2016

Raider Outboards
1855 Shepard Drive
Titusville, FL 32780

SERVICE MANUAL

Raider 40 Gen II

Submersible / Multi-Fuel Outboard Motor

Part No. R40-ES-003-16-3

[Raider Service Manual No. R40-ES-003-16-3
Instructions for repair the Raider 40 Outboard Engine
– Shop Manual

For Military Use Only

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SECTION 1 - SERVICE SAFETY

⚠⚠ WARNING

Inadequate knowledge of safe shop practices can result in severe injury or death. Review general safety procedures and specific safety information provided for each procedure prior to beginning any repairs.

INTRODUCTION

Raider outboards is required to comply with special E P A regulations and standards to ensure your military products are safe and reliable. As the military technician, it is your responsibility to keep these products safe when performing normal repair and maintenance operations.

It is not possible to foresee all safety hazards which may occur or to include all the knowledge of an experienced technician in a single service manual. Therefore, it is assumed those using this manual have a working knowledge of 2-cycle outboard engines and the proper technical training for servicing.

Raider outboards is considered a Commercial Off The Shelf (COTS) outboard engine. The engine comes from a family of engines: Mercury, Nissan and Tohatsu.

This section discusses safe shop practices and general safety concerns relevant to the operations performed throughout this manual. Read this section carefully and follow all safety statements in this manual as they pertain to the procedures at hand. Remember, always use common sense when servicing outboard engines!

Raider supports three manuals for Generation II Outboards:

Owner/Operators Gen II Manual; R40-ES-001-16-1;
Parts and Assembly Gen II Manual: R40-ES-001-16-2 which has all part numbers and assembly information; and
Raider Gen II Service Manual R40-ES-001-16-3 that provides complete information to repair the Raider 40 Generation II outboard motor.

SAFETY STATEMENTS

The following safety statements are found throughout this manual indicates information which, if ignored, could result in safety hazards or faulty service.

⚠ DANGER

Indicates the presence of a hazard which, if ignored, **WILL** result in severe injury or death.

⚠⚠ WARNING

Indicates the presence of a hazard which, if ignored, **COULD** result in severe injury or death.

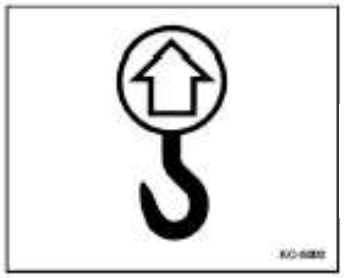
⚠ CAUTION

Indicates the presence of a hazard which, if ignored, **COULD** result in minor personal injury or damage to product, equipment, or other property.

NOTE

Indicates special information to *facilitate the installation, operation,* or *maintenance of the product* or *further clarify information which* is *important but not hazard related.*

SAFETY PRECAUTIONS



Raider Outboard Engines

Never disable the neutral switch start-in-gear prevention system. Always test the neutral switch and emergency stop switch before returning an engine to the user.

Lifting devices and hardware must be of suitable capacity for the weight of the outboard engine. Be aware the engine may swing outward when lifted.

The Raider engine stand must be in good condition; Raider engine must be mounted properly to prevent unexpected shifting.

Engine covers (cowling) are guards to prevent personal contact with the spinning flywheel and high voltage components such as spark plugs and coils. Never wear jewelry or loose clothing near a running engine. Keep hands, arms and hair away from the flywheel. Never touch electrical components when the engine is running.

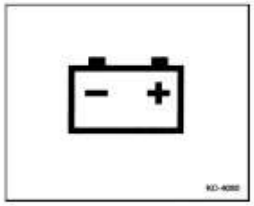
Two people working on a running engine must use extreme caution and be aware of one another. Never attempt to start an engine or operate any controls before signaling your partner.

To prevent accidental startup during operations which may cause the flywheel to turn, always perform the following steps:

1. Insure battery is disconnected or removed.
2. Disable the engine ignition system.
3. Shift engine to NEUTRAL and verify propeller shaft is not in gear.

Rotating propellers are not equipped with guards and can cause severe injury or dismemberment. Always stay clear of rotating propellers and make sure there is no possibility of engine startup before removing or installing a propeller. The propeller nut must always be tightened to torque specification prior to starting the engine.

Additional Safety Precautions



Avoid running the engine at high RPM. Engine speed can easily increase to excessive RPM when under a no load condition. To avoid engine damage during testing, always use the correct test propeller and keep engine speed below 2000 RPM.

Run engines only in well ventilated areas to prevent exposure to Carbon Monoxide (CO) gas. Direct and prolonged exposure to CO will cause brain damage or death.

Always wear eye protection, protective clothing, gloves and use other applicable safety equipment when work activities present the risk of personal injury.

Batteries

Never leave batteries in Raider outboards for long periods of time. Always unplug when not in use.

Place batteries on “maintainer” when not in use.

Never use “fast” charge on batteries that are used on vehicles. These batteries are sealed lithium Iron; 270 Cranking Amps.

- Prior to Mission – place on maintainer for 6 hours
- Battery can be left in RAMZ for up to three months.
- Disconnect internal connection when placed in RAMZ.
- If detection of heat in battery remove and discard.
- Make sure battery looks in good condition.

Hazardous Materials

Gasoline vapors are highly flammable and can cause an explosion. Never smoke or allow sparks or flames nearby when handling fuel Always store gasoline in a shaded, well ventilated area in an approved safety container.
Heavy Fuels that can be burned in the Raider 40 have harmful fumes that must be considered hazardous. Wear masks.

Ventilate all fumes as soon as detected. Be aware that appliance pilot lights, such as those in furnaces and water heaters, can ignite gasoline vapors and cause explosion.

Never use gasoline as a cleaner, and always clean up fuel spills immediately and properly dispose of rags in an approved safety container.

Read and follow the safety labels on products used around the shop. Adhesives, lubricants, solvents, and fuel additives are usually poisonous and flammable. Store and dispose of these products properly.

Shop Environment

Make sure the shop and your work area are properly ventilated.

Shops must be equipped with the proper tools and safety equipment such as fire extinguisher, eye flushing device, and first aid kit.

Keep the shop clean and free of clutter. Clean up spills on the floor as soon as possible to prevent someone from slipping.

WORKMANSHIP STANDARDS

1. Avoid damage to the mating surfaces of crankcase and cylinder assembly. Do not use a sharp metal scraper to clean these areas.
2. Replace gaskets, 0-rings, seals, cotter pins, lock nuts, and spring pins when removed during repair operations.
3. Use only genuine factory replacement parts and accessories.
4. Use recommended special tools when specific repairs require them.
5. Calibrate measurement tools and test equipment on a regular basis.
6. Clean all metal parts with solvent before inspection and assembly operations.
7. Use penetrating solvents when necessary to remove rusted or seized hardware.

8. Keep all removed parts separated for ease of identification during assembly.
9. Locate alignment marks on components being disassembled. If marks are not present and should be, scribe or match mark them yourself to ensure the pieces are assembled properly.
10. Follow torque sequences and specifications where they apply. First, tighten each bolt in the specified sequence. Use the same sequence to torque each bolt to final specification. Special torque specifications are listed at the beginning of each section. Standard torque specifications for common fasteners are listed in Section 3.

11. Use lubricant when assembling seals to prevent damage to the seal lips. Make sure seal lips are facing the correct direction.

12. Use the correct type and amount of sealing compound on metal to metal surfaces.

13. When using compressed air to clean or dry parts, make sure air supply is regulated not to exceed 25 psi [172 kPa /1.76 kg/cm'].

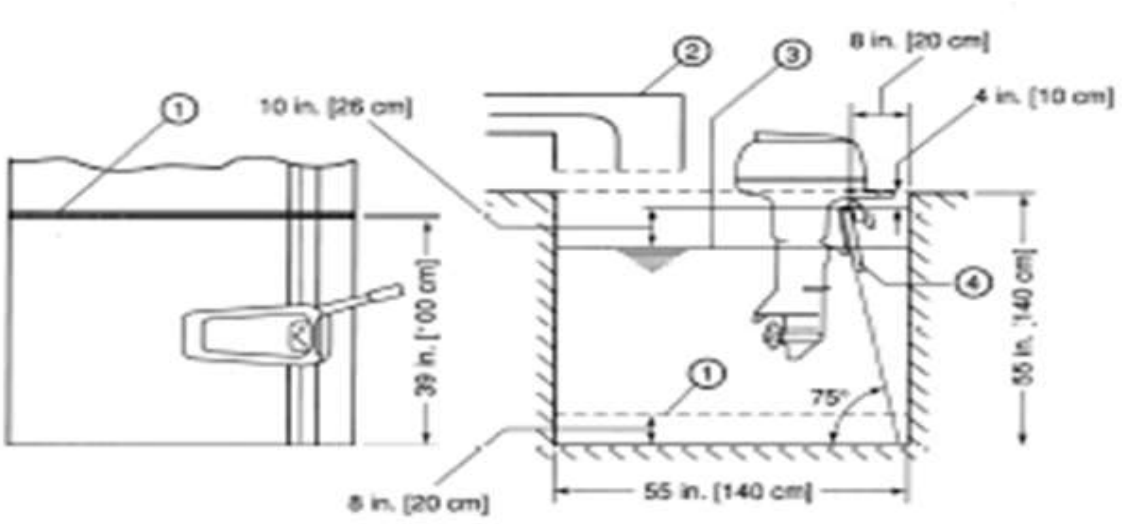
14. Replace missing or damaged safety labels on the engine before returning it to the user.

NOTE: Throughout this manual "genuine" oil if used. This oil is the Raider Outboard two-stroke oil; however, any TC-W3 approved oil can be substituted and used.

TEST TANK GUIDELINES

When properly setup, test tanks provide a safe and controlled environment in which to perform outboard engine adjustment and testing procedures. Test tanks must be setup to the minimum dimensions shown. If multiple engines will be installed in the tank, secure partition plate (1) so that the minimum dimensions are maintained for each outboard engine installed. In addition, adhere to the following guidelines to prevent engine damage:

- Continuous usage raises the water temperature in the tank which can lead to engine seizure. Make sure water temperature in the tank does not exceed 77°F [25°C].
- Repeated use introduces carbon into the water which can adhere to the engine cooling system and degrade its ability to cool the engine. Always replace dirty tank water at regular intervals with clean, fresh water.
- Exhaust gases produced during engine operation can collect around the engine, causing suction into the carburetors and affecting engine performance. To prevent this condition, install forced ventilation equipment (2) to move gases away from the engine and work area.
- Water may splash out of the tank during testing. Maintain water level (3) in the tank as illustrated.
- Keep transom board (4) at an approximately 75° angle to the tank bottom to ensure near vertical engine position.
- Test Tank Drawing:



SECTION 2 – General Information

General Precautions

Before performing any service work on the outboard engine, read and understand Section 1 - Service Safety.

Use only genuine factory replacement parts with equivalent characteristics such as type, material, and strength. Failure to do so may result in product malfunction and injury to the operator or passengers.

Follow the **Standard Torque Values** chart. When a special torque value for a certain fastener is not listed in the **Special Torque Values** chart at the beginning of each section tighten using the **Standard Torque Values** chart.

Rather than just repairing a bad part, use repair kits and overhaul kits when applicable to ensure complete and efficient repair of the complete component. Wear not readily noticed on other parts can lead to malfunction soon after the repair.

When indicated in a procedure, use manufacturer special tools. In some cases, the use of substitute tools will damage the part.

When using compressed air to clean or dry parts, make sure air supply is regulated not to exceed 25 psi [172 kPa / 1.76 kg/cm'].

Abbreviations and Symbols

Abbreviations

A	ampere
AC	alternating current
AH	ampere-hour
approx.	approximately
API	American Petroleum Institute
ATDC	after top dead center
BTDC	before top dead center
°C	degree Celsius
CCA	cold cranking amp
cm	centimeter
cm^3	cubic centimeter
cm^3/min	cubic centimeter per minute
cu-in	cubic inch
DC	direct current
DVA	direct volt adapter
Kg-m	kilogram meter
°F	degree Fahrenheit
fl oz	fluid ounce (U.S.)
fl oz/min	fluid ounce (U.S.) per minute
ft	foot
ft-lb	foot pound
ft-lbf/min	foot pound force per minute
g	gram
gal/hr	gallon (U.S.) per hour
gal	gallon (U.S.)
GL	gear lubricant
GM	General Motors Company
HP	horsepower (U.S.)
I.D.	inside diameter
in	inch
in-lb	inch pound
kg	kilogram
kg/cm^2	kilogram per square centimeter
ESG	electronic speed governor
kPa	kilopascal
kW	kilowatt
L	liter
L/hr	liter per hour
lb	pound
mL	milliliter
mm	millimeter
mV	millivolt
N	newton
N·m	newton meter
NMMA	National Marine Manufacturers Association
No.	number
O.D.	outside diameter
oz	ounce
PS	horsepower (metric)
psi	pound per square inch
qt	quart (U.S.)
RPM	revolution per minute
SAE	Society of Automotive Engineers
sec.	second
t	short ton 2000 lb
TDC	top dead center
V	volt
VAC	volt alternating current
VDC	volt direct current
W	watt

Symbols

°	angular degree
+	plus
-	minus
±	plus or minus
Ω	ohm
µ	micro
%	percent

Unit Conversions

Unit Prefixes

Prefix	Symbol	Power
mega	M	x 1,000,000
kilo	k	x 1,000
centi	c	x 0.01
milli	m	x 0.001
micro	µ	x 0.000001

Units of Length

mile	x	1.6090 = km
ft	x	0.3050 = m
in	x	2.5400 = cm
in	x	25.4000 = mm
km	x	0.6210 = mile
m	x	3.2810 = ft
cm	x	0.3940 = in
mm	x	0.0394 = in

Units of Volume

gal (U.S.)	x	3.78540 = L
qt (U.S.)	x	0.94635 = L
cu-in	x	0.01 639 = L
cu-in	x	16.38700 = mL
fl oz (U.S.)	x	0.02957 = L
fl oz (U.S.)	x	29.57000 = mL
cm^3	x	1.00000 = mL
cm^3	x	0.03382 = fl oz (U.S.)

Units of Mass

lb	x	0.45360 = kg
oz	x	28.35000 = g
kg	x	2.20500 = lb
g	x	0.03527 = oz

Units of Force

lbf	x	4.4480 = N
lbf	x	0.4536 = kgf
N	x	0.2248 = lbf
N	x	0.1020 = kgf
kgf	x	2.2050 = lbf
kgf	x	9.8070 = N

Units of Torque

ft-lb	x	1.3558 = N-m
ft-lb	x	0.1383 = kg-m
in-lb	x	0.1130 = N-m
in-lb	x	0.0115 = kg-m
kg-m	x	7.2330 = ft-lb
kg-m	x	86.8000 = in-lb
kg-m	x	9.8070 = N-m
N-m	x	0.7376 = ft-lb
N-m	x	8.8510 = in-lb
N-m	x	0.1020 = kg-m

Units of Pressure

psi	x	0.0689 = bar
psi	x	6.8950 = kPa
psi	x	0.0703 = kg/cm^2
bar	x	14.5030 = psi
bar	x	100.0000 = kPa
bar	x	29.5300 = in Hg (60°F)
kPa	x	0.1450 = psi
kPa	x	0.0100 = bar
kPa	x	0.0102 = kg/cm^2
kg/cm^2	x	14.2200 = psi
kg/cm^2	x	0.9807 = bar
kg/cm^2	x	98.0700 = kPa
in Hg (60°F)	x	0.0333 = bar
in Hg (60°F)	x	3.3770 = kPa
in Hg (60°F)	x	0.0344 = kg/cm^2

Units of Power

HP	x	1.01400 = PS
HP	x	745.70000 = W
HP	x	550.00000 = ft-lbf/s
PS	x	0.98630 = HP
PS	x	735.50000 = W
PS	x	542.50000 = ft-lbf/s
W	x	0.00134 = HP
W	x	0.00136 = PS
W	x	0.73760 = ft-lbf/s
kW	x	1.34100 = HP
kW	x	1.36000 = PS
kW	x	737.56000 = ft-lbf/s
ft-lbf/s	x	0.00181 = HP
ft-lbf/s	x	0.00184 = PS
ft-lbf/s	x	1.35600 = W

Units of Temperature

°F = (1.8 • °C) + 32

°C = 0.556 • (°F - 32)

Service Specifications

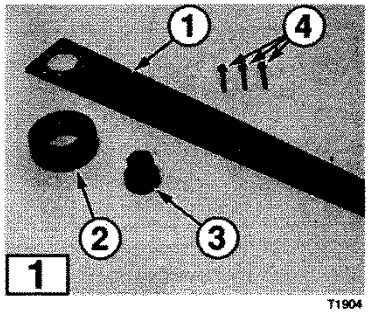
Standard Torque Values

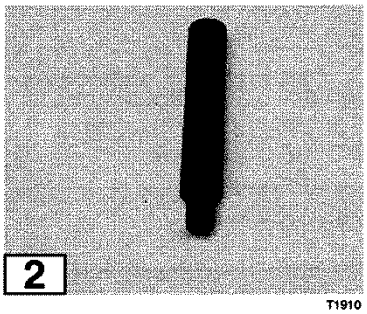
Size	Torque			
	in-lb	ft-lb	N-m	kg-m
M4	10 - 17	0.8 - 1.4	1 - 2	0.1 - 0.2
MS	26 - 35	2.2 - 2.9	3 - 4	0.3 - 0.4
MS	44 - 52	3.6 - 4.3	5 - 6	0.5 - 0.6
MS	97 - 133	8 - 11	11 - 15	1.1 - 1.5

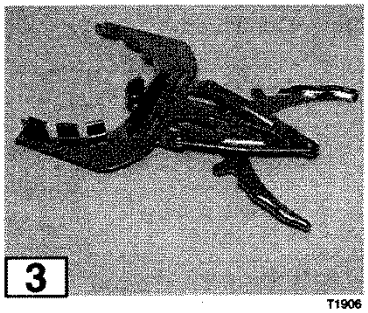
These torque values apply only when a special torque specification is not listed in the Special Torque Values chart at the beginning of each section.

Note: Factory technicians can purchase the following Special Tools; Raider technicians use a conventional gear puller to remove flywheel. Tools found in your tool box can be used to perform maintenance on the Raider 40.

Special Tools for Repair – Raider 40







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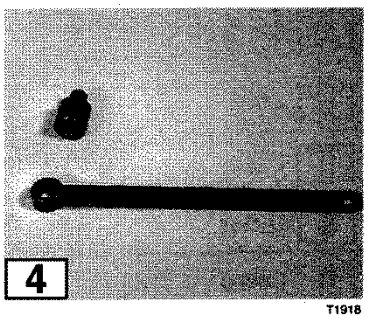
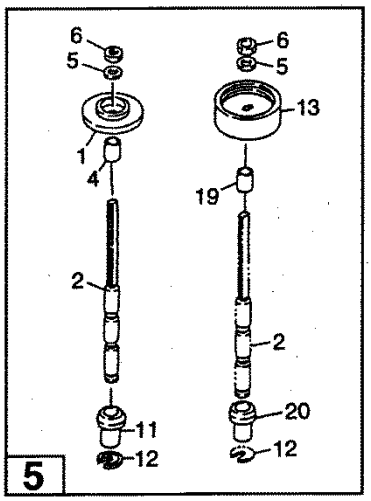
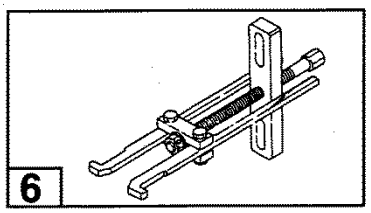
Tool Description	Part No.	Components
1 Flywheel Puller Assembly	369-72211-0	Arm (1) Adapter (2) Pressing Bolt (3) Bolts (4)
2 Piston Pin Tool	345-72215-0	
3 Piston Ring Tool	353-72249-0	
4 Wrench, Bevel Gear B Nut	346-72231-0	Wrench
4 Socket, Bevel Gear B Nut	345-72232-0	Socket
5 Needle Roller Bearing Puller	3C8-72700-0	Kit
5 Flange A	3C8-72701-0	(1)
5 Shaft	346-72702-0	(2)
5 Shaft Stopper A	346-72704-0	(4)
5 Washer	346-72707-0	(5)
5 Nut, 12P=1.25	346-72706-0	(6)
5 Guide A	345-72705-0	(11)
5 Retainer A	345-72703-0	(12)
5 Flange B	346-72701-5	(13)
5 Shaft Stopper B	345-72704-5	(19)
5 Guide	345-72705-5	(20)
6 Bevel Gear Bearing Puller	3A3-72755-0	Assembly







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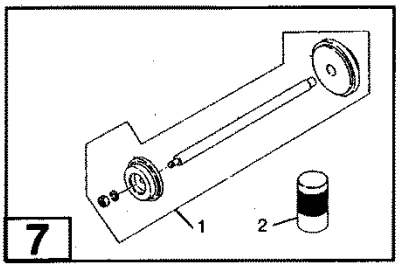
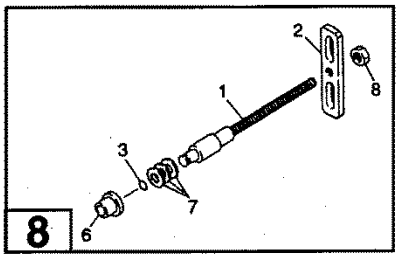
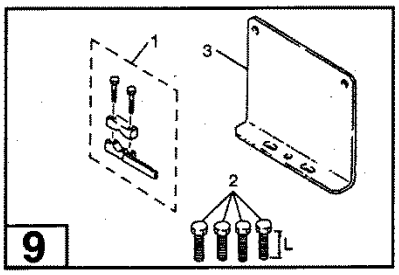
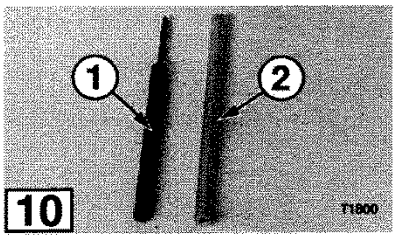
40 Continued

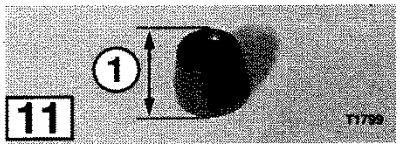
Tool Description	Part No.	Components
7 Bearing Outer Press Kit	3B7-72739-0	Kit, ①
7 Bevel Gear Bering Installing Tool	3C8-72719-0	② , Ø 42 mm
8 Backlash Measuring Tool	3C8-72234-0	Kit
8 Shaft	345-72723-0	①
8 Plate	3A3-72724-0	②
8 O-ring	332-60002-0	③
8 Collar	353-72245-1	⑥
8 Cone Disk Spring, d=12	345-72763-0	⑦ , 3 pcs
8 Nut, M10	930191-1000	⑧
9 Clamp Assembly	3B7-72720-0	①
9 Bolt, H625	910191-0625	② for lower pump case
9 Plate, Dial Gauge	3B7-72729-0	③
10 Spring Pin Tool A	345-72227-0	Pin Punch
10 Spring Pin Tool B	345-72228-0	Hollow Punch
11 Clutch Pin Snap Tool	345-72229-0	① = 2.36 in 60 mm
12 Shimming Gauge	3C8-72250-0	①
12 Thickness Gauge	353-72251-0	②
13 Rubber Mount Puller	361 -72760-0	Kit
Tool Box	353-72254-0	

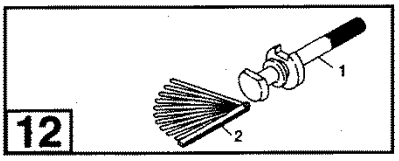


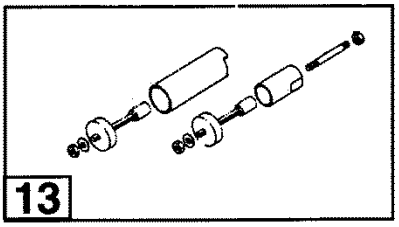












General Equipment Required

Water Pressure Gauge, 0 - 15 psi [0 - 103 kPa / 0 - 1 kg / cm^2]
Fuel Pressure Gauge, 0 - 15 psi [0 - 103 kPa / 0 - 1 kg / cm^2]
Torque Wrench, 0 - 150 in-lb [0 - 17 N·m / 0- 1.7kg-m]
Torque Wrench, 0 - 750 ft-lb [0 - 1000 N·m / 0 - 100 kg-m]
Dial Gauge, minimum scale 0.0001 in [0.01 mm]
Micrometer Set or Dial Caliper, minimum scale 0.0001 in [0.01 mm]
Telescoping Gauge, Inside Micrometer Set, or Dial Caliper, minimum scale 0.0001 in [0.01 mm]
Variable Load High Rate Discharge Tester, *Electronic Specialties® Model 700 or equivalent*
Analog Multimeter, *Electronic Specialties® Model M-530 or equivalent*
Digital Multimeter, *Electronic Specialties® Model KD 3200 or equivalent*
Digital Pulse Tachometer, 10 - 6000 RPM, *Electronic Specialties® Model 321 or equivalent*
Ammeter, 0 - 100 A
Gearcase Pressure Tester, *Stevens® S-34 or equivalent*
Gearcase Vacuum Tester, *Stevens® V-34 or equivalent*
Engine Compression Gauge, 0 - 300 psi [0 - 2000 kPa / 0 - 20 kg/cm^2]
Spark Gap Tester, *Stevens® S-13C, S-48, or equivalent*
Flexible Fuel Tubing, 1/4 in I.D. x 5 in [6 mm I.D. x 127 mm]
Flexible Fuel Tubing, 3/8 in I.D. x 5 in [9.5 mm I.D. x 127 mm]
Industrial Thermometer, minimum 300°F [150°C]
Heat-Resistant Container, *Pyrex®*
Bearing Puller
Seal Pullers
Seal Installers
Heat Gun

Consumables Required

Threadlocker, *Loctite 242*
Threadlocker, *Loctite 243*
Gasket Dressing, *Permatex Hylomar Aerosol High-Temp Gasket Dressing*
Gasket Sealant, *Permatex High* Tack *Gasket Sealant*
Anaerobic Gasket Maker, *Loctite 518*
Silicone Sealant, *Permatex" Hi-Temp RTV Silicone Gasket* Super Bond Adhesive, *Permatex Super Glue Gel* Cleaning Pads, *Scotch-Brite Abrasive Pads*
Low Temperature Lithium Grease
Genuine Grease or Equivalent Friction Surface Marine Grease
isopropyl Alcohol Cleaning Solvent Gasket Remover
Gear Lubricant, *Genuine gear oil or AP/ grade GLS, SAE #80 - #90* Engine Lubricant, *Genuine engine oil or NMMA certified TC-W3 oil* Automotive Crankcase Oil, flashpoint above 300'F [150°C]
Battery Spray Protector, *Permatex Battery Protector & Sealer*
Electrical Shrink Tubing, various diameters
Form-A-Gasket, Permatex (Aviation Sealant Liquid) – Head Gasket
Corrosion Zero – anti-corrosion spray can

Section 2
Raider 40 Specifications

Operational

Power
Raider .....40 HP [29.4 kW]

Full Throttle RPM Range
Raider .....5200 - 5800

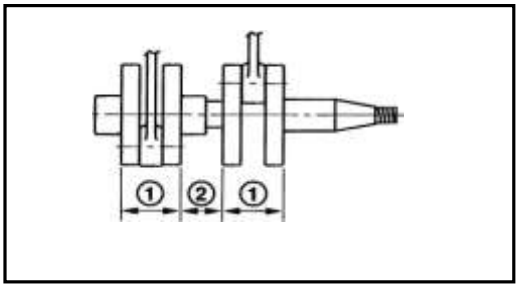
Idle RPM **In Gear** **Neutral**
Raider 850 1000

Fuel Consumption at Full Throttle
Raider .....4.0 g/hr

Multiple Fuels
Gasoline – primary – Heavy Fuel Optional JP-5/8; Kerosene; Diesel; Bio-diesel]

Submersible – special dewatering
66 feet underwater/18 hours – start 5 min.

Crankshaft Dimensions



Dimension 1
Raider 40 .....2.071 + 0 in [52.6 + 0 mm] - 0.002 - 0.05

Dimension 2
Raider 40 ..... 1.591 ± 0.002 in [40.4 ± 0.05 mm]

Clutch System
Raider 40 ..... Dog clutch type (Forward-Neutral-Reverse

Electrical System

Ignition Type .....
Flywheel magneto capacitor discharge

Ignition Timing
See Ignition Timing Adjustment in Section 2

Spark Plug
Raider 40 ..... Pulstar Model SBE 1/10

Spark Plug Gap
Raider 40 .....0.035 0.055 (not to exceed)

Battery (Sealed)
Raider 40 .....Lithium Iron 270 CA

Test Propeller
Raider 348-64111-0

Powerhead

Number of Cylinders
Raider 2

Displacement
Raider.....30.08 cu. in [493 cm']

Standard Bore
Raider .....2.76 in [70 mm]

Stroke
Raider.....2.520 in [64 mm]

Piston Clearance
Raider 40 ...0.0020 - 0.0039 in [0.05 - 0.10 mm]

Piston Ring End Gap
Raider 40 .....0.008 - 0.016 in [0.20 - 0.40 mm]

Gearcase

Gear Ratio

Raider..... 13 : 25

Alternator
Raider 40 .....12V *BOW*

Charging Performance (at 5500 RPM)
Raider 40 .....5 A

Number of Tachometer-to-Alternator Coil Impulses
Raider 40 4

Alternator Coil Resistance
Raider 40 ....Y-W : 0.65 - 0.98 Ω
Y-B : 0.31 - 0.47 Ω
W-B : 0.37 - 0.55 Ω

Ignition Coil Resistance (±25%)

Primary Coil
Raider 40 .....0.2 - 0.3 Ω

Secondary Coil
Raider 40.....4.1 - 6.1 KΩ

Heavy Fuels: Raider Additive Required.

Fuel and Lubricant System

Required Fuel, Lubricant, and Mix Ratio
See Fuel System Requirements in Section 3
50:1 normal mix; 30:1 break-in period.

NOTE
A special mix ratio is required during break-in.
See *"Break-In"* at *end of this section.*

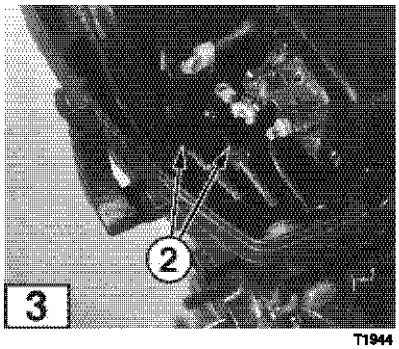
Carburetor (Fuel Induction System)
Raider 40 ..... Heavy Fuel Additive
Check levers

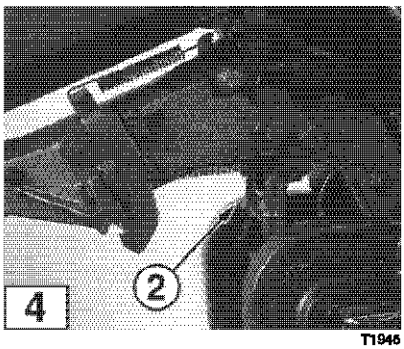
Lubrication of Raider 40

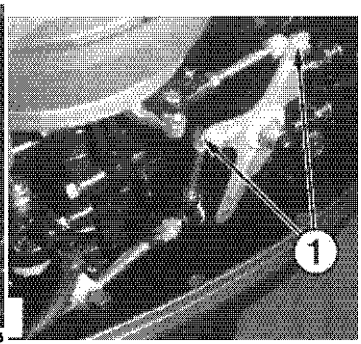
NOTE

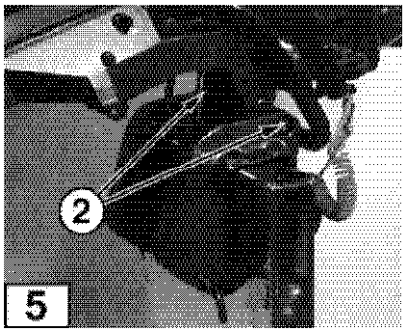
Recommended intervals are for freshwater military operation.
Decrease interval by 50% for salt water and severe duty operation.

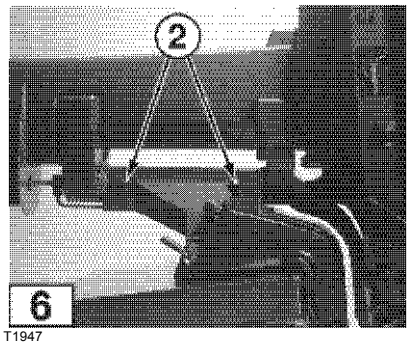
Lube Type:
Low Temperature Lithium Grease
Genuine Grease or equivalent Friction Surface Marine Grease
Non-flammable solvent
Genuine Gear Oil or API Grade GL5 #80 - #90



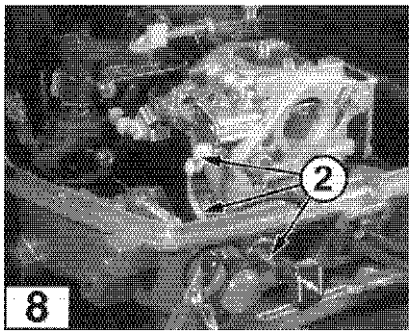


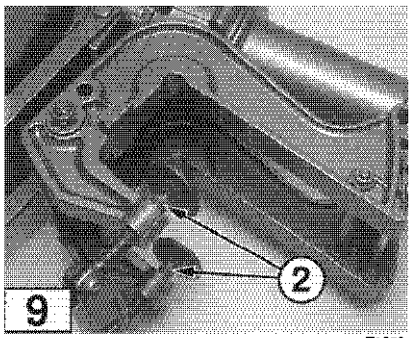


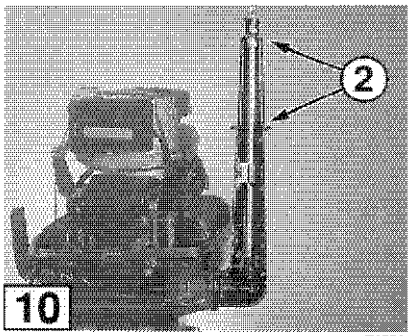


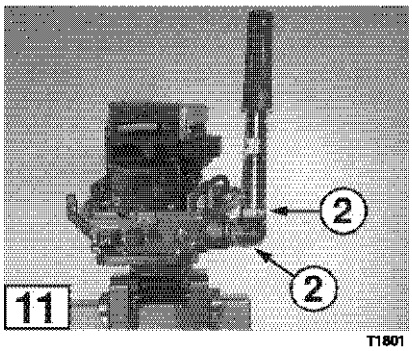


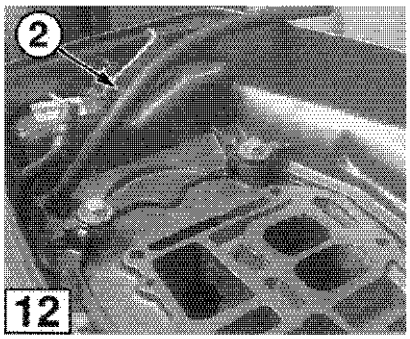
Lubrication Points and Lubricant				
Fig.	**Location**	**Lube Type**	**40**	**Running Hours**
1	Shift Lever Mechanism	1	yes	50
2	Throttle Linkage	1	yes	50
3	Throttle Cable	2	yes	50
4	Tilt Stopper	2	yes	50
5	Bracket Bolt	2	yes	50
6	Bracket Shaft	2	yes	50
7	Carburetor Cable	2	yes	50

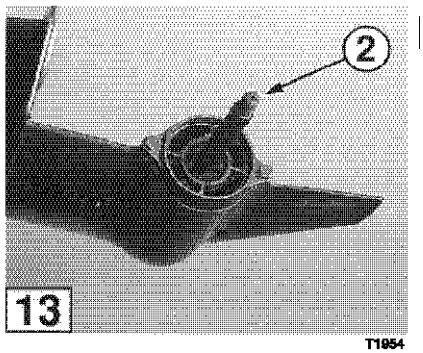


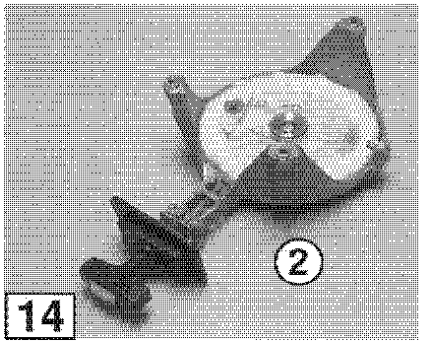


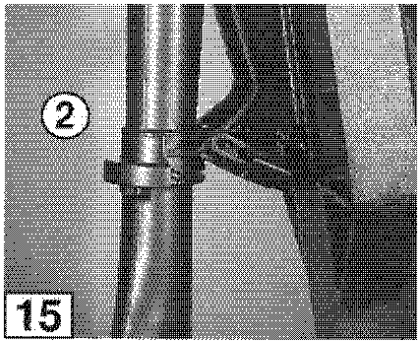


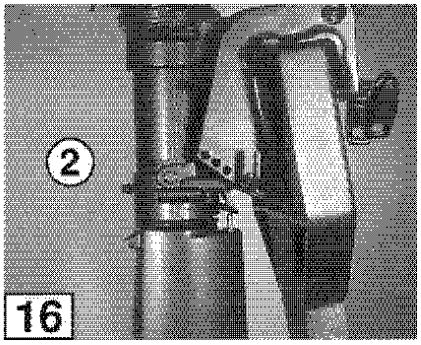






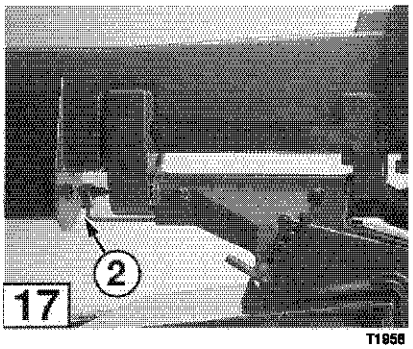






Lubrication Points and Lubricant

Fig.	Location	Lube Type	40	Hours	
8	Choke Mechanism	2	yes	•	50
9	Clamp Screw	2	yes	•	50
10	Grip	2	yes	•	50
11	Handle	2	yes	•	50
12	Hook Lever Mechanism	2	yes	•	50
13	Propeller Shaft	2	yes	•	50
14	Recoil Starter	2	yes	•	50
15 16	Reverse Lock	2	yes	•	50



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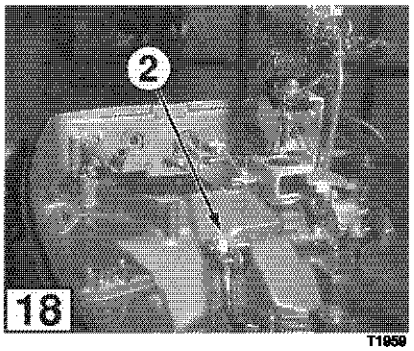

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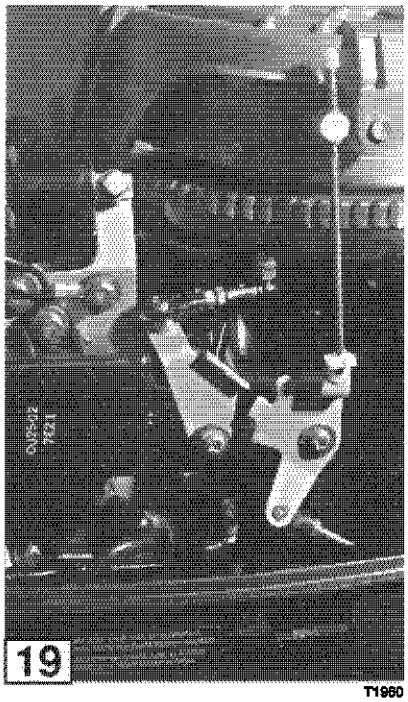

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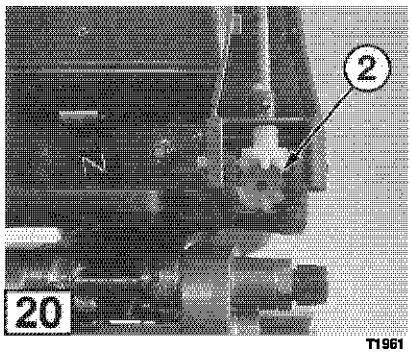

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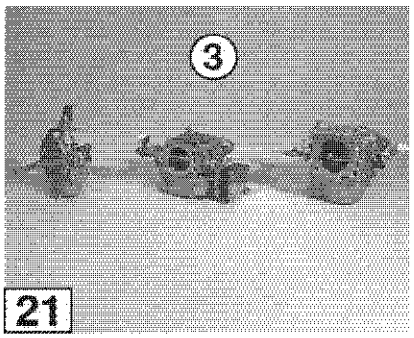

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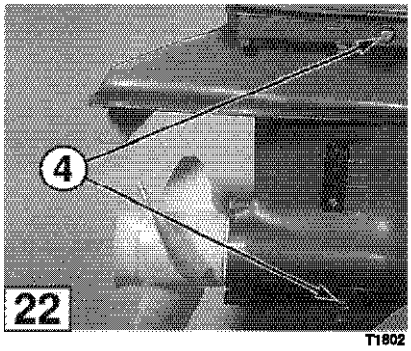
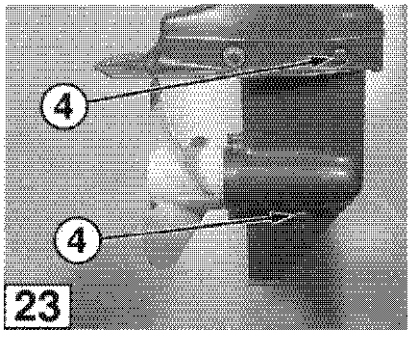
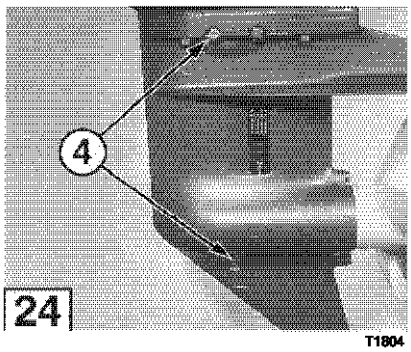
Lubrication Points and Lubricant				
Fig.	**Location**	**Lube Type**	**40**	**Hours**
17	Reverse Lock	2	•yes	50
18	Shift Lever Stopper	2	•yes	50
19	Starter Lock	2	•yes	50
20	Throttle Mechanism	2	•yes	50
21	Carburetor (Note *1*)	2	•yes	100

Note 1: *Disassemble,* remove *dust and clean with air and non-flammable solvent. Completely dry all* components *and* reassemble.







Lubrication points and Lubricant			Frequency	
Fig.	Location	Lube Type	Hours	
22	First Gear Oil Change	4	Yes	10
23	Top Off Gear Oil	4	Yes	50
24	Oil Change *(Note 2)*	4	Yes	100

Note *2: Change Gearcase oil after every 100 hours of* operation, *and prior* to *prolonged storage, such* as *over the winter.*

Commercial Fogger must be used in Fuel Induction System prior to long term storage.

Periodic Inspections

NOTE: *It is recommended that a complete engine overhaul be performed after 400 operating hours.*

Item	Inspection	Before Each Use	After 1st 10 Hours 2 Days	Every 30 Hrs or 7 Days	Every 50 Hrs or 30 Days	Every 100 Hrs or 60 Days	Remarks
Fastener torque	Check the following: Cylinder head bolts Cylinder head cover bolts Exhaust cover bolts Carburetor mounting bolts Intake manifold bolts Crankcase bolts Flywheel nut Starter motor installation bolts (where applicable) Driveshaft housing bolts Gearcase bolts Propeller shaft housing bolts Propeller nut Lower engine cover mounting bolts Engine mounting bolts		•		•		Torque to specification.
Gearcase	Check oil level and add oil as required. Check for water or metallic matter in gear oil.			•			See Lubrication Chart in this section.
Spark Plugs	Check plug gap. Remove carbon deposits.		•		•		Replace plugs when electrodes are worn
Fuel Induction System	Disassemble and clean. Check float valve for wear.					•	Replace worn partsas required.
Fuel Tank, Pick-up Tube, Filters, and Fuel Pump	Disassemble, clean, and inspect. Check for leakage. Check for cracks.		•		•		
Fuel and Recirculation Hoses	Clean and inspect Check all hose clips.					•	Replace hoses every 2 years.

Item	Inspection	Before Each Use	After 1st 10 Hours 2 Days	Every 30 Hrs or 7 Days	Every 50 Hrs or 30 Days	Every 100 Hrs or 60 Days	Remarks
Engine Compression	Check with compression gauge				•		Obtain normal operating temperature and check at full throttle.
Water Pump	Check for wear and damage.				•		Replace impeller every 200 hours (12 months).
Cooling and Exhaust Components	Remove dirt and deposits from the following: Water pump and impeller Water pipe Thermostat Exhaust cover Exhaust pipe Engine base Reverse gas passage					•	
Power head Cleaning	Inspect and remove carbon deposits from the following: Cylinder head Pistons Rings Inner exhaust cover Outer exhaust cover					•	Check every200 hours (12 months).
Electrical Wiring	Check for loose connections Inspect wires and insulation for damage		•			•	
Ignition Timing and FIS	Check and adjust timing Adjust linkage.		•			•	See Synchronization and Linkage Adjustments in this section.
Throttle and Choke Valve Linkage	Inspect for the following: Loose ball joints and lock nuts Bent link rods Loose rod snaps		•	•			

Item	Inspection	Before Each Use	After 1st 10 Hours 2 Days	Every 30 Hrs or 7 Days	Every 50 Hrs or 30 Days	Every 100 Hrsor 60 Days	Remarks
Sacrificial Anodes	Inspect amount of erosion. Test for proper installation.				•		Replace when anode has been reduced to 2/3 its original size(1/3 eroded). See Anodes - Inspection and Testing in this section.
Water Intake Screens	Check for blockages.	•					Remove and clean as required.
Operational Checks	Check function and condition of the following: Water discharge from check ports Tiller or remotesteering controls Manual or remote clutch engagement Main switch key Emergency stop switch Drag link and hardware	•					

Break In Procedure – Raider 40

⚠ CAUTION

Failure to follow the Break-In Procedure I Owner's Manual and special fuel mixture requirements for break-in may lead to serious engine damage and shortened engine life.

⚠ CAUTION

After break-in has been successfully completed fuel bladder should be filled with a 50:1 ration gas/oil premix. If heavy fuels are to be used follow instructions on label.

First 10 Minutes {0 - 0.16 Hours)

1. Fill the fuel tank with a 25:1 gasoline to oil premix – full synthetic only for Raider 40.
2. Operate the engine at minimum idle speed ONLY.
3. Verify a steady stream of water from the cooling water check port and idle port on the engine, indicating the water pump is functioning property.

Next 50 Minutes {0.16 to 1 Hour)

1. DO NOT operate the engine above 1/2 throttle.
2. DO NOT maintain a constant throttle setting. Vary engine speed from 1/4 to 1/2 throttle every 15 minutes.

NOTE

Zodiac boats which come onto plane easily, use full throttle to quickly accelerate onto plane; then immediately reduce throttle t0 1/2 and maintain this speed. Wing Inflatable's – with Raider should not be any different.

Next Hour (1 to 2 Hours)

1. Use full throttle to quickly accelerate boat onto plane; then immediately reduce throttle to 3/4 and maintain this speed.
2. At intervals, run engine at ¾ throttle for 1-10 minutes then return to ½ throttle for a cooling period.
3. Vary engine speed every 15 minutes.
4. Check for water discharge from cooling water check ports.

Next Eight Hours (2 to 10 Hours)

1. Run engine at 3/4 throttle.
2. For short periods of time, run engine at full throttle and then reduce speed back to 3/4 throttle. As this part of the break-in period progresses, open to full throttle for longer and longer periods of time, but never longer than 5 minutes.
3. Vary engine speed every 15 minutes.

DO NOT exceed the Full Throttle RPM Range of the engine. See Engine Specifications in this section.

