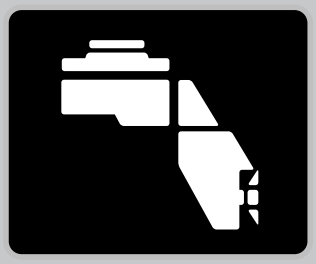
YAMAHA



DE-DHD

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STERN DRIVE SERVICE MANUAL

070027

6U3-28197-ZH-11

NOTICE

This manual has been prepared by Yamaha primarily for use by Yamaha dealers and their trained mechanics when performing maintenance procedures and repairs to Yamaha equipment. It has been written to suit the needs of persons who have a basic understanding of the mechanical and electrical concepts and procedures inherent in the work, for without such knowledge attempted repairs or service to the equipment could render it unsafe or unfit for use.

Because Yamaha has a policy of continuously improving its products, models may differ in detail from the descriptions and illustrations given in this publication. Use only the latest edition of this manual. Authorized Yamaha dealers are notified periodically of modifications and significant changes in specifications and procedures, and these are incorporated in successive editions of this manual.

STERN DRIVE
SERVICE MANUAL

1st Edition, November 2005

Printed in Japan.

HOW TO USE THIS MANUAL

MANUAL FORMAT

This manual provides the mechanic with descriptions of the operations of disassembly, repair, assembly and inspection, each of which is presented in a sequential, step-by-step procedure.

To assist you in finding your way around this manual, the section title and major heading is given at the head of each page.

A table of contents is provided on the first page of each section.

ILLUSTRATIONS

Some illustrations in this manual may differ from the model you have. This is because a procedure described may relate to several models, though only one is illustrated. (The name of the model described will be mentioned in the description).

To help you identify components and understand the correct procedures of disassembly and assembly, exploded diagrams are provided. Steps in the procedure are numbered: 1), 2), 3). Parts shown in the illustrations are identified as: ①, ②, ③.

REFERENCES

These have been kept to a minimum. References to other sections of the manual include the relevant page number.

WARNINGS, CAUTIONS AND NOTES

Attention is drawn to the various warnings, cautions and notes that distinguish important information in this manual in the following ways.

⚠ The Safery Alert Symbol means ATTENTION! BECOME ALERT! YOUR SAFETY IS INVOLVED!

⚠ WARNING

Failure to follow WARNING instructions could result in severe injury or death to the marine vehicle operator, a bystander, or a person inspecting or repairing the Stern Drive.

CAUTION:

A CAUTION indicates special precautions that must be taken to avoid damage to the Stern Drive.

NOTE:

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

CONSTRUCTION OF THIS MANUAL

This manual consists of chapters for the main categories of subjects. (See "Symbols" on the next page.)

1st title ① : This is a chapter with its symbol on the upper right of each page.
2nd title ② : This title appears on the top of each page, to the left of the chapter symbol.
3rd title ③ : This title appears only in the chapter "Periodic inspection and adjustment".

All the procedures in this manual are organized in a sequential, step-by-step order. The information has been compiled to provide the mechanic with an easy-to-read, handy reference that contains comprehensive explanations of all disassembly, inspection, repair, and assembly procedures.

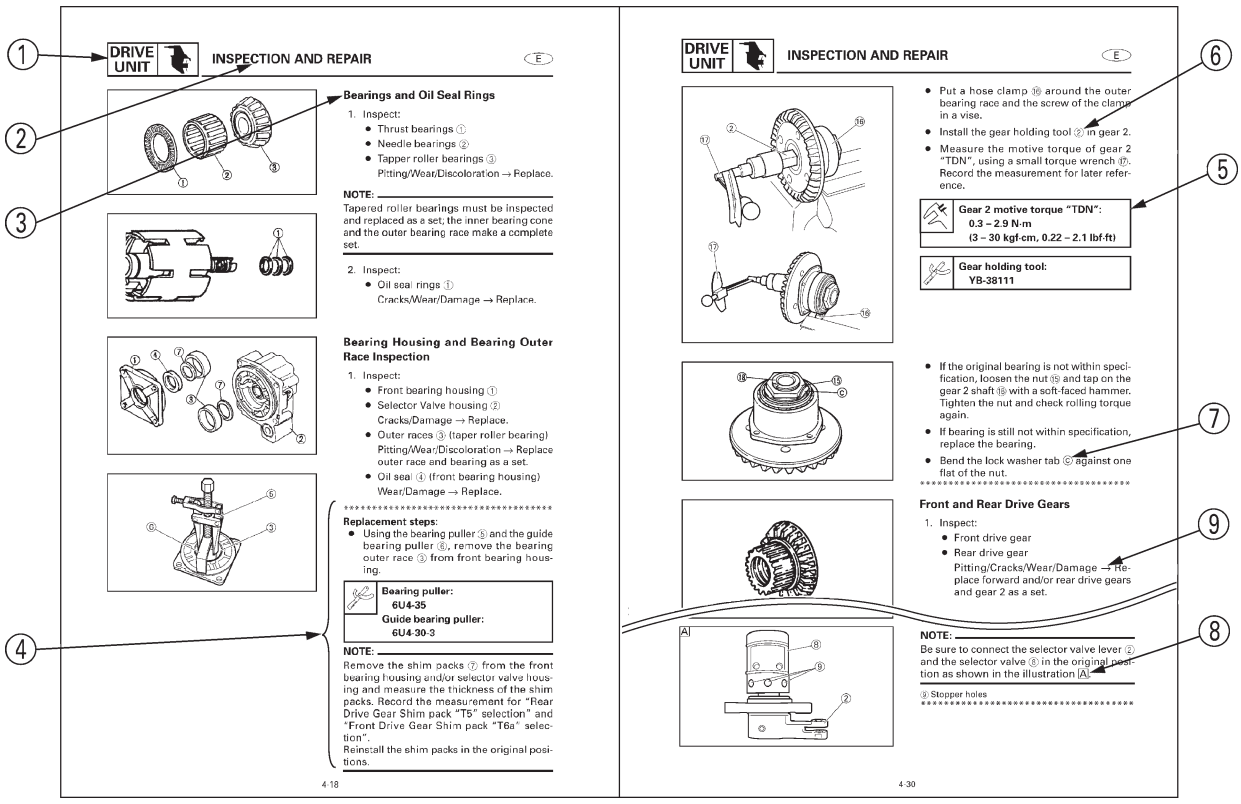
A particularly important procedure ④ is framed by two lines of asterisks "*" and each step of the procedure is preceded by " ● ".

