

SEADOO®

SHOP MANUAL



2000

219 100 104

GS 5644
GSX RFI 5645
XP 5651
GTI 5647

GTX 5653
GTX RFI 5648
GTX RFI (green) 5515

2000 ***Shop Manual***

VOLUME 1

GS/GTI/GTS/GTX/XP

GSX RFI/GTX RFI

BOMBARDIER
RECREATIONAL PRODUCTS



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SAFETY NOTICE

This manual has been prepared as a guide to correctly service and repair some 2000 SEA-DOO watercraft. See model list below.

This edition was primarily published to be used by watercraft mechanic technicians who are already familiar with all service procedures relating to Bombardier made watercraft. Mechanic technicians should intent to continuous training courses given by Bombardier Training Dept.

Please note that the instructions will apply only if proper hand tools and special service tools are used.

This *Shop Manual* uses technical terms which may be slightly different from the ones used in the *Parts Catalog*.

It is understood that this manual may be translated into another language. In the event of any discrepancy, the English version shall prevail.

The content depicts parts and/or procedures applicable to the particular product at time of writing. *Service* and *Warranty Bulletins* may be published to update the content of this manual. Make sure to read and understand these.

In addition, the sole purpose of the illustrations throughout the manual, is to assist identification of the general configuration of the parts. They are not to be interpreted as technical drawings or exact replicas of the parts.

The use of Bombardier parts is most strongly recommended when considering replacement of any component. Dealer and/or distributor assistance should be sought in case of doubt.

The engines and the corresponding components identified in this document should not be utilized on product(s) other than those mentioned in this document.

Torque wrench tightening specifications must be strictly adhered to. Locking devices (ex.: locking tab, self-locking fasteners, etc.) must be installed or replaced with new ones. If the efficiency of a locking device is impaired, it must be renewed.

This manual emphasizes particular information denoted by the wording and symbols:

WARNING

Identifies an instruction which, if not followed, could cause serious personal injury including possibility of death.

CAUTION: Denotes an instruction which, if not followed, could severely damage vehicle components.

NOTE: Indicates supplementary information needed to fully complete an instruction.

Although the mere reading of such information does not eliminate the hazard, your understanding of the information will promote its correct use. Always use common shop safety practice.

Bombardier Inc. disclaims liability for all damages and/or injuries resulting from the improper use of the contents. We strongly recommend that any services be carried out and/or verified by a highly skilled professional mechanic. It is understood that certain modifications may render use of the vehicle illegal under existing federal, provincial and state regulations.

WHAT'S NEW

WHAT'S NEW

THIS SECTION INDICATES PROCEDURES THAT WERE MODIFIED OR NEWLY ADDED IN THIS MANUAL.

INTRODUCTION

- Self-locking fasteners procedure.
- Loctite application procedure.
- Tightening torques chart.

SERVICE TOOLS AND PRODUCTS

Added the following new tools:

- VCK (Vehicle Communication Kit) for all models
- bearing/seal installer tool for **outlet end** of 155.6 mm (6-1/8 in) pump
- drive shaft alignment shaft for XP model.

Added the following new products:

- medium strength threadlocker Loctite 243
- Molykote 111.

STORAGE

- New procedure with air pressure to empty the cooling system.

EXHAUST SYSTEM

- New procedure to install tuned pipe on 787 RFI engine.
- New procedure to remove and install tuned pipe on 947 engine.

COOLING SYSTEM

- New diagram for the cooling system (all engines).

FUEL SYSTEM

- Procedure to remove fuel tank on all models.

AIR INTAKE

- New procedure to install air intake on 947 engine.

FUEL INJECTION

- Fault codes chart (B.U.D.S. versus RFI).

JET PUMP

- New procedure for anti-rattle system.
- New procedure for wear ring installation.

TECHNICAL DATA

- Updated specifications for each model.

WIRING DIAGRAMS

- Updated wiring diagrams for each model.

INTRODUCTION

INTRODUCTION

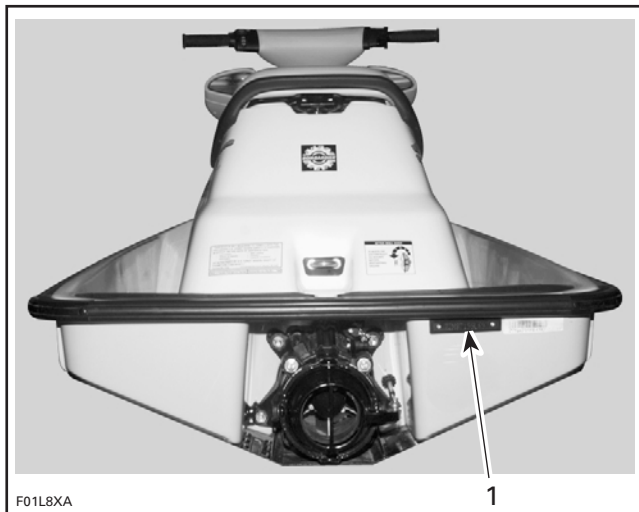
This *Shop Manual* covers the following BOMBARDIER made SEA-DOO® 2000 watercraft models.

MODELS	MODEL NUMBER
GS	5644
GS International	5827
GSX RFI	5645
GSX RFI International	5654
XP	5651
XP International	5655
GTI.....	5647
GTI International	5657
GTS International.....	5639
GTX.....	5653
GTX International	5669
GTX RFI.....	5648
GTX RFI International	5658
GTX RFI (green)	5515
GTX RFI International (green).....	5516

HULL IDENTIFICATION NUMBER (H.I.N.)

GTS Only

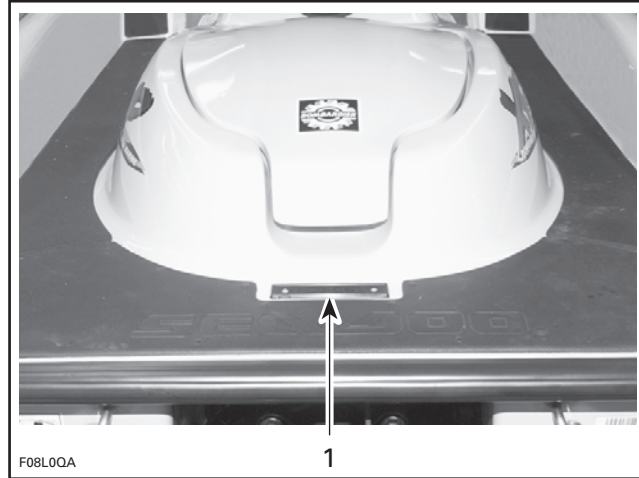
It is located at right hand rear side of hull.



1. Hull Identification Number (H.I.N.)

All Other Models

It is located on floorboard at the rear of the watercraft.

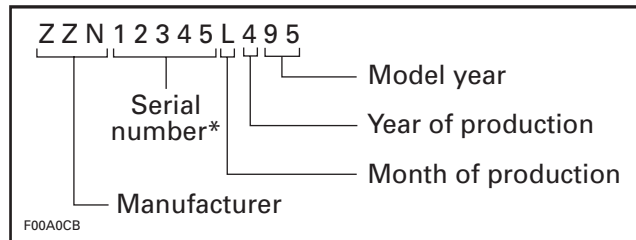


TYPICAL

1. Hull Identification Number (H.I.N.)

All Models

The Hull Identification Number is composed of 12 digits:

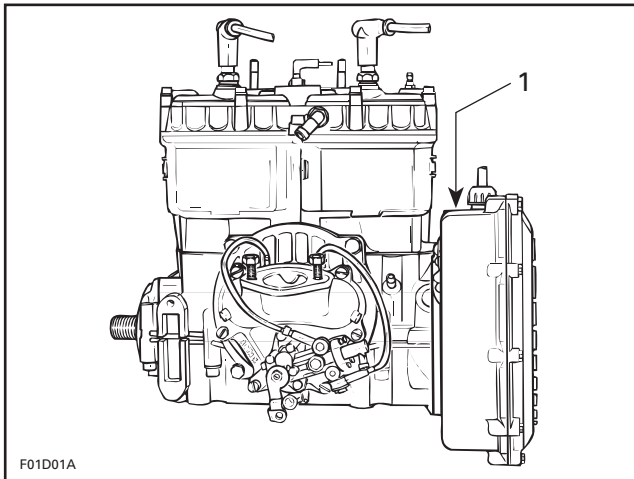


*A letter may also be used as a digit.

ENGINE IDENTIFICATION NUMBER (E.I.N.)

717 Engine

The Engine Identification Number is located on the upper side of the magneto housing.

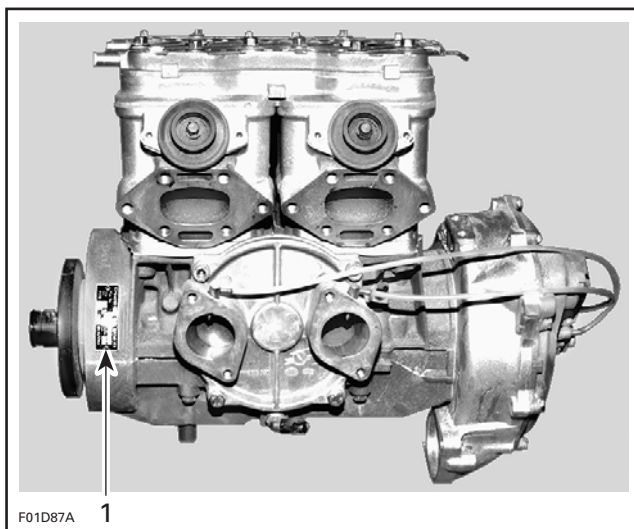


TYPICAL

1. Engine Identification Number (E.I.N.)

787 RFI Engine

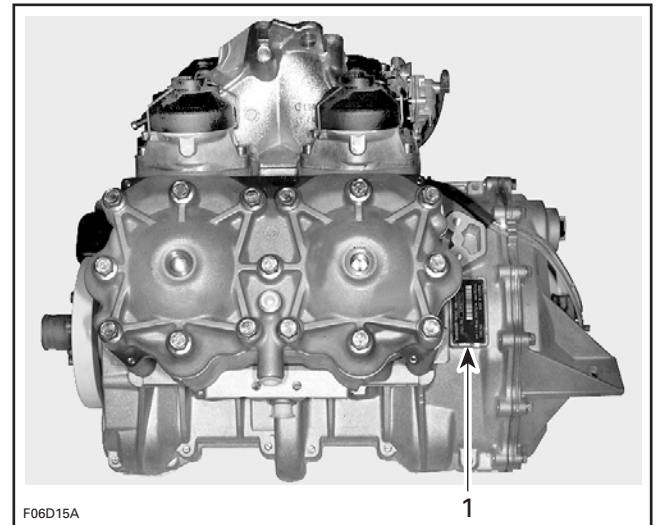
The Engine Identification Number is located on the upper crankcase on PTO side.



1. Engine Identification Number (E.I.N.)

947 Engine

The Engine Identification Number is located on the upper crankcase on MAGNETO side.



1. Engine Identification Number (E.I.N.)

ARRANGEMENT OF THIS MANUAL

The manual is divided into 14 major sections:

- 01 SERVICE TOOLS AND PRODUCTS
- 02 MAINTENANCE
- 03 TROUBLESHOOTING
- 04 ENGINE
- 05 COOLING SYSTEM
- 06 FUEL SYSTEM
- 07 LUBRICATION SYSTEM
- 08 ELECTRICAL SYSTEM
- 09 PROPULSION SYSTEM
- 10 STEERING SYSTEM
- 11 SUSPENSION
- 12 HULL/BODY
- 13 TECHNICAL DATA
- 14 WIRING DIAGRAMS

Several sections are divided in various subsections. There is a table of contents at the beginning of many sections.

INTRODUCTION

TYPICAL PAGE

The diagram shows an exploded view of a magneto system. At the top, the page heading reads "Section 03 ENGINE" and "Subsection 04 (MAGNETO SYSTEM)". Below this, the main title "MAGNETO SYSTEM" is followed by the italicized sub-title "717 Engine". The diagram includes 15 numbered parts: 1 (nut), 2 (screw), 3 (washer), 4 (gear), 5 (nut), 6 (screw), 7 (nut), 8 (screw), 9 (nut), 10 (gear), 11 (cover), 12 (cover), 13 (screw), 14 (washer), and 15 (nut). Torque specifications are provided for several parts: 5 N•m (44 lbf•in) for part 11, 9 N•m (80 lbf•in) for parts 13 and 2, 6 N•m (53 lbf•in) for parts 4, 5, 6, 7, and 9, and 145 N•m (107 lbf•ft) for part 15. Application instructions for Loctite 243 and Anti-seize lubricant are also shown. A dotted box encloses parts 6, 7, 8, and 9. The illustration number "F01A0CS" and the page number "03-04-1" are also present.

Page heading indicates section and subsection detailed.

Subsection title indicates beginning of the subsection.

Section 03 ENGINE
Subsection 04 (MAGNETO SYSTEM)

MAGNETO SYSTEM

717 Engine

5 N•m (44 lbf•in)

9 N•m (80 lbf•in)

Loctite 243

Loctite 243

6 N•m (53 lbf•in)

Loctite 243

6 N•m (53 lbf•in)

Loctite 243

6 N•m (53 lbf•in)

Loctite 243

145 N•m (107 lbf•ft)

Anti-seize lubricant

9 N•m (80 lbf•in)

Dotted box contains parts of a particular model or an exploded view.

Explored view assists you in identifying parts and related positions.

Italic sub-title above exploded view indicate pertaining models.

Drop represents a liquid product to be applied to a surface. In this case Loctite 243 to screw threads.

Bold face number indicates special procedure concerning this part.

Tightening torque nearby fastener. In this case, nut must be torqued to 145 N•m (107 lbf•ft).

CAUTION: Pay attention to torque specifications. Some of these are in lbf•in instead of lbf•ft. Use appropriate torque wrench.

Page numbering system:
03: ENGINE section
04: MAGNETO SYSTEM subsection
1: First page of this subsection

Illustration number for publishing process.

F01A0CS

03-04-1

TYPICAL PAGE

Sub-title with part name(s) from exploded view.

Section 06 FUEL SYSTEM
Subsection 03 (CARBURETORS)

CARBURETOR REMOVAL

To remove carburetors from engine, proceed as follows:

- Remove air vent tube support.
- Unlock retaining slides holding air intake silencer base.
- Remove air intake silencer base from watercraft.
- Remove screws holding flame arrester base support to cylinder head cover.
- Unscrew base retaining screws then remove base from carburetors and move to front of watercraft.
- Turn the valve to OFF position.

NOTE: For fuel line removal, use pliers (P/N 295 000 054).

- Disconnect pulse line from fuel pump.
- Disconnect fuel supply line from fuel pump.
- Disconnect fuel return line.
- Disconnect oil injection pump cable, throttle cable and choke cable.

XP Model Only

- Remove screws no. 6 and lock washers no. 7 retaining carburetors.

All Others Models

- Remove 4 bolts no. 8 and lock washers no. 12 from rotary valve cover then move carburetors and rotary valve cover on top of engine.

NOTE: When removing rotary valve cover, pay attention that the rotary valve stay in place, otherwise it must be timed.

- Remove carburetors from intake manifold.
- Disconnect fuel bypass line between carburetors (twin carburetors).
- Remove carburetor(s) from rotary valve cover.

DISASSEMBLY AND INSPECTION

Inspect parts for corrosion damage (shaft, butterfly, spring, etc., check valve housing, etc.).

Diaphragm

PUMP DIAPHRAGM LEAK TEST

Using a suitable pump gauge tester, perform the following test proceeding as follows:

- Install pump gauge tester (P/N 295 000 083) on pulse nipple.
- Pump tester until it reaches 28 kPa (4 PSI).

TYPICAL

Step 1: Install pump gauge tester to pulse nipple.
Step 2: Pump tester until it reaches the desired pressure.

Legend:
1: Fuel outlet nipple
2: Fuel inlet nipple
A: 28 kPa (4 PSI)

Diaphragm must stand pressure for 10 seconds. If pressure drops, replace diaphragm.

06-03-4

Title indicates main procedure to be carried-out.

Service tool to be used to perform a certain procedure.

Title in italic indicates a particular procedure concerning a model.

Sub-sub-title in this case indicates that particular procedure for XP is finished, so from this point, all others models are concerned.

Sub-sub-title in capital indicates a particular testing, adjustment or repair procedure.

Illustration always follows text it is pertained to.

"TYPICAL" mention indicates a general view which does not represent full detail.

Numbers in a frame are used to give a sequence to be performed.

Letters are used for any measures.

Bold numbers in the text refer to the parts shown in the exploded view at the beginning of the subsection.

Numbers are used for description of components.

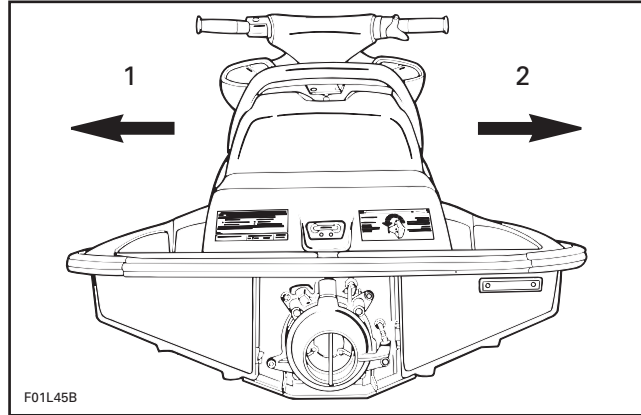
INTRODUCTION

LIST OF ABBREVIATIONS USED IN THIS MANUAL

	DESCRIPTION
AC	Alternate Current
APS	Air Pressure Sensor
ATS	Air Temperature Sensor
CDI	Capacitor Discharge Ignition
CPS	Crankshaft Position Sensor
CSI	Cooling System Indicator
DC	Direct Current
DESS	Digitally Encoded Security System
E.I.N.	Engine Identification Number
ECU	Electronic Control Unit
HP	Horse Power
LED	Light Emitting Diode
MAG	Magneto
MPEM	Multi-Purpose Electronic Module
MPH	Mile Per Hour
N.A.	Not Applicable
OPT	Optional
P/N	Part Number
PFD	Personal Flotation Device
PSI	Pound Per Square Inch
PTO	Power Take Off
RAVE	Rotax Adjustable Variable Exhaust
RFI	Rotax Fuel Injection
RPM	Revolution Per Minute
STD	Standard
TPS	Throttle Position Sensor
VDC	Volt Direct Current
VROI	Variable Rate Oil Injection
VTS	Variable Trim System
WTS	Water Temperature Sensor

GENERAL INFORMATION

The use of RIGHT and LEFT indications in the text, always refers to driving position (when sitting on watercraft).



1. Left (port)
2. Right (starboard)

The information and component/system descriptions contained in this manual are correct at time of publication. Bombardier Inc. however, maintains a policy of continuous improvement of its products without imposing upon itself any obligation to install them on products previously manufactured.