After Break-in Re-torque cylinder head bolts to specification after engine has been run and cylinder head has cooled to the touch.

Empty fuel tank and replenish with a 50:1 gasoline/oil mixture.

Tune Up Procedures

⚠⚠ WARNING

Deteriorated or damaged parts identified during engine tune-up must be replaced in order to maintain safe engine operation.

1. Inspect engine for leaks, missing, loose or damaged parts, or other visible defects.

2. Remove each spark plug and check for fouling, cracks in ceramic, and incorrect gap. Replace plugs if needed.

3. Check engine compression. Refer to Cylinder Compression -Test in Section 4.

4. Check all wiring, connectors, and clamps for damage. Replace parts as needed.

5. Replace fuel filter and inspect carburetor. Check fuel hoses for deterioration. Replace as needed.

6. Check for proper clutch engagement and make shift linkage adjustments as needed for proper operation of the reverse lock mechanism.

Model	Adjustment Part
Raider 40	Shift lever stopper holder : Position onto Shift lever stopper plate

Adjust the engine ignition timing and Fuel Induction System. See Synchronization and Linkage Adjustments, this section.

Remove propeller and inspect propeller shaft oil seal for leakage. Inspect propeller thrust washer, and other propeller shaft hardware for damage. Replace as needed.

1. Drain and refill the Gearcase with gear oil. See Engine Specifications in this section.

2. Lubricate all engine components as specified in the Lubrication Chart, this section.

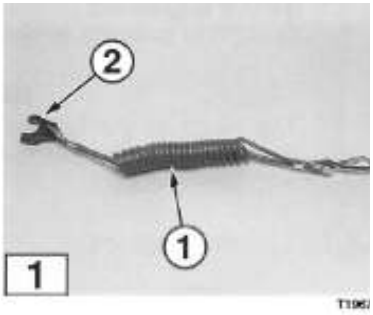
3. Verify that all bolts and screws are torque to specification by applying a torque wrench to each.

4. Run engine in test tank with proper test propeller and check for the following:

- Abnormal engine noise.
- Improper clutch operation.
- Little or no cooling water discharge from check port and idle port.
- Fuel leaks from mating surfaces of crankcase.
- Fuel leaks from mounting surface of intake manifold.
- Cooling water leaks from mating surfaces of cylinder head.
- Cooling water leaks from engine mounting surfaces.
- Cooling water leaks from exhaust cover mounting surfaces.
- Improper idle RPM and stability.
- Defective stop switch.

Emergency Stop Switch and Lanyard

The emergency stop switch and lanyard should be inspected and tested after servicing outboard. The operator should perform Emergency Stop function test with the boat in the water prior to leaving the launch area.



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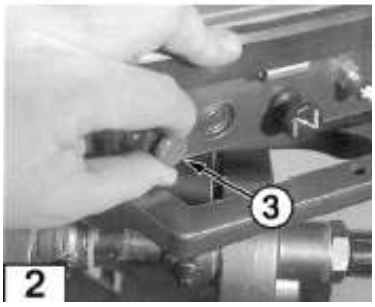

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⚠⚠ WARNING

Do not attempt to repair worn of faulty stop switch and lanyard. Replace only with genuine parts. Do not substitute.

Inspection

1. Inspect lanyard (1) for cuts or fraying, lock clip (2) for cracks.
2. Inspect stop switch assembly {3) for signs of wear and make sure the switch has adequate spring tension to hold the lanyard lock clip in place.

Stop Switch Test

1. Attach the lanyard lock clip to the stop switch.
2. Start the engine.
3. With the engine running, pull the lanyard to disengage the lock clip. Engine should stop running.

   NOTE
   The stop switch also operates as a push-button switch with the lanyard left attached.

4. Repeat the test but do not remove the lanyard. Press down firmly and hold the stop switch until engine stops running.

If engine continues to run in either test, the stop switch or wiring are faulty and must be replaced before engine is operated.

Synchronization and Linkage Adjustments

To ensure consistent engine idling and smooth operation throughout the full RPM range, it is important that each procedure be performed exactly as written and in the following sequence:

1. Ignition Timing Adjustment
2. Fuel Induction Synchronization

⚠⚠ WARNING

Before beginning procedures, disconnect the magneto leads to disable the ignition system, remove battery, insure spark plug wires are removed from the spark plugs.

NOTE

The seam at the mating surfaces of the crankcase halves is the alignment point for all ignition timing degree measurements.

Throttle Setting	Full Open		Full Closed (In Gear)	
Raider	Match Mark	Target RPM	Match Mark	Target RPM
40	BTOC 25°	5200 - 5800	ATOC 2°	850

Raider 40 Adjustment Procedure

Rotate the throttle grip to the FAST side until the throttle stops

Adjust ignition timing link so that the timing full open match mark is aligned with the fitting line (Crankcase Mating Surfaces).

Adjust the stopper bolt so that the advancer arm touches the full open stopper bolt when throttle is fully opened.

Turn the throttle grip toward SLOW side.

Adjust the stopper bolt (for fully close adjustment) so that it hits the stopper bolt at the position where the magneto coil plate timing mark (fully closed side) meets the ignition timing inspection line (crank case mating surface).

⚠ CAUTION

After making adjustments, check that the advancer arm moves freely and smoothly. Tighten adjusting nut after completing adjustments.

Carburetor – Raider Gen II – idling Speed

In Neutral	In Gear	No. of Turns Pilot Adjusting Screw
1000 RPM	850 RPM	1-1/4 ± 1/4

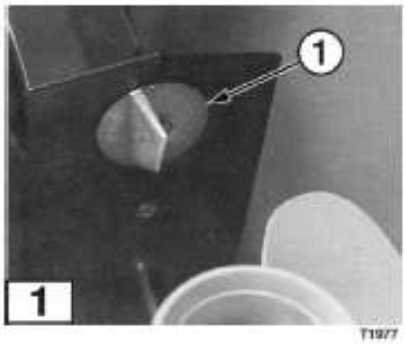
Adjustment Procedure:

- Set the pilot adjusting screw to the standard reverse turns and adjust the engine rpm by using he pilot adjusting screw and throttle stop screw while monitoring the tachometer.
- The engine rpm should reach maximum hen the pilot adjusting screw is within +/_ ¼ turns of the standard position.

Note: Replace the pilot adjusting screw if the tip is worn.

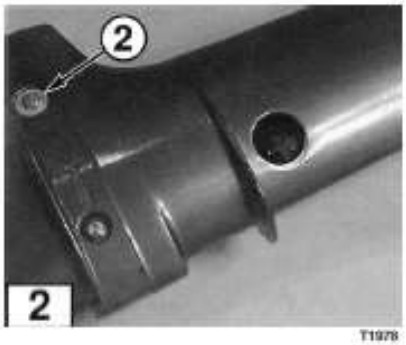
ANODES - INSPECTION AND TESTING

Engines are equipped with several sacrificial anodes to help protect metal parts from the effects of galvanic corrosion (electrolysis). Disintegration of the anodes indicates they are performing their function. An anodes must be replaced when it has been reduced to 2/3 its original size (1/3 eroded). Engine corrosion will increase if eroded anodes are not replaced.



⚠ CAUTION

Do not paint or coat anodes or their mounting surfaces.



External Anodes

Anodes mounted externally on the engine should be inspected every 3 months, or more frequently if the engine is operated in salt or polluted water.

1 Inspect the sacrificial trim tab **(1)** for erosion.

2 Inspect the mid-section or lower unit anode **(2)** for erosion.

Powerhead Anode

The powerhead is protected by an anode mounted in the cylinder head or cylinder. The anode should be replaced whenever service work requires removal of the cylinder head, or when a complete overhaul of the engine is performed.

Installation Test

Use the following procedure to test for proper installation of the anode. Make sure the surface of the anode is clean before testing.

1. Calibrate an ohmmeter on high ohms scale.

2. Connect one meter lead to a ground on the powerhead and the other lead to the anode. The ohmmeter should show a low reading. If not, remove the anode and clean the surface where it was mounted. The anode and its mounting hardware should also be cleaned. Install anode and retest.

SECTION 3 - FUEL SYSTEM

General Precautions

⚠⚠ WARNING

Gasoline is extremely flammable and can explode if mishandled. JP-5/8 is also hazardous.

1. Before performing any service work on the fuel system, read and understand Section 1 - Service Safety.
2. Before servicing the fuel system, disable the ignition system by removing all spark plug leads to prevent accidental starting of engine.
3. Fuel leakage can contribute to a fire or explosion. After service work is complete and engine is fully assembled, always run the engine momentarily to pressurize the fuel system. Then check for leaks.
4. Never attempt to run the engine with any fuel system component removed or disconnected.
5. Check fuel hoses and other non-metallic component's for indications of damage or deterioration. Always replace components with authorized factory replacement parts suitable for fuel systems.
6. Clean up fuel spills immediately and store rags in approved containers. Keep drained fuel in approved containers for proper disposal.
7. When using compressed air to clean or dry parts, make sure the air supply is regulated not to exceed 25 psi [172 kPa / 1.76 kg/cm2].

Service Specifications,

NOTE

Refer to Section 2 for Standard Torque Values chart.

Description	40	Torque
Fuel Induction Mounting Bolt	40 - 55 4.6 - 6.2 0.47 - 0.64	**in-lb** **N·m** **kg-m**
Air Silencer Cover Bolt/Screw•	43.2 - 54.6 4.9 - 6.4 0.50 - 0.65	**in-lb** **N·m** **kg-m**
Inlet Manifold Mounting Bolts	43.2 - 54.6 4.9 - 6.4 0.50 - 0.65	**in-lb** **N·m** **kg-m**

•Loctite #242 required

No Manufacturer Special Tools are required.

General Equipment Required

Fuel Pressure Gauge, 0 - 15 psi [0 - 1 kg/cm•]
Tee Fitting with 3/8 in O.D. barbs [9.5 mm O . D .]
Torque Wrench, 0 - 150 in-lb [0- 17 N·m/0 - 1.7kg-m] Digital Pulse Tachometer
Flexible Fuel Tubing, 3/8 in I.D. x 5 in. [9.5 mm I.D. x 127 mm]

Consumable Supplies Required

Thread Locking Compound, *Loctite 272*
Isopropyl Alcohol Cleaning Solvent Lint-free Wipes

Fuel System Requirements

Acceptable Fuel - Gasoline

Any gasoline with pump posted octane rating over 87 (research octane rating of 91) and with no more that 10% Ethanol by volume.

Acceptable Fuel – Heavy Fuels

JP-5/8; kerosene; Jet-A, diesel #2; are acceptable. It is critical to insert additive in 50:1 mix. 50:1 mix must be used in addition to the additive.

Unacceptable Fuel

Gasoline with more than 5% Methanol (even if it contains co-solvents or corrosion inhibitor) or more than 10% Ethanol, regardless of the octane rating.

Fuel Storage Life

Fuel stored more than three months should not be used.

Acceptable Lubricant

Any NMMA certified TC-W3 2-cycle outboard engine oil is acceptable for fuel tank premix applications on gasoline. Do not use automotive oils which can damage the engine and shorten spark plug life. For Heavy Fuels (JP-5/8, Jet-A, kerosene, diesel) use additive (Mercury JP or Raider JP with additive).

Mix Ratios

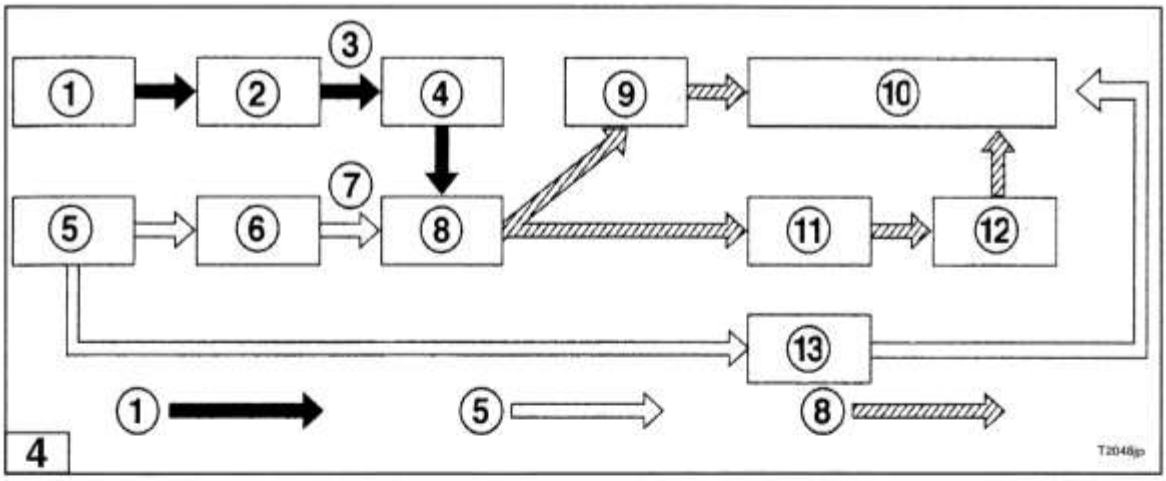
⚠ CAUTION

A 25 : 1 gasoline/oil mixture is required during engine break in. Refer to Break-In Procedure in Section 2.

Gasoline Premixing
A 50:1 gasoline/oil mixture (2% oil) is required. New engines or reconditioned power heads require a 25:1 gasoline/oil mixture {4% oil) during break-in.

Heavy Fuel Premixing
A 50:1 Heavy Fuel Additive is required. Each container will support a 6 gallon bladder.

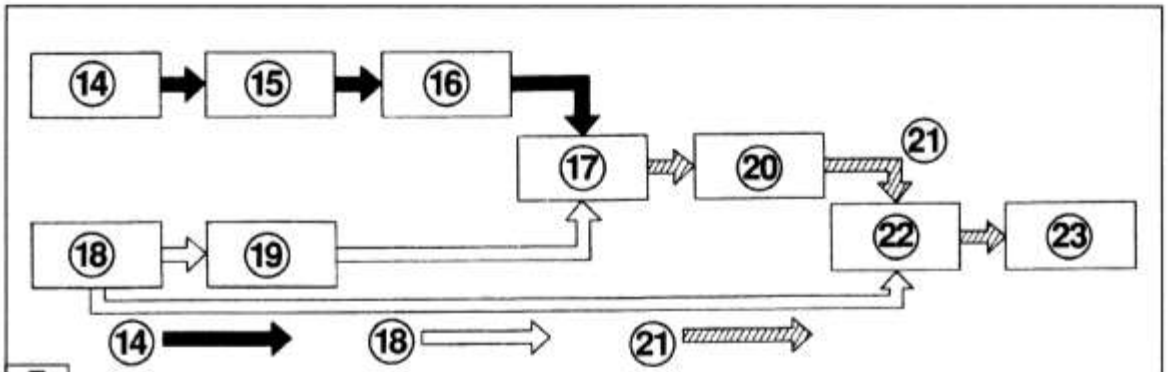
Fuel System



Under idling conditions, the mixture of fuel and air is mainly output from the pilot outlet. As throttle is increased, the negative pressure applied to the pilot system increases and allows more of the mixture to flow from the bypass. When the throttle is opened further, the increase of air causes a pressure drop which allows the main system to assume full control of fuel delivery.

Main System

5 The main system in the carburetors is a high speed system consisting of the main jet, main nozzle and main air jet. As the throttle valve opens, mixed fuel **(14)** enters the carburetor and flows from the carburetor float chamber **(15)** to main jet **(16)**. The fuel is then measured and directed to the main nozzle **(17)** bleed hole where it combines with air **(18)** from the main air jet **(19)**. The increased air quantity and flow rate at venturi **(22)** allows pressure drop at the tip of main nozzle **(20)**, causing increased output of fuel/ air mixture **(21)**. The fuel mixture combines with main air at the venturi **(22)** before entering the engine **(23)**.

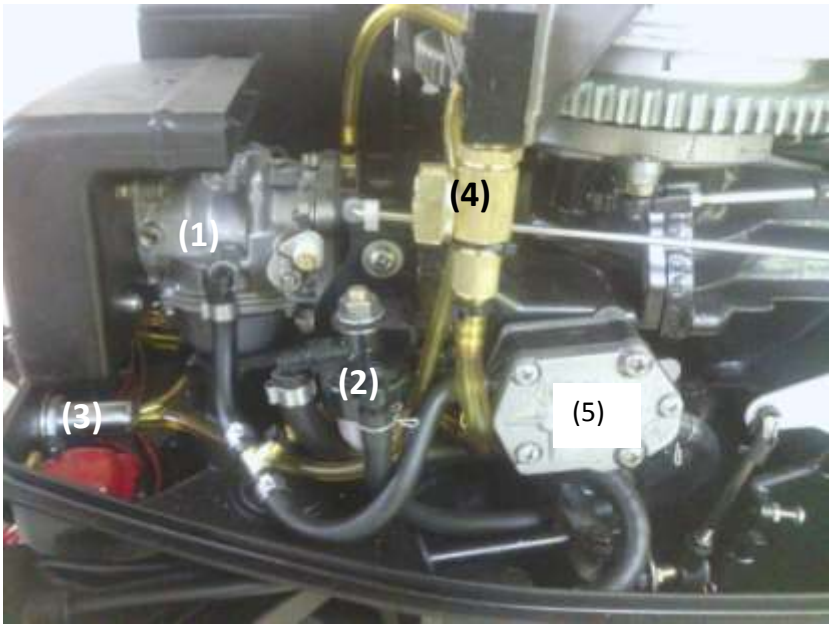


Fuel System Operation – Raider

Fuel flows from bladder to input valve (1) ; input valve to fuel filter (2); fuel filter to fuel pump (3); fuel pump to Carburetor (4); Carburetor into combustion chamber.

Troubleshooting fuel issues

The troubleshooting chart lists common engine symptoms related to problems with the fuel system. It also indicates specific malfunctions in the fuel system which may be causing the problem so it can be isolated more effectively. Before beginning major troubleshooting operations on the fuel system, perform the following operations:



1. Carburetor
2. Fuel Filter
3. Primer Pump
4. Heavy Fuel Valve
5. Fuel Pump

- Disconnect fuel pump line to carburetor and insure fuel is pumping.
- Replace filter element in the fuel bladder pickup hose.
- Primer pump to insure fuel is being pushed to carburetor
- Insure line to carburetor is clear

Troubleshooting Fuel Issues

Checks \ Symptom	Hard to start or will not start	Misses at low speeds	Misses at high speeds	Poor acceleration, hesitation or coughs	Runs rough and smokes	Idles well, then slows and stops	Will not start and after fires into exhaust housing	No acceleration, low/full throttle RPM	Idles well but slows when accelerated	Runs at high speed only when hand primer is used	Engine stops suddenly	Runs noisy and knocks	Excessive fuel consumption
FUEL TANK AND FILTERS													
Empty fuel tank	•										•		
Low fuel in tank		•		•									
Fuel tank air vent closed	•					•				•	•		
Poor quality or old fuel	•	•	•		•								
Water in fuel system	•		•						•				
Fuel hose pinched or disconnected	•							•	•	•			
Restricted fuel pickup pipe or clogged pipe filter	•							•	•	•			
Faulty primer bulb	•												
Improper or faulty anti-siphon valve	•							•	•	•			
Clogged fuel filter	•							•	•	•			
Loose connector or vacuum leak	•								•				

Oil and Carburetor

Checks \ Symptom	Hard to start or will not start	Misses at low speed	Misses at high speed	Poor acceleration, hesitation or coughs	Runs rough and smokes	Idles well, then slows and stops	Will not start and after fires into exhaust housing	No acceleration, low/full throttle RPM	Idles well but slows when accelerated	Runs at high speed only when hand primer is used	Engine stops suddenly	Runs noisy and knocks	Excessive fuel consumption
OIL MIXTURE													
Mixture too rich (too much oil)		•			•								
Mixture too lean (not enough oil)		•				•		•	•			•	
CARBURETOR													
Carburetor out of adjustment	•	•		•	•			•	•	•			
Carburetor obstruction or faulty needle valve	•												
Restricted air flow to carburetor					•								
Faulty choke valve	•				•				•				
Carburetor and ignition timing not synchronized	•							•					
Float position too high					•								•
Float position too low				•					•	•			
Jet obstructed or defective				•					•	•			•
Carburetor gasket leakage				•									•

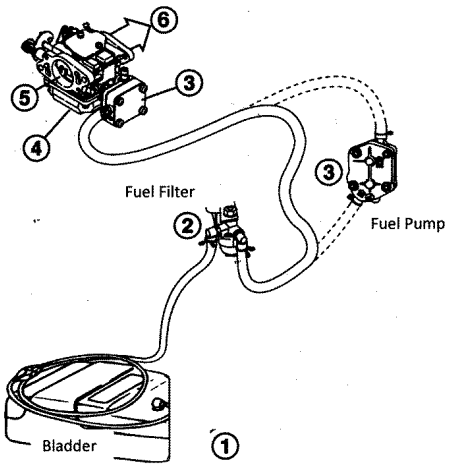
Troubleshooting Recirculation, Fuel Pump, Inlet Manifold

Checks \ Symptom	Hard to start or will not start	Misses at low speed	Misses at high speed	Poor acceleration, hesitation or coughs	Runs rough and smokes	Idles well, then slows and stops	Will not start and after fires into exhaust housing	No acceleration, low/full throttle RPM	Idles well but slows when accelerated	Runs at high speed only when hand primer is used	Engine stops suddenly	Runs noisy and knocks	Excessive fuel consumption
RECIRCULATION													
Puddle drain valve or hose blockage		•			•	•							
Recirculation hose misrouted		•		•									
FUEL PUMP													
Mounting gasket leakage						•				•			
Check valve sticking open or closed				•						•			
Ruptured diaphragm				•									•
INLET MANIFOLD													
Warped inlet manifold		•		•									
Manifold gasket leakage		•		•									
Faulty reed valve operation or broken valve		•		•				•					
Reed valve gasket leakage		•		•			•	•					

Raider – Description of Operation

Upon engine startup, premixed fuel is drawn from fuel bladder (1) by vacuum pressure on the suction side of the fuel pump through the fuel filter (2) and, into fuel pump (3). Fuel flows from the fuel pump into the carburetor (4). Fuel is drawn from the fuel plate (if heavy fuel valve is open) where it is mixed with air and pulled into the crankcase (6).

1. Fuel Bladder
2. Fuel Filter
3. Fuel Pump
4. Carburetor
5. Fuel Plate
6. Crankcase



Fuel Pump [3] above

The fuel pump is integral with the carburetor and mounted on the side of the crankcase and contains one or more internal diaphragms (1). The diaphragms move in response to changing crankcase pressures (2) which draws fuel in (3) and pumps fuel out (4). A series of check valves (5) in the pump ensure that fuel moves only in one direction.

Carburetor [1] above

The carburetor is used a pilot system and works in conjunction with the fuel plate to deliver an atomized fuel mixture to the engine for combustion under varying operating conditions.

Recirculation

Recirculation hoses at the inlet manifold and crankcase re-circulate unburned fuel for engine consumption.

Fuel Bladder Connection

Raider provides a 10 ft. fuel hose from the bladder to the Raider 40. The hose comes with a connector that goes into the fuel bladder to insure proper connection.

Cleaning

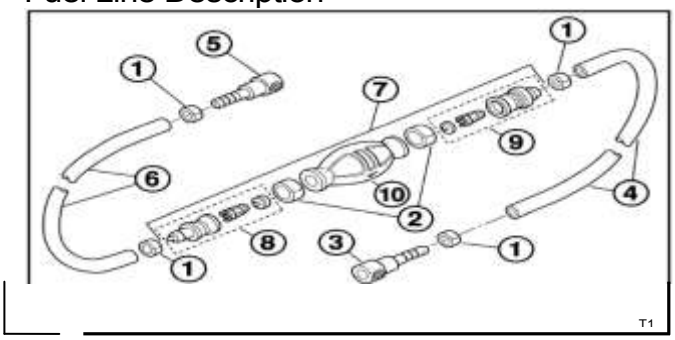
Water or dirt in the fuel bladder can cause fuel starvation and engine problems. Clean and inspect fuel bladder once a year or after long time storage (more than 3 months).

1. Disconnect fuel line from fuel bladder.
2. Empty remaining fuel from bladder and properly dispose.
3. Fill tank 1/4 with fresh gasoline and install cap. Rigorously shake tank for 30 seconds to loosen dirt particles.
4. Empty gasoline from tank and properly dispose.
5. Inspect tank components before refilling.

Inspection

All worn, damaged, or missing parts must be replaced.

Fuel Line Description



5-Bladder connection to Raider See Parts and Assembly Manual R40 ES-001-15-2 for part numbers.

1. Clamp P/N 332702010M
2. Clamp P/N 3C7702170M
3. Fuel Connector to Bladder P/N 3B2702810M
4. Fuel Hose - 7MM (5/16") Use fuel line material
5. Fuel Connector Engine side female P/N 3B2702501M
6. Fuel Hose - 7MM (5/16")
7. Complete Assembly – No Part No. available
8. Joint Assembly outer – P/N: 3C7702241M
9. Joint Assembly inner – P/N: 3C7702201M
10. Primer Bulb – P/N 3C7702111M

*MALE QUICK CONNECTOR

The connector to be inserted into Fuel Bladder is attached to the fuel hose. It has a barbed connector to insure a good fit.

Fuel bladder is connected to the engine by a hose with a primer bulb. The primer bulb forces fuel into the Fuel Induction System for engine starting. Check valves on each side of the primer bulb maintain fuel flow, in one direction only, from the tank to the engine.

Disassembly

NOTE
Direction of *fuel flow* as *indicated by the arrow* on *the primer bulb.*

1. Remove and discard hose clamps (1) and primer bulb clamps (2) as required.
2. Remove tank connector (3) and hose (4).
3. Remove engine connector (5) and hose (6).
4. Remove primer bulb assembly 7. Remove check valves
5. (8) and (9) from primer bulb (10).

Cleaning and Inspection

1. Clean components using soap and water.
2. Dry all components with low pressure compressed air. Make sure all parts and passages are completely dry. Inspect primer bulb and hoses for cracks and deterioration.
3. Inspect bladder and engine quick connectors for damage and wear. Make sure check valves in quick disconnects open freely when pressed.
4. Inspect primer bulb check valves for damage.
5. Reassemble all components.

In-Line Fuel Filter Replacement

NOTE

In-line fuel filters cannot be serviced. Replace in-line fuel filters once a year or with each tune-up. When replacing an in-line fuel filter, note direction of fuel flow as indicated by the arrow on the filter housing for proper installation.

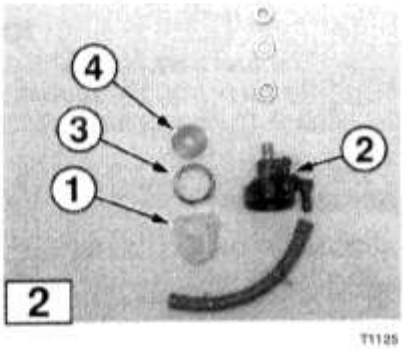
1

1. Loosen clips **(1)** on each side of the filter **(2)** and slide down the hose.

2. Separate the fuel filter from the hoses and discard.

3. Replace with new fuel filter.

4. Attach hoses and secure clips.



Bowl Type Fuel Filter Cleaning and Inspection

2

1. If necessary, use a wrench on the square at the bottom of the sediment bowl **(1)** to loosen the bowl. Remove the bowl from filter body **(2)**.

2

2. Remove gasket **(3)** and screen **(4)**.

3. Clean bowl and screen.

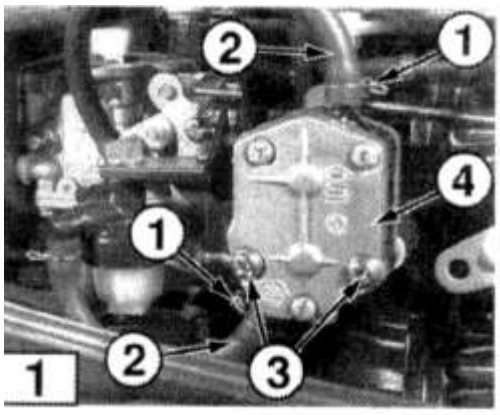
NOTE

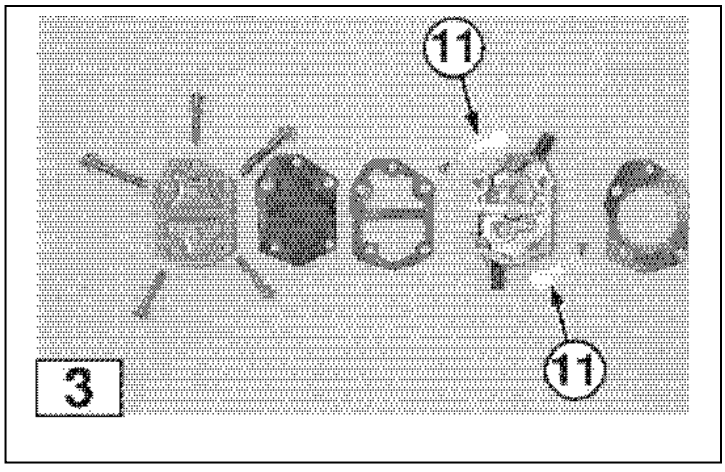
Clean the screen with a soft brush and solvent.

4. Inspect bowl for cracks and screen for damage. Replace gasket.

5. Install screen and bowl.

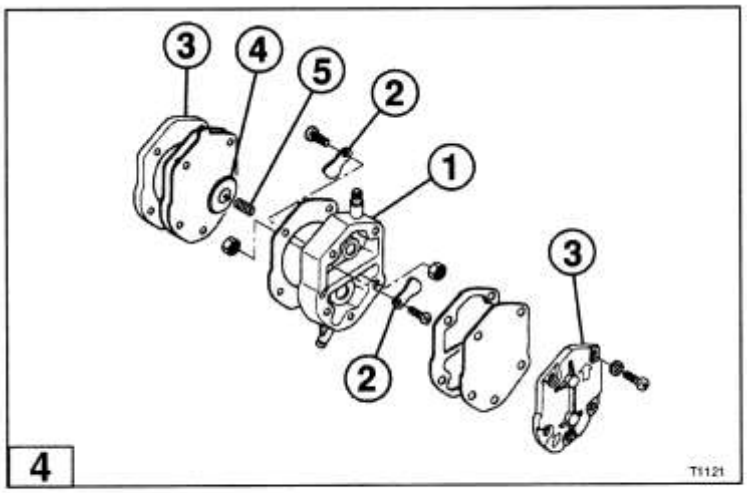
Disassembly – Fuel Pump





NOTE
Mark part before disassembly to be able to reassemble in same position. Reference the *illustrations in the Inspection procedure to ensure proper orientation of internal components.*

Expand and move clips (1) on fuel hose(s) (2).
Disconnect fuel hoses from fuel pump.
Loosen pump mounting screws (3) and remove fuel pump (4) and gasket from crankcase.
Remove fuel pump cover screws (5) and cover (6). Gently separate the pump components.
Remove all check valves (11) from pump body.
Remove and discard all unserviceable gaskets and diaphragms



Inspection

4 1. Inspect pump body **(1)** for cracks.

4 2. Inspect check valves **(2)** for deformation.

4 3. Inspect pump covers **(3)** for cracks and surface deformation.

4 4. Inspect guide plate **(4)** and spring **(5)**, if equipped, for deformation and tension.

5. Inspect gasket between crankcase and fuel pump for dryness (crankcase-mounted pumps).

Cleaning

1. Clean all pump components with kerosene.
2. If necessary, clean pump mounting surface on FIS with isopropyl alcohol.
3. Dry all components with low pressure compressed air.

Inspection

1. Inspect pump body (1) for cracks.
2. Inspect check valves (2) for deformation.

3. Inspect pump covers (3) for cracks and surface deformation.
4. Inspect guide plate (4) and spring (5), if equipped, for deformation and tension.
5. Inspect gasket between crankcase and fuel pump for dryness (crankcase-mounted pumps).

Assembly

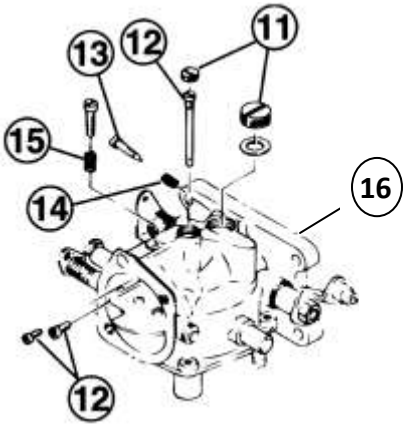
1. Install all check valves in pump body.

2. Fully assemble fuel pump. All unserviceable gaskets and diaphragms must be replaced.

3. Install fuel pump. Use Loctite 242 on mounting screw threads.

4. Connect fuel hoses to fuel pump.

Carburetor



Removal

1. Remove motor cover
2. Disconnect fuel supply.
3. Remove fuel hose from carburetor
4. Loosen clamp bolts and remove carburetor.

⚠ **CAUTION**

Use the following precautions during carburetor disassembly

1. Clean plastic parts with warm soapy water.

2. Dry all components with low pressure compressed air.

3. DO NOT inspect passages or holes with wire or similar materials. Doing so may

scratch or enlarge jet holes and alter the fuel-air ratio.

NOTE

Before inspection, all fuel induction components must be cleaned. All worn or damaged parts must be replaced.

1 **Removal of Carburetor**

1. **Remove the air silencer**
2. **Remove the carburetor primer rod linkage**
3. **Remove the fuel hose**
4. **Remove carburetor and fuel plate - discard carburetor base gaskets**
5. **Remove drain screw from float chamber – allow to drain**
6. **Remove float chamber**
7. **Remove float valve assembly, if serviceable, remove needle seat**
8. **Remove jets, plugs, nozzles from carburetor**
9. **Remove pilot adjust and throttle stop screw**

Replace any worn parts and re-assemble.

Reed Valve

Disassembly

1. Follow steps listed in Carburetor Removal procedure, this section.

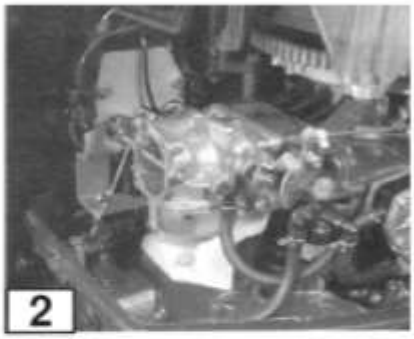
2 2. Disconnect the linkage at the throttle cam.

3. Remove the crankcase recirculation hose from the manifold.

4. Remove recoil starter or flywheel cover as applicable, refer to Powerhead section.

3 5. Remove the intake manifold.

6. Remove the reed valve assemblies from the manifold or lift them from the crankcase as applicable. DO NOT disassemble the reed valve assemblies. (Except 8/9.8)



Inspection

4 1. Inspect the reed valve assemblies:

- All gasket surfaces must be flat, within ± 0.003 in [0.08 mm].
- Inspect reeds **(1)** for cracks or chips. Reeds must be seated flat without any preload.
- Check tightness of reed valve stoppers **(2)**. If loose, tighten screws using Loctite 242.
- Inspect valve seat surface **(3)** for rise, wear, or damage.

Lift height of each reed valve and stopper must meet specification.

5 Reed Valves Raider

	40
No. Valves Strips Valves/Strip	12
	4 Strips
	3 Valves/Strip
A=Valve Height	0.236-0.244 in (6.0-6.2 mm)
B=Gap Valve End Valve Seat	0.0079 in (0.2 mm)

- Inspect entire valve assembly

If any part of the reed valve assembly is worn, damaged, or corroded, entire valve assembly must be replaced.

CAUTION

Used reeds must never be turned over and re- used. Reed could break when returned to service, causing serious powerhead damage.

2. Inspect the intake manifold:
   - All gasket surfaces must be smooth and free of nicks .

6 Check manifold surface for flatness in all directions.
Mounting surface must be flat, within ± 0.004 in [0.10 mm].

NOTE

All intake manifold components must be perfectly clean before assembly. Use isopropyl alcohol. DO NOT use a carburetor cleaner or a soaking tank.

Never reinstall the used reed valve screws because the effect of the adhesive has been lost and may lead to reed valve failure during operation.

Verify that the clearance between the reed valve and the valve seat is 0.0078 inches (0.2 mm) or less after assembly.

7 1. Assemble the intake manifold components as illustrated:

- Install all gaskets dry.
- Torque manifold bolts evenly to specification.

2. Connect the crankcase recirculation hose to the manifold.

3. Follow steps listed in Carburetor Installation procedure, this section.

4. Connect the linkage at the throttle cam.

5. Install recoil starter or flywheel cover as applicable, refer to Powerhead section.

SECTION 4 - POWERHEAD

General Precautions

Before performing any service work on the powerhead, read and understand the Service Safety section at the beginning of this manual.

Use the manufacturer special tools as indicated during servicing of the powerhead.

Use caution when performing tests with the engine cover removed. Do not wear loose clothing or jewelry. Keep hair, hands, and clothing away from the flywheel.

Check entire fuel system for leaks after servicing the powerhead to prevent fire or explosion.

Make sure all ignition and electrical leads are properly routed and clamped in their original positions.

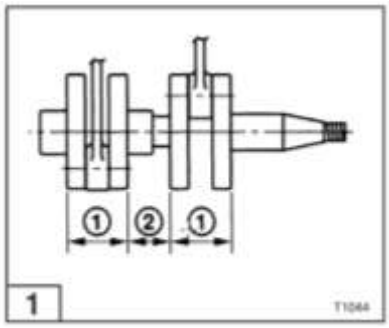
Disable the ignition system and disconnect the battery when servicing the powerhead.

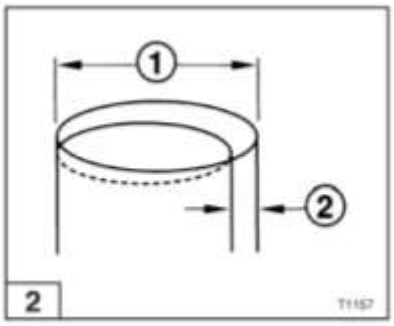
Replace locking fasteners when their locking feature becomes weak. Use only factory replacement parts.

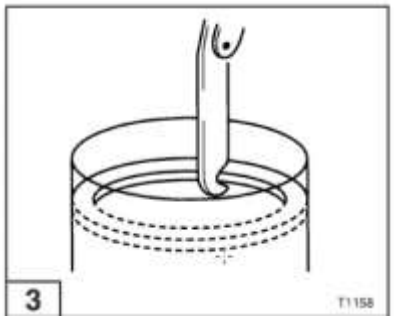
Always inspect and test the start-in-gear prevention system before returning engine to customer.

Service Specifications - (Standard Value)

Fig	Description		Unit	Raider 40
	Compression		psi kPa kg/cm•	106.6 735 7.5
	Thermostat Opening Temperature		OF OC	125.6 52
	Crankshaft (off center)		in mm	<0.002 <0.05
1	Crankshaft (dimensions)	①	in mm	2.071 ±0.002 52.6 ±0.05
		②	in mm	1.591 ± 0.002 40.4 ± 0.05
2	Cylinder Bore	①	in mm	2.756 70
2	Piston Clearance	②	in mm	0.0024 - 0.0039 0.05 –0.10
3	Piston Ring End Gap		in mm	0.008 - 0.016 0.20 –0.40







Manufacturer Special Tools Required

Flywheel Puller Assembly, 336-72214-0
Flywheel Stripper, 386-72214-1
Piston Pin Tool, 332-72215-0 Piston Ring Tool, 353-72249-0 Thickness Gauge Set, 353-72251-0
Raider Flywheel holder, 353-722-R40-4

General Equipment Required

Compression Gauge, 0 - 199 psi [0 - 1,350 kPa / 0 - 13.7 kg/cm²]
Water Pressure Gauge, 0 - 15 psi [0 - 98 kPa / 0 - 1 kg/cm²]
Torque Wrench, 0 - 150 in-lb [0 - 17 N-m / 0 - 1.7kg-m]
Torque Wrench, 0 - 750 ft-lb [0 - 1000 N-m / 0 - 100 kg-m]
Micrometer Set or Vernier Caliper, graduation 0.0001 in [0.01 mm], 0 - 1 in [0 - 30 mm] range
Telescoping Gauge, Inside Micrometer Set, or Vernier Caliper, graduation 0.0001 in [0.01 mm], 1.5 - 4 in [40 - 100 mm]
Dial Indicator, graduation 0.0001 in [0.01 mm], 0 - 1 in [0 - 30 mm] range
Analog Multimeter, *Electronic Specialties® Model M-530 or equivalent*
Digital Pulse Tachometer, 10 - 6000 RPM, *Electronic Specialties® Model 321 or equivalent*
Industrial Thermometer, minimum 300°F [150°C]
Heat-Resistant Container, *Pyrex®*
Bearing Puller
Seal Pullers
Seal Installer
Surface Plate, 20 x 20 in [500 x 500 mm], 0.0001 in [0.01 mm] accuracy

Consumables Required

Threadlocker, *Loctite® 242*
Threadlocker, *Loctite® 243*
Gasket Dressing, *Permatex® Hylomar® Aerosol High-Temp Gasket Dressing*
Gasket Sealant, *Permatex® High Tack Gasket Sealant*
Anaerobic Gasket Maker, *Loctite® 518*
Dielectric Lubricant, *Permatex® Dielectric Tune-Up Grease*

Troubleshooting – Power Head

The troubleshooting chart lists common engine symptoms related to problems with the powerhead. It also indicates specific component failures which may be causing the problem so it can be isolated more effectively.

Symptom / Checks	Hard to Start Or Will not start	Low Compression	Runs Rough or Erratically	Idles Poorly	No Acceleration fails to reach full RPM	RPM Decrease	Engine Overheats	Runs Noisy Excess. Vibration
Poor crankcase seal	•							
Ignition timing or throttle linkage out of adjustment, see Section 2	•		•		•			
Water entering crankcase	•			•		•		
Defective thermostat					•		•	

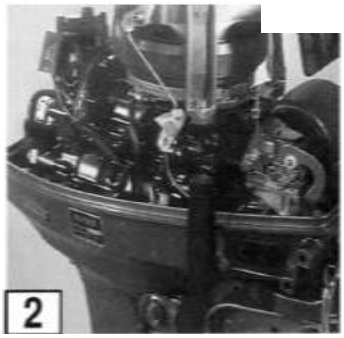
Fouled, defective or incorrect spark plug; wrong gap setting	•		•	•		•	•	
Worn or defective cylinder, piston, rings or warped head	•	•			•			•
Blown cylinder head or engine base gasket	•	•	•	•	•	•		•
Worn connecting rod or crankshaft bearings, internal wear limits out of specification	•		•					•
Defective ignition components, see Section 7	•		•		•			
Carbon accumulation in combustion chamber	•				•	•		

DESCRIPTION OF OPERATION

1 2 The power head of this outboard motor is a two-stroke engine (or two-stroke cycle engine). The engine completes its one cycle operation including gas mixture suction, compression, explosion and exhaust while the crankshaft rotates once i. e. the piston moves upward and then downward (two strokes).

As the piston starts to move toward top dead center (TDC), the interior of the crank case is made vacuum pressure causing the reed valve to open and the gas mixture to be taken into the crankcase. As the piston comes near the TDC, the spark plug produces the sparks to ignite the compressed gas mixture for combustion. As the fuel mixture is exploded, the piston moves toward bottom dead center (BDC) and open the exhaust port and then scavenging port. The scavenging is an action that sends the fresh gas mixture in the crankcase to the cylinder.

1



2

· The Raider outboards are unusual from commercial outboards; the head of the Raider has included two dewatering valves that allow water to escape after submersion – when opened. The heads have also been modified to allow more water flow which keeps the engine cooler and will increase reliability and life of the Raider.

Cylinder Compression Test

1. Operate engine to normal operating temperature.
2. Stop engine.
3. Disconnect the magneto leads to disable the ignition system.

⚠⚠ WARNING
Ignition system – must be disabled; magneto leads disconnected; battery disconnected

4. Remove spark plugs and install thread-type compression tester in spark plug hole.
5. Place throttle in fully open position and crank engine with pull rope starter through at least four compression strokes.
6. Take reading for each cylinder and verify specified pressure is obtained:

Raider	Cylinder Compression* psi [kPa / kg / cm2]
40	106.6 [735.0 / 7.5]

*Compression variation among cylinders should not exceed 15 psi [103 kPa / 1.05 kg/cm2] on two cylinder engines.

If variation of cylinder compression, on two cylinder engines, exceeds 15 psi [103 kPa/ 1.05 kg/cm2], check for the following:

- Scored cylinder walls.
- Piston damage.
- Head gasket damage.
- Stuck or broken piston rings.

On two cylinder models, if cylinder compression is equal, engine is difficult to start and runs poorly, check for the following:

- Scored cylinder walls.
- Piston damage.
- Stuck or worn piston rings.

Thermostat

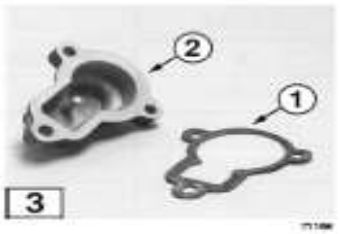
Removal

1. Remove thermostat cap screws. Gently tap thermostat cap (3) with rubber mallet to loosen and remove cap and gasket. - Discard gasket.

2. Remove thermostat and inspect for obvious damage and corrosion.

3. Check pressure relief valve for proper operation.

4. Perform thermostat Function Test if thermostat is suspect.



Installation

Install thermostat in cylinder head.

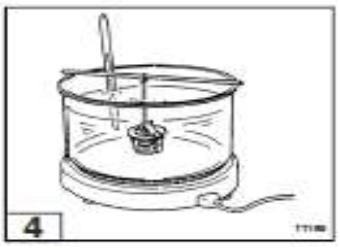
Lightly coat both sides of new thermostat cap gasket (1) with gasket sealant. Mount gasket on cap (2).

Install thermostat cap and gasket and torque to specification.

Function Test

Suspend thermostat and thermometer in a heat-resistant container filled with water.

Slowly heat and stir the water. Verify the thermostat opens at 140°F 60°C If it does not open at specified temperature, replace thermostat.



⚠⚠ WARNING

Use a heat-resistant container such as Pyrex® glassware. DO NOT allow Thermostat or thermometer to rest against the glass. Items could overheat and rupture.

1. Remove thermostat and observe its closing action as it cools. If closing action is not slow and smooth, replace thermostat.

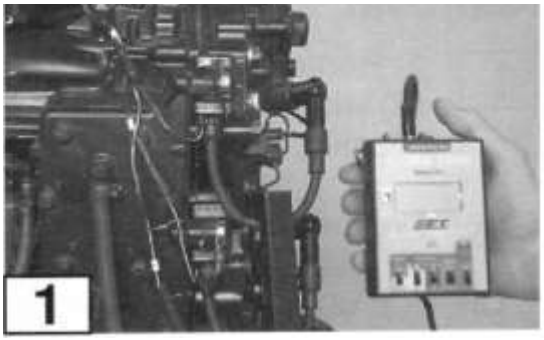
RPM Performance Test

⚠ CAUTION

Do not perform RPM test if engine shows signs of overheating.

Perform this test with correct test propeller Installed and with the engine in a test tank.

1. Operate engine up to normal operating temperature.
2. Stop engine and install tachometer.
3. Start and run engine at NEUTRAL idle and verify specified RPM is obtained.
4. If test tank conditions permit, run engine in forward gear at trolling and full throttle speeds and check for correct RPM:



Raider 40	NEUTRAL RPM	Trolling Speed RPM	I Throttle Speed RPM
	950	850	5200-5800

If test results vary, refer to Troubleshooting in this section.

Recoil Starter

⚠⚠ **WARNING**

The Raider 40 engines have neutral start mechanism (start-in-gear protection) attached to the recoil starter. This feature disables the engine from starting while in gear (forward or reverse). During reassembly of the engine following repair, ensure that you DO NOT DISABLE THE START-IN-GEAR PROTECTION.

⚠⚠ **WARNING**

Ignition system must be disabled to prevent accidental engine startup during servicing of the recoil starter.