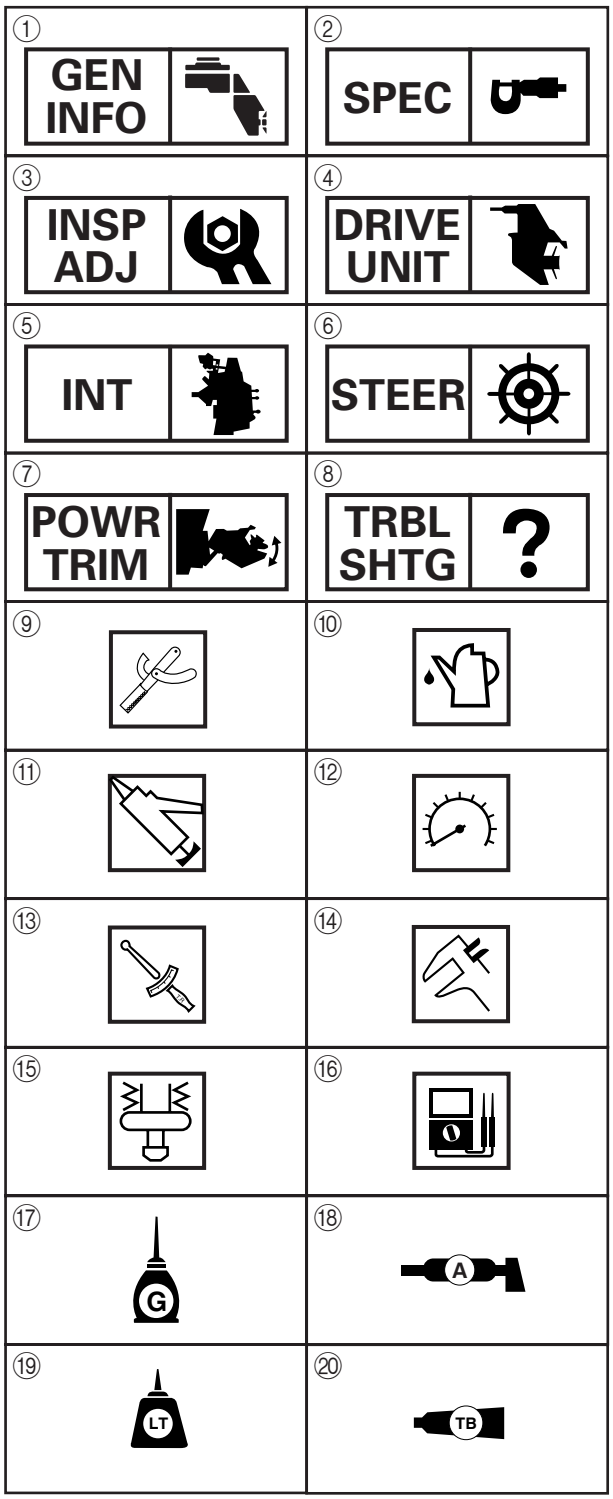
IMPORTANT FEATURES

- Important engine data and information about special tools are framed in a box together with an illustrative symbol ⑤.
- A circled numeral ⑥ indicates a part name. A circled lower case letter indicates data or an alignment mark ⑦. Illustrations are sometimes labeled with an upper case letter ⑧.
- An arrow ⑨ indicates the course of action required to remedy the stated condition of a component.

EXPLODED DIAGRAM

Each chapter begins with exploded diagrams which facilitate correct disassembly and assembly.





SYMBOLS

Symbols ① to ⑧ are designed as thumb-tabs and indicate the content of a chapter.

① General information
② Specification
③ Periodic inspection and adjustment
④ Drive unit assembly
⑤ Intermediate assembly
⑥ Steering system
⑦ Power trim system
⑧ Troubleshooting

Symbols ⑨ to ⑯ indicate specific information:

⑨ Special tool
⑩ Recommended fuel
⑪ Lubricant
⑫ Engine speed
⑬ Tightening torque
⑭ Specified value, measure, limit
⑮ Press load
⑯ Resistance (Ω), voltage (V), electric current (A)

Symbols ⑰ and ⑱ in an exploded diagram indicate grade of lubricant and location of lubrication point:

⑰ Apply Yamaha gear-case lubricant
⑱ Apply water resistant grease (Yamaha marine grease A, D)

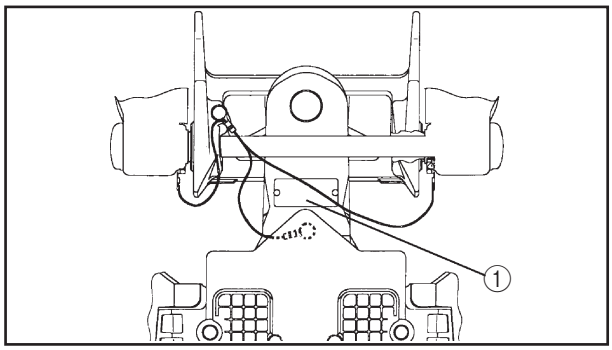
⑲ Apply LOCTITE® No.271, 242, 572,1829 or 1501
⑳ Apply Three Bond® 1322, 1324, 1524 or 1501

NOTE:

Some of the above symbols may not appear in this manual.

INDEX

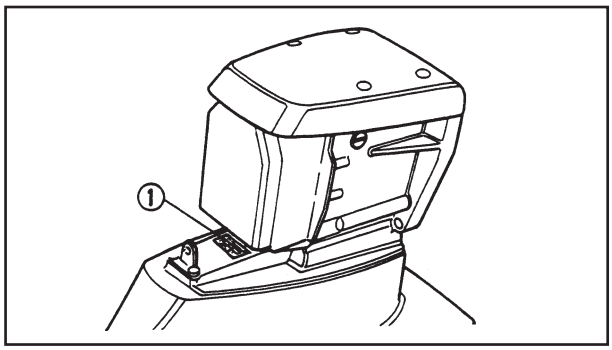
CHAPTER 1
GENERAL INFORMATION



OUTDRIVE IDENTIFICATION

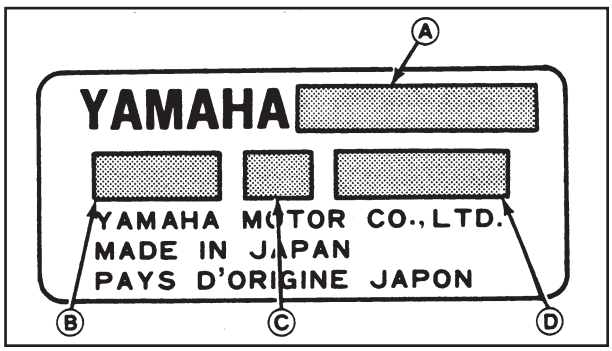
Intermediate Assembly

The model and serial number plate ① is located on the bottom surface of the intermediate housing.



Drive Unit

The model and serial number plate ① is located on the upper case of the drive unit.
The different models can be identified by checking the model and serial number plate and using the following plate.