Bombardier Inc. reserves the right at any time to discontinue or change specifications, designs, features, models or equipment without incurring obligation.

This *Shop Manual* uses technical terms which may be different from the ones of the *Parts Catalogs*.

When ordering parts always refer to the specific model *Parts Catalogs*.

ILLUSTRATIONS AND PROCEDURES

The illustrations show the typical construction of the different assemblies and, in all cases, may not reproduce the full detail or exact shape of the parts shown, however, they represent parts which have the same or a similar function.

CAUTION: These watercraft are designed with parts dimensioned in both the metric and the imperial systems. When replacing fasteners, make sure to use only those recommended by Bombardier.

As many of the procedures in this manual are interrelated, we suggest, that before undertaking any task, you read and thoroughly understand the entire section or subsection in which the procedure is contained.

A number of procedures throughout the book require the use of special tools. Before undertaking any procedure, be sure that you have on hand all the tools required, or approved equivalents.

SELF-LOCKING FASTENERS PROCEDURE

The following describes the most common application procedures when working with self-locking fasteners.

Use a metal brush or a screwtap to clean the hole properly then use a solvent (Methyl-Chloride), let act during 30 minutes and wipe off. The solvent utilization is to ensure the adhesive works properly.

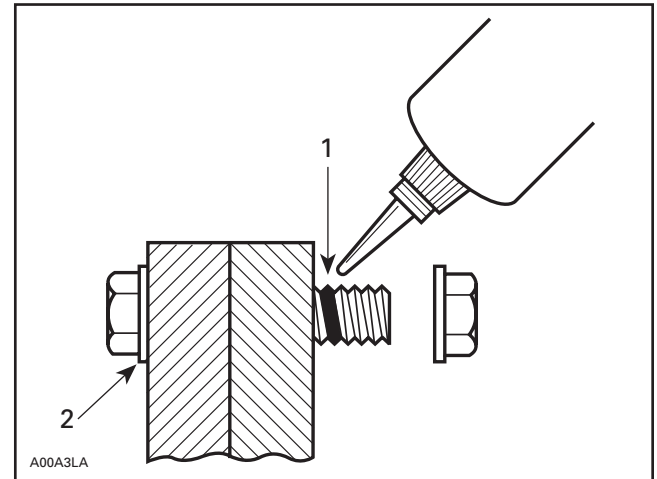
LOCTITE APPLICATION PROCEDURE

The following describes the most common application procedures when working with Loctite products.

NOTE: Always use proper strength Loctite product as recommended in this *Shop Manual*.

THREADLOCKER

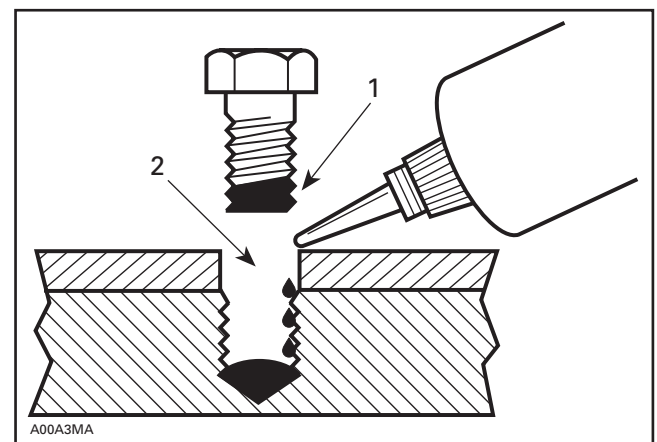
Uncovered Holes (bolts and nuts)



1. Apply here
2. Do not apply

1. Clean threads (bolt and nut) with solvent.
2. Apply Loctite Primer N (P/N 293 800 041) on threads and allow to dry.
3. Choose proper strength Loctite threadlocker.
4. Fit bolt in the hole.
5. Apply a few drops of threadlocker at proposed tightened nut engagement area.
6. Position nut and tighten as required.

Blind Holes

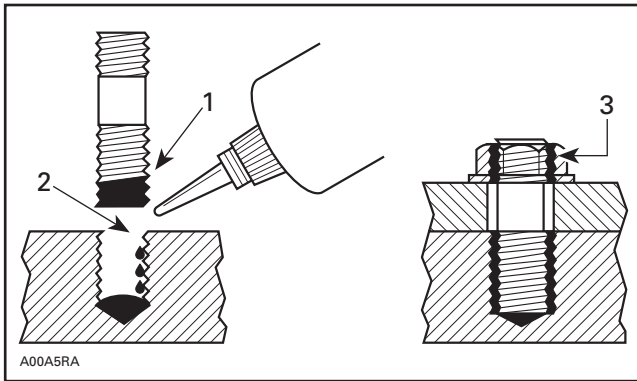


1. On threads
2. On threads and at the bottom of hole

INTRODUCTION

1. Clean threads (bolt and hole) with solvent.
2. Apply Loctite Primer N (P/N 293 800 041) on threads (bolt and nut) and allow to dry for 30 seconds.
3. Choose proper strength Loctite threadlocker.
4. Apply several drops along the threaded hole and at the bottom of the hole.
5. Apply several drops on bolt threads.
6. Tighten as required.

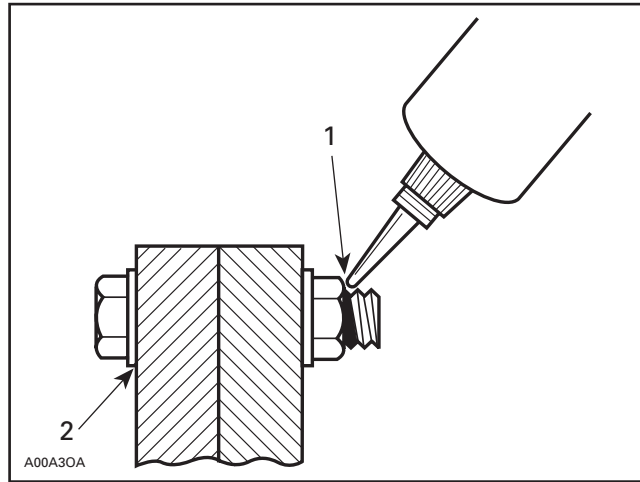
Stud in Blind Holes



1. On threads
2. On threads and in the hole
3. Onto nut threads

1. Clean threads (stud and hole) with solvent.
2. Apply Loctite Primer N (P/N 293 800 041) on threads and allow to dry.
3. Put several drops of proper strength Loctite threadlocker on female threads and in hole.
4. Apply several drops of proper strength Loctite on stud threads.
5. Install stud.
6. Install cover, etc.
7. Apply drops of proper strength Loctite on uncovered threads.
8. Tighten nuts as required.

Preassembled Parts

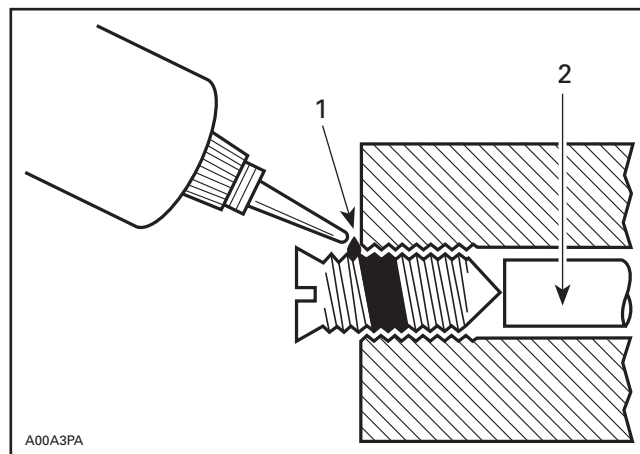


1. Apply here
2. Do not apply

1. Clean bolts and nuts with solvent.
2. Assemble components.
3. Tighten nuts.
4. Apply drops of proper strength Loctite on bolt/nut contact surfaces.
5. Avoid touching metal with tip of flask.

NOTE: For preventive maintenance on existing equipment, retighten nuts and apply proper strength Loctite on bolt/nut contact surfaces.

Adjusting Screw



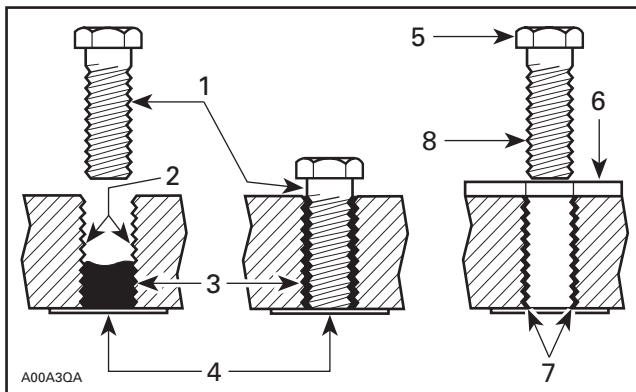
1. Apply here
2. Plunger

1. Adjust screw to proper setting.
2. Apply drops of proper strength Loctite threadlocker on screw/body contact surfaces.
3. Avoid touching metal with tip of flask.

NOTE: If it is difficult to readjust, heat screw with a soldering iron (232°C (450°F)).

STRIPPED THREAD REPAIR

Stripped Threads



1. Release agent
2. Stripped threads
3. Form-A-Thread
4. Tape
5. Cleaned bolt
6. Plate
7. New threads
8. Threadlocker

Standard Thread Repair

1. Follow instructions on Loctite FORM-A-THREAD (P/N 413 708 600) package.
2. If a plate is used to align bolt:
 - a. Apply release agent on mating surfaces.
 - b. Put waxed paper or similar film on the surfaces.
3. Twist bolt when inserting it to improve thread conformation.

NOTE: NOT intended for engine stud repairs.

Repair of Small Holes/Fine Threads

Option 1: Enlarge damaged hole, then follow **Standard Thread Repair** procedure.

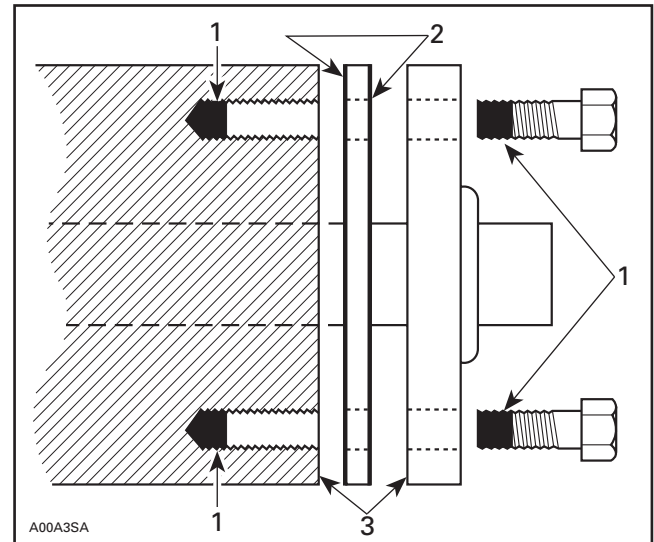
Option 2: Apply FORM-A-THREAD on the screw and insert in damaged hole.

Permanent Stud Installation (light duty)

1. Use a stud or thread on desired length.
2. **DO NOT** apply release agent on stud.
3. Do a **Standard Thread Repair**.
4. Allow to cure for 30 minutes.
5. Assemble.

GASKET COMPOUND

All Parts



1. Proper strength Loctite
2. Loctite Primer N (P/N 413 708 100) and Gasket Eliminator 515 (P/N 413 702 700) on both sides of gasket
3. Loctite Primer N only

1. Remove old gasket and other contaminants with Loctite Chisel remover (P/N 413 708 500). Use a mechanical mean if necessary.

NOTE: Avoid grinding.

2. Clean both mating surfaces with solvent.
3. Spray Loctite Primer N on both mating surfaces and on both sides of gasket. Allow to dry 1 or 2 minutes.
4. Apply GASKET ELIMINATOR 515 (P/N 413 702 700) on both sides of gasket, using a clean applicator.
5. Place gasket on mating surfaces and assemble immediately.

NOTE: If the cover is bolted to blind holes (above), apply proper strength Loctite in the hole and on threads. Tighten.

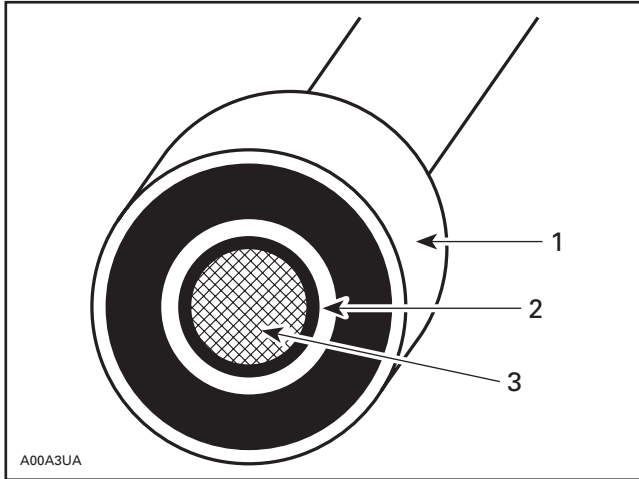
If holes are sunken, apply proper strength Loctite on bolt threads.

6. Tighten as usual.

INTRODUCTION

MOUNTING ON SHAFT

Mounting with a Press



1. Bearing
2. Proper strength Loctite
3. Shaft

Standard

1. Clean shaft external part and element internal part.
2. Apply a strip of proper strength Loctite on shaft circumference at insert or engagement point.

NOTE: Retaining compound is always forced out when applied on shaft.

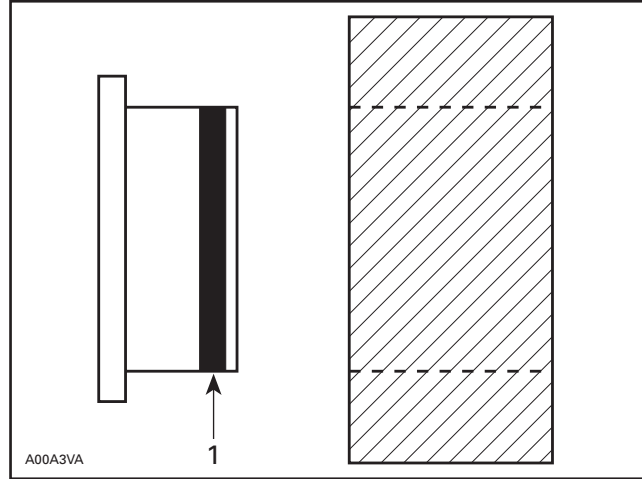
3. DO NOT use anti-seize Loctite or any similar product.
4. No curing period is required.

Mounting in Tandem

1. Apply retaining compound on internal element bore.
2. Continue to assemble as shown above.

CASE-IN COMPONENTS

Metallic Gaskets



1. Proper strength Loctite

1. Clean inner housing diameter and outer gasket diameter.
2. Spray housing and gasket with Loctite Primer N (P/N 293 800 041).
3. Apply a strip of proper strength Loctite on leading edge of outer metallic gasket diameter.

NOTE: Any Loctite product can be used here. A low strength liquid is recommended as normal strength and gap are required.

4. Install according to standard procedure.
5. Wipe off surplus.
6. Allow it to cure for 30 minutes.

NOTE: Normally used on worn-out housings to prevent leaking or sliding.

It is generally not necessary to remove gasket compound applied on outer gasket diameter.

TIGHTENING TORQUES

Tighten fasteners to torque mentioned in exploded views and text. When they are not specified refer to following table. The table also gives the metric conversion.

N•m	FASTENER SIZE (8.8)	Lbf•in
1		9
2	M4	18
3		27
4	M5	35
5		44
6		53
7		62
8		71
9		80
10	M6	89
11		97
12		106
13		115
14		124
15		133
16		142
17		150
18		159
19		168

N•m	FASTENER SIZE (8.8)	Lbf•ft
20		15
21		15
22		16
23	M8	17
24		18
25		18
26		19
27		20
28		21
29		21
30		22
31		23
32		24
33		24
34		25
35		26
36		27
37		27

N•m	FASTENER SIZE (8.8)	Lbf•ft
38		28
39		29
40		30
41		30
42		31
43		32
44		32
45		33
46		34
47		35
48	M10	35
49		36
50		37
51		38
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71		52
72		53
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75		55
76		56
77		57
78		58
79		58
80	M12	59
81		60
82		60

INTRODUCTION

N•m	FASTENER SIZE (8.8)	Lbf•ft
83		61
84		62
85		63
86		63
87		64
88		65
89		66
90		66
91		67
92		68
93		69
94		69
95		70
96		71
97		72
98		72
99		73
100		74
101		74
102		75
103		76
104		77
105		77
106		78
107		79
108		80
109		80
110		81
111		82
112		83
113		83
114		84
115		85
116		86
117		86

N•m	FASTENER SIZE (8.8)	Lbf•ft
118		87
119		88
120		89
121		89
122		90
123		91
124		91
125		92
126		93
127		94
128		94
129		95
130		96
131		97
132		97
133		98
134		99
135	M14	100
136		100
137		101
138		102
139		103
140		103
141		104
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TIGHTENING TORQUES FOR 8.8 GRADE BOLTS AND NUTS

Technical Publications
 Bombardier Inc.
 Valcourt (Quebec), Canada

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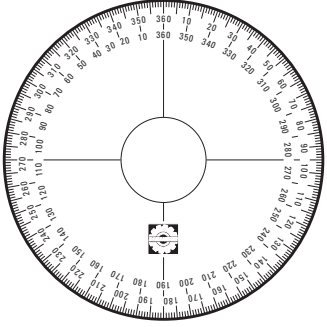
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MANDATORY SERVICE TOOLS

ENGINE

Degree wheel
P/N 529 035 607



A00B334

APPLICATION
717 and 787 engines.

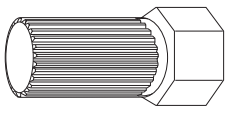
Piston circlip installer
A) P/N 529 035 562
B) P/N 529 035 563



F06B014

APPLICATION
A) 717 and 787 engines.
B) 947 engine.


PTO flywheel
remover/installer
P/N 295 000 001



F01J0T4

APPLICATION
717 engine.
NOTE: This tool is also used for the impeller.

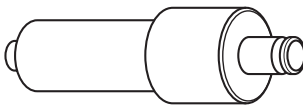
Bearing pusher
P/N 420 876 501



F00B074

APPLICATION
717 and 787 engines.

Starter drive bearing pusher
P/N 290 876 502



F06B054

APPLICATION
947 engine.


Piston pin puller
P/N 529 035 503
Expansion sleeve:
P/N 295 000 117 (787 engine)



F00B0T4

APPLICATION
All engines.

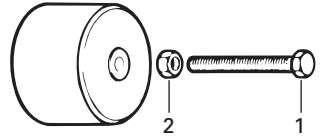
Sleeve set
A) P/N 529 035 542
(20 mm sleeve)
B) P/N 529 035 543
(21 mm sleeve)



F00B0U4

APPLICATION
A) 717 and 787 engines.
B) 947 engine.

