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E **STERN DRIVE
SERVICE MANUAL**

070030

6U5-28197-ZJ-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**

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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 Safety 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 the each page, to the left of the chapter symbol.

3rd title ③ : This title precedes the paragraphs describing the working procedure.

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, check, repair, and assembly procedures.


Important procedures including bearing removing, checking, and assembling steps ④ are explained in detail.

IMPORTANT FEATURES

- Important engine data and information about special tools 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.
- An arrow ⑧ indicates the course of action required to remedy the started condition of a component.

EXPLODED DIAGRAM

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


① → **UPPER UNIT**  **SHIM SELECTION (UPPER UNIT HOUSING)** ⑥

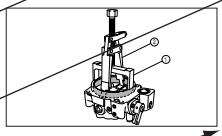
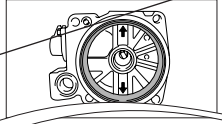
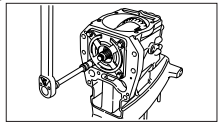
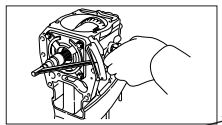
R-gear Shim (T5) Adjustment

- Use the guide, bearing puller 2 ① and the bearing puller ② to remove the bearing outer race from the selector valve housing.

NOTE:

- When the bearing and the selector valve housing are not replaced, DO NOT remove the bearing outer race.
- When replacing the bearing, replace the total inner and outer set.
- Make sure that the bearing puller is set at the position specified in the illustration.

 **Guide, bearing puller 2:**
6U4-30-3
Bearing puller:
6U4-35







3. Loosen the drive shaft to 1/2 rotation and measure pre-load B (motive torque) of the drive shaft.

NOTE:
Measure resistance of the clutch disk section as the pre-load B (motive torque).


4. Calculate the drive shaft pre-load (motive torque) based on the pre-load (motive torque) A and B.

Formula:
Drive shaft pre-load = pre-load (A) - pre-load (B)

 **Drive shaft motive torque (A):**
0.4 - 1.5 N·m


NOTE:
If the drive shaft pre-load (motive torque) is greater than the specification, reduce the shim T6b. If the drive shaft pre-load (motive torque) is less than the specification, increase the shim T6b.

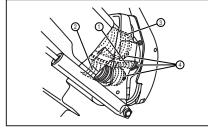
4-27


INSP ADJ  **BELLOWS AND HOSE INSPECTION** ⑥


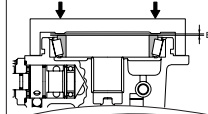
BELLOWS AND HOSE INSPECTION

- Inspect:
 - Shift cable bellows ①
 - Exhaust bellows ②
 - Universal joint bellows ③
 Cracks/Weathering/Damage → Replace.
Loose clamps ④ → Tighten.
Refer to "SWIVEL BRACKET AND BELLOWS" section (P7-7).

 **Clamp screw:**
3 N·m




UPPER UNIT  **UPPER UNIT HOUSING** ⑥





















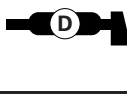





- After inserting the bearing outer race with press, install the inner race. Use the shimming tool, T5/T6a ① to measure the clearance (Measurement B) between the tool and the bearing with a thickness gauge.

NOTE:
To have the clearance, measure the line between the point ② and ③ on the bearing.

 **Shimming tool, T5/T6a:**
6U4-28

⑦

① GEN INFO 	② SPEC 
③ INSP ADJ 	④ UPPER UNIT 
⑤ 6U41 LOWER 	⑥ 6U51 LOWER 
⑦ INT 	⑧ STEER 
⑨ POWR TRIM 	⑩ TRBL SHTG ? 
⑪ 	⑫ 
⑬ 	⑭ 
⑮ 	⑯ 
⑰ 	⑱ 
⑲ 	⑳ 
㉑ 	㉒ 
㉓ 	

SYMBOLS

Symbols ① to ⑩ are designed as thumb-tabs and indicate the content of a chapter.