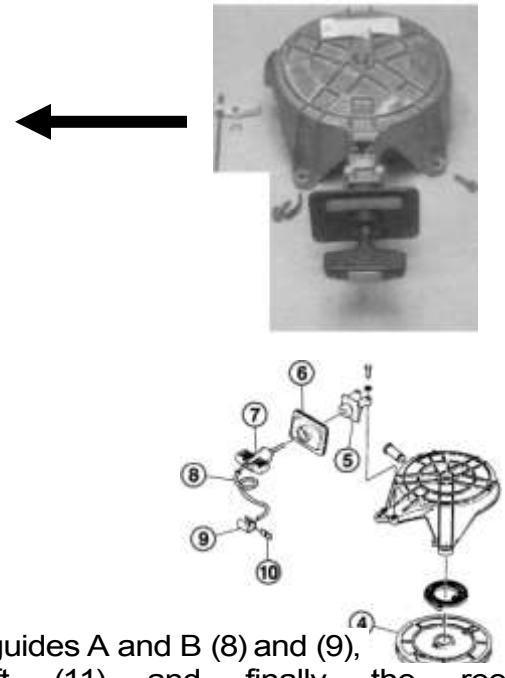
Removal for Emergency Operation

Using the tools found in the Emergency Tool Kit; use the socket that has 10 mm on one side and 13 mm on the other end.

1. Remove the neutral start mechanism components and remove the recoil starter unit from the engine.

2. Rewind the reel and loosen the recoil starter spring.
Use a screw driver to put the starter rope in the reel notch. With the rope hooked in the notch, rotate the reel slowly to loosen the rope.
Repeat this process until the starter spring does not pull the reel.

3. Remove the handle from the starter rope (8).



4. Remove ratchet e-ring (7), ratchet (5), ratchet guides A and B (8) and (9), starter shaft bolt (14), starter shaft (11) and finally the reel.

Cleaning and Inspection

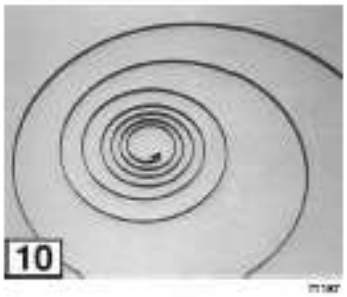
All worn, damaged, or missing parts must be replaced.

1. Clean metal parts with solvent and dry with low pressure compressed air. Clean plastic parts with dry cloth.
2. Inspect following components as follows:
3. Starter rewind spring for cracked or broken and loops.
4. Ratchet and reel stopper springs for deformation or poor tension.
5. Sliding plates, stopper components, and busing for cracks or signs of wear.
6. Reel assembly for wear.
7. Starter housing for sharp or rough edges which could fray starter rope. Starter rope for frays and rope handle for damage.

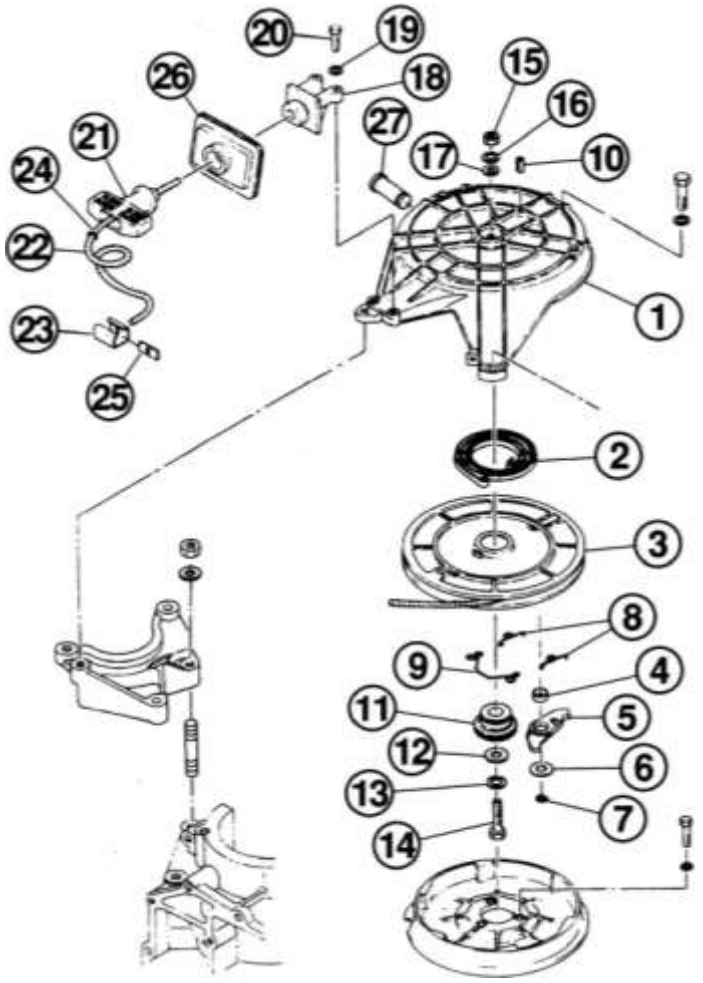
Assembly -

For assembling, reverse the disassembly procedure while observing the following notes.

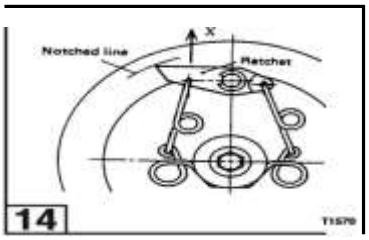
- When setting the starter spring **(2)** on the starter spring case **(1),** direct the outer edge hook of the coil spring to the right and set it in the notch of the starter spring case outer circumference.
- When winding the starter spring **(2),** rotate the reel (3) in the direction it would turn *if* pulling the rope (clockwise looking down at it). Then, set the spring so that the reel rotates 1/4 of a turn when rope is fully pulled out.
- Apply anti-freeze grease to both ends of the starter spring (2) and sliding area between the starter shaft bolt **(14)** and friction plate.
- Tighten the starter shaft bolt to the specified toque.



Pull Starter Diagram



1. Install the starter locking rod, the starter locking cam shaft and the starter handle.
2. Verify that the ratchet operates when the proper load is applied to the ratchet.
3. Set ratchet face up, apply grease and measure force.



Ratchet Load Requirements	
40:	300 to 500 grams

Flywheel

NOTE

Flywheel magneto must be of a particular strength in order to run the ignition system. Flywheels seldom go bad and would only be replaced as a last resort in solving an ignition problem.

⚠ CAUTION

Flywheel is under high torque and requires the use of special tools for removal and installation. Failure to use the specified tools can result in injury or damage to the flywheel or coil plate electrical components.

⚠ CAUTION

The force needed to loosen and tighten the flywheel nut requires flywheel be removed and installed with engine mounted and secured on an engine stand.

NOTE

Reference the following specification table for flywheel Removal and Installation special tool requirements.

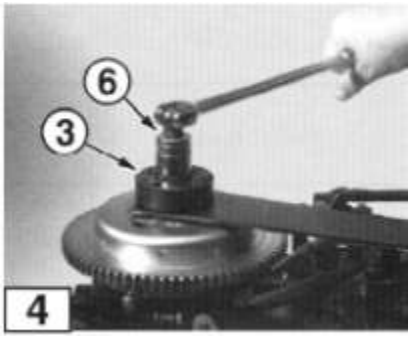
Wheel Puller Part Number: 211-0 (336-72214-1) for Raider 40 Outboard

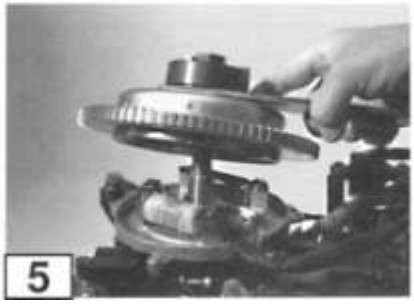
⚠⚠ WARNING

Ignition System must be disabled to prevent accidental engine startup during removal of the flywheel.

1. Remove recoil starter and starter pulley

2. Determine the direction of rotation for removing flywheel nut by running your thumbnail along the threads of the crankshaft.





Inspection

1. Inspect flywheel for cracks, chips, and damaged taper.
2. Inspect crankshaft for thread damage and damaged taper.
3. Inspect flywheel key and keyway for damage.

Installation of Flywheel

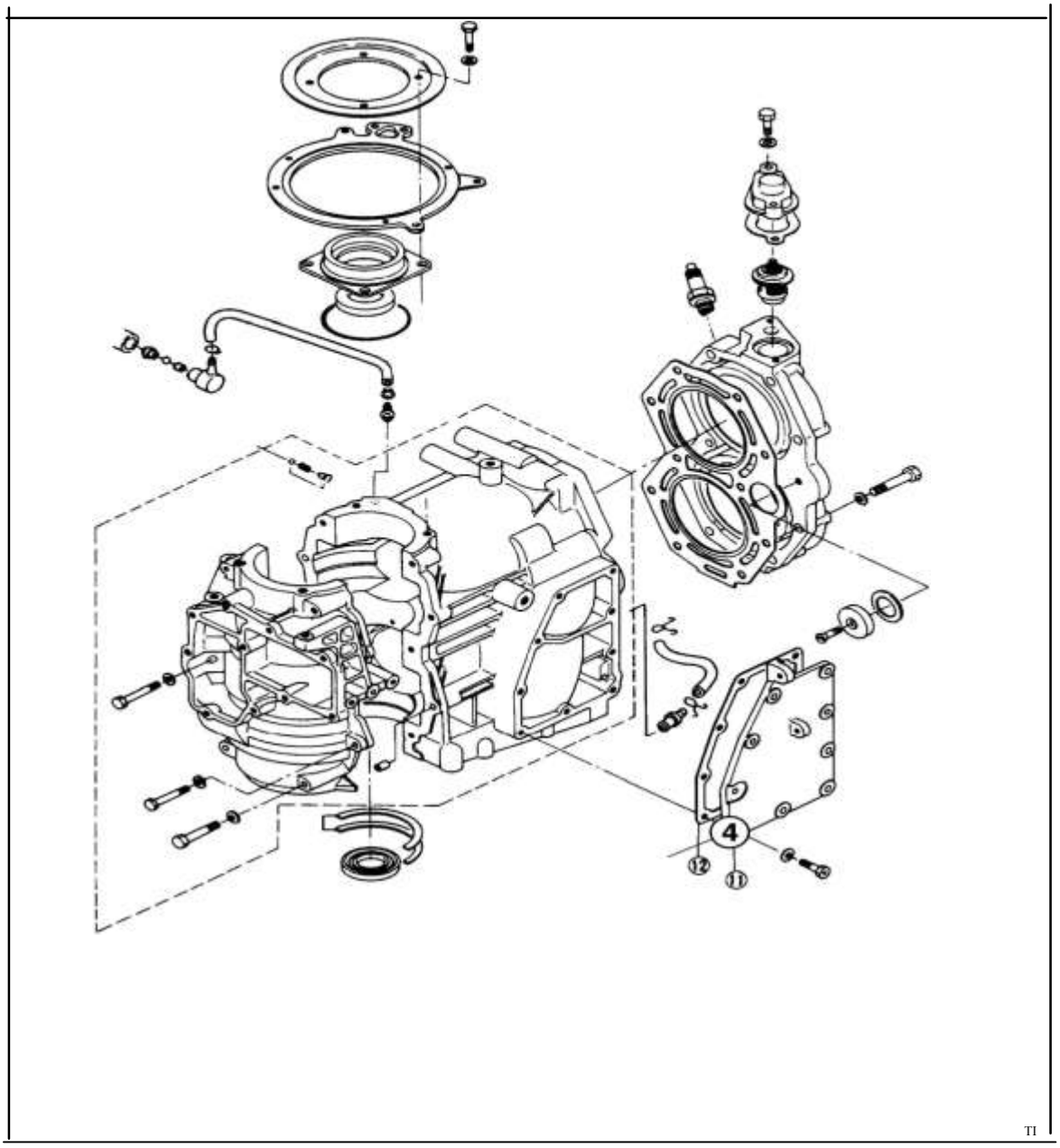
⚠⚠ WARNING

Ignition system must be disabled to prevent accidental engine startup during installation of the flywheel.

1. Remove all grease from tapered portion of flywheel and crankshaft with solvent.
2. Check flywheel key is inserted in crankshaft.
3. Align flywheel keyway and install on crankshaft.
4. Install the flywheel washer. Install puller arm (1) on flywheel using bolts (2).
5. Hold puller arm and torque flywheel nut to specification.
6. Install recoil starter.

Model	Flywheel Torque
Raider 40	1043 - 1217 in-lb 118 - 137 N-m 12 - 14 kg-m

Raider Engine Block – 2 Cylinder/2 Stroke



Removal of Raider Engine

⚠⚠ WARNING

Ignition system must be disabled – disconnect magneto leads and disconnect battery

NOTE

If service work requires flywheel to be removed, remove flywheel before lifting powerhead from the rest of the engine. See *Flywheel, this section.*

NOTE

Mark the mounting location of all clamps so they can be returned to their original positions during assembly of the powerhead.

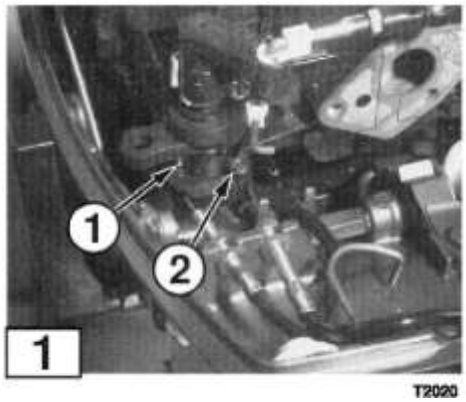
1. Disconnect the battery and fuel tank.
2. Disable the ignition system and disconnect the battery terminals on the power head.
3. Disconnect all electrical connections
4. Disconnect fuel INPUT hose from fuel filter.
5. Disconnect pilot water hose from exhaust cover.

Complete the following operations.

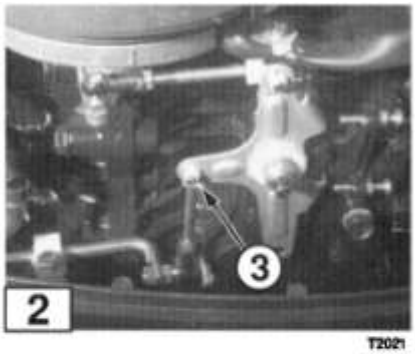
- Remove link rod (3) from advancer arm
- Disconnect shift cable from shift arm.
- Disconnect throttle cable from advancer arm.

Remove engine mounting bolts.
Rock engine back and forth to break seal, then remove the powerhead by lifting straight up.

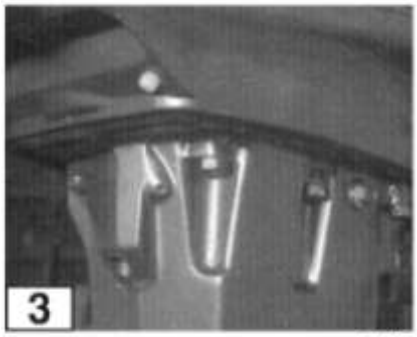
Remove lower crankcase head bolts (4). Insert screwdriver in pinch groove and remove lower crankcase head.



Remove Link Rod (3) from Advancer arm

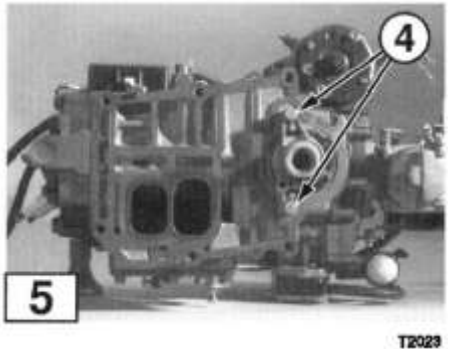


Remove bolts from outside holding Raider powerhead.



7. Remove engine mounting bolts.
8. Rock engine back and forth to break seal, then remove the powerhead by lifting straight up.
9. Remove lower crankcase head bolts **(4)**
. Insert screwdriver in pinch groove and remove lower crankcase head.

f



Disassembly – Power Head

1. Remove all Fuel Induction System (carburetor), ignition, and electrical components from the powerhead.

2. Remove the intake manifold and reed valves. See Intake Manifold in Section 3.

NOTE

The reed valve of the single cylinder models is attached directly to the crankcase. *Therefore, it is removed after dividing the crankcase.*

Cylinder Head

3. Remove and inspect the thermostat. See Thermostat, this section.

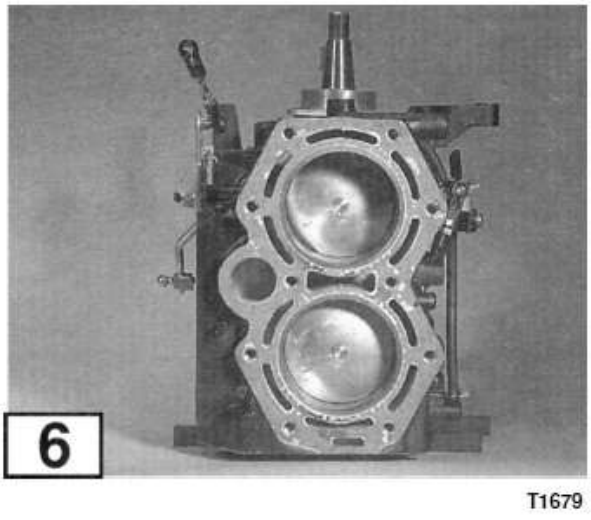
6 4. Remove the cylinder head bolts. Separate and remove cylinder head.

7

NOTE

Start with those farthest from the center of the cylinder head and work inward.

5. Using a pointed scribe, identify the heads of the cylinders for correct positioning during assembly operations.



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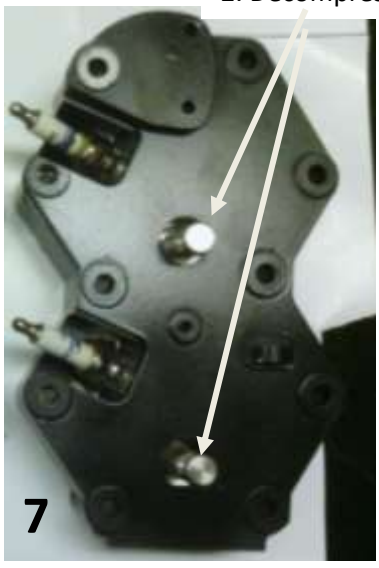
2. Decompression Valves



Inside view of Raider 40 Powerhead
1. Look for any damage
2. Replace gasket
3. Use Permatex Aviation gasket cement when assembly

8 9 6. Remove the exhaust cover bolts. Insert screwdrivers into pinch grooves to separate and remove outer and inner exhaust covers.

Crankcase and Crankshaft

10 7. Remove and discard oil seal **(1)** and o-ring **(2)** from lower crankcase head (or engine base or lower cowl). Use a seal puller to prevent damage to the head.

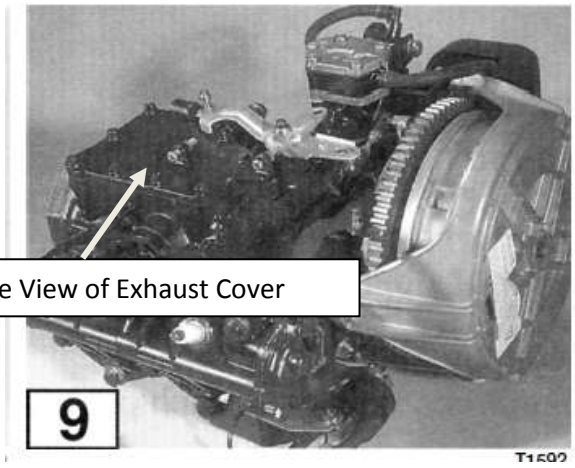
11 8. Remove the crankcase bolts and separate the crankcase from the cylinder block.

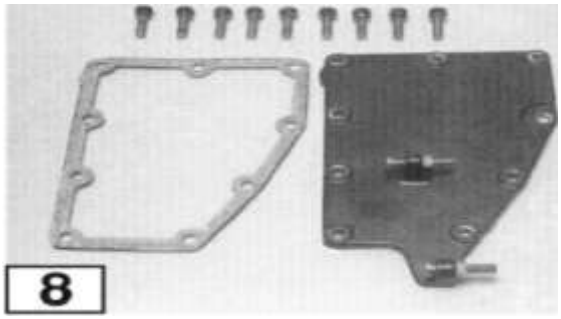
NOTE

Start with the bolts farthest from the center of the crankcase and work inwald.

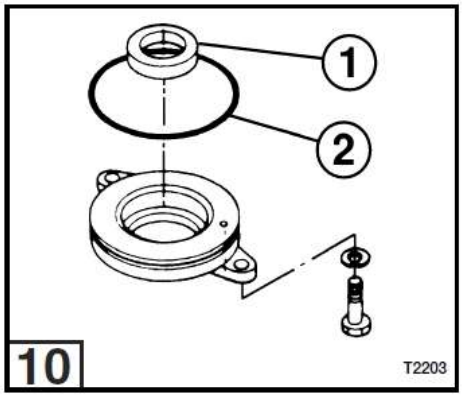
12 13 9. Tap the tapered portion of the crankshaft **(3)** with a rubber mallet to loosen it. Lift the crankshaft and pistons from the cylinder block and place on bench for disassembly.

14 10. Slide the upper main bearing off the crankshaft. Remove and discard bearing oil seal **(4)** and o-ring **(5)**.

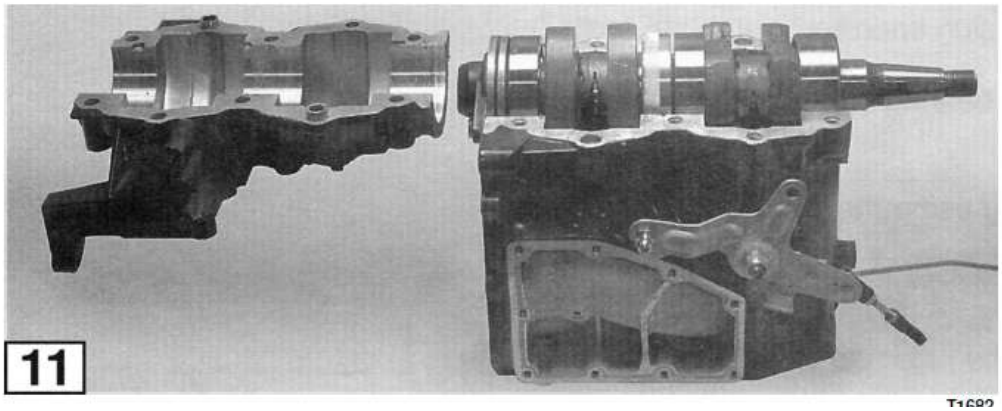


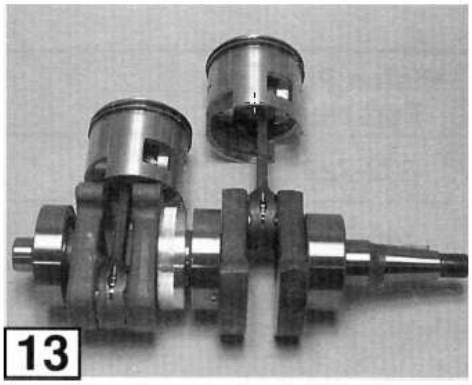


8. Exhaust Cover. Remove (9) cover bolts. Insert screwdriver into pinch grooves to separate and remove.



Remove Replace Oil Seals





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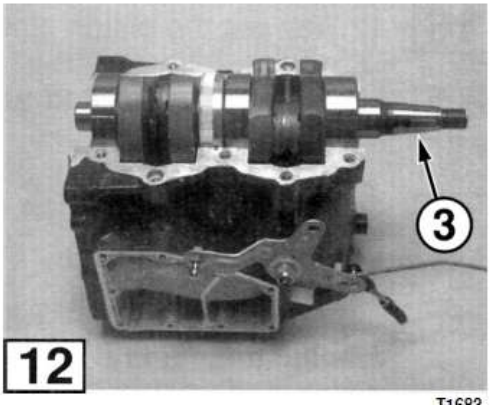
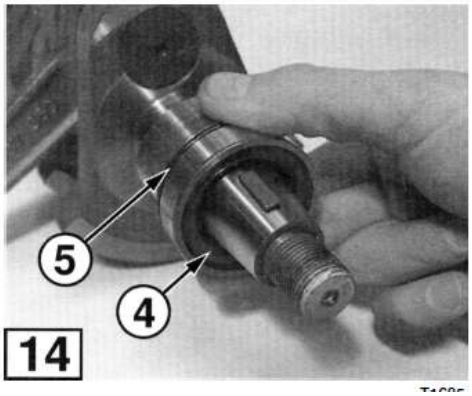


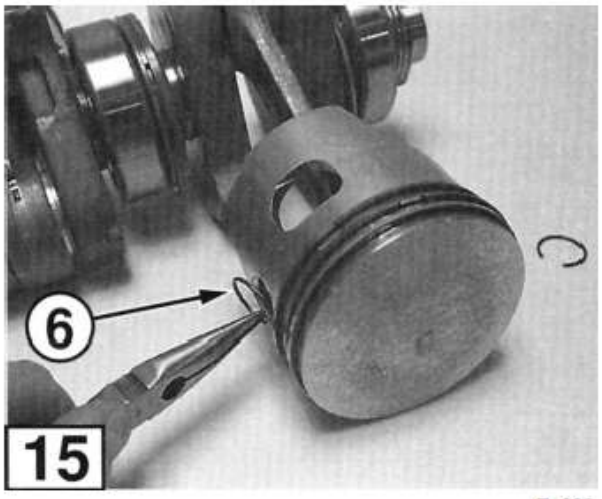


Pistons

NOTE

Pistons, rings, and connecting rod bearings are *wear parts which* seat *with operation of the engine. Make sure these parts* are *marked and kept together* so *they can be returned to their original positions during assembly.*

15. Remove piston pin clip (6) from each side of each piston. (Discard the clips).

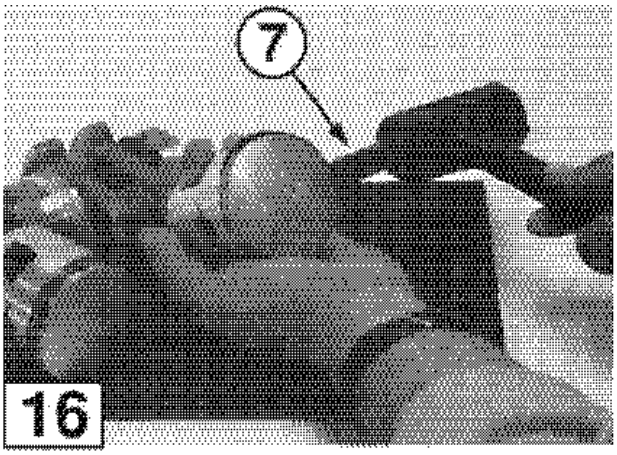


16. Tap out the piston pins using specified piston pin tool (7).

Piston Pin Tool Part Number	Raider
345-72215-0	40

15. .

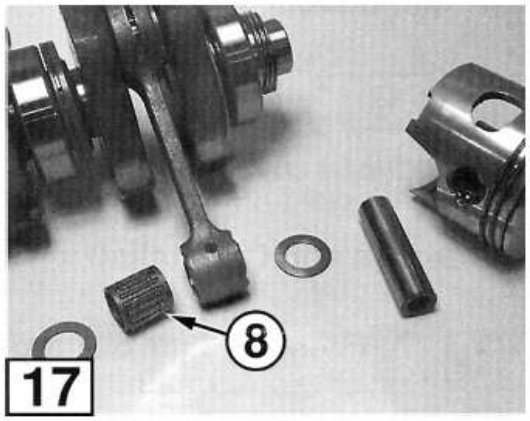
16 Remove each piston ring using the piston ring tool (Part No. 353-72249-0).



NOTE

Identify each ring so it can be returned to its original piston and ring groove.

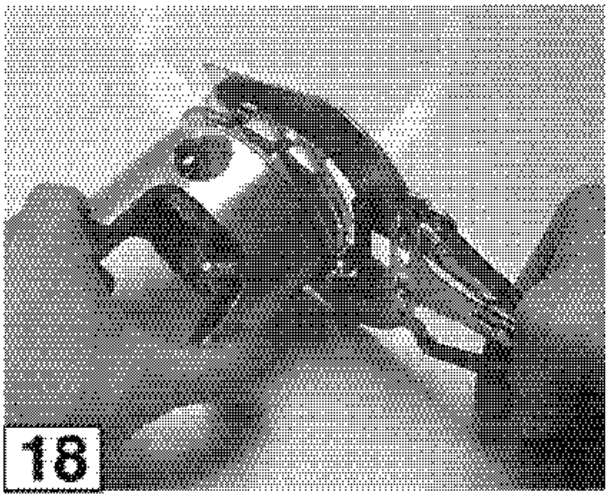
17. Remove the piston and bearing **(8)** from the connecting rod



18 14. Remove each piston ring using the piston ring tool (Part No. 353-72249-0).

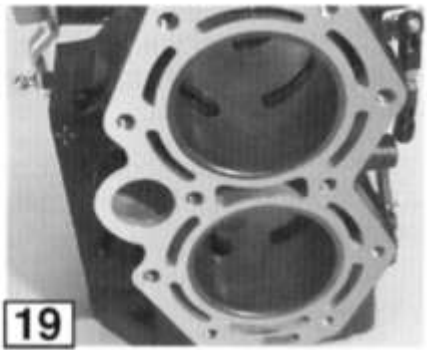
NOTE

Identify each ring so it can be returned to its original piston and ring groove.



Cleaning

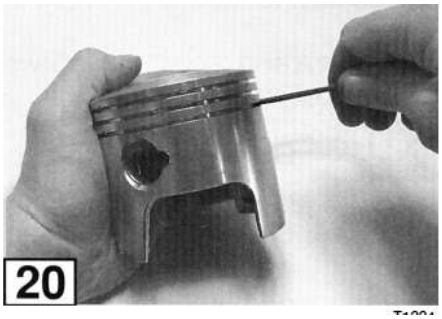
1. Remove all carbon accumulation from exhaust port areas and cylinder head combustion chambers.



19 2. Use gasket remover and Scotch-Brite Abrasive Pads to remove all traces of gasket and sealer from the cylinder block, crankcase, cylinder head, intake manifold, exhaust covers, and air silencer.

⚠ CAUTION

DO NOT use a metal scraper on gasket surfaces or the mating surfaces of the crankcase.



20 3. Remove all carbon deposits from the tops and ring grooves of the pistons.

NOTE

A ring groove cleaning tool can be made by breaking an old ring and grinding an ang/e on its end. Do not damage the grooves when cleaning.

21 4. Wipe off all traces of oil and thoroughly wash the cylinder block and crankcase with warm, soapy water. Air dry the cylinder block and crankcase. Dry all holes and passages with low pressure compressed air.

5. Coat the cylinder walls with genuine engine oil or certified TC-W3 oil to protect them from corrosion.

Inspection

NOTE

Before inspection of the powerhead, all components must be perfectly clean and free of contaminants.

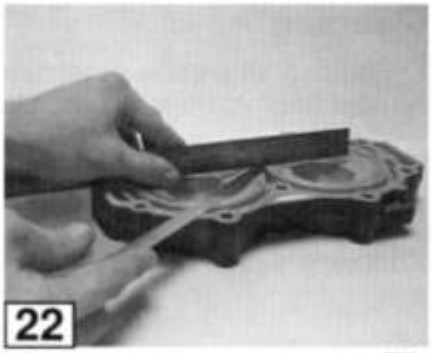
⚠ CAUTION

After the inspection, when it is found that the cylinder(s) requires re-finishing or boring, all the work needs to be done in an appropriate machine shop. Light scuffing or burn does not require boring for removal. Use water-resistant #320 sand paper to remove the damages, the use #400 and #600 to finish.

1. Visually inspect all internal components. lnspect for unusual wear patterns, heat-related discoloration of bearings, broken parts, and scuffing or damage to aluminum parts.

2. Inspect the intake manifold and reed valves. See intake Manifold – Section 3.

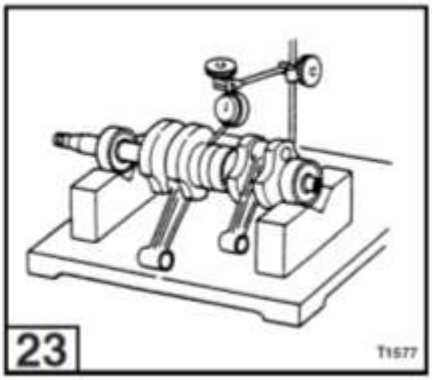
22 3. Check the cylinder head for warpage using a machinist straight edge and the thickness gauge set (Part No. 353-72251-0). If warpage exceeds 0.004 in [0.10 mm], replace the cylinder head.



23 4. Using an accurate dial indicator, measure the crankshaft deflection with the upper and lower main bearings installed. Measure as follows:

- Support both ends of the crankshaft at the main bearings in precision V-blocks or an alignment jig.
- Slowly rotate crankshaft and record measurement at each crankshaft bearing **(1)** and at both ends of the crankshaft.

If deflection is more than 0.002 in [0.05 mm], replace the crankshaft.

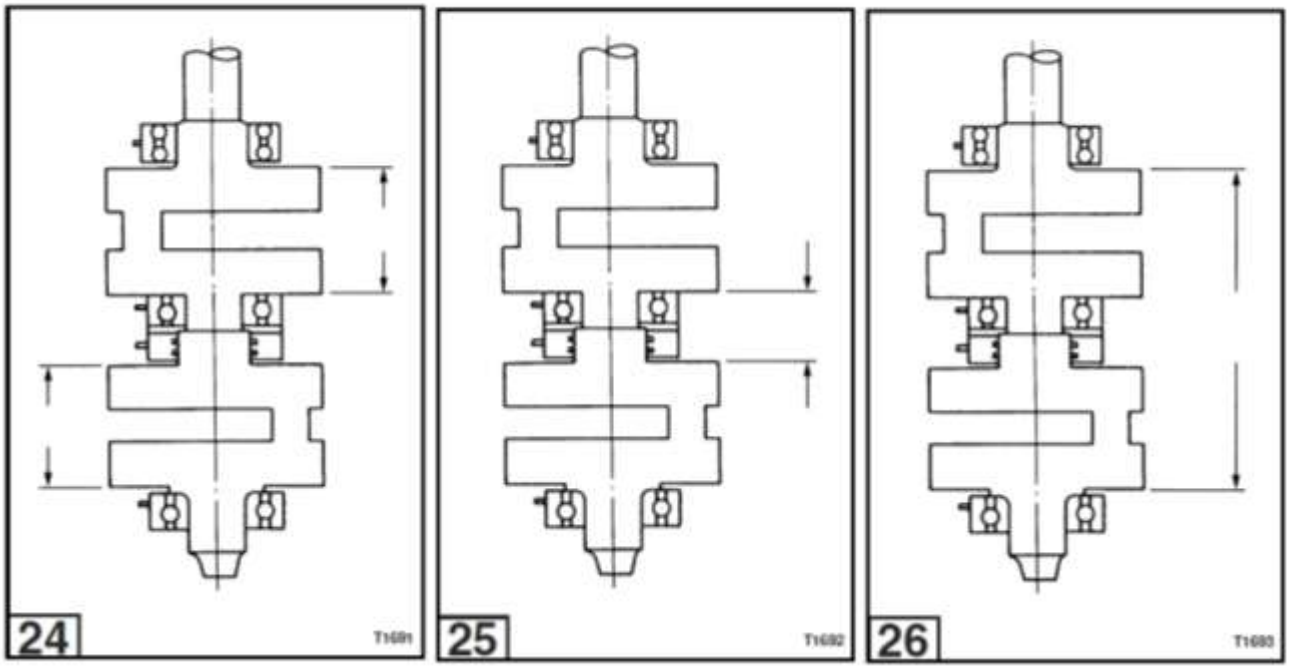


5. Measure and record the following crankshaft dimensions and check for signs of wear:

24 • Dimension 1 : Distance between the outside edges of each pair of cranks haft webs. Measure at both ends of the webs.

25 • Dimension 2: Distance between each pair of crankshaft webs.

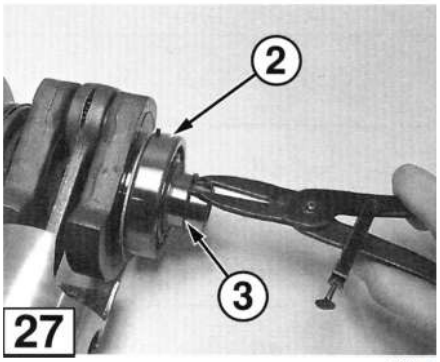
26 • Dimension 3: Distance between the outside edges of the first and last crankshaft webs.



Model	Dimension 1 in [mm]	Dimension 2 in [mm]	Dimension 3 in [mm]
40	$2.071^{+0}_{-0.002}$ [$52.6^{+0}_{-0.05}$]	1.591 ± 0.002 [40.4 ± 0.05]	5.733 [145.6]

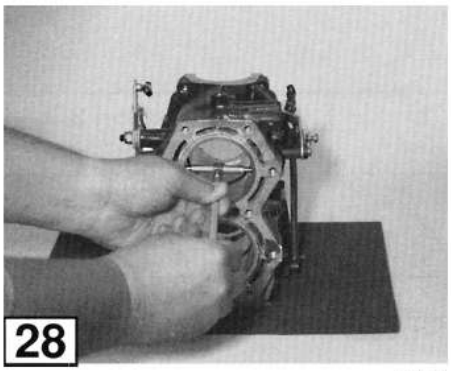
27 6. Check for smooth operation of all crankshaft and connecting rod bearings. Upper and lower main bearings and small end connecting rod bearings are serviceable. Wear of other parts requires replacement of the crankshaft assembly. If lower main bearing **(2)** is defective, proceed to remove the components as follows:

- Remove snap ring **(3)**.
- Install a universal bearing puller with bearing retainer plate and remove lower main bearing **(2)** from the crankshaft.
- See powerhead Assembly procedure for installation.



NOTE

DO NOT fully disassemble the crankshaft assembly unless further wear or damage is suspect.



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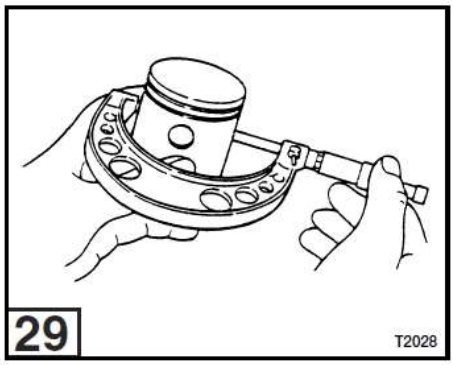

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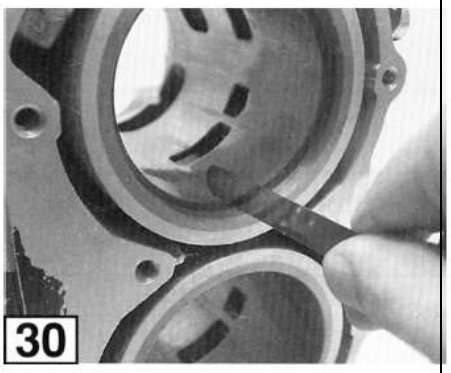


T1238

28 **29** 7. Measure and record the diameter of each cylinder bore and the outside diameter of its respective piston. Subtract the values to calculate the piston clearances. If any bore diameter or piston clearance exceeds the specified limit, the cylinder must be professionally bored oversize for use with an oversize piston.

Model	Standard Bore Diameter in [mm]	Standard Piston Clearance in [mm]	Repair Limit Piston Clearance in [mm]
40	2.76 [70]	0.0020 - 0.0039 [0.05 - 0.10]	0.006 or over [0.15 or over]

30 8. Complete the following inspection for new or used piston ring sets. Inspect each ring separately:

- Place ring in its respective cylinder bore.
- Use a piston to square the ring in the bore.
- Use the thickness gauge set (Part No. 353-72251-0) to measure the ring end gap.

The ring end gap must be within specification:

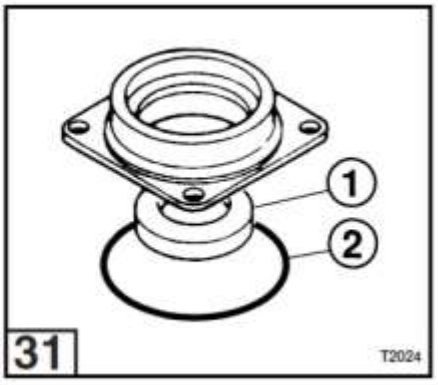
Model	Standard Ring End Gap in [mm]	Repair Limit Ring End Gap in [mm]
40	0.08 - 0.019 [0.33 - 0.48]	0.031 [0.8] or over

Assembly

NOTE

Before assembly of the powerhead all components Must be perfectly clean and lightly coated with Raider two-Stroke engine oil (Genuine oil) or a NMMA certified TC-W3 oil. All Unserviceable gaskets and seals must be replaced.

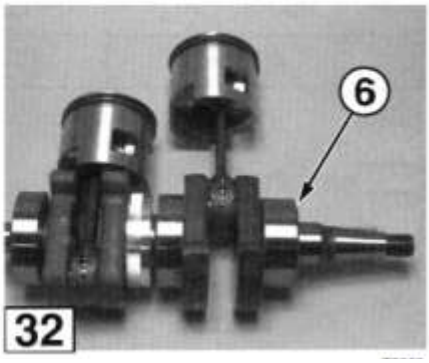
Preliminary



31 1. Before installation, lightly coat the outside surfaces of new bearing seals and o-rings with genuine engine oil or TC-W3 oil. Apply bearing cup grease to the seal lips. Press fit the seals into place using an appropriate size seal installer to avoid damaging the seal or component.

- Install a new oil seal in lower crankcase head and a new o-ring on base of lower crankcase head (or engine base or lower cowl).
- Install new oil seal **(1)** in upper magneto base and new o-ring **(2)**.

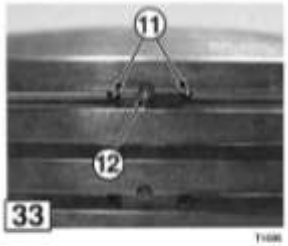
2. Coat the rotating surfaces of the crankshaft and connecting rod bearings, bearing washers, and bearing thrust plates (model 40) with genuine engine oil or TC-W3 oil.



Crankshaft

32 3. If upper main bearing was removed, slide and install the upper main bearing onto crankshaft **(6)**.

4. If lower main bearing was removed, coat lower end of crankshaft with genuine engine oil or TC-W3 oil and install the bearing.



Pistons

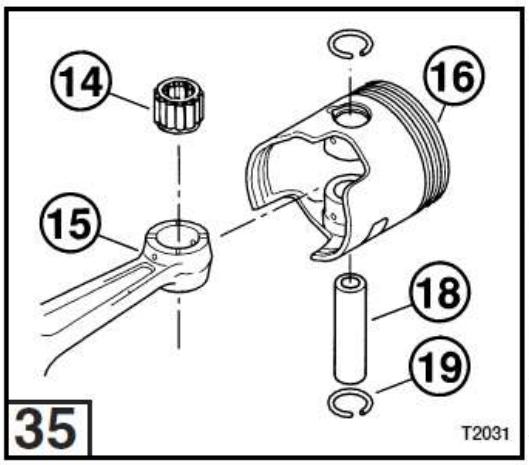
33 5. Install each piston ring in its original groove on its original piston using the piston ring tool (Part No. 353-72249-0). Each ring must be installed so end notches **(11)** fit the contour of piston knock **(12)** when the ring is compressed.

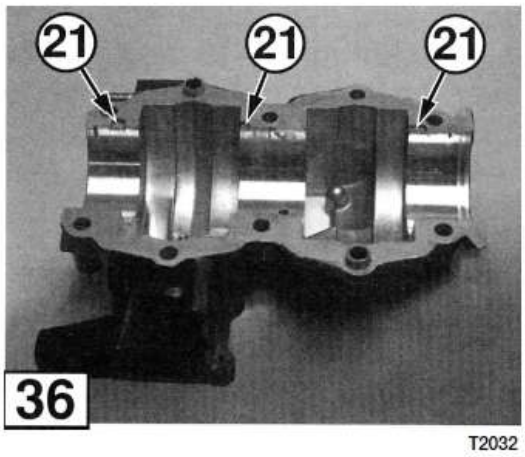
34 6. Install each piston on its respective connecting rod as follows:

NOTE

*An arrow **(13)** or the word "UP" is cast on the top of the piston. This mark is used to align the piston in a specific orientation. See chart for proper orientation.*

40	*"Up" mark points to flywheel*





35 Insert bearing **(14)** into small end of connecting rod **(15)**.

35 Correctly position piston **(16)** onto the connecting rod.

35 Align components so piston pin hole is not obstructed and install piston pin **(18)** using piston pin tool.

35 Install new piston pin clips **(19)**. Do not reuse old clips.

Raider 40 is a two-cylinder; the second piston is identical to piston one.

35 Align components so piston pin hole is not obstructed and install piston pin **(18)** using piston pin tool.

35 Install new piston pin clips **(19)**. Do not reuse old clips.

Cylinder Block and Crankcase

7. Coat the pistons, rings and cylinder walls with genuine engine oil or TC-W3 oil. Install the bearing washers or thrust plates (model 40) into cylinder block, guiding each piston into its respective cylinder. Ensure the following:

36 All main bearing knocks **(21)** are seated against the crankcase mating flange of the cylinder block.

- Bearing washers or thrust plates (model 40) are seated properly in the cylinder block.

37 8. Degrease the crankcase flange and mating surface of the cylinder block. Apply anaerobic gasket maker(Loctite 518) to the cylinder block frange. The application must cover the flange evenly and not be excessive.

9. Install crankcase on cylinder block.

10. Install crankcase mounting bolts and torque to specification:

NOTE

Start with the bolts closest to the center of the crankcase and work outward.

Cylinder Head

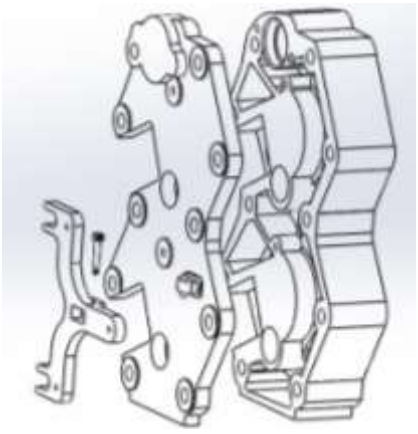

37

38 39 11. Head gasket requires adhesive. Recommended is Permatex Aviation cement. Install head gasket to Raider 40 outboard. Gasket is required between head and dewatering cover plate. Permatex Aviation cement is recommended. This gasket material does not harden like typical cement; excellent for submersion characteristics.

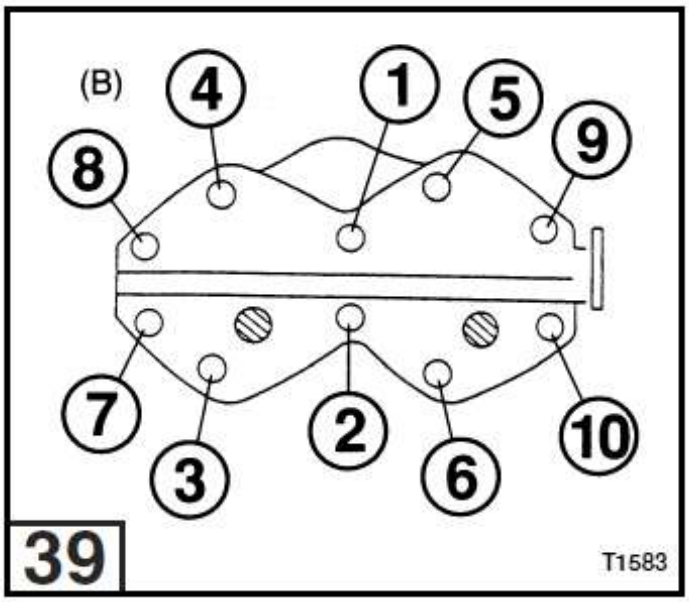
12. Install cylinder head. Torque bolts to specifications.

