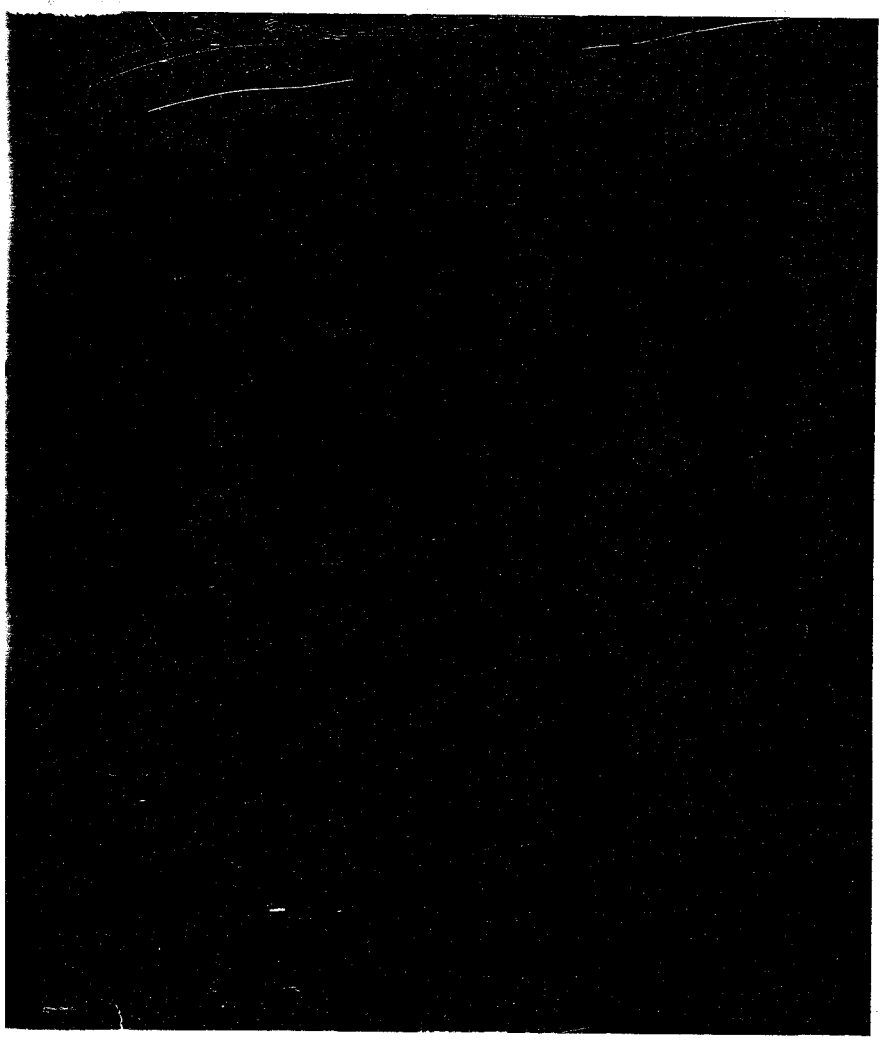


MARINE

MERCURY OUTBOARDS

MODELS 1966 THRU 1972

C-90-63094 (REV-1-11/73)

SIGNPOSTS

Black can and spar buoys

Obstruction marker

Red nun and spar buoys

Mid-channel buoy

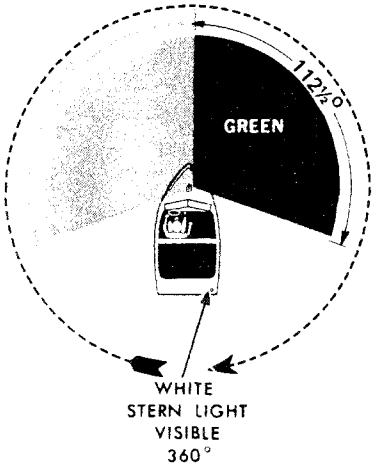
Know the channel markers to follow a SAFE and CONFIDENT course.

- When returning, keep the red buoys on your right; black buoys on your left.
- Black-and-white vertically striped buoys indicate middle of channel; always pass close to them, either side.
- Black-and-red horizontally striped buoys indicate obstruction; give them a wide berth.

RULES of the WATERWAY

Keep practicing water SAFETY night-and-day by observing the following simple rules:

- Do not operate boat near swimmers, skin divers or fishermen.
- Keep clear of sailing craft and rowboats, yielding right-of-way.
- Always keep to the right; show courtesy at all times.



Mercury Marine, Fond du Lac, Wisconsin 54935 U.S.A.

Litho in U.S.A.

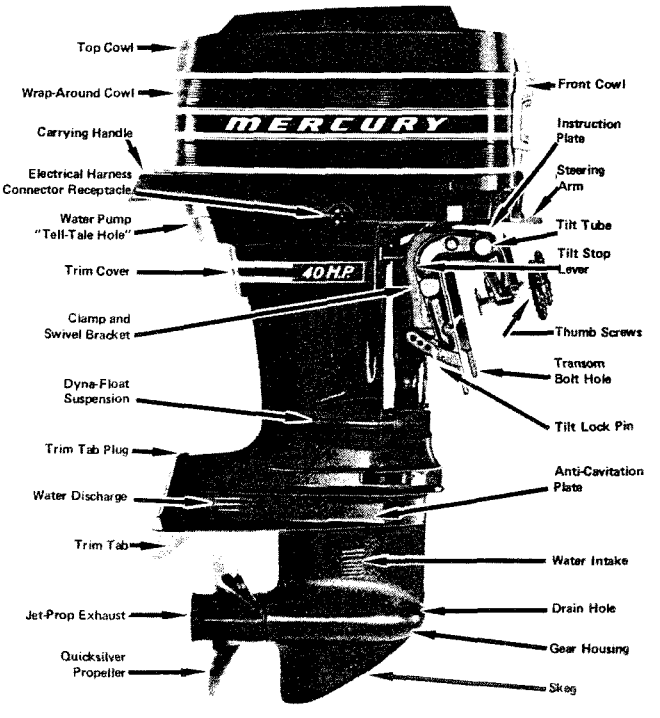
TABLE of CONTENTS

Page

Specifications 3
Section 1 - General Information 5
1-1. Important 5
1-2. Directional References 5
1-3. Periodic Checkup 5
1-4. Write a Letter of Explanation 5
1-5. Service Recommendations 5
1-6. Serial Number 6
1-7. Motor and Boat Insurance 6
1-8. Recording Electric Starting Key Number 6
Section 2 - Motor Installation 6
2-1. Outboard Motor Mounting 6
2-2. Tilt Pin Adjustment 8
2-3. Tilt-Up and Shallow Water Troll Lever Operation 9
2-4. Tilt Stop Lever 10
2-5. Conditions Affecting Operation 10
2-6. Adjusting Co-Pilot 10
Section 3 - Propeller Recommendations 11
3-1. Propellers 11
3-2. Propeller Selection 11
3-3. Installing Propeller 11
6-Cyl. Models and 4-Cyl. Merc 800-650 12
Merc 650 (3-Cyl. 1972) 12
Merc 500-402-400(2-Cyl.) and 350 13
Merc 200-110-75-40-39 13
3-4. How to Remove Propeller 13
3-5. Propeller Repair 13
Section 4 - Accessories Installation 1
4-1. Remote Control Attachment (Single Lever) 1
All 1966-thru-1972 Models, except Merc 200-110-75-60-40-39 1
Merc 200-110-75-60-40-39 1
4-2. Dual Motor Installation 1
Section 5 - Fuel Mixture and Fuel System 1
5-1. Installing Fuel Tank 1
5-2. Recommended Fuel Mixture 1
5-3. Correct Fuel Mixing Procedure 1
5-4. Importance of Consistent Fuel Mixtures 1
Section 6 - Starting and Stopping 1
6-1. Description - Electric Starting 1
6-2. Electric Starting Procedure 1
6-3. Emergency Starting Procedure (Elec. Start Models) 2
6-4. Manual Starting Procedure (Manual Starting Models) . . . 2
6-5. Stopping 2
6-6. Removing Motor from Boat 2
Section 7 - Operation 2
7-1. Throttle and Shift 2
7-2. Don'ts 2
7-3. Adjustable Tim Tab and Galvanic Corrosion Inhibotor . . 2
7-4. Power Trim Operation 2
7-5. How to Tell Whether Water Pump Is Operating 27
7-6. Cavitation 28
7-7. Shallow Water Operation 28
7-8. Operation in Salt Water 28

Section 8 - Fuel System Maintenance 28
8-1. Removing Cowling 28
8-2. Carburetor Adjustment 30
8-3. Approximate Initial Setting 30
8-4. Low Speed Adjustment 31
8-5. Servicing Fuel Tank Filter 31
8-6. Servicing Motor Fuel Filter 31
Section 9 - Lubrication 32
9-1. Mercury Outboards Lubrication Chart 32
9-2. Lower Drive Unit Lubrication 33
Section 10 - Ignition Maintenance 35
10-1. Maintenance 35
10-2. Servicing Spark Plugs 35
10-3. Battery - Electric Start Models 35
10-4. Maintenance of Battery 36
10-5. Winter Storage Care of Battery 36
10-6. Electrical Accessories Connections 36
Section 11 - Special Care Required 37
11-1. Periodic Inspection 37
11-2. Preparation for Storage 37
11-3. Attention Required following Operation in Salt Water or Silt 38
11-4. Attention Required following Complete Submersion 39
Section 12 - Trouble Chart 41

All information herein was in effect when this book was printed. Mercury Marine, whose policy is one of continuous improvement, reserves the right to discontinue models at any time or to change specifications or designs without notice and without incurring obligation.



07047

Figure 1. Merc 402 Model

GENERAL SPECIFICATIONS - 1966 thru 1972 MERC MODELS

Year	Merc Model	HP	Cu.In. Displ.	Full Throttle RPM Range	Bore	Stroke	Spark Plug Type	Plug Setting	Ignition Type	Point Setting
1966	39	3.9	5.5	5000-5400	2"	1-3/4"	Champion J8J	.025"	Phelon	.020"
1967-68	39	3.9	5.5	5000-5400	2"	1-3/4"	Champion L9J	.030"	Phelon	.020"
1969	40	4	5.5	4500-5500	2"	1-3/4"	Champion L9J	.030"	Phelon	.020"
1970-71-72	40	4	5.5	4500-5500	2"	1-3/4"	AC-V40FFK	None	Thunderbolt	.020"
1966	60	6	7.2	5000-5400	1-3/4"	1-1/2"	Champion J7J	.025"	Phelon	.020"
1967-68	60	6	7.2	5000-5400	1-3/4"	1-1/2"	Champion L7J	.030"	Phelon	.020"
1969	75	7.5	11	4500-5500	2"	1-3/4"	Champion L7J	.030"	Phelon	.020"
1970-71-72	75	7.5	11	4500-5500	2"	1-3/4"	AC-V40FFK	None	Thunderbolt	.020"
1966	110	9.8	11	5000-5400	2"	1-3/4"	Champion J7J	.025"	Phelon	.020"
1967-68-69	110	9.8	11	5000-5400	2"	1-3/4"	Champion L4J	.030"	Phelon	.020"
1970-71-72	110	9.8	11	4500-5500	2"	1-3/4"	AC-V40FFK	None	Thunderbolt	.020"
1966	200	20	22	5000-5400	2-9/16"	2-1/8"	Champion J6J	.025"	Phelon	.020"
1967-68-69	200	20	22	5000-5400	2-9/16"	2-1/8"	Champion L4J	.030"	Phelon	.020"
1970-71-72	200	20	22	4800-5500	2-9/16"	2-1/8"	AC-V40FFK	None	Thunderbolt	.020"
1966	350	35	32.5	4800-5200	3"	2.3"	Champion J6J	.025"	Phelon	.020"
1967-68-69	350	35	32.5	4800-5300	3"	2.3"	Champion L4J	.030"	Phelon	.020"
1970-71	400 (2-Cyl.)	40	33.3	4800-5300	2-7/8"	2-9/16"	AC-V40FFM	None	Thunderbolt	None
1972	402	40	33.3	4800-5300	2-7/8"	2-9/16"	AC-V40FFM	None	Thunderbolt	None
1966	500	50	44	5200-5600	2-9/16"	2-1/8"	Champion J4J	.025"	Kiekhaefer	.010" §
1967	500M-500S	50	44	5200-5600	2-9/16"	2-1/8"	Champion L4J	.030"	Kiekhaefer	.010" §
1967-68-69	500SS	50	44	5200-5600	2-9/16"	2-1/8"	AC-V40FFM	None	Kiekhaefer	None
1970-71-72	500	50	43.8	4800-5500	2-7/8"	2-1/8"	AC-V40FFM	None	Thunderbolt	None

Metric Conversion: 1" = 25.4mm; 1 Cu. In. = 16.4cc

Year	Merc Model	HP	Cu.In. Displ.	Full Throttle RPM Range	Bore	Stroke	Spark Plug Type	Plug Setting	Ignition Type	Point Setting
1966	650	65	60	4800-5200	2-7/8"	2.3"	Champion J4J	.025"	Kiekhaefer	.010" §
1967	650S	65	62.4	4800-5200	2-15/16"	2.3"	Champion L4J	.030"	Kiekhaefer	.010" §
1968-69	650SS	65	62.4	4800-5300	2-15/16"	2.3"	AC-V40FFM	None	Thunderbolt	None
1970-71	650	65	62.42	4800-5300	2-15/16"	2.3"	AC-V40FFM	None	Thunderbolt	None
1972	650 (3-Cyl.)	65	49.8	4800-5300	2.87"	2-9/16"	AC-V40FFM	None	Thunderbolt	None
1969	800	80	66.6	4800-5300	2-7/8"	2-9/16"	AC-V40FFM	None	Thunderbolt	None
1970-71	800	80	66.6	4800-5300	2-7/8"	2-9/16"	AC-V40FFM	None	Thunderbolt	None
1972	800	80	66.75	4800-5300	2.87"	2-9/16"	AC-V40FFM	None	Thunderbolt	None
1966	950	95	90	4800-5200	2-7/8"	2.3"	Champion L4J	.030"	Kiekhaefer	45° Dwell
1966	950SS	95	90	4800-5200	2-7/8"	2.3"	AC-V40FFM	None	Kiekhaefer	90° Dwell
1967	950SS	95	90	4800-5200	2-7/8"	2.3"	AC-V40FFM	None	Kiekhaefer	None
1968-69	1000SS	100	90	4800-5300	2-7/8"	2.3"	AC-V40FFM	None	Thunderbolt	None
1968	1000BP	100	90	6200-6500	2-7/8"	2.3"	AC-V40FFM	None	Thunderbolt	None
1969	1000 Super BP	100	99.81	6200-6500	2-7/8"	2.3"	AC-V40FFM	None	Thunderbolt	None
1966	1100	110	93.5	4800-5200	2-15/16"	2.3"	Champion L4J	.030"	Kiekhaefer	90° Dwell
1966	1100SS	110	93.5	4800-5200	2-15/16"	2.3"	AC-V40FFM	None	Kiekhaefer	45° Dwell
1967	1100SS	110	93.5	4800-5200	2-15/16"	2.3"	AC-V40FFM	None	Kiekhaefer	None
1970-71	1150	115	99.81	4800-5300	2-7/8"	2-9/16"	AC-V40FFM	None	Thunderbolt	None
1972	1150	115	99.81	4800-5300	2.87"	2-9/16"	AC-V40FFM	None	Thunderbolt	None
1968-69	1250SS	125	99.81	4800-5300	2-7/8"	2-9/16"	AC-V40FFM	None	Thunderbolt	None
1968-69	1250BP and Super BP	125	99.81	5000-5600	2-7/8"	2-9/16'	AC-V40FFM	None	Thunderbolt	None
1970-71	1350	135	99.81	4800-5300	2-7/8"	2-9/16"	AC-V40FFM	None	Thunderbolt	None
1972	1400	140	99.81	4800-5800	2.87"	2-9/16"	AC-V40FFM	None	Thunderbolt	None

NOTE: Champion L-77V may be used in place of AC-V40FFM.
Champion L-78V may be used in place of AC-V40FFK.