Puller ass'y
P/N 290 876 488
1) Screw P/N 290 240 860
2) Hexagonal nut
P/N 290 242 210



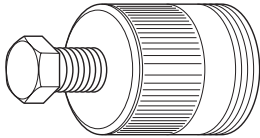
F01B014

APPLICATION
717 and 787 engines.

Section 01 SERVICE TOOLS AND PRODUCTS

Subsection 02 (MANDATORY SERVICE TOOLS)

Puller
P/N 529 035 547



A00C1A4

Puller plate
P/N 420 876 080



A00C1R4

Extension handle
P/N 295 000 125



F01D164

Screw M8 x 35 (3)
P/N 420 841 591



F00A094

Sleeve (3)
P/N 290 847 220



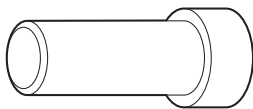
F00A0A4

APPLICATION

717 engine.

Puller is also used for PTO flywheel on 947 engine.

Pusher
P/N 420 876 605



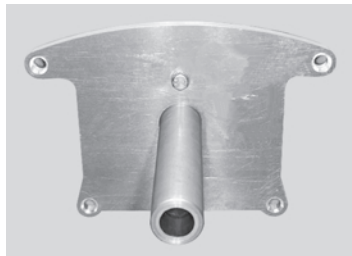
A00C0Y4

APPLICATION

717 engine.

Alignment support plate kit
P/N 529 035 506

- 1) Alignment plates
A) P/N 529 035 507
B) P/N 529 035 508
- 2) Support
P/N 529 035 511
- 3) Screw (2)
P/N 207 182 544
- 4) Lock washer (2)
P/N 234 181 601
- 5) Flat washer (2)
P/N 234 081 410



F00B0F4

APPLICATION

All models.

- A) 155.6 mm jet pump.
- B) 139.5 mm jet pump.

Alignment shaft
P/N 295 000 141

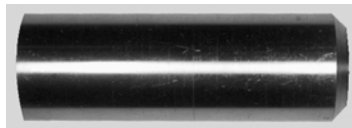


F00B0G4

APPLICATION

All models.

Adapter
P/N 529 035 590



F00B124

APPLICATION

XP model.

VCK (Vehicle Communication Kit)
P/N 529 035 676



F12H0A4

APPLICATION

All models.

Flywheel extractor
P/N 295 000 156



F00B044

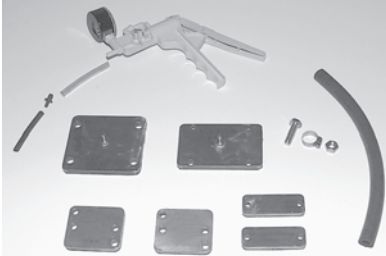
APPLICATION

787 RFI engines.

Section 01 SERVICE TOOLS AND PRODUCTS

Subsection 02 (MANDATORY SERVICE TOOLS)

Engine leak tester kit
P/N 295 500 352
Pump only P/N 529 021 800



F01B205

APPLICATION

717 and 787 engines.

Supplementary engine leak test kit

P/N 295 500 780

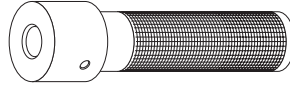
- 1) 787 RFI Intake plate
P/N 296 000 024
- 2) 947 Intake plate
P/N 296 000 025
- 3) 947 Rave plate
P/N 296 000 026
- 4) 947 Exhaust plate
P/N 296 000 027

APPLICATION

787 RFI and 947 engines.

NOTE: This kit is supplementary to P/N 295 500 352.

Handle
P/N 420 877 650



A00C3V4

APPLICATION

Use with pushers (P/N 290 876 609 and 290 877 740).

Ring gear puller tool
P/N 420 976 235
(puller ass'y)
P/N 529 035 549
(puller bolt)

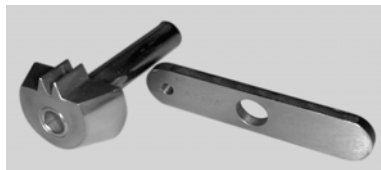


F01B294

APPLICATION

787 and 947 engines.

Ring gear blocking tool
P/N 295 000 155



F01B264

APPLICATION

787 engine.

Puller plate
P/N 529 035 533

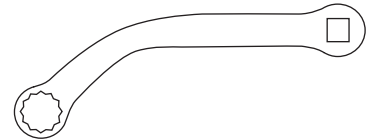


F00B174

APPLICATION

947 engine.

Polygonal wrench
P/N 529 035 505

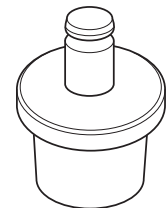


F00B0Y4

APPLICATION

Exhaust system of the 947 engine.

Rotary valve shaft pusher
P/N 290 876 690



F01B2B4

APPLICATION

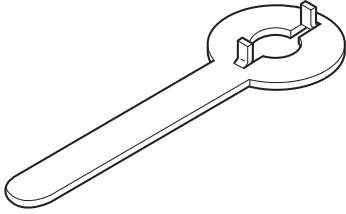
787 RFI engine.

Section 01 SERVICE TOOLS AND PRODUCTS

Subsection 02 (MANDATORY SERVICE TOOLS)

COOLING/FUEL/OIL SYSTEMS

Gear holder
P/N 420 277 905



A00C164

APPLICATION

717 engine.

Coupler hose
P/N 295 500 258

41 cm (16 in)



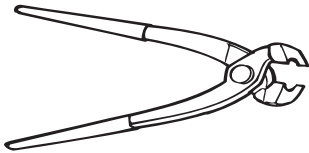
F01E0Z4

APPLICATION

GTS model.

Pliers
P/N 295 000 070

Oetiker 1099



F01D174

APPLICATION

All models.

Fuel pressure gauge
P/N 529 035 591



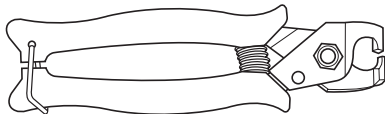
F02B0B4

APPLICATION

787 RFI engine.

Pliers
P/N 295 000 054

Caillau



F01B1T4

APPLICATION

All models.

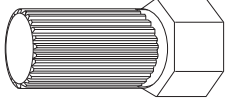
NOTE: This tool is also used for the propulsion system.

Section 01 SERVICE TOOLS AND PRODUCTS

Subsection 02 (MANDATORY SERVICE TOOLS)

PROPULSION SYSTEM

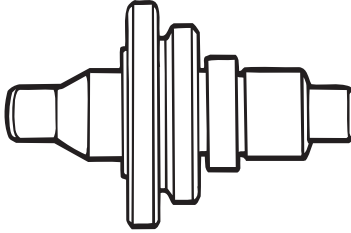
Impeller remover/installer
P/N 295 000 001



F01J0T4

APPLICATION
All models.
NOTE: This tool is also used for the PTO flywheel (on some models).

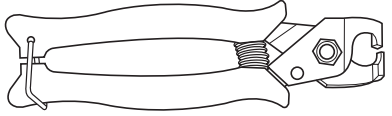
Bearing/seal installer
P/N 295 000 107



F01J4K4

APPLICATION
All models except GTX and XP.

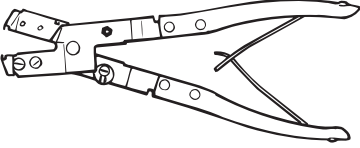
Pliers
P/N 295 000 054
Caillau



F01B1T4

APPLICATION
All models.
NOTE: This tool is also used for the fuel system.


Pliers
P/N 295 000 069
Oetiker 1090



F01D184

APPLICATION
All models.

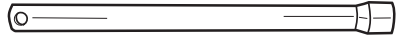
Inner seal installer
P/N 529 035 609



F08B014

APPLICATION
155.6 mm (6-1/8 in) jet pump.

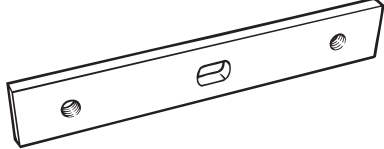
VTS tool
P/N 295 000 133



F01B2P4

APPLICATION
GSX RFI and XP models.

Impeller shaft holder
P/N 295 000 082



F01B0W4

APPLICATION
All models.


Drive shaft alignment tool
P/N 529 035 590



F08B024

APPLICATION
XP model.

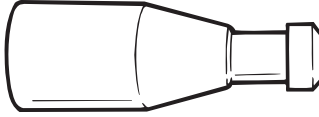
Jet pump bearing remover
P/N 295 000 144



F01J114

APPLICATION
All models.

Impeller shaft guide
P/N 295 000 002



F01J104

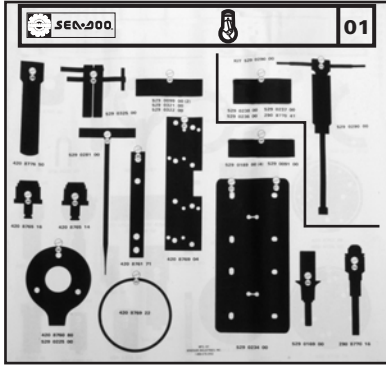
APPLICATION
All models.

Section 01 SERVICE TOOLS AND PRODUCTS

Subsection 02 (MANDATORY SERVICE TOOLS)

WORKSHOP

Tool board
P/N 295 500 608



F00A0S4

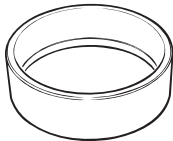
APPLICATION

All models.

OPTIONAL SERVICE TOOLS

ENGINE

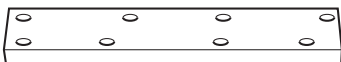
Coil centering tool
P/N 420 876 922



A01B1V4

APPLICATION
717 engine.

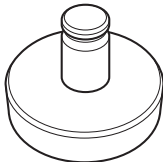
Cylinder aligning tool
P/N 420 876 904



A00B084

APPLICATION
717 engine.

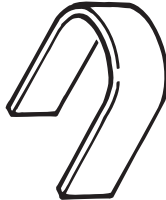
Oil seal pusher
P/N 290 877 740



F01B2C4

APPLICATION
787 engine.

Distance gauge
A) P/N 529 034 800, 14 mm
B) P/N 529 034 900, 15.4 mm
C) P/N 529 035 100, 11.5 mm
D) P/N 529 035 000, 7.5 mm



F01B0H4

APPLICATION
A) 717 engine.
B) 787 engine.
C) 947 engine (MAG).
D) 947 engine (PTO).


Stroboscopic timing light
P/N 529 031 900



A00B4F4

APPLICATION
All models.

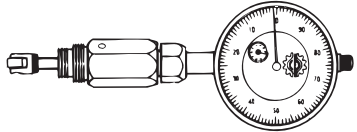
A) Four-pin magneto harness
P/N 295 000 131
B) Six-pin magneto harness
P/N 295 000 136



F01B284

APPLICATION
A) 717 engine.
B) 787 and 947 engines.

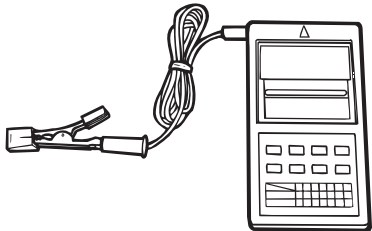
Dial indicator (TDC gauge)
P/N 295 000 143



A00B4E4

APPLICATION
All models.

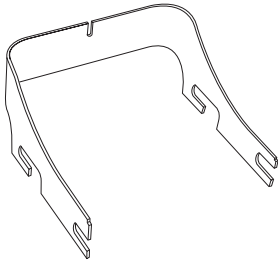
Digital/induction type
tachometer
P/N 529 014 500



F01B1G4

APPLICATION
All models.

Timing mark pointer
P/N 295 000 130



F01B2O4

APPLICATION
717 engine.

Section 01 SERVICE TOOLS AND PRODUCTS

Subsection 03 (OPTIONAL SERVICE TOOLS)

Timing mark pointer
P/N 295 000 135



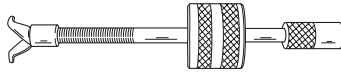
F01H544

APPLICATION

787 and 947 engines.

Slide hammer puller
Not sold by Bombardier

Snap-on: Handle CJ93-1
Hammer CJ125-6
Claws CJ93-4



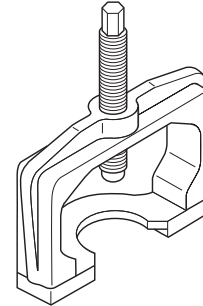
F01J0Z4

APPLICATION

717 and 787 engines.

NOTE: This tool is also used to pull out impeller shaft seal.

Gear/bearing puller
P/N 290 877 665



F04B034

APPLICATION

787 RFI engine.

Crimping tool
P/N 295 100 164



F00B0E4

APPLICATION

Contacts of AMP plug connectors.

Protective mat
P/N 295 000 128

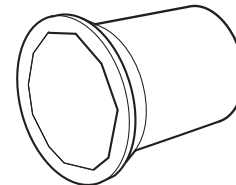


F02B0A4

APPLICATION

All models.

Exhaust outlet tool
P/N 295 000 132



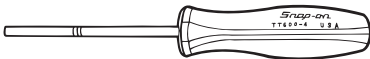
F01B2A4

APPLICATION

All models.

Terminal (Packard) remover
Not sold by Bombardier

Snap-on
TT 600-4



F01B1J4

APPLICATION

All models.

Crankshaft protector
P/N 420 876 552



F00B034

APPLICATION

For use with pullers.

Engine lifting device
Not sold by Bombardier

Do it yourself

Refer to REMOVAL AND INSTALLATION section.

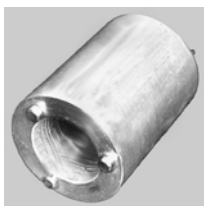


F01D0A4

APPLICATION

717 engine.

Safety lanyard switch tool
P/N 529 034 600



F01B244

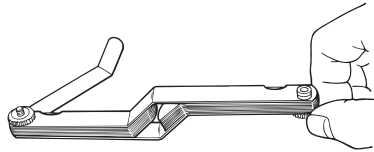
APPLICATION

All models.

Section 01 SERVICE TOOLS AND PRODUCTS

Subsection 03 (OPTIONAL SERVICE TOOLS)

Feeler gauge 45°
Not sold by Bombardier
Snap-on
FB 300 A

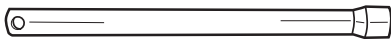


F01B1K4

APPLICATION

717 and 787 RFI engines.

Steering cable tool
P/N 295 000 145

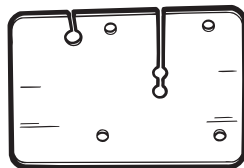


F01B2P4

APPLICATION

All models except GTS.

Rubber pad
P/N 295 000 101

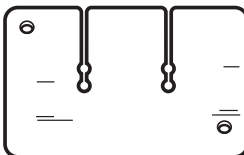


F01B0J4

APPLICATION

717 and 787 RFI engines.

Rubber pad
P/N 290 877 032



F06B064

APPLICATION

947 engine.

MPEM programmer
P/N 529 035 718

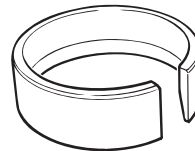


A01B5B4

APPLICATION

All models.

Piston ring compressor (2)
A) P/N 290 876 965 (88 mm)
B) P/N 290 876 979 (82 mm)

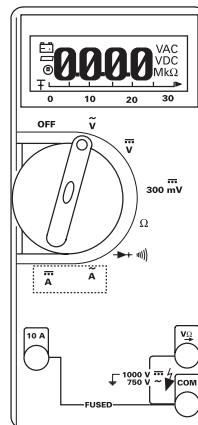


F01B1T4

APPLICATION

A) 947 engine.
B) 717 and 787 RFI engines.

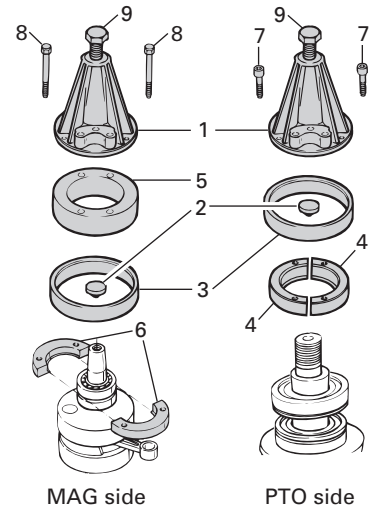
Digital multimeter
P/N 529 022 000



F01B104

APPLICATION

All models.



F01D885

- 1) Puller ass'y
P/N 420 877 635
- 2) Protective cap
P/N 420 876 557
P/N 290 877 414 (947 engine)
- 3) Ring (both ends)
P/N 420 977 490
P/N 420 977 480 (947 engine)
- 4) Ring halves (PTO)
P/N 420 977 475 (2)
P/N 420 876 330 (947 engine)
- 5) Distance ring (MAG)
P/N 420 876 569
- 6) Ring halves (MAG)
P/N 420 276 025 (2)
- 7) Screw M8 x 40
P/N 420 840 681 (2)
- 8) Screw M8 x 70
P/N 420 841 201 (2)
- 9) Puller bolt
P/N 420 940 755

APPLICATION

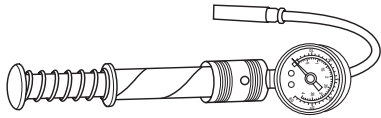
All engines.

Section 01 SERVICE TOOLS AND PRODUCTS

Subsection 03 (OPTIONAL SERVICE TOOLS)

COOLING/FUEL/OIL SYSTEMS

Pump gauge tester
P/N 295 000 114



F01B0X4

APPLICATION

All models except RFI models.

Lighted adjustable mirror
Not sold by Bombardier

Snap-on
50101

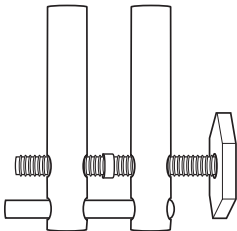


F01B114

APPLICATION

All models.

Hose pincher
P/N 529 032 500

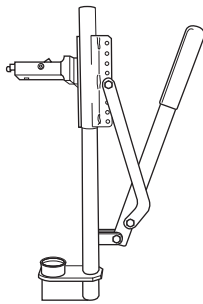


F01B234

APPLICATION

All models.

Spring compressor
P/N 529 035 504



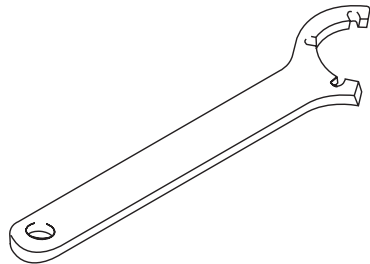
A01B404

APPLICATION

XP model.

Suspension adjustment
wrench

P/N 529 012 200



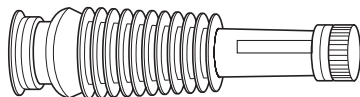
A25A014

APPLICATION

XP model.