NOTE

Start with bolts closest to the center of the crankcase and work outward.



38 Head Assembly with dewatering lever

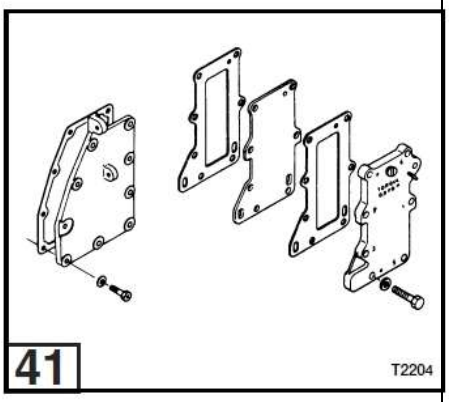


40 13. Install thermostat and torque thermostat cap bolts to specification. See Thermostat, this section.

40 Thermostat located outside dewatering plate.

Exhaust Cover

41 14. Lightly coat both sides of new (inner and outer) exhaust cover gaskets with gasket sealant. Install gaskets and mount exhaust covers to cylinder block. Torque exhaust cover bolts to specification from lowest embossed number to highest.

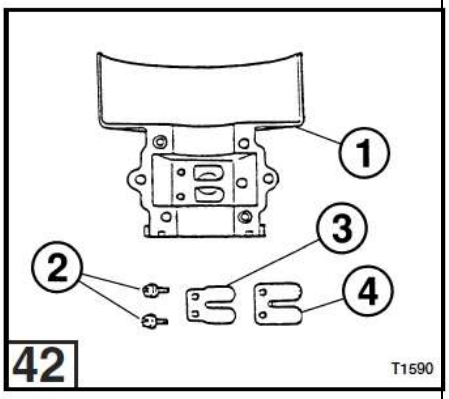


Final Assembly

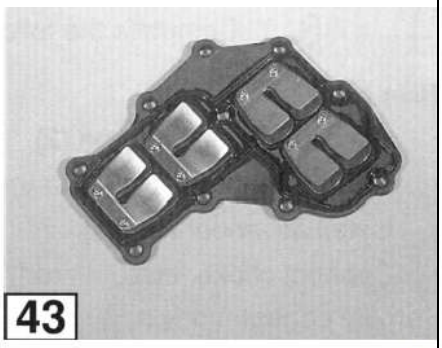
42 43 15. Install the reed valves and intake manifold. Check the reed valve and lift to verify setting. If damaged, replace with new assembly. See Reed Valve in Section 3.

16. Install all carburetion, ignition, and electrical components on the powerhead using the following guidelines. Assemble as much as possible before mounting powerhead to engine midsection.

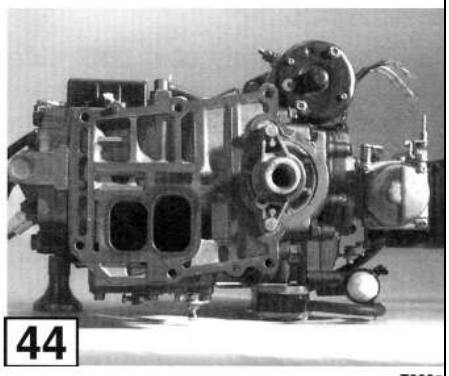
- Follow all relevant procedures and wiring diagrams in other sections of this manual.
- Torque fasteners to specification. Use Loctite 243 on the pulsar coil assembly screws.
- Lubricate powerhead components as specified. See Lubrication Chart in Section 2.
- Route and clamp all wires and hoses away from moving engine parts.
- Do not install flywheel until powerhead has been bolted to engine base.



17. Install lower crankcase head.



44 19. Apply high temperature gasket dressing to engine base gasket and install gasket on powerhead.



Installation

45 1. Degrease the engine base surface and coat driveshaft splines **(1)** with genuine engine oil or TC-W3 oil.

2. Apply high temperature gasket dressing to bottom surface of engine base gasket. Lower powerhead onto engine base, guiding the driveshaft into the lower crankcase head.

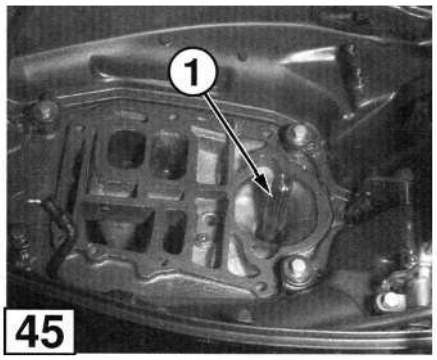
46 3. Install the engine mounting bolts and torque to specification.

4. Connect fuel INPUT hose to fuel filter.

5. Connect pilot water hose to nipple.

6. Complete the following electrical connections:
- Remote control or main key switch wire harness.
- Neutral safetyswitch.

  Reference the appropriate wiring diagram in Section 7 for electrical box connections. Leave ignition system disabled.



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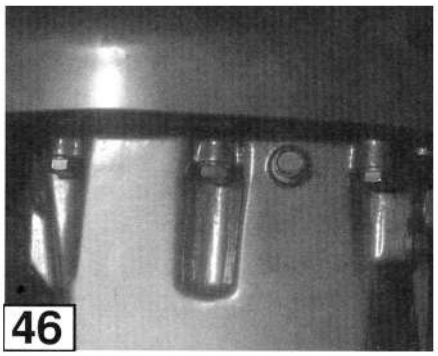
47 **48** 7. Complete the following operations.

Tiller models:
- Connect starter lock rod **(2)**.
- Secure throttle cable **(3)** to throttle cable bracket **(4)**.
- Install advancer arm **(5)**.
- Connect choke knob link rod **(6)**.

Remote control models:
- Connect shift cable to shift arm.
- Connect throttle cable to advancer arm.



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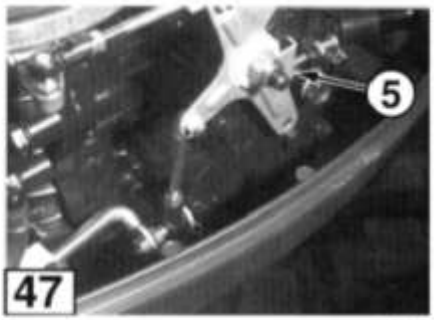
8. Install flywheel and recoil starter (if equipped). See Flywheel and Recoil Starter, this section.

9. Perform all carburetor and ignition timing adjustments. See Synchronization and Linkage Adjustments in Section 2.

10. Perform all tune-up operations. See Tune-Up Procedure in Section 2.

11. Test and inspect all safety features of the engine and instruct operator to repeat the original break-in procedure described in Section 2 before engine is put into normal service.



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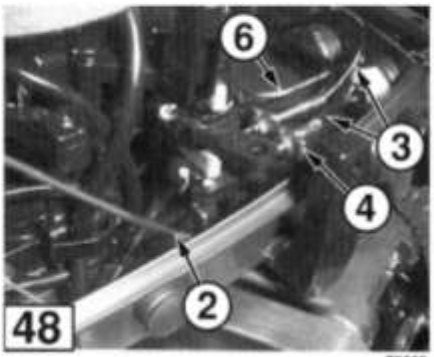


T2039

SECTION 5 – MIDSECTION

General Precautions

Before performing any service work on the midsection, read and understand the Service Safety section at the beginning of this manual.

Replace locking fasteners when their locking feature becomes weak. Use only factory replacement parts.

When using compressed air to clean or dry parts, make sure air supply is regulated not to exceed 25 psi [172 kPa / 1.76 kg/cm'].

Always inspect and test the start-in-gear prevention system before returning engine to customer.

Most service work on the midsection requires preliminary steps to remove major components. Follow all applicable procedures in other sections when indicated.

Use threadlockers and follow torque specifications as indicated to ensure shock-absorbing components remain secure after returning the engine to service.

Service Specifications

Special Torque Values - Raider 40

Description	4b	Threadlocker
Bracket Bolt Nut (Tilt Tube Nut)	23.5 - 25.5 2.4 - 2.6	
Shift Lever Shaft Holder Bolt	41-55 4.6-6.3 0.47-0.64	Loctite 242

Required

Spring Pin Tool, 03 and 03.5 : 345-72227-0, 345-72228-0, 369-72217-0, 369-72218-0
Rubber Mount Tool Kit- 40 : 361-72760-0

General Equipment Required

Torque Wrench, 0-150 in-lb [0-17 N-m / 0-1.7 kg-m] Torque Wrench, 0-145 ft-lb [0-200 N-m / 0-20 kg-m]
Dial Indicator, minimum scale 0.0001 in [0.01 mm

Consumable Supplies Required

Threadlocker, *Loctite 242*
Threadlocker, *Loctite 243*
Gasket Dressing, Permatex Hylomar *Aerosol High-Temp Gasket Dressing*
Silicone Sealant, *Permatex Hi-Temp RTV* Silicone
Gasket Super Bond Adhesive,
Permatex Super Glue Gel
Cleaning Pads, *Scotch-Brite® Abrasive Pads*
Isopropyl Alcohol Cleaning Solvent Gasket Remover
Genuine Grease or Equivalent Friction Surface Marine Grease

Tiller Steering Handle -Raider 40

General Information

The tiller steering handle is used for steering, control throttle through a pinion throttle linkage.

The tiller is capable of lifting up the Raider. When two motors are controlled via a single tiller two additional elements must be added; (1) Cable from motor one to motor two; (2) Control rod that is placed in the back of each Raider. This option must be ordered in the initial sale.

For parts description use Raider Parts Assembly Manual; RPAM 40ES-001.
Figure 1 shows tiller assembly.

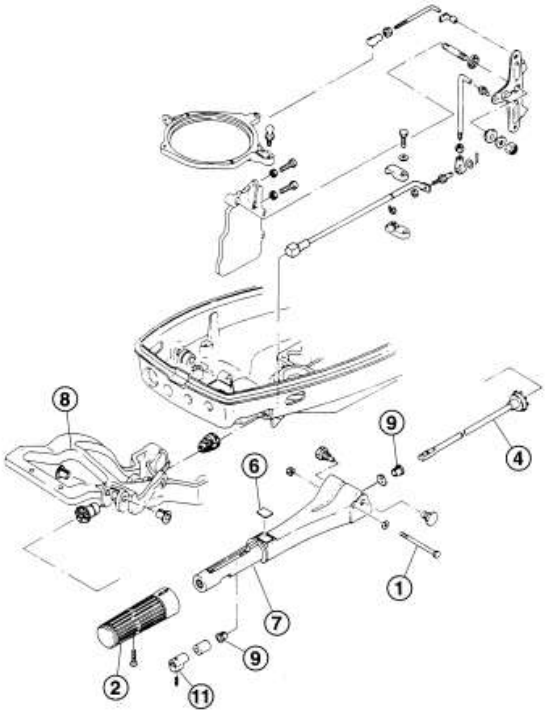


Figure 1. Tiller Assembly

1 2 3 4 3. Inspect all plastic and rubber bushings and spacers, grip **(2)**, and friction piece **(5)** for cracks or deformation caused by wear.

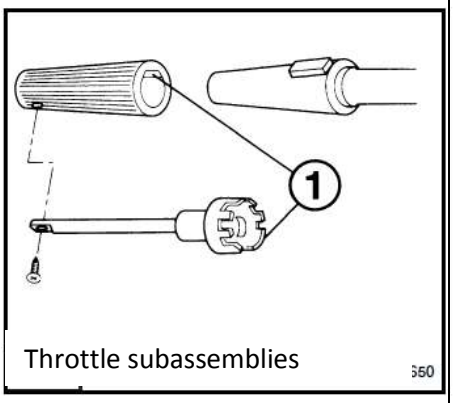
4. Check all fasteners for thread damage, all washers for deformation.

2 3 4 5. Replace throttle label **(6)** if damaged or missing.

1 2 3 4 6. Verify the following components and their friction surfaces are not cracked, bent, or wom:

- Steering handle **(7)**
- Steering bracket **(8)**

1 2 7. Inspect throttle cables **(3)** for kinks, wear, cracks in the protective covering, and excessive stretch.



Throttle subassemblies

Assembly

2 3 4 **NOTE**

*Apply genuine grease or equivalent friction surface marine grease to bushings **(9)**, spacer **(11)**, and the grip portion of steering handle **(7)** before assembly. DO NOT lubricate friction piece **(5)**.*

1. Apply spray lubricant to the throttle cables. Work the cables back and forth to ensure full coverage under the protective covering.

2 3 4 2. Assemble all components onto throttle shaft **(4)** and connect throttle cables **(3)** to throttle shaft as required. Route opposite end of throttle cables through steering handle **(7)**.

7 **NOTE**

Make sure the throttle position (1) as shown in installation drawing.

1 2 3 4 4. Install grip **(2)**.

5. Fully assemble all remaining components as illustrated.

Twist Handle and Linkage Assembly

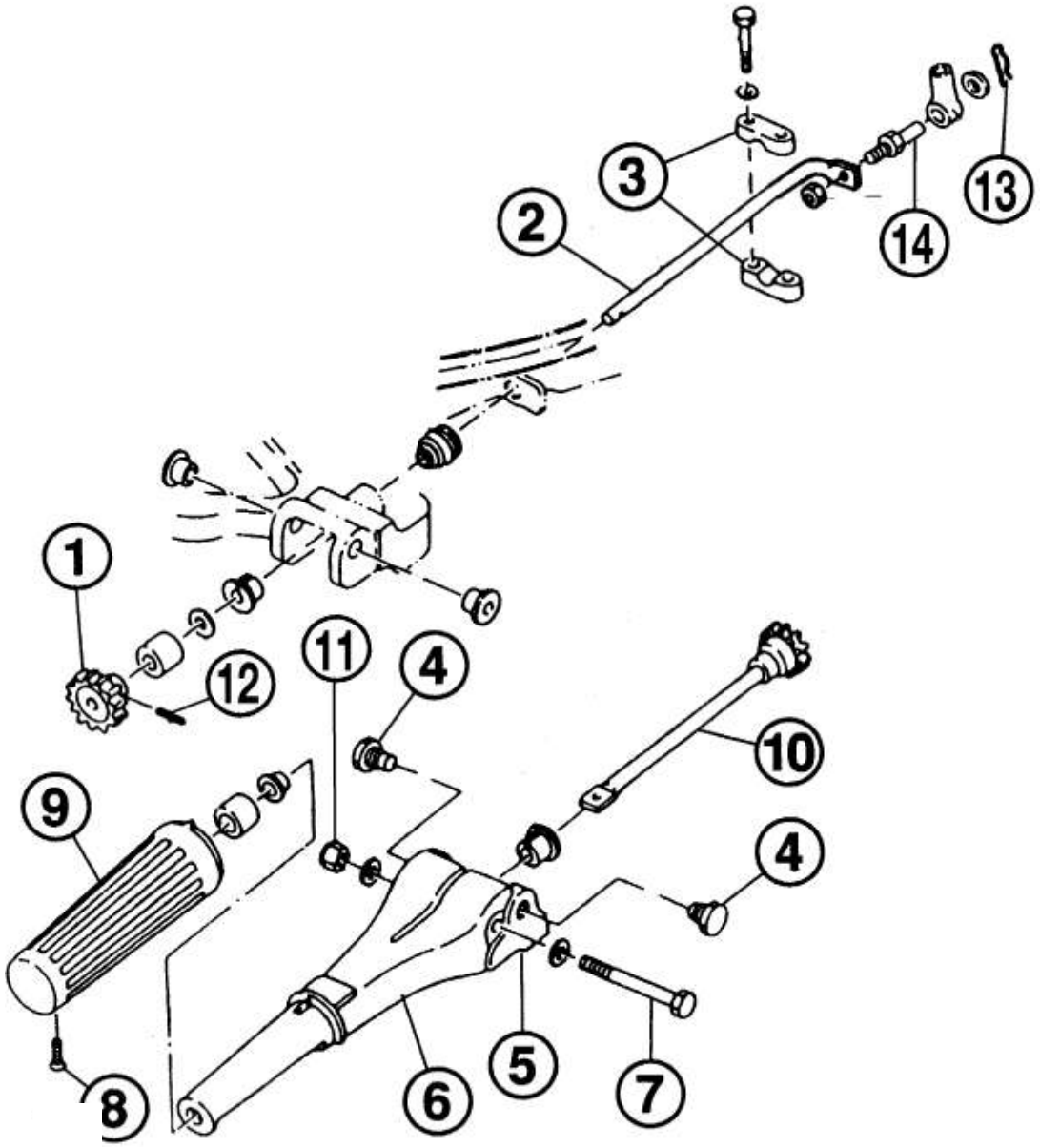


Figure 2. Tiller Arm Subassemblies

Handle and Linkage Disassembly

1. Loosen the M6 nylon nut **(11)** and remove the two handle bolts **(4)**.

2. Remove the handle assembly from the steering bracket.

3. Remove the Spring pin **(12)** from the universal pinion **(1)**.

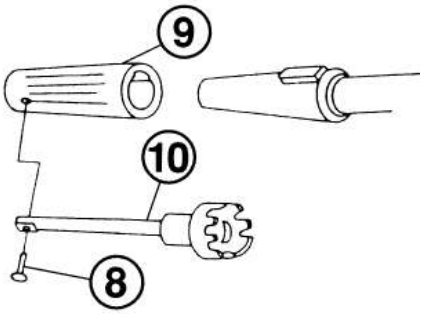
4. Remove the R-pin **(13)** from the cable pin **(14)**.

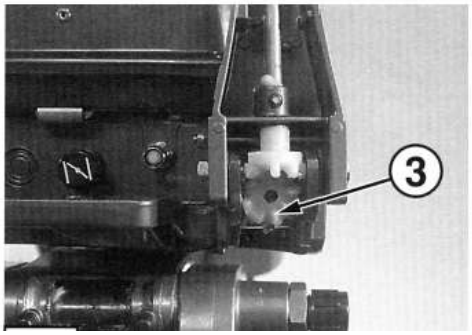
5. Remove the throttle shaft supports **(3)**.

6. Remove the throttle shaft B **(2)** and the universal pinion **(1)**, and relevant parts.

7. Remove the handle grip mounting screw **(8)** and pull out the grip **(9)** from handle **(6)**.

8. Pull out the throttle shaft A **(10)**, and relevant parts.





Twist Handle and Linkage Inspection

1. Check all components for wear or cracks.

2. Lubricate all moving surfaces.

Twist Handle and Linkage Assembly

] 1. Install throttle shaft A **(10)** after applying grease.

] 2. Install grip on handle A and insert the handle grip **(9)** and mounting screw **(8)**.

3. Install Throttle Shaft B Assembly in the lower motor cover, installing the tip of inner throttle shaft in the proper orientation for the link rod.

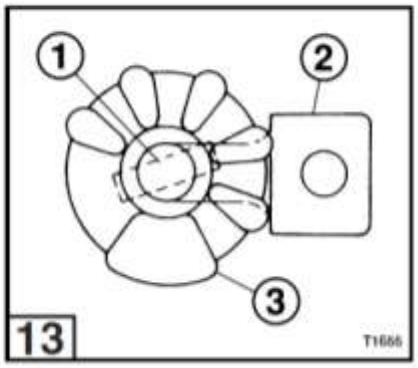
] 4. Install the universal pinion **(3)** after coating with grease. Maintain the relationship between inner throttle shaft and the universal pinion, and inner throttle shaft and the collar as shown.

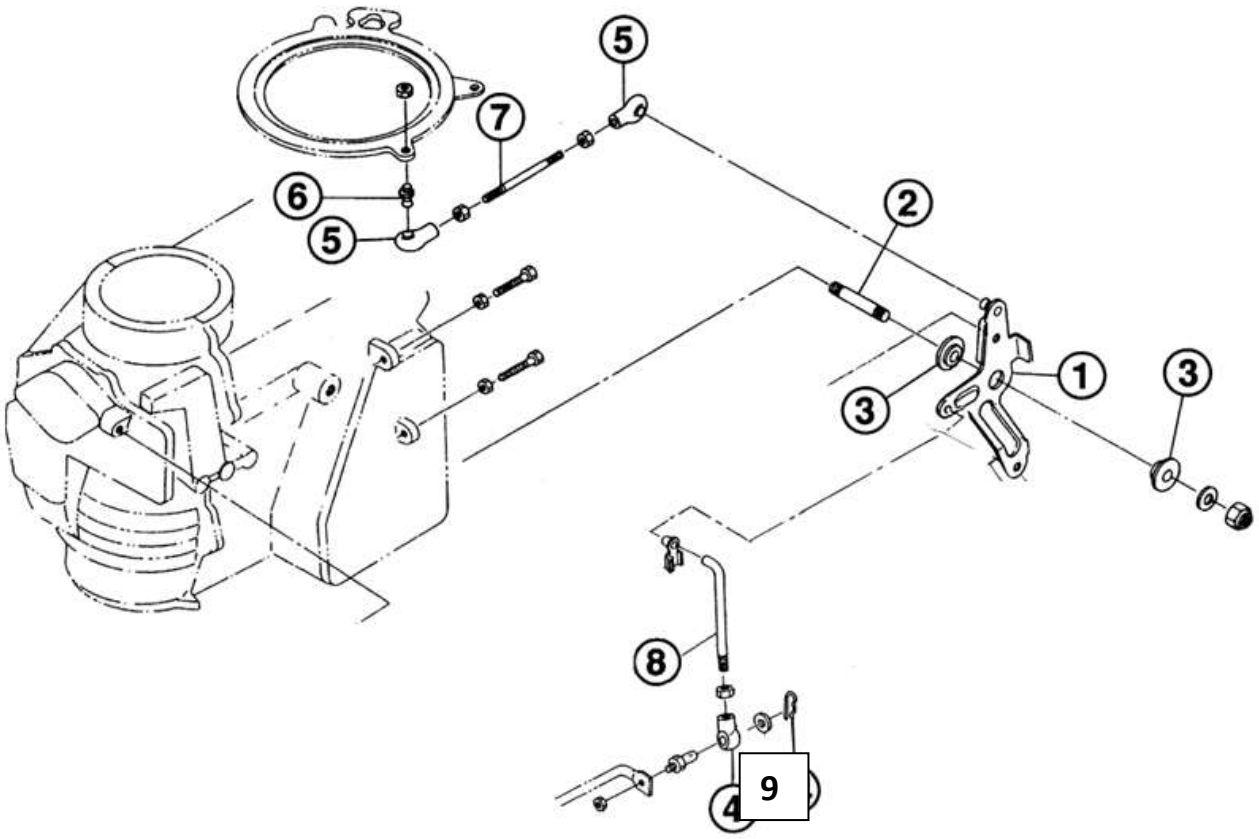
Item	Description
1.	Spring Pin
2.	Throttle Shaft B
3.	Universal Pinion

5. Assemble handle and assembly to the steering bracket.

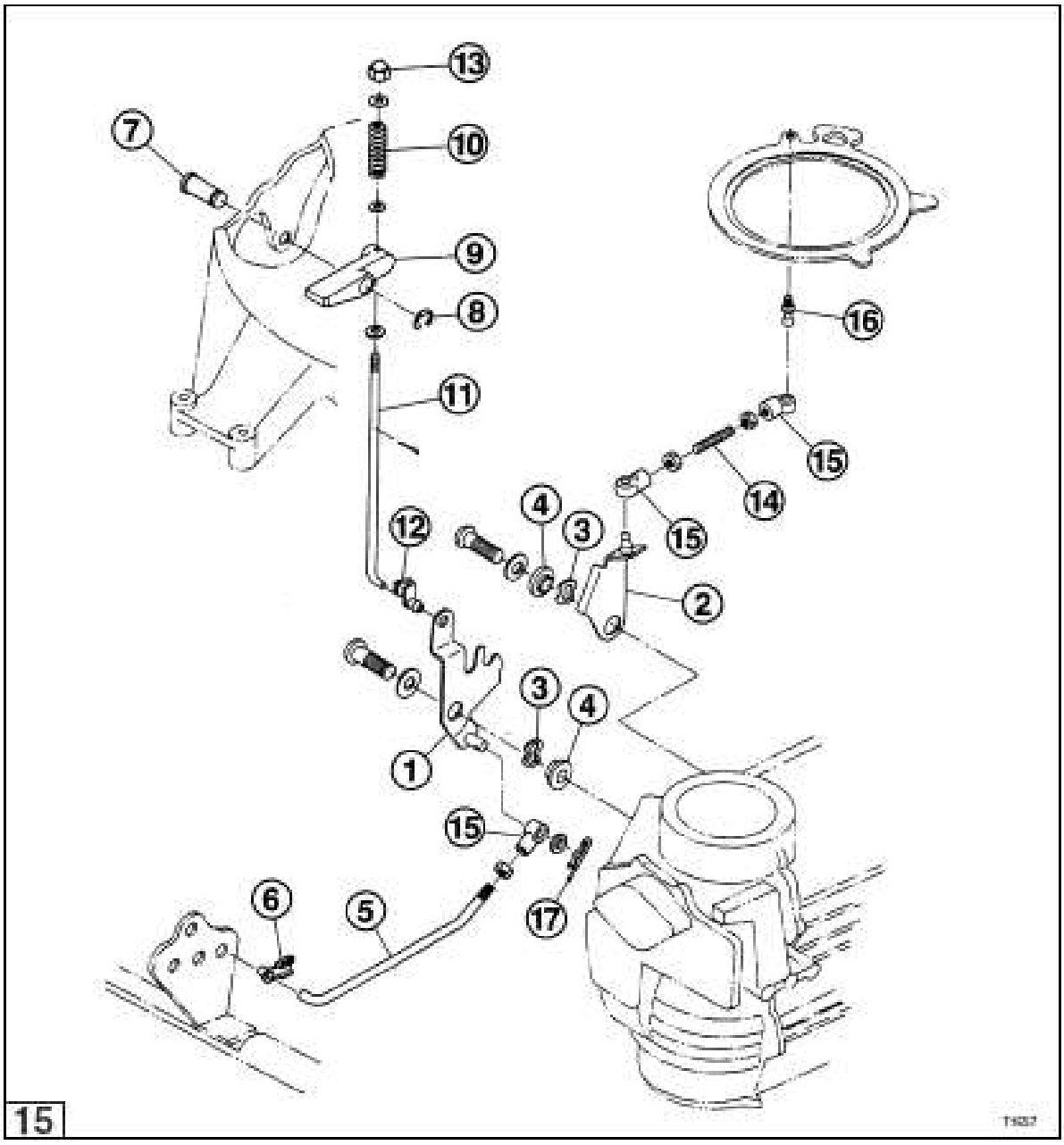
6. Tighten the handle friction bolt so that the handle does not drop from the vertical position.

7. Install the throttle shaft supports.



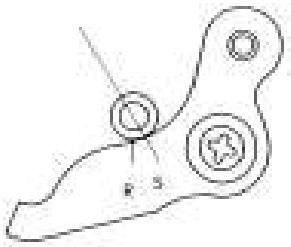


Item	***Description***
1	Advancer Arm
2	Stud Bolt
3	Advancer Arm Bushing
4	O5 Rod Joint
5	Ball Joint Cap
6	Ball Joint B
7	Advancer Link Rod, 5-50L
8	Handle Link Rod, 5-75L
9	R-Pin, d=8

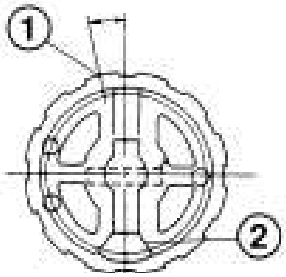


Item	Description
1.	Starter Lock Arm
2.	Throttle Stop Arm
3.	Wave Washer
4.	Bushing
5.	Starter Lock Arm Rod
6.	Starter Lock Arm Rod Snap
7.	Starter Lock Lever Shaft
8.	Starter Lock Lever Shaft E-ring
9.	Starter Lock Lever

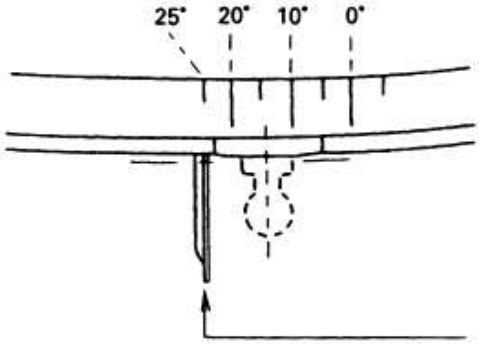
Item	Description
10.	Starter Lock Spring
11.	Starter Lock Rod
12.	Starter Lock Rod Snap
13.	Starter Lock Lever Cap
14.	Throttle Stop Arm Rod
15.	Ball Joint Cap
16.	Ball Joint B
17.	R-Pin, d=8



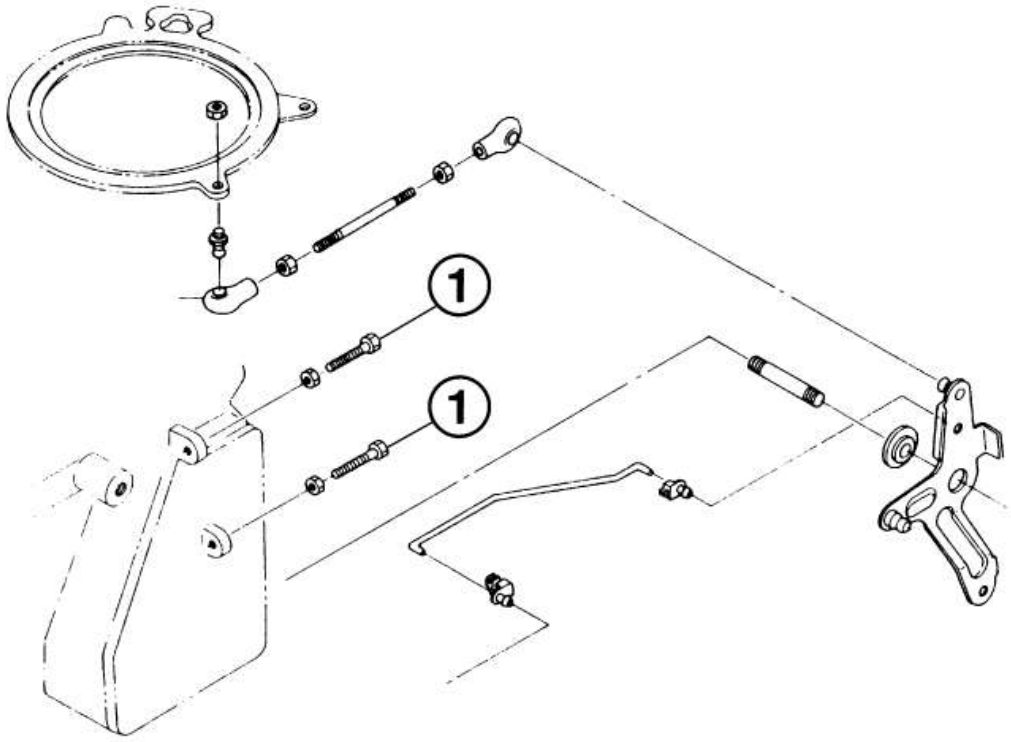
1. Turn the handle grip so that the collar center of the carburetor throttle lever in on the “S” marking line.



2. Adjust the length of the handle link rod so that the START match mark on the handle grip is aligned to the START position on the tiller handle.

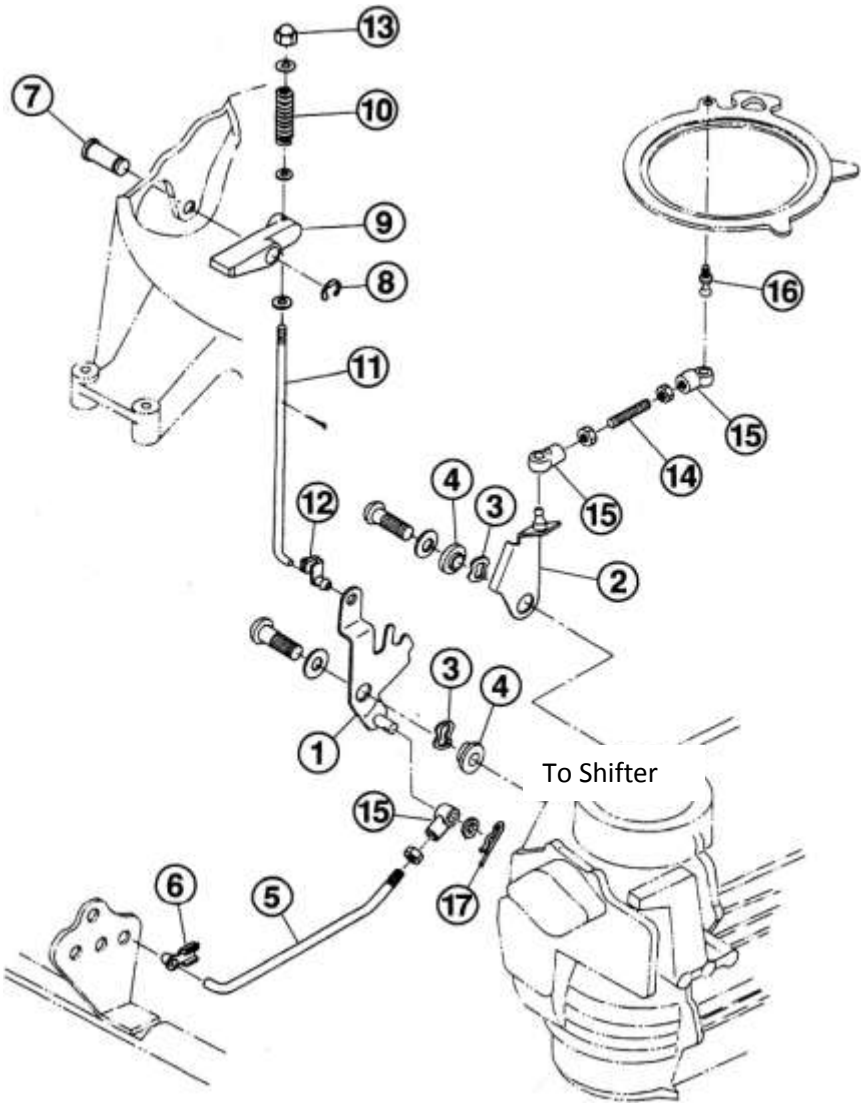


BTDC 25 degrees



20 . Check that the throttle valve is fully open, and the ignition timing mark at starting comes to the crankcase mating surface. Under this state, adjust the advancer arm stopper bolts **(1)** so that the advancer arm stops at the throttle valve full-open and full-close positions, and lock the bolts with a nuts.

Timing Set at: ATDC 2 degrees



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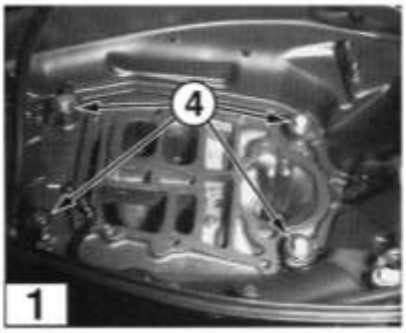
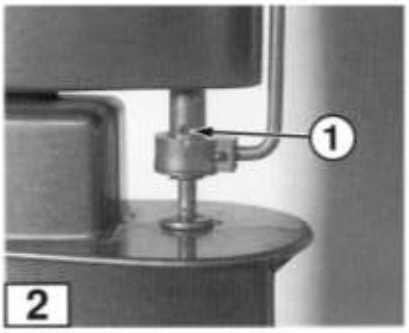
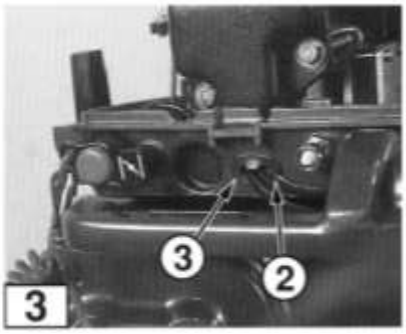
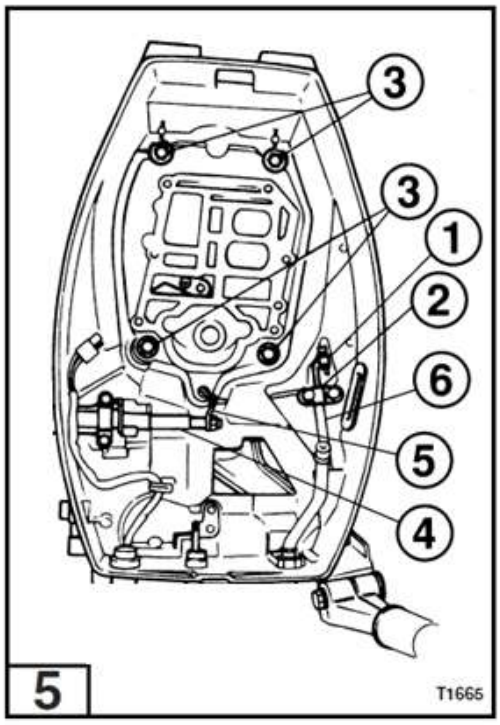
Item	Description
1.	Starter Lock Arm
2.	Throttle Stop Arm
3.	Wave Washer
4.	Bushing
5.	Starter Lock Arm Rod
6.	Starter Lock Arm Rod Snap
7.	Throttle Stop Arm Rod
8.	Ball Joint Cap
9.	Starter Lock Lever

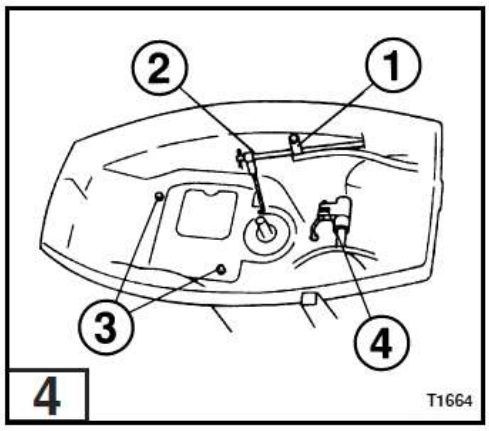
Lower Engine Cover – Raider 40

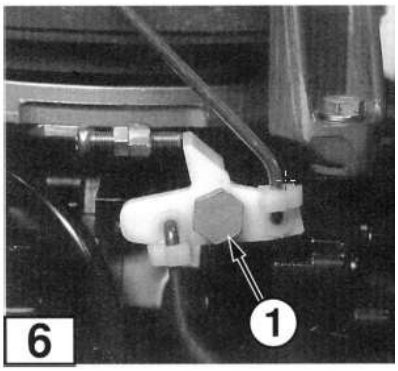












Removal

1. Remove powerhead as described in Section 4
2. Remove control cables, electrical leads and grommets as required from lower engine cover
3. Remove lower engine cover bolts (4)
4. Lift cover off engine base

.

5 1. Remove throttle shaft ball joint **(1)**.

5 2. Remove upper and lower throttle shaft supports **(2)**.

5 3. Remove lower motor cover bolts **(3)**.

5 4. Raise the cover slightly and remove the shift rod **(4)** from the shift rod lever **(5)**.

5 5. Remove the lower cover.

Installation

6 Installation is done in the reverse order of Removal. Use Loctite 242 on throttle stopper bolt **(1)** if removed.

DRIVESHAFT HOUSING

Removal

1. Remove powerhead as described in Section 4.

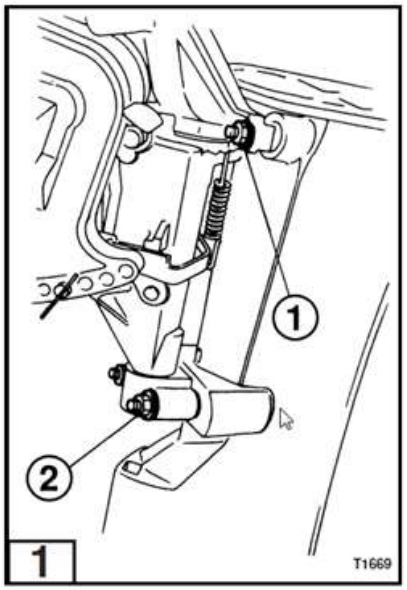
2. Remove tiller steering handle if equipped, this section.

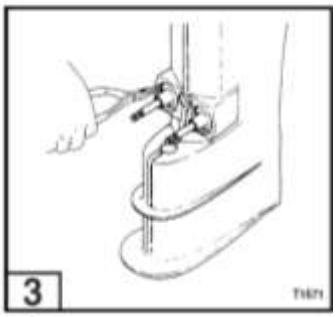
3. Remove lower engine cover, this section.

4. Remove gearcase as described in Section 6.

1 5. Remove upper rubber mount nut **(1)**.

1 6. With driveshaft housing tilted fully down, remove the nut from each lower rubber mount bolt **(2)**. Do not remove the bolts.





⚠ CAUTION

Driveshaft housing is free to fall if lower rubber mount bolts are removed.

2 7. Hold driveshaft housing securely and pull lower rubber mount bolts and remove driveshaft housing. Place housing on bench for disassembly.

3 8. Remove the clip from the lower rubber mount and remove the upper and lower rubber mounts.

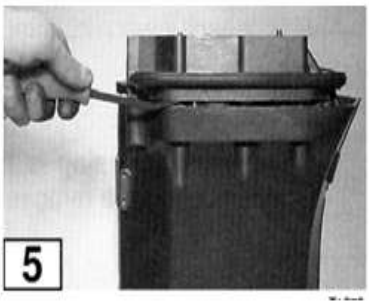
NOTE

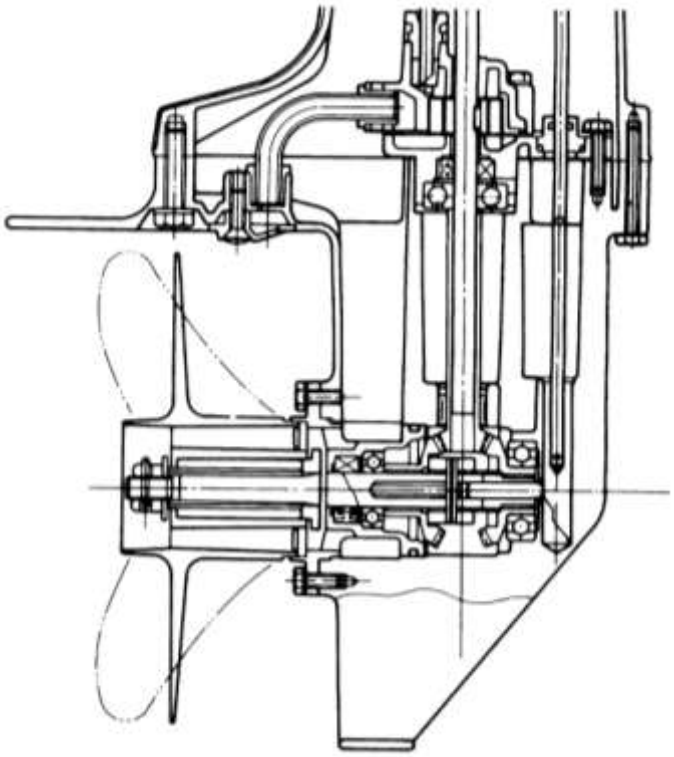
use the special tool 361-72760-0 for removing the rubber mounts.

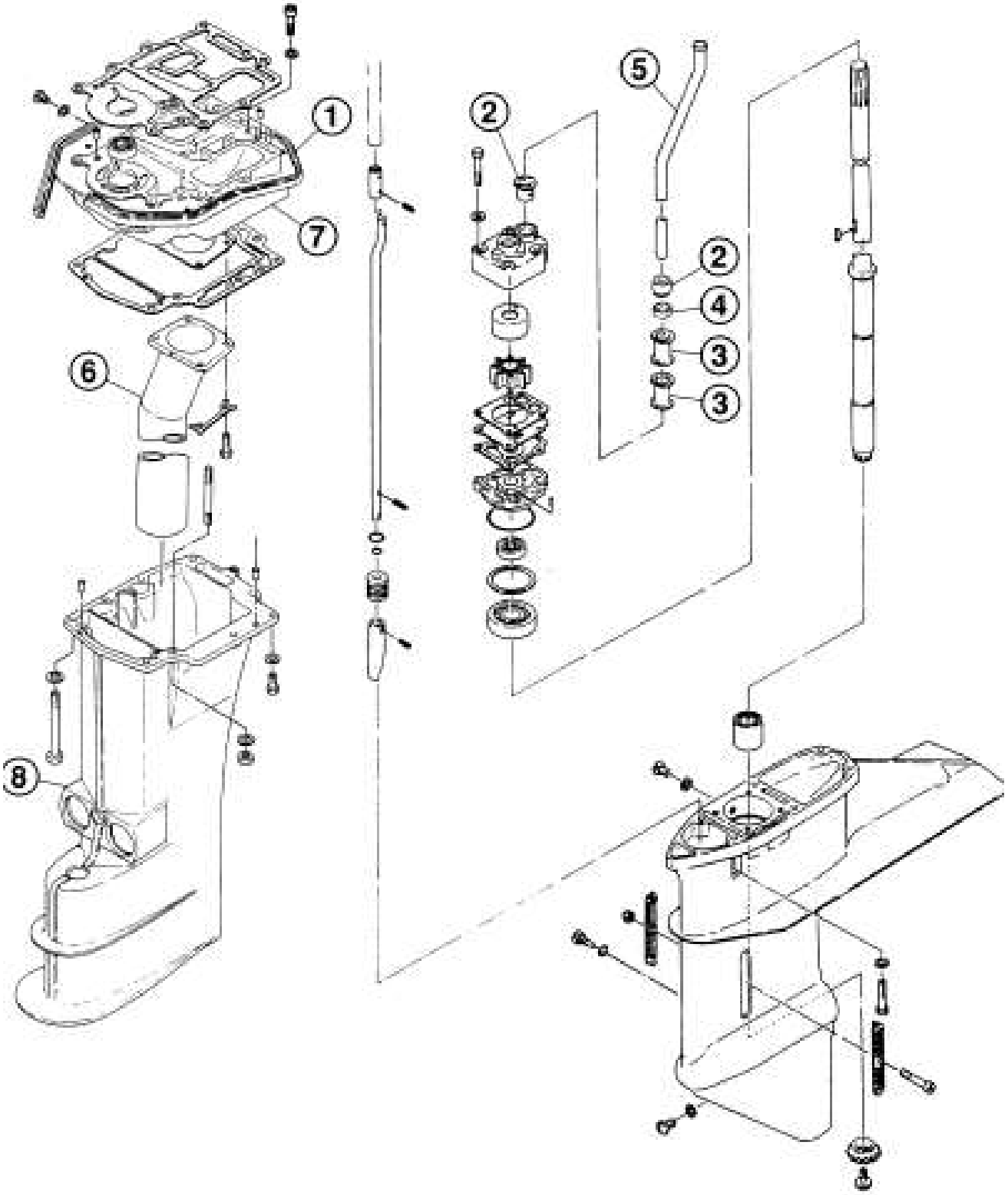
5

⚠ CAUTION

Engine base and driveshaft housing are aligned with dowel pins and may be difficult to separate. Avoid damage to the mating surfaces and gently pry sections apart if necessary .



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Cleaning and Inspection

All worn, damaged, or missing parts must be replaced.

1. Before cleaning, examine the following rubber parts as applicable and remove if damaged, dry, or brittle:

8
- Lower cover grommets and seal ring
- Lower engine cover seal (1)
- Water pipe seal (2) locking rubber (3), and rubber set ring (4)

Use super bond adhesive to install new rubber parts as needed on metal surfaces. Make sure metal surfaces are clean and dry before installation of rubber parts.

2. Thoroughly clean all parts including fasteners with solvent and dry with low pressure compressed air. Verify all carbon deposits, gasket adhesives, and threadlocker residue have been removed.

8 3. Inspect water pipe (5) for kinks or obstruction. Replace as needed.

8 4. Inspect exhaust pipe (6), engine base (7), and driveshaft housing (8) for cracks, chips, dents or other damage.

9 5. Examine the upper and lower rubber mount components for damage or signs of deterioration. Replace as needed.

Assembly

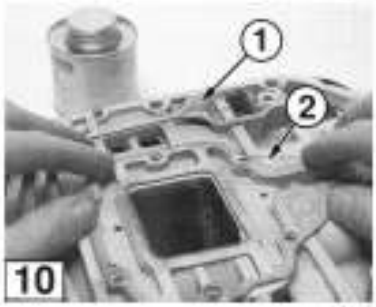
1. Verify all new rubber replacement parts have been installed on components as needed.

