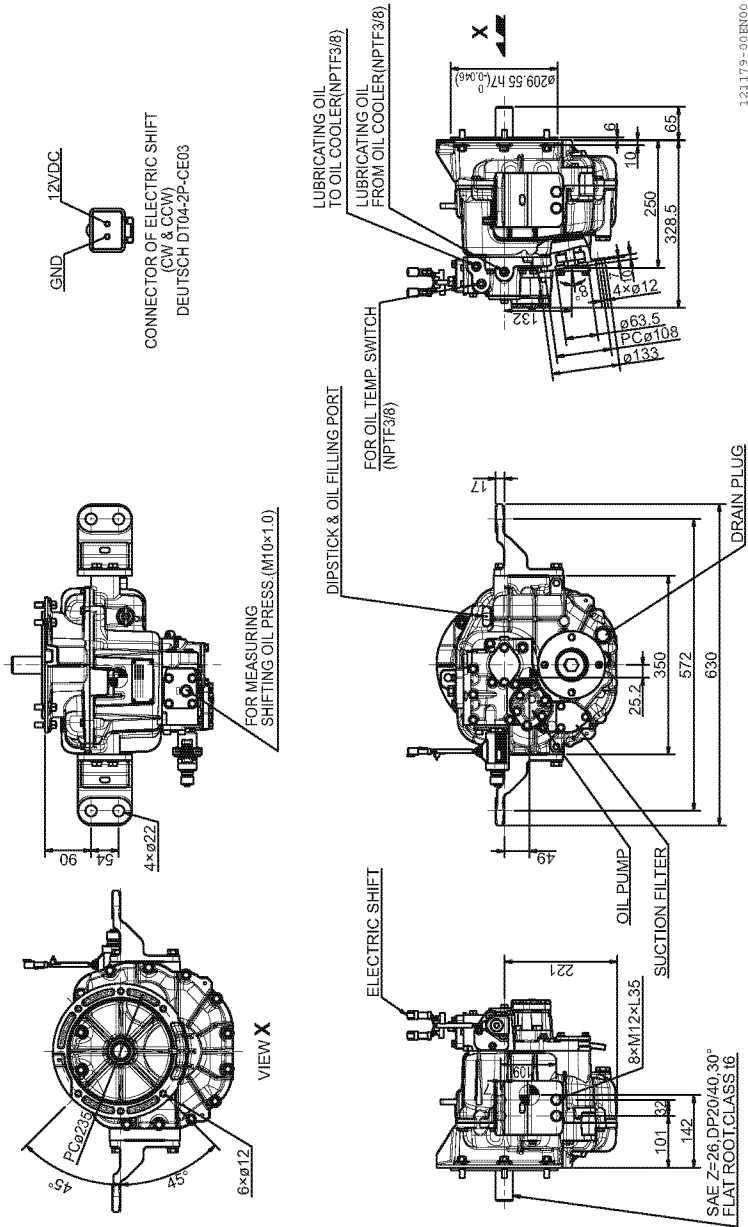


Figure 10

KMH50A for M1VD-V with Electric Shift

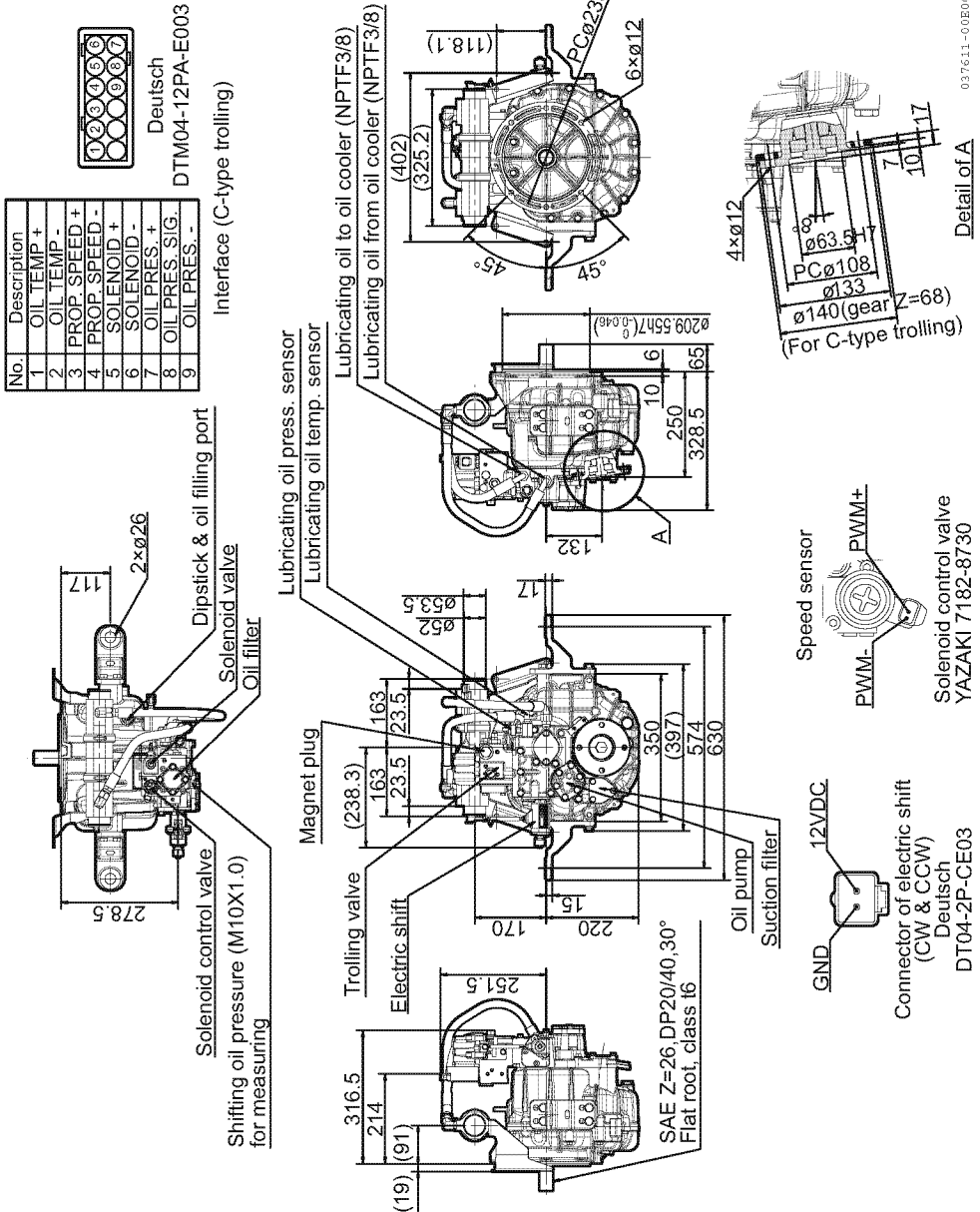


Figure 11

06	SPECIFICATIONS OUTLINE DRAWINGS	No. 06-02-00	Page 12/13
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KMH51A for 6BY3 with Mechanical Shift