Flexible spout (oil)

P/N 414 837 300

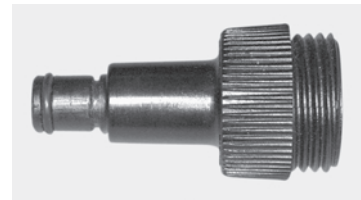


F04B044

APPLICATION

All models.

Flushing adapter
P/N 295 500 473



F00B104

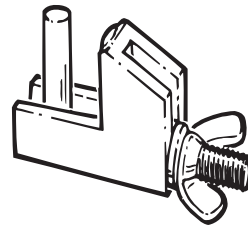
APPLICATION

All models except GTS.

Use with coupler hose (P/N 295 500 258).

Hose pincher

P/N 295 000 076



A01B214

APPLICATION

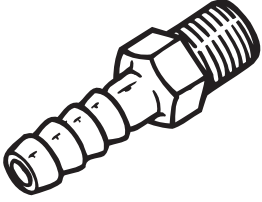
All models.

Section 01 SERVICE TOOLS AND PRODUCTS

Subsection 03 (OPTIONAL SERVICE TOOLS)

PROPULSION SYSTEM

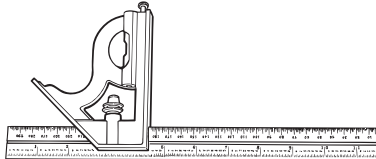
Fitting
P/N 295 000 086



F01B0Z4

APPLICATION
All models.

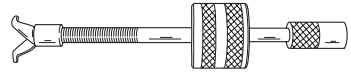
Machinist's square
Not sold by Bombardier
Snap-on
PMF 122



F02B064

APPLICATION
GTS model.

Slide hammer puller
Not sold by Bombardier
Snap-on: Handle CJ93-1
Hammer CJ125-6
Claws CJ93-4

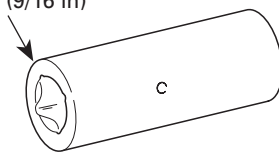


F01J0Z4

APPLICATION
All models.
NOTE: This tool is also used to remove rotary valve shaft bearing.

Fitting remover
Not sold by Bombardier
Do it yourself
Refer to JET PUMP section.


Deep socket
14 mm (9/16 in)



F01J2R4

APPLICATION
GTS model.

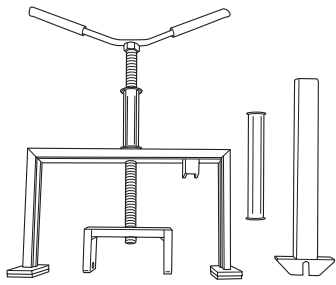
Hacksaw
Not sold by Bombardier
Snap-on
HS3



F01B1M4

APPLICATION
All models.

Impeller housing remover
P/N 295 000 113



F01L204

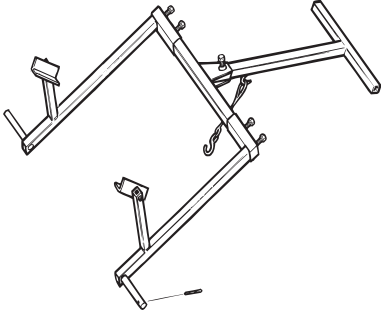
APPLICATION
GTS model.

Section 01 SERVICE TOOLS AND PRODUCTS

Subsection 03 (OPTIONAL SERVICE TOOLS)

WATERCRAFT HANDLING

Dolly (with wheels)
P/N 295 000 126



F01B014

Beach wheels
(set of 2 wheels)
P/N 295 000 005



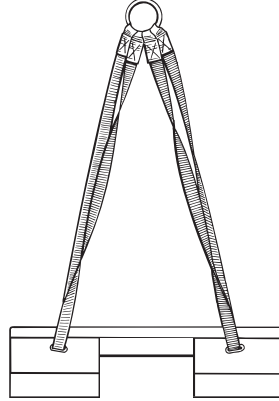
F01B074

APPLICATION
Dolly.

Tie-down with ratchet
3.60 m (12 ft) long
P/N 295 100 104

APPLICATION
All models.

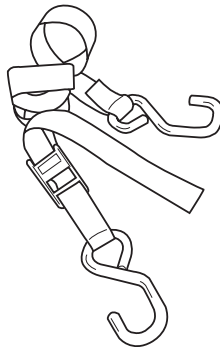
Lift kit
P/N 295 100 044



F00B0Z4

APPLICATION
All models.

Tie-down
1.50 m (5 ft) long
P/N 295 100 103



F00B014

APPLICATION
All models.

SERVICE PRODUCTS

Loctite® is a trademark of Loctite™ Corporation.

Permatex® is a trademark of Loctite™ Corporation.

Dow Corning® is a trademark of Dow Corning Corporation.

Medium strength threadlocker
P/N 293 800 060

Loctite 243 (blue)
(10 mL)



F00A004

High temperature threadlocker
P/N 420 899 788

Loctite 648 (green)
(5 g)



A00B3D4

Retaining compound
P/N 413 703 100

Loctite RC/609 (green)
(10 mL)



A00B2S4

High temperature retaining
compound
P/N 293 800 054

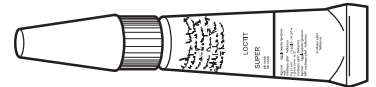
Loctite 642
(50 mL)



F00B024

General purpose instant adhesive
P/N 293 800 021

Loctite 495



A00B2V4

High strength threadlocker
P/N 293 800 005

Loctite 271 (red)
(10 mL)



A00B2U4

Gasket eliminator
P/N 293 800 038

Loctite 518
(50 mL)



F01B124

Section 01 SERVICE TOOLS AND PRODUCTS

Subsection 04 (SERVICE PRODUCTS)

Gasket stripper
P/N 413 508 500

(500 mL)



F01B1W4

Primer for gasket eliminator
P/N 293 800 041

Loctite
764



A00B3N4

Ultra Copper High temp sealant
P/N 413 710 300

(80 g)



A02B044

Thread sealant
P/N 293 800 050

Loctite 577
(250 mL)



F00B0W4

Pipe sealant

A) P/N 293 800 018

B) P/N 293 800 013

A) Loctite 592 (50 mL) B) Loctite 567 (250 mL)



A00B2W4

Dielectric grease

P/N 293 550 004

Dow Corning
(150 g)



F01B164

Solvent

P/N 293 800 019

Loctite Safety
Solvent 755
340 g (12 oz)



A00B3M4

Hylomar sealant

P/N 293 800 001

PL-32
(100 g)



A00B3F4

Deoxit contact lubricant

P/N 293 550 015

(200 mL)



F00B0X4

Molykote 111
(P/N 413 707 000)



A00B3W4

Sealant

P/N 293 530 011

Sikaflex 221 (black)
(350 mL)



F01B1D4

Section 01 SERVICE TOOLS AND PRODUCTS

Subsection 04 (SERVICE PRODUCTS)

Grease
P/N 293 550 005

(400 g)



A00B2L4

BOMBARDIER LUBE
P/N 293 600 016

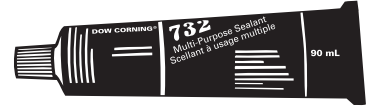
(12 x 14 oz)



F01B0S4

732 Multi-purpose sealant
P/N 293 800 033

Dow Corning (90 mL)
(clear)



F01B1C4

Synthetic grease
P/N 293 550 010

(400 g)



F01B154

BOMBARDIER injection oil
P/N 413 802 900

(12 x 1 L)



F01B184

Super Lube grease
P/N 293 550 014



A00B474

Bombardier storage oil
P/N 413 711 600

(12 x 350 g)



A02B054

BOMBARDIER injection oil
P/N 413 803 000 (3 x 4 L)
P/N 413 803 200 (205 L)



F01B2H4

Anti-seize lubricant
P/N 293 800 023

Loctite 767
454 g (16 oz)



F01B174

Sea-Doo fuel stabilizer
P/N 413 408 600

236 mL (8 oz)



A00B3V4

Section 01 SERVICE TOOLS AND PRODUCTS

Subsection 04 (SERVICE PRODUCTS)

BOMBARDIER Formula XP-S
synthetic injection oil
P/N 413 710 500 (12 x 1 L)



F01B2G4

The Right Stuff (sealant)
P/N 293 800 053

Permatex®
(198 g)



F00B0V4

BOMBARDIER Formula XP-S
synthetic injection oil
P/N 413 711 000 (3 x 4 L)
P/N 413 710 700 (205 L)



F01B354

Jet pump oil
P/N 293 600 011 (12 x 6 oz)

Sea-Doo
synthetic jet pump oil



F01B0P4

Sealant adhesive
P/N 293 800 033

Adchem 4511
(clear)



F01B1S4

Sea-Doo Cleaner
P/N 293 110 001 (400 g)
P/N 293 110 002 (4 L)



F01B2J4

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STORAGE.....	02-05-1

PERIODIC INSPECTION CHART

NOTE: Servicing period is given in hours. Shaded area shows the maintenance frequency.

DESCRIPTION	FREQUENCY			
	FIRST 10 HOURS	EVERY 25 HOURS	EVERY 50 HOURS	EVERY 100 HOURS OR SEASONALLY
Lubrication/corrosion protection of metallic components	①			
Engine ignition timing				
Spark plug replacement				
Throttle/choke cables, inspection/lubrication	①			
Flame arrester inspection (717 and 787 RFI engines)				
Carburetor adjustment including choke/throttle cable adjustments and linkage				
Fuel injector sensors verification (RFI)				
RAVE valve cleaning (787 RFI and 947 engines)				
Engine counterbalance shaft oil level (787 RFI and 947 engines)				
Water flow regulator valve inspection (787 RFI and 947 engines)				
Oil injection pump adjustment				
Fuel filter and oil filter inspection				
Fuel filter and oil filter replacement				
Engine head bolts or nuts, retorque				
Steering system inspection				
Reverse system/reverse cable adjustment (if applicable)				
Variable trim system (if applicable)				
Fastener tightening (flame arrester support, carburetor(s), engine mount, exhaust system, etc.)				
Muffler, battery and reservoir fastening devices				
Fuel/oil lines, check valve and hose inspection, fuel system pressurization				
Fuel/vent line pressure relief valve inspection				
Inspect/clean engine drain hose	①			
Water tank trap drain inspection (GTS)				
Bailer pick up inspection				
Battery condition				
Electrical connections (starter, battery, etc.)				
Monitoring beeper				
Jet pump reservoir oil level/oil condition				
Jet pump oil replacement				
Jet pump cover pusher inspection				
Jet pump seal replacement				REPLACE AT 150 HOURS
Impeller condition and impeller/wear ring clearance		②		
Drive shaft boot/spline condition (both ends)		②		
PTO flywheel and seal carrier lubrication (if applicable)				
Water intake grate condition		②		
Hull condition				
Cooling system flushing	③			

① Every 10 hours in salt water use.

② These items have to be initially checked after 25 hours. Thereafter, servicing to be made as specified in this chart.

③ Daily flushing in salt water or foul water use.

FLUSHING AND LUBRICATION

GENERAL

Flushing the cooling system with fresh water is essential to neutralize corroding effects of salt or other chemical products present in water. It will help to clean up sand, salt, shells or other particles in water jackets (engine, exhaust manifold, tuned pipe) and/or hoses.

Cooling system flushing and engine internal lubrication should be performed when the watercraft is not expected to be used further the same day or when the watercraft is stored for any extended time.

CAUTION: Failure to flush cooling system, when necessary, will severely damage engine and/or exhaust system. Never flush a hot engine. Make sure engine operates during entire procedure.

PROCEDURE

⚠ WARNING

Perform this operation in a well ventilated area. Do not touch any electrical parts or jet pump area when engine is running.

Clean jet pump by spraying water in its inlet and outlet and then spray BOMBARDIER LUBE lubricant.

⚠ WARNING

Always remove safety lanyard cap from switch to prevent accidental engine starting before cleaning the jet pump area. Engine must not be running for this operation.

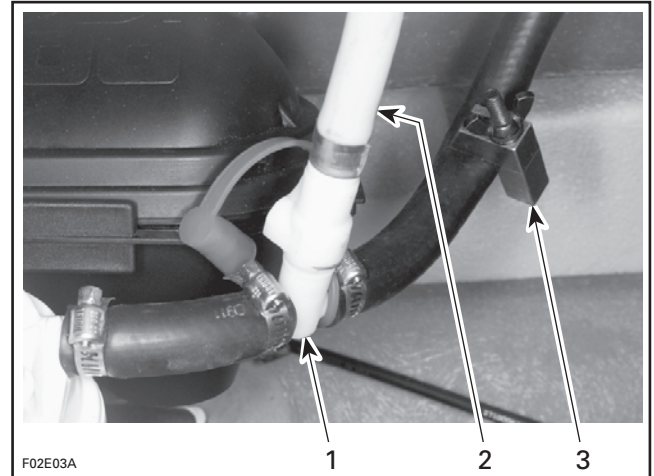
GTS Model

Remove seat to allow access to cooling system.

Remove dust cap from fitting spigot and attach coupler hose (P/N 295 500 258). Make sure coupler hose is properly locked to fitting spigot.

Install a hose pincher on water outlet hose.

CAUTION: This prevents water from exiting through outlet socket. Remove hose pincher after flushing operation.



GTS MODEL

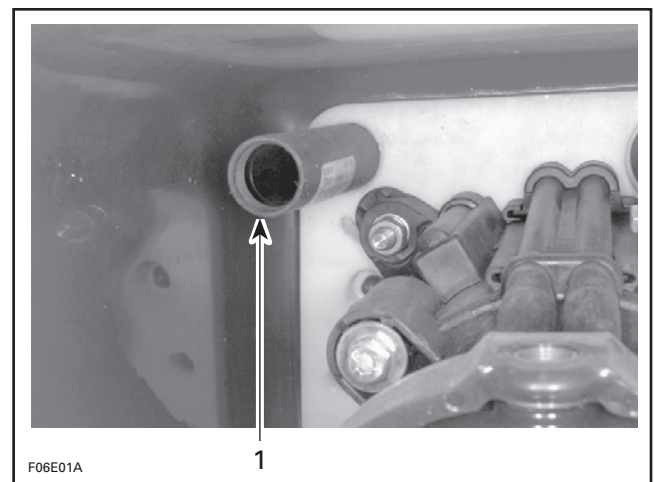
1. Fitting spigot
2. Coupler hose
3. Hose pincher

Attach other end of coupler hose to a garden hose.

CAUTION: Do not open water tap yet.

All Models Except GTS

Install flushing adaptor (P/N 295 500 473) to the water outlet located at the rear of the watercraft.



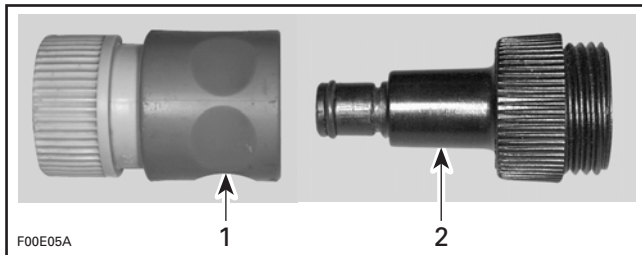
1. Install flushing adaptor

Section 02 MAINTENANCE

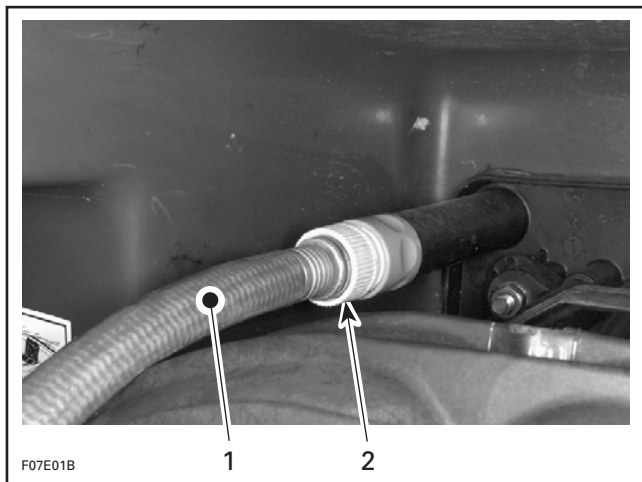
Subsection 03 (FLUSHING AND LUBRICATION)

Connect a garden hose to the flushing adaptor.

NOTE: A quick connect adapter can be used to ease garden hose installation.



1. Quick connect adapter
2. Flushing adaptor (P/N 295 500 473)



1. Garden hose installed
2. Quick connector adaptor

All Models

Start the engine **then** immediately open the water tap.

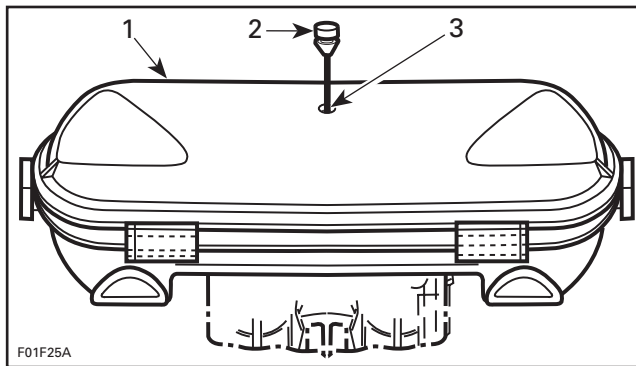
WARNING

Do not touch any electrical parts or jet pump area when engine is running.

CAUTION: Never flush a hot engine. Always start the engine before opening the water tap. Open water tap immediately after engine is started to prevent overheating.

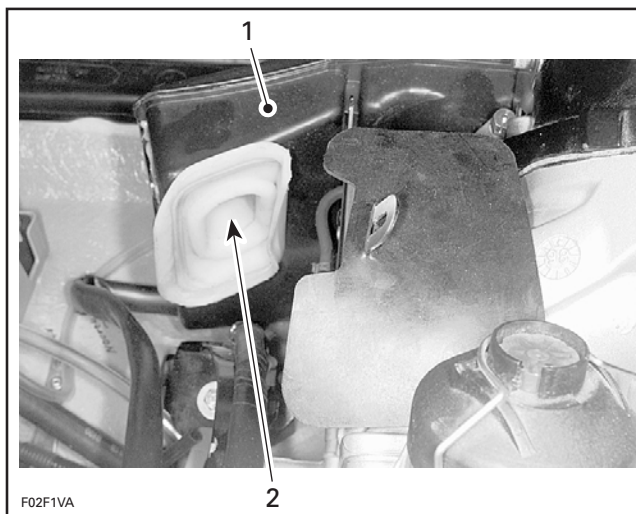
Run the engine about 3 minutes at a fast idle around 3500 RPM.

Spray BOMBARDIER LUBE lubricant through air intake silencer keeping engine at fast idle.