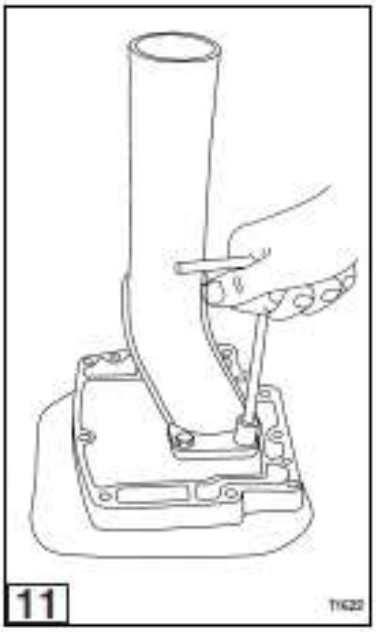
2. Position engine base with powerhead side facing down.

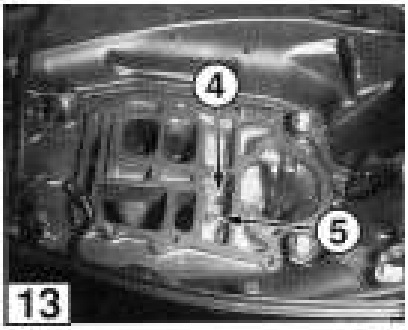
10 3. Mount new exhaust pipe gasket (2) on engine base (1). Apply high temperature gasket dressing to both sides of gasket.

11 4. Install exhaust pipe.

12 5. Apply genuine grease or equivalent friction surface marine grease to water pipe seal (3).

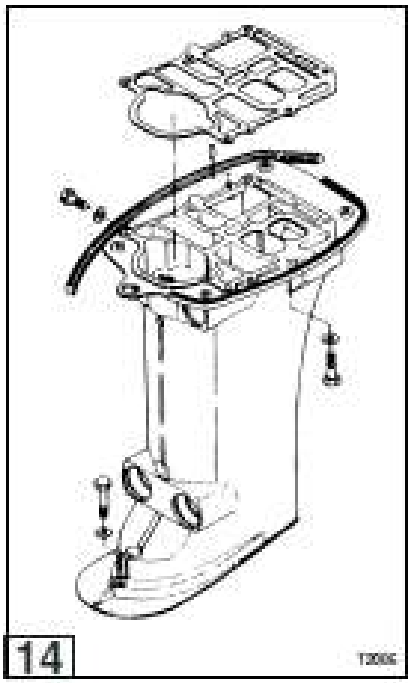






13 6. Install water pipe (4) in engine base (5) and align for installation in the driveshaft housing.

14 7. Verify knocks (where used) are installed in driveshaft housing. Apply high temperature gasket dressing to both sides of new driveshaft housing gasket and install gasket on housing.



Installation

16 1. Insert the damper cap (1) and damper collar (2) into the drive shaft housing.

2. Assemble the lower rubber mount components and install them into the drive shaft housing.

3. Apply Loctite 243 to bolt threads and torque to specification.

4. Install clip.

17 5. Assemble the upper rubber mount components and install them into the engine base.

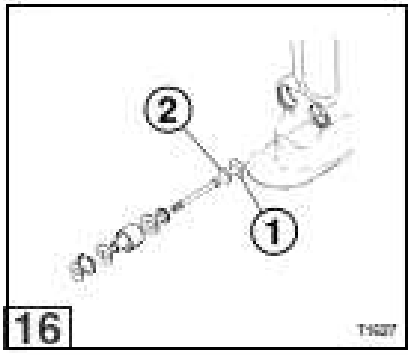
6. Apply Loctite 242 to bolt threads, install the retainer and torque to specification.

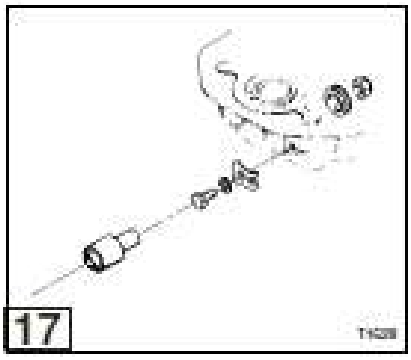
7. Install gearcase as described in Section 6.

8. Install lower engine cover, this section.

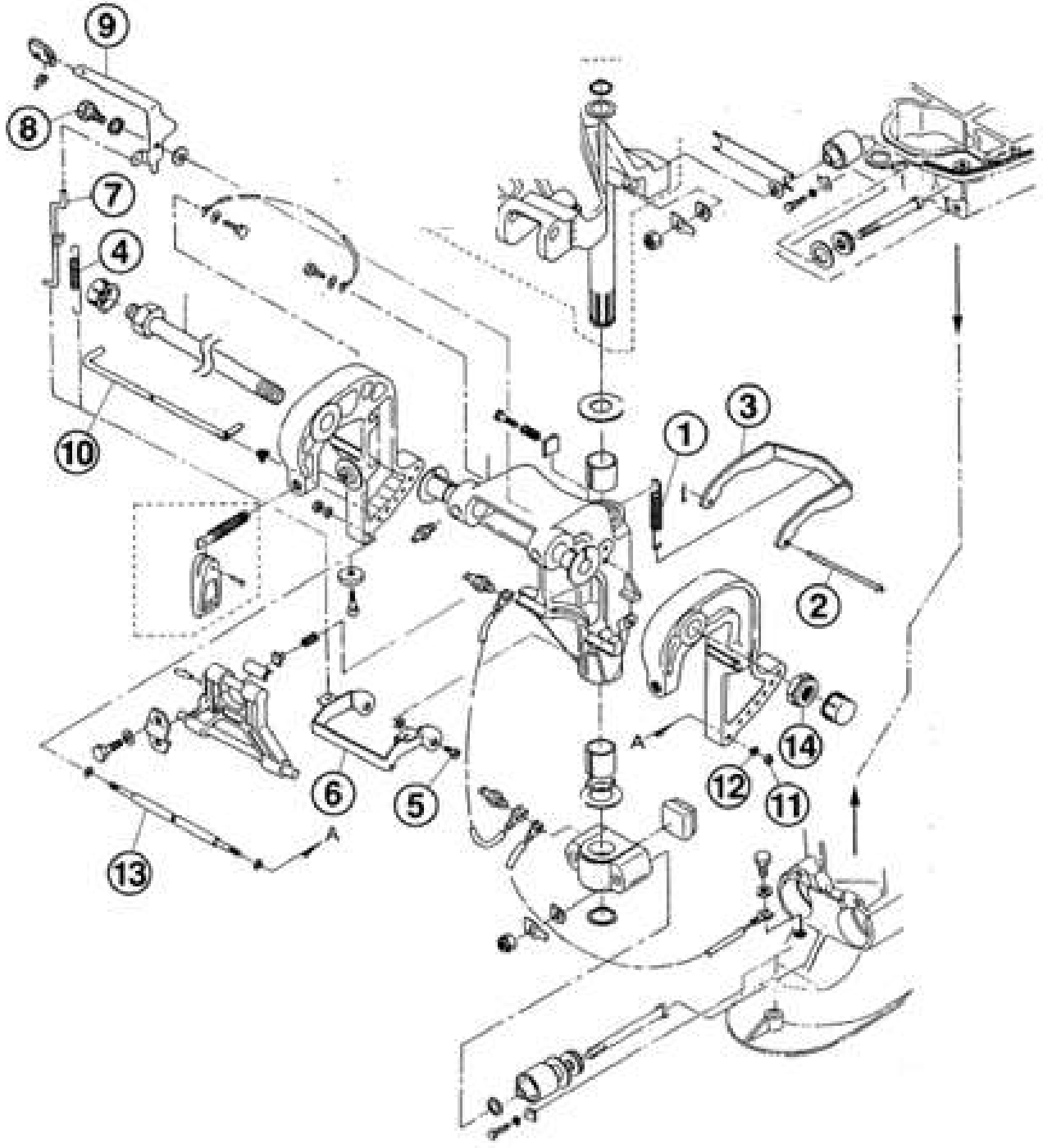
9. Install tiller steering handle if equipped, this section.

10. Install powerhead as described in Section 4.





Stern Bracket – Disassembly (Raider 40)



Stern Bracket – Disassembly

1. Remove the reverse lock spring (1)
2. Remove the split pin from the reverse lock rod (2) and remove the reverse lock rod (2) and reverse lock (3).
3. Remove the reverse lock lever spring (4)
4. Remove the reverse lock arm shafts (5) and remove the reverse lock arm (6).
5. Remove the reverse lock link (7).
6. Remove the reverse lock lever shafts (8) and remove the reverse lock lever (9).
7. Remove the thrust rod (10).
8. Remove the bracket distance piece nuts (11) and washer (12) and pull out the bracket distance piece (13)
9. Remove the bracket nut (14) and separate the brackets.

Swivel Bracket and Reverse Lock

Raider 40	***Swivel Bracket***	***Reverse lock***
	Turning Radius 80 degrees **Port: 40 degrees** **Starboard: 40 degrees**	**Lock all of shifting positions** **Unlocking is carried out by** **Operating the reverse lock lever.**

SECTION 6 - GEARCASE

General Precautions

Before performing any service work on the gearcase, read and understand the Service Safety section at the beginning of this manual.

Full servicing of the gearcase requires manufacturer special tools. Follow all special tool requirements as specified. Substituting special tools with those not provided by the manufacturer may result in severe personal injury, equipment or engine damage, or faulty service work.

Perform bearing removal and installation operations exactly as specified to avoid damage to the bearing or housing during pressing operations.

Replace locking fasteners when their locking feature becomes weak.
Use only factory replacement parts.

When using compressed air to clean or dry parts, make sure air supply is regulated not to exceed 25 psi [172 kPa / 1.76 kg/cm'].

SERVICE SPECIFICATI0NS

Special Torque Values – Raider 40

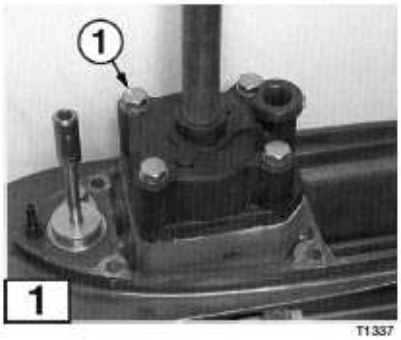
Description	Torque In-lb (ft-lb) N-m Kg-m	Thread – locker
Propeller Nut	(21.7 - 28.9) 29.4 - 39.2 3.0-4.0	–
Pump case Bolts	41-55 4.6-6.2 0.47 - 0.64	Locte 242
Bevel Gear B Nut/Bolt	(17.3 - 18.8) 23.5 - 25.5 2.4 - 2.6 Bolt	–

Special Equipment Required

Part Name	Part Number	40
Bevel Gear A Bearing Puller Ass'y	3A3-72755-0	•
Bearing Outer Press Rod	3B7-72731-0	•
Bearing Outer Press Plate	353-72732-0	•
Bearing Outer Press Plate	346-72732-0	
Bearing Outer Press Guide	346-72733-0	•
Bevel Gear A Set Tool	346-72719-0	
Bevel Gear A Set Tool	3C8-72719-0	•
Backlash Measuring Tool Kit	3B7-72740-0	
Backlash Measuring -Tool Sub-Ass'y	*369-72730-0	
Backlash Measuring Tool Arm	*369-72727-0	
Backlash Measuring Tool Arm	*3B2-72727-0	
Backlash Measuring Tool Kit	3C8-72234-0	•
Measuring Tool Shaft	*345-72723-0	•
Backlash Measuring Tool Plate	*3A3-72724-0	•
O-Ring, 2-9	*332-60002-0	•
Backlash Measuring Tool Collar	*350-72245-0	
Backlash Measuring Tool Collar	*346-72245-1	
Backlash Measuring Tool Collar	*353-72245-1	•
Nut, 10P1.5	*930191-1000	• (2)
Conedisk Spring, d=12	*3B7-72734-0	• (3)
Clamp Ass'y Backlash Measur'g Tool	3B7-72720-0	•
Bolt	910191-0625	• (4)
Dial Gauge Plate	3B7-72729-0	•
Shimming Gauge	346-72250-0	
Shimming Gauge	3C8-72250-0	•
Thickness Gauge	353-72251-0	•

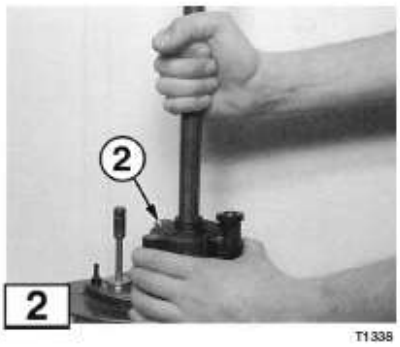
General Equipment Required

Torque Wrench, 0-150 in lb (0-17/0-1.7 kg-m)
Torque Wrench, 0-150 ft-lb (0-200 N-m / 0-20 kg-m)
Dial Indicator, minimum scale 0.0001 in (0.01 mm)
Gearcase Pressure Tester, Stevens S-34 or equivalent
Gearcase Vacuum Tester, Stevens V-34 or equivalent
Seal Pullers
Seal Installers
Heat Gun



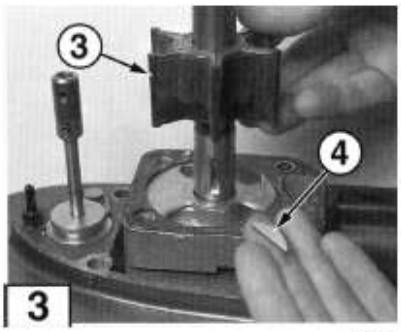
Consumables Required

Threadlocker, *Loctite® 242*
Gasket Sealant, *Permatex® High Tack Gasket Sealant*
Anaerobic Gasket Maker, *Loctite® 518*
Silicone Spray Lubricant, *Permatex® Silicone Spray Lubricant*
Genuine Grease or Equivalent Friction Surface Marine Grease
Isopropyl Alcohol
Cleaning Solvent
Engine Lubricant, *Genuine engine oil or NMMA certified TC-W3 oil*
Gear Lubricant, *Genuine gear oil or API grade GL5, SAE #80 - #90*
Cleaning Pads, *Scotch-Brite® Abrasive Pads*
Gasket Remover



WATER PUMP

If the engine has been run without water for any length of time, the water pump should be serviced with a water pump repair kit. Use the following procedures to install the repair kit.



Removal

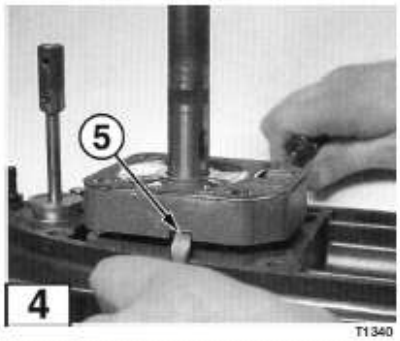
1. Remove the gearcase. See Gearcase, this section.

1 2. Remove water pump mounting bolts **(1)**.

2 3. Hold upper pump case **(2)** securely and rotate driveshaft clockwise to free impeller from upper pump case.

⚠ CAUTION

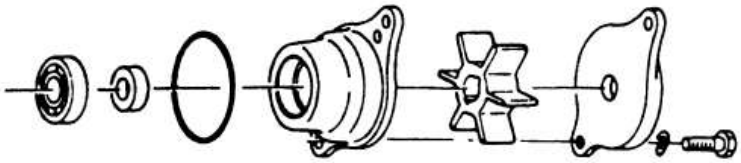
Do not rotate driveshaft counterclockwise. Doing so will bend impeller fins in wrong direction and may weaken or damage the impeller.



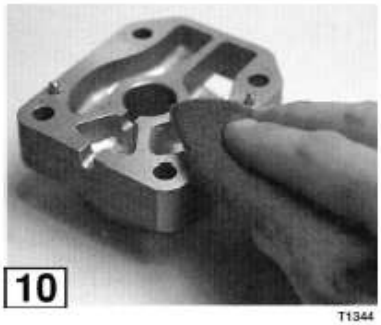
3 4. Slide upper pump case off driveshaft and remove pump impeller **(3)** and impeller key **(4)**.

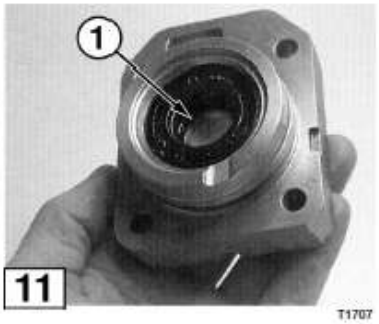
4 5. Insert a screwdriver in each lower pump case notch **(5)** and gently pry upward to remove. Slide lower pump case off driveshaft.

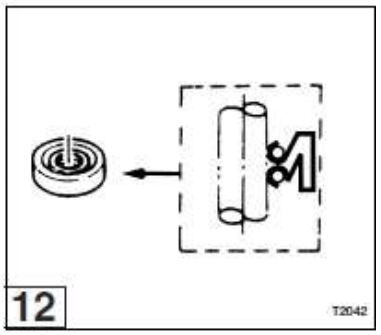
Water Pump Assembly



1. Disassemble the water pump component as illustrated and verify the kit parts match the originals before discarding old parts.



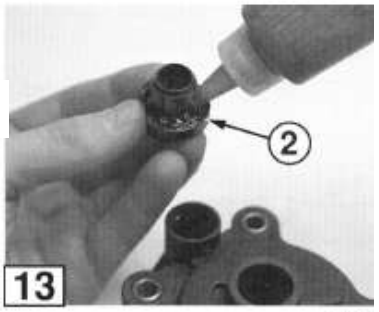




10 2. Remove all gasket residue from lower pump case with abrasive cleaning pads and gasket remover. Do not scrape the gasket surface with metal scraper. Thoroughlv clean all components with isopropyl alcohol and dry with compressed air. low pressure

3. Inspect the upper and lower pump cases for signs of melting and cracks. Replace as needed.

11 4. Examine lower pump case oil seals **(1)** for signs of damage and deterioration.



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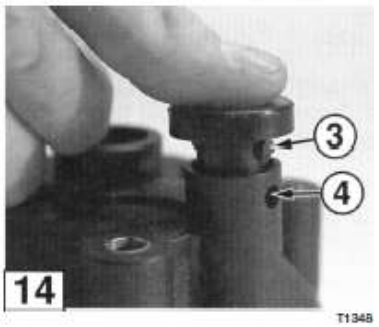
NOTE

If necessary to replace seals, use appropriate size seal puller and installer to avoid damaging new seals and seating surfaces in lower pump case. Apply silicone spray lubricant to seals and install so lips face direction indicated.

13 5. Apply anaerobic gasket maker to seating surface of water pipe lower seal **(2)**.

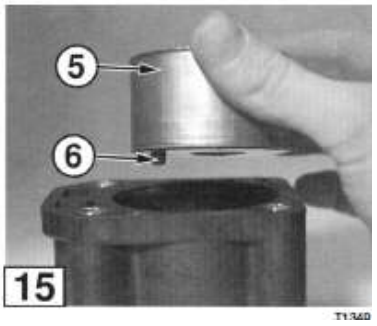
14 6. Install seal in upper pump case so locking tabs **(3)** align with holes **(4)**.

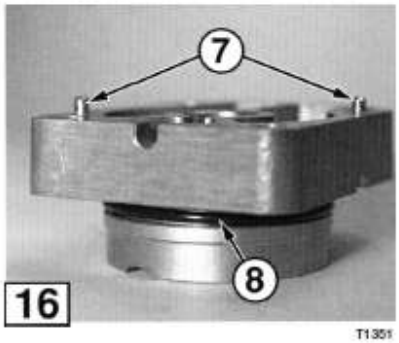


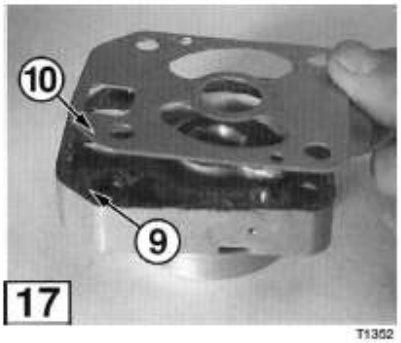
15 7. Slide pump case liner **(5)** partially into upper pump case housing so locking tab **(6)** is aligned with notch in housing.

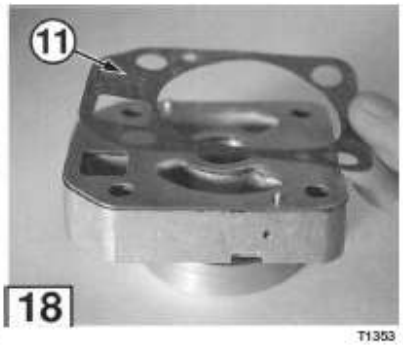
NOTE

Pump case liner must be flush with flanged surface of upper pump case. If not, remove liner and re-align locking tab with notch in upper pump case housing.





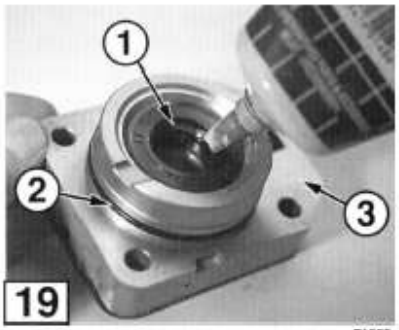




16 8. Install lower pump case dowel pins **(7)** if removed and o-ring **(8)**.

17 9. Apply gasket sealant to both sides of guide plate gasket **(9)**. Mount gasket and guide plate **(10)** on lower pump case.

18 10. Apply gasket sealant to guide plate side of upper pump case gasket **(11)**. Mount gasket on guide plate.



Installation

19 1. Apply a light coating of genuine grease or equivalent friction surface marine grease to the lower pump case driveshaft passage, oil seal lips **(1)**, and o-ring **(2)**. Apply an aerobic gasket maker to flanged surface **(3)** to provide adequate seal between lower pump case and gearcase.

20 2. Slide lower pump case down driveshaft and seat into position on gearcase.

3. Slide the impeller down the driveshaft onto lower pump case.

21 4. Insert impeller key **(4)** in driveshaft and align impeller slot with key. Hold the impeller key in place and push impeller down until seated in position.

22 5. Lubricate the impeller blades with soapy water and slide upper pump case down driveshaft. Hold pump case securely and push downward while rotating driveshaft clockwise to seat the impeller.

⚠ CAUTION

Do not rotate driveshaft counterclockwise. Doing so will bend impeller blades in wrong direction and may weaken or damage the impeller.

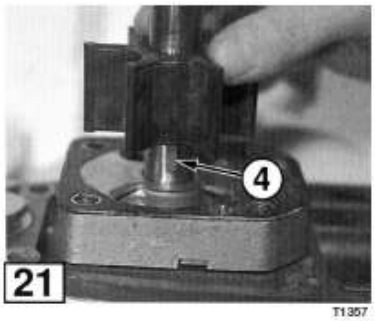
6. Ensure upper pump case is aligned and fully seated on the dowel pins. Hold the upper pump case in position and rotate driveshaft clockwise to ensure free movement.

⚠ CAUTION

Make sure impeller blades are not caught or pinched between upper and lower pump cases when upper pump case is fully seated.

23 7. Apply genuine grease or equivalent friction surface marine grease to neck portion of water pump mounting bolts. Install the bolts.

8. Install the gearcase. See Gearcase, this section.



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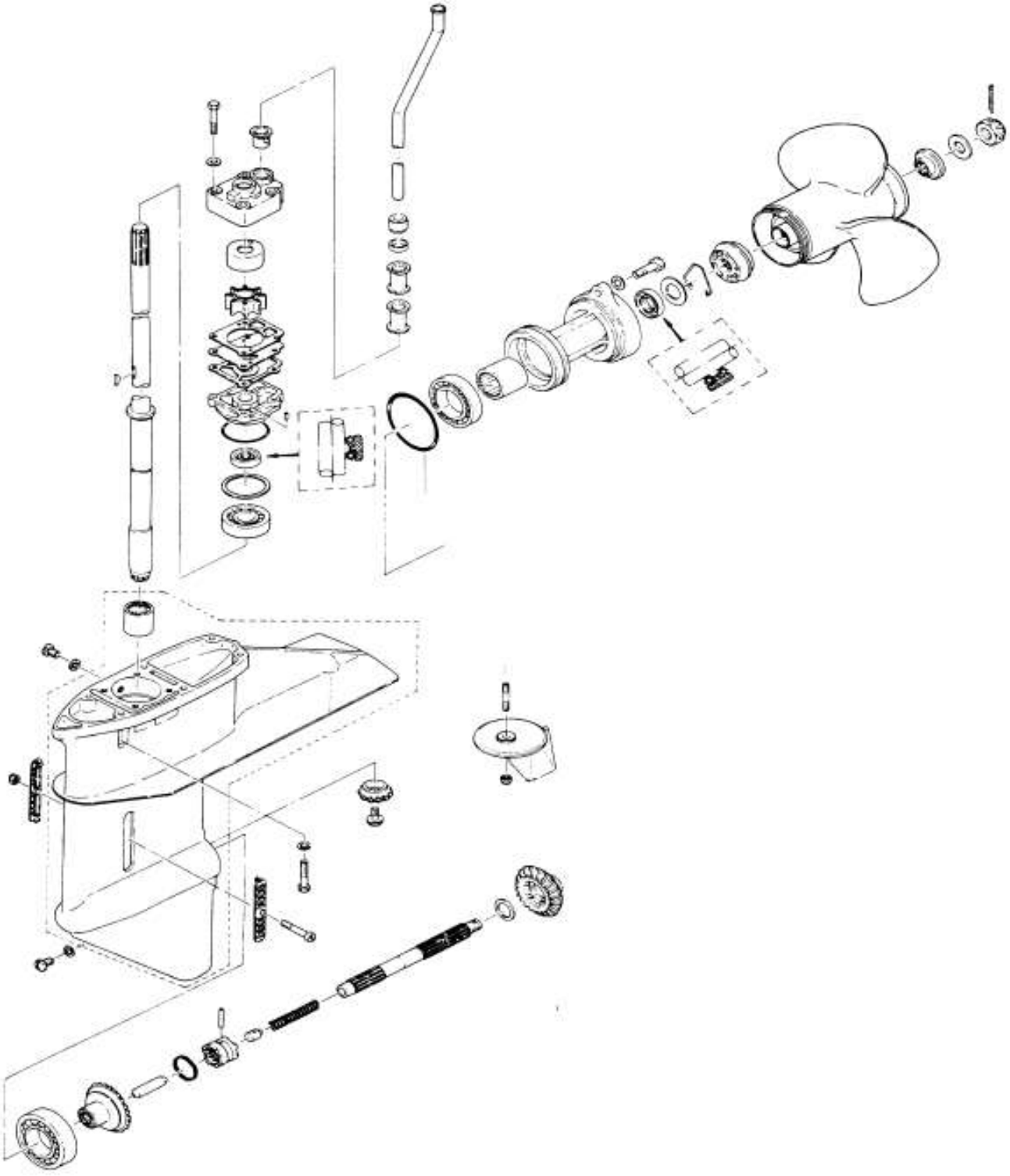
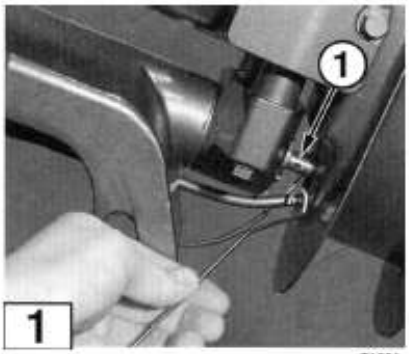
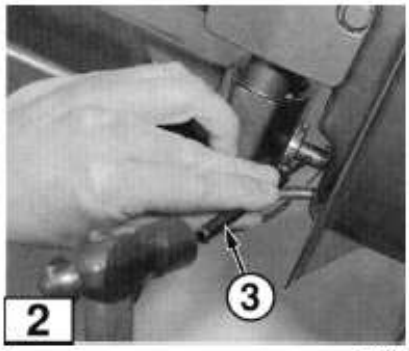
T1358

GEARCASE







Removal

⚠⚠ WARNING

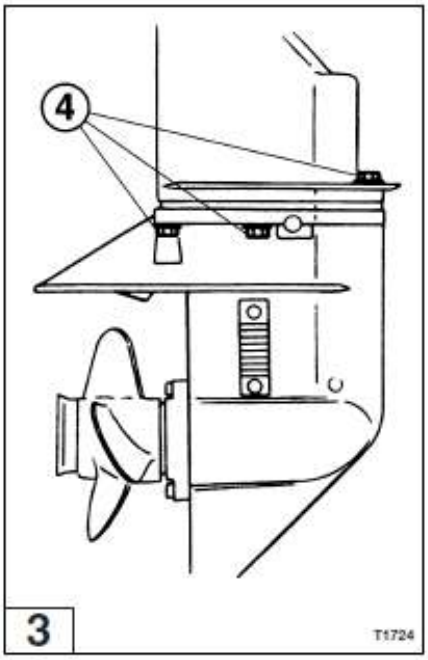
Ignition system must be disabled to prevent accidental engine start-up during removal of the gearcase. Disconnect coil wire (black/yellow)

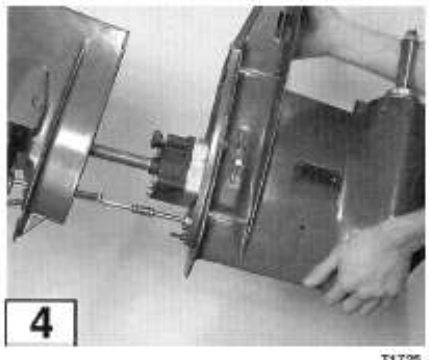
1. Place engine in FORWARD gear so shift rod joint **(1)** is accessible.

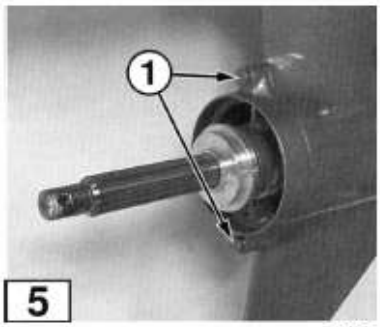
2. Use spring pin tool A **(3)** (Part No. 345-72227-0) to remove upperspring pin from shift rod joint. Discard the spring pin.

3. Remove gearcase mounting bolts **(4)** from both sides of gearcase.

4. Separate gearcase from driveshaft housing.







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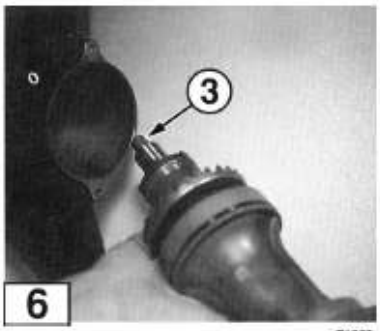
T1367



6

T1369

Disassembly

⚠ CAUTION

Gearcase must be secured in a suitable holding fixture during disassembly.

1. Drain all gearcase oil into a container and inspect the oil for metal chips.

NOTE

Small metal fragments may indicate normal wear of gears, bearings, and shafts. Large metal chips usually indicate extensive internal damage. Record your observations for future reference when inspecting internal components.

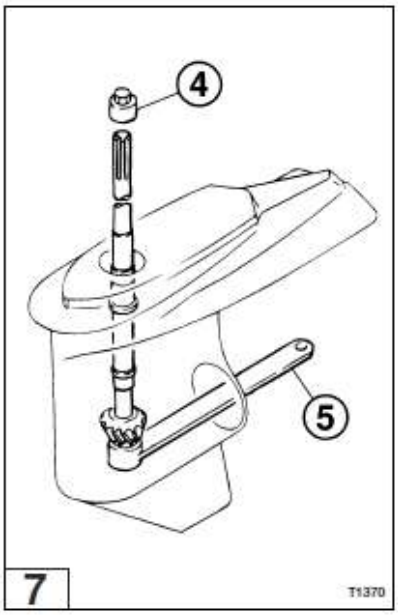
2. Remove the water pump and install a water pump repair kit if gearcase has been in service for any length of time. See Water Pump, this section.

3. Remove propeller mounting nut, washers and propeller.

5 4. Remove propeller shaft housing bolts **(1)**.

6 5. Remove propeller shaft and housing from gearcase. Make sure clutch push rod **(3)** is also removed. The push rod and spring may "pop" out with removal. Set the assembly aside.

7 8 6. Install socket **(4)** (Part No. 9.9/15/18: 350-72232-0, 25/30: 346-72232-0, 40: 345-72232-0) and wrench **(5)** (Part No. 346-72231-0). Hold bevel gear B nut with wrench and turn driveshaft counterclockwise to loosen the nut. Remove bevel gear B **(6)** and nut **(7)** from gearcase.



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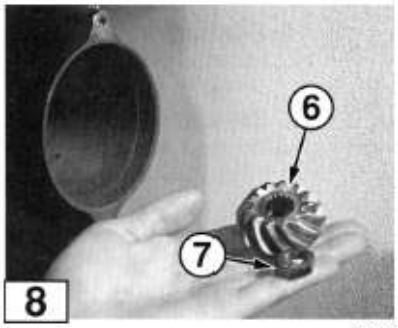
T1370



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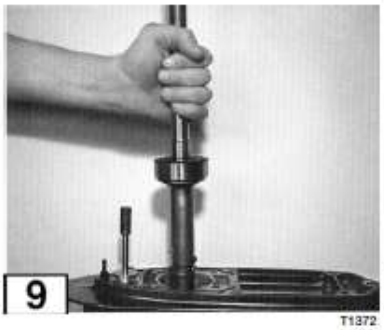
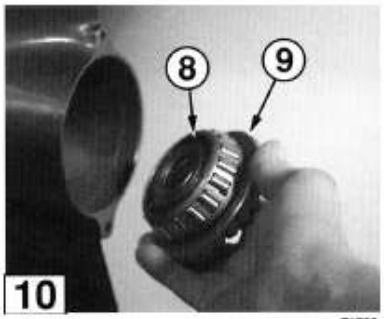
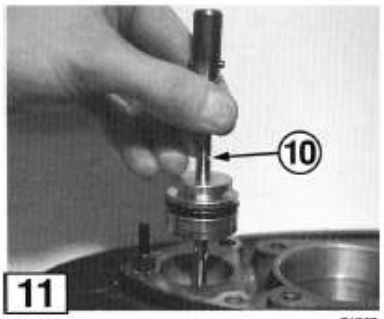
T1371







9 8. Lift the driveshaft from the gearcase and set it aside.

10 9. Reach inside gearcase and remove roller bearing **(8)** and bevel gear A **(9)**.

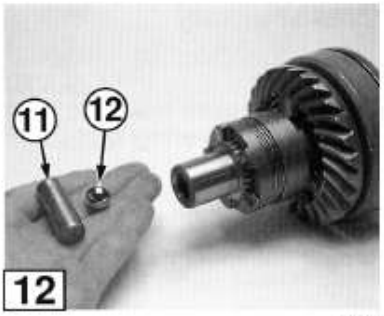
NOTE

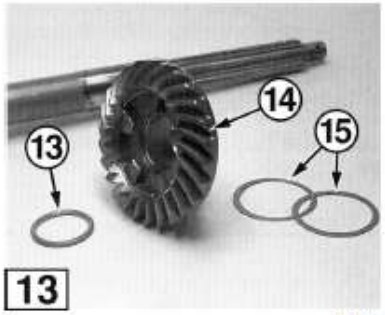
Taper bearing for bevel gear A is only used on Model 40.

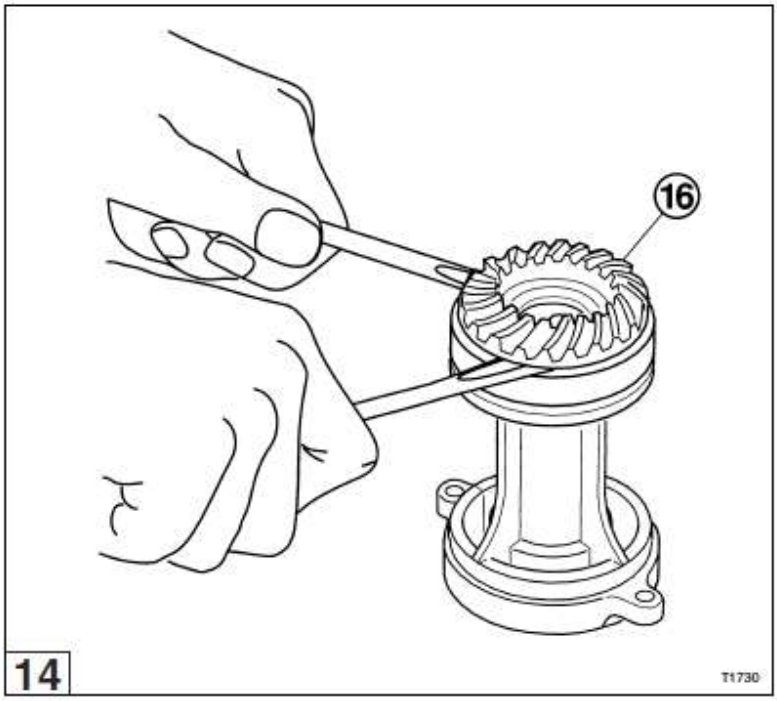
11 10. Remove the stopper and lift cam rod **(10)** from gearcase. Fullydisassemble the cam rod components, including the cam rod bushing internal and external o-rings.

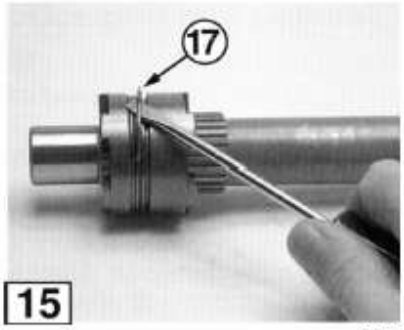
12 11. Remove clutch push rod **(11)** and ball **(12)** from propeller shaft. Pull propeller shaft out of housing.

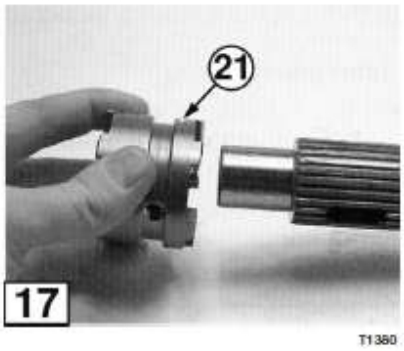
13 12. Remove washer **(13)**, bevel gear A **(14)**, and all shims **(15)** (25/30 and 40) from propeller shaft.

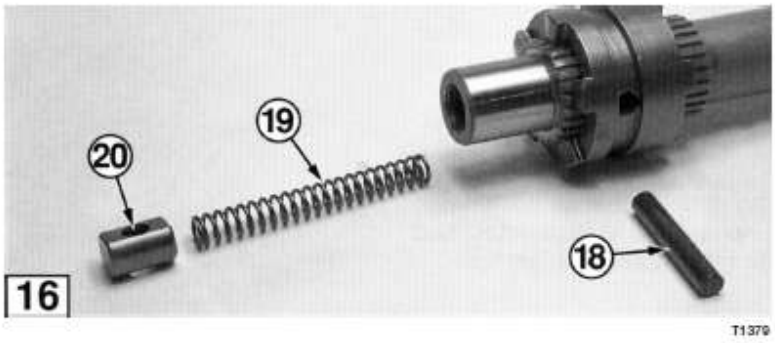












14 13. Remove bevel gear C **(16)** from the propeller shaft housing.

15 14. Insert screwdriver under one end of clutch pin snap spring **(17)**. Remove spring from groove by unwrapping it from clutch. Discard the spring.

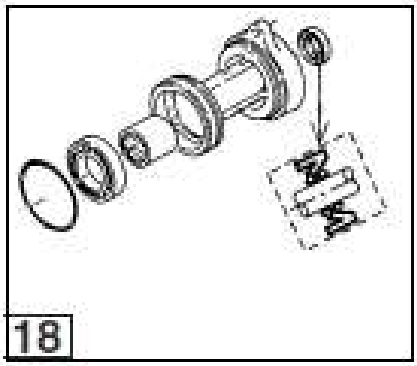
16 15. Place propeller shaft open end against bench surface and push out clutch pin **(18)**. Remove clutch spring **(19)** and spring holder **(20)**.

⚠⚠ WARNING

Wear safety glasses and DO NOT hold open end of propeller shaft towards face or body when removing clutch pin. Clutch spring and spring holder come out with great force.

17 16. Pull clutch **(21)** off propeller shaft.

Cleaning and Inspection


18

NOTE

All worn, damaged, and missing pails must be replaced.

1. Discard the clutch pin snap spring and all seals and o-rings that have been removed.

2. Clean all gearcase components with solvent and dry with low pressure compressed air. After cleaning, apply specified gear oil to all internal components to prevent rusting.

3. Perform the following inspections:

Gearcase Housing

- Inspect internal and external surfaces of housing for cracks and other damage. All threaded holes must be undamaged and free of corrosion and sealing agents.
- Checkthe sacrificial trim tab ford amage and erosion. See Anodes - Inspection and Testing in Section 2.
- Inspect the water intake screens for damage and blockage. If screens cannot be fully cleaned, replace them.

Propeller and Shaft

- Verify the propeller is true and free of nicks, chips, and other damage that will affect performance. Inspect the thrust washer and mounting hardware for damage.
- Check the propeller shaft threads and splines for wear and damage.

Propeller Shaft Housing

18 Examine propeller shaft housing and components for wear, damage, and deterioration. If necessary, disassemble and repair as needed. See Gearcase Repair Procedures, this section.

Driveshaft

- Check driveshaft threads and splines for wear, chips, and cracks. Severe spline wear or the appearance of spline "twisting" indicates the gearcase or exhaust housing has been distorted, possibly by impact damage.
- Bearing(s) must be free of damage, corrosion, and discoloration. Replace bearing(s) as required. See Gearcase Repair Procedures, this section.

All Internal Components

Inspect all internal components for signs of wear, chipping, pitting, distortion, and discoloration due to improper lubrication. Special attention to the following:

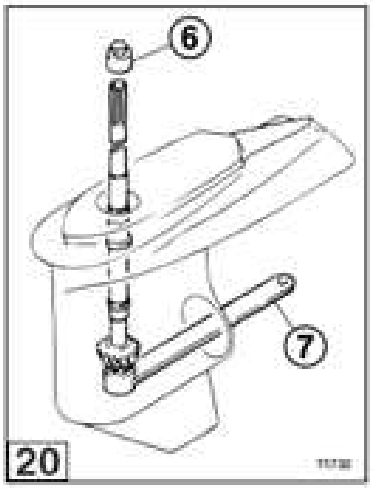
- Check the bevel gear A tapered roller bearing outer race. If damaged or corroded, replace both the race and the bearing. See Gearcase Repair Procedures in this section.
- Inspect clutch and gear teeth and the clutch cam for chips and signs of metal transfer. Replace parts as needed.

Assembly

1. Install new gearcase needle bearing, bevel gear A & B roller bearing and outer race, and driveshaft bearing(s) if any of these parts were removed. See Gearcase Repair Procedures, this section.

2. Secure gearcase in holding fixture with water pump side facing upward.

19 3. Apply Loctite 242 to the thread of bevel gear B nut (3). Slide bevel gear B (4) onto driveshaft (5) as shown from propeller shaft side of gearcase. Hand tighten nut (3) to secure the gear in place.



NOTE

Before applying Loctite 242, remove all grease from tapered portion of bevel gear B and driveshaft with solvent, and thread of driveshaft and bevel gear B nut also.

4. Install specified socked (6) Part No. 345-72232-0 and wrench (7) (Part No. 346-7223-1-0). Hold bevel gear B nut with wrench and turn driveshaft clockwise to tighten the nut. Torque bevel gear B nut to specification

5. Perform all adjustment steps before proceeding. See Adjustments, this section.

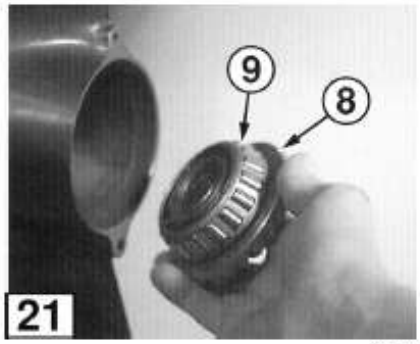
⚠ CAUTION

Failure to perform the adjustment steps may result in poor engine performance, premature wear of parts, or severe damage to gearcase components.

6. Install the water pump. See Water Pump, this section.

NOTE

Make sure all necessary adjustment shims are installed on driveshaft bearing before installing lower pump case.

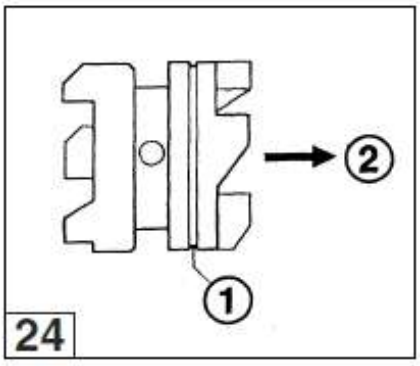


21 7. Install bevel gear A **(8)** so tapered roller bearing **(9)** is seated in outer race.

22 8. Replace cam rod bushing internal o-rings **(10)** and external o-ring **(11)**. Coat the internal o-rings and inner surface of bushing with specified gear oil. Then fully assemble the cam rod components.

23 9. Apply genuine grease or equivalent friction surface marine grease to the exterior of the cam rod bushing and o-ring.

10. Insert the cam rod into the cam rod port on the gearcase and seat the bushing. Install stopper with stopper bolt.

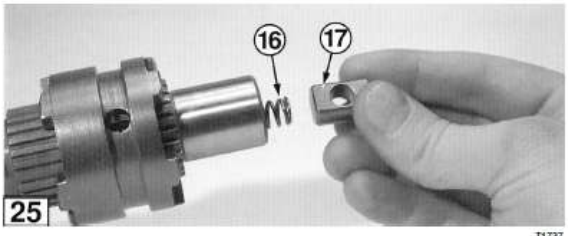


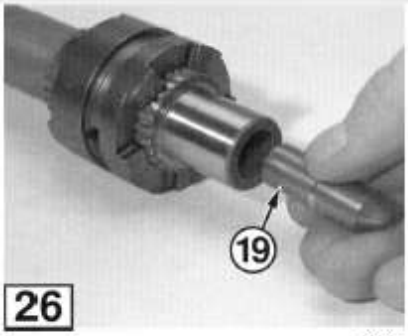
24 11. Align hole in clutch with slot in propeller shaft. Slide clutch onto shaft so the side with the groove **(1)** faces the side with bevel gear A **(2)**.

CAUTION

The clutch is not symmetrical (except 5 HP). If installed backwards, clutch and gears will be damaged.

25 12. Insert clutch spring **(16)** and install spring holder **(17)** so hole in spring holder is aligned with clutch hole.





26 13. Install clutch push rod **(19)** so tapered end faces bevel gearA.

27 14. Compress the clutch spring by applying pressure to push rod **(19)**. Align the holes of the clutch and spring holder and insert clutch pin **(20)**.

⚠ CAUTION

Wear safety glasses and DO NOT hold spring end of propeller shaft towards face or body when compressing the clutch spring.

28 15. Install new clutch pin snap spring **(21)** using the clutch pin snap tool. Do not reuse old snap Spring.

Part number of clutch pin snap tool

40 : 345-72229-0

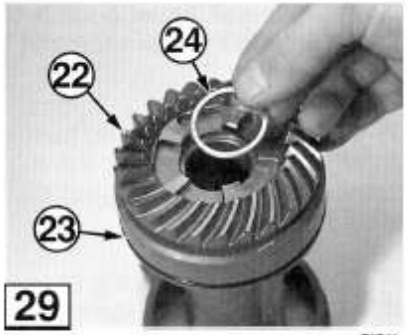
⚠ CAUTION

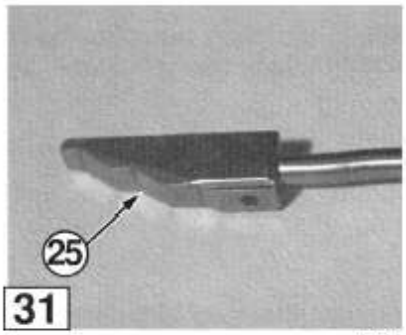
DO NOT reuse clutch pin snap spring (21), it must be replaced. Reusing clutch pin snap spring may cause severe damage to gears and other components.