§ $^{+.000}_{-.002}$ (or 48° Dwell)

Metric Conversion: 1" = 25.4mm; 1 Cu. In. = 16.4cc

Section 1 - General Information

1-1. IMPORTANT

A standard one-year warranty, covering material and workmanship, was issued by your dealer for the outboard motor (not used commercially) when sold new. Replacement parts on service work after one year carry a 3 month warranty.

1-2. DIRECTIONAL REFERENCES

Front of boat is bow; rear is stern. Starboard is right side; port is left side. In this book, all directional references are given as they appear when viewing boat from stern, looking toward bow. (Figure 2)

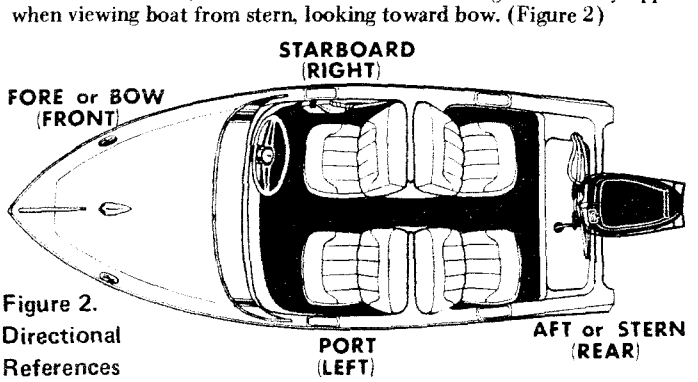


Figure 2.
Directional
References

1-3. PERIODIC CHECKUP

All mechanical products, such as your Mercury Outboard, require periodic care and maintenance.

Your outboard should be taken to an authorized Mercury dealer every six months or 100 hours of operation – or at least once each year -- for lube change, tuneup, etc, to include the following:

1. Clean filters on carburetor(s) and fuel system.
2. Check lubricant in lower unit.
3. Check water pump operation.
4. Lubricate control linkage, distributor or magneto adaptor (4 and 6-cylinder models) and swivel pin.
5. Lubricate reverse lock lever.
6. Check and tighten all nuts and bolts.
7. Test and adjust motor after completing checkup.

To find the Authorized Mercury Service facilities in your locality or when traveling, refer to the classified pages in the local telephone directory under "Outboard Motors".

1-4. WRITE a LETTER of EXPLANATION

If writing to the factory, include the following information: 1) Serial number, 2) model number, 3) date purchased, 4) dealer from whom purchased, 5) number of hours motor has been operated, 6) details of trouble experienced, 7) dates of previous correspondence, 8) boat make and size, 9) propeller pitch and number of blades or part number, and 10) normal use and approximate load.

No Motor Is to Be Shipped to the Factory without Specific Written Authorization. All Shipping Charges Must Be Prepaid.

1-5. SERVICE RECOMMENDATIONS

This publication includes operating and service instructions applying to Mercury models listed on the preceding "specifications" page. In the preparation of this book, careful consideration was given to such adjusting and service operations as are usually required in normal service. Illustrations shown are typical of all specified motors, except where model is designated.

We do not recommend that the owner attempt repairs which are not specifically covered in this book. Other repairs, particularly those which require disassembly or replacement of internal parts, should be done only by Authorized Mercury Service facilities. Such facilities would have the necessary factory-designed tools and equipment, plus the knowledge and experience required to do the job correctly and economically.

1-6. SERIAL NUMBER

The serial number is stamped into the instruction plate on the swivel bracket. The number is the manufacturer's key to numerous engineering details which apply to your motor. When ordering parts, accessories and tools, or when corresponding with the manufacturer or dealer in regard to service matters, always specify model and serial number.

CAUTION: Water pump impeller will be damaged if motor is operated out of water. Read flushing instructions carefully in Paragraph 11-3, following.

1-7. MOTOR and BOAT INSURANCE

Your local insurance agent can offer you motor and boat protection which covers damage, theft, etc, as well as liability for property damage and personal injury to others. Contact your insurance dealer for full details.

1-8. RECORDING ELECTRIC STARTER KEY NUMBER (Electric Starting Models)

RECORD YOUR ELECTRIC STARTER KEY NO. HERE	*If key is lost, a new key may be purchased from your local Mercury dealer. Give key number (left) at time of purchase.*

Section 2 - Motor Installation

2-1. OUTBOARD MOTOR MOUNTING

Installation of the motor on the transom should be given very careful attention. The clamp bracket not only must support the weight of the motor, but it is subject to thrust, impact, inertia and steering stresses. These forces are applied directly to the transom thru the clamp bracket assembly.

Your Mercury Motor is designed for a recommended transom height as shown in Figure 3. To avoid damage to transom and to prevent the motor from working loose during operation, it is important that clamp (thumb) screws are tightened securely and equally. Thumb screw grips should be in (or near) a horizontal plane to allow full tilt up and turn of the motor. Failure to observe this thumb screw position could result in damage to steering parts.

TRANSOM MOUNTING SPECIFICATIONS

(Refer to Illustrations on Next Page)

Merc Model	Min. A§	Min. B	Min. C**	Min. D	Min. E	F* Short Shaft	F* Long Shaft	G	H***	J	Control On Boat Mount▲
1400-1350-1250-1150-1100-1000-950	33"	17"	16"	27¾"	32"	15½"	20"	30"	4-3/8"	2-3/8"	R. Side
800 & 650 (1966-thru-1971)	33	17	16	22½	28½	15½	20	24	4-3/8	2-3/8◆	R. Side
650 (3-Cyl. 1972)	33	17	18	18	26½	15½	20	19½	4-3/8	2-3/8	R. Side
500	31½	16	15½	20	25½	16½●	20	20½	4-3/8	2-3/8◆	R. Side
402-400-350 (2-Cyl.)	34	16	18	16	24	16½●	20■	17-3/4	4-3/8	2¼	R. Side
200	39¼	21	18¼	16¾	23-3/8	15½	20½	19-5/8♦	4-3/8	1-7/8◆	R. Side
110-75-60	35¼	21¾	13½	14-3/8	20-1/8	15½	20½	19-5/8♦	2-7/8	1-7/8◆	R. Side
40-39	35¼	21¾	13½	12¾	18¼	15½	20½	18¾♦	2-7/8	1-7/8◆	R. Side

* Best transom height for 4 and 6-cylinder engines is to locate engine's anti-cavitation plate parallel and even with the boat bottom. Boats with heavy keels will require lower settings to avoid propeller cavitation. Very fast boats may benefit from higher settings.

** Variable on deep "V" hulls § Includes clearance for Power Trim where applicable.

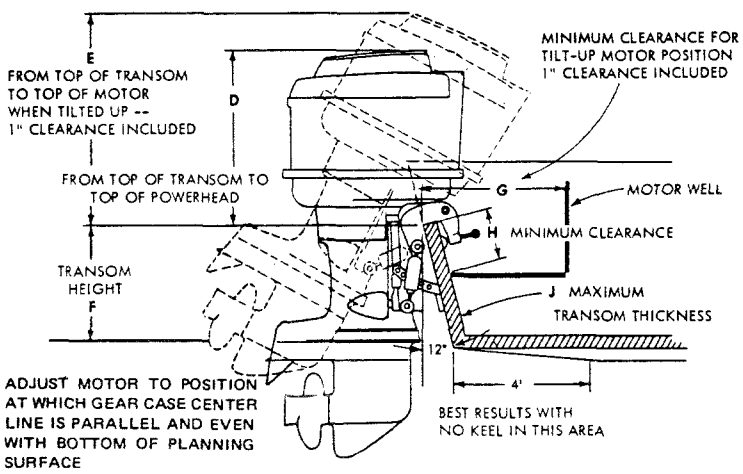
*** Allows sufficient clearance for Ride-Guide Steering. For rope steering, add to this figure according to type of bracket used.

▲ Recommended location for mounting remote throttle-shift and steering controls on boat to balance engine torque caused by direction of propeller rotation.

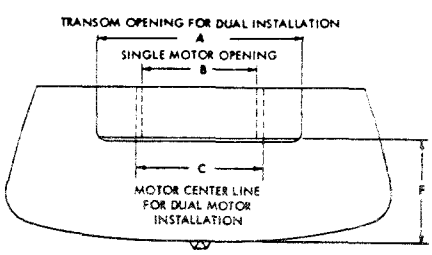
◆ 2¼" for 1971-72 models ●15½" for 1970-71-72 Merc 400-500 and for Merc 402

■ 21½" for 1966 Merc 350 ♦End of throttle-shift-steering (tiller) handle

Metric Conversion: 1" = 2.54cm



Metric Conversion: 1" = 25.4mm (millimeters)
1' = 0.3m (meter)



In setting up a boat for maximum speed, run the first test with the motor way in, close to the transom; then move it out one tilt pin hole at a time until maximum performance is reached.

Figure 3. General Specifications Transom Mounting

CAUTION: Before operating, motors of 20-or-more horsepower must be secured to boat with 2 bolts placed through transom into slots provided at bottom of clamp bracket. Refer to Figure 1 and instructions on red "Caution" tag attached to new motor. Upper mounting bolts must be installed on all 6-cylinder motors and on 3 and 4-cylinder motors if transom has an extremely hard, smooth surface or for severe service. During operation, clamp screws should be checked occasionally for tightness on the transom. Failure to bolt motor to transom may result in damage to boat and/or loss of motor and possible injury to occupants of boat.

2-2. TILT PIN ADJUSTMENT

Do not operate motor with tilt lock pin removed.

Holes are provided in the clamp bracket to permit changing location of tilt lock pin for proper adjustment of tilt angle. Tilt angle of motor on transom should be set so that anti-cavitation plate (Figures 1, 3 and 4) is about parallel and even with bottom of boat. Speed of boats, which have center of gravity located forward, may sometimes be improved by tilting motor out one tilt pin hole. This will tend to raise bow and reduce wetted surface. If motor is tilted in, boat will ride bow down, wetting more of the bottom and reducing speed. The preceding generally, will improve operation in rough water. Under ideal conditions, efficiency is best with lower unit operating in level position, because entire thrust then is applied parallel to plane of motion. With some boats, however, and under certain unfavorable conditions of loading, there will be a tendency to ride stern high or bow high. (Figure 3) This condition can be corrected considerably by adjusting tilt angle so that boat rides level.

It must be considered that operation with excessive tilt will reduce performance noticeably and may induce cavitation. It is, therefore, preferable to level boat by proper loading rather than by extreme adjustment of tilt angle. Except on very rough water, if tilt angle is correctly adjusted and boat is favorably loaded, a properly designed boat will ride level and will plane without "spanking" or "bucking." (Figure 4)

2-3. TILT-UP and SHALLOW WATER TROLL LEVER OPERATION (Models with Less Than 10 HP)

Motor is spring-locked in operating position and will tilt up only when striking a submerged object abruptly while in forward motion. To release motors of less than 10 horsepower for tilt pin adjustment, push tilt-up lever, then tilt motor up. (Figure 5) To lock in tilt position for running in shallow water, push lever in direction of "Release" arrow. To release, return to "Lock" position. Motors of more than 10 horsepower can be tilted-up by placing in "Forward" gear and lifting up-out on skeg. (Figure 1)

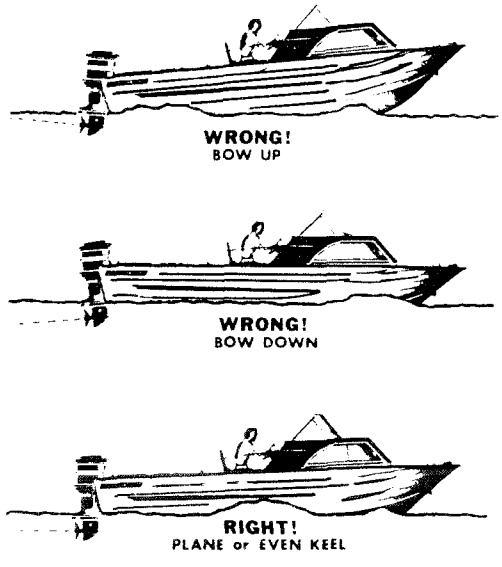


Figure 4. How to Plane a Boat

Model 1972 Merc 110-75-40 motors can be placed in shallow wate "Troll" position and released from this position as follows:

1. Retard twist grip throttle to "Shift Range" and shift int "Forward".
2. Push lever in direction of "Troll".
3. Tilt motor manually to engage in shallow water "Troll" position (Figure 6)
4. To release from shallow water "Troll", retard throttle and shift t "Forward". Push lever to the side and down, then tilt motor i manually by lifting up slowly to disengage from the "Troll" position.

Figure 5. Tilt-Up Lever

Figure 6. Tilt Stop Lever

Model 1969-70-71 Merc 110-75-40 motors can be placed in a shallow water troll position automatically as follows:

1. Retard twist grip throttle to "Shift Range".
2. Push lever in direction of "Release" arrow (Figure 5); shift to reverse.
3. Advance throttle in reverse. This will cause motor to tilt up and engage shallow water troll lever (Figure 6) automatically.
4. Retard throttle to "Shift Range" and shift into forward.

Release motor from shallow water troll as follows:

1. To release, return to "Lock" position. (Figure 6)
2. Retard throttle to "Shift Range" and place shift lever in reverse.
3. Advance throttle until shallow water troll lever becomes disengaged.
4. Retard throttle and shift into forward.

2-4. TILT STOP LEVER

Motor can be locked in tilt-up position by pulling tilt stop lever (Figure 6) with motor fully tilted.

IMPORTANT: DO NOT use tilt stop lever while trailering. Tilt motor and place a block of wood between clamp and swivel bracket.