GS, GTS, GTI, GSX RFI AND GTX RFI MODELS

1. Air intake silencer
2. Pull plug
3. Spray BOMBARDIER LUBE here



XP AND GTX MODELS

1. Air intake silencer
2. Spray BOMBARDIER LUBE here

NOTE: Lubrication of engine should be done at least for 1 minute.

After approximately half a minute, close fuel valve to run engine out of fuel while lubricating.

CAUTION: When engine begins to run irregularly because of fuel starvation, immediately close the water tap to stop water flow before engine dies.

Close the water tap **then** stop the engine.

CAUTION: Always close the water tap before stopping the engine.

Disconnect the garden hose.

GTS Model

Unlock and remove coupler hose. Reinstall dust cap over fitting spigot.

Remove hose pincher from water outlet hose.

CAUTION: Serious engine damage can occur if hose pincher is not removed.

All Models Except GTS

CAUTION: Remove quick connect adapter after flushing operation (if used).

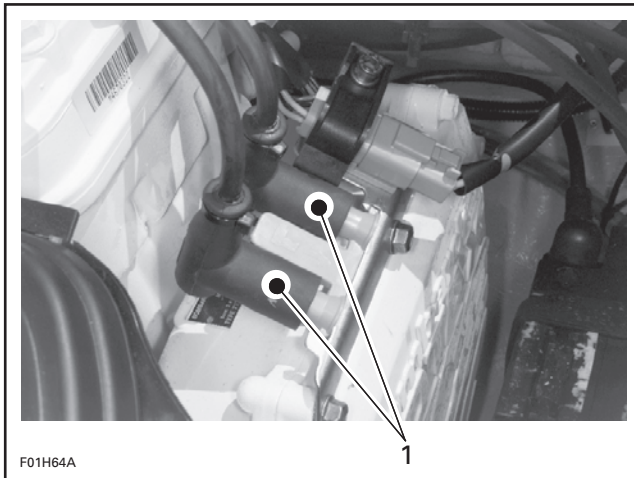
All Models

Wipe up any residual water from the engine.

Remove spark plug cables and connect them on the grounding device.

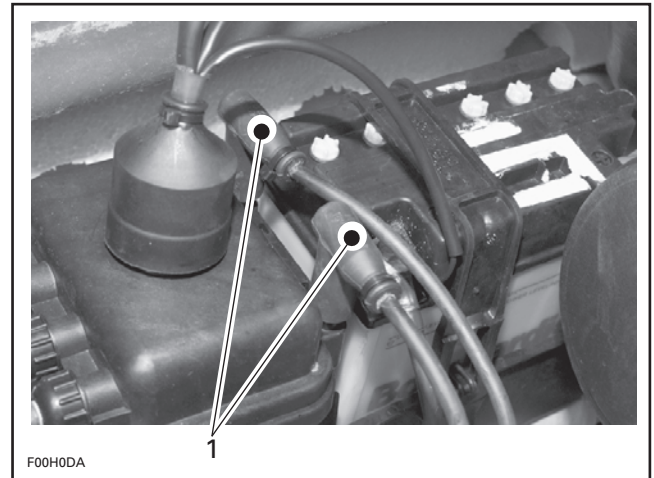
WARNING

Always use spark plug cable grounding device when removing spark plugs.



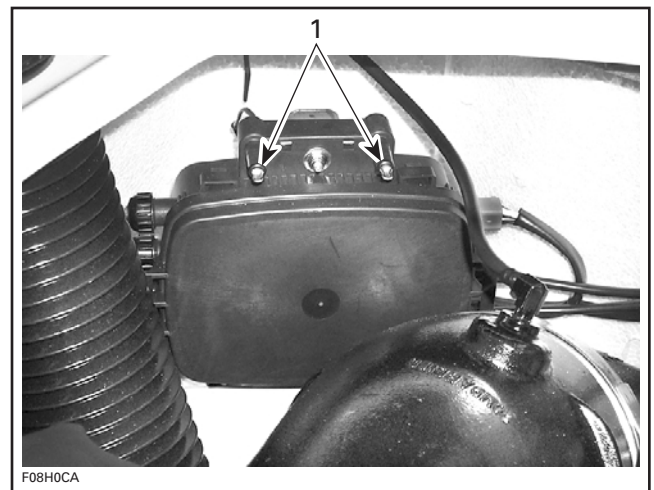
GTS MODEL

1. Spark plug cables on grounding device



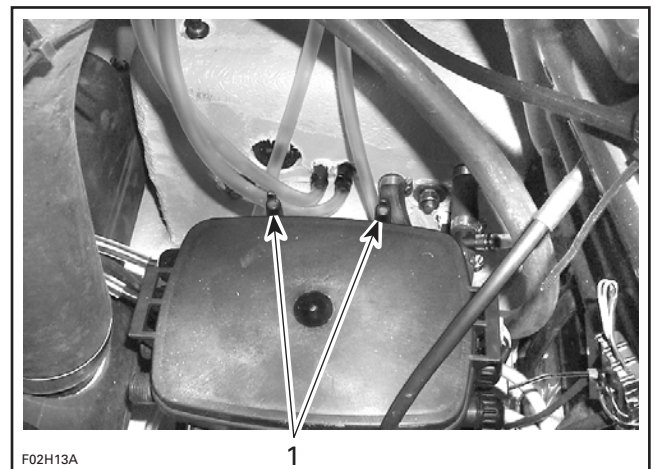
GS AND GTI MODELS

1. Spark plug cables on grounding device



XP MODEL

1. Grounding device

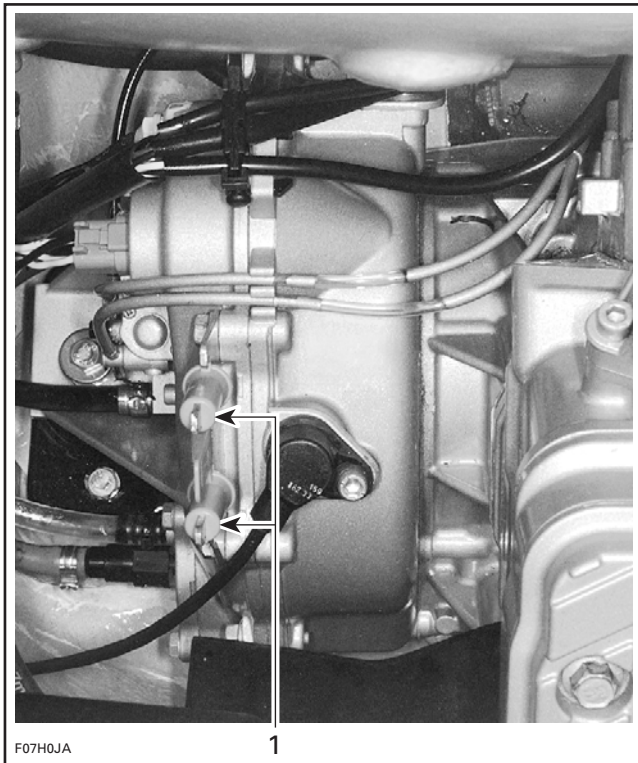


GTX MODEL

1. Grounding device

Section 02 MAINTENANCE

Subsection 03 (FLUSHING AND LUBRICATION)



GSX RFI AND GTX RFI

1. Grounding device

Remove both spark plugs and spray BOMBARDIER LUBE lubricant into each cylinder.

Connect safety lanyard cap to the switch.

Fully depress the throttle lever then press the start/stop button to crank the engine a few turns to distribute the oil onto cylinder wall.

GSX RFI and GTX RFI Models

On RFI models, fully depress throttle lever and connect the safety lanyard to the switch.

Press the start/stop button to crank the engine a few turns and distribute the lubricant onto cylinder walls.

NOTE: Proceeding in this order, no fuel will be injected into the engine.

Apply anti-seize lubricant on spark plug threads then reinstall them.

Reinstall plug on air intake silencer cover (GS, GTS and GTI models).

NOTE: Engine fogging should be done with BOMBARDIER LUBE lubricant whenever the watercraft is to be stored for a few days or a long period.

CAUTION: Never leave rags or tools in the engine compartment or in the bilge.

WATER-FLOODED ENGINE

GENERAL

If engine is water-flooded, it must be serviced within a few hours after the event. Otherwise engine will have to be overhauled.

CAUTION: A water-flooded engine must be properly lubricated, operated then lubricated again, otherwise parts will be seriously damaged.

PROCEDURE

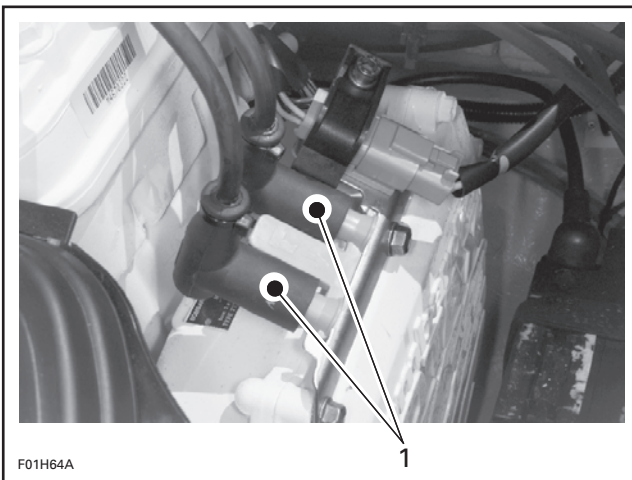
Check fuel and oil reservoirs for water contamination. If necessary, siphon and refill with fresh fluids. Turn fuel valve to OFF position then drain fuel filter bowl. Refer to FUEL CIRCUIT.

Drain bilge if water is present.

Remove spark plug cables and connect them on the grounding device.

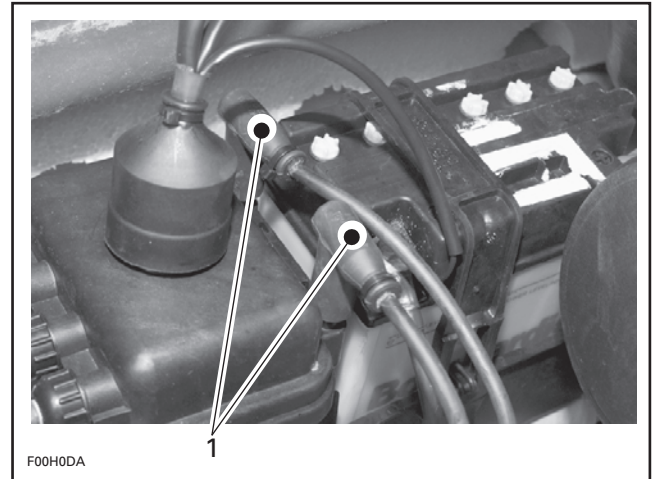
⚠ WARNING

Never crank engine with spark plugs removed unless spark plug cables are connected to the grounding device.



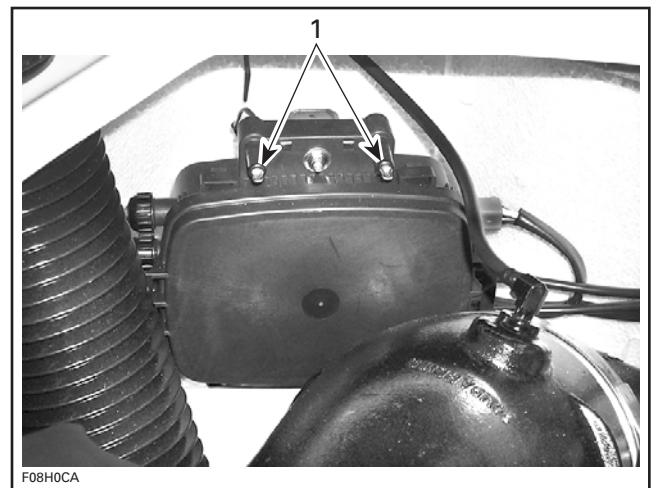
GTS MODEL

1. Spark plug cables on grounding device



GS AND GTI MODELS

1. Spark plug cables on grounding device

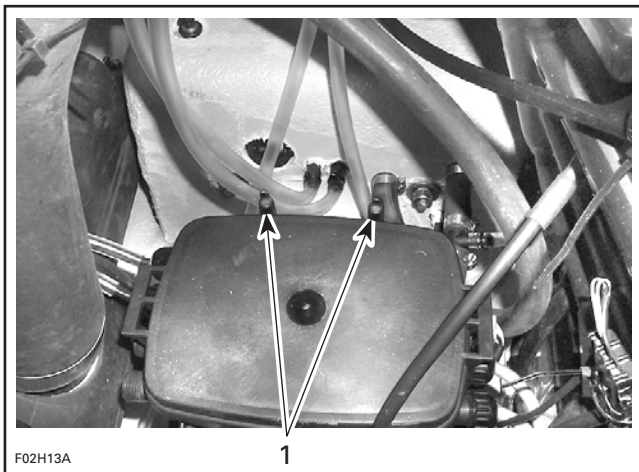


XP MODEL

1. Grounding device

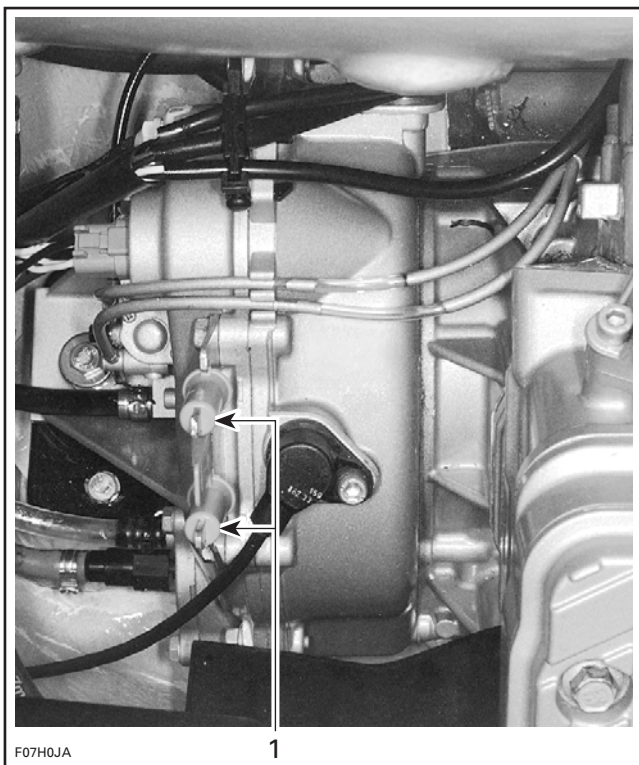
Section 02 MAINTENANCE

Subsection 04 (WATER-FLOODED ENGINE)



GTX MODEL

1. Grounding device



GSX RFI AND GTX RFI MODELS

1. Grounding device

Remove spark plugs and dry them with a clean cloth. A contact cleaner spray can be used. It may be preferable to replace spark plugs. Do NOT install spark plugs on engine.

Crank engine to drain crankcase.

⚠ WARNING

Be careful when cranking engine, water will spray out from spark plug holes.

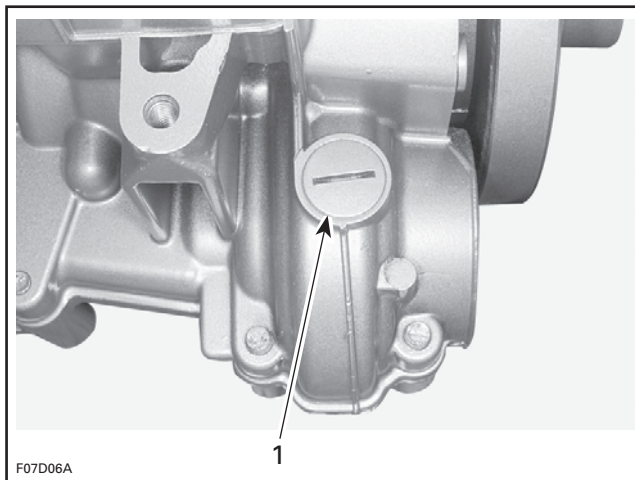
Spray BOMBARDIER LUBE lubricant (P/N 293 600 016) into spark plug holes.

Crank engine again.

Reinstall spark plugs and spark plug cables.

787 RFI Engine

Remove the filler plug of the counterbalance shaft on the engine crankcase.

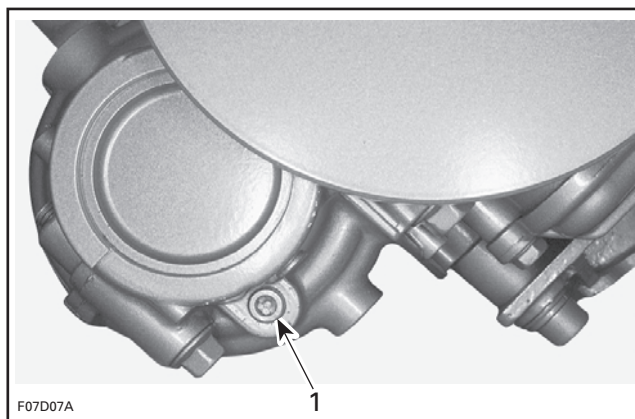


787 RFI ENGINE

1. Remove filler plug

Insert a wire through oil filler hole to check oil condition. A whitish oil indicates water contamination and must be replaced.

In order to replace the oil, remove the drain plug of the counterbalance shaft located on the PTO side of the lower crankcase.



787 RFI ENGINE

1. Drain plug

Drain completely the crankcase oil of the counterbalance shaft. Reinstall drain plug with Loctite 515.

Add 30 mL (1 oz) of SAE 30 motor oil.

Reinstall filler plug.

All Models Except GSX RFI and GTX RFI

Turn fuel valve to ON position.

Start engine. It may be necessary to use the choke. If engine does not start, repeat previous steps as necessary.

GSX RFI and GTX RFI Models

Start engine according to normal starting procedure.

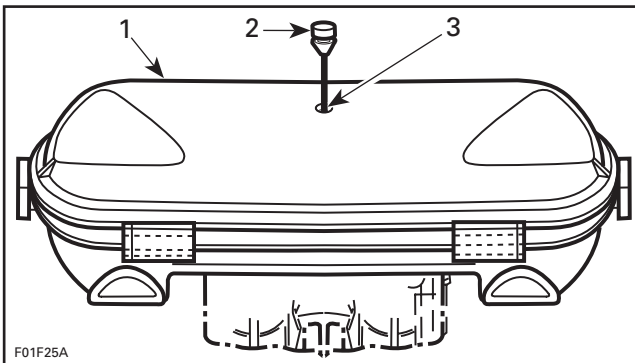
All Models

CAUTION: To avoid starting motor overheating, the cranking period should not exceed 5-10 seconds and a rest period of 30 seconds should be observed between cranking cycles.

NOTE: If engine does not start after several attempts, check ignition system for spark occurrence. Refer to IGNITION SYSTEM.