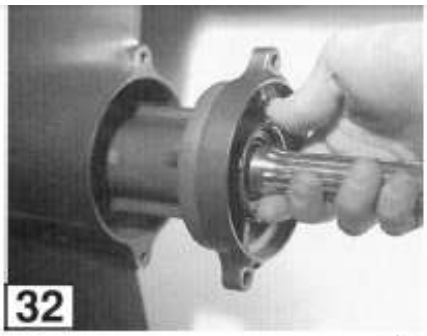
29 16. Make sure all necessary adjustment shims are installed on bevel gear C **(22)** and install gear onto propeller shaft housing **(23)**. Install washer **(24)** onto bevel gear.

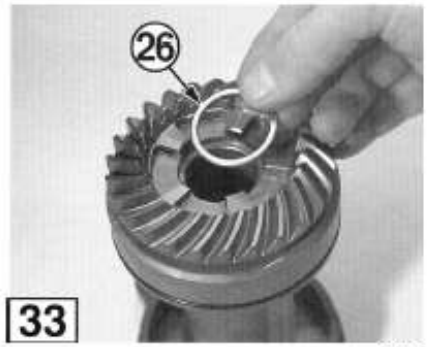
30 17. Apply genuine grease or equivalent to the propeller shaft housing o-ring and oil seal. Slide the propeller shaft into the propeller shaft housing.

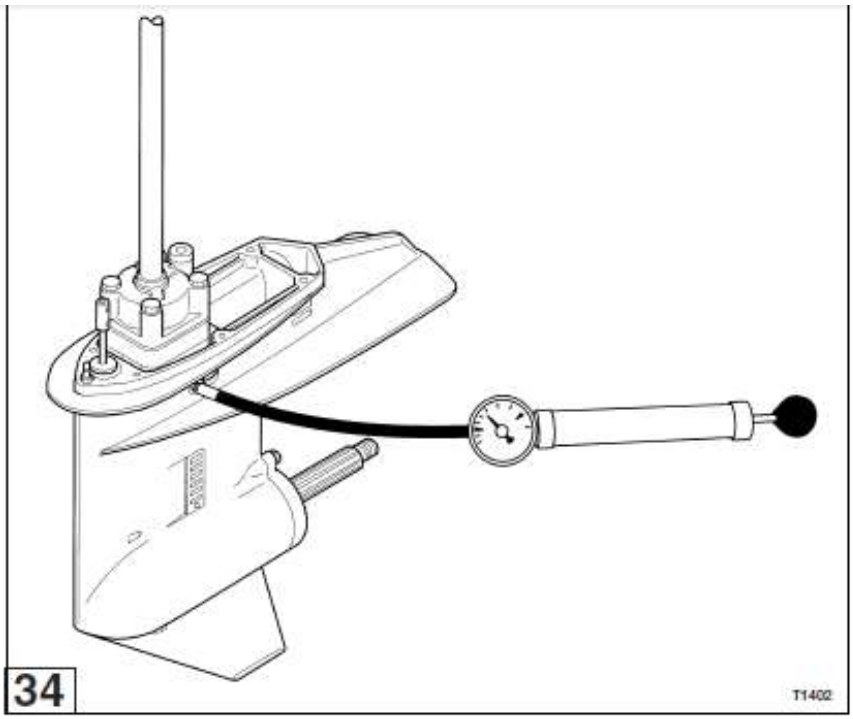
31 18. Lift the cam rod to the fully UP position and verify through the gearcase opening that clutch cam beveled side **(25)** faces gearcase opening.











32 19. Align the clutch push rod with the clutch cam and slide the propeller shaft and housing into the gearcase opening. Push forward and rotate the propeller shaft as needed until bevel gears have engaged. Ensure the propeller shaft housing bolts are completely clean and apply Loctite 242 to the bolt threads. Install and torque the bolts evenly to prevent improper seating of the housing.

33 20. Move the cam rod to each position and rotate the driveshaft to test gearcase function in all gears. Check the propeller shaft for looseness in the forward and reverse directions. If looseness exceeds 0.016 in [0.40 mm], replace bevel gear C washer **(26)** with one of correct thickness.

NOTE

Refer to current Parts Catalog for washer availability

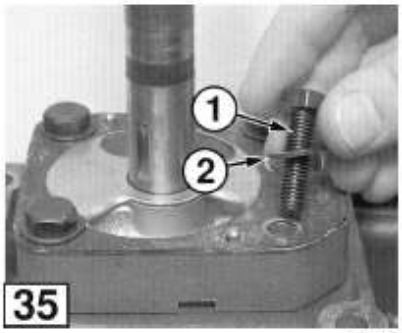
34 21. Before adding gear oil, pressure test and vacuum test the gearcase as follows:

- Remove the oil level plug and install gearcase pressure tester.
- Pump pressure tester until gauge indicates 3 - 6 psi [20 - 39 kPa / 0.2 - 0.4 kg/cm²]. If pressure loss occurs, determine source of leakage by submerging gearcase in water. Make necessary repairs to correct the problem and retest.
- Remove the pressure tester and install gearcase vacuum tester.

- pump vacuum tester until gauge indicates 3 - 5 in [76 - 127mm] of mercury. If loss of vacuum occurs at either range, apply oil around suspected seal. If leak stops or oil is drawn in, the seal is defective and must be replaced. Make necessary repairs to correct the problem and retest.

22. Fill gearcase with specified gear lubricant. See Engine Specifications in Section 2 for gearcase capacities.

23. Apply genuine grease or equivalent to the propeller shaft and propeller mounting hardware. Install the propeller and propeller mounting hardware.



⚠ CAUTION

Make sure propeller thrust holder is installed and seated against the propeller shaft oil seal before installing propeller. If installed improperly, propeller may be pushed into gearcase housing during tightening.

Adjustments

⚠ CAUTION

DO NOT attempt gearcase adjustments without proper manufacturer special tools and adequate knowledge of gearcase setup.

NOTE

Specific assembly steps must be completed in order to perform the gearcase adjustments. If these steps have not been performed, refer to Assembly, this section.

NOTE

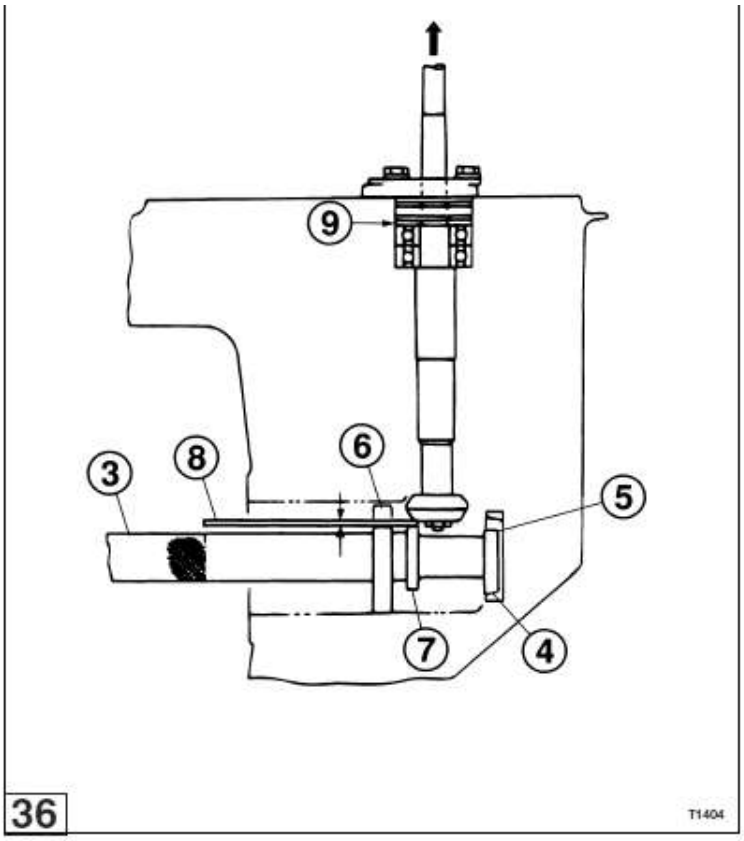
Unless otherwise indicated, all gearcase adjustment specifications are based on measurements obtained with manufacturer special tools.

35 1. Slide lower pump case onto driveshaft and seat into position on gearcase. Secure lower pump case with bolts **(1)** and plain washers **(2)**.

36 2. Insert shimming gauge (3) into gearcase (40 gauge: 3C8-72250-0).

NOTE

Correct positioning of the shimming gauge in the gearcase is critical, Make sure tapered side (4) is fully seated I'n bevel gearA bearing outer race with ilat side (5) and notch (6) facing upward.



36 3. Eliminate all looseness between driveshaft and gearcase using one of the following methods:

- Lift driveshaft upward and tap down on gearcase with rubber mallet.
- Slide acompression spring (obtain locally) over driveshaft and seat onto lower pump case. Install backlash measuring tool clamp assembly (Part No. 3B7-72720-0) on driveshaft. Compress the spring and tighten the clamp to maintain the spring compression and provide constant upward pressure against driveshaft.

With all looseness eliminated, measure the gap between collar **(7)** and bevel gear B using thickness gauge set **(8)** (Part No. 353-72251-0). If gap measurement is not within 0.023 - 0.025 in [0.60 - 0.64 mm], remove the lower pump case and install correct size shim onto roller bearing outer race at location **(9)**.

NOTE

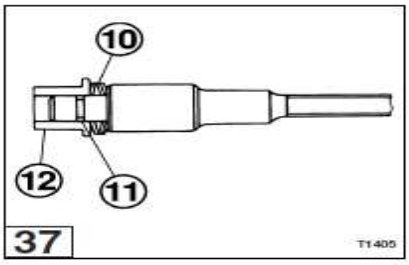
Refer to current Parts Catalog for shim availability.

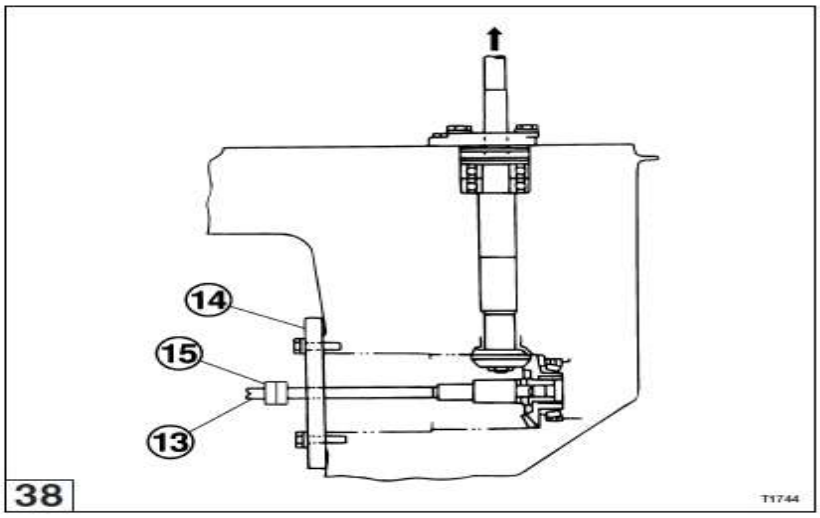
4. If shimming was necessary re-install the lower pump case before proceeding with Backlash Adjustment - Bevel Gears A and B.

Backlash Adjustment - Bevel Gears A and B

Backlash

Special tools are required for measuring backlash. The following describes how to measure and correct backlash in the Raider 40 outboard.





5. With the tapered roller bearing installed, position bevel gear A in gearcase so bearing is fully seated in outer bearing race. Rotate the driveshaft to ensure gears are property meshed.

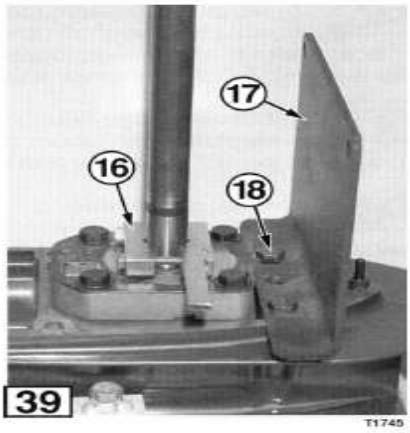
6. Assemble the following backlash tool components. Note the correct quantity and orientation of conedisk spring washers:

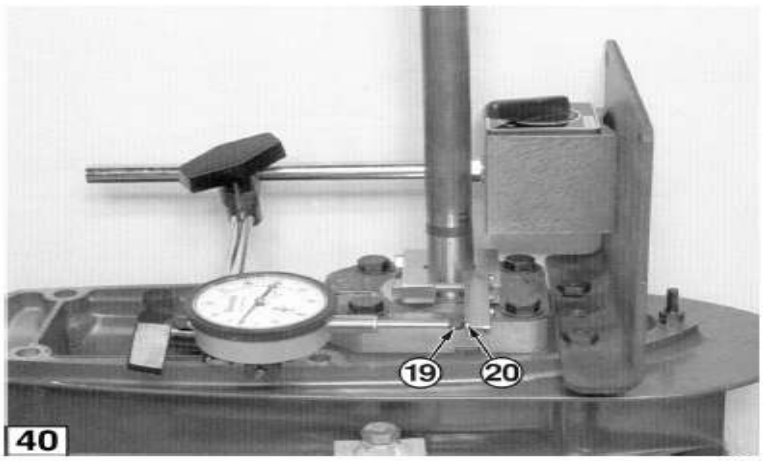
37 Assemble three conedisk spring washers **(10)**, o-ring **(11)**, and collar **(12)**.

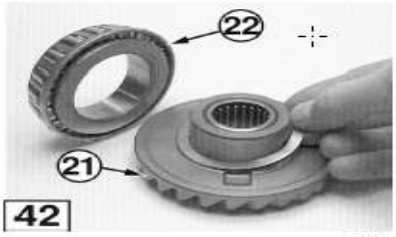
38 7. Insert shaft **(13)** into gearcase and seat collar/guide end in bevel gear A. Install plate **(14)** using appropriate size bolts. Turn shaft nuts **(15)** onto shaft. Tighten the nuts against each other so outer nut can be used to tighten shaft **(13)**.

8. Look the nuts **(15)**.

39 9. Mount clamp assembly **(16)** on driveshaft as close as possible to lower pump case. Install dial gauge plate **(17)** on gearcase with appropriate size bolts **(18)**.





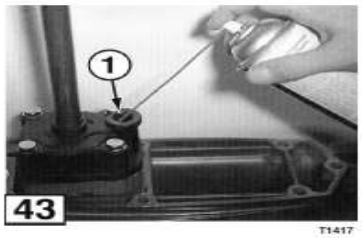


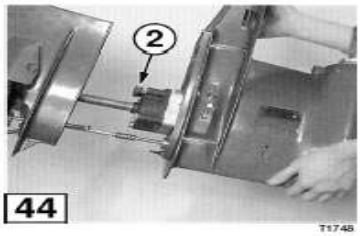
40 10. Mount a magnetic base and dial gauge (obtain locally) as shown. Lift driveshaft upward and tap down on gearcase with rubber mallet to eliminate all looseness and proceed to adjust the setup so dial gauge **(19)** is aligned with V-notch **(20)**.

41 11. Set dial gauge to zero. Lift driveshaft upward and rotate driveshaft in both directions and record the dial gauge reading.

42 If the dial gauge reading is not within the specified range, adjust shim thickness between bevel gear A **(21)** and tapered roller bearing **(22)** in accordance with the Backlash - Shim Adjustment Table, this section. See Gearcase Repair Procedures in this section for removal and installation of the bevel gearA roller bearing.

Model	Acceptable Dial Gauge Reading	
	in	mm
Raider 40	0.0236 – 0.0394	0.60 – 1.00





Installation

⚠ WARNING

Ignition system must be disabled to prevent accidental engine start-up during installation of the gearcase.

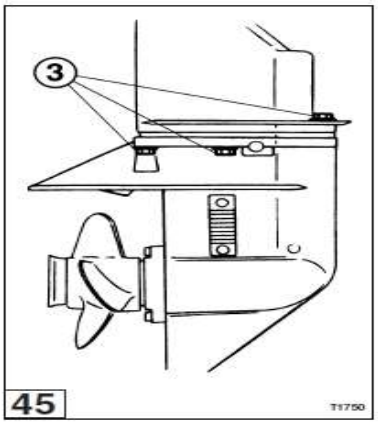
43 1. Lightly coat the driveshaft splines with genuine engine oil or TC-W3 oil and apply silicone spray lubricant to water pipe lower seal **(1)**.

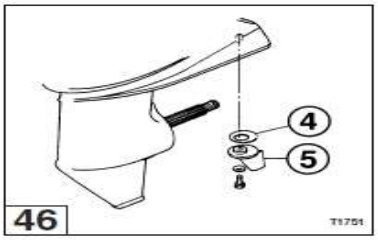
44 2. Slide driveshaft into lower crankcase head. Align water pipe with lower seal **(2)** before seating gearcase on driveshaft housing.

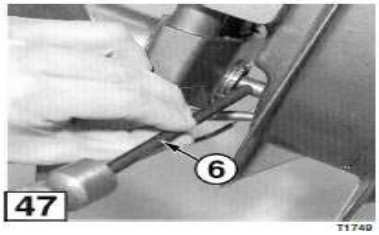
45 3. Apply Loctite 242 to threaded portion of gearcase mounting bolts. Install the gearcase mounting bolts **(3)** and torque all bolts to specification.

46 4. Inspect trim tab **(5)** and replace if corroded. Install trim tab packing **(4)** and trim tab **(5)**.

47 5. Use spring pin tool B **(6)** (Part No. 345-72228-0) to install new upper spring pin in shift rod joint. DO NOT reuse the old spring pin.







Dial Gauge Setting		Shim Thickness + Increase shim thickness – Decrease shim thickness	
40			
in	mm	in	mm
0 - 0.002	0.00 - 0.05	-0.0098	-0.25
0.002 - 0.006	0.06 - 0.15	-0.0079	-0.20
0.006 - 0.014	0.16 - 0.35	-0.0059	-0.15
0.014 - 0.018	0.36 - 0.45	-0.0039	-0.10
0.018 - 0.023	0.46 - 0.59	-0.002	-0.05
0.024 - 0.039	0.60 - 1.00	0	0.00
0.04 – 0.041	1.01 - 1.05	+0.002	+0.05
0.042 - 0.045	1.06 - 1.14	+0.0039	+0.10
0.045 - 0.047	1.15 - 1.20	+0.0059	+0.15
0.048 - 0.053	1.21 - 1.35	+0.0079	+0.20
0.054 - 0.059	1.36 - 1.50	+0.0098	+0.25
0.059 - 0.065	1.51 - 1.65	+0.0118	+0.30
0.065 - 0.071	1.66 - 1.80	+0.0138	+0.35
0.071 - 0.077	1.81 - 1.95	+0.0157	+0.40
0.077 - 0.083	1.96 - 2.10	+0.0177	+0.45
0.083 - 0.089	2.11 - 2.25	+0.0197	+0.50
		+0.0217	+0.55
		+0.0236	+0.60

GEARCASE REPAIR PROCEDURES

⚠ CAUTION

DO NOT attempt gearcase repairs without proper manufacturer special tools.

Use this section when service work requires disassembly or replacement of the following gearcase components:

- Driveshaft roller bearings.
- Gearcase needle bearing.
- Propeller shaft housing needle bearing.
- Bevel gear A bearing outer race.
- Bevel gear A roller bearing.

Driveshaft Roller Bearings

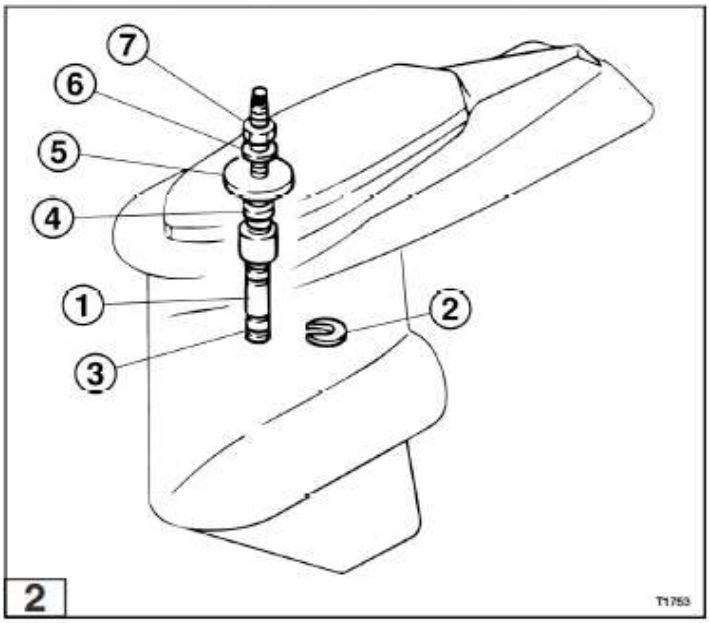
1

⚠ CAUTION

If it is determined after complete inspection that replacement of driveshaft roller bearing (1) is necessary, all pressing operations during removal and installation must be performed at a qualified machine shop equipped with minimum 1 ton Press.

Gearcase Needle Bearing:

Note: Obtain needle roller bearing puller kit: P/N: 3C8-72700-0.



Removal

2 1. Insert shaft **(1)** through needle bearing from water pump side of gearcase.

2 2. Attach retainer **(2)** from propeller shaft side of gearcase to shaft groove **(3)**. Make sure retainer is fully seated in groove with raised surface facing bearing:

2 3. Slide guide **(4)** onto shaft from water pump side of gearcase. Make sure guide is seated in bearing.

4. Install plate/flange **(5)**, washer **(6)**, and nut **(7)** onto shaft.

5. Hold end of threaded shaft with wrench and tighten nut **(7)** until bearing releases from housing.

Installation

3 1. Insert shaft **(1)** through needle bearing housing in gearcase.

3 2. Coat the new needle bearing with genuine gear oil. Slide bearing onto shaft from propeller shaft side of gearcase so bearing stamped surface **(2)** faces propeller shaft side.

⚠ CAUTION

Stamped surface of needle bearing must face propeller shaft side of gearcase or bearing could be damaged during installation.

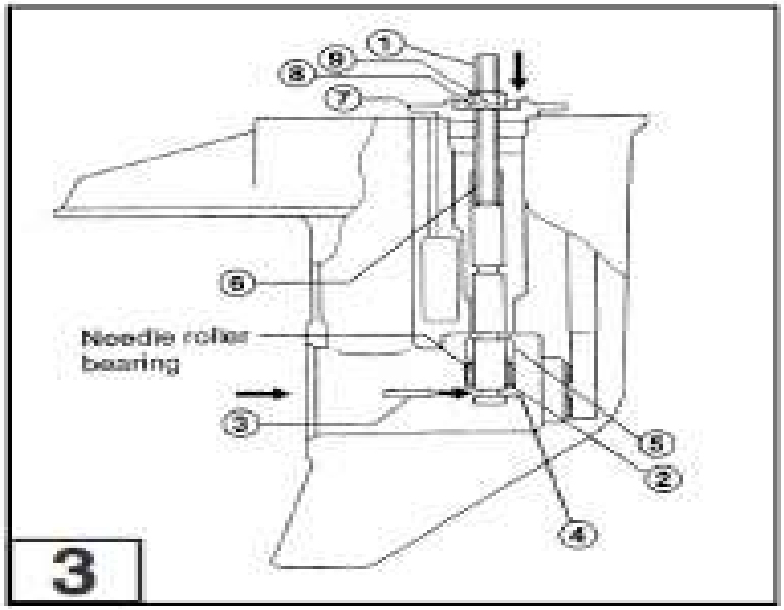
3 3. Attach retainer **(3)** from propeller shaft side of gearcase to specified shaft groove **(4)**. Make sure retainer is fully seated in groove with raised surface facing bearing.

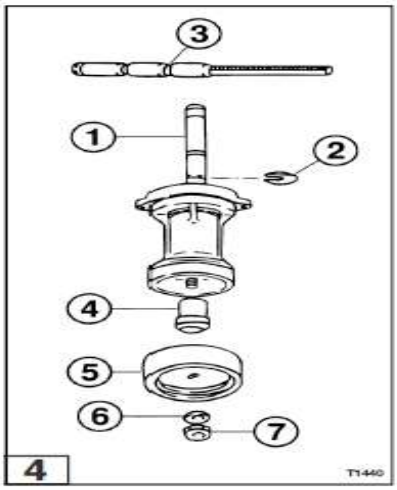
3 4. Slide guide **(5)** onto shaft from water pump side of gearcase. Make sure guide is seated in bearing.

3 5. Install stopper **(6)**, plate/flange **(7)**, washer **(8)**, and nut **(9)** onto shaft from water pump side of gearcase.

3 6. Hold end of threaded shaft with wrench and tighten nut **(9)** until stopper **(6)** contacts plate/flange **(7)**.

7. Remove tools and verify needle bearing is fully seated in housing.





Propeller Shaft Needle Bearing

4 Removal

1. Remove oil seal from propeller shaft housing.

2. Remove roller bearing from propeller shaft housing by heating the housing with hot water.

3. Place shaft **(1)** through needle bearing.

4. Attach retainer A **(2)** to shaft groove **(3)** with raised surface of retainer facing bearing.

5. Slide guide B **(4)** and flange B **(5)** onto shaft and secure with washer **(6)** and nut **(7)**.

6. Tighten nut **(7)** until needle bearing releases from housing.

5 **Installation**

1. Attach retainer A **(2)** to shaft groove **(3)** with raised surface of retainer facing bearhg.

2. Coat new needle bearing with gear oll. Slide bearing onto shaft so bearing stamped surface faces retainer A **(2)**.

⚠ CAUTION

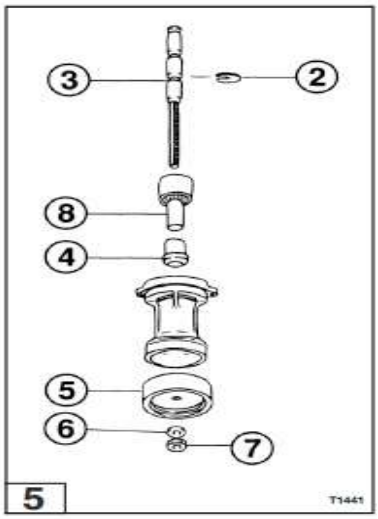
Stamped surface of needle bearing must face retainer or bearing could be damaged during installation.

3. Slide stopper B **(8)** and guide B **(4)** onto shaft and insert shaft in propeller shaft housing.

4. Slide flange B **(5)** onto shaft and secure with washer **(6)** and nut **(7)**.

5. Tighten nut **(7)** until stopper B **(8)** contacts flange B **(5)**.

6. Remove tools and verify needle bearing is fully seated in housing.

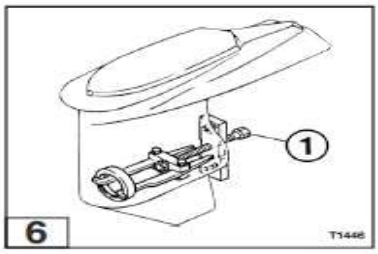


Bevel Gear A Bearing Outer Race

Removal

1. Install bevel gear A bearing puller assembly (Part No. 3A3-72755-0).

6 2. Tighten bolt (1) until bearing race releases from housing.



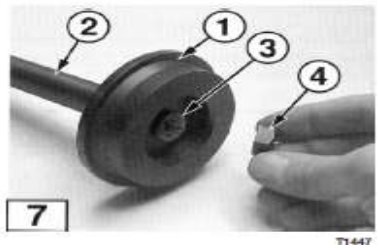
Installation

1. Secure gearcase horizontally in padded vice or other fixture so propeller shaft opening faces upward.

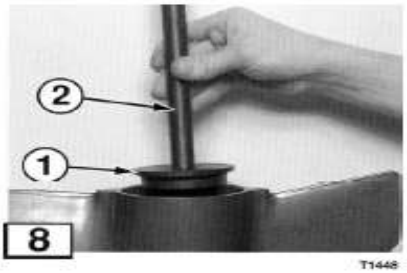
2. Verify bearing race seating surface in gearcase is clean and smooth.

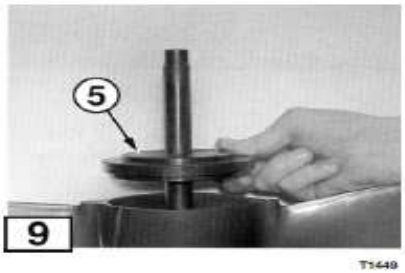
3. Apply specified gear oil to exterior of bearing race. Position race in gearcase so stamped surface faces closed end of gearcase.

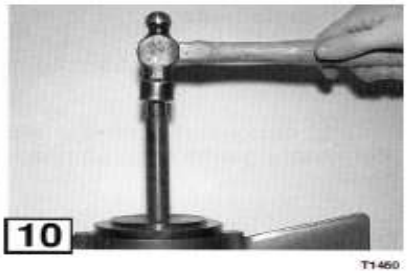
7 4. Attach plate **(1)** to threaded end of rod **(2)** using spring washer **(3)** and nut **(4)**. Tighten nut with wrench.



Tool	Part Number	Model
Bearing Outer Press Kit	3B7-72739-0	' 40



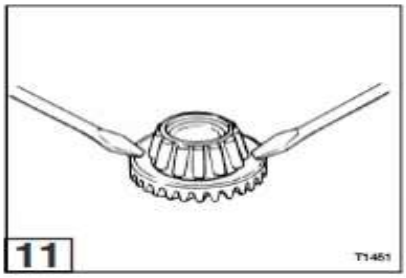




8 5. Insert rod **(2)** into gearcase so plate **(1)** is seated within the bearing race.

9 6. Slide guide **(5)** onto rod and seat into position on gearcase. Raised surface of guide must fit tightly within the circumference of the gearcase opening.

10 7. Fully seat bearing race in gearcase by hammering the rod end.

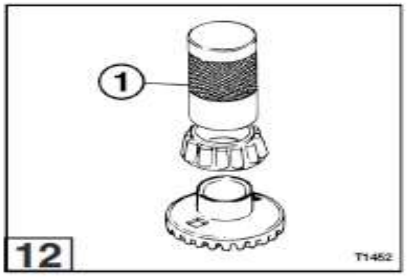


Bevel Gear A Roller Bearing

Removal and Installation

11 1. Insert screwdrivers in notches of bevel gear A and gently pry gear and bearing apart.

12 2. Use specified set tool **(1)** to press fit bearing onto bevel gear.



Tool	Part Number	Model
Set Tool, Bevel Gear A Bearing	3C8-72719-0	40

SECTION 7 – ELECTRICAL SYSTEM

General Precautions

Before performing any service work on the electrical system, read and understand the Service Safety section at the beginning of this manual.

Use the manufacturer and special tools as indicated during servicing of the electrical system.

Avoid electrical shock:

- Do not handle spark gap tester leads during performance testing.
- Do not touch ignition coils, exciter coil, pulser coils, or alternator coils while the engine is cranking or running.

Use the spark gap tester to prevent the engine from starting when performing static ignition performance tests.

Use caution when performing tests with the engine cover removed. Do not wear loose clothing or jewelry. Keep hair, hands, and clothing away from the flywheel and other moving parts.

After repairs are complete, make sure all ignition and electrical leads are properly routed and clamped in their original positions.

Replace locking fasteners when their locking feature becomes weak.
Use only factory replacement parts.

Always inspect and test the start-in-gear prevention system before returning engine to customer.

SERVICE SPECIFICATIONS

Special Torque Values

Description	Torque in-lb (ft-lb) N-m kg-m	Threadlocker
	40	
Spark Plug	(19 - 21) 25 - 29 2.6 - 3.0	—
Flywheel Nut	(87 - 101) 118 - 137 12 - 14	—

NOTE

Verify direction of flywheel nut rotation. Most are right-hand threads, however, some will have left-hand threads (past production models 9.9/15/18 and 40).

*Refer to Section 2 for Standard Torque Values chart.

Manufacturer Special Tools Required

None

General Precautions

Before performing any service work on the Raider electrical system, read and understand the Service Safety section at the beginning of this Service Manual. Use the manufacturer and special tools as indicated during servicing of the electrical system.

Avoid electrical shock:

- Do not handle spark gap tester during performance testing.
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Use caution when performing tests with the engine cowling removed. Do not wear loose clothing or jewelry. Keep hair, hands, and clothing away from the flywheel and other moving parts.

After repairs are complete, make sure all ignition and electrical leads are properly routed and clamped in their original positions.

Replace locking fasteners when their locking feature becomes weak.

Use only COTS factory parts (Mercury, Nissan or Tohatsu) or Raider replacement parts.

Always inspect and test the start-in-gear prevention system before returning engine to mission readiness.

Always disconnect battery when not in use.

General Equipment Required

Analog Multimeter, *Electronic Specialties® Model M-530 or equivalent*
Digital Multimeter, *Electronic Specialties® Model KD 3200 or equivalent*
Spark Gap Tester, *Stevens® S- 13C, S-48, or equivalent*
Digital Pulse Tachometer, 10 - 6000 RPM, *Electronic Specialties® Model 321 or equivalent*
Variable Load High Rate Discharge Tester, *Electronic Specialties® Model 700 or equivalent*
Hydrometer
Heat Gun
Torque Wrench, 0 - 150 in-lb [0 - 17N-m / 0 - 1.7kg-m]

Consumables Required

Dielectric Lubricant, *Permatex® Dielectric Tune-Up Grease*
Battery Spray Protector, *Permatex® Battery Protector and Sealer*
Low Temperature Lithium Grease
Genuine Grease or Equivalent Friction Surface Marine Grease
Threadlocker, *Loctite® 243*
Isopropyl Alcohol
Cleaning Solvent
Thermomelt Stik, 125°F [52°C] and 163°F [73°C]
Electrical Shrink Fit Tubing, various diameters

Electrical System - Overview

Ignition Type: Flywheel Magneto Capacitor Discharge
Ignition Timing: Before Top Dead Center (BTDC) – 25 Degrees ATDC – 2 Degrees
Spark Plug: Pulstar – Model SBE 1/10
Spark Plug Gap: .033 (No larger than .050)
Battery: Part No. 365-265-001 (Raider sealed Lithium Iron – 265 CA)
Alternator: 12V 80W
Charging Performance @ 5500 – 5 Amps
Ignition Coil Resistance – Primary Coil: 0.2 – 0.3 KOhms
Secondary Coil: 4.1 – 6.1 K Ohms
CD Unit Output (Cranking): 198-220 DVA
Exciter Coil Output (Cranking): 100 DVA Mim
Pulser Coil Output (Cranking): 4.75 – 5.0 DVA
Coil Resistance – Exciter Coil: 130-195 Ohms
Alternator W-Y: Y-W 0.65 - 0.98
Y-B 0.31 – 0.47
W-B – 0.37 – 0.55

Electrical Connectors

When you replace electrical components or perform diagnostic tests, you must disconnect electrical connectors in many instances.

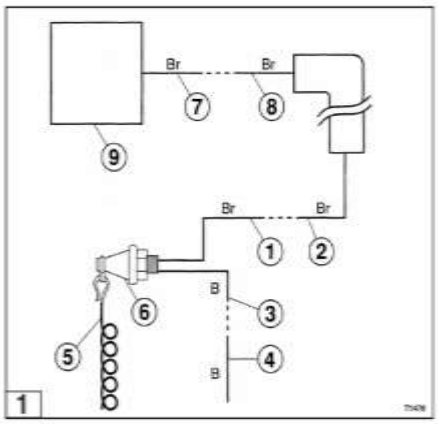
The following discussion will help you recognize connectors in electrical drawings and show you how to disconnect and connect them.

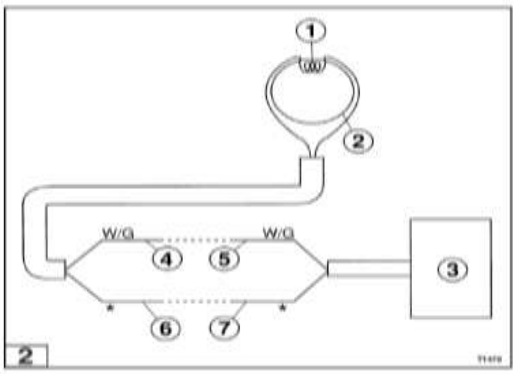
Electrical Connector Drawings

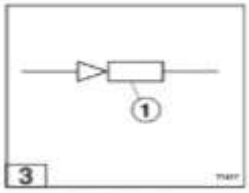
In most of the electrical drawings in this section, the physical shape of electrical connectors has been eliminated to clarify testing procedures.

1 A typical electrical drawing illustrates several connectors. Items **(1)**, **(2)**, **(3)**, **(4)**, **(7)** and **(8)** are terminals that are located inside of electrical connectors. The dashed line between two terminals [e.g., between terminal **(7)** and **(8)**] means that they are a part of the same connector but have been disconnected for testing.

Note that Terminal **(7)** is directly connected to the CD Unit **(9)** (no connectors between the terminal and CD Unit). When you disconnect an electrical connector to test a component, it is very important that you disconnect the FIRST CONNECTOR. Terminals **(1)**, **(3)** and **(7)** are examples of how the first connector is illustrated.







2 Special cases are the connectors used to test components located on the coil plate assembly. For testing purposes, the first connector is located at the far end of the cable (away from the coil plate assembly).

Bullet Connectors

NOTE

3 *Bullet connectors **(1)** are shown like this in electrical drawings.*

Disconnecting Bullet Connectors

1. Carefully examine the connector to determine which end is removable and which end is fixed. Typically the insulation surrounding the removable end is tapered so it fits inside of the insulation for the fixed end.

4 2. Grasp the fixed end **(1)** of the connector and carefully pull the removable end **(2)** straight out without twisting or bending it.

NOTE

Never twist or bend bullet connectors or damage to the connectors will occur. Always PULL these connectors apart.

Electrical Cable Color Codes

Electrical cables have color coded conductors so you can locate the correct conductor during troubleshooting and repair procedures. All conductor colors are in capital letters in this manual.

Some conductors have a background color and a different color stripe that runs the length of the conductor. These conductors are designated as follows:

A/B
Where A = Background Color
B = Stripe Color

Example:
BLACK/WHITE
This conductor has a BLACK background with a WHITE stripe.

Electrical Drawings

All electrical drawings shown in this manual have been simplified to clarify the circuit that is being tested. They represent typical configurations and may not look exactly like the electrical wiring for your engine. Complete electrical schematics are provided in the Outboard Motors Service Data publication.

Troubleshooting - Electrical

The troubleshooting chart lists common engine symptoms related to problems with the electrical system. It also indicates specific malfunctions in the electrical system which may be causing a problem so it can be isolated more effectively. Before beginning major troubleshooting on the electrical system, perform the following operations:

- Check the following electrical connections and make sure they are secure and free of corrosion:
  - Battery cables
  - Starter solenoid wiring
  - Starter motor wiring (including ground connection)
  - Spark plug leads
  - Ignition circuit wiring
  - Stop circuit wiring
  - Charge circuit wiring
- Make sure shift lever or remote control lever operates freely.
- Attach lanyard to emergency stop switch, see Section 2.

Ignition System

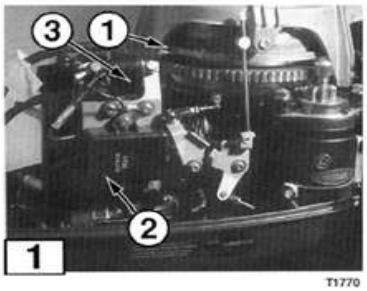
SYMPTOM / CHECKS	Cranks but will not start	Wilt not start and pops or backfi res	Starts but stops immediately	Low or high speed miss	Poor accel-eration, low top end RPM	Engine will not shut off
Faulty stop circuit - see Test 2 - stop Circuit Test, this section						●
Faulty ignition system - see Ignition System Performance Testing, this section		●		●	●	●
Faulty spark plug(s) - See Section 2	●		●	●	●	
Incorrect ignition timing or carburetor synchronization - See Section 2		●	●	●	●	

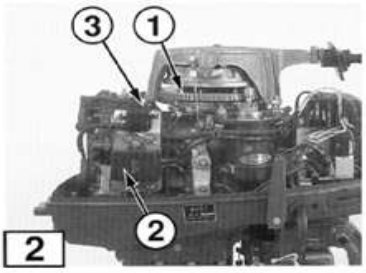
Starting System

SYMPTOM / CHECKS	Will not crank
Faulty coil pack	●
Faulty main key switch	●
Not in Neutral, defective Neutral switch	●
Faulty battery, starter solenoid/ starter motor cable	●
Faulty starter solenoid	●
Faulty starter motor: - Faulty brushes - Damaged pinion assembly	●

Charging System

SYMPTOM / CHECKS	Battery does not maintain charge / recharges
Wiring/Connector	●
Shorted or faulty alternator coil	●
Faulty recitier/regulator	●
Faulty charge circuit wiring	●

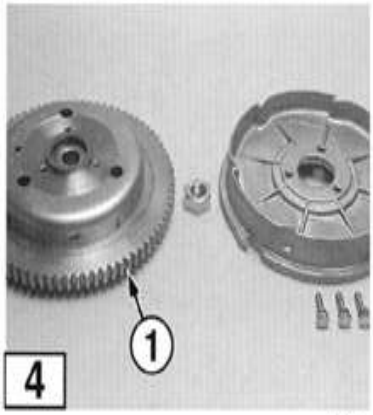




DESCRIPTION OF OPERATION

Ignition System

1 2 3 The ignition system consists ofthe magneto **(1)**, Capacitive Discharge (CD) unit **(2)**, ignition coil **(3)**, main key switch **(4)** and emergency stop switch **(5)**. The purpose of this system is to provide an electric spark inside each cylinder at the precise moment needed by the combustion chamber.



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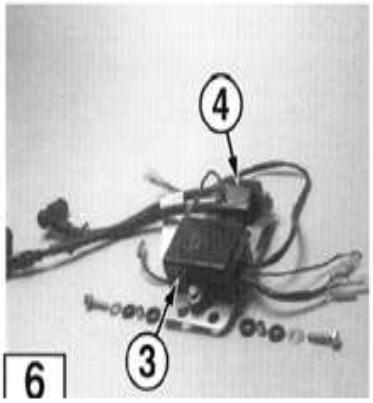
Magneto

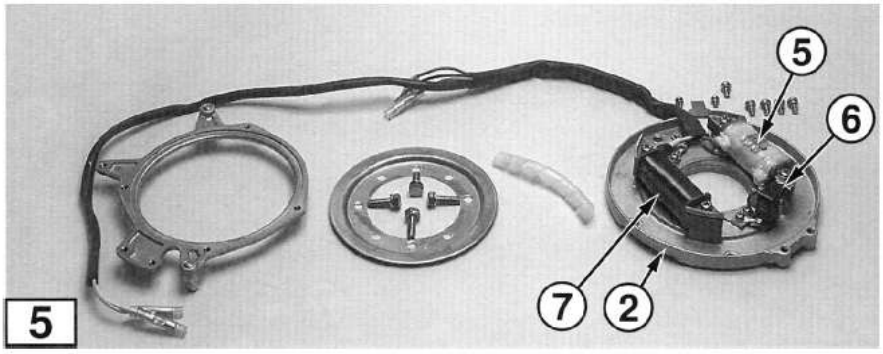
4 5 6 7 The electrical system consists of a flywheel **(1)**, coil plate assembly **(2)**, a CD unit **(3)** and an ignition coil **(4)**. The 1/2 cylinder engines are comprised of seven basic electrical systems. The following chart demonstrates not only the differences but the similarities:



Raider has: (1) CD Unit; (2) Coil Plate; (3) Exciter Coil; (4) Ignition Coil; (5) Pulser Coil; (6) Alternation/Lighting coil.

4 Flywheel

Mounted radially inside the flywheel **(1)** are a number of high performance ferrite magnets. As the flywheel rotates, the magnets pass in front of the coils (exciter / alternator) to produce voltage in the coils.



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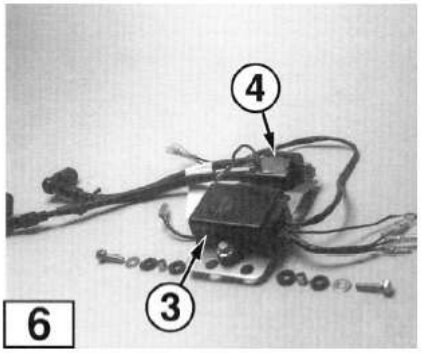
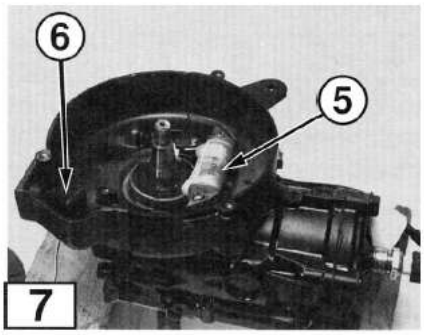


T1983

5 7 Coil Plate

The coil plate is a part to which exciter coil, pulser coil and alternator coil are attache .) The coil plate is rotated for ignition advance.



T2212

5 7 Exciter Coil

The exciter coil **(5)** consists of many windings of wire wrapped around a metal lamination. Once the flywheel exceeds a minimum cranking RPM, the lines of force from the ferrite magnets contained within the flywheel cut through the exciter coil windings. This will produce about 100 DVA or over(peak voltage) at cranking speed. A minimum of 100 DVA(peak voltage) at cranking speed must be detected. The output of the exciter coil provides power to the CD Unit.

5 7 Pulser Coil

The pulser coil **(6)** consists of an iron core with numerous windings of a wire wrapped around it. The flywheel is equipped with a metallic cam called an interrupter molded into it. When the interrupter passes in close proximity to the pulser coil, the permanent magnet's lines of force collapse momentarily. At cranking speed this produces a 4.75 to 5.0 DVA signal in the coil. A minimum of 3 DVA must be detected during testing.

The output voltage from the pulser coil is used to control a small electronic switch (SCR) located inside the CD Unit. When the CD Unit receives an output from a pulser coil, it directs an output, approximately 220 DVA, to the appropriate ignition coil primary.

5 Alternator/Lighting Coil

The larger 1/2 cylinder engines (9.9-40) are provided with an alternator coil **(7)** mounted on the coil plate which may be used to power a lighting circuit and/or recharging circuit if equipped with this option. An Alternator/Lighting Coil is available as an add-on to the 5 and 8/9.8 models.

6 CD Unit

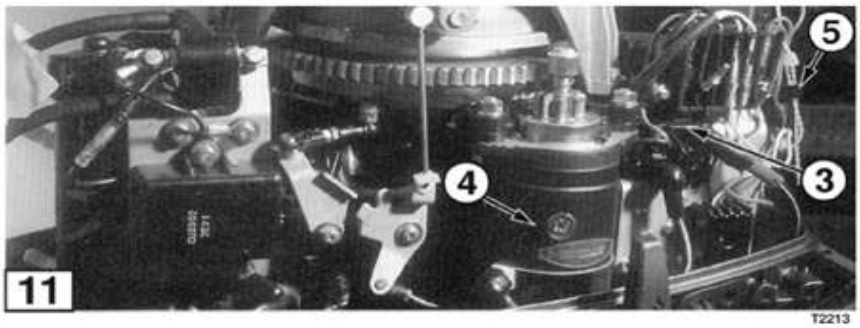
The CD Units incorporate a printed circuit board (PCB) encased in a black resin housing to protect the circuitry from water and vibration. Major components include a diode used to rectify current generated by the exciter coil, a capacitor which charges the voltage supplied, a thyristor which serves as a breaker and a zener diode used to control the thyristor. Additional components such as resistors and SCR's are also provided depending upon the model.