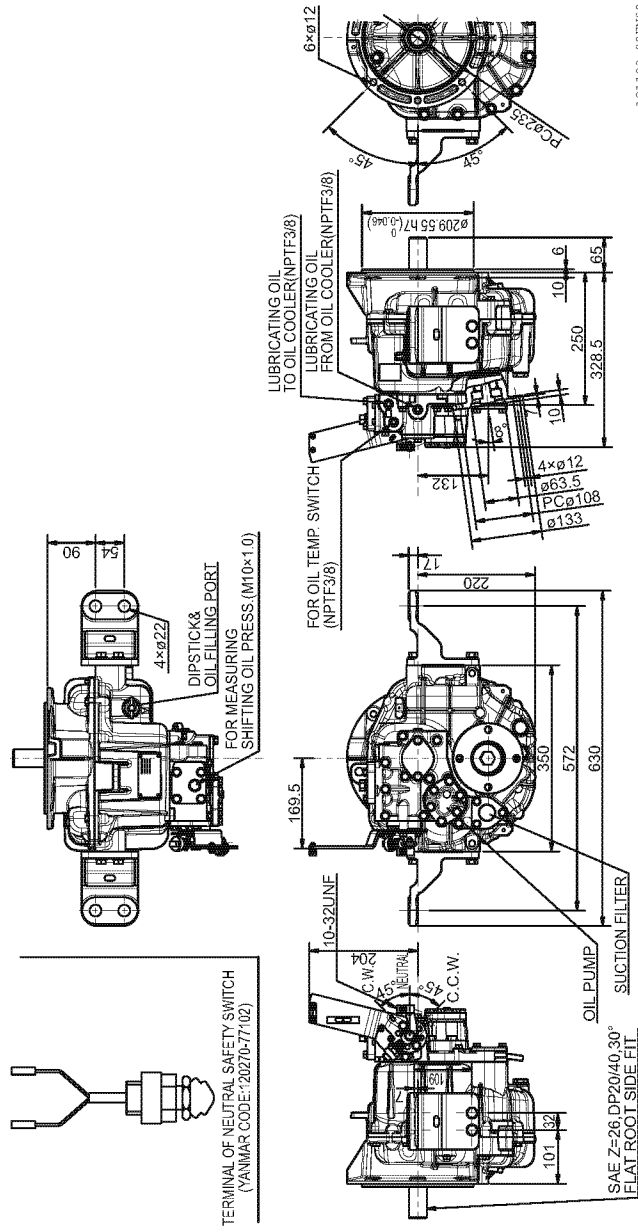


Figure 12

KMH51A for 6BY3 with Electric Shift

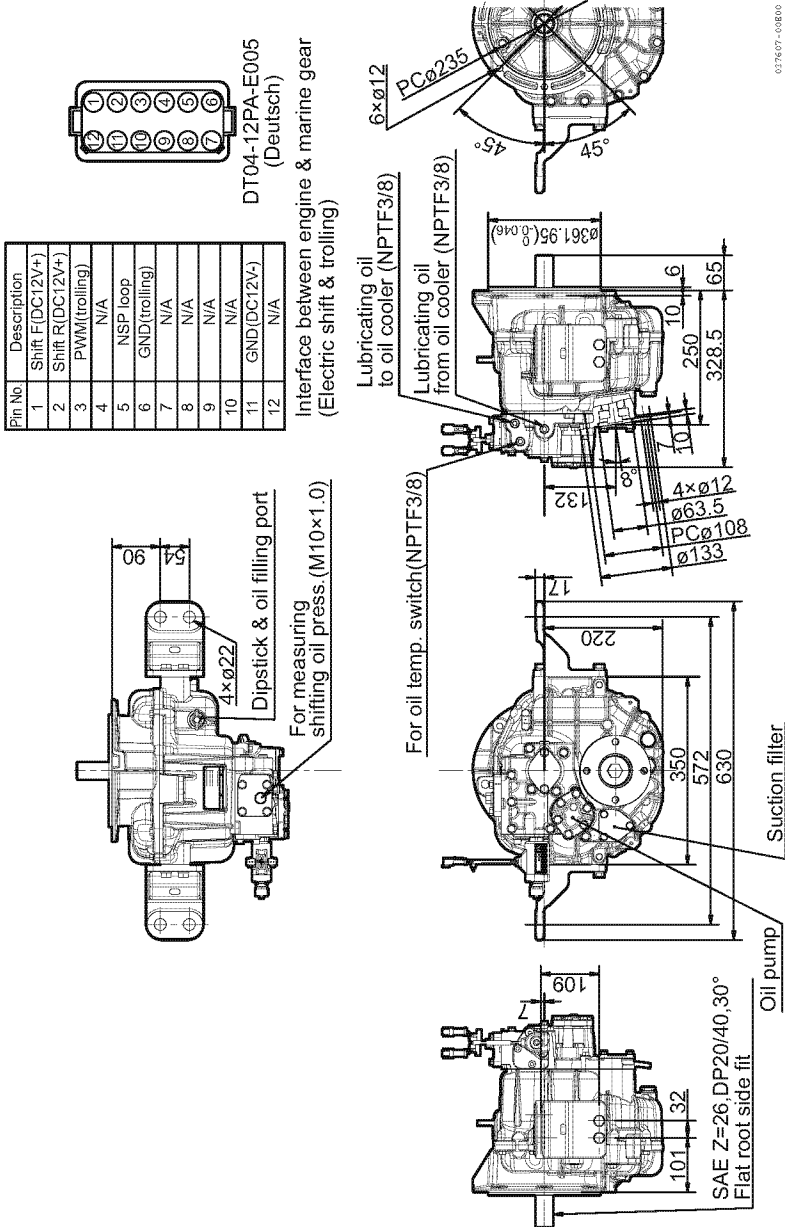


Figure 13

Flange size SAE standard (Type A) (Option)