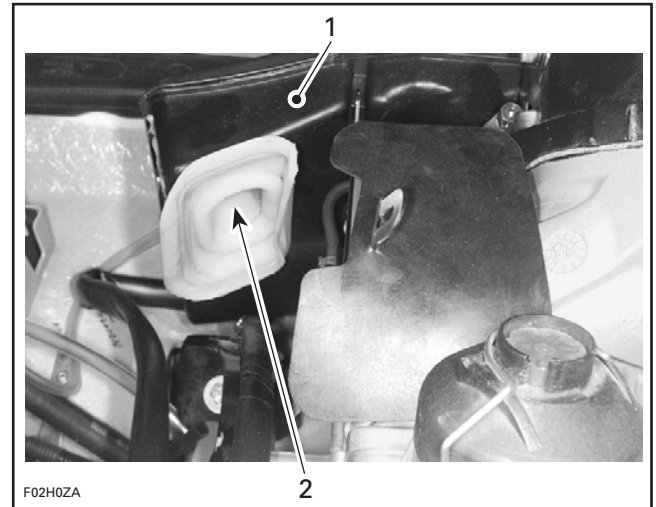
Check crankshaft if needed, it may be misaligned or deflected. Refer to BOTTOM END.

After engine has started, spray BOMBARDIER LUBE lubricant through air intake silencer while engine is running.



717 AND 787 RFI ENGINES

1. Air intake silencer
2. Pull plug
3. Spray BOMBARDIER LUBE here



947 ENGINE

1. Air intake silencer
2. Spray BOMBARDIER LUBE here

Run engine until it reaches its normal operating temperature.

CAUTION: Engine must be cooled using the flush kit.

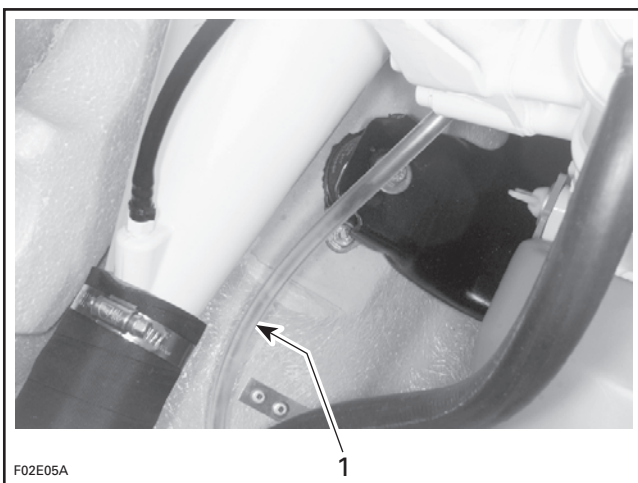
STORAGE

Engine Draining

All Models Except GSX RFI and GTX RFI

Check engine drain hose (lowest hose of engine). Make sure there is no sand or other particles in it and that it is not obstructed so that water can leave the engine. Clean hose and fitting as necessary.

CAUTION: Water in engine drain hose must be free to flow out, otherwise water could be trapped in engine. Should water freeze in engine, severe damage will occur. Check engine drain hose for obstructions.



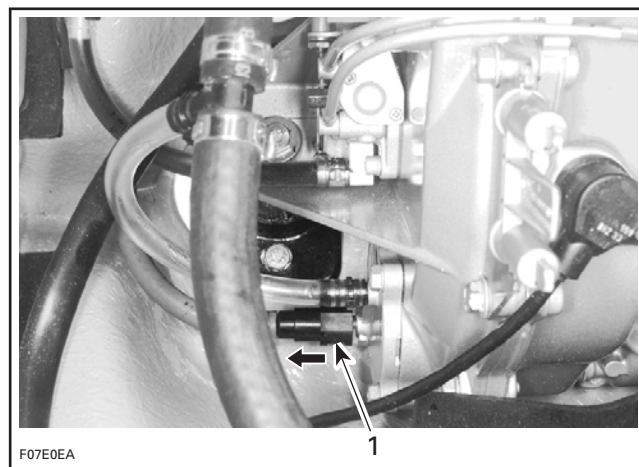
TYPICAL

1. Engine drain hose

GSX RFI and GTX RFI Models

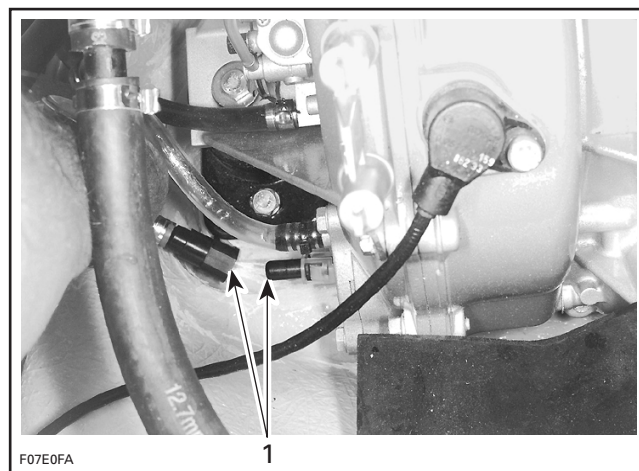
Disconnect the water supply hose used to cool the magneto. It features a quick connect fitting. Press both tabs and pull fitting in order to disconnect hose.

This hose is located at the bottom of the magneto cover beside the engine support.



1. Disconnect this hose

Water should flow out of the fitting (magneto cooling circuit) and hose (crankcase heat exchanger).



1. Make sure water flows out of fitting and hose

CAUTION: Water in heat exchanger system must be free to flow out. Should water freeze in engine, severe damage will occur.

Reconnect water supply hose to magneto heat exchanger.

Section 02 MAINTENANCE

Subsection 05 (STORAGE)

Fuel System

Sea-Doo Fuel Stabilizer (P/N 413 408 600) or equivalent should be added in fuel tank to prevent fuel deterioration and, if so equipped, carburetor(s) gumming. Follow manufacturer's instructions for proper use.

On RFI models, fill up fuel tank completely. Ensure there is no water inside fuel tank.

CAUTION: Should any water be trapped inside fuel tank, severe internal damage will occur to the fuel injection system.

NOTE: Fuel stabilizer should be added prior engine lubrication to ensure that the carburetor(s), if so equipped, is (are) protected against varnish deposits.

⚠ WARNING

Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area.

Always turn the fuel valve to OFF position when storing the watercraft (except RFI models).

Cooling System Flushing and Engine Internal Lubrication

Cooling system has to be flushed with fresh water to prevent salt, sand or dirt accumulation which will clog water passages.

Engine must be lubricated to prevent corrosion on internal parts.

For proper procedure, refer to FLUSHING AND LUBRICATION.

Propulsion System

JET PUMP

Lubricant in impeller shaft reservoir should be drained. Reservoir should be cleaned and refilled with SEA-DOO synthetic 75W90 GL5 polyolester oil. Refer to JET PUMP for proper procedure.

CAUTION: Use only SEA-DOO jet pump oil or equivalent synthetic gear oil, otherwise component service life could be reduced. Do not mix oil brands or types.

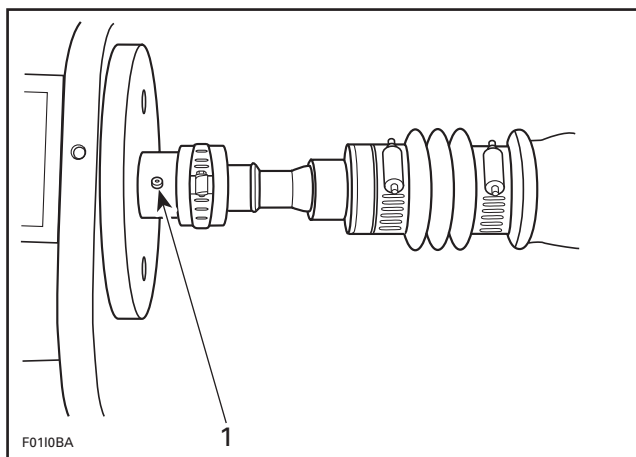
PTO FLYWHEEL

All Models

Remove PTO flywheel guard.

Lubricate PTO flywheel at grease fitting with synthetic grease (P/N 293 550 010).

CAUTION: Do not lubricate excessively. Immediately stop when a slight movement is noticed on rubber boot.



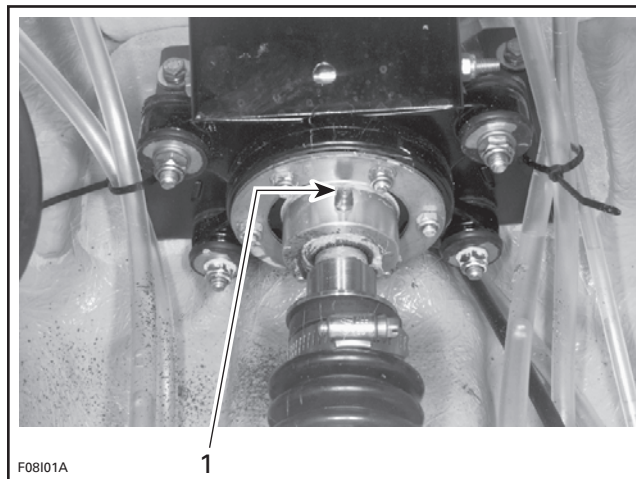
1. Grease PTO flywheel

CAUTION: Never leave any clothing, tool or other objects near PTO flywheel and drive shaft.

SEAL CARRIER

XP Model

Lubricate seal carrier of drive shaft support with synthetic grease. Stop lubricating when grease is just coming out of seal.



1. Grease seal carrier

Battery

For battery removal, cleaning and storage, refer to CHARGING SYSTEM.

Watercraft Cleaning

Clean the bilge with hot water and mild detergent or with bilge cleaner. Rinse thoroughly. Lift front end of watercraft to completely drain bilge. If any repairs are needed to body or to the hull, touch up paint and Gelcote® repair kit are available. Replace damaged labels/decals.

Wash the body with soap and water solution (only use mild detergent). Rinse thoroughly with fresh water. Remove marine organisms from the hull. Apply a nonabrasive wax.

CAUTION: Never clean fiberglass and plastic parts with strong detergent, degreasing agent, paint thinner, acetone, etc.

If the watercraft is to be stored outside, cover it with an opaque tarpaulin to prevent sun rays and grime from affecting the plastic components, watercraft finish as well as preventing dust accumulation.

CAUTION: The watercraft must never be left in water for storage. Never leave the watercraft stored in direct sunlight.

Anticorrosion Treatment

Wipe off any residual water in the engine compartment.

Spray BOMBARDIER LUBE lubricant over all metallic components in engine compartment.

Lubricate the throttle cable with BOMBARDIER LUBE lubricant.

The seat should be partially left opened during storage (the engine cover for the XP model). This will avoid engine compartment condensation and possible corrosion.

Additional Recommended Protection

All Models

In cool regions (where freezing point may be encountered), cooling system should be emptied with air pressure or filled with water and antifreeze solution (40% water, 60% antifreeze).

CAUTION: Always use ethylene-glycol antifreeze containing corrosion inhibitors specifically recommended for aluminum engines.

NOTE: The engine will not have to run during this operation.

Air Pressure Method

Install an air pressure adaptor to the water outlet located at the rear of the watercraft.

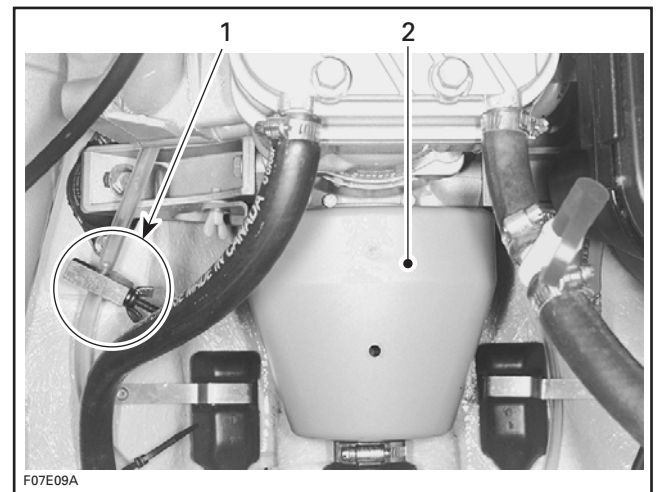
Connect the air pressure hose to the air pressure adaptor and open air pressure circuit.

The air pressure will expell all water out of engine.

Water and Antifreeze Method

Install a hose pincher to engine drain hose near the PTO flywheel guard.

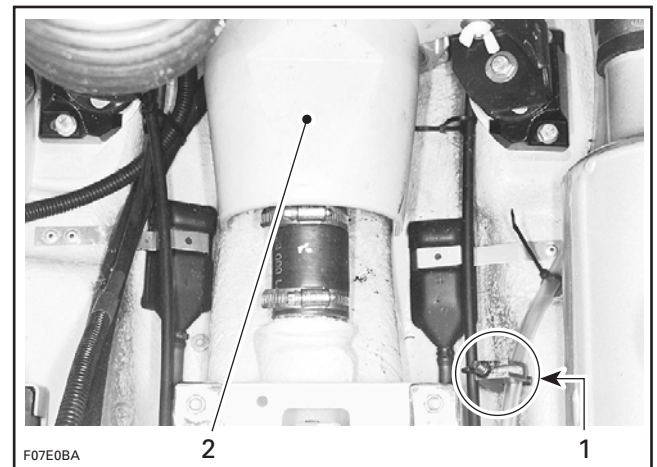
The engine drain hose in generally the lowest water hose coming out of the engine.



F07E09A

TYPICAL — 717 ENGINE

1. Hose pincher installed on engine drain hose
2. PTO flywheel guard



F07E0BA

GTX MODEL — 947 ENGINE

1. Hose pincher installed on engine drain hose
2. PTO flywheel guard

Section 02 MAINTENANCE

Subsection 05 (STORAGE)

NOTE: On XP model, open rear cover to have access to engine drain hose.

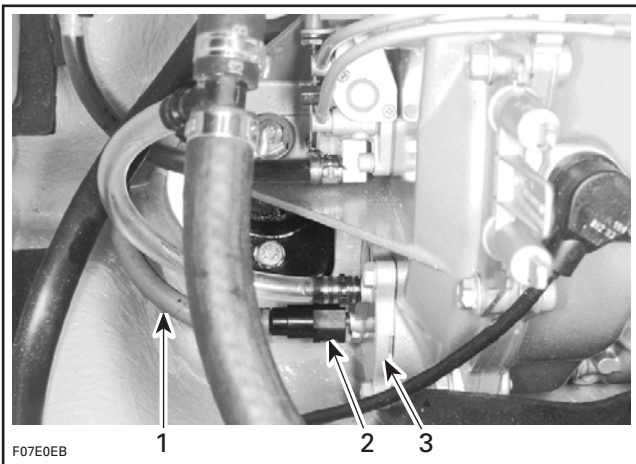


XP MODEL — 947 ENGINE

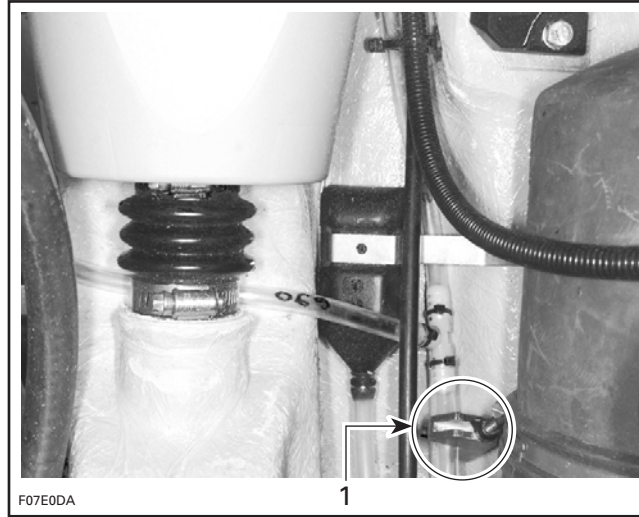
1. Hose pincher installed on engine drain hose

787 RFI Engine

Make sure the water supply hose from crankcase heat exchanger is connected to the magneto cooling system.



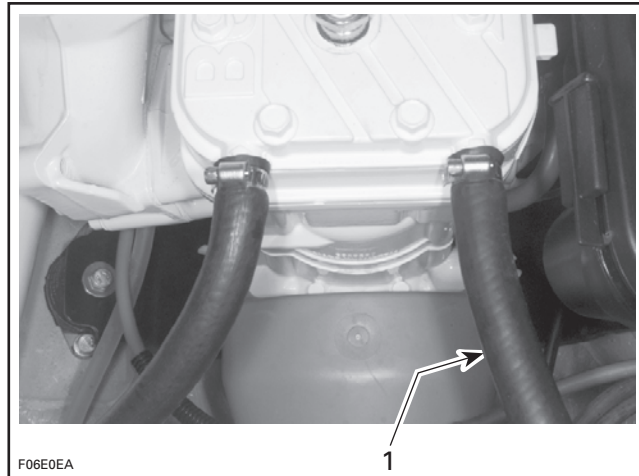
1. Water supply hose from crankcase heat exchanger
2. Quick connector
3. Magneto heat exchanger



RFI MODELS — 787 ENGINE

1. Hose pincher installed on engine drain hose

Disconnect engine water return hose.



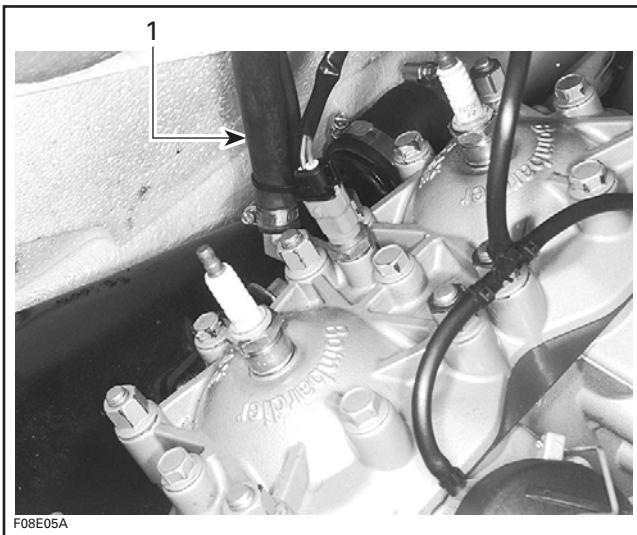
717 AND 787 RFI ENGINES

1. Disconnect engine water return hose

Section 02 MAINTENANCE

Subsection 05 (STORAGE)

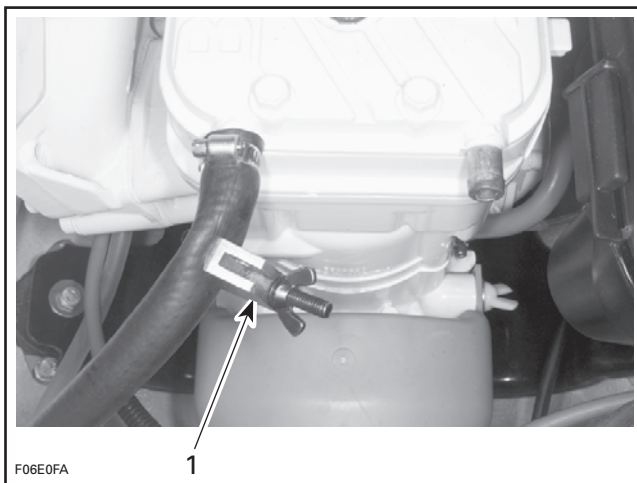
On 947 engine, disconnect the water supply hose at cylinder head.