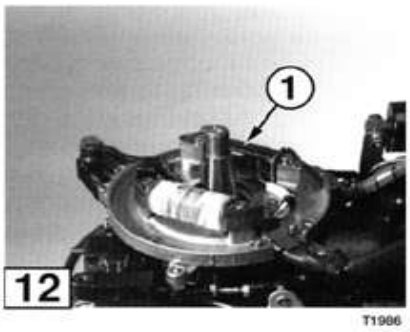
6 Ignition Coil

Each ignition coil **(4)** consists of two windings or wire wrapped around a compacted ferrite material. The coil has a primary and secondary terminal connection and a ground plate. Through mutual induction, the ignition coil transforms the output from the CD Unit to as much as 20,000 - 30,000 volts to fire the spark plug. The ignition coil is generally adjacent to the CD Unit and attached to its mounting bracket, with the exception of the 8/9.8 CD Unit where the ignition coil is molded as together as part of the CD Unit.

Main Key Switch and Emergency Stop Switch

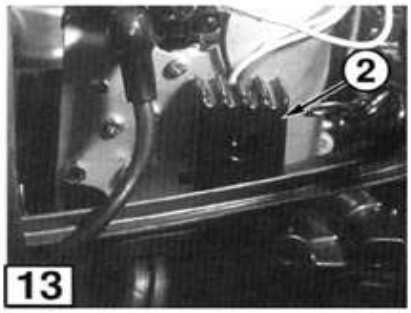
The emergency stop switch is connected to the CD Unit through an engine wiring harness. When lanyard is removed from the emergency stop switch, an input to the CD Unit is grounded. This deactivates the CD Unit and the engine shuts down. If the engine is fitted with the Remote Control feature, pressing the stop switch on the Remote Control Unit will also ground the CD Unit.





Starting System - Optional Electric Start

11 The starting system consists of the battery, main key switch, neutral start switch, starter solenoid **(3)**, starter motor **(4)** and 15 A engine fuse **(5)**. When the main key switch is in the START position, and the start contacts of the neutral start switch are closed, power is sent to the starter solenoid, energizing it. When the starter solenoid is energized, a connection between the positive terminal of the battery and the starter motor is provided. The connection between the starter motor and ground completes the circuit. The fuse opens if the coil circuit of the starter solenoid shorts or overloads.



Charging System

12 **13** The charging system consists of the alternator coil set **(1)**, rectifier **(2)**, 10 or 15 A engine fuse, and the battery. When the flywheel is turning approximately 1500 RPM or higher, the alternator coil set provides alternating current (AC) voltage to the rectifier/regulator. The rectifier transforms the AC voltage into direct current (DC) voltage.

Battery Care and Maintenance

⚠⚠ **WARNING**

The Raider 40 outboard motor has a battery located internal, located under the cowling. This battery is a fully sealed lithium-iron battery shown below.

The battery has one plug with two connectors (+) and (-). It is constructed that it can be plugged into the mating connector one way.

Battery Size: Length: 5.83 inches x Width 2.63 x Height 4.13 inches
Weight: 2.5 pounds
Cold Cranking Amps: 270
Polarity: (+) (-)
Charging System: Output of 13.1 Volts
Lithium-iron: 18 Ah PbEq 12V; eq, "L" polarity, Sealed
Fastening System: Slot in base of battery receptacle; single screw at top.

General Procedures - Inspection

Inspect battery case for damage
Inspect connector for corrosion
Inspect cables
Check battery mounting

Cleaning

Disconnect and remove battery
Clean battery, connectors - Wash with water and let dry
Place dielectric grease on both sides of connector
Replace battery, tighten screw.
Do not plug in connector until ready for use

⚠ CAUTION

All cranking output tests must be performed with spark plugs installed and torque in the cylinder head. If necessary to remove the spark plugs, be sure to keep the spark gap tester away from open spark plug holes

⚠ CAUTION

Avoid electrical shock:

- **Do not handle spark gap tester heads during performance testing.**
- **Do not touch ignition coils, exciter coil, pulser coils, or alternator coils while the engine is cranking or running.**

⚠ CAUTION

Use proper precautions when performing tests with the engine cover removed. Do not wear loose clothing or jewelry. Keep hair, hands, and clothing away from the flywheel and other moving parts.

When repairs are complete; make sure all ignition and electrical Leads are properly routed and clamped in their original systems And the in-gear prevention system must be tested prior to delivering to units.

Ignition System Performance Testing

Ignition Performance Testing is divided into two sections. The first section consists of a flow chart. This chart presents the correct sequence of performing ignition system performance tests to effectively and efficiently check for problems in starting and running the engine. Follow the steps in the order listed until the problem is resolved and the ignition system meets specifications while the engine is running.

The chart references specific performance tests that must be completed to resolve each problem. These tests are described in detail in the section which follows the flow chart.

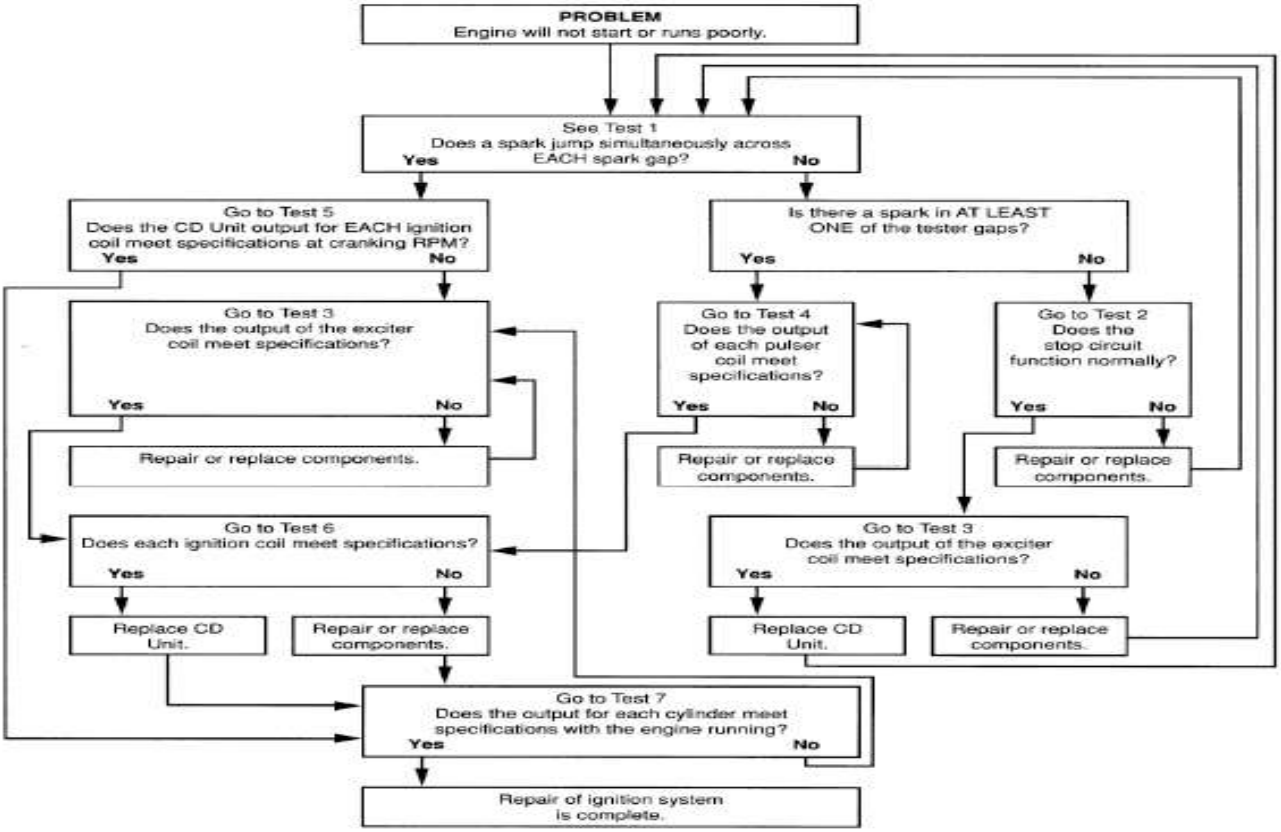
The performance tests, identified as Test 1 through Test 7, contain specific instructions for testing and servicing various ignition system components. Use this section to perform the tests correctly in accordance with the factory recommendations.

NOTE

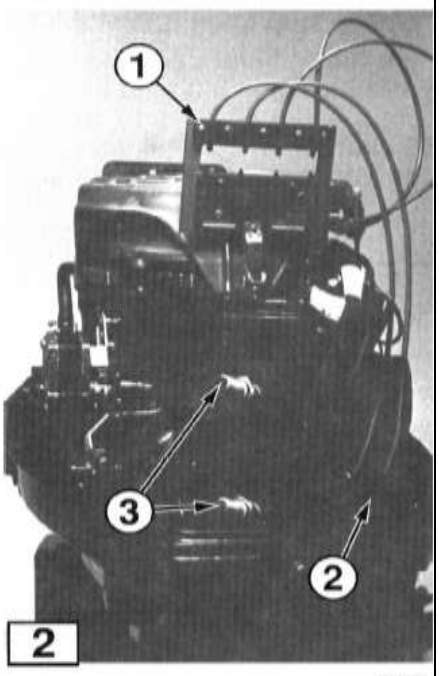
After you complete each performance test refer back to the flow chart for the next step. You must follow the flow chart until the ignition system meets specifications while the engine is running. The only way to be sure that you have uncovered and repaired all ignition system problems is to follow these procedures in a systematic fashion.

If you have problems stopping Raider outboard proceed directly to test 2 – Stop Circuit Test

Ignition System Performance Testing Flow Chart



Test 1 - Spark Test



NOTE

Make sure all electrical terminals are connected during this test except those that are noted in the test procedure.

Check for continuity between chassis ground and the ground connection for the magneto plate, CD Unit, and ignition coils before conducting the following procedure.

1. Remove all spark plug leads, and spark plugs **(3)**.

2 2. Adjust spark gap tester **(1)** to 7/16 in [11 mm].

3. Connect each spark plug lead to spark gap tester **(2)**.

4. Secure spark gap tester to a clean ground on engine block.

⚠⚠ WARNING

To avoid possible shock hazard, do not handle ignition coils or spark gap tester during cranking tests.

NOTE

To prevent possible arcing of high voltage, route tester leads at least 2 in [51 mm] from any metal surface.

Ground unused test leads to a clean engine ground.

5. Attach lanyard to emergency stop switch,

6. Crank engine.

A spark should jump across the gap for each cylinder and alternate from one gap to another.

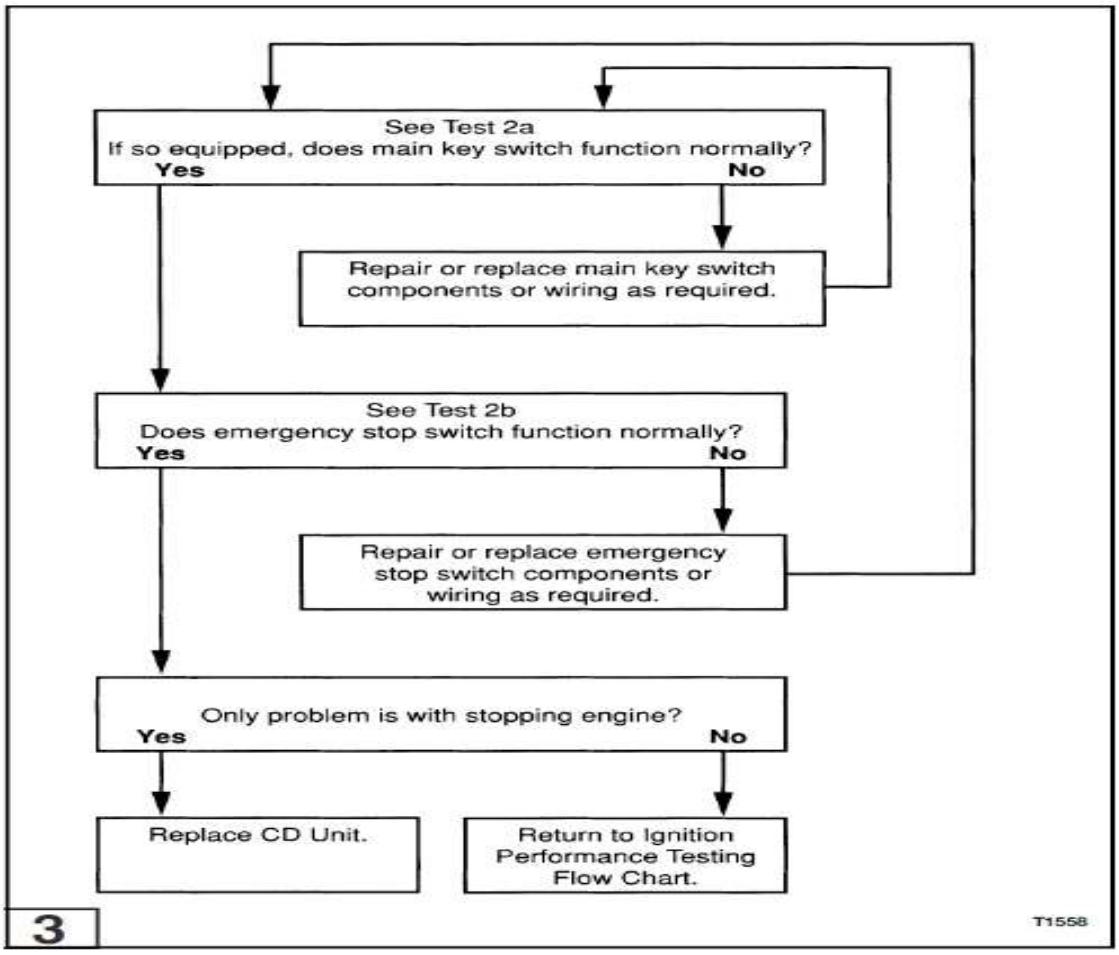
7. Reconnect all wires disconnected during test.

8. Return to Ignition System Performance Testing Flow Chart.

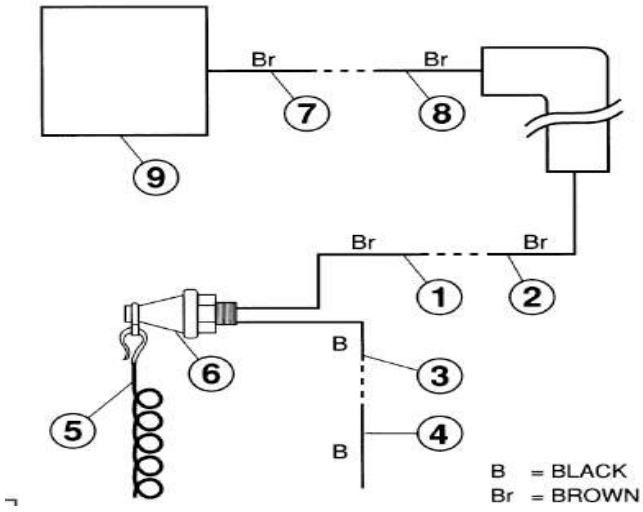
Test 2 – Stop Circuit Test

Stop circuit malfunction can cause Raider not to start or preventing it from stopping. Several component failures can cause the stop circuit to malfunction. Use this flow Chart to isolate and repair all component failures.

Note: After you complete each stop circuit test, refer back to this flow chart for the Next step.



Test 2b. Stop Circuit Emergency Stop Switch Test



The emergency stop switch test is used to determine whether it is functioning normally.

Note: Make sure all electrical terminals are connected during this test except those that are noted in the test procedure. Check for continuity between chassis ground and the ground connection for the magneto plate, CD Unit, and ignition coils before conducting the following procedure. All continuity tests must be conducted or you may damage the meter.

Remove plug from Raider battery.

6 2. Disconnect emergency stop switch terminals **(1)**, **(2)**, **(3)** and **(4)**.

6 3. Set analog multimeter to check continuity. Connect one meter lead to terminal **(1)** and the other to terminal **(3)**.

6 4. Attach lanyard **(5)** to emergency stop switch **(6)**, meter must not show continuity. If it does, replace emergency stop switch.

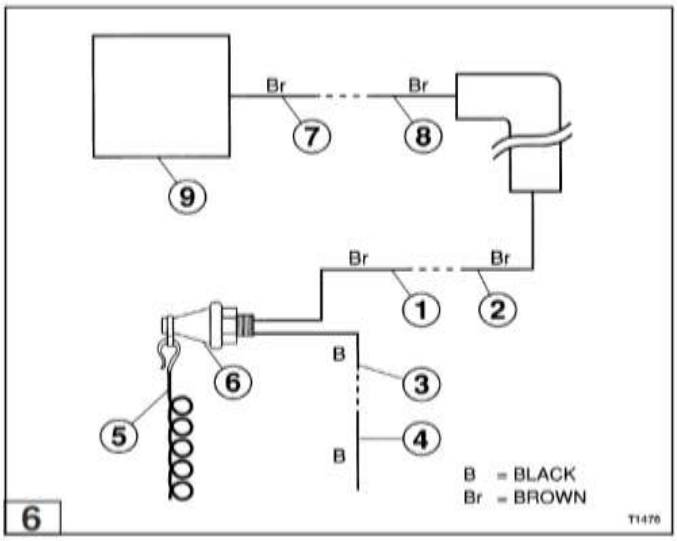
6 5. Remove lanyard **(5)** from emergency stop switch **(6)**, meter must show continuity. If not, replace emergency stop switch.

6 6. Disconnect CD Unit **(9)** terminals **(7)** and **(8)**.

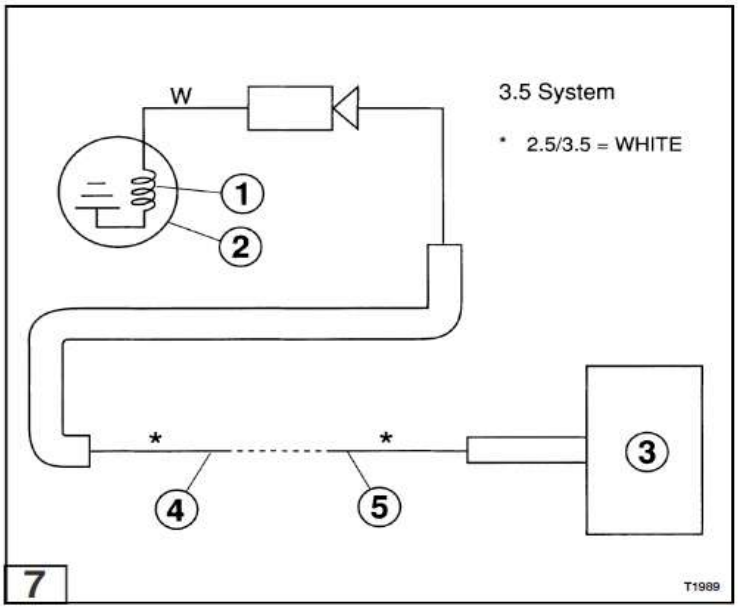
6 7. Connect one meter lead to terminal **(8)** and the other to terminal **(2)** and check continuity. If the meter does not show continuity, replace the cable.

6 8. Connect one meter lead to terminal **(8)** and the other to a clean engine ground. If the meter shows continuity, replace the cable.

9. Reconnect all wires and return to -Test 2 - Stop Circuit Test flow chart.



Test 3 – Exciter Coil Test



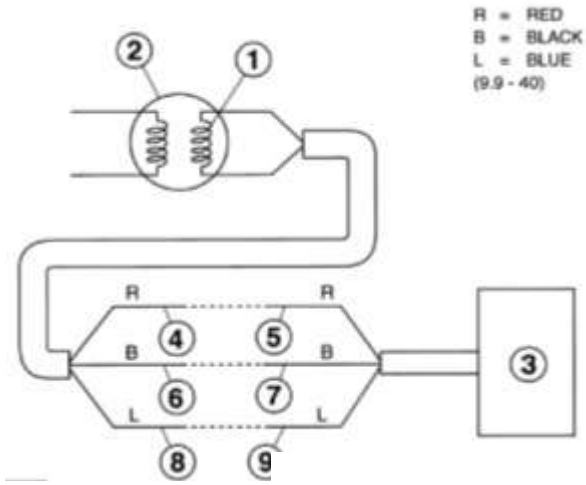
NOTE

Make sure all electrical terminals are connected during this test except those that are noted in the test procedure.

Check for continuity between chassis ground and he ground connection for the magneto place, CD Unit, and ignition coils before conducting the following procedure.

Reference the following electrical drawings for the exciter coil test. The pulser and alternator coils have been removed from both illustrations for clarity.

Test 3 – Exciter Coil Test



The exciter coil test is used to determine the output voltage, in DVA, from the exciter coil located on the coil plate assembly (2) to the CD Unit while you are cranking the engine.

Disconnect terminals 4, 5, 8 and 9.

Set the digital multimeter to ohms and connect the leads between the following Terminals to read the resistance of the exciter coil:
Connect multimeter between 4 and 8 terminals.
The meter should read 200 – 300 ohms +/- 25%
If the resistance is not within the indicated range, replace the exciter coil set. See Ignition System Repair Procedures – Exciter Coil. After repairs are made, return to Ignition System Performance Flow Chart. If the resistance is within indicated range, proceed to the next step.
Connect multimeter between these terminals 4 and 8; set the analog multimeter to "400" on the "DVA" scale. Connect the RED tester lead to terminal "4" and BLACK tester lead to termanal "8".
Attach lanyard to emergency stop switch.
Crank Raider outboard engine.
At cranking RPM, the tester should show the following results: 100 DVA Minimum.
If the exciter coil test results are not within the acceptable range, replace the exciter coil set. See Ignition System Repair Procedures Exciter Coil.

Reconnect all wires disconnected during test.

Return to flow chart.

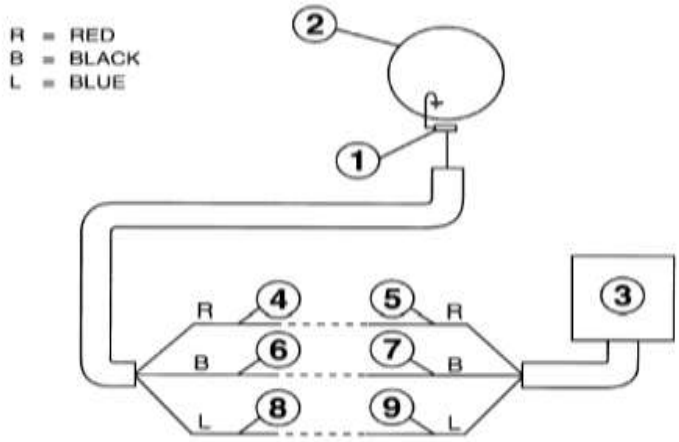
Test 4. Raider Pulser Coil Test

NOTE

Make sure all electrical terminals are connected during this test except those that are noted in the test procedure.

Check for continuity between chassis ground and the ground connection for the magneto plate, CD Unit, and ignition coils before conducting the following procedure.

Reference the following electrical drawings for the Raider pulser coil test. The exciter and alternator coils have been removed from both illustrations for clarity.

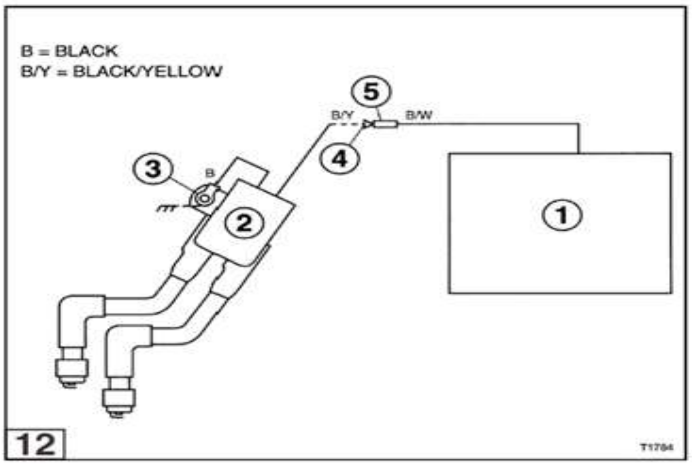


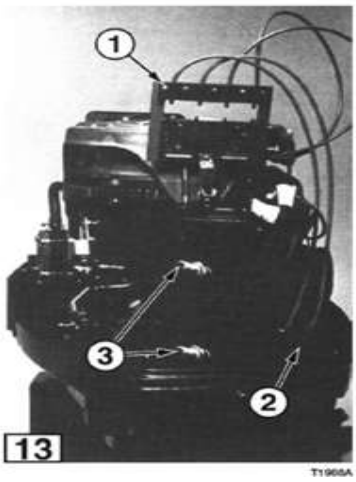
The Raider pulser coil test is used to determine the output voltage, in DVA, from the pulser coil (1) located on the coil plate assembly (2) to the CD unit (3) while you are cranking the engine.

Disconnect the following terminals: 4, 5, 6, 7, 8 and 9
Set the digital multimeter to ohms and connect the leads to test the resistance of the coil.
Connect multimeter between 6 and 8 terminals.
Multimeter should indicate 30 – 45 ohms +/- 25%
If the resistance is not within the indicated range, replace the Raider pulser coil. See Ignition System Repair Procedures – Pulser Coil. After repairs are made, return to Ignition System Performance Testing Flow Chart.
If the resistance is within the indicated range, proceed to the next step.
Set the analog multimeter to “20” on the “DVA” scale.
Insert the banana plug of the RED tester lead into the meter connection labeled “DVA” and the banana plug of the BLACK tester lead into the meter connection labeled “COM.”
Black lead to Terminal 6 and Red Lead to Terminal 8.
Attached lanyard to emergency stop switch.
Crank engine.

At the cranking RPM; the tester should show the following results – minimum of 3.0 DVA
If the pulser coil test results are not within the acceptable range, replace the pulser coil set. See Ignition System Repair Procedures – Pulser Coil.
Reconnect all wires disconnected during test.

Test 5. CD Unit Output test – Cranking RPM





NOTE

Make sure all electrical terminals on Raider are connected during this test except those that are noted in the test procedure.

Check for continuity between chassis ground and the ground connection for the magneto plate, DC Unit and Ignition Coil before conducting the following procedure.

Reference the electrical drawings for the CDE Unit Output Test – Cranking RPM.

[12] The CD Unit Output Test – Cranking RPM is used to determine the output voltage, in DVA, from the CD Unit (1) to the ignition coil (2) while you are cranking the engine.

1. Remove two spark plug leads and remove spark plugs (3)

[13] 2. Adjust spark gap tester (1) to 7/16 inches - 11 mm

3. Connect each spark plug lead to spark gap tester (2)
4. Secure spark gap tester to a clean ground on engine block.
5. Secure spark plug gap tester to a clean ground on engine block.

⚠⚠ **WARNING**

To avoid possible shock hazard, do not handle
Ignition coils or spark gap tester during cranking tests.

NOTE
To prevent possible arcing of high voltage, route tester leads
At least 2 inches from any metal surface.

Ground unused test leads to a clean engine ground.

5. Set the tested to “400” on the “DVA” scale.

Insert the banana plug of the RED tester head into the meter connection labeled “DVA” and the banana plus of the BLACK tester lead into the meter connection labeled “-COM.”
Connect the BLACK tester lead to terminal (3).

[12] 8. Carefully slide the RED tester into the bullet connector (terminal 4) sleeve until it makes contact with the terminal.

NOTE

DO NOT disconnect the CD Unit output connector
(terminals (4) and (8). Damage to the CD Unit may result.

9. Attach lanyard to emergency stop switch.

10. Crank engine

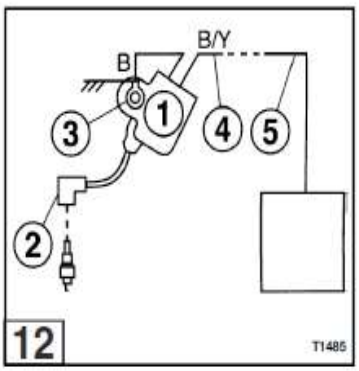
At cranking RPM, the tester should show the following result for each CD Unit output – 100 DVA minimum.

If the test results for any CD Unit output is not within acceptable range, replace the CED Unit. See Ignition System Repair Procedures – CD Unit.

Reconnect all wires disconnected during test.

Return to flow chart.

Test 6 - Ignition Coil Tests



NOTE

Make sure all electrical terminals are connected during this test except those that are noted in the test procedure.

Check for continuity between chassis ground and the ground connection for the magneto plate, CD Unit, and ignition coils before conducting the following procedure.

14 The following tests check the resistance of the primary and secondary windings in each ignition coil **(1)**.

1. Remove spark plug lead **(2)**.

2. Set digital multimeter to ohms.

3. Disconnect terminals **(4)** and **(5)**.

4. Connect one tester lead to terminal **(3)** and the other terminal **(4)**.

5. The meter should indicate the following readings for the primary winding.

Repeat readings for each ignition coil: 0.2 – 0.3 ohms +/- 25%

6. If primary winding for any ignition coil is not within the acceptable range, replace the ignition coil. See Ignition System Repair Procedures - Ignition Coil. After repairs are made, return to Ignition System Performance Testing Flow Chart.

If the primary windings are within the acceptable range, proceed to the next step.

7. Connect one tester lead to terminal **(3)** and the other to spark plug lead (cap) [terminal **(2)**].

8. The meter should indicate the following readings for the secondary winding.

4.1 – 6.1 kohms +/- 25%

9. If secondary winding for any ignition coil is not within the acceptable range, replace the ignition coil. See Ignition System Repair Procedures - Ignition Coil. After repairs are made, return to Ignition System Performance Testing Flow Chart.

10. Reconnect all wires disconnected during test.

11. Return to flow chart.

15 **Test 7 - Output Tests - Engine Running**

⚠ CAUTION

The following tests must be performed with correct test propeller and with the engine in a test tank. Note that some performance problems cannot be duplicated in a test tank, in these cases the tests must be conducted with the engine mounted on a boat and operated in open water.

NOTE

Make sure all electrical terminals are connected during this test except those that are noted in the test procedure.

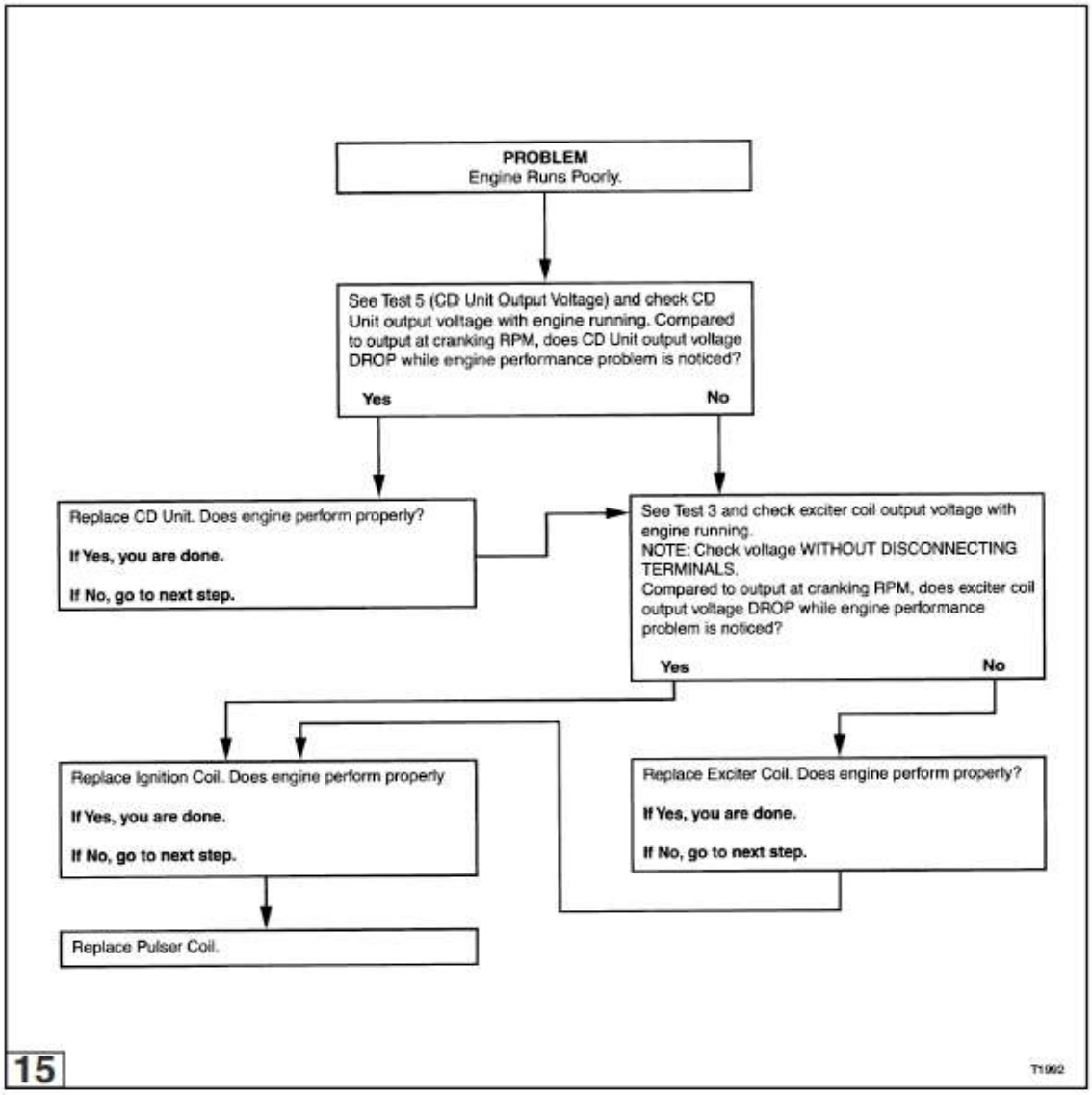
Check for continuity between chassis ground and the ground connection for the magneto plate, CD Unit, and ignition coils before conducting the following procedure.

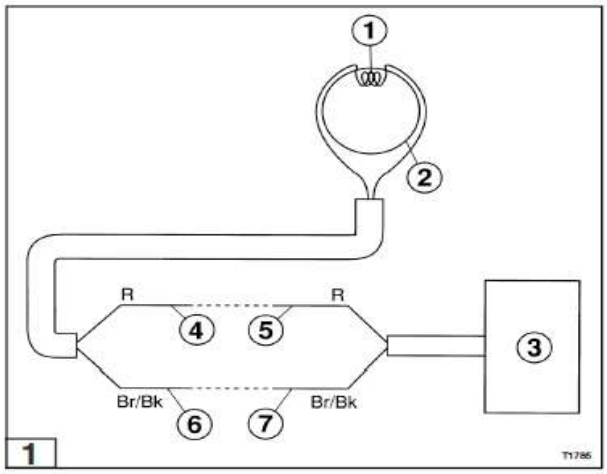
These series of tests are designed to efficiently find faulty ignition components that can cause an engine to run poorly. Use the flow chart to systematically eliminate the possible causes to the problems.

The tests assume that:

- The engine starts.
- Tune-Up Procedure has been performed, see Section 2.
- Ignition Timing and the Carburetor Synchronization Procedure has been performed, see Section 2.
- Engine is at operating temperature.
- Tests are performed with engine running in forward gear.
- Tachometer is installed.

15 Output Tests - Engine Running - Flow Chart





⚠⚠ WARNING

Disable ignition system, by disconnecting exciter coil terminals (4), (5), (6), (7), to prevent accidental engine startup during removal and replacement of the flywheel.

⚠ CAUTION

Flywheel is under high torque and requires the use of special tools for removal and installation. Failure to use the specified tools can result in injury or damage to the flywheel or coil plate electrical components.

⚠ CAUTION

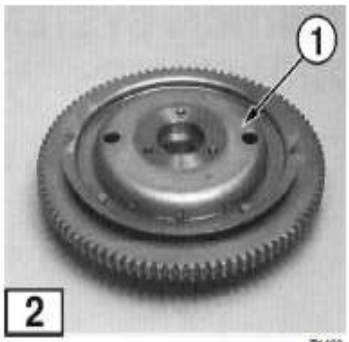
The force needed to loosen and tighten the flywheel nut requires flywheel be removed and installed with engine mounted and secured on an engine stand.

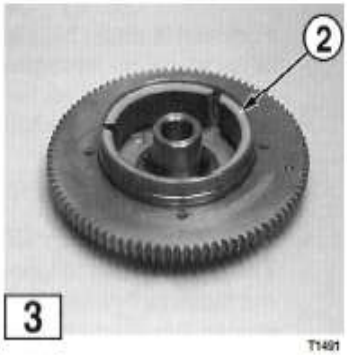
⚠ CAUTION

Use proper precautions when performing tests with the engine cover removed. Do not wear loose clothing or jewelry. Keep hair, hands, and clothing away from the flywheel and other moving parts.

⚠ CAUTION

When repairs are complete, make sure all ignition and electrical leads are properly routed and clamped in their original positions and the start-in-gear prevention system must be tested before returning engine to customer.





Flywheel

Replacing the exciter coil or coil plate assembly requires the removal of the flywheel, see Section 4, Flywheel, for the proper procedure.

NOTE

Flywheel magnets must be of a particular strength in order to run the ignition system. Weak magnets can cause low ignition voltage which may affect engine performance. Flywheels seldom go bad and would only be replaced as a last resort in solving an ignition problem.

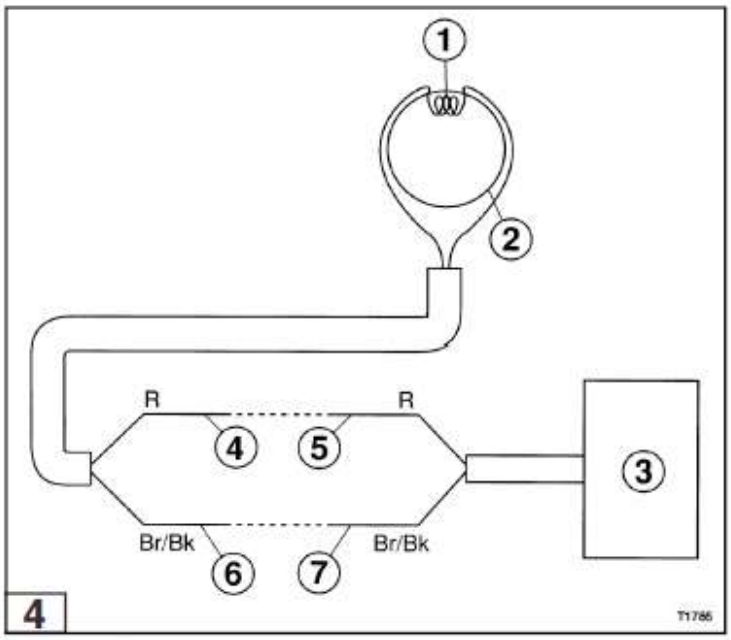
2 3 Carefully inspect flywheel **(1)** for cracks, chips, and worn taper after it is removed. Also inspect the magnets **(2)** for cracks and chips and make sure they are firmly attached to the flywheel.

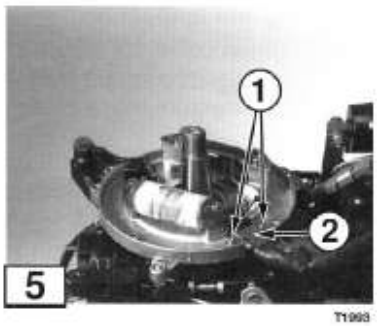
Exciter Coil

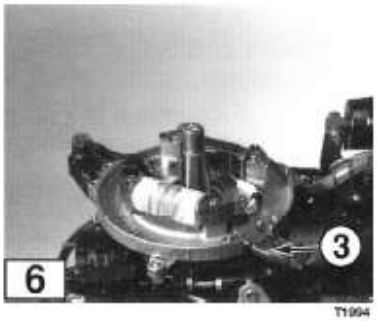
NOTE

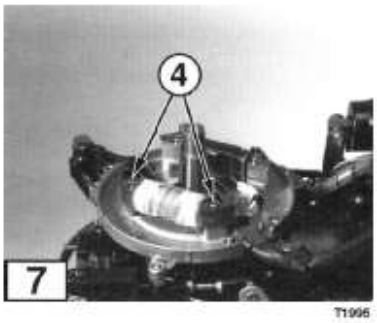
Disconnect negative battery cable from battery before removing exciter coil.

This procedure assumes exciter coil is available as a separate replaceable component. Some engine configurations might require replacement of entire coil plate assembly. Check current Parts Catalog for availability.









Removal

1. Remove the flywheel.

4 2. Disconnect terminals **(4)**, **(5)**, **(6)** and **(7)** for exciter coil **(1)** connectors. Note that these terminals interconnect cable from coil plate assembly **(2)** to cable from CD Unit **(3)**:

5 3. Remove coil plate assembly cable clamp screws **(1)** and cable clamp **(2)**.

6 4. For models 9.9 / 15 / 18 / 25 / 30 / 40 ONLY: Carefully slit coil plate assembly cable shield **(3)**.

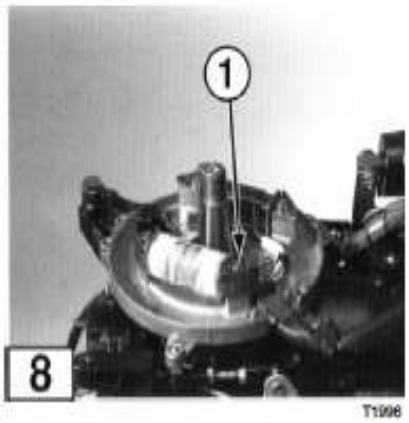
NOTE

Make sure you don't cut electrical conductors inside of coil plate assembly cable when you slit cable shield.

7 6. Remove exciter coil screws **(4)** and exciter coil from the mounting bracket.

Cleaning and Inspection

8 Clean coil plate assembly, upper main bearing seal **(1)**, set ring, ignition timing link, alternator coils, pulser coils, coil leads, and coil connectors with isopropyl alcohol as required.



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Check for the following and repair or replace as required:

- Bent, chipped, cracked, or corroded coil plate assembly.
- Coil leads for integrity, cut or cracked insulation, and damaged connectors.
- Broken or bent alternator coil Laminations damaged alternator coil windings and missing alternator coil screws.
- Broken, cracked, or misaligned pulser coils and missing pulser coil screws.

9 • Free motion of ignition timing link (1). Repair, adjust, and lubricate as needed, see Section 2.

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Installation

Install in reverse order of removal.

NOTE

Use threadlocker on screw threads before installing screws.

Use a length of shrink tube to fabricate a new coil plate assembly cable shield as required. Inside diameter of shrink tubing must be large enough to pass over the largest connector.

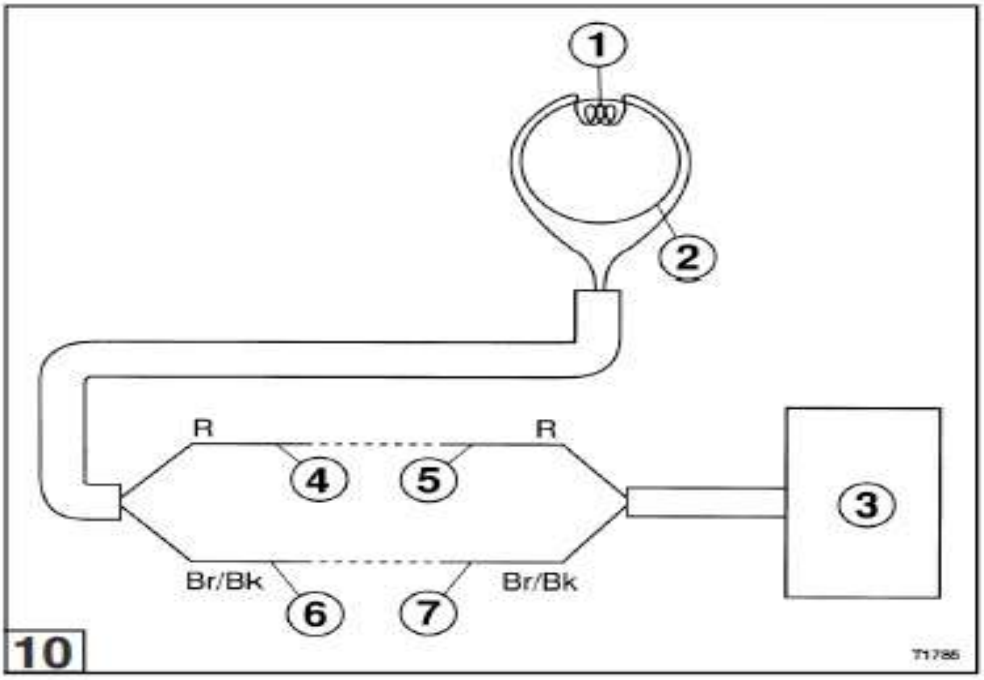
Coil Plate Assembly

Removal

1. Remove the flywheel.

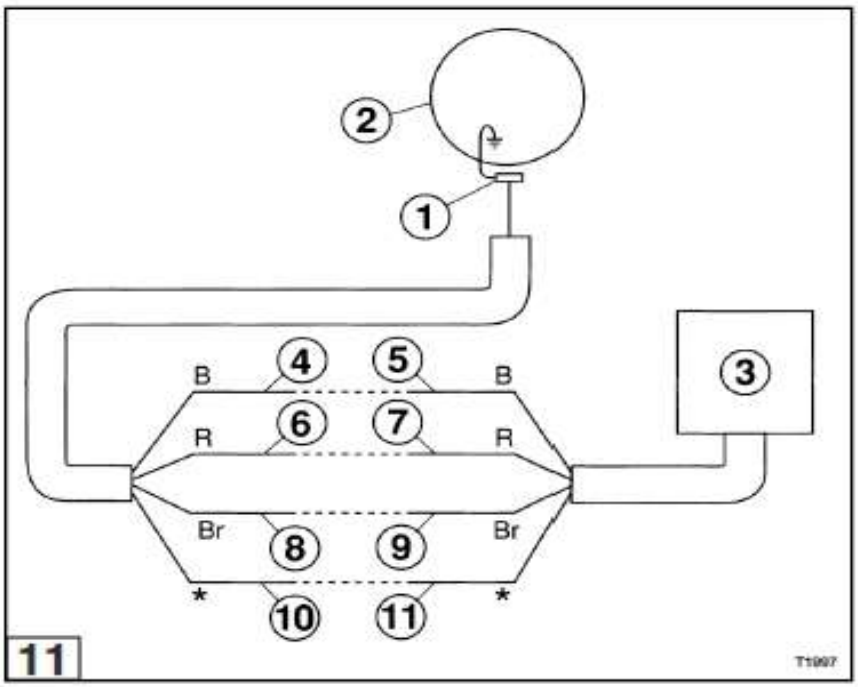
2. Disconnect the following terminals:

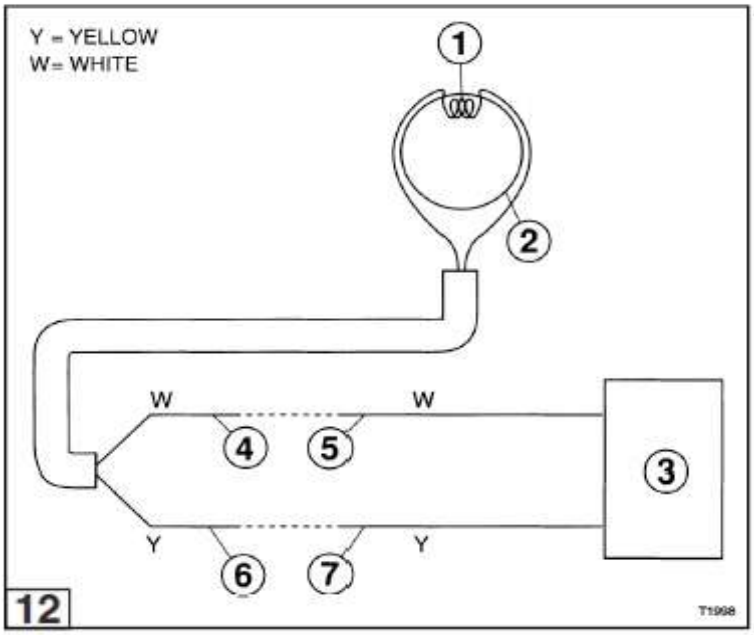
10 Exciter coil **(1)** terminals. Note that these terminals interconnect cable from coil plate assembly **(2)** to cable from CD Unit **(3)**. Disconnect terminals **(4)**, **(5)**, **(6)** and **(7)**.