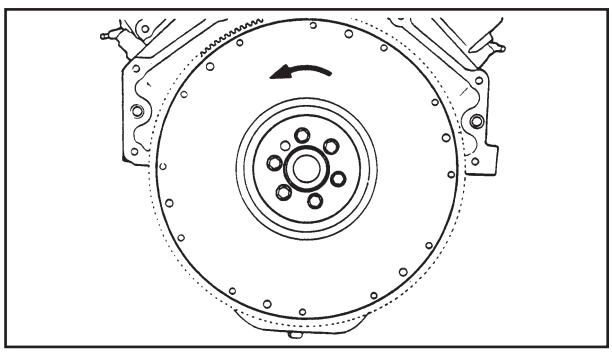
MODEL Ⓐ	PREFIX Ⓑ	VARIATION* Ⓒ	SERIAL NO. Ⓓ
INT-HDP	6U00	DP	① *******
INT-HDL	6U00	DL	
DE-DHD8D	6U3	A	② *******

① Intermediate Assembly
② Drive Unit

*Code Explanation:
A–1.50:1 Gear Ratio
P–Power Steering
L–Left Rotation
D–For Diesel Model

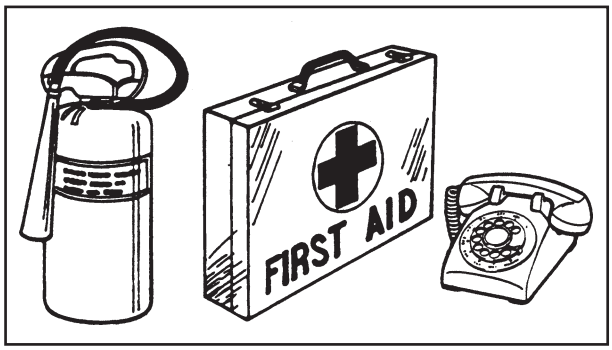
NOTE:

INT-HDP 6U0 DP *******
INT-HDL 6U0 DL *******



Propeller and Engine Rotation

DO NOT rely on propeller rotation to be in the same direction as engine rotation.
Engine rotation is determined by looking at the flywheel end of the engine. The Yamaha engines covered in this manual rotate counterclockwise to the left as viewed from the flywheel.



SAFETY PRECAUTIONS

Prepare for Emergencies

Be prepared for possible fires. Keep the following items handy:

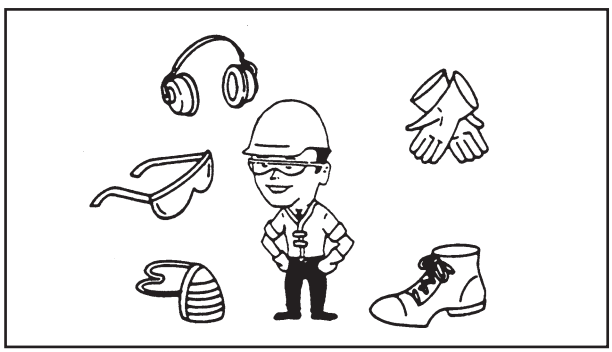
- First Aid Kit
- Fire Extinguisher
- Emergency Phone Numbers

Handle Fuel Safely

Use care when handling fuel; it is highly flammable. DO NOT smoke or have open flames or sparks nearby when handling fuel.
Always clean up spilled fuel and dispose of cleaning materials properly.

Prevent Battery Explosion

Batteries produce explosive gases. Keep sparks and flames away from batteries. Check battery electrolyte level using a flashlight.
Never check battery charge by connecting the battery posts with a conductor. Use a voltmeter or hydrometer. Always disconnect the negative (–) cable first and reconnect it last.
DO NOT charge a battery if the battery is frozen. Allow the battery to warm up first.
Charge the battery in a well-ventilated area.
Battery electrolyte is poisonous and dangerous. It contains sulfuric acid and causes severe burns. Avoid contact with skin, eyes or clothing. If electrolyte gets in the eyes, flush with water for 15 minutes and get prompt medical attention.

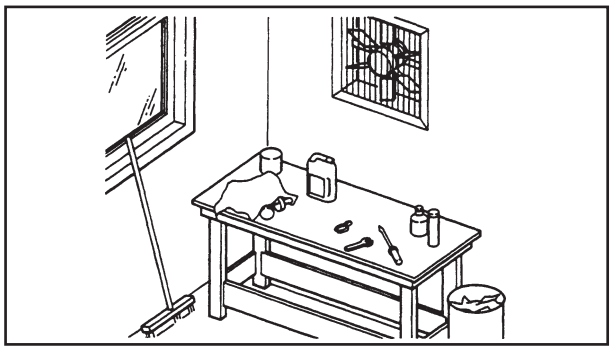


Wear Protective Clothing

Wear safety equipment whenever necessary:

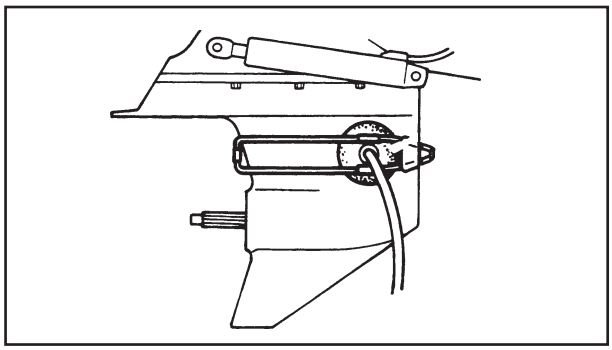
- Safety glasses or goggles
- Earmuffs or earplugs
- Safety shoes
- Gloves
- Respiratory protection

Avoid wearing loose clothing and jewelry.



Keep Work Area Clean

Properly ventilate your work area.
Keep the shop bench and floor clean and dry.
Cover all parts and part openings when they are not being worked on, to prevent foreign materials from entering and damaging the drive unit.
Cleaning and protection of machined surfaces and friction areas are part of the repair procedure; this is considered standard shop practice.

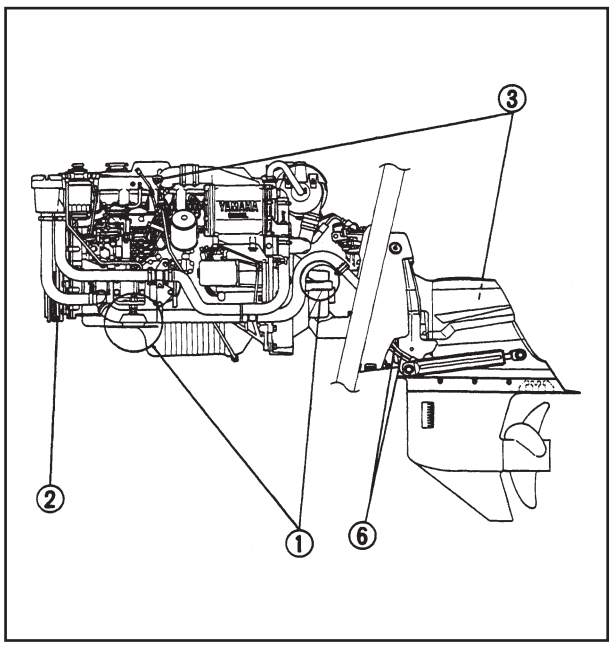


Operate Stern Drive Safely

Remove the propeller (Refer to "PROPELLER SHAFT AND NUT INSPECTION" section (P3-23).).
DO NOT operate engine without cooling water supplied to the water inlet ports on the drive unit.