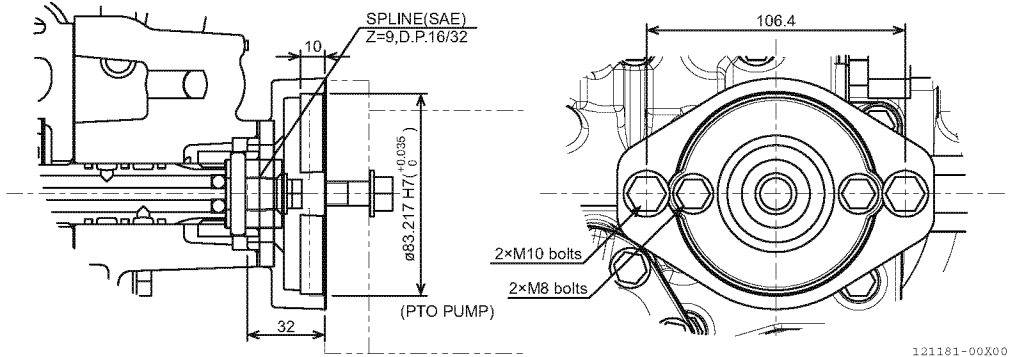


Figure 1

PTO Specification

Item	Unit	Specification
Flange size	-	SAE#A
Permissible torque	N·m	120
Permissible weight	kg	2.5
Permissible length	mm	110