947 ENGINE

1. Disconnect engine water supply hose

Install a hose pincher to engine water supply hose (except the 947 engine).

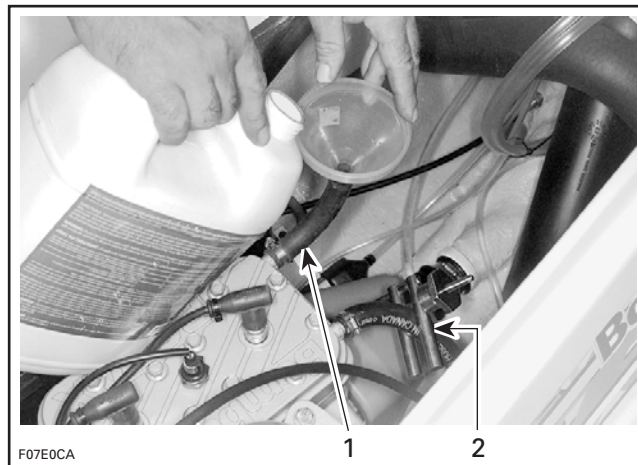


717 AND 787 RFI ENGINES

1. Hose pincher installed on the engine water supply hose

Temporarily install a short piece of hose to engine water outlet at cylinder head.

Insert a funnel into hose and pour antifreeze mixed with water (40% water, 60% antifreeze) in engine until the colored solution appears in the engine drain hose.



TYPICAL

1. Hose and funnel installed at water outlet on cylinder head
2. Hose pincher installed on water supply hose

Remove temporary hose and reconnect engine water return hose.

Remove hose pinchers.

All Models

Most of the antifreeze will drain out when removing hose pincher(s). Use a container to recover it. Dispose of antifreeze as per your local laws and regulations.

NOTE: Although antifreeze will mainly drain out, the antifreeze has mixed with the water that was possibly trapped in the cylinder water jackets and thus preventing freezing problems.

At pre-season preparation, drain the remaining antifreeze from cooling system prior using the watercraft.

TROUBLESHOOTING CHART

The following is provided to help in diagnosing the probable source of troubles. It is a guideline and should not be assumed to have all causes for all problems.

NOTE: On GTX RFI and GSX RFI models, always check for active fault codes recorded in the ECU first. If a fault code is detected, service the fault code first and recheck operating conditions.

Refer to FUEL INJECTION for the procedure and the fault code table.

ENGINE WILL NOT START

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Engine does not turn over	<ul style="list-style-type: none"> • DESS operation non functional • Safety lanyard switch or harness damaged • Burnt 5 A fuse on MPEM • 5 A fuse keeps on burning • Discharged battery • Battery connections • Water/fuel hydrolock • Starter • Seized engine • Seized jet pump • Faulty sensor or ECU (RFI) 	<ul style="list-style-type: none"> • If 2 short beeps are not heard when installing safety lanyard, refer to DIGITALLY ENCODED SECURITY SYSTEM • Replace • Check wiring then replace fuse • Check wiring, solenoid and MPEM • Check/recharge • Check/clean/tighten • Check, refer to subsection 02-04 • Check, refer to subsection 08-04 • Check/repair as needed • Check, refer to subsection 09-02 • Check faulty codes in ECU memory, refer to subsection 06-05
Engine turns slowly	<ul style="list-style-type: none"> • Discharged/weak battery • Restriction in jet pump • Seizure in jet pump • Partial engine hydrolock • Partial engine seizure • Worn starter 	<ul style="list-style-type: none"> • Check/charge/replace • Check/clean pump • Inspect, refer to subsection 09-02 • Check, refer to subsection 02-04 • Check compression, refer to subsection 04-05 • Check, refer to subsection 08-04

Section 03 TROUBLESHOOTING

Subsection 01 (TROUBLESHOOTING CHART)

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Engine turns over	<ul style="list-style-type: none">• Fuel water-contaminated• Dirty fuel filter• Fouled or defective spark plugs• Water in engine• Carburetion• Ignition• Burnt fuel pump fuse (RFI)• Flooded engine<ul style="list-style-type: none">– Carburetor needle valve stuck open• Excessive rotary valve clearance (if applicable)• Internal engine damage• Sheared flywheel key• Incorrect rotary valve timing (if applicable)	<ul style="list-style-type: none">• Check/siphon and refill• Clean/replace• Replace• Check, refer to subsection 02-04• Check, refer to subsection 06-04• Check, refer to subsection 08-02• Check wiring then replace fuse• Check, refer to subsection 06-04• Check, refer to subsection 04-07• Check, refer to subsections 04-05 and 04-06• Check timing mark, refer to subsection 08-02• Check, refer to subsection 04-07
No spark at spark plugs	<ul style="list-style-type: none">• Faulty rev limiter• Faulty ignition module	<ul style="list-style-type: none">• Replace MPEM• Replace MPEM or ignition module depending upon the model

Section 03 TROUBLESHOOTING
Subsection 01 (TROUBLESHOOTING CHART)

ENGINE MISFIRES, RUNS IRREGULARLY

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Weak spark	<ul style="list-style-type: none"> • Fouled, defective, worn spark plugs • Faulty rev limiter or ignition module • Sheared flywheel key • Faulty ECU (RFI) 	<ul style="list-style-type: none"> • Check/verify heat range/gap/replace • Check, refer to subsection 08-02 • Check timing mark, refer to subsection 08-02 • Check faulty codes in ECU memory, refer to subsection 06-05
Lean fuel mixture. Dry spark plug (except when water fouled)	<ul style="list-style-type: none"> • Low fuel level • Low fuel pressure • Stale or water fouled fuel • Fuel filter dirty or restricted • Carburetion dirty or out of adjustment • Glopped fuel injectors (RFI) • Defective sensor or ECU (RFI) • Leaking crankshaft seal(s), intake or rotary valve cover O-ring • Restricted fuel valve • Loose carburetor 	<ul style="list-style-type: none"> • Check/refill • Check pump, regulator, injectors and hose pinchers or if filter is plugged. Replace if necessary • Check/siphon and refill • Check/clean/replace • Check/clean/adjust, refer to subsection 06-04 • Remove and clean injectors • Check faulty codes in ECU memory, refer to subsection 06-05 • Pressure check engine, refer to subsection 04-02 • Check/replace • Tighten carburetor(s)
Rich fuel mixture. Fouled spark plug	<ul style="list-style-type: none"> • Partially closed choke • Flame arrester dirty or restricted • Carburetor adjustment • Loose main jet • Defective fuel injector(s) • Defective sensor or ECU (RFI) • Rotary valve shaft seal leaking (if applicable) • Oil pump adjustment • Worn needle(s) and seal(s) • Excessive rotary valve clearance (if applicable) • High fuel pressure 	<ul style="list-style-type: none"> • Check/adjust choke cable • Check/replace • Check/adjust, refer to subsection 06-04 • Check, refer to subsection 06-04 • Remove and replace fuel injector(s), refer to subsection 06-05 • Check faulty codes in ECU memory, refer to subsection 06-05 • Check/replace, refer to subsection 04-07 • Check/adjust, refer to subsection 07-03 • Check, refer to subsection 06-04 • Check, refer to subsection 04-07 • Check pump, regulator, injectors, hose pinchers or if filter is plugged. Replace if necessary
Difficult to start	<ul style="list-style-type: none"> • Incorrect rotary valve timing (if applicable) • Excessive rotary valve clearance (if applicable) 	<ul style="list-style-type: none"> • Check/adjust, refer to subsection 04-07 • Check, refer to subsection 04-07

Section 03 TROUBLESHOOTING

Subsection 01 (TROUBLESHOOTING CHART)

ENGINE OVERHEATS

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Monitoring beeper sounds continuously	<ul style="list-style-type: none">• Restricted jet pump water intake• Cooling system restriction• Grounded temperature sensor or sensor wire	<ul style="list-style-type: none">• Check/clean• Check/flush, refer to subsection 02-03• Check/repair/replace

ENGINE CONTINUALLY BACKFIRES

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Weak spark	<ul style="list-style-type: none">• Fouled, defective spark plugs• Malfunction of rev limiter	<ul style="list-style-type: none">• Clean/replace• Clean/replace, refer to subsection 08-02
Ignition timing	<ul style="list-style-type: none">• Incorrect setting• Sheared flywheel key	<ul style="list-style-type: none">• Check/reset, refer to subsection 08-02• Check/replace, refer to subsections 08-02 and 04-04
Rotary valve (if applicable)	<ul style="list-style-type: none">• Incorrect timing	<ul style="list-style-type: none">• Check/reset, refer to subsection 04-07
Carburetor	<ul style="list-style-type: none">• Carburetion to lean	<ul style="list-style-type: none">• Check/adjust, refer to subsection 06-04
Engine	<ul style="list-style-type: none">• Intake leak/crankshaft seal failure	<ul style="list-style-type: none">• Pressure check engine, refer to subsection 04-02

ENGINE DETONATION OR PINGING

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Ignition	<ul style="list-style-type: none">• Timing too far advanced• Spark plug heat range too high• Defective ignition module or MPEM	<ul style="list-style-type: none">• Check/reset• Check/change to correct range• Check/replace, refer to subsection 08-02
Engine temperature	<ul style="list-style-type: none">• Engine overheats• Fuel of poor quality	<ul style="list-style-type: none">• Check, see engine overheats• Use good quality fuel

Section 03 TROUBLESHOOTING
Subsection 01 (TROUBLESHOOTING CHART)

ENGINE LACKS ACCELERATION OR POWER

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
	<ul style="list-style-type: none"> • Weak spark • Carburetion, jetting too rich/lean • Throttle does not open fully • Low compression • Exhaust system restriction • Water in fuel or oil • Debris in carburetor needle valve • Impeller leading edge damaged • Twisted crankshaft • Gloqged fuel injectors (RFI) • Low fuel pressure • Incorrect throttle position sensor (TPS) adjustment 	<ul style="list-style-type: none"> • Check/replace, refer to subsection 08-02 • Check/adjust, refer to subsection 06-04 • Check/readjust, refer to subsection 06-04 • Check/repair, refer to subsection 04-05 • Check/clean • Check/siphon/replace • Check/clean, refer to subsection 06-04 • Check/replace, refer to subsection 09-02 • Check, refer to subsection 04-06 • Remove and clean injectors • Check fuel line and fuel pump pressure • Check and adjust TPS, refer to subsection 06-05
<p>Engine revs lower than its maximum operational RPM (787 RFI and 947 engines)</p> <p>Peak performance is delayed until higher RPM range is reached (787 RFI and 947 engines)</p>	<ul style="list-style-type: none"> • RAVE valve does not open • RAVE valve is stuck opened 	<ul style="list-style-type: none"> • Check, refer to subsection 04-05 • Check, refer to subsection 04-05

ENGINE RUNS TOO FAST

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Engine RPM too high	<ul style="list-style-type: none"> • Faulty rev limiter • Improper impeller pitch (too low) • Incorrect throttle position sensor (TPS) adjustment 	<ul style="list-style-type: none"> • Check, refer to subsection 08-02 • Check/replace, refer to subsection 09-02 • Check and adjust TPS, refer to subsection 06-05
Jet pump cavitation	<ul style="list-style-type: none"> • Damaged leading or trailing edge of impeller • Sealing of ride plate, jet pump support or jet pump 	<ul style="list-style-type: none"> • Check/replace <p>NOTE: Leading edge damage contributes to poor performance from start. Trailing edge damage contributes to poor top performance and stator vanes erosion.</p> <ul style="list-style-type: none"> • Check/reseal, refer to subsection 09-02 or 12-02

Section 03 TROUBLESHOOTING

Subsection 01 (TROUBLESHOOTING CHART)

ABNORMAL NOISE FROM PROPULSION SYSTEM

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
	<ul style="list-style-type: none">• Weeds/debris caught in intake grate or impeller• Low oil level in jet pump• Worn anti-rattle system• Damaged or bent drive shaft• Broken motor mounts	<ul style="list-style-type: none">• Check/clean• Check/troubleshoot source of leak/refill supply, refer to subsection 09-02• Check/replace anti-rattle system, refer to subsection 09-02• Check/replace, refer to subsection 09-03• Check/replace, refer to subsection 04-03

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LEAK TEST

GENERAL

A Sea-Doo Engine Leak Test Kit (P/N 295 500 352) and Supplementary Engine Leak Test Kit (P/N 295 500 780) are available to help diagnose engine problems such as engine seizure, poor performance, oil leakage, etc.

Before disassembling any components of the engine, it is important to perform a leakage test to determine which part is defective.

It is also very important after servicing the engine, even for a complete engine rebuilt, to perform another leakage test; at this stage, it may avoid further engine problems and minimizing the risk of having to remove and reinstall the engine again.

Static bench testing is the most effective way to conduct a leakage test. Inboard testing does not allow complete access to, and observation of all engine surfaces and should be avoided whenever possible.

On the 717 engine, cylinders can not be verified individually due to leakage from one cylinder to another through a common intake manifold.

When installing hoses of the Engine Leak Test Kit or Supplementary Engine Leak Test Kit, use the collars provided in the kit to ensure a proper sealing.

When pressurizing the engine, first confirm that the components of the Engine Leak Test Kit or Supplementary Engine Leak Test Kit are not leaking by spraying a solution of soapy water on all hoses, connections, fittings, plates, etc. If there is a leak, bubbles will indicate leak location.

Three areas of the engine will be tested in sequence as per the diagnostic flow chart (see the end of this sub-section).

1. Engine Cooling System.
2. Bottom End and Top End.
3. Rotary Valve Shaft (except 947 engine).

NOTE: If a leak is found, it is important to continue testing as there is the possibility of having more than one leak. Continue pumping to compensate for the air lost to find another leak.

PREPARATION

Verify fuel system for leaks.

WARNING

If any fuel leak is found, do not start the engine. Correct the leak and wipe off any fuel spillage. Do not use electric powered tools unless fuel system has passed pressure test.

Disconnect battery BLACK negative cable.

WARNING

Always disconnect battery cables in the specified order, BLACK negative cable first.

Disconnect battery RED positive cable.

TESTING PROCEDURE

Engine Cooling System

Remove the tuned pipe. Refer to EXHAUST SYSTEM.

Remove the exhaust manifold gasket and ensure the surface is clean.

Disconnect engine cooling hoses.

Install the appropriate exhaust manifold plate from the Engine Leak Test Kit (P/N 295 500 352) or Supplementary Engine Leak Test Kit (P/N 295 500 780). Tighten plate using fasteners provided in the kit.

NOTE: Do not torque plate excessively.

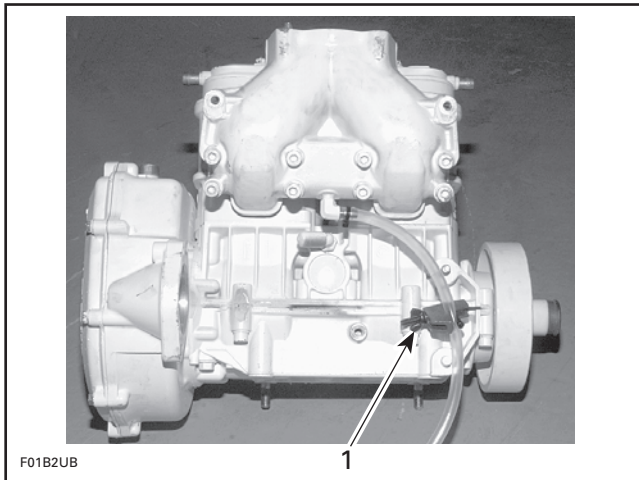
Install a hose pincher on engine drain hose.

Use hoses provided in the kit and install them on the engine.

Install pump using reducer and appropriate tube(s) as necessary.