PRE-DELIVERY INSPECTION

Perform the following inspections to prepare the outdrive for delivery to the customer.



Check Engine Alignment

- Use an engine alignment tool to check engine alignment. Make any adjustments as necessary. (Refer to "ENGINE ALIGNMENT" section (P3-22).)
- Make sure all engine mounting hardware ① is tight.

Inspect Drive Belts

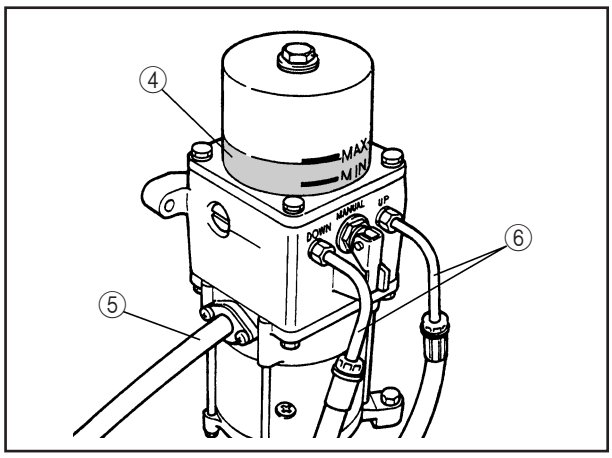
Check the tension of the alternator belts ②.

Check Gear Oil

Make sure break-in oil is at the proper level ③.

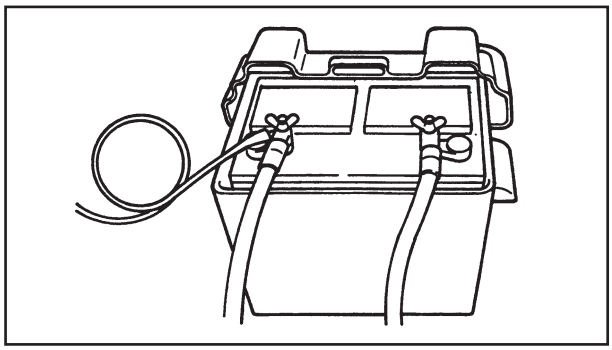
Inspect Outdrive Exterior

- Touch-up any painted surfaces with matching paint.
- Replace any parts damaged in shipping.



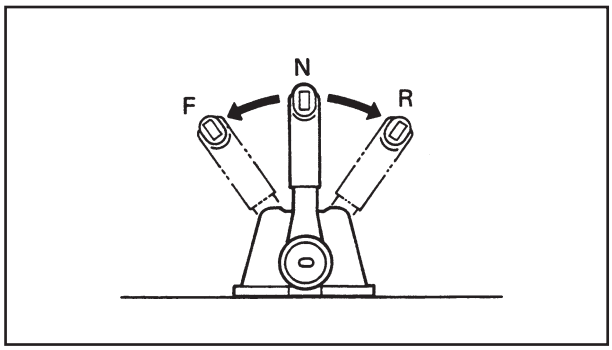
Check Power Trim System

- Check the oil level of the trim pump reservoir ④.
- Make sure all wires ⑤ and hydraulic lines ⑥ are connected properly.
- Use the trim switch to check the trim operation. Make sure lines and wire harnesses do not bind and are not interfered with when the outdrive is moved up, down, right or left.



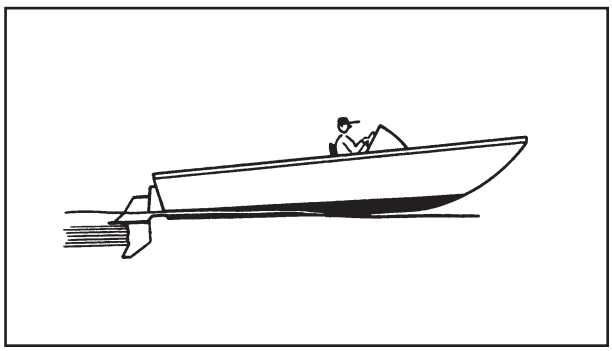
Inspect Battery and Electrical Connections

- Check the battery fluid level.
- The battery should be fully charged.
- Make sure the battery is mounted securely in the boat.
- Battery cables must be connected correctly and must be tight.
- Inspect all wire harness connections for proper contact and tightness.



Check Remote Control Operation

- Make sure the drive unit can be controlled properly from the remote control.



Perform Test Run

- Make sure gear shifting and steering is smooth.
- Check for any leaks in the transom.

Drive Unit Break-in

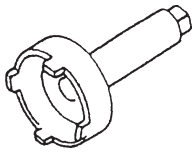
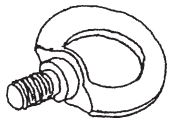
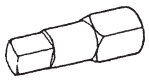
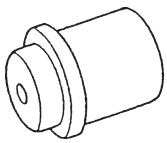
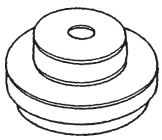
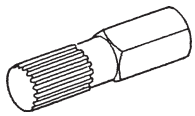
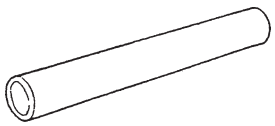
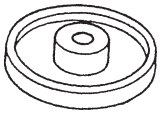
NOTE:

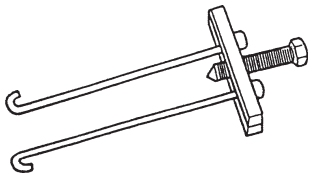
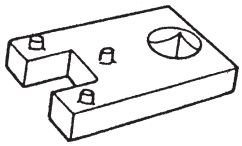
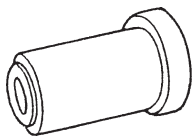
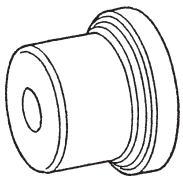
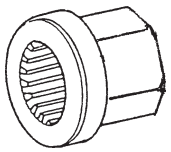
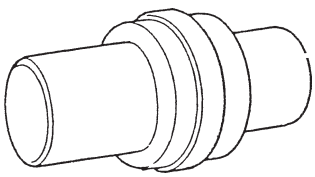
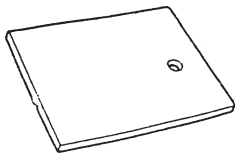
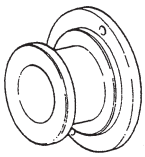
Allow a 10 hour break-in period for the drive unit. If the drive unit is new or if the drive gears have been replaced, observe the following steps to allow the gears a break-in period.