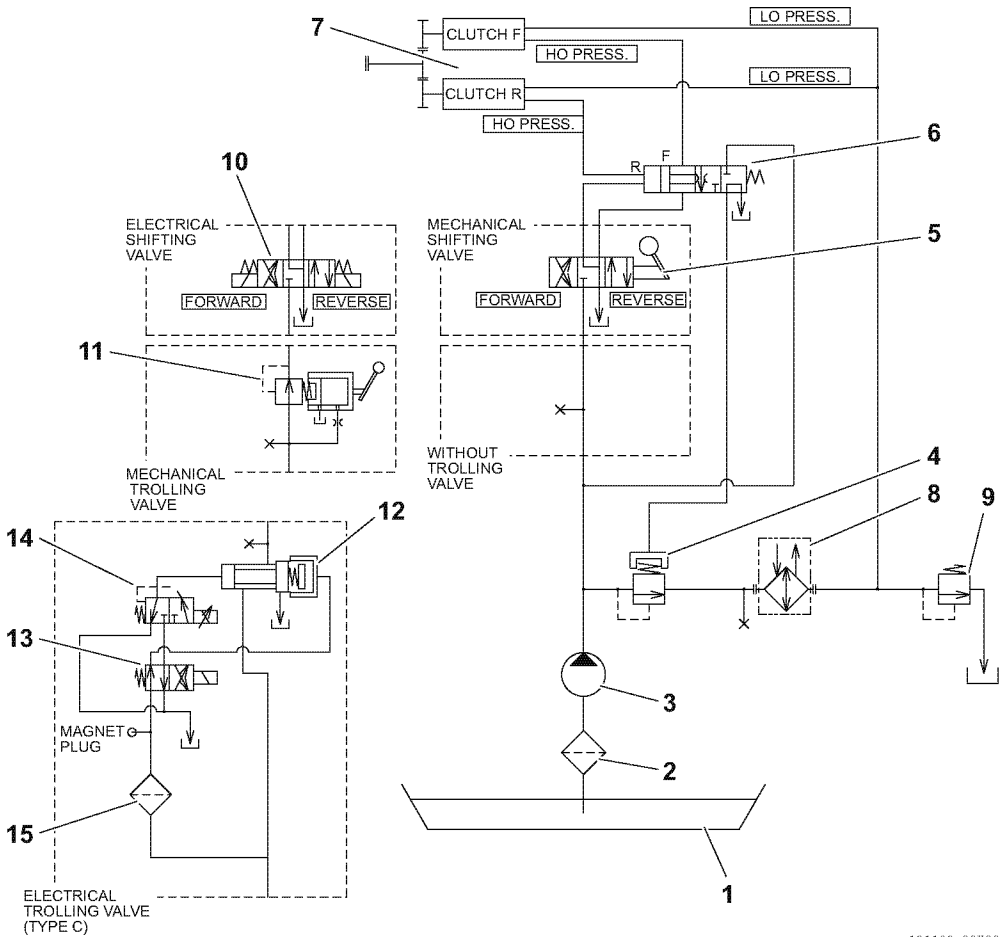


Figure 1

06	SPECIFICATIONS HYDRAULIC CIRCUIT DIAGRAM	No. 06-04-00	Page 2/2
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No.	Names of parts	No.	Names of parts
1	Case (Oil pan)	9	Lubricating oil pressure regulating valve
2	Lubricating oil suction strainer (150 mesh)	10	Ahead/astern selector valve (Electrical type) (Option)
3	Hydraulic oil pump	11	Trolling valve (Mechanical type) (Option)
4	Hydraulic oil pressure regulating valve	12	Pressure regulating valve (Option)
5	Ahead/astern selector valve (Mechanical type)	13	Proportional electromagnetic valve (Option)
6	Hydraulic oil pressure throttle valve	14	Direct-drive electromagnetic valve (Option)
7	Ahead/Astern clutch	15	Strainer (10μ) (Option)
8	Lubricating oil cooler		

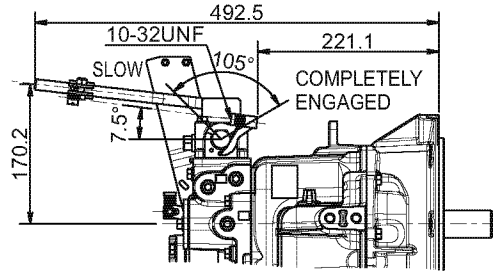