2-5. CONDITIONS AFFECTING OPERATION

1. Center of Gravity Location: For minimum drag and maximum speed - which allow best fuel economy at a given throttle setting per-mile and per-hour of operation - move weight aft until boat porpoises or is about to porpoise. This reduces wetted surface to a minimum, only the rear half of the boat being wet.
2. Boat Bottom: For maximum speed, a boat bottom should be nearly a flat plane where it contacts the water and particularly straight and smooth in fore-and-aft direction.
   a. Hook: Exists when bottom is concave in fore-and-aft direction when viewed from below. When boat is planing, "hook" causes more lift on bottom near transom and allows bow to drop, thus greatly increasing wetted surface and reducing boat speed. "Hook" frequently is caused by supporting boat too far ahead of transom while hauling on a trailer or during storage.
   b. Rocker: The reverse of hook and much less common. "Rocker" exists if bottom is convex in fore-and-aft direction when viewed from below, and boat has strong tendency to porpoise.
   c. Surface Roughness: Moss, barnacles, etc., on boat or corrosion of motor's gear case increase skin friction and cause speed loss. Clean surfaces when necessary.

2-6. ADJUSTING CO-PILOT (Models with 20 HP and Less)

The co-pilot provides velvet-smooth friction control in the steering mechanism. Recommended adjustment is such that the motor will remain in a fixed-course position without the need of manual control, yet will not be too tight to allow free and easy steering. Adjustment is attained by means of a hexagon head screw on bottom face of swivel bracket (top face on 1972 Merc 110-75-40 models). (Figure 7) Tighten the screw to increase friction; loosen to decrease friction. Loosen friction when using remote controls.

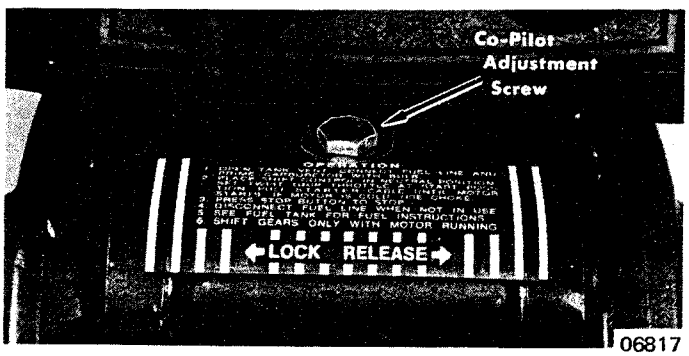


Figure 7. Co-Pilot Adjustment

Section 3 - Propeller Recommendations

3-1. PROPELLERS

It is not possible to design a single propeller which will give optimum performance under all conditions of motor speed, boat type and speed and load. The Quicksilver propeller, which you have selected, is suitable for most applications. If it does not fit a particular application, we suggest that you keep it for general use and acquire another Quicksilver propeller for the particular application.

For propeller recommendations applying to your particular boat, consult your Mercury dealer and see the following paragraph. Using an improper propeller for the application on a new motor will void the Warranty Agreement.

3-2. PROPELLER SELECTION

The speed at which a given boat will travel is governed mainly by the horsepower available. Use of the correct propeller will allow the motor to turn at a recommended RPM and develop full power. First select trial propeller from dealer's listing, using approximate boat length and load, if known. This usually will be the correct choice. Refer to transom height recommendation in chart in Figure 3. Establish exact tilt pin setting by test.

To check, make a trial run, using an accurate tachometer. It is important that the motor speed (RPM) falls within the recommended limits. The trial run should be made with a light load (one person). Under these conditions, it is desireable to have the engine speed near the top of the recommended limit so that, under a heavy load, motor speed will not fall below recommendations. If the motor speed is too high, try a higher pitch or the same pitch cupped. Likewise, if motor speed is low, try a lower pitch prop. There normally is a 300-500 RPM charge between propeller pitches.

For dual installation, the next higher pitch propeller may be best. For water skiing, it may be desireable to use the next lower pitch propeller, however, be cautious - do not operate at full throttle when using ski propeller but not pulling skiers. If, in this connection, a propeller has too little pitch for the application, dangerous overspeed of the motor may result! If a propeller has too much pitch for the application, acceleration will be slow.

Light, fast boats require higher pitch propellers, while heavier boats require lower pitch propellers. Use aluminum propellers in salt water areas to reduce electrolytic action which can result in corrosion and pitting of metal surfaces.

3-3. INSTALLING PROPELLER

Apply a liberal coat of Perfect Seal (C-92-34227) or a waterproof-type lubricant on splines of propeller shaft, especially if operated in salt water, to aid in removing at any future time.

FOLLOW THESE STEPS:

WARNING: When installing or removing propeller, because of the motor's ease in starting, (be sure that switch is off on electric starting models), place a block of wood between anti-cavitation plate and propeller to prevent accidental starting and to protect hands from propeller blades while removing the propeller nut.

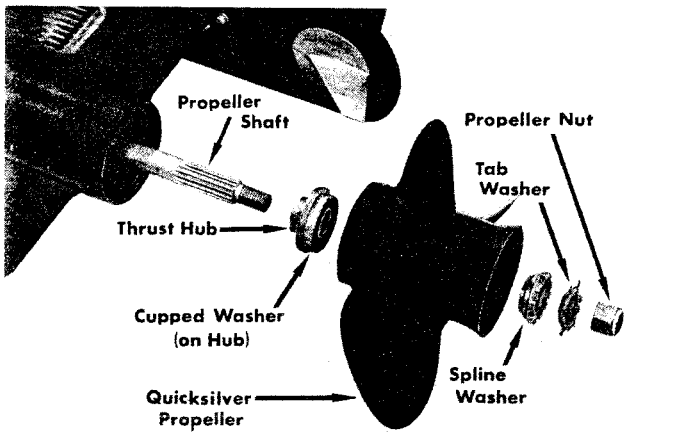


Figure 8. Installing/Removing Propeller - 6-Cyl. and 4-Cyl. Merc 800-650 Models

6-Cyl. Models and 4-Cyl. Merc 800-650 (Figure 8)

1. Place thrust hub into propeller hub (shoulder into recess of propeller).
2. While aligning splines, place Quicksilver jet-prop propeller (with thrust hub) and spline washer on propeller shaft in this order.
3. Place propeller nut in groove of tab washer.
4. Thread propeller nut on propeller shaft and tighten with 1-1/16" or adjustable wrench.
5. Bend 3 of the tabs of the tab washer down in grooves of spline washer to secure propeller nut.

Merc 650 (3-Cyl. 1972) (Figure 9)

1. Place small thrust hub into propeller hub (shoulder into recess of propeller).
2. While aligning splines, place Quicksilver jet-prop propeller (with small thrust hub) and large thrust hub on propeller shaft in this order.
3. Thread propeller nut on propeller shaft and tighten securely with 15/16" or adjustable wrench.

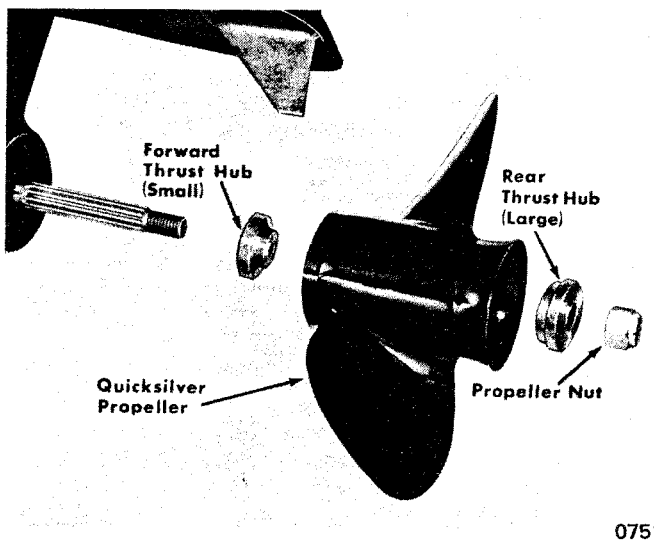


Figure 9. Installing/Removing Propeller - Merc 650 (3-Cyl.)

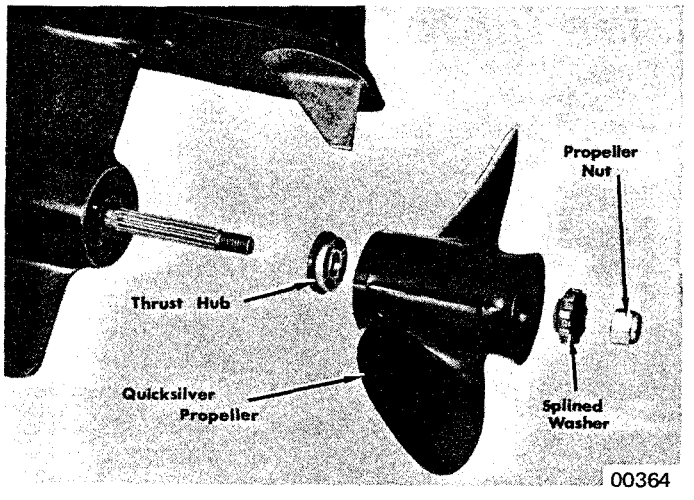


Figure 10. Installing/Removing Propeller - Merc 500-402-400 and 350

Merc 500-402-400 (2-Cyl.) and 350 (Figure 10)

1. Place thrust hub into propeller hub (shoulder into recess of propeller).
2. While aligning splines, place Quicksilver jet-prop propeller (with thrust hub) and spline washer on propeller shaft in this order.
3. Thread propeller nut on propeller shaft and tighten securely with 15/16" or adjustable wrench.

Merc 200-110-75-60-40-39 (Figure 11)

1. Apply a liberal coat of Perfect Seal (C-92-34227) on propeller shaft splines.
2. Slide collar and propeller onto shaft.
3. Place washers (one washer on 1972 models) and nut on end of propeller shaft and tighten nut securely.

3-4. HOW to REMOVE PROPELLER

To remove propeller, reverse procedure from Paragraph 3-3, preceding.

3-5. PROPELLER REPAIR

If your propeller should become damaged, see your Mercury Outboard dealer for repair. This is your assurance that your propeller's original superb precision will be restored in the process of repair and that you will continue to enjoy its superior performance.

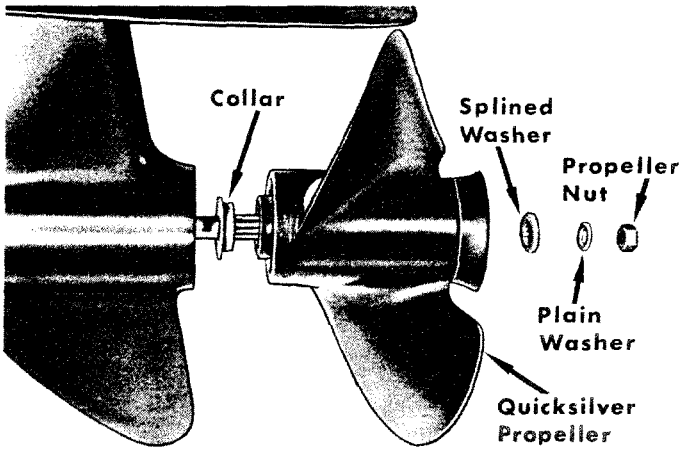


Figure 11. Installing/Removing Propeller - Merc 200-110-75-60-40-39

Section 4 - Accessories Installation

4-1. REMOTE CONTROL ATTACHMENT (Single Lever Mer-Control)

All 1966-thru-1972 Models, except Merc 200-110-75-60-40-39

Right side mounting in boat is recommended. If left side mounting is necessary, remove throttle-shift control handle and place on opposite side of control housing. Install control cables on motor in the following manner:

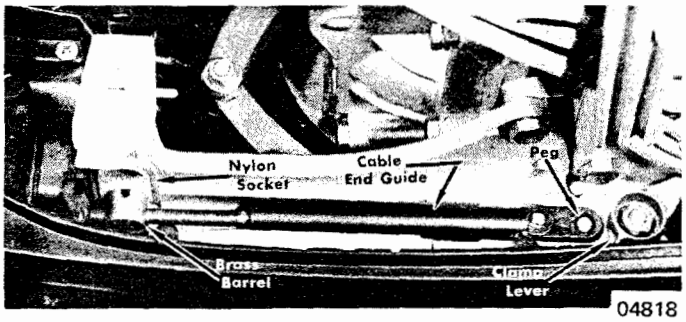


Figure 12. Shift Cable Brass Barrel Positioned in Nylon Socket

1. Remove front cowl and wrap-around cowl. (See Paragraph 8-1.)
2. Place remote control handle and motor in neutral position and smaller neutral warmup lever (on side of remote control box) down all the way.
3. Place throttle and shift cables thru opening in bottom cowl.
4. Place SHIFT cable end guide over peg and secure brass barrel in recess without disturbing neutral setting. (Figures 12 and 13 are typical.)
5. If necessary, readjust brass barrel for correct position and to compensate for backlash.

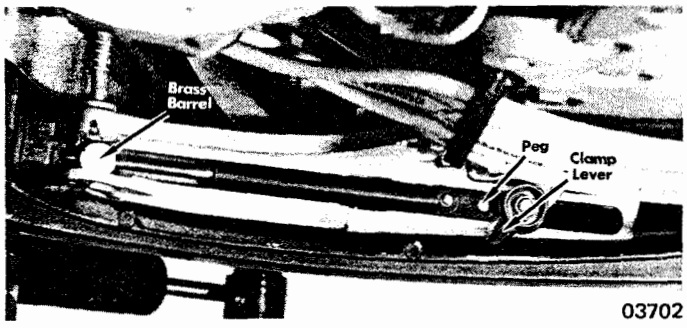
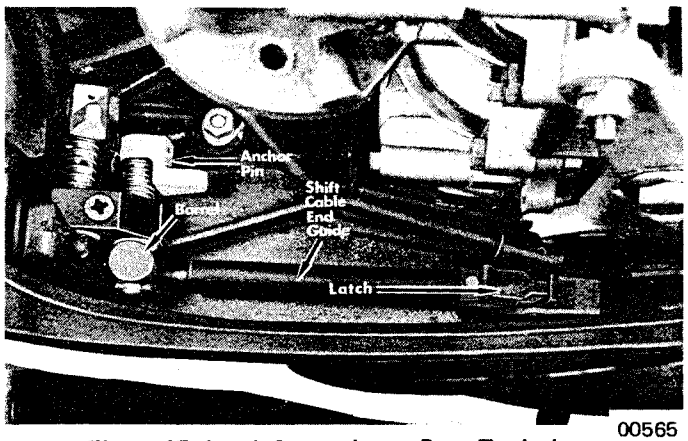


Figure 13. Shift Cable Brass Barrel Secured on Anchor Pin

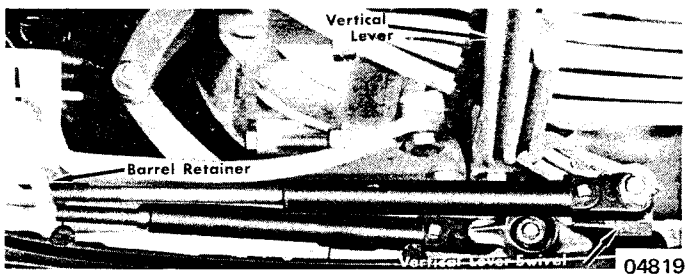
Figure 14. Clamp Lever Secured over Peg - Typical



00565

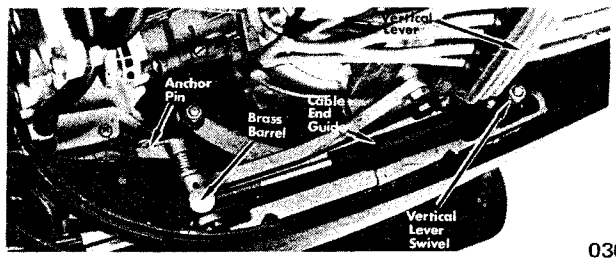
Figure 15. Latch Secured over Peg - Typical

6. Secure clamp lever (Figure 14) or latch (Figure 15) over peg.
7. Check that motor is in neutral when control is in neutral. If not, adjust shift cable brass barrel.
8. Secure brass barrel of THROTTLE cable over shift cable brass barrel. (Figures 16 and 17 are typical.)
9. Position vertical lever (Figure 16, typical) so that distributor (or magneto; throttle actuator on Merc 402) is held lightly against idle stop screw. (Figure 18 is typical.)
10. Attach throttle cable end guide to vertical lever without disturbing idle stop setting. If necessary, adjust brass barrel for correct position and to compensate for cable backlash.
11. Move single lever remote control handle to forward position, then back to neutral. Check that distributor (or magneto or throttle actuator) is held lightly against idle stop screw when control handle is in neutral.