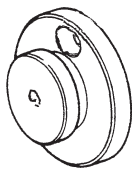
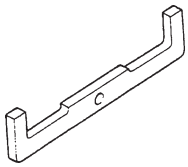
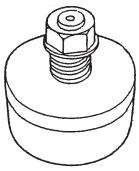
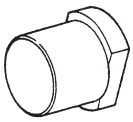
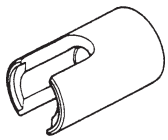
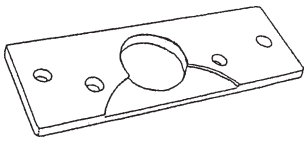
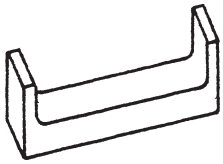
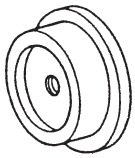
1. Avoid full throttle starts. Ease the boat into motion.
2. DO NOT operate the unit at any one steady speed for more than 5 minutes.
3. DO NOT operate the engine at more than 3/4 of full throttle for the first 5 hours of operation.
4. Operate the engine at full throttle only intermittently during the next 5 hours.
5. The drive unit should be shifted into front drive gear a minimum of 10 times during the break-in period, with run-in time at moderate r/min after each shift.

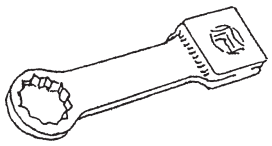
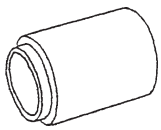
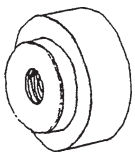
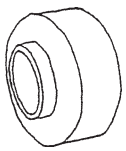
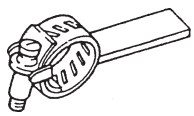
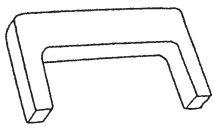
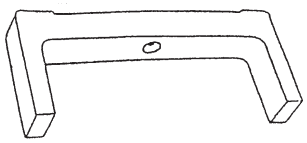
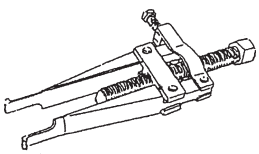
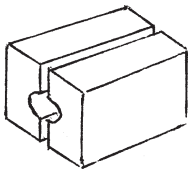
SPECIAL TOOLS

The proper special tools are necessary for complete and accurate adjustment and assembly. Using special tools will help avoid damage caused by the use of improper tools or incorrect procedures.

Tool name	Tool No.	Illustration
Ring nut wrench	YB-34447	
Eye bolt	YB-38105	
Swivel bolt wrench	YB-38106	
Bearing installer	YB-38108	
Bearing installer	YB-38109	
Gear holding tool	YB-38111	
Adapter, Slide hammer	YB-38114-1	
Bearing installer	YB-38115	
Center bolt	YB-6029-1	

Tool name	Tool No.	Illustration
Driver handle	YB-6071-1	
Driver handle	YB-6071-2	
Bearing housing puller	YB-6117	
Tilt cylinder wrench	YB-6175	
Bearing remover	YB-6194	
Bearing installer	YB-6196	
Drive shaft holding tool	YB-6201	
Oil seal installer	YB-6246	
Backlash measurement plate	YB-7003	
Shimming tool	YB-6B00	

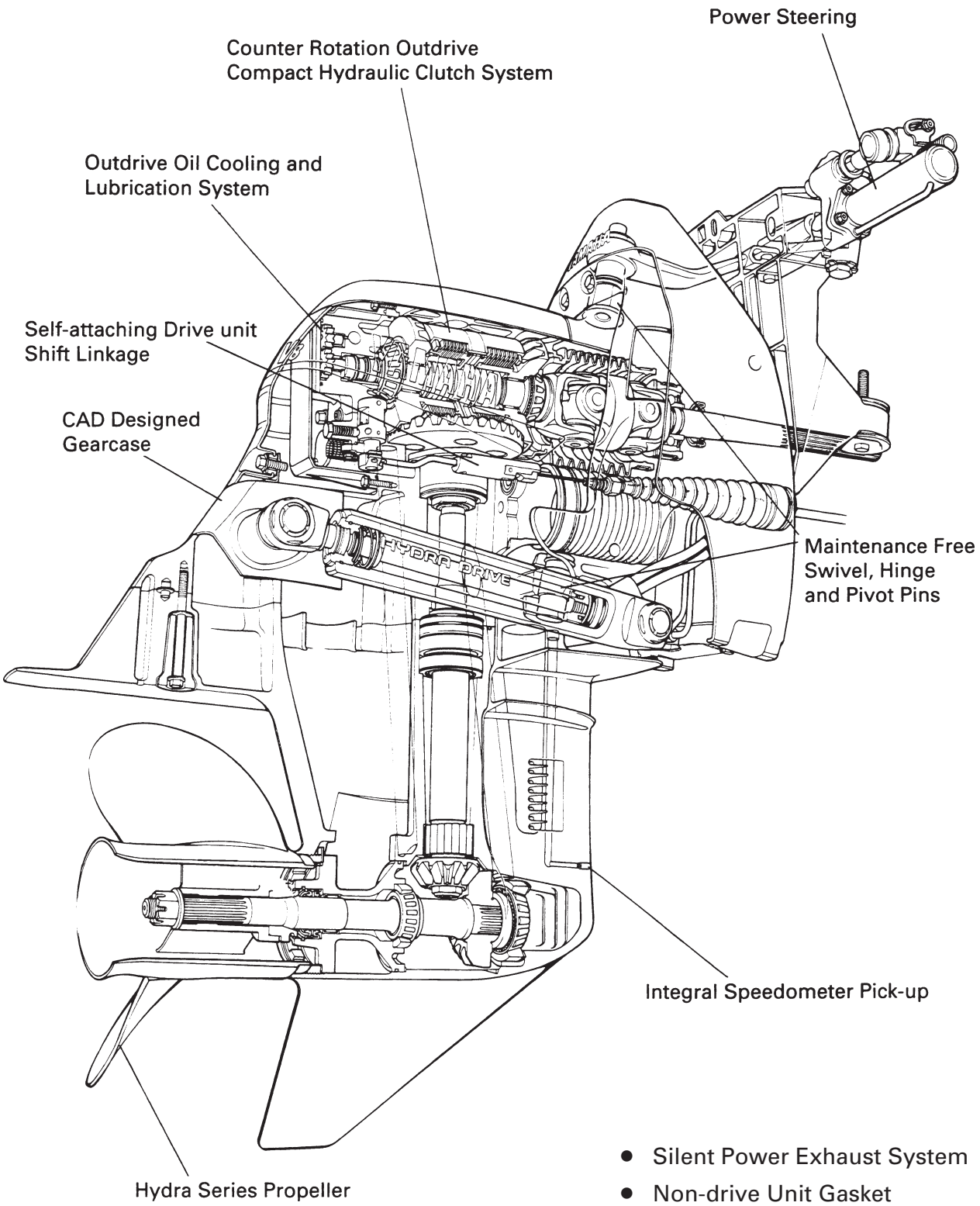
Tool name	Tool No.	Illustration
Shimming tool	YB-6B01-1	
Shimming tool	YB-6B03	
Shimming tool	YB-6B05	
Bearing installer	YB-6B08	
Bearing remover	YB-6B09	
Clutch spring compress	YB-6B16	
Shift adjuster 2	YB-6B19	
Yoke holder	YB-6B21-1	
Guide bearing puller	6U3-001	
Bearing installer	YS-6BA1-1	