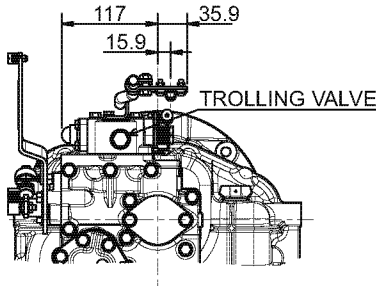
Lubricating oil is sucked up from the oil pan with the lubricating oil pump via the suction strainer.

After pressure is adjusted by the hydraulic oil pressure-regulating valve, lubricating oil is sent to each clutch with the ahead/astern selector valve.

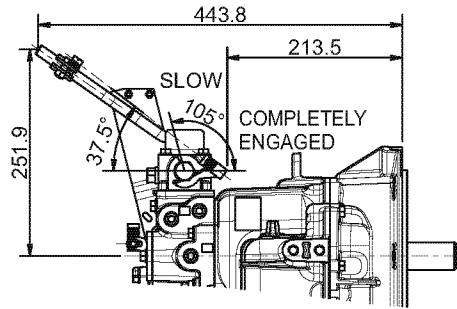
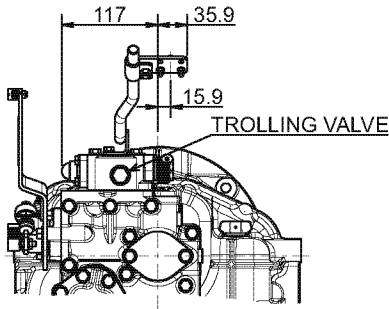
The pressure of remaining oil that is not sent to the clutches is adjusted with lubricating oil pressure-regulating valve. The adjusted oil lubricates the clutch bearing bush and roller bearings. The gears are to be lubricated with oil spray.

06	SPECIFICATIONS	No.	Page
	TROLLING DEVICE	06-05-00	1/2

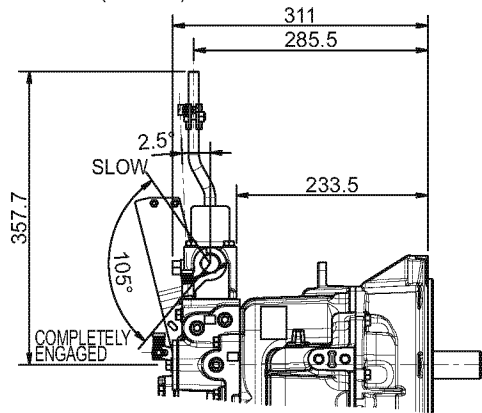
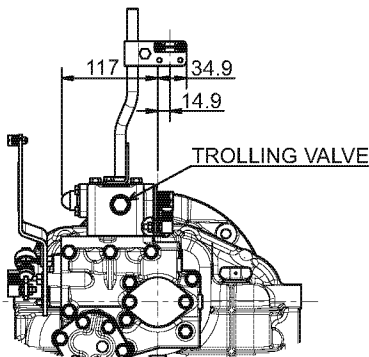
Mechanical Trolling Type (Type1, Type2, Type4)