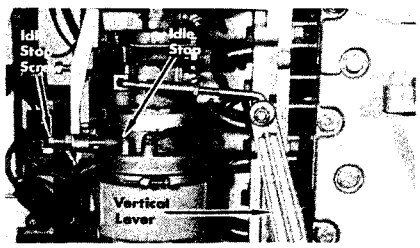
04819

Figure 16. Throttle Cable Brass Barrel Secured in Nylon Socket



03660

Figure 17. Throttle Cable Brass Barrel Secured with Anchor Pin



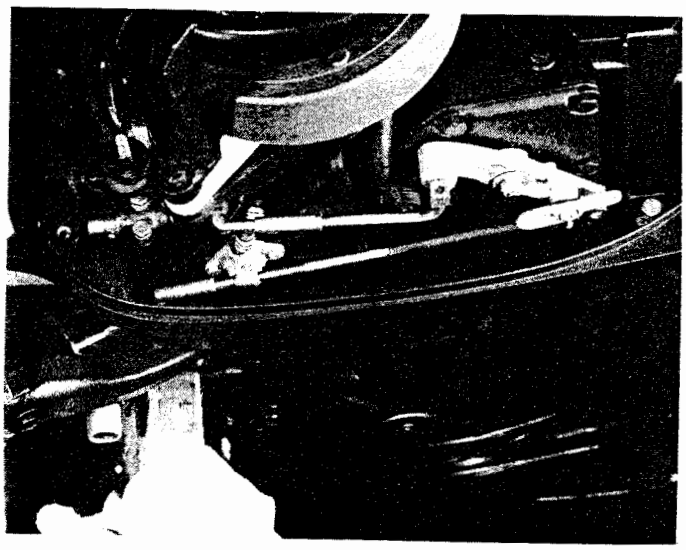
04813

Figure 18. Idle Stop Screw

Merc 200-110-75-60-40-39 Models

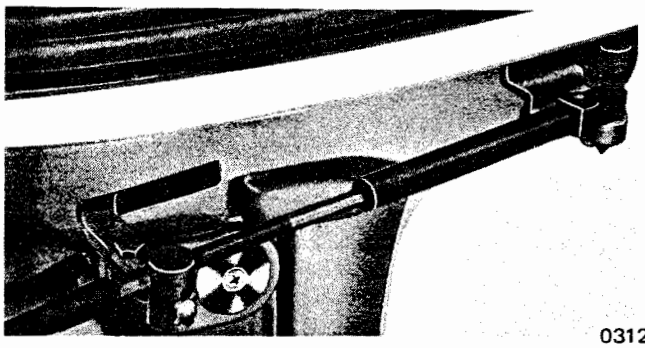
If control cables are removed from motor at any time, reinstall by following instructions included in remote control attaching kit. See Figure 19 for Merc 200 and Figure 20 for Merc 40.

NOTE: On all models without electric start, install stop switch (to stop motor) between remote control housing and "Stop" button on bottom cowl. (Figure 21) On all electric starting models, the stop switch is incorporated in the wiring harness and requires no separate installation.



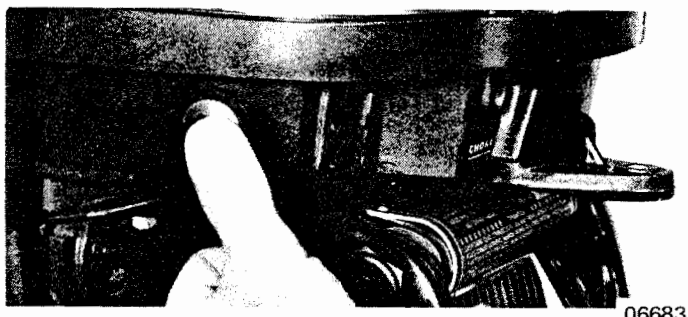
04733

Figure 19. Merc 200 Throttle Attachment



03120

Figure 20. Merc 40 Throttle Attachment



06683

Figure 21. "Stop" Button

4-2. DUAL MOTOR INSTALLATION

When operating two electric starting outboard motors on the same boat, it is recommended to use two batteries, each independent of the other. "RIDE-GUIDE" Dual Steering Control is recommended for dual motor installation.

Section 5 - Fuel Mixture and Fuel System

5-1. INSTALLING FUEL TANK

Set the fuel tank (Figure 22) in approximate correct position in bottom of boat. Connect fuel line to motor by inserting twist connector into receptacle in bottom cowl. (Figure 23) Lock by turning 1/8-turn clockwise. Determine the most favorable position of the fuel tank, bearing in mind the importance of arranging the fuel line in such a manner that it cannot become pinched, kinked, sharply bent or stretched during operation of the motor. Check with the motor in extreme left and right turn positions.

Secure tank to boat. Mercury "Tank Traps" (Mercury Accessory No. A-24016) are excellent for this purpose. They are simple, rugged thumb screw clamps which can be installed permanently in the boat. The tank then can be locked or freed by a turn of each thumb screw.

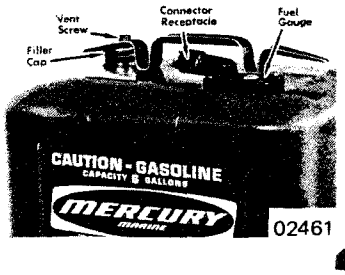


Figure 22. Fuel Tank

Figure 23. Fuel Connector

CAUTION: Use CARE when transporting fuel tanks, whether in a boat or car. DO NOT fill fuel tanks to maximum capacity. Cool gasoline expands considerably and builds up pressure in the fuel tank due to higher outside temperatures. This can cause fuel leakage and a potential fire hazard.

NOTE: In Imperial measure, one U.S. ounce is 0.3 liter; one U.S. gallon is .83 Imperial gallon or 3.8 liters.

CAUTION: DO NOT OPERATE your Mercury Outboard on white gasolines intended for use in stoves or lanterns. Regular leaded, low-lead and lead-free automotive fuels are satisfactory in all Mercury Outboards. Some premium gasolines, other than Amoco lead-free premium, may contain additives harmful to 2-cycle engines, and their use should, therefore, normally be avoided.
Some oil companies manufacture high-grade fuels, leaded or lead-free, which are specifically designed for use in 2-cycle engines, either directly or as pre-mixes. Such fuels, if known to be of good quality, may continue to be used.
Mercury Marine reserves the right to refuse warranty on parts which are damaged when using improper fuels or lubricants.

5-2. RECOMMENDED FUEL MIXTURE

Use automotive regular leaded or low-lead or lead-free gasoline and mix with oil in the following ratios:

1. When using FORMULA 50 Quicksilver 2-Cycle Outboard Motor Oil (Figure 24), thoroughly mix one 12-ounce can with each 5 gallons

of gasoline (8 ounces with each 3 gallons) in your remote fuel tank; 50:1 ratio. (Figure 22) (Imperial measure: 15 imp. oz. oil to 5 imp. gals. gasoline; metric measure: 400cc oil to 20 liters gasoline)

2. When using FORMULA 50-D Quicksilver 2-Cycle Outboard Motor Oil, thoroughly mix one 8-ounce can with each 3 gallons of gasoline in your remote fuel tank; 50:1 ratio. (Figure 22)
3. In emergency, when FORMULA 50 or 50-D Quicksilver Oil are not available, substitute a high quality 2-cycle oil that is intended for outboard use and meets BIA rating TC-W, shown on oil container. BIA rating TC-W is the Boating Industry Association's designation for approved 2-cycle, water-cooled outboard oils. Use manufacturer's recommended gas/oil mixture or, if not available, mix 24 oz. oil with each 5 gallons of gas (25:1 ratio). (Imperial measure: 30 imp. oz. oil to 5 imp. gals. gasoline; metric measure: 800cc oil to 20 liters gasoline)

Figure 24.
Formula 50
Quicksilver
2-Cycle
Outboard
08342 Motor Oil

CAUTION: The use of other than FORMULA 50 and 50-D Oil in the 50:1 ratio may cause piston scoring, bearing failure or both.

Do not, under any circumstances, use multi-grade or other automobile oils or oils which contain metallic additives. This type of oil is harmful to 2-cycle outboard motors and may result in piston burning, scoring or both.

5-3. CORRECT FUEL MIXING PROCEDURE

CAUTION: Observe fire prevention rules, particularly in the matter of smoking. Mix fuel outdoors or at least in a well-ventilated location.

Mix directly in remote fuel tank. Measure accurately the required amounts of oil and gasoline. Pour a small amount of gasoline into the remote tank (Figure 22) and add a small amount of oil (about the same amount as gas). Mix thoroughly by shaking or stirring vigorously; then add balance of oil and gasoline and mix again. Cleanliness is of prime importance in mixing fuel, as even a very small particle of dirt can cause carburetion trouble.

IMPORTANT: Always use fresh gasoline. When standing, gasoline forms certain gum and varnish deposits and, when kept in a tank for a length of time, may give carburetor trouble and cause spark plug fouling.

5-4. IMPORTANCE OF CONSISTENT FUEL MIXTURES

Carburetor idle adjustment is sensitive to fuel mixture variations which result from use of different gasolines and oils or due to inaccurate measuring or mixing. This may necessitate frequent readjustment of the carburetor idle needle. Be consistent. Prepare each batch of fuel exactly the same as previous ones.

IMPORTANT: Using less than the recommended proportion of oil may result in very serious motor damage from lack of sufficient lubrication. Using more than the recommended proportion of oil will cause spark plug fouling, erratic carburetion, excessive smoking and faster-than-normal carbon accumulation.

Section 6 - Starting and Stopping

CAUTION: Never start motor while out of the water, or water pump impeller will become damaged.

6-1. DESCRIPTION - ELECTRIC STARTING

The electric starter system of electric start models is negative ground, a 12-volt type especially designed for outboard use, as simple and dependable as the starting system on your automobile. There are no adjustments to make. The starting system consists of a 12-volt electric starter, fully spray-proof, an electrically operated choke and a full-wave rectifier converting generated alternating current in direct current for charging the battery.

The electrical system consists of four circuits: The generating circuit, starter circuit, choke circuit and ignition circuit. (Merc 650S and 500S 1967-68-69 models do not have the generating circuit.)

1. Generating Circuit: Within the flywheel are permanent magnets and a wound stator. The alternating current generated in the stator windings passes to the rectifier which, in turn, produces direct current from the alternating current. Negative side of the rectifier is grounded; positive side goes to the internal harness plug. Through the plug, current passes to the battery on the positive side. Negative side of battery is connected through connector to ground of motor.
2. Starter Circuit: Consists of a 12-volt motor and starter engaging mechanism. A starter solenoid makes it unnecessary for full starting current to pass through the ignition switch.
3. Choke Circuit: To operate choke, key must be in "ON" position. While using electric choke, manual choke must be in down position.
4. Ignition Circuit: Motor is stopped by grounding the ignition. This is accomplished by turning key to "OFF" (left) position. Three, four and 6-cylinder models also are stopped by interrupting the ignition circuit via the mercury switch when the motor is tilted up.

WARNING: Be sure that outboard is in "NEUTRAL" gear before attempting to start manually or electrically. If outboard starts while in gear, occupants may be thrown from boat.

6-2. ELECTRIC STARTING PROCEDURE

1. Be sure fuel tank contains a sufficient amount of fuel mixture and that tank is properly secured in boat.
2. Connect fuel line to motor by inserting twist connector into receptacle on cowl. Lock by twisting 1/8-turn clockwise, as shown in Figure 23.
3. Open air vent screw on fuel tank cap. (Figure 22)
4. Be sure that remote control cables are attached as instructed in Paragraph 4-1.
5. Fasten connector plug on end of electrical wiring harness to receptacle on front side of motor. (On 3-cyl. Merc 650, secure connector plug in place with retainer plate and 2 screws.) (Figure 25)

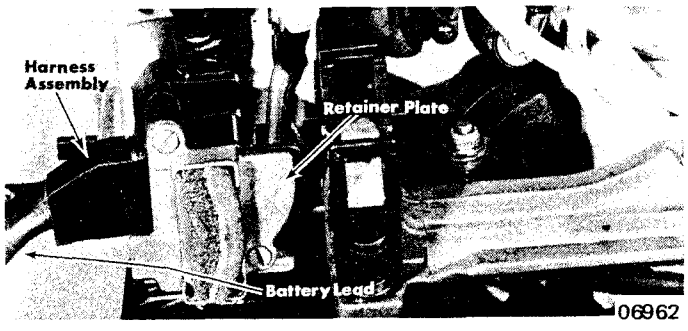


Figure 25. Securing 3-Cyl. Merc 650 (1972) Connector Plug

Figure 26.
Quicksilver Battery
(No. C-52941)
for Electric
Starting

08402

CAUTION: Connect red cable to positive (+) battery terminal. (Figure 26) Failure to attach cables correctly will result in destruction of rectifier and/or switch box.

6. Connect battery leads. Install battery lugs on end of lead wires and fasten securely to correct terminals on battery. Red lead of harness attaches to positive (+) post of battery and black lead to negative (-) post of battery. Use grease to prevent corrosion of terminals. The positive battery clamp has a 3/8" (9.5mm) stud for battery cable, and negative battery clamp has a 5/16" (7.9mm) stud. The positive (+) battery lead from the harness will have a larger hole in the spade end.
7. Prime carburetors and fuel system by squeezing primer bulb on fuel line. (Figure 27) When fully primed, bulb will feel firm.
8. **Shift into neutral.**

CAUTION: The starter motor is not designed for continuous operation, and serious damage may result if operated continuously. Do not operate for longer than 30 seconds. Allow a 2-minute cooling period between starting attempts.