Tool name	Tool No.	Illustration
Lock nut wrench	YS-6BA2	
Bearing installer	6U4-08	
Oil seal installer	6U4-10	
Guide bearing installer	6U4-12	
Backlash indicator gauge	6U4-23-1	
Guide bearing puller	6U4-30-1	
Guide bearing puller	6U4-30-3	
Bearing puller	6U4-35	
Oil seal installer	6U0-001	
Rod holding tool	6U0-002	

OTHER EQUIPMENT TOOLS

TOOL NAME	REMARKS
Digital caliper	
Outside micrometer	
Straight measure	
Digital circuit tester	
Oil pressure gauge	0 ~ 3.5 MPa (R1/4)
Thickness gauge (Filler gauge)	
Torque wrench	~ 15 kgf/cm, ~ 30 kgf/cm, ~ 120 kgf/cm, ~ 6 kgf/m, ~ 9 kgf/m, ~ 20 kgf/m
Dial gauge	
Magnetic base	
Heater gun	
Flat chisel	
Slide hammer	
Bearing separator puller	
Hose band	ϕ72 mm
Snap ring plier	
Hand tap & Tap handle	
Hand dies & Dies handle	
Pin punch	ϕ3.5 mm
Thermometer	100 °C

FEATURES



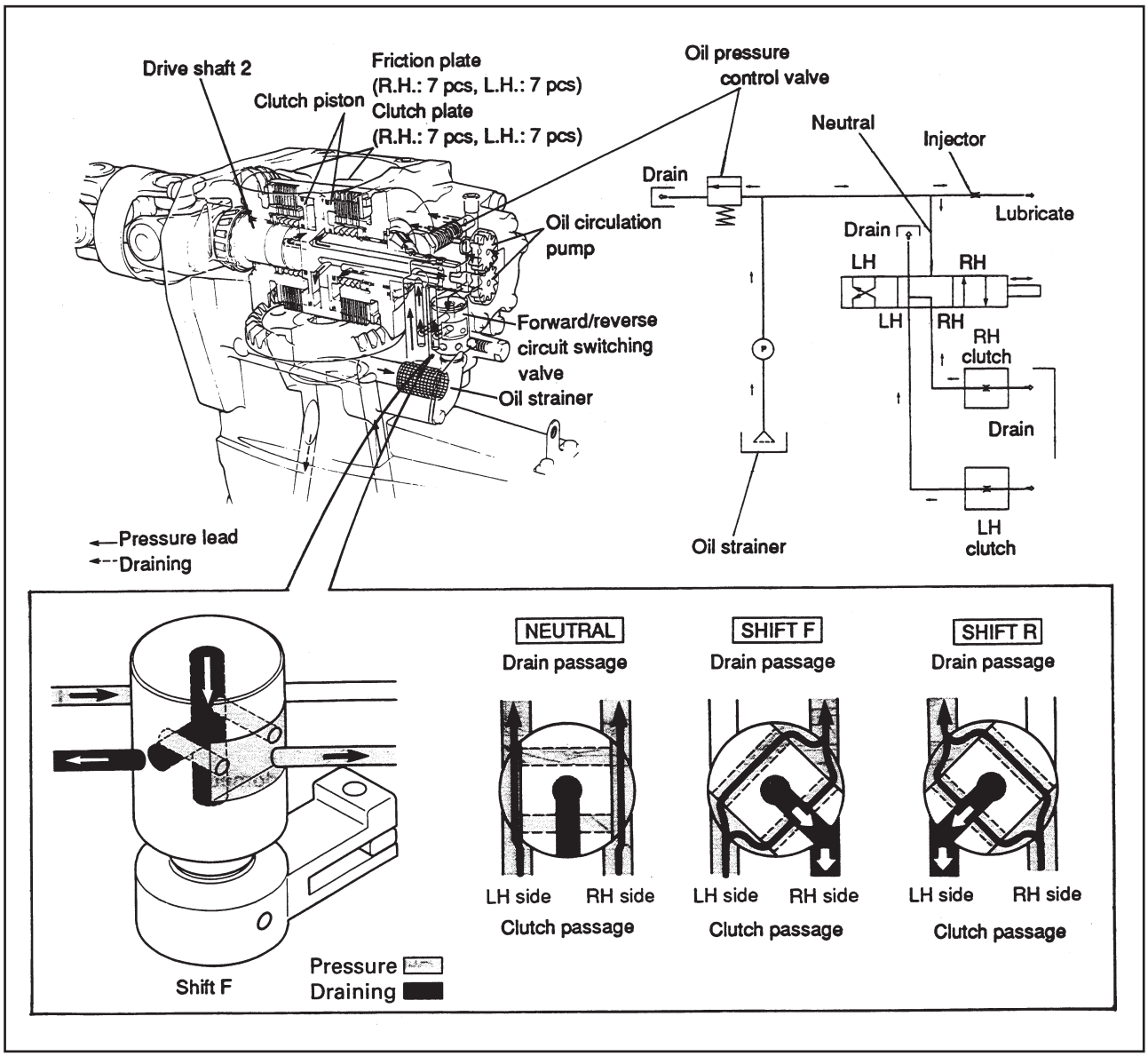
- Silent Power Exhaust System
- Non-drive Unit Gasket
- Acrylic Outdrive Coating
- 46.5° Tilt up Angle
- Visual Oil Level Gauge
- External Tilt Switch
- Outdrive Manual Tilt Release

Hydraulic Clutch System

Cool oil is pumped from the lower case, through the oil filter, into the upper case. If the oil pressure gets too high, an oil pressure control valve opens to allow some of the oil to flow back. From the oil pump, the oil flows to the circuit switching valve, a device that allows the oil flow to be routed into the clutch for forward or reverse drive, or into the upper case if the valve is set to neutral.