- ① General information
- ② Specification
- ③ Periodic inspection and adjustment
- ④ Upper unit housing
- ⑤ 6U41 Lower unit housing
- ⑥ 6U51 Lower unit housing
- ⑦ Intermediate assembly
- ⑧ Steering system
- ⑨ Power trim system
- ⑩ Troubleshooting

Symbols ⑪ to ⑱ indicate specific information:

- ⑪ Special tool
- ⑫ Recommended fuel
- ⑬ Lubricant
- ⑭ Engine speed
- ⑮ Tightening torque
- ⑯ Specified value, measure, limit
- ⑰ Press load
- ⑱ Resistance (Ω), voltage (V), electric current (A)











Symbols ⑲ to ㉑ in an exploded diagram indicate grade of lubricant and location of lubrication point:

- ⑲ Apply Yamaha gear-case lubricant
- ⑳ Apply water resistant grease (Yamaha marine grease A)
- ㉑ Apply corrosion resistant grease (Yamaha marine grease D)

Symbols ㉒ and ㉓ in an exploded diagram indicate grade of sealing or locking agent, and location of application point:

- ㉒ Apply LOCTITE® No. 271, 242, 572, 1829 or 1501
- ㉓ Apply ThreeBond® TB-1322, 1324, 1524 or 1501

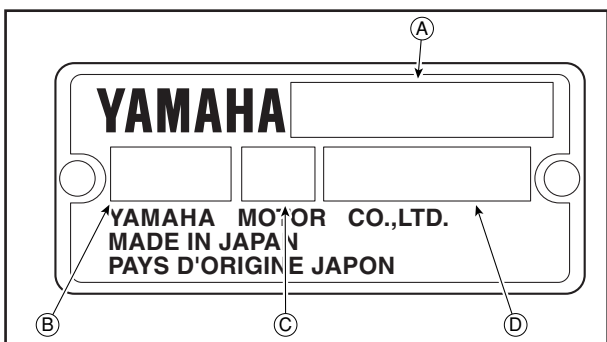
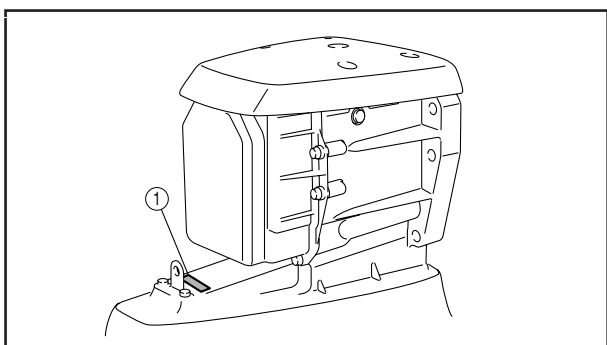
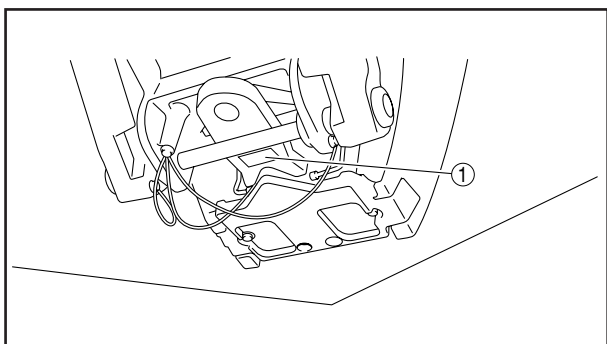
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CHAPTER 1 GENERAL INFORMATION



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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.

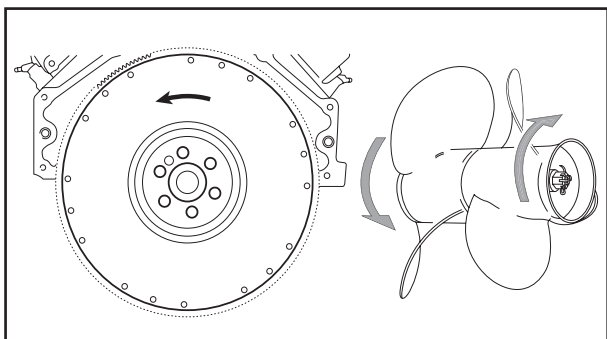
MODEL A	PREFIX B	VARIATION* C	SERIAL NO. D
INT-HDP	6U00	DP	① *****
INT-HDL	6U00	DL	① *****
DE-DHT	6U41 6U51	C D	② *****

- ① Intermediate Assembly
- ② Drive Unit

*Code Explanation:
 DP—With Power Steering
 DL—Without Power Steering, for Twin Installation
 D—1.68:1 Gear Ratio
 C—1.78:1 Gear Ratio

NOTE:

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



Engine and Propeller 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.

As for the propeller rotation, the front propeller rotates counterclockwise, and the rear propeller rotates clockwise.



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.