9. With throttle handle in neutral, raise neutral warmup lever (on side of remote control housing, as shown in Figure 30) to the top and actuate electric starter by turning ignition key past "ON" position and allow to return to "ON". Before shifting motor, return neutral warmup lever to closed position (down).
10. If motor should falter, actuate choke. (Figure 28 is typical.)

02462

Figure 27. Priming Fuel System

NOTE: If motor is cold, engage starter with key in full right position and, simultaneously, depress choke button on the remote control box. During normal operation, do not depress choke button.

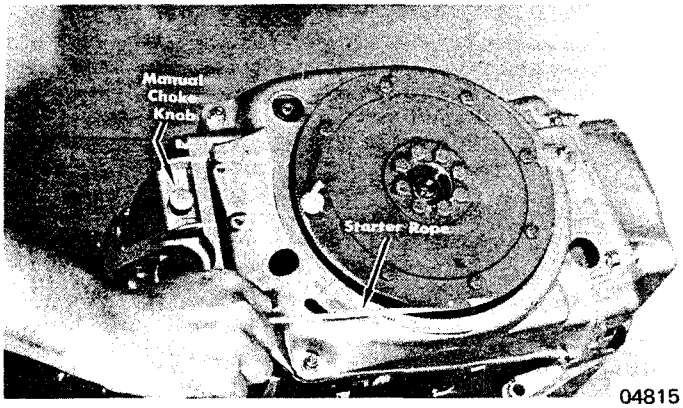


Figure 28. Manual Starting and Manual Choke (Pull "Up")

6-3. EMERGENCY STARTING PROCEDURE

Electric Starting Models

1. Be sure that fuel tank contains a sufficient amount of fuel mixture and that tank is properly secured in boat.
2. Connect fuel line to motor by inserting twist connector into receptacle in bottom cowl. Lock by twisting 1/8-turn clockwise as shown in Figure 23.
3. Open air vent screw on fuel tank cap. (Figure 22)
4. Be sure that remote control cables are attached as instructed in Paragraph 4-1.

CAUTION: Battery leads must be installed to battery (even though battery may be dead) as described in Paragraph 6-2. Failure to connect battery leads correctly will result in destruction of rectifier and/or switch box.

5. Prime fuel system by squeezing primer bulb on fuel line. (Figure 27) When fully primed. bulb will feel firm.
6. Remove cowling as described in Paragraph 8-1.
7. Shift in neutral and raise neutral warmup lever (Figure 30) to the advance position.
8. Turn switch to "On" position.
9. If motor is cold, set manual choke (Figure 28, typical) in closed position (pull or turn "Up"). Avoid use of choke if motor is warm.
10. Engage end of hand starter rope in one of the recesses provided in the flywheel starter plate. (Figure 28) (On 2-cylinder models, hand starter rope handle is on the top cowl.) Grasp handle firmly and pull with a full, vigorous stroke.
11. After motor starts, open choke and replace cowling.

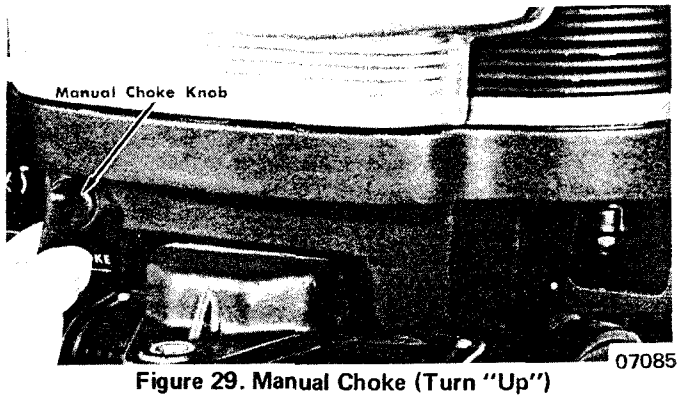
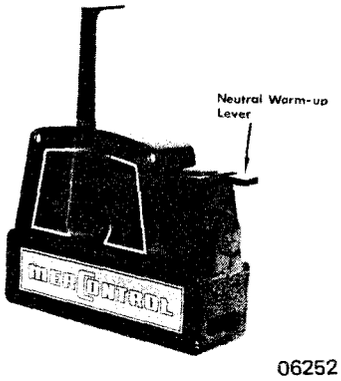


Figure 29. Manual Choke (Turn "Up")



06252

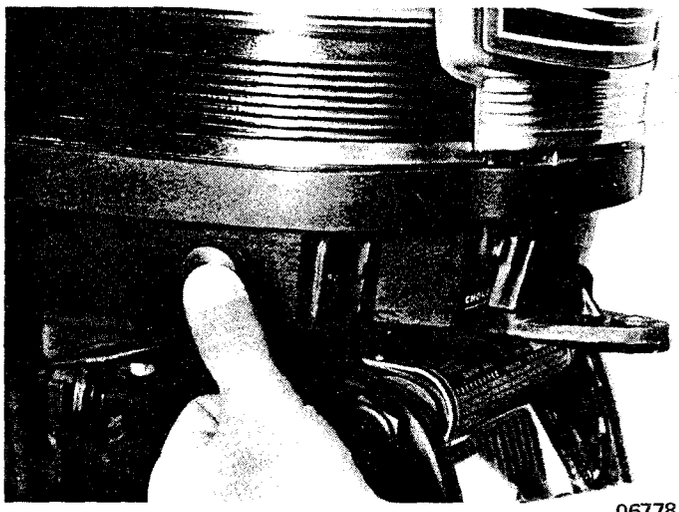
Figure 30. Single Lever Remote Control

6-4. MANUAL STARTING PROCEDURE

Manual Starting Models

1. Accomplish 1-through-4 in Paragraph 6-2.
2. Prime fuel system by squeezing primer bulb on fuel line. (Figure 27) When fully primed, bulb will feel firm.
3. If motor is cold, set manual choke in closed position (pull or turn "Up"). (Figure 29) Should motor begin to falter after starting, continue priming until fuel supply in carburetor is built up by running of motor. Avoid use of choke if motor is warm.
4. Shift into neutral.
5. On models so equipped, turn distributor or magneto shorting switch to "On" position. On electric starting models, turn key to "On" position.
6. With shift in neutral position and neutral warmup lever (if using remote controls) raised to the stop position, operate manual rewind starter. As soon as motor starts, move manual choke to open position and return neutral warmup lever to closed position "Down"). (Figure 30) During normal operation, always keep choke in open position ("Down").

NOTE: Starter is automatic rewind type. Proper operating technique will add many hours of life to starter cable and to starter internal mechanism. Grasp handle firmly and pull outward slowly until engagement of ratchet mechanism can be felt. Then continue outward pull with a full, vigorous stroke. Do not release handle at end of stroke and allow it to snap back. Retain grip on handle and allow cable to rewind slowly. Ratchet release mechanism is designed so that starter cannot engage during rewind.



06778

Figure 31. "Stop" Button

6-5. STOPPING

WARNING: If the motor will not be operated for a period of time, if it is to be removed from the boat, or if it is to be tilted up, we recommend the following practice to prevent spillage from the carburetor throat and bowl and to prevent gum formation in the carburetor during storage:

1. **Disconnect the fuel lines.**
2. **Allow motor to run at idling speed until it stops of its own accord, indicating that carburetor(s) have run dry.**
3. **Turn key to "Off" position on electric starting models (shorting switch "Off" on manual starting remote control box).**

If the motor is to remain installed on the boat, ready for immediate re-start, stop by shifting into neutral gear and, with motor running at slow idle, turn key to "Off" position on electric starting models (by turning shorting switch off on manual starting remote control box; by depressing "Stop" button on 2-cylinder models (Figure 31) or by shifting into "Neutral" and moving choke lever to left on Merc 40-39 models).

6-6. REMOVING MOTOR from BOAT

Disconnect the remote controls, steering connections and electrical starting harness (if so equipped) from the motor. Disconnect the fuel line. Remove bolts which secure motor to transom and loosen the clamp bracket thumb screws.

IMPORTANT: Keep motor in an upright position, resting on its skeg until all water has drained from the drive shaft housing. If the motor is placed on its side while water remains trapped in the drive shaft housing, some water may enter the cylinders through the exhaust ports and cause internal damage. Be sure that all water drain holes in gear housing are open, so that water will drain completely.

Section 7 - Operation

7-1. THROTTLE and SHIFT

When Using Remote Controls (Figure 30)

SHIFT: Shift remote control with a firm, quick motion. Approximately the first 45 degrees of control handle travel . . forward and reverse . . . shifts the motor.
THROTTLE: The remainder of the control handle movement advances the throttle.

IMPORTANT: Smooth operation of the single-lever remote control will ensure best results.

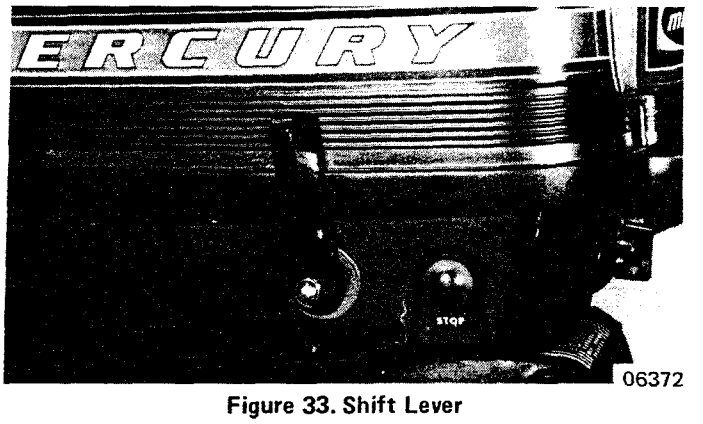
07330

Figure 32. Twist Grip Throttle

When Using Twist Grip Throttle - Merc 200-110-75-60-40 (Figure 32)

SHIFT: Gear shift is located on right side of motor. (Figure 33) Gear positions are "Forward", "Neutral" (vertical, as shown in Figure 33) and "Reverse".

THROTTLE: Ring on twist grip throttle has three settings - "Fast", "Start" and "Shift Range". (Figure 32) On 1972 Merc 200-110-75-40 models, the end of the twist grip has a friction device ("Troll Set") to hold throttle at a desired boat speed. To set the desired speed, select



06372

Figure 33. Shift Lever

the throttle setting by rotating the twist grip, then turn "Troll Set" clockwise. To release the drag, turn the "Troll Set" counterclockwise. FOR EMERGENCY THROTTLE OPERATION: Even though the "Troll Set" has been set to maintain a constant speed, the twist grip still can be turned manually to over-ride the setting without releasing the "Troll Set".

IMPORTANT: FOR EMERGENCY STOP of models with "Stop Button", depress "Stop Button" on bottom cowl. (Figure 31) Stop single-cylinder model by choking.

7-2. DON'TS

1. Don't operate motor with tilt lock pin removed.
2. Don't try to shift into "Reverse" while motor is not running.

Reverse gear clutch may not be in exact relative position to permit engagement with shifter clutch. Forcing shift lever under this condition will result in bent or damaged shifting mechanism.

3. Don't operate motor out of water or with flushing attachment, or water pump impeller will be damaged. Read "Flushing" instructions carefully, following in Paragraph 11-3.
4. Don't try to shift gears unless twist grip throttle is in "Shift Range" position.
5. Don't ease gears into engagement. A firm, quick shift is recommended.
6. Don't force gears into engagement.

7-3. ADJUSTABLE TRIM TAB and GALVANIC CORROSION INHIBITOR - Merc 350 thru 1400 Models

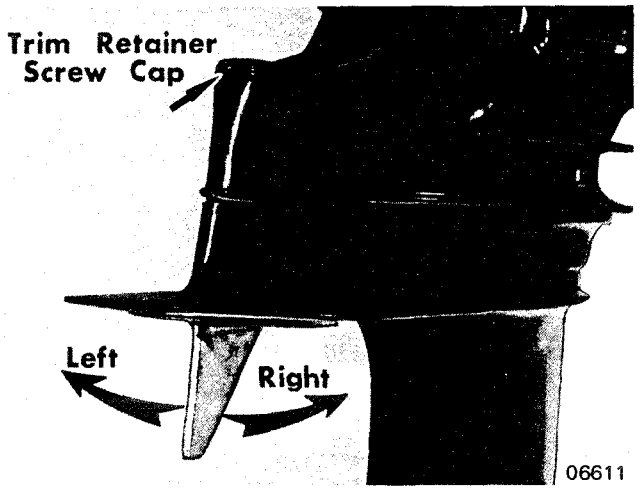


Figure 34. Trim Tab and Galvanic Corrosion Inhibitor

The trim tab and galvanic corrosion inhibitor balances "steeri torque" so that the steering wheel will turn with equal tension in ea direction. (Figure 34) If the boat turns more easily to the left, remo plug on top of drive shaft housing extension (Figure 1), loosen c screw and move trim tab to the left when viewing motor from behin Tighten cap screw and replace plug. Reverse the procedure if boat tur more easily to right. This special alloy trim tab has been developed aid in protecting the surfaces of the drive shaft housing and ge housing from electrolytic action (corrosion and pitting of met surfaces) on units operated in salt water areas. Surface erosion in sa water requires periodic replacement of the corrosion inhibitor. Do n paint or place protective coating on the trim tab, or its inhibiting val is lost.

For further protection from the effects of electrolysis, install th Quicksilver MerCathode System (C-46733A1), which provide solid-state electronic corrosion protection and can be obtained fro your Mercury dealer.

7-4. POWER TRIM OPERATION

CAUTION: When using Power Trim on some boats, operation at extreme "In" or "Out" positions greatly increases steering torque, and steering becomes difficult. Outboard should be trimmed to a safe operating angle to provide easy steering.

Trimming Up and Down for Forward Operation under High Thrust

NOTE: Do not turn at high speed with outboard tilted out beyon tilt pin flanges of clamp bracket, as outboard will have no side thrust support when tilted that high. Refer to "Tilt Pin Adjustment", Paragraph 2-2, before operating Power Trim. The tilt angle adjustment pin must be positioned as outlined to assure proper control of boat.

1. Raising with Power Trim: Press "Up/Out" button and hold butto

until outboard has moved out to angle required to properly trim boat. Power Trim unit is equipped with a cutout switch which will stop the outboard from moving out beyond the last tilt pin hole in the clamp bracket.

2. Lowering with Power Trim: Press "In" button and hold button until outboard has moved in to angle required to properly trim boat or until end of downward travel has been reached.

Trailering Boat or Reduced Throttle Operation (Beaching, Shallow Water, Etc.)