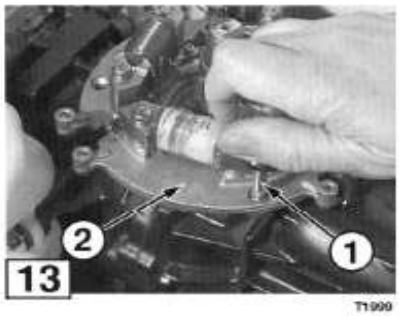
11 pulser coil **(1)** terminals. Note that these terminals interconnect cable from coil plate assembly **(2)** to cable from CD Unit **(3)**. Disconnect terminals **(4)**, **(5)**, **(6)**, **(7)**, **(8)**, **(9)**, **(10)** and **(11)**.

12 Alternator coil **(1)** terminals. Note that these terminals interconnect cable from coil plate assembly **(2)** to rectifier/ regulator **(3)**. Disconnect terminals **(4)**, **(5)**, **(6)** and **(7)**.





13 3. Remove the screws **(1)** and remove coil plate assembly **(2)** from the set ring.



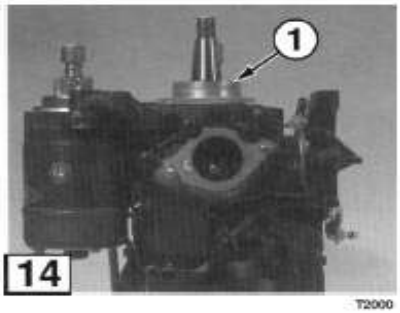
Cleaning and Inspection

14 15 Clean upper main bearing seal **(1)**, guide plate **(2)** and set ring **(3)** with dry cloth.

Check for the following and repair or replace as required:

- Bent, chipped, cracked, or corroded guide plate.
- Broken or bent set ring.

Apply light coat of low temperature lithium grease to guide plate **(2)**.



Istallation

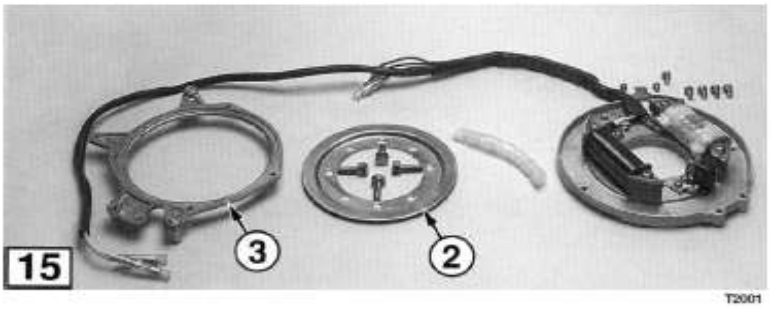
Install in reverse order of removal.

NOTE

Disconnect negative battery cable from battery before installing coil plate assembly.

Use threadlocker on screw threads before installing screws.

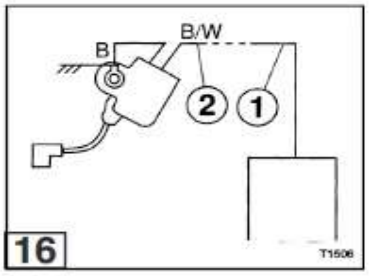
Apply light coat of low temperature lithium grease to the guide plate.

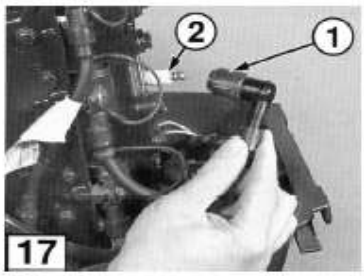


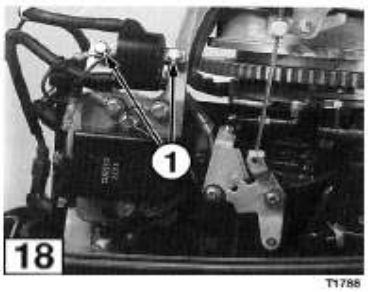
Ignition Coil

NOTE

Disconnect negative battery cable from battery before removing ignition coil.





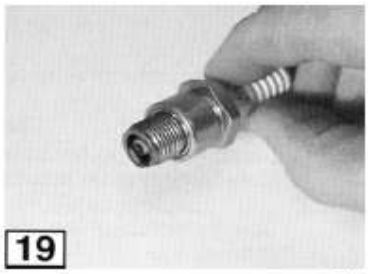


Removal

16 1. Disconnect CD Unit output lead **(1)** from ignition coil primary cable **(2)**.

17 2. Disconnect spark plug cap **(1)** from spark plug **(2)**.

18 3. Remove bolts **(1)** and remove ignition coil.



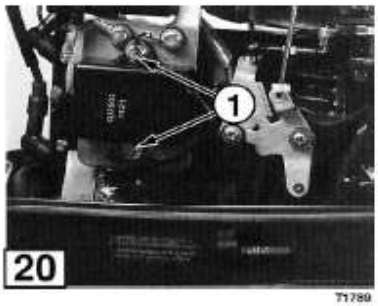
Cleaning and Inspection
Clean mounting area with isopropyl alcohol.

Check for the following and repair or replace as required:

19 Remove spark plug(s) and inspect for fouling, damaged electrodes, or damaged ceramic insulator.
CD Unit output connectors and leads for integrity, cut or cracked insulation.

Installation
Install in reverse order of removal.

CD Unit



NOTE

Disconnect negative battery cable from battery before removing CD Unit.

Removal

20 1. Remove bolts **(1)**.

2. Remove CD Unit.

Cleaning and Inspection
Examine electrical conductors and connectors.

Installation
Install in reverse order of removal.

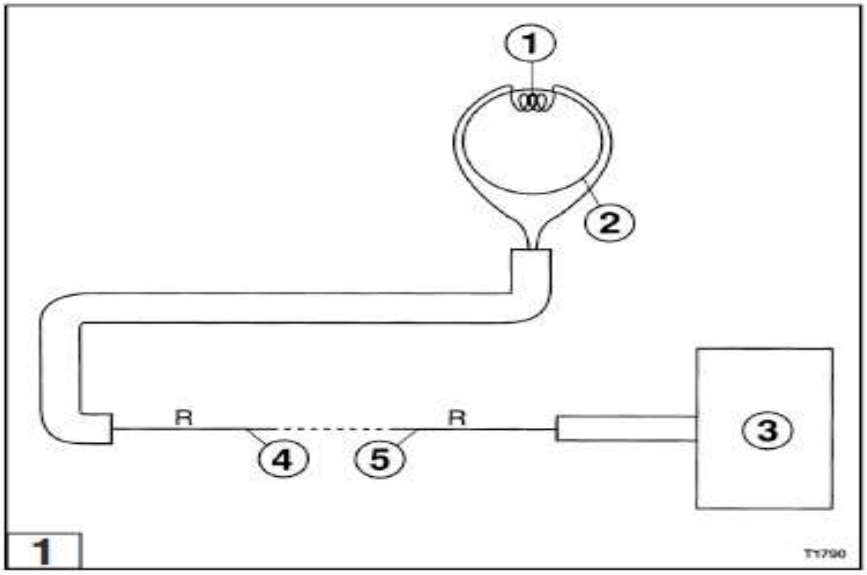
NOTE

Make sure that all electrical conductors are properly routed before you insert CD Unit to avoid pinching them.

STARTING SYSTEM

⚠⚠ WARNING

Disable ignition system, by disconnecting exciter coil terminals (4) and (5) to prevent accidental engine startup during testing of starter circuit.



⚠ CAUTION

Use proper precautions when performing tests with the engine cover removed. Do not wear loose clothing or jewelry. Keep hair, hands, and clothing away from the flywheel and other moving parts.

⚠ CAUTION

When repairs are complete, make sure all ignition and electrical leads are properly routed and clamped in their original positions and the start-in-gear prevention system must be tested before returning engine to customer.

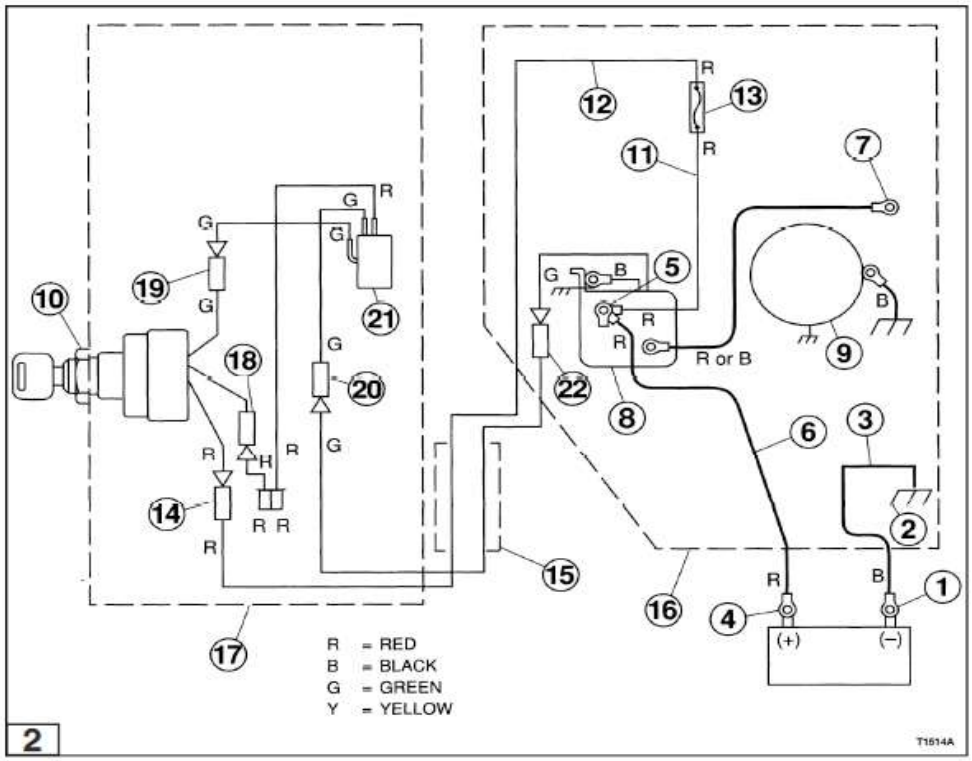
Starter System Testing

The starter system may cause three types of problems:

- The engine does not crank, see Starter Circuit Tests in this section.
- The starter motor runs but does not engage or disengage from the flywheel, see Starter Motor Test in this section.
- The starter motor will not shut off, see Starter Solenoid -Test in this section.

Before you begin testing of starting system:

- Check battery fluid level and specific gravity. Charge or replace as required. See Battery Care and Maintenance, this section.
- Check the following electrical connections and make sure they are secure and free of corrosion:
  - Batterycables and clamps.
  - Starter solenoid wiring (including ground connection).
  - Starter motor wiring (including ground connection to engine block and/or cowling).
  - Main key switch and neutral start switch cables.
- Make sure shift lever or remote control lever is in NEUTRAL and it operates freely.



2 **3** **Starter Circuit Tests**

These tests are designed to quickly isolate the faulty starter circuit component if the engine does not crank.

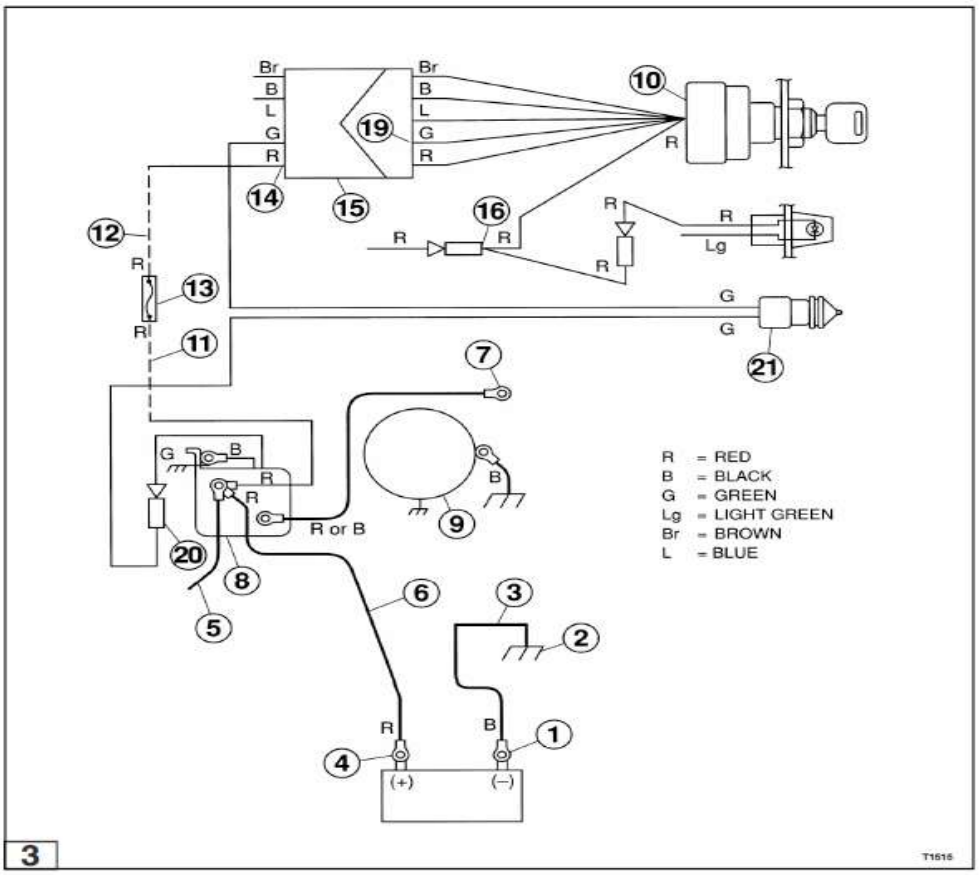
NOTE

The electrical drawings have been simplified to show only those elements necessary to test the starter circuit.

Two types of starter circuits are used and illustrated in:

2 • *Models with remote control box.*

3 • *Models without remote control box.*



3

1. Disconnect negative battery cable **(3)** from negative battery terminal **(1)**.

2. Set analog multimeter to check continuity. Connect one tester lead to negative battery terminal **(1)** and the other tester lead to the ground connection **(2)** for negative battery cable **(3)**.

If the meter does not indicate continuity, clean connections and/or replace negative battery cable.

If the meter indicates continuity, go to the next step.

3. Set analog multimeter to "iDCV" and set range to "20". Connect BLACK tester lead to "- COM" and the RED tester lead to "+ VΩ".

4. Connect BLACK tester lead to clean engine ground.

5. Connect RED tester lead to positive battery terminal **(4)**.

If meter does not indicate 11.8 to 13.2 VDC (battery voltage), see Battery Care and Maintenance, this section.

If meter indicates battery voltage go to next step.

6. Reconnect negative battery cable **(3)** to negative battery terminal **(1)**.

7. Connect RED tester lead to starter solenoid terminal **(5)**.

If meter does not indicate battery voltage, replace battery cable **(6)**.

If meter indicates battery voltage go to next step.

8. Disconnect lead **(7)** from starter solenoid **(8)** to starter motor **(9)**.

9. Connect RED tester lead to starter solenoid lead **(7)** and turn main key switch **(10)** to START position.

If meter indicates battery voltage, repair or replace starter motor, see Starter Motor Tests in this section.

If meter does not indicate battery voltage, go to next step.

10. Connect RED tester lead to connector closest to fuse holder **(11)**.

If meter does not indicate battery voltage, repair or replace cable between **(5)** and **(11)**.

If meter indicates battery voltage, go to next step.

11. Connect RED tester lead to connector closest to fuse holder **(12)**.

If meter does not indicate battery voltage, find source of overload or short and replace 15 A engine fuse **(13)**. Possible sources of short or overload:

- Short in starter circuit wiring or components, such as starter solenoid, main key switch, or neutral start switch.
- Short in charging circuit wiring or components, such as the alternator coils or rectifier/regulator.
- Short in accessories.
- Short in starter motor.

If meter indicates battery voltage, go to next step.

12. Connect RED tester lead to connector closest to main key switch **(14)**.

NOTE

*For models with remote control box - Make sure you test the correct terminal in this step. Terminal **(14)** is connected directly to the main key switch **(10)** and the RED lead that comes out of the large cable **(15)** that connects the engine compartment **(16)** to the remote control box **(17)**. DO NOT CONFUSE TERMINAL **(14)** WITH TERMINAL **(18)**.*

NOTE

*For models without remote control box - You might have to pull connector **(15)** apart and measure voltage at terminal.*

Make sure you test the correct terminal in this step.

If meter does not indicate battery voltage, repair or replace cable between (12) and (14).

If meter indicates battery voltage, go to next step.

13. Connect RED tester lead to main button starter switch and push Raider start button.

14. Connect RED tester lead to neutral start switch lead **(20)** and turn main key switch **(10)** to START position.

If meter does not indicate battery voltage, test neutral start switch **(21)**. Refer to Neutral Start Switch Test in this section.

If meter indicates battery voltage, go to next step.

15. For models with remote control box ONLY - Connect RED tester lead to starter solenoid lead **(22)** and turn main key switch **(10)** to START position.

If meter does not indicate battery voltage, repair or replace cable between **(20)** and **(22)**.

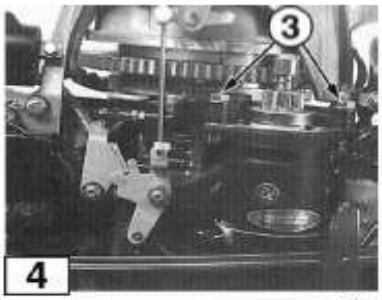
If meter indicates battery voltage, go to next step.

16. Connect RED tester lead to starter solenoid lead **(7)** and turn main key switch **(10)** to START position.

If meter does not indicate battery voltage, test starter solenoid **(8)**. Refer to Starter Solenoid Test in this section,

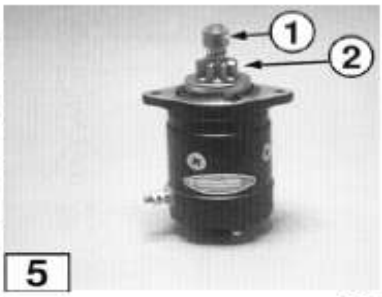
Starter Motor Tests

- If the engine does not crank and you completed the Starter Circuit Tests previously described, remove the starter motor and inspect the brush assembly. If the brush assembly meets specifications, replace the starter motor or have it rebuilt.
- If the starter motor runs but the starter motor does not engage or disengage from the flywheel, remove the starter motor and inspect the pinion assembly. If the pinion assembly meets specifications, inspect the flywheel for chipped or worn teeth and replace as needed.



4

T2214



5

T2215

Remove Starter Motor

NOTE

Disconnect negative battery cable from battery before removing starter motor.

4 1. Disconnect starter solenoid cable and ground cable.

2. Remove starter motor bolts **(3)**.

3. Slide starter motor out of bracket.

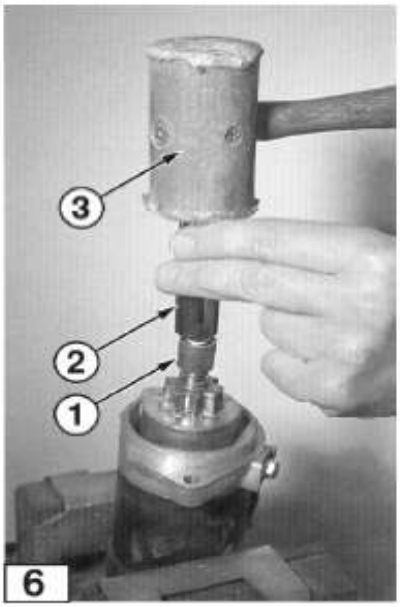
4. Clean bracket with cleaning solvent.

Inspect and Remove Pinion Assembly

5 1. Grasp pinion collar **(1)** and wind pinion gear **(2)** in a clockwise direction. Make sure gear moves freely and returns to original position. If any binding is noted, remove and replace pinion assembly.

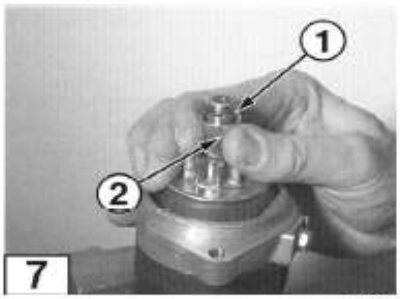
6 2. Release pinion collar **(1)** by tapping it with a socket **(2)** (with same outside diameter as pinion collar and clearance for motor shaft) and mallet **(3)**.

7 3. Push down on pinion collar (2) and remove locking ring **(1)**.



6

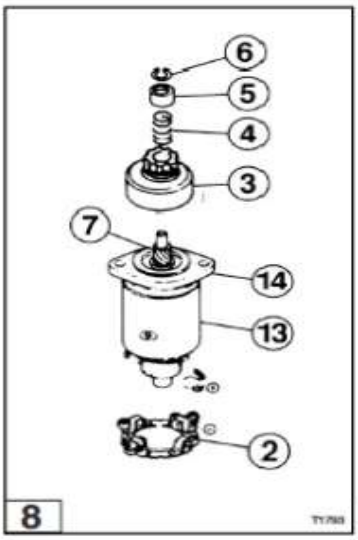
T1522

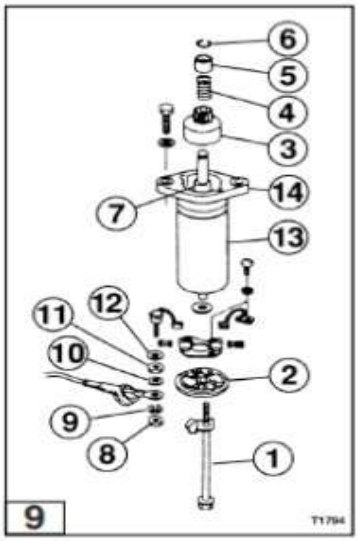


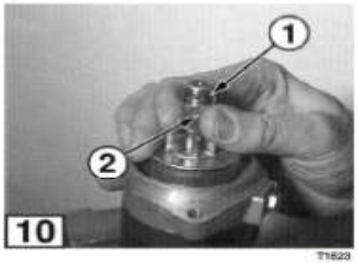
7

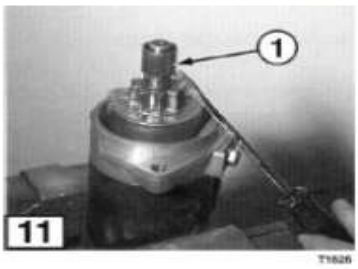
T1523

Note: After disassembly prior to assembly spray “Corrosion Zero” on all parts.









8 9 4. Remove pinion gear **(3)**, spring **(4)** and pinion collar **(5)**.

5. Clean removed components with cleaning solvent and examine pinion gear for wear and chipped teeth and spring for tension or distortion and replace assembly as required.

NOTE

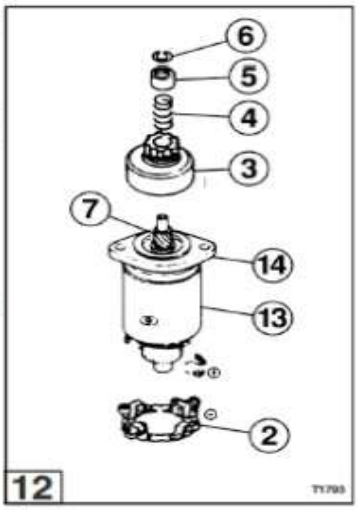
Do not allow cleaning solvent to come in contact with starter motor.

6. Apply a light coat of low temperature lithium grease to motor shaft **(7)** and slide on pinion gear **(3)**, wind counterclockwise to seat.

7. Slide spring **(4)** and pinion collar **(5)** on motor shaft **(7)**.

10 8. Push down on pinion collar **(2)** and install locking ring **(1)**.

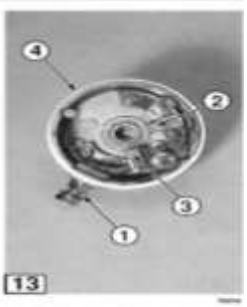
11 9. Tap pinion collar **(1)** in place.



Disassemble Starter Motor

9 12 1. Remove bolts **(1)**.

2. Remove motor base **(2)**.



Inspect Brush Assembly

13 1. Clean starter motor terminal and hardware **(1)** with isopropyl alcohol and fine emery cloth and replace brush assembly if terminal or hardware cannot be restored to original condition.

13 **14** **15** 2. Check brushes **(2)** and **(3)** for chips, fractures, and wear. If not within specifications, replace brush assembly:

The Raider 40 Original Length (a) is 0.295 inches (7.5 mm). Repair Limit (b) is 0.177 inches (4.5 mm).

3. Check spring tension. If springs are weak, replace brush assembly.

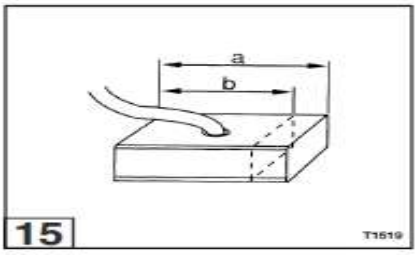
4. Check continuity with analog multimeter between:

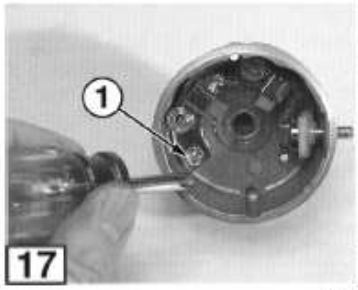
Brush **(2)** and **(3)**. Replace brush assembly if meter indicates continuity.

Brush **(3)** and the motor base **(4)**. Replace brush assembly if meter indicates continuity.

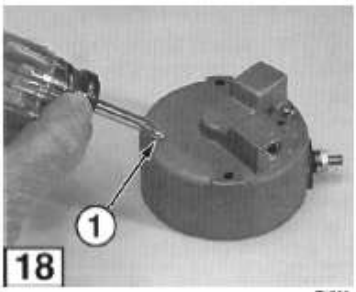
Brush **(3)** and the starter motor terminal **(1)**. Replace brush assembly if meter does not indicate continuity.

Brush **(2)** and the motor base **(4)**. Replace brush assembly if meter does not indicate continuity.

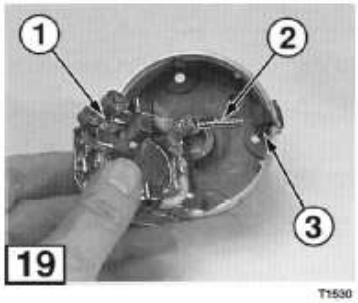




T1628



T1629



T1630

Remove Brush Assembly

17 18 1. Remove screws **(1)**.

19 Remove brush assembly **(1)** carefully guiding the starter motor terminal **(2)** through the bushing **(3)**.

Install Brush Assembly

20 1. Apply genuine grease to bearing cup **(1)**.

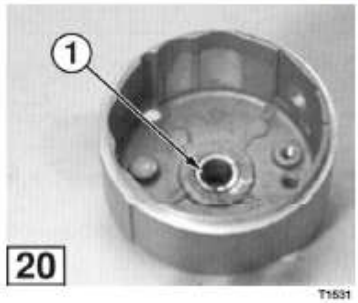
21 2. Install brush assembly **(1)**. Make sure that the starter motor terminal **(2)** is fully seated in the bushing **(3)**.

Assemble Starter Motor

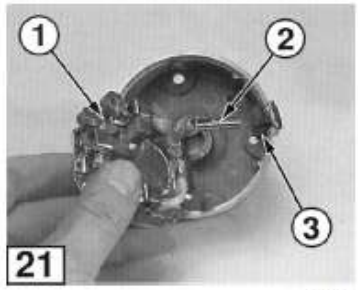
NOTE

Bolts for models 25 / 30 / 40 may not be available as separate parts. Check current Parts Catalog for availability.

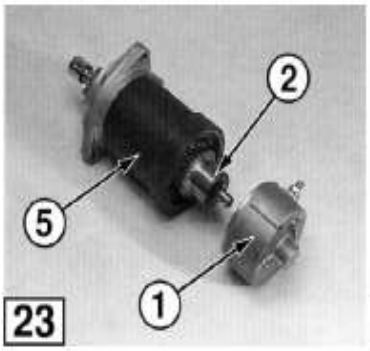
22 1. Clean commutator **(1)** with fine emery cloth.



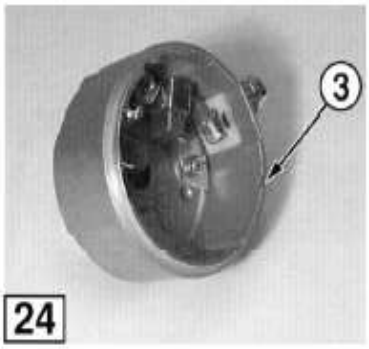
T1631



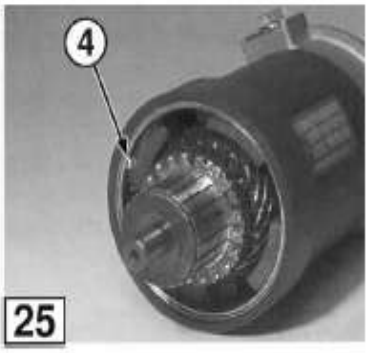
T1630



T1533



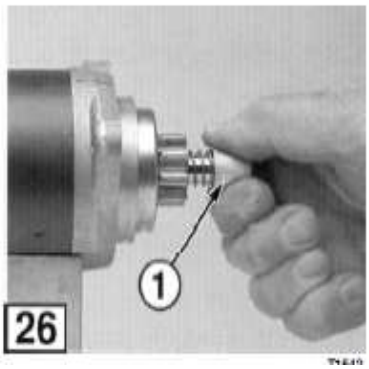
T1536



T1537

23 **24** **25** 2. Retract brushes as you slide motor base **(1)** over commutator **(2)**. Align notch **(3)** in motor base with tab **(4)** in motor body **(5)** and seat motor baseto motor body.

26 3. Grasp pinion collar **(1)** and rotate several times to make sure brushes are seated.



Install Starter Motor

29 1. Slide starter motor into bracket, apply threadlocker to bolt threads, and install mounting bolts.

2. Connect starter solenoid cable and ground cable.

3. Coat terminals with battery spray protector.

Starter Solenoid Test

30 1. Disconnect terminals **(4)** and **(5)** and disconnect terminal **(3)** from chassis ground.

T1796

2. Set analog multimeter for continuity. Check for continuity between terminals:

(3) and **(5)**. If meter does not show continuity, replace starter solenoid **(1)**.

(5) and clean chassis ground. If meter shows continuity, replace starter solenoid.

(3) and clean chassis ground. If meter shows continuity, replace starter solenoid.

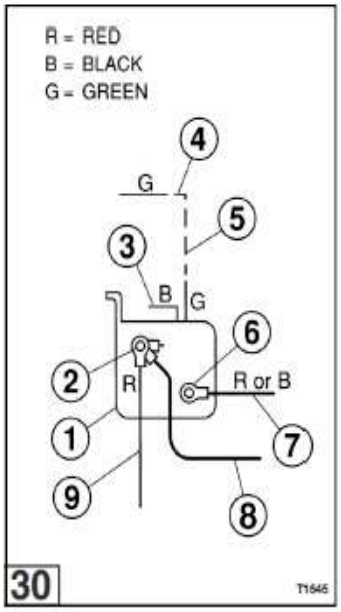
3. Disconnect positive battery lead **(8)** and RED starter switch lead **(9)** from starter terminal **(2)** and disconnect starter motor lead **(7)** from starter terminal **(6)**.

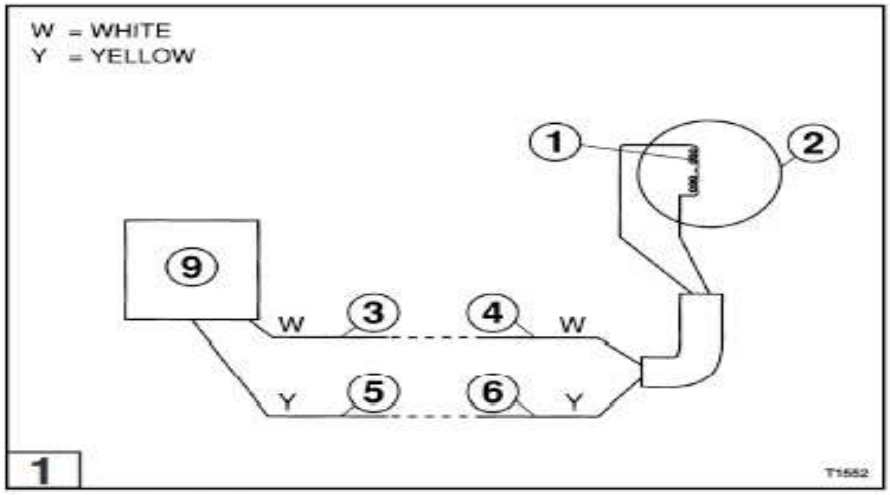
4. Check for continuity between terminals:

(2) and **(6)**. If meter shows continuity, replace starter solenoid.

(2) and clean chassis ground. If the meter shows continuity, replace starter solenoid.

(6) and clean chassis ground. If the meter shows continuity, replace starter solenoid.





Alternator Coil Tests

NOTE

Make sure all electrical terminals are connected during this test except those that are noted in the test procedure.

Check for continuity between chassis ground and the ground connection for the magneto plate, CD Unit, and ignition coils before conducting the following procedure.

Reference the following electrical drawings for the alternator coil test, The pulser and exciter coils have been removed from both illustrations for clarity.

1 The alternator coil test is used to determine whether the alternator coils **(1)**, located on the coil plate assembly **(2)** are open or shorted.The output from the alternator coil goes to the rectifier/regulator **(9)**.

1 1. Disconnect terminals **(3)**, **(4)**, **(5)** and **(6)**.

1 2. Set the digital multimeter to ohms and connect the leads between terminals **(4)** and **(6)** to read the resistance of the alternator coil.

Note: Black (B is 2); White (W is 3); Yellow (Y is 4); Red (R is 5)

The meter should indicate the following resistance: Y-W: 0.65 – 0.98
Y-B : 0.31 – 0.47
W-B: 0.37 – 0.55

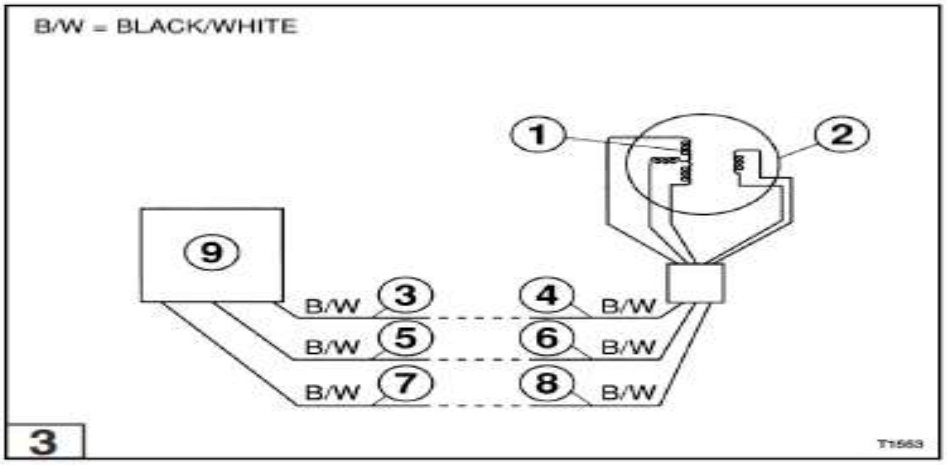
4. If the resistance is not within the indicated range, replace the alternator coils. See Charging System Repair Procedures - Alternator Coils.

If the resistance is within the indicated range, proceed to the next step.

2 3 5. Connect one tester head to a clean engine ground and connect the other tester lead to terminals **(4)** and **(6)** (one terminal at a time) to check for any resistance to ground:

6. If the meter indicates any resistance to ground, replace the alternator coils. See Charging System Repair Procedures - Alternator Coils.

If the meter does not indicate any resistance to ground, proceed to the next step.



7. Set the analog multimeter to "40" on the "ACV" scale.

8. Insert the banana plug of the RED tester lead into the meter connection labeled "+VΩ" and the banana plug of the BLACK tester lead into the meter connection labeled "-COM".

3 9. Connect the BLACK tester lead to a clean engine ground and the RED tester lead to terminals **(4)** and **(6)** (one terminal at a time) to check for any voltage to ground:

10. Start engine.

11. At idle and full throttle, if the meter indicates any voltage to ground, replace alternator coils. See Charging System Repair Procedures - Alternator Coils.

If no voltage to ground is indicated, the test is complete.

12. Reconnect alternator terminals.

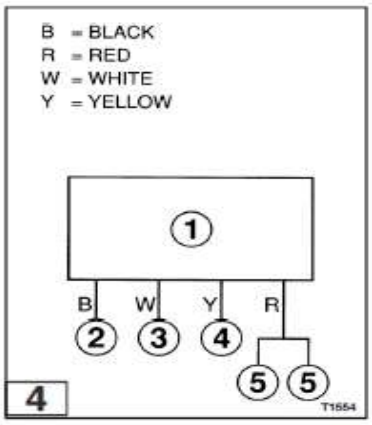
Rectifier/Regulator Tests

NOTE

Make sure all electrical terminals are connected during this test except those that are noted in the test procedure.

Check ior continuity between chassis ground and the ground connection for the magneto plate, CD Unit, and ignition coils before conducting the following procedure.

Reference the following electrical drawings for the rectifier/regulator test.



The rectifier/regulator tests check whether the rectifier/regulator **(1)** is shorted or open.

1. Disconnect terminals **(2)**, **(3)**, **(4)** and **(5)** from all other wiring:

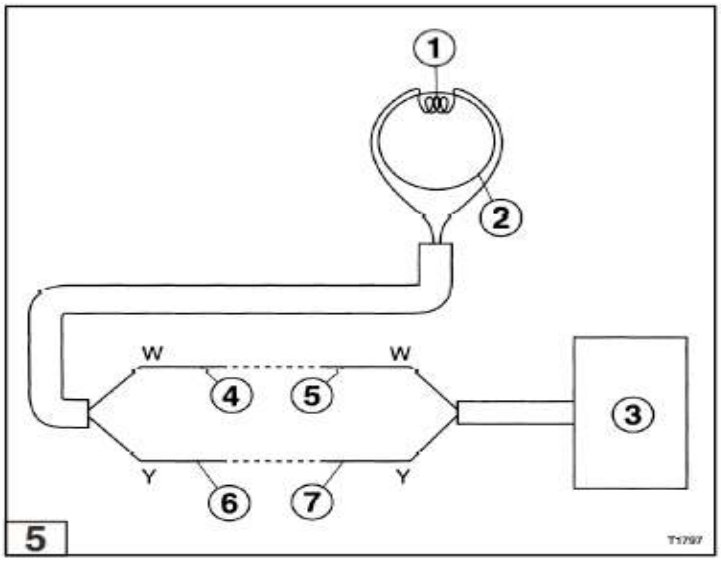
2. Set analog multimeter to check continuity.

3. Insert the banana plug of the RED tester lead into the meter connection labeled "+VΩ" and the banana plug of the BLACK tester lead into the meter connection labeled "-COM".

4. Connect the RED and BLACK tester leads to the terminals as shown and note the results:

- Follow the tests listed in the chart starting at the TOP of each COLUMN and going DOWN.
- Follow the tests listed in the chart starting at the LEFT of each ROW and going to the RIGHT.

Replace rectifier/regulator if continuity tests are not as shown. If continuity checks are within specifications, proceed to next step.



NOTE

Continuity on chart means that the meter showed continuity (some resistance indicated by meter - exact value depends on test conditions). No Continuity on chart means that meter had no deflection.

		RED Tester Lead			
		Terminal (2)	Terminal (3)	Terminal (4)	Terminal (5)
BLACK Teste Lead	Terminal (2)	NA	Continuity	Continuity	Continuity
	Terminal (3)	NO Continuity	NA	NO Continuity	Continuity
	Terminal (4)	NO Continuity	NO Continuity	NA	Continuity
	Terminal (5)	NO Continuity	NO Continuity	NA	NA

5. Connect rectifier/regulator leads.

Charging System - Repair Procedures

5

⚠⚠ WARNING

Disable ignition system, by disconnecting exciter coil terminals (4), (5), (6), (7), to prevent accidental engine startup during removal and replacement of the flywheel.

⚠ CAUTION

Flywheel is under high torque and requires the use of special tools for removal and installation. Failure to use the specified tools can result in injury or damage to the flywheel or coil plate electrical components.

⚠ CAUTION

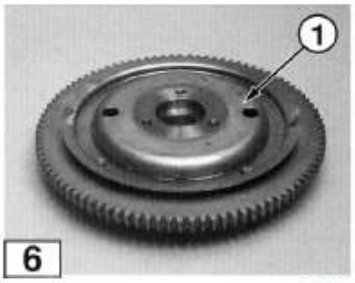
The force needed to loosen and tighten the flywheel nut requires flywheel be removed and installed with engine mounted and secured on an engine stand.

⚠ CAUTION

Use proper precautions when performing tests with the engine cover removed. Do not wear loose clothing or jewelry. Keep hair, hands, and clothing away from the flywheel and other moving parts.

⚠ CAUTION

When repairs are complete, make sure all ignition and electrical leads are properly routed and clamped in their original positions and the start-in-gear prevention system must be tested before returning engine to customer.



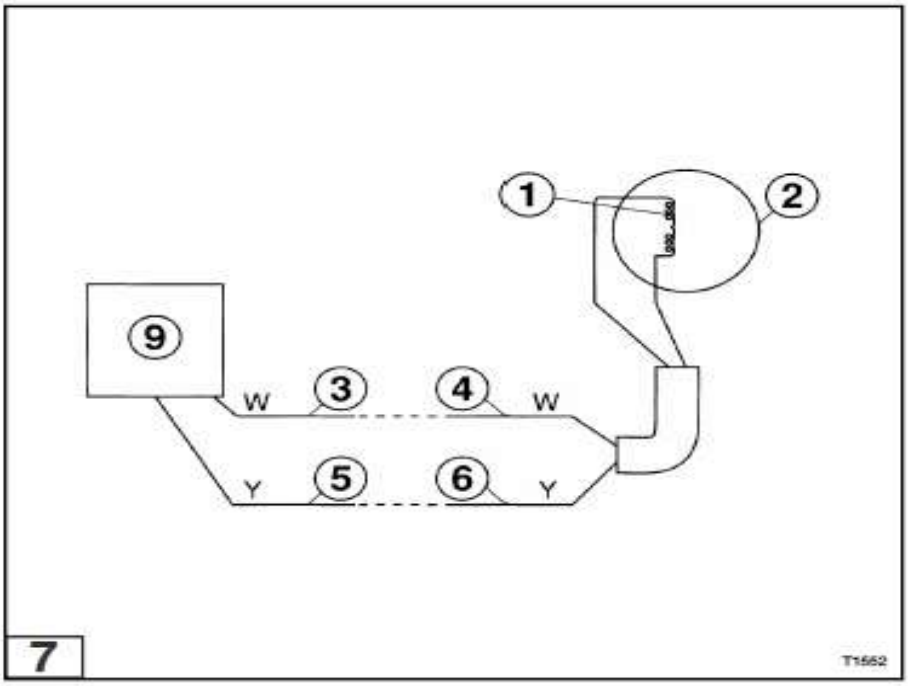
Flywheel

Replacing the exciter coil or coil plate assembly requires the removal of the flywheel, see Section 4, Flywheel, for the proper procedure.

NOTE

Flywheel magnets must be of a particular strength in order to run the ignition system. Weak magnets can cause low ignition voltage which may affect engine performance. Flywheels seldom go bad and would only be replaced as a last resort in solving an ignition problem.

6 Carefully inspect flywheel **(1)** for cracks, chips, and worn taper after it is removed. Also inspect the magnets for cracks and chips and make sure they are firmly attached to the flywheel.



Alternator Coils

NOTE

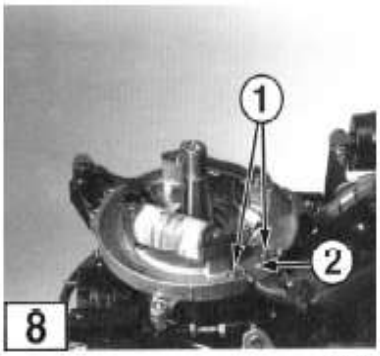
Disconnect negative battery cable from battery before removing alternator coils.

This procedure assumes alternator coils are available as a separate replaceable component. Some engine configurations might require replacement of entire coil plate assembly. Check current Parts Catalog for availability.

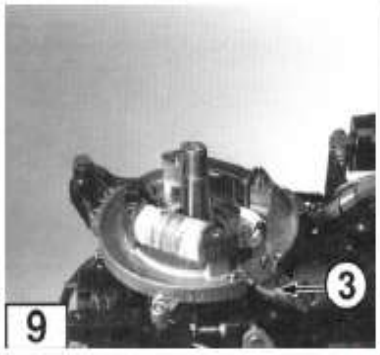
Removal

1. Remove the flywheel.

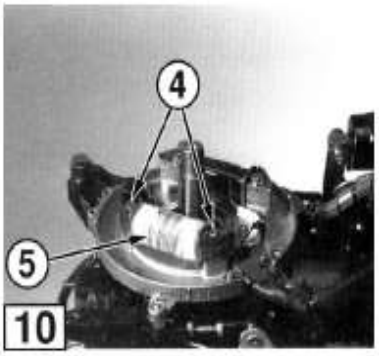
7 2. Disconnect terminals **(3)**, **(4)**, **(5)** and **(6)** for alternator coils **(1)**. Alternator coils are located on the coil plate assembly **(2)**.



T1993



T1994



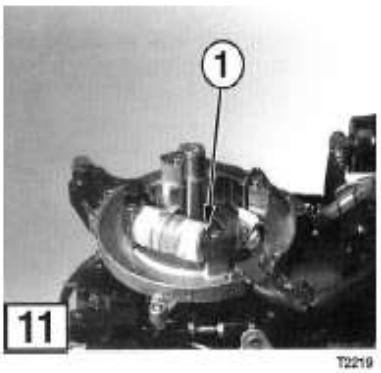
T2218

8 3. Remove coil plate assembly cable clamp screws **(1)** and cable clamp **(2)**.

NOTE

Make sure you don't cut electrical conductors inside of coil plate assembly cable when you slit cable shield.

9 : Carefully slit coil plate assembly cable shield **(1)**.



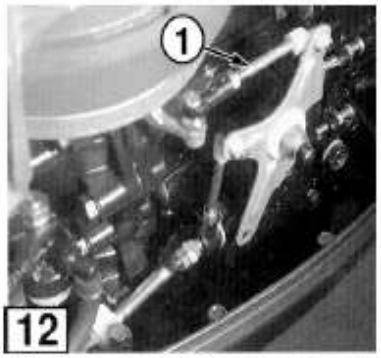
T2219

NOTE

Make sure you don't cut electrical conductors inside of coil plate assembly cable when you slit cable shield.

5. : Cut tie wrap.

10 6. Remove alternator coil screws **(4)** and alternator coil **(5)** from the mounting bracket.



T1798

Cleaning and Inspection

11 Clean coil plate assembly, upper main bearing housing, set ring, ignition timing link, exciter coil, pulser coil, coil leads, and coil connectors with isopropyl alcohol as required.

Check for the following and repair or replace as required:

- Bent, chipped, cracked, or corroded coil plate assembly.
- Coil leads for integrity, cut or cracked insulation, and damaged connectors.
- Broken or bent exciter coil laminations, damaged exciter coil windings, and missing exciter coil screws.
- Broken, cracked, or misaligned pulser coils and missing pulser coil screws.

12 • Free motion of ignition timing link **(1)**, Repair, adjust, and lubricate as needed. see Section 2.

This service manual was developed for the Raider 40 HP Generation II outboard motor.

If you have any questions regarding this motor please contact:

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