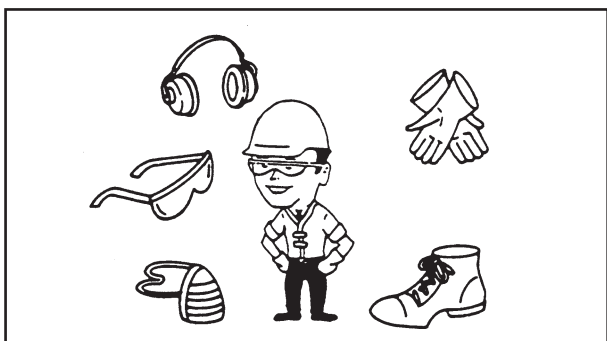
Always clean up spilled fuel and dispose of cleaning materials properly.



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.

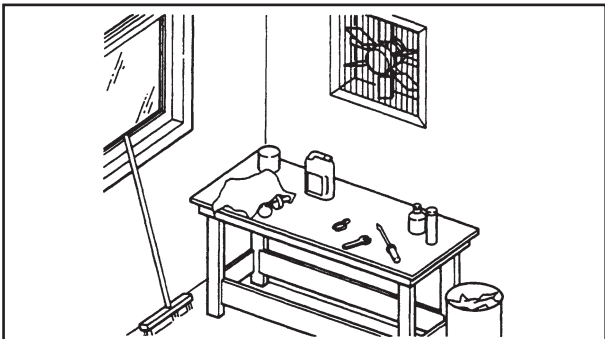


Wear Protective Clothing

Wear safety equipment whenever necessary:

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

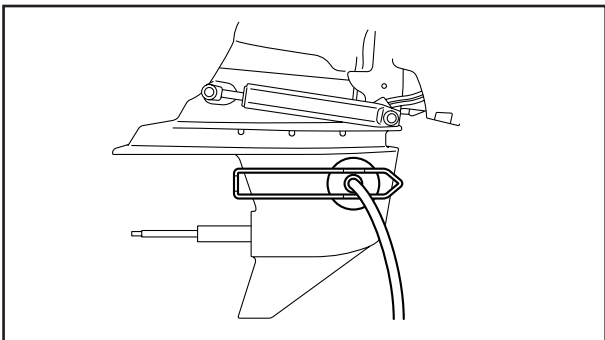
Avoid wearing loose clothing and jewelry.



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.



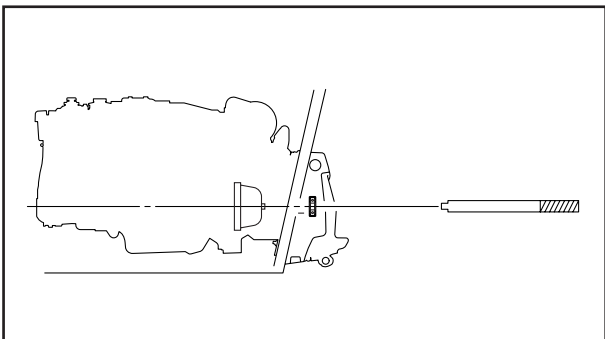
Operate Stern Drive Safely

Remove the propeller. (Refer to "PROPELLER SHAFT AND NUT INSPECTION" section (P3-31).)

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 (P3-29).)
- Make sure all engine mounting hardware is tight.

Inspect Drive Belts

Check the tension of the alternator belts.

Check Gear Oil

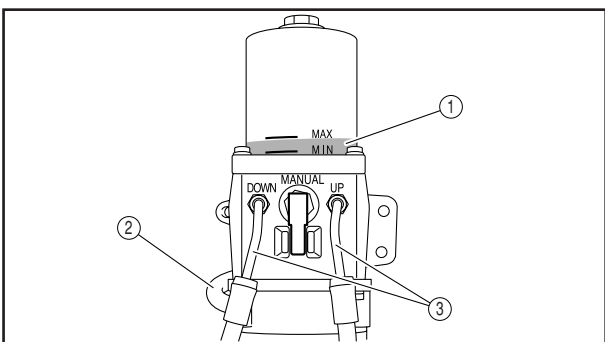
Make sure break-in oil is at the proper level.