CAUTION: Exercise caution when operating engine at extreme tilt angles in shallow water. Should the water level fall below the water intake ports, overheating or water pump impeller damage could result.

To facilitate boat launching and loading, the outboard may be raised up beyond the clamp bracket flange by pressing the trailer "Up" and "Up/Out" buttons at the same time. Lower by using the "In" button. The outboard also may be raised and lowered when operating in shallow water at reduced throttle by using these buttons.

1. To raise outboard, press "Up" and "Up/Out" buttons and hold buttons until outboard has raised up to desired position or reaches end of upward travel.

   NOTE: If buttons remain depressed after outboard reaches end of upward travel, an overload cutout switch will open and pump motor will stop. To prevent cutout from opening, it is recommended that "Up" and "Up/Out" buttons be released as soon as outboard reaches the end of upward travel. If cutout should open, do not depress switches for approximately one minute. After this period of time, cutout will close, and unit may be operated.

2. To lock outboard up for repairs, etc, pump full up, then tilt by hand an additional small amount and engage tilt lock.

3. To lower outboard, press "In" button (disengage tilt lock if previously locked) and hold button until outboard has moved down to desired position or reaches end of downward travel.

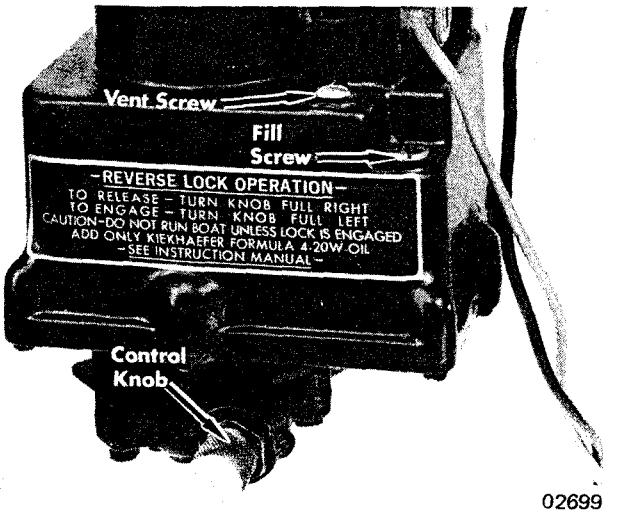


Figure 35. Control Knob and Fill Plug - Power Trim

Tilting Up Manually

1. Rotate control knob (Figure 35) full to the "right" (clockwise). This releases reverse lock and allows tilting up by hand from down position only. Manual control knob will not release to down position when it has been tilted up with pump.
2. To re-engage reverse lock in hydraulic pump, rotate knob fully to the "left" (counterclockwise) and press "In" button to return outboard to full down position.

NOTE: Unit will not hold reverse thrust if lock is not re-engaged.

Adjusting Trim Limit Switch

NOTE: Tilting and trimming up and down for operation under high thrust is done by using only the "Up/Out" and "In" buttons. This control allows a limit switch to stop pumping action while the engine still is within the clamp bracket for protection against breakage. Adjust tilt limit switch, if necessary, as follows:

1. Press "Up/Out" button and hold until engine tilts up and stops. Engine should not tilt beyond last tilt pin hole of clamp bracket.
2. Determine position to which engine has tilted by pulling out on lower unit to take up slack in hydraulic cylinders and attempt to install a tilt pin into the last pin hole. Proper adjustment is made when the tilt pin just inserts completely into the last hole.

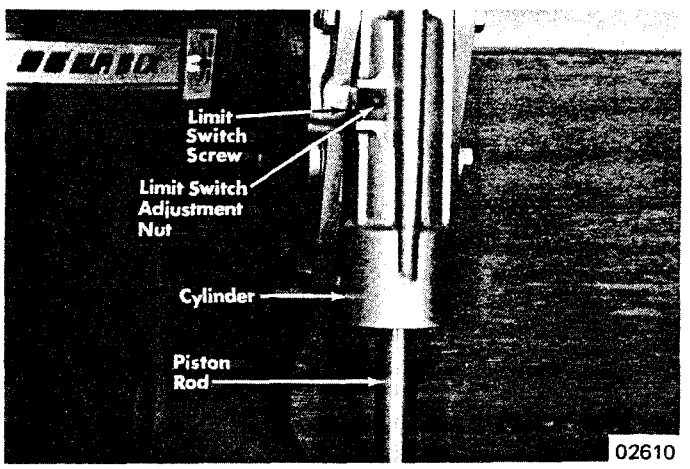


Figure 36. Trim Limit Switch - Power Trim

NOTE: If piston rods retract into cylinder more than 1/8" while pulling out on lower unit, it will be necessary to bleed air from the system.

3. If engine tilts out beyond last tilt pin hole of clamp bracket or does not tilt out far enough (as determined in preceding paragraph), loosen limit switch screw and adjust nut on limit switch. (Figure 36) Turn nut out (counterclockwise), if engine tilts out beyond last tilt pin hole, or turn nut in (clockwise) to allow engine to tilt out further.
4. Repeat steps No. 2 and 3, as necessary, to obtain proper trim position. Tighten limit switch screw.
5. To tilt engine up completely, see preceding information.

Checking Oil Level

Check hydraulic system oil level periodically as follows:

1. Tilt outboard to full up position.
2. Remove "Fill" plug. (Figure 35)
3. Fill to bottom of threads with a high quality, name brand SAE 20-20W specification MS automotive oil. Do not overfill.
4. Replace "Fill" plug and return outboard to normal operating position.

7-5. HOW TO TELL WHETHER WATER PUMP IS OPERATING

Normal operation of the water pump is indicated by a "tell-tale" stream of water issuing from a small hole at the rear of the bottom cowl. (Figure 1) If, at any time during operation, this stream is not evident, turn motor off immediately and check hole with a piece of wire to be sure that it is not clogged. If clogged, and unable to dislodge obstruction with wire, avoid futher operation until water pump and cooling system have been checked for failure. Operation of motor with

inoperative water pump or with obstruction in the cooling system will cause severe damage from overheating. Motor should be referred to an Authorized Mercury Service facility for inspection and necessary repair.

7-6. CAVITATION

Cavitation is indicated by intermittent or continued overspeed of the motor, accompanied by violent water agitation and a sharp reduction of boat speed. Cavitation occurs when the slipstream (flow of water past propeller) changes from a smooth, consistent flow to a turbulent flow. Under conditions of cavitation, the turbulent area or cavity around the propeller causes a very noticeable loss of forward thrust. Most commonly, cavitation is caused by one of the following:

1. Propeller operating too close to surface. This may be due to transom being too high, tilt angle adjusted so that lower unit is too high or boat riding stern-high because of improper loading. (Figure 3)
2. Turbulence in slipstream due to obstruction such as a wide or deep keel. This can be helped in most cases by tapering keel in both width and depth from a point about 20" forward of trailing edge; however, for best results, boat should have no keel in last 4 feet of stern.
3. Propeller fouled by weeds, rope, etc.
4. Damaged or broken propeller blades. Broken blade is usually indicated by excessive vibration.
5. Propeller safety clutch slipping due to damage. This might be mistaken for cavitation.

7-7. SHALLOW WATER OPERATION

CAUTION: When shift lever is in "Neutral" or "Reverse" position, lower unit is locked in normal operating position. Shock load of impact could cause transom breakage, particularly when boat is backing up. Proceed cautiously when in reverse motion and be careful of under water obstructions. DO NOT accelerate motor to high RPM.

7-8. OPERATION in SALT WATER

Prior to operation in salt water, it is recommended that the cowl be removed, and the entire powerhead be sprayed with Quicksilver Corrosion and Rust Preventive (C-92-29152 or C-92-63260).

Section 8 - Fuel System Maintenance

8-1. REMOVING COWLING

MODELS with FRONT COWL and WRAP-AROUND COWL (Figure 1): Remove front cover plate by pressing in and turning the knob on the bottom of the plate a ¼-turn and lifting up and out until the hinge disengages at the pivot point. (Figure 37) Release the fastening clamps (Figure 38) to permit the cowl band to be removed from the motor. Remove the top cowl by lifting up and releasing the latch located at the front (Figure 39) or side of the top cowl. Under normal conditions, all motor parts that need adjustment now are exposed.

MERC 650 (3-Cyl.): Remove front cowl by pushing release lever toward fuel line receptacle and lift cowl up until the hinge disengages at the pivot point. (Figure 40) Remove fastening clamps from the wrap-around cowl (Figure 38) and push both sides of the cowl outward. Lift cowl up and to the rear to remove.

MERC 402-400-350: Remove front cover plate by pressing down on button under starter handle and pulling off front cover plate. (Figure 41) Release the fastening clamps to permit removal of cowl band from motor.

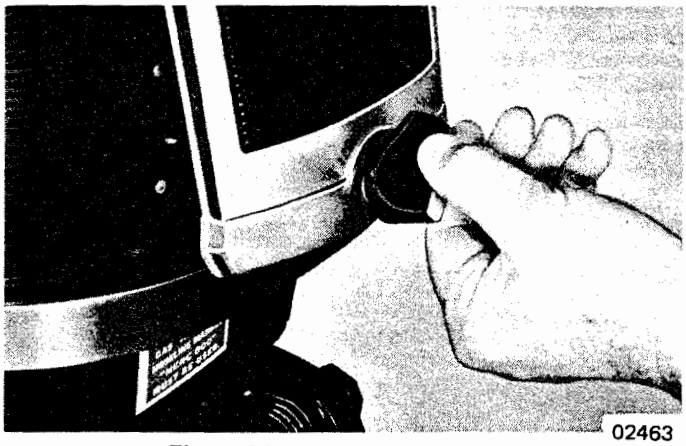


Figure 37. Removing Front Cowl

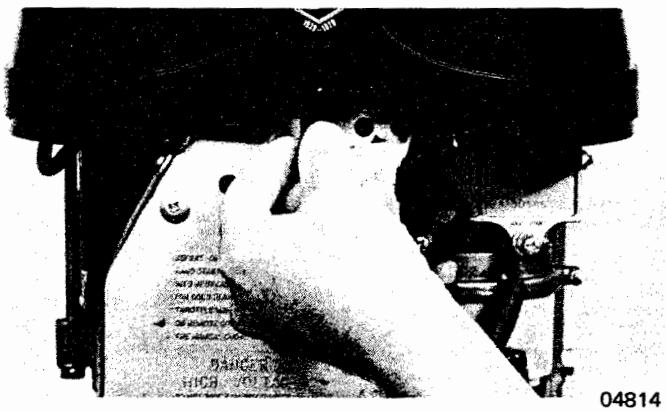


Figure 39. Removing Top Cowl

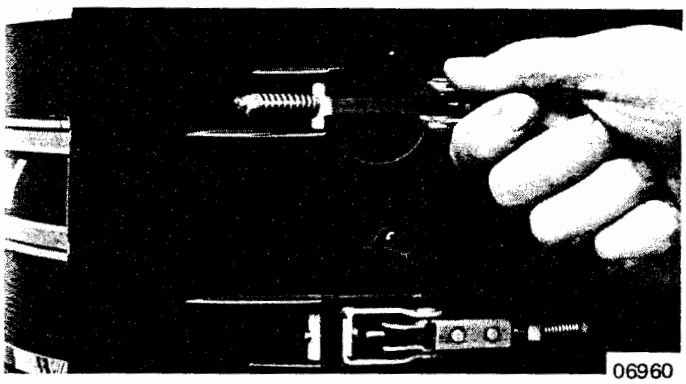


Figure 38. Removing Wrap-Around Cowl

Figure 40. Removing Front Cowl - Merc 650 (3-Cyl.)

Figure 41. Removing Front Cover Plate

MERC 200: Press button above front cover plate (under starter handle) and remove plate. This exposes the fastening clamps which secure the cowl (wrap-around) band. Release the two clamps and remove band.

MERC 110-75-60: Remove top cowl by pulling down on the two "Unlock" levers on the inside of the tilt handle from underneath. (Figure 42)

MERC 40-39: Pull the two latch pin levers outward from side of bottom cowl (Figure 43) and lift top cowl off (up and forward).

Avoid operation of motor with cowling removed.

8-2. CARBURETOR ADJUSTMENT

Each carburetor is provided with one adjustment; however, before attempting to readjust carburetor(s), check for other possible causes of trouble as outlined in "Trouble Chart," Section 12. The low speed mixture adjusting needle turns clockwise for leaner mixture, counterclockwise for richer mixture. High speed has a fixed jet, similar to those used in automobiles.

8-3. APPROXIMATE INITIAL SETTING

If carburetor(s) are out of adjustment so motor cannot be started, turn low speed mixture adjusting needle inward (clockwise) until it seats lightly, then turn back out one turn. (Turning tight will damage the needle and seat.) This approximate setting will permit starting but may be found too rich for normal operation; therefore, as soon as motor starts, correct final adjustment may be attained as instructed in "Low Speed Mixture Adjustment," Paragraph 8-4.

Carburetor(s) are factory adjusted and, therefore, require no additional adjustment if operated at an elevation of less than 4,000 ft. In mountainous areas with high elevations, the dealer will select different high speed jet(s), install in the carburetor(s) and adjust carburetor(s) before delivery of the motor. In making final adjustment of 4 and 6-cylinder carburetors, it should be borne in mind that only two

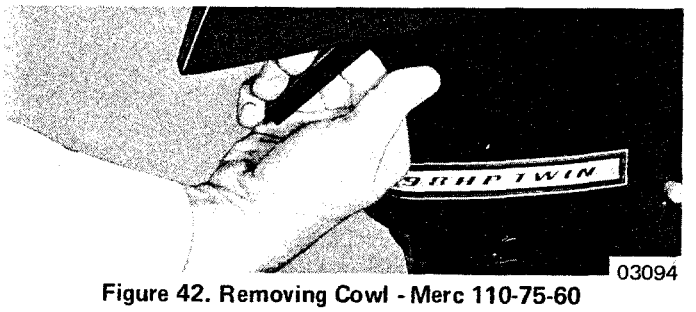


Figure 42. Removing Cowl - Merc 110-75-60

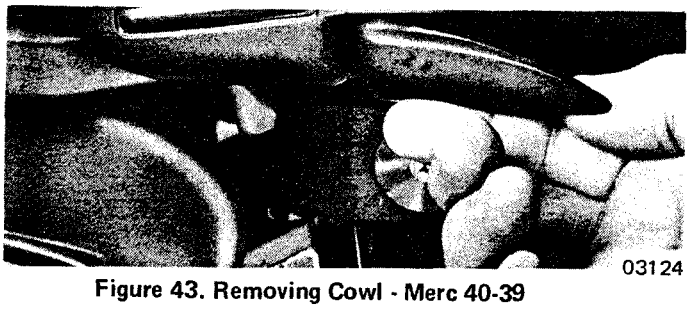


Figure 43. Removing Cowl - Merc 40-39

cylinders are fed by one carburetor; therefore, adjustments on each carburetor will affect mixture to corresponding cylinders only.