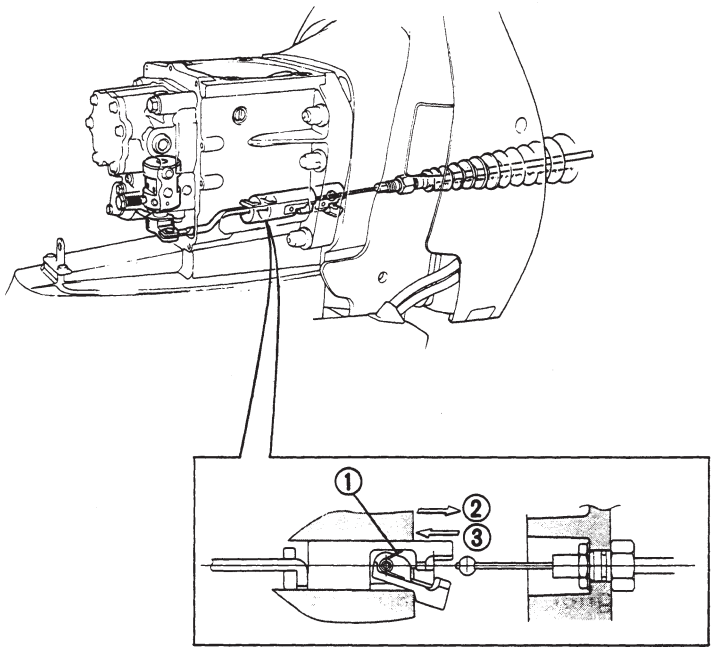
In addition to operating the clutch, the oil in the drive also lubricates the gears, bearings and other components of the drive and clutch system. After lubricating these components, the oil flows back into the lower case where it is cooled.

The hydraulic clutch is compact and durable; shifting is virtually effortless and shock-free. The clutch operates smoothly and efficiently. The reliability and longevity of all related stern drive components (i.e., gears, bearings, shift control, shift linkage, cables, etc.) are greatly improved.



Self-attaching Drive Unit Shift Linkage

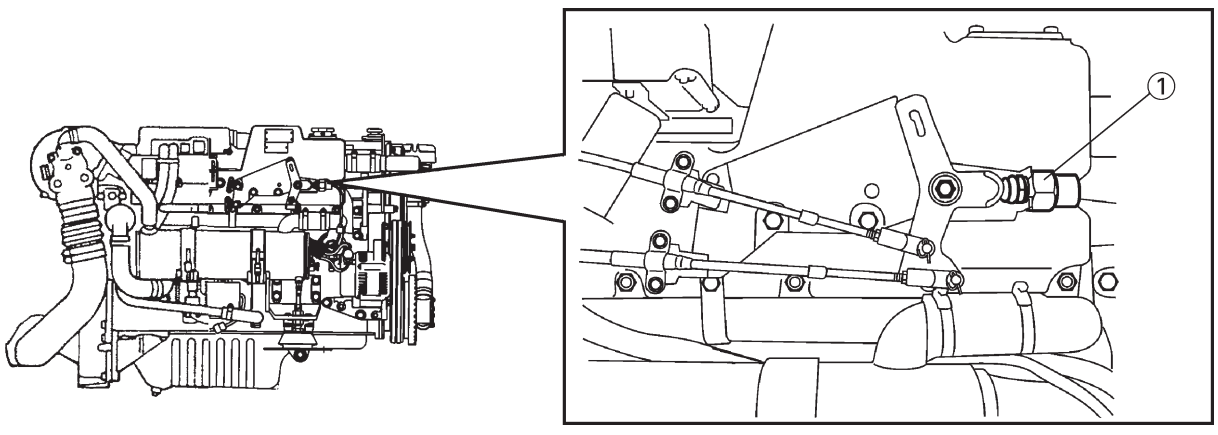
This new system makes the installation of the drive unit easier. When the drive unit is removed or installed, the shift cable disengages or connects automatically and reliably, without need for any readjustment. When the drive is installed on the gimbal housing, the ball end on the shift cable seats itself into the connector. As the drive is fitted and tightened against the gimbal housing, the connector is pushed into the drive housing and the connector's lower jaw closes securely on the ball end. When removing the drive, the connector is pulled out of the housing until the lower jaw is open wide enough to release the cable ball end.



① V-shaped spring
② (When removing)
③ (When installing)

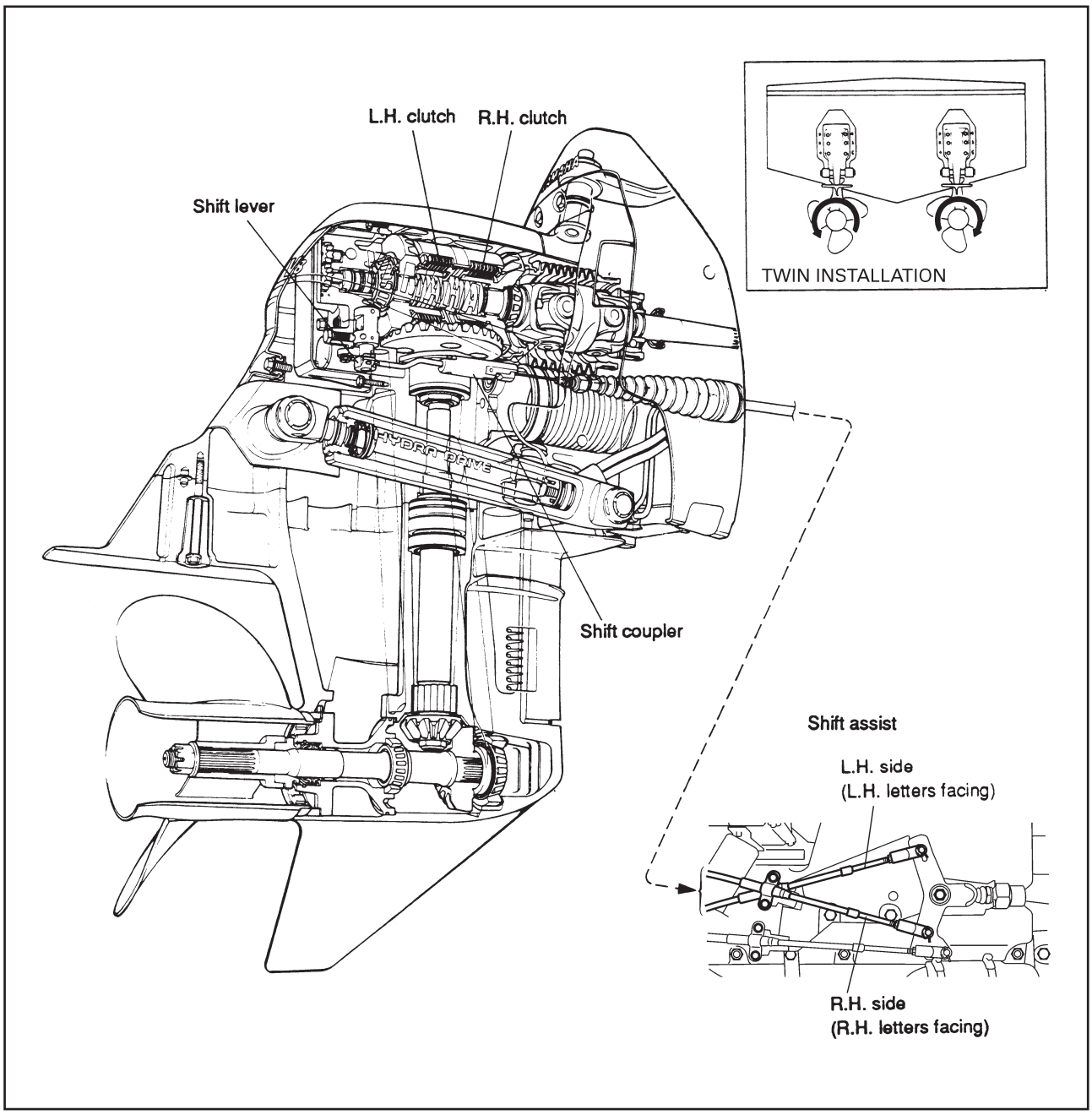
Neutral Switch

The neutral switch ① is mounted on the shift assist rather than into the throttle lever. The first distinctive advantages of this feature is that the switch stays operational, even when the remote control cable is removed. The second advantage is that the neutral position can be easily identified from the substation in dual-station configurations. The neutral switches in the remote controls are still there, but the neutral indicator on the dashboard is linked to the neutral switch on the shift assist.