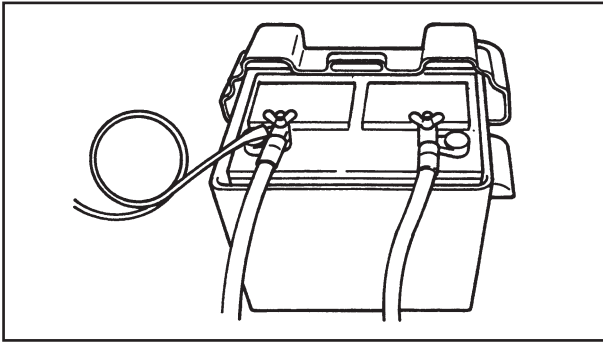
Inspect Outdrive Exterior

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

Check Power Trim System

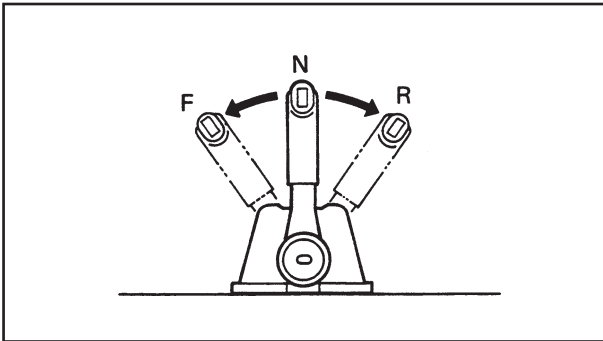
- Check the oil level of the trim pump reservoir ①.
- Make sure all wires ② and hydraulic lines ③ are connected properly.
- Use the trim switch to check the trim operation. Make sure lines and wireharnesses do not bind and are not interfered with when the outdrive is moved up, down, right or left.





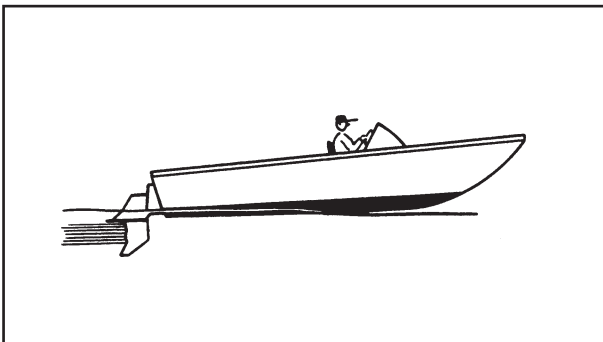
Inspect Battery and Electrical Connections

- 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 wireharness 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.



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.

Position	No. of Blades	Diameter (in.)	Pitch (in.)	Material	Part Number
F	3	15	19	Stainless Steel	
F	↑	↑	20	↑	
F	↑	↑	21	↑	
F	↑	↑	22	↑	6U4-45942-00-98
F	↑	↑	23	↑	6U4-45946-00-98
F	↑	↑	24	↑	6U4-45951-00-98
F	↑	↑	26	↑	6U4-45955-00-98
F	↑	↑	28	↑	6U4-45959-00-98
R	↑	↑	19	↑	
R	↑	↑	20	↑	
R	↑	↑	21	↑	
R	↑	↑	22	↑	6U4-45944-00-98
R	↑	↑	23	↑	6U4-45948-00-98
R	↑	↑	24	↑	6U4-45953-00-98
R	↑	↑	26	↑	6U4-45957-00-98
R	↑	↑	28	↑	6U4-45961-00-98