8-4. LOW SPEED ADJUSTMENT

1. Warm up motor before attempting to make adjustment.
2. Remove cowling as instructed in Paragraph 8-1.
3. With the motor running at idle speed while in forward gear, turn the low speed mixture adjusting needle counterclockwise until motor starts to "load-up" or fire unevenly due to over-rich mixture. (Figure 44)
4. Then slowly turn the needle clockwise until cylinders fire evenly and motor picks up speed.

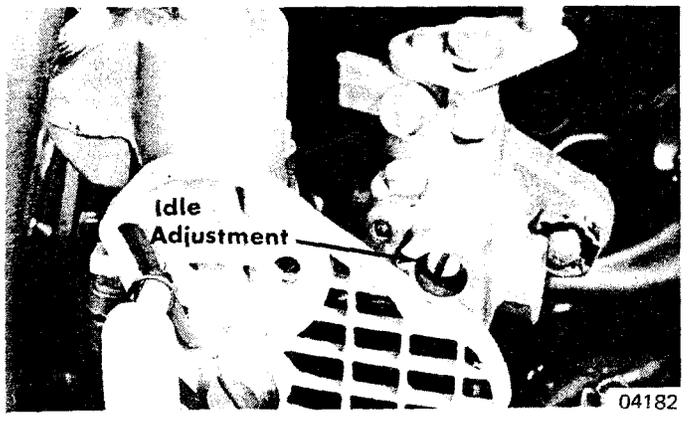


Figure 44. Low Speed Adjustment - 200-110-75-60-40-39

5. Continue turning clockwise until too lean a mixture is obtained and motor slows down and misfires.
6. Set adjustment screw halfway between rich and lean.
7. Do not adjust leaner than necessary to attain reasonably smooth idling. When in doubt, it is preferable to have the mixture set slightly rich rather than too lean.

NOTE: Idle cannot be adjusted effectively in "Neutral", or motor will sputter and stop when shifted to "Forward" because of "no load" condition while adjusting.

8-5. SERVICING FUEL TANK FILTER

Detach the fuel line from fuel tank and remove fuel pickup tube by removing screws in top connector housing. The filter, a fine wire mesh, can be cleaned by rinsing in clean benzol (benzine).

8-6. SERVICING MOTOR FUEL FILTER

1. Remove cowling as instructed in Paragraph 8-1.
2. Remove front bracket from 4 and 6-cylinder models by taking off cap screws which secure it to front of bottom cowl and top plate.
3. Remove screw from top of filter cover(s) on the carburetor(s).
4. Remove fuel filter cover(s).
5. Inspect filter(s), fuel lines and fittings for signs of wear or leakage.
6. Drain and clean filter(s).
7. Replace filter cover(s), tighten screw(s) and install front bracket (4 and 6-cylinder models) and cowl.

NOTE: Fuel filter is more than adequate to take care of all requirements under normal use. If, after all other checks, fuel filter is found to be the cause of the trouble, the filter element should be replaced.

Section 9 - Lubrication

9-1. MERCURY OUTBOARDS LUBRICATION CHART

1966 thru 1972 Merc Models	Location	Fig. No.	Lubricant	Frequency: Every 30 Days	Every 60 Days	Once in Season	Twice in Season
All	Lower Drive Unit	45	Super-Duty Gear Lubricant (C-92-52650 or C-92-63225)	X			
All	Propeller Shaft Splines	8	Perfect Seal (C-92-34227)	X			
All	Swivel Pin	46	Anti-Corrosion Grease (C-92-45134 or C-92-63290)	*	X		
3-4 & 6-Cyl.	Distributor Adaptor	47	Multipurpose Lubricant			X	*
If Equipped	Ride-Guide Tube and Cable	48	(C-92-49588 or C-92-63250)	*	X		
402-400-350	Reverse Lock Cam	--			X		
If Equipped	Ride-Guide Pivot/Ball Joint	48		*	X		
All	Throttle/Shift Linkage	49		*	X		
All	Upper Shift Shaft	49	Anti-Corrosion Oil	*	X		
All	Thumb Screws	50	(C-92-39928A1 or	*	X		
All	Reverse Lock Lever	50	C-92-63281)	*	X		
All	Tilt Stop Lever	6		*	X		
200-110-75-60-40-39	Stator Plate Clamps	--				X	*
110-75-40-39	Tiller Handle Pivot/Gears	51		*	X		
Electric Start Models	Starter Motor Pinion Gear	--	No. 10 Oil		*	X	
If Equipped	Power Trim Pump Oil Level	35	Formula 4 Oil (C-92-33157 or C-92-55573)		X		

** Units Operated in Salt Water*

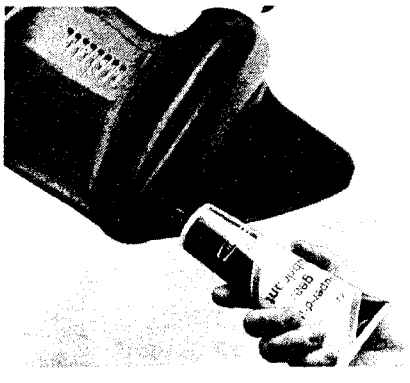
9-2. LOWER DRIVE UNIT LUBRICATION

Periodically lubricate drive unit with SUPER-DUTY Quicksilver Outboard Gear Lubricant (C-92-52650 or C-92-63225) as follows:

1. Remove lubricant filler plug and washer, located on bottom of gear housing. (Figure 45)
2. Insert lubricant tube into filler hole, then remove air vent screw and washer.

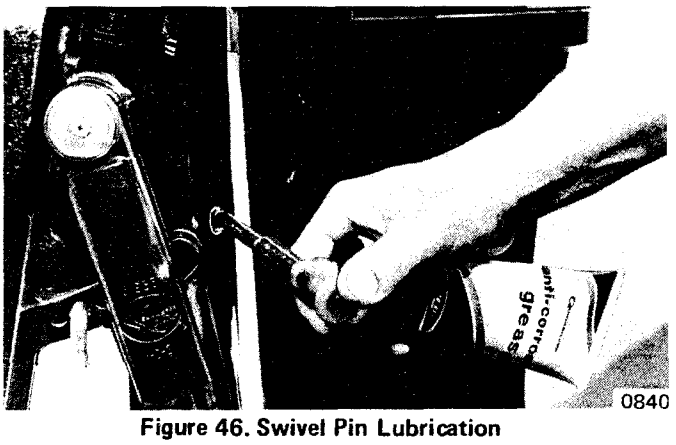
   IMPORTANT: Never apply lubricant to the lower unit without first removing air vent screw, as the injected lubricant displaces air which must be allowed to escape so that the gear housing can be filled completely. DO NOT use regular automotive grease in the lower drive unit. Use ONLY SUPER-DUTY Quicksilver Gear Lubricant.

3. Fill gear housing with lubricant until excess starts to flow out of air vent screw hole.
4. Replace air vent screw and washer.
5. Remove lubricant tube from filler hole and install filler plug and washer.



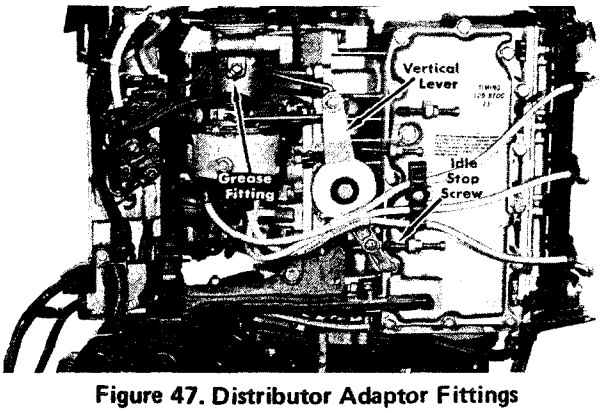
08404

Figure 45. Lower Drive Unit Lube



0840

Figure 46. Swivel Pin Lubrication



0695

Figure 47. Distributor Adaptor Fittings

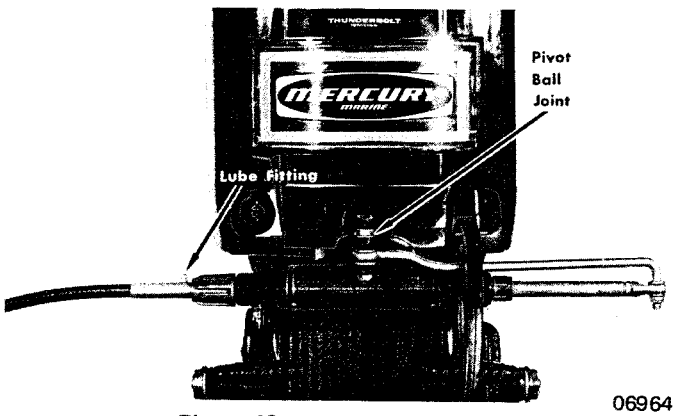


Figure 48. Ride-Guide Tube

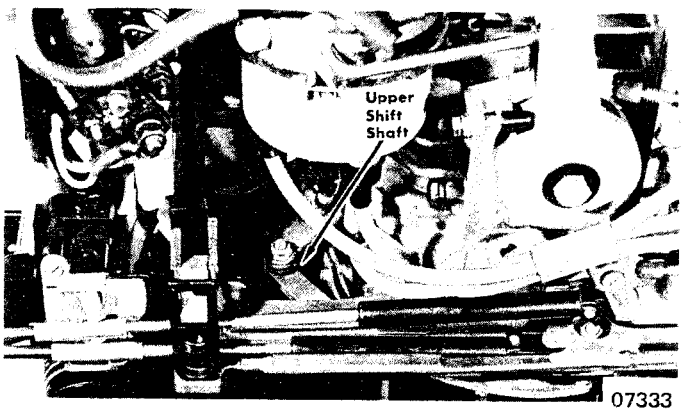


Figure 49. Throttle-Shift Linkage and Upper Shift Shaft

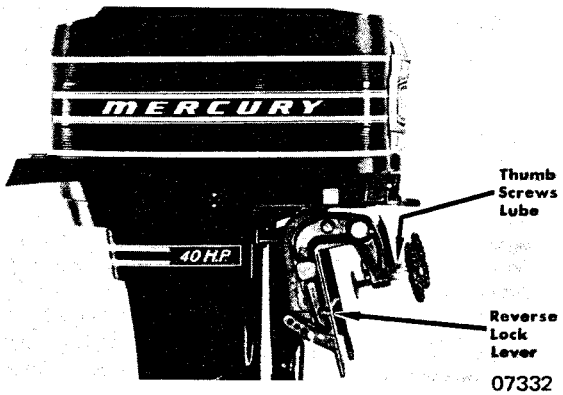


Figure 50. Reverse Lock Lever - Thumb Screws - Tilt Stop Lever

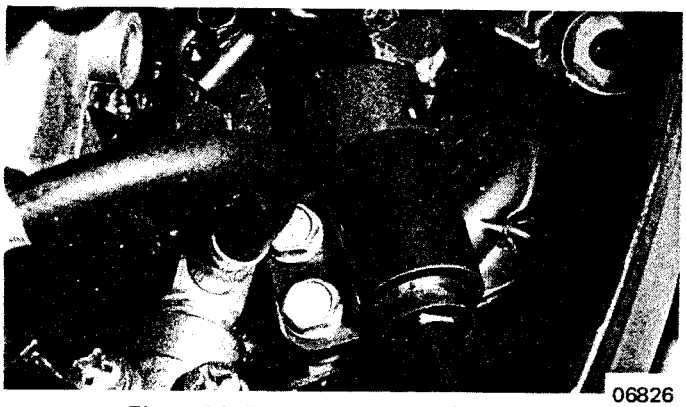


Figure 51. Tiller Handle Pivot/Gears

Section 10 - Ignition Maintenance

10-1. MAINTENANCE

The electrical system is as trouble-free and as simple as our research and engineering department has been able to make it. If, for any reason, some part of the electrical system is not in operation, do not attempt to fix it yourself, but refer to your nearest Authorized Mercury Service facilities. (See Sections 8, 10 and 11).

10-2. SERVICING SPARK PLUGS

WARNING: Do not touch or disconnect any ignition system parts while engine is running or while battery cables of electric starting models are connected.

Do not remove spark plug connectors and hold them in your hand to check for spark while engine is running, as high voltage is present.

Operation with old or wrong type spark plugs will be reflected by motor performance as indicated by hard starting, fouling, missing, overheating, pre-ignition or lack of normal power. Therefore, whenever motor performance indicates that the spark plugs are in need of attention (see "Trouble Chart", Section 12), service as follows:

1. Remove cowling as instructed in Paragraph 8-1.
2. Disconnect spark plug leads.
3. Remove spark plugs, clean and inspect. If the electrode on plugs with Thunderbolt Ignition is burned away to the extent that it is 1/32" (.8mm) below plug surface, replace with new spark plugs, as indicated on "Specifications" page, preceding. On models without Thunderbolt Ignition, adjust plug gap to recommendation shown on "Specifications" page, preceding.
4. Install spark plugs. Be sure that gaskets are in good condition. Sta the threads one or two turns with fingers to avoid danger c cross-threading. After seating plug finger-tight on gasket, a additional ½-turn with a wrench generally will be sufficient t tighten. Do not overtighten; insulator may crack, due to ove stressing spark plug body, or threads may strip in cylinder head.
5. Connect the spark plug leads. Be sure that each lead is connected t its respective spark plug. If high tension lead insulation is damage or deteriorated, new leads must be installed. Defective insulatio will cause hard starting and mis-firing due to intermittent shortin of the high tension circuit.

10-3. BATTERY - ELECTRIC START MODELS

A strong battery . . . 70 ampere hour minimum capacity (32 ampe hour or larger for Merc 200 with electric starting kit) . . . must b maintained. If the battery shows less than 9½ volts when under startin load, it should be recharged. Check with a DC voltmeter. A readin under 9½ volts (measured at the battery terminals under starting loa indicates insufficient voltage and subsequent shortage of power, wit the result that the motor will not turn fast enough to start.

Check also can be made with a hydrometer. If the reading is belo 1.230 (specific gravity), recharge or replace the present battery. Whe installing a new battery, make it a habit to wire brush the tapere terminals and clamp terminals, then clean and grease them. This wi protect against high resistance connections which make it difficult t keep the battery fully charged and may contribute to low availabl voltage in entire electrical starting system.

10-4. MAINTENANCE of BATTERY

All lead acid batteries (Figure 26) have an inherent self-discharge characteristic when not in use. Recharge every 60 days or when specific gravity drops below 1.230. (Recharge rate should not be over 6 amperes. Discontinue charging when gravity reaches 1.260.) Cover plates with distilled water, but not over 3/16" (4.8mm) above perforated baffles.

10-5. WINTER STORAGE CARE of BATTERY

1. Remove battery from its installation as soon as possible and remove all grease, sulfate and dirt from top surface with water hose and compressed air hose or other means.
2. Cover plates with distilled water, but not over 3/16" (4.8mm) above perforated baffles.