MECHANICAL TROLLING (TYPE 1)



MECHANICAL TROLLING (TYPE 2)

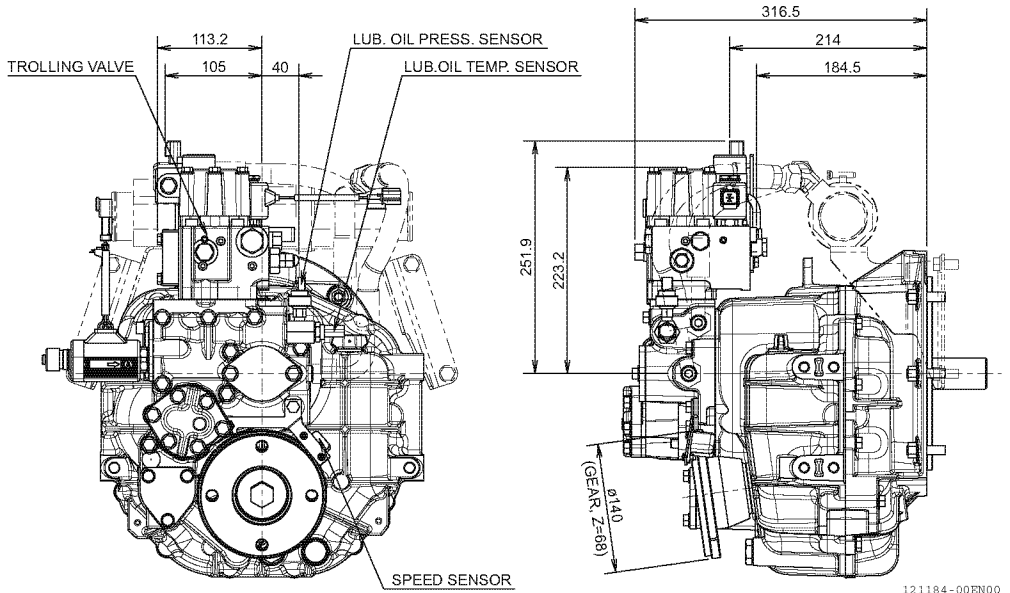


MECHANICAL TROLLING (TYPE 4)

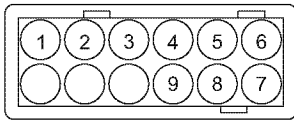
121183-00EN00

Figure 1

Electrical Trolling Type for VCS (Type C)



121184-00EN00

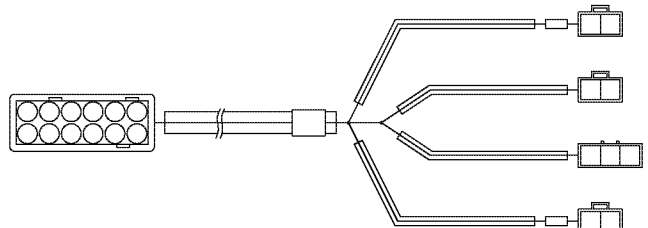


DEUTSCH DTM04-12PA-E003

No.	DESCRIPTION
1	OIL TEMP +
2	OIL TEMP -
3	PROP. SPEED +
4	PROP. SPEED -
5	SOLENOID +
6	SOLENOID -
7	OIL PRES. +
8	OIL PRES. SIG.
9	OIL PRES. -

121185-00X00

INTERFACE



121186-00X00

Harness for VCS (accessory part)

Figure 2

07	OPTIONAL ACCESSORIES	No.	Page
	OPTIONAL ACCESSORIES	07-01-00	1/1

The optional accessories include the following:

- ELECTRIC SHIFT VALVE
- TROLLING VALVE
- PTO SPLINE SLEEVE AND FLANGE

For installation of the optional accessories, contact your authorized YANMAR dealer or distributor.

PTO SPLINE SLEEVE AND FLANGE

By installing the PTO output port in the rear portion of the marine gear input shaft, engine power can be taken off to drive the pump, etc... The PTO output port complies to the SAE standard (type A).

ELECTRIC SHIFT VALVE

The electric shift valve can electrically switch to forward, neutral, and reverse.

TROLLING VALVES

By decreasing the propeller speed lower than the propeller speed at the engine low idling, the trolling valve can operate the boat at low speed. The trolling valve has a mechanical trolling valve and an electric trolling valve.

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