F: Front, Counterclockwise Rotation

R: Rear, Clockwise Rotation



CHAPTER 2 SPECIFICATIONS

2

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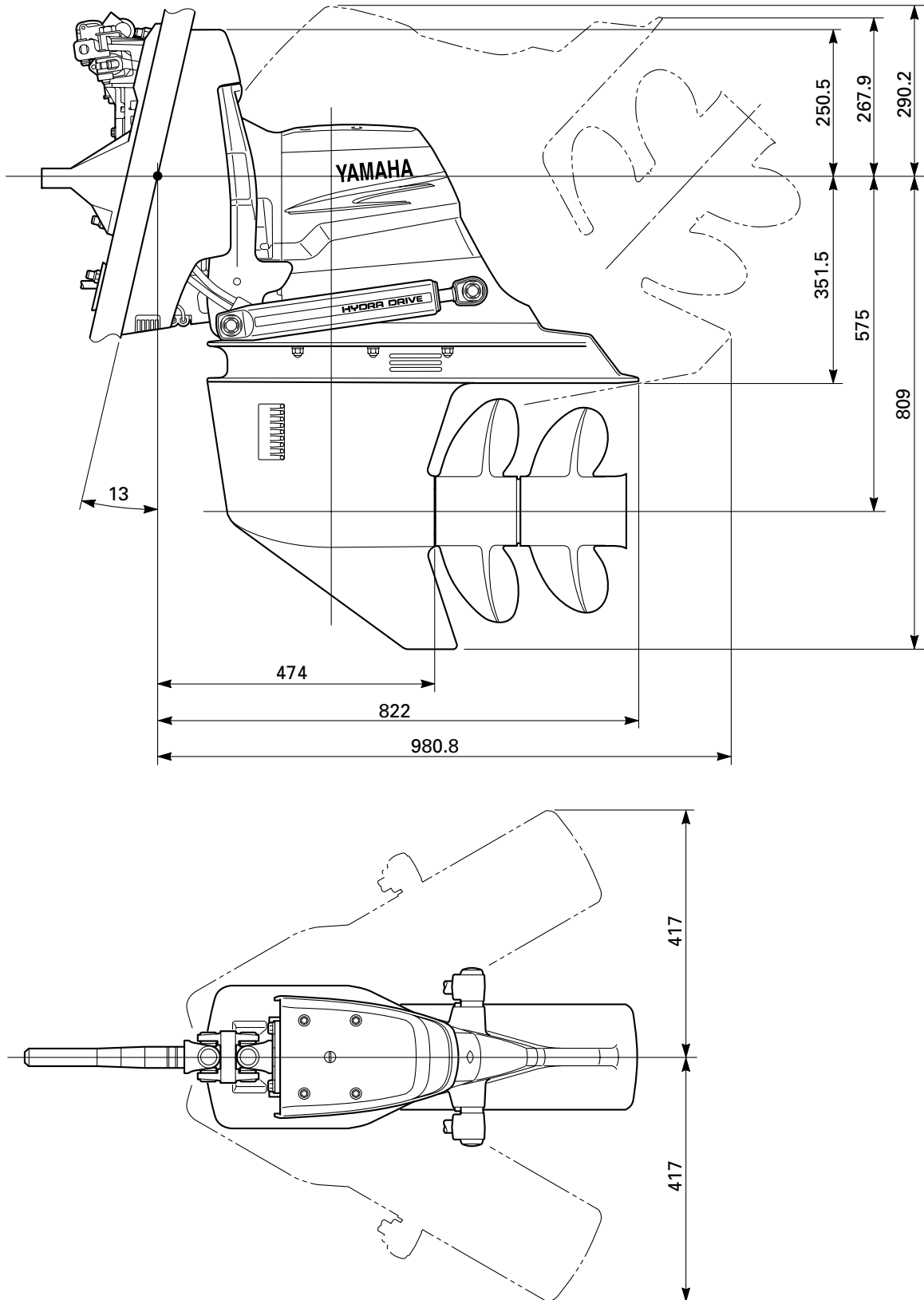
GENERAL SPECIFICATIONS

Outdrive Specifications

Items		Model name	INT-HD (6U00)	
		INT	DE-DHT-C (6U41)	DE-DHT-D (6U51)
Gear ratio	Upper (Driven/Drive)		35/30	35/30
	Lower (Driven/Drive)		26/17	26/18
	Total		1.78	1.68
Clutch system		Hydraulic clutch system		
Drive unit oil capacity			2.4 L	2.45 L
Drive unit recommended oil		Yamaha Stern Drive Gear Oil or Hypoid Gear Oil (SAE90) GL-4, GL-5 or equivalent		
Mounting form		Direct mounting on transom, gimbal ring type		
Steering system		Steering guide system		
Steering angle		30° each, right and left		
Tilt/trim system		Hydraulic tilt/trim system		
Tilt angle		46.5 ° (in reference to 13 ° transom)		
Trim angle		– 6 ° to 15 ° (in reference to 13 ° transom)		
Power trim/pump recommended oil		Automatic Transmission Fluid (ATF) Dexron Type II.		
Power trim/tilt system oil capacity		0.82 L		
Propeller driving system		Spline drive system		
Exhaust system		Through propeller hub		
Cooling system		Inlet on the lower case side, seawater pump located at the front of the engine		
Lubricating system		Integrated (upper and lower) oil chamber and oil pump		
Transom length (crankshaft center – cavitation plate)		351.5 mm		
Weight (dry, without power steering cylinder)		107 kg		
Power steering		Standard		



Drive Unit Dimensions



* Dimensions are based on a boat transom angle of 13°. Dimensions will change slightly when used on boats with transom angles other than 13°.