CAUTION: A discharged battery can be damaged by freezing.

3. Grease terminal bolts well with cup grease or vaseline.
4. Store battery in a COOL-DRY place in a dry carton or box.
5. Remove battery from storage every 60 days. Check water level and put on charge for 5 to 6 hours at 6 amperes. DO NOT FAST CHARGE.
6. When ready to place the battery back into service, remove excess grease from terminals (leaving small amount on), recharge as necessary and reinstall in your equipment.

If unable to have above performed by your local Mercury dealer, contact your local automotive garage.

10-6. ELECTRICAL ACCESSORIES CONNECTIONS

Any accessories, such as horns, running lights, etc, should be installed with electrical connections attached directly to battery terminals via the screws on the battery lugs. (Figure 26) the current charge to the battery on electric start models is a maximum 14 amps gross (7.5 on Merc 402) at full throttle, the exact current depending upon battery condition and engine model.

Section 11 - Special Care Required

11-1. PERIODIC INSPECTION

Periodic systematic inspection is the simplest and most positive way of discovering and correcting a failure before it can cause inconvenience or mechanical damage. The recommended inspection interval is based on average operating conditions in utility service. Under severe conditions, continuous heavy duty or high speed operation, the inspection interval should be shortened.

In salt water, however, continuous operation is more beneficial than occasional use.

The inspection includes the following:

1. Clean the entire unit thoroughly, including all accessible powerhead parts.
2. Check entire unit for loose, damaged or missing parts. Tighten or replace as required.
3. Lubricate the lower drive unit as instructed in Paragraph 9-2.

4. Lubricate other points as instructed in Paragraph 9-1.
5. Lubricate starter motor shaft on electric start models with light film of S.A.E. No. 10 oil. Do not over-lubricate.
6. Service spark plugs as instructed under Paragraph 10-2.
7. Inspect spark plug leads and electrical leads for damage or deterioration, particularly where insulation comes in contact with metal parts. Be sure to reconnect each lead to its respective post.
8. Inspect fuel lines for damage or deterioration.
9. Service the fuel filters as indicated in Paragraphs 8-5 and 8-6.
10. Remove propeller and inspect. Trim nicks and burrs with a file, being careful not to remove more metal than absolutely necessary. Inspect for cracks, damage or bent condition. If condition is doubtful, refer to Authorized Mercury Service facilities for inspection. Before reinstalling the propeller, lubricate the propeller shaft with a liberal coat of Perfect Seal (C-92-34227) or a waterproof-type lubricant. Refer to Paragraphs 3-3 and 3-4.
11. Inspect the finish for damage or corrosion. Thoroughly clean damaged or corroded areas and apply matching paint (Quicksilver Spray Paints - See your local dealer).
12. Check trim tab and galvanic corrosion inhibitor on models so equipped. (Figure 34) for damage or for deterioration from salt water operation.
13. Check remote controls on models so equipped. Be sure that all connections and fittings are in good condition, properly secured and correctly adjusted.

11-2. PREPARATION for STORAGE

WARNING: As a safety precaution, remove positive (+) battery cable on electric start models when boat is placed in storage, on display or in transit. This will eliminate possibility of accidental starting of engine and result in overheating and damage to the engine due to lack of water.

In preparing a motor for storage or shipment, the unit must be protected 1) against physical damage and 2) from rust, corrosion and dirt. The original shipping carton is ideal for storage or shipment but, if it is no longer available and a new container must be made, see your dealer for proper bracing, ventilation, etc, and complete the following:

1. Operate motor in water tank or flush cooling system according to instructions in Paragraph 11-3. Disconnect the fuel line from the motor and allow motor to run at idling speed until it stops of its own accord, indicating that carburetor(s) have run dry.
2. Drain fuel tank and fuel lines.
3. Remove cowling.
4. Service fuel filters as instructed in Paragraphs 8-5 and 8-6.
5. Lubricate lower drive unit as instructed in Paragraph 9 -2.
6. Lubricate control linkage as instructed in Paragraph 9-1.
7. Remove spark plugs.
8. Rotate crankshaft to position where the number one (top) piston is at bottom dead center position. This can be determined by inserting a pencil or rod into the spark plug hole. Apply Quicksilver Storage Seal (C-92-54778 or C-92-63233) into a spark plug hole, allowing time for some of the oil to drain into the crankcase via transfer ports. Repeat this operation on the other cylinder(s), then install spark plugs and operate the manual starter several times to distribute oil around the inside of the crankcase and cylinders.
9. Connect the spark plug cables. Be sure that each cable is connected to its respective spark plug.
10. Lubricate distributor adaptor on 3-4 and 6-cylinder models. See Paragraph 9-1.
11. Clean the motor thoroughly, including all accessible powerhead parts, and spray with Quicksilver Corrosion and Rust Preventive (C-92-29152 or C-92-63260). Install the cowling and apply a thin film of clean, fresh engine oil to all painted surfaces.
12. Remove the propeller, apply a liberal coat of Perfect Seal (C-92-34227) or a waterproof-type lubricant to the propeller shaft and reinstall propeller. Refer to Paragraphs 3-3 and 3-4.

and reinstall propeller. Refer to Paragraphs 3-3 and 3-4.

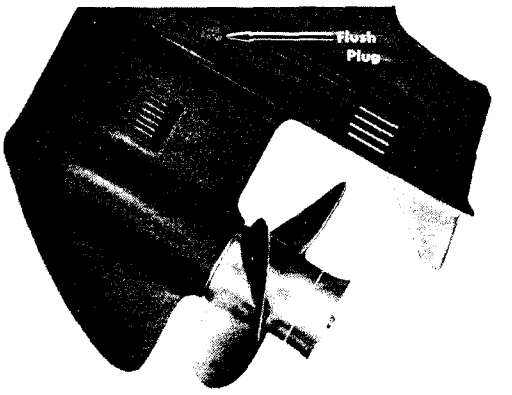
13. Lubricate swivel bracket. See Paragraph 9-1.
14. Battery storage and care. See Paragraphs 10-3, 10-4 and 10-5.

IMPORTANT: When storing outboard motors for the winter, be sure thatl all water drain holes in the gear housing are open and free and that the flushing plug is removed so that all water will drain out. Trapped water may freeze and expand, thus cracking the gear housing and/or water pump housing. Check and refill lower unit with SUPER-DUTY Quicksilver Gear Lubricant (C-92-52650 or C-92-63225) before storage to protect against possible water leakage into gear housing which is caused by loose air vent plug or loose grease filler plug. Be sure to replace gaskets under screws and flush plug, renewing any damaged gaskets.

11-3. ATTENTION REQUIRED following OPERATION in SALT WATER or SILT

Even though the interior surfaces of this outboard motor are treated to resist corrosion, there still is a possibility of a mechanical build-up of salt and silt deposits which no form of protective coating can prevent and which can be eliminated only by occasional flushing with fresh water. While there is no complete protection known for exterior surfaces, there are ways by which electroylsis and corrosion damage can be minimized. (Refer to trim tab and galvanic corrosion inhibitor, on models so equipped, in Paragraph 7-3.) Follow the simple steps, 1-thru-6 following, to materially increase the life of all exposed parts and decorative finishes:

1. When outboard is left on boat, it is recommended that it be left in operating position when moored. If partially tilted out of water, the trim tab cannot act as a galvanic corrosion inhibitor.
2. Disconnect the negative battery terminal on electric starting motors when in dock or in storage for any long period of time.
3. Lubricate the thumb screws (Figure 50) of the motor with Anti-Corrosion Grease (C-92-45134 or C-92-63290) to ensure smooth operation.
4. Lubricate the propeller shaft splines occasionally with a liberal coat of Perfect Seal (C-92-34227) or a waterproof-type lubricant, thus enabling the propeller to be removed easily.
5. The entire powerhead can be sprayed with a coating of Corrosion and Rust Preventive (Part No. C-92-29152 or C-92-63260) to protect the finish of all parts beneath the cowl. The exterior of the motor also can be sprayed or wiped to prevent salt corrosion from dulling the finish.
6. With motor in an upright position, flush cooling system by removing plug in gear housing marked "FLUSH" (beneath drive shaft trim cover on Merc 110-75-60; in right side of bottom cowl on Merc 40-39) (Figure 52 or 53), threading flushing device (C-48755A1) into hole and attaching garden hose coupling with hose. Turn on water but DO NOT OPERATE the outboard while flushing. Water flow is strong enough that flushing can be done with water pressure provided from the city water tap. DO NOT USE full water pressure.



01266

Figure 52. "Flush" Plug - 4 and 6-Cylinder and Merc 650-402-200

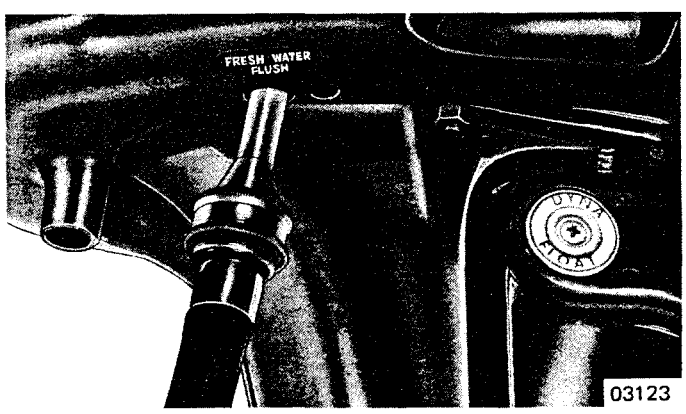


Figure 53. Flushing Motor - Merc 40 - 39

CAUTION: If outboard must be operated while flushing, in order to prevent damage to the water pump impeller it will be necessary to use a Flush-Test Device which attaches directly over the intake holes in the gear housing strut and provides cooling water at this point. DO NOT OPERATE outboard above idle speed while flushing with Flush-Test Device, or RPM cannot be controlled. See your local Mercury Outboard dealer for this device.

WARNING: When flushing, be certain that area in vicinity of propeller is clear and that no person is standing nearby, to avoid possible injury. It is advisable to remove propeller as a precautionary measure.

While and after flushing, keep motor in upright position, resting on skeg, until all water has drained from drive shaft housing to prevent water from entering the powerhead via drive shaft housing and exhaust ports. By following the preceding simple preventive maintenance operations at regular intervals, longer life will be added to your motor when used in salt water.

11-4. ATTENTION REQUIRED following COMPLETE SUBMERSION

Motor which has been submerged must be completely disassembled for cleaning and inspection. This requires the facilities and experience of Authorized Mercury Service facilities and should be accomplished as soon as possible after recovery. Delayed action will encourage rust and corrosion of internal parts. If Authorized Mercury Service is not immediately available, follow instructions in steps 6 through 11 under Paragraph 11-1. This will retard rust and corrosion. Basically the points to remember are these:

1. Recover motor and begin cleaning as quickly as possible.
2. Wash entire motor with fresh, clean water to remove salt, mud, silt, weeds, etc.
3. Get as much water as possible out of powerhead. Most of the water can be eliminated by removing spark plugs and operating manual starter (Figure 28) with spark plug holes facing downward.
   If starter does not turn over freely when starter is operated, do not force. This may be an indication of internal damage such as a bent connecting rod or a broken piston. Never run motor with water intake out of water.
4. Pour alcohol in cylinders first, or use Quicksilver Engine Cleaner (C-92-47949 or C-92-63214); rotate engine with manual starter, then lubricate with motor oil all internal parts which can be reached. This is best accomplished by injecting oil into spark plug holes, installing spark plugs and operating starter to distribute oil. If alcohol and oil are not available, insert a rod into fuel check unit to open check valve and actuate primer bulb. Direct fuel flow into cylinders.
5. Take motor to Authorized Mercury Service facilities as soon as possible.

SECTION 12 - TROUBLE CHART

A Does Not Start

B Runs Irregularly or Misses

C Starts Momentarily and Cuts Out

D Does Not Idle Properly

E Motor Speed Faster Than Normal

F Motor Speed Slower Than Normal

G Does Not Develop Normal Boat Speed

H Motor Overheats

A	B	C	D	E	F	G	H	POSSIBLE CAUSE	REFERENCE
●		●						Fuel Tank Empty	Para. 5-3
●	●	●						Motor Is Cold or Flooded	Para. 6-2
●		●						Fuel Line Not Connected	Para. 5-1
●	●	●	●		●	●	●	Fuel Line Pinched or Kinked	Para. 5-1
	●		●		●	●		Fuel Filter(s) in Need of Cleaning	8-5 & 8-6
●	●	●	●		●	●	●	Air Leak in Fuel System	Para. 5-1
●	●	●	●					Low Speed Needle Valves Mal-Adjusted	Para. 8-4
			●		●	●	●	Wrong Oil or Not Enough Oil in Fuel Mixture	Para. 5-3
	●		●		●	●	●	Wrong Gasoline or Too Much Oil in Fuel Mixture	Para. 5-3
●	●		●		●	●	●	Spark Plugs Fouled or Defective	Para. 10-2
	●		●		●	●	●	Wrong Type Spark Plugs	Para. 10-2
●								No Spark	Para. 10-2
●	●	●	●		●	●	●	Weak Spark or Intermittent Spark	Para. 10-2
●	●				●	●		Spark Plug Leads Interchanged	Para. 10-2
					●	●	●	Water Pump Failure or Cooling System Clogged	Para. 7-5
				●		●		Cavitation	Para. 7-6
				●		●		Propeller Damaged	Para. 3-5
				●		●		Tilt Angle Not Correctly Adjusted	Para. 2-2
				●	●	●		Boat Improperly Loaded	Para. 2-2
					●	●		Transom Too Low	Para. 2-1
				●		●		Transom Too High	Para. 2-1
	●				●	●	●	Excessive Spark Advance	Pages 3-4
					●	●		Insufficient Spark Advance	Pages 3-4
				●	●	●		Propeller of Wrong Pitch or Diameter	Para. 3-1

FORCE	KNOTS	DESCRIPTION	WAVE CONDITIONS	
	1-3	Light airs	Glassy smooth with few ripple patches	RIPPLES
	4-6	Light breeze	Surface now covered with ripples	
	7-10	Gentle breeze	Short waves are beginning.	WAVES
	11-16	Moderate breeze	Waves are longer	
	17-21	Fresh breeze	Few whitecaps are breaking	WHITECAPS
	22-27	Strong breeze	Larger waves, many whitecaps	
	28-33	Moderate gale	Sea running high, some spray blown	CONFUSION, DANGER
	34-40	Fresh gale	Waves, crests growing, much spray	
	41-47	Strong gale	Similar but more intense	
	48-55	Whole gale	High waves, long crests, large foam patches	
	56-66	Storm	Wind pressure is intense; air is filled with spray and the sea with streaky foam, while waves are so high that large vessels are hidden in the troughs	
	Above 66	Hurricane		

By studying the wave action, a person can judge whether the water is calm enough for boating, or it is rough and dangerous. When combined with CURRENT, the action may differ somewhat, but can still be applied.