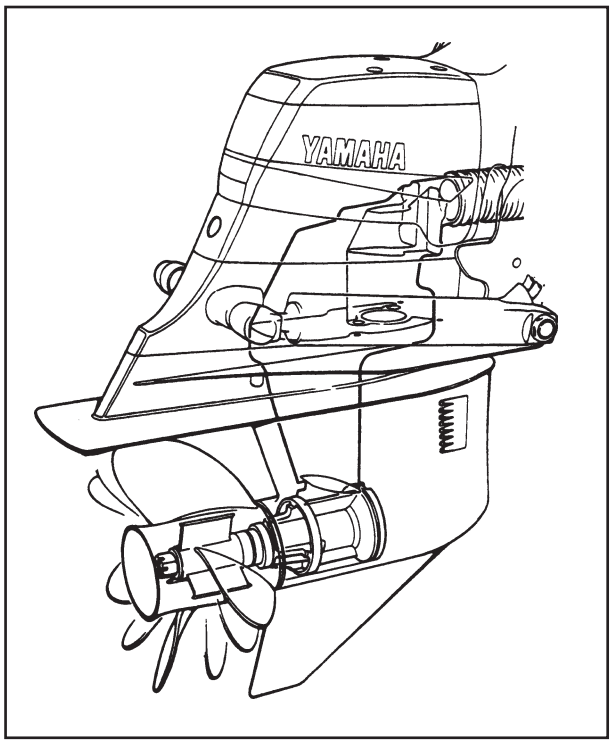
Counter-rotation Capability

One of the outstanding features offered by this design (in addition to the above-mentioned qualities of the hydraulic clutch) is that the same drive unit can be used for forward or reverse rotation without major adjustment. All that needs to be done is to switch the drive cables (R.H. and L.H.) on the shift assist. Counter-rotation of the drive is required to prevent steering and heeling to port when two engines and stern drives are installed.
A stern drive switched to counter-rotation needs a corresponding counter-rotation propeller.



Hydrodynamic Yamaha Stern Drive

The lower unit has been re-designed to allow the use of a larger propeller. This large-size propeller has been added to Yamaha's range of propellers specifically for diesel stern drives. The fine blade design and large thrust make it an excellent complement to this Yamaha diesel model.



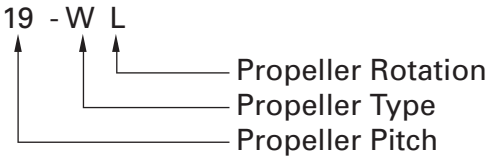
Hydra Series Propeller

Solid hub features superior holding ability and improved acceleration.
No rubber Hub is needed as the hydraulic clutch system provides impact protection.
Blades are designed for improved top speed and mid-range fuel economy.

PROPELLERS

Propellers

As the propeller turns, water is pushed down and back, creating a positive pressure on the face of the blade. At the same time, a negative pressure is produced on the back of the blade, thus sucking water to it. The positive and negative pressures cause the boat to move forward.



The propeller size indicates the propeller diameter, pitch and type or style.
The pitch of a propeller is the distance the propeller will move forward in one complete revolution. (This is similar to the pitch of a screw as it moves into a hole.)
The pitch indicated by the propeller size is a theoretical or designed pitch. The actual forward motion on each revolution is less than the theoretical pitch. The difference is known as the "slip" of the propeller.
Water is a fluid which gives way a little under the pressure of the blades. A 10 % to 15 % slip is considered acceptable.

Propeller Selection

Because of the many designs and different materials used, it is necessary to select the right propeller for the boat's specific use. A boat can be used for various uses such as skiing, cruising, fishing, racing, towing, etc. Different designs affect the boat and engine differently. Depending on the propeller design, the speed, acceleration, engine life, fuel economy, and boating and steering qualities can be changed to fit the particular needs of the boat by changing propellers.
The material the propeller is made of and where the boat is used, for example; in rivers, seas, shallows, rock-bound waters, high mineral waters, etc. are also important. Aluminium propellers are economical, have good strength, good corrosion resistance and are easily repaired. Stainless steel propellers have tremendous strength and superb corrosion resistance.
Whatever the purpose of the boat, always make it a habit to carry spare propellers and hand tools. In case of heavy propeller damage, you will be able to rely on the spare propeller to power you to a nearby port.
Below is a list of Yamaha propellers available through your dealer.

W/WL model

Rotation	No. of Blades	Diameter (in.)	Pitch (in.)	Material	Part Number
R	3	18	13	Stainless Steel	6U3-45971-00-98
R	↑	17-1/2	15	↑	6U3-45973-00-98
R	↑	17	17	↑	6U3-45975-00-98
R	↑	16-3/4	19	↑	6U3-45977-00-98
R	↑	16-3/8	21	↑	6U3-45979-00-98
R	↑	16-3/8	23	↑	6U3-45931-00-98
L	↑	18	13	↑	6U3-45971-10-98
L	↑	17-1/2	15	↑	6U3-45973-10-98
L	↑	17	17	↑	6U3-45975-10-98
L	↑	16-3/4	19	↑	6U3-45977-10-98
L	↑	16-3/8	21	↑	6U3-45979-10-98
L	↑	16-3/8	23	↑	6U3-45931-10-98

V/VL model

Rotation	No. of Blades	Diameter (in.)	Pitch (in.)	Material	Part Number
R	3	15-1/4	17	Stainless Steel	6U3-45933-A0-98
R	↑	15-1/4	19	↑	6U3-45937-A0-98
R	↑	14-7/8	21	↑	6U3-45935-A0-98
R	↑	14-1/2	23	↑	6U3-45939-A0-98
L	↑	15-1/4	17	↑	6U3-45933-B0-98
L	↑	15-1/4	19	↑	6U3-45937-B0-98
L	↑	14-7/8	21	↑	6U3-45935-B0-98
L	↑	14-1/2	23	↑	6U3-45939-B0-98

R Right Clockwise
L Left, Counterclockwise