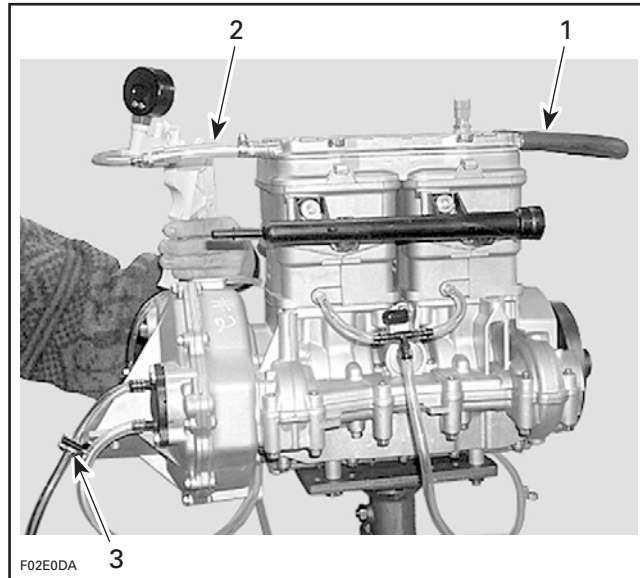
Section 04 ENGINE

Subsection 02 (LEAK TEST)



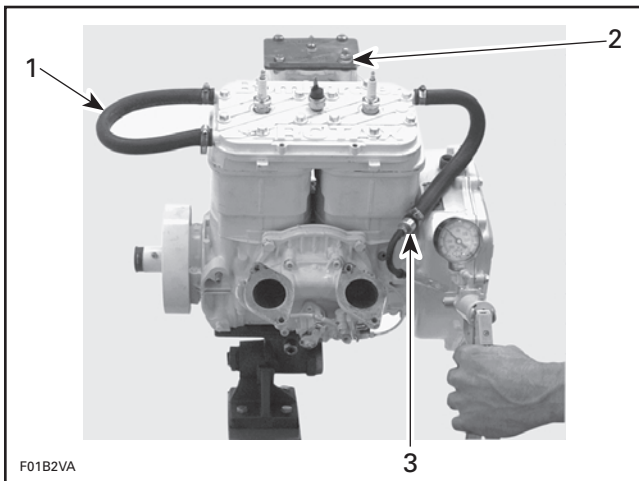
717 ENGINE — REAR VIEW

1. Engine drain hose blocked with a hose pincher



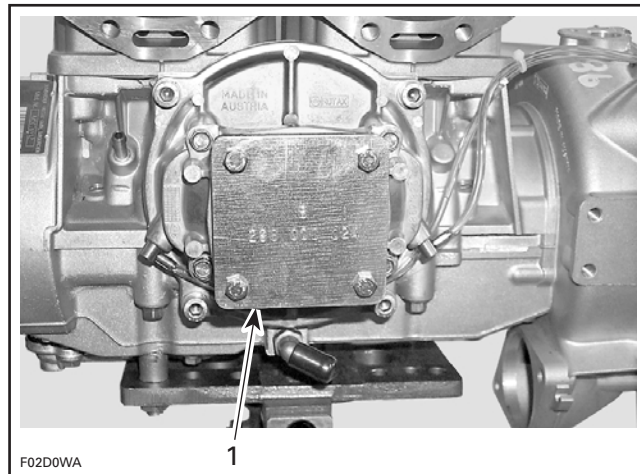
787 RFI ENGINE — REAR VIEW

1. Loop hose and use clamps
2. Hose with clamps. Install pump to the end
3. Block engine drain hose with a hose pincher



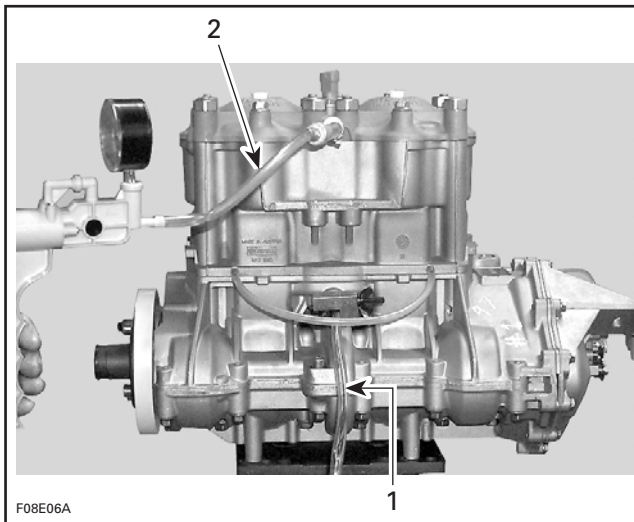
717 ENGINE — FRONT VIEW

1. Loop hose and use clamps
2. Use two washers with exhaust manifold stud
3. Hose with adapter and nipple



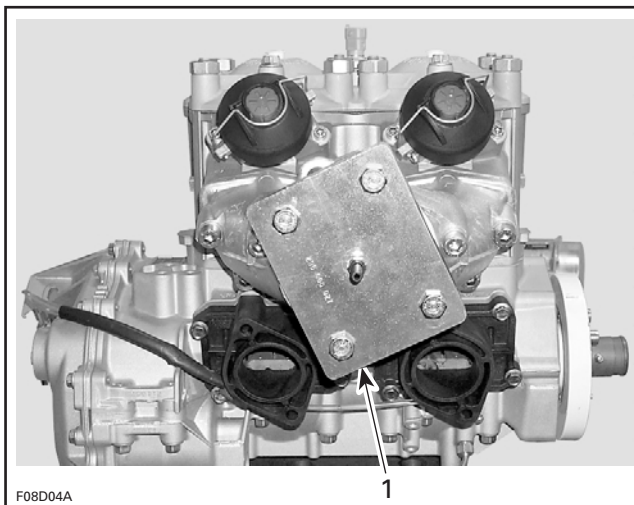
787 RFI ENGINE — FRONT VIEW

1. Exhaust manifold plate



947 ENGINE — REAR VIEW

1. Block engine drain hose with a hose pincher
2. Install pump to inlet drain



947 ENGINE — FRONT VIEW

1. Exhaust manifold plate

NOTE: Water is not required for testing.

Activate pump and pressurize engine cooling system to 34 kPa (5 PSI).

Wait 3 minutes and check if pressure drops; if so, verify all testing components.

- If kit components are not leaking and pressure drops, verify all external jointed surfaces, temperature sensor and the O-ring between the spark plug area and the engine cylinder head cover. If none of these components are leaking, there is an internal leak and it can be detected with Bottom End and Top End testing.

Bottom End and Top End

Remove the carburetor(s) and gasket(s). Make sure the surface of the intake manifold (717 and 947 engines) or rotary valve cover (787 RFI engine) are clean.

Install the intake plate(s) with fasteners from the kit and tighten adequately.

NOTE: For the 787 RFI and 947 engines, use the intake and exhaust plates included in the Supplementary Engine Leak Test Kit (P/N 295 500 780).

On engines with the RAVE system, remove the RAVE valves and gaskets.

Install the RAVE valve plates with fasteners from the kit and tighten adequately.

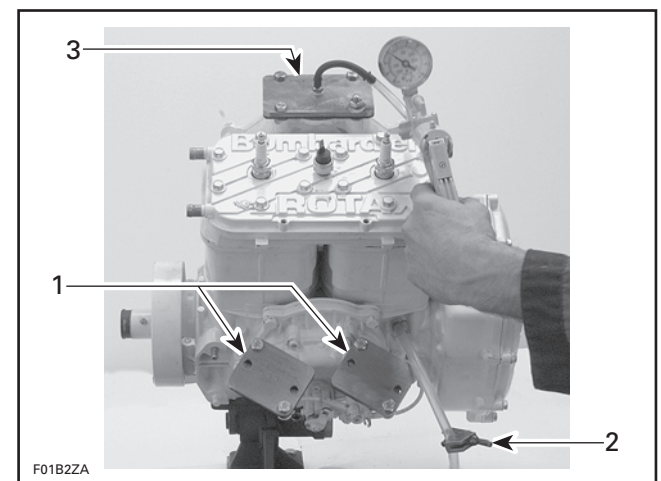
NOTE: On engines with the RAVE system, the boot and O-ring can be checked for leakage with the valve in place. Simply remove the cover to expose the boot.

Make sure the spark plugs are installed and tightened.

Block pulse hose using a hose pincher.

NOTE: Do not block the rotary valve shaft hoses.

Install pump to the exhaust plate fitting.

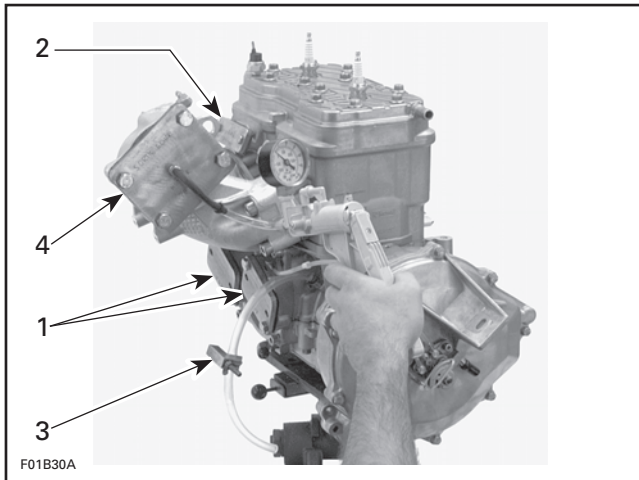


717 ENGINE

1. Intake plates
2. Pulse hose blocked with a hose pincher
3. Exhaust plate

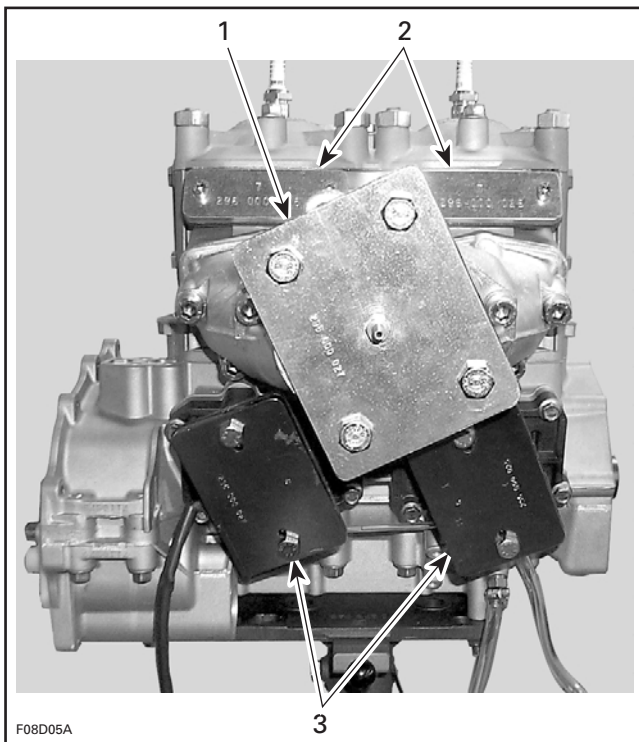
Section 04 ENGINE

Subsection 02 (LEAK TEST)



787 RFI ENGINE

1. Intake plates
2. RAVE valve plates
3. Pulse hose blocked with a hose pincher
4. Exhaust plate



947 ENGINE

1. Exhaust plate
2. Rave valve plates
3. Intake plates

Activate pump and pressurize engine to 34 kPa (5 PSI).

CAUTION: Do not exceed this pressure.

Wait 3 minutes and check if pressure drops; if so, verify all testing components.

If kit components are not leaking, verify engine jointed surfaces as per following areas:

- spark plugs
- cylinder head gasket
- cylinder base gasket
- crankcase halves
- rotary valve cover (except 947 engine)
- engine plugs
- exhaust manifold
- intake manifold (717 engine)
- oil injection pump (717 engine).

Check also small oil injection pump lines and fittings; check for air bubbles or oil column going toward pump, which indicate a defective check valve.

If the above mentioned components are not leaking, block both oil hoses of the rotary valve shaft using hose pinchers.

NOTE: If leakage stops at this point, proceed with **Rotary Valve Shaft** testing.

If there is still some leakage, remove the PTO flywheel to verify outer seal.

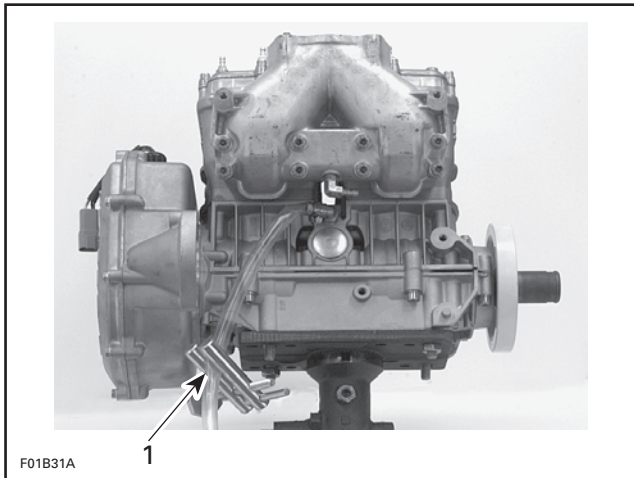
If no leak is found on the PTO side outer seal, remove magneto flywheel and verify crankshaft outer seals.

Proceed with the **Rotary Valve Shaft** testing if the crankshaft outer seals are not leaking.

Rotary Valve Shaft

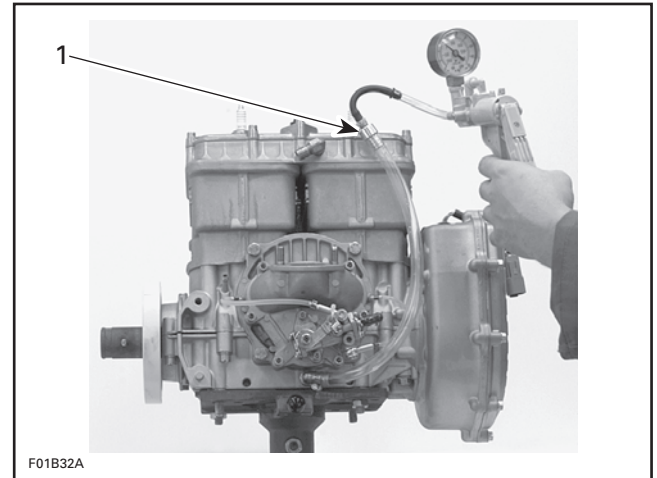
NOTE: It is preferable to drain the injection oil from the rotary valve shaft, but it is not mandatory.

Block oil return hose of the rotary valve shaft with a hose pincher.



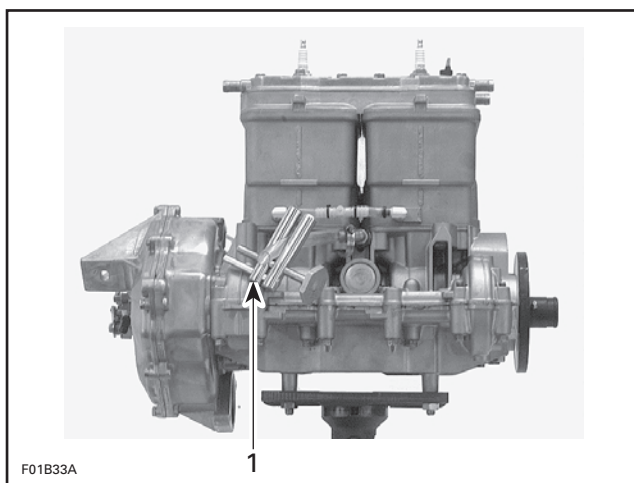
717 ENGINE

1. Oil return hose blocked with hose pincher



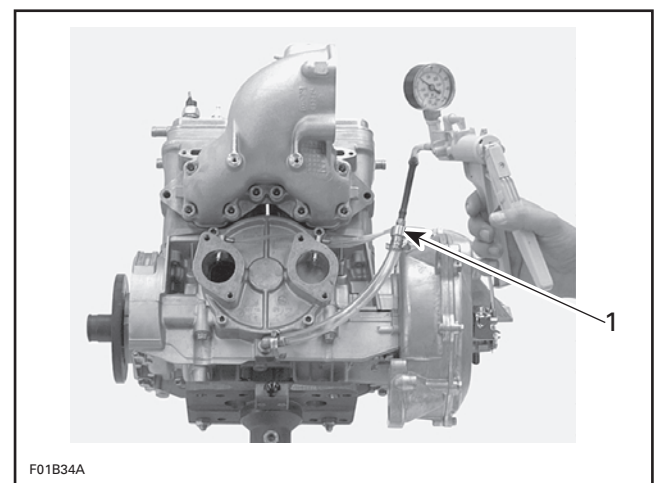
717 ENGINE

1. Pump with reducer and nipple



787 RFI ENGINE

1. Oil return hose blocked with hose pincher



787 RFI ENGINE

1. Pump with reducer and nipple

Install pump with reducer and nipple to the oil supply hose of the rotary valve shaft.

Activate pump and pressurize to 5 PSI (34 kPa).
 Check plug of the rotary valve shaft in crankcase.
 Remove PTO side spark plug. If pressure drops, it indicates a defective PTO side crankshaft inner seal.
 Remove MAG side spark plug. If pressure drops, it indicates a defective MAG side crankshaft inner seal.

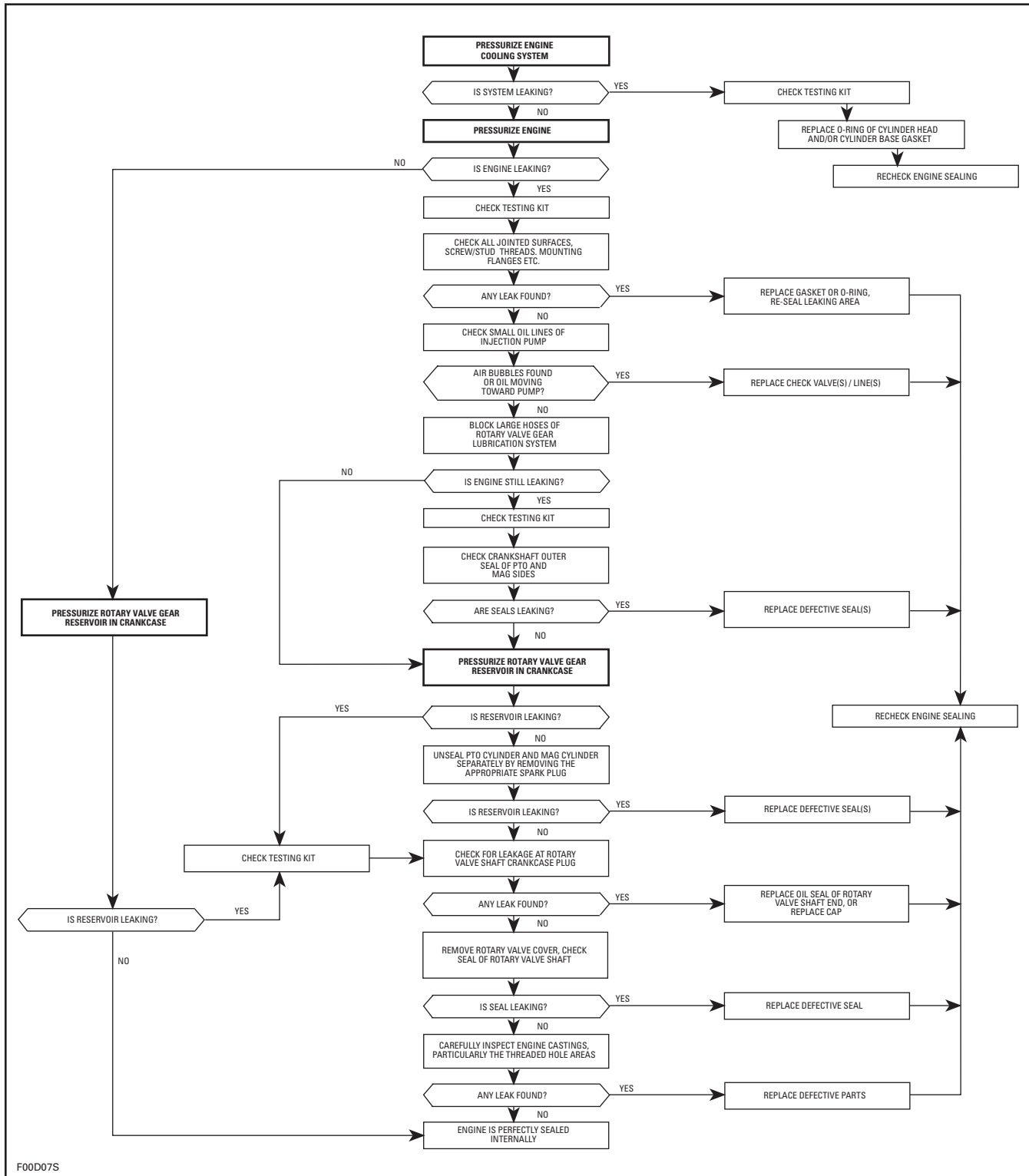
If the above mentioned components are not leaking and there is a pressure drops, remove the rotary valve cover. Check the seal of the rotary valve shaft.
 If the rotary valve shaft is not leaking, it could indicate a defective engine casting. Disassemble engine and carefully check for defects in castings. Pay attention to tapped holes which may go through sealed areas of engine and thus lead to leakage.

Section 04 ENGINE

Subsection 02 (LEAK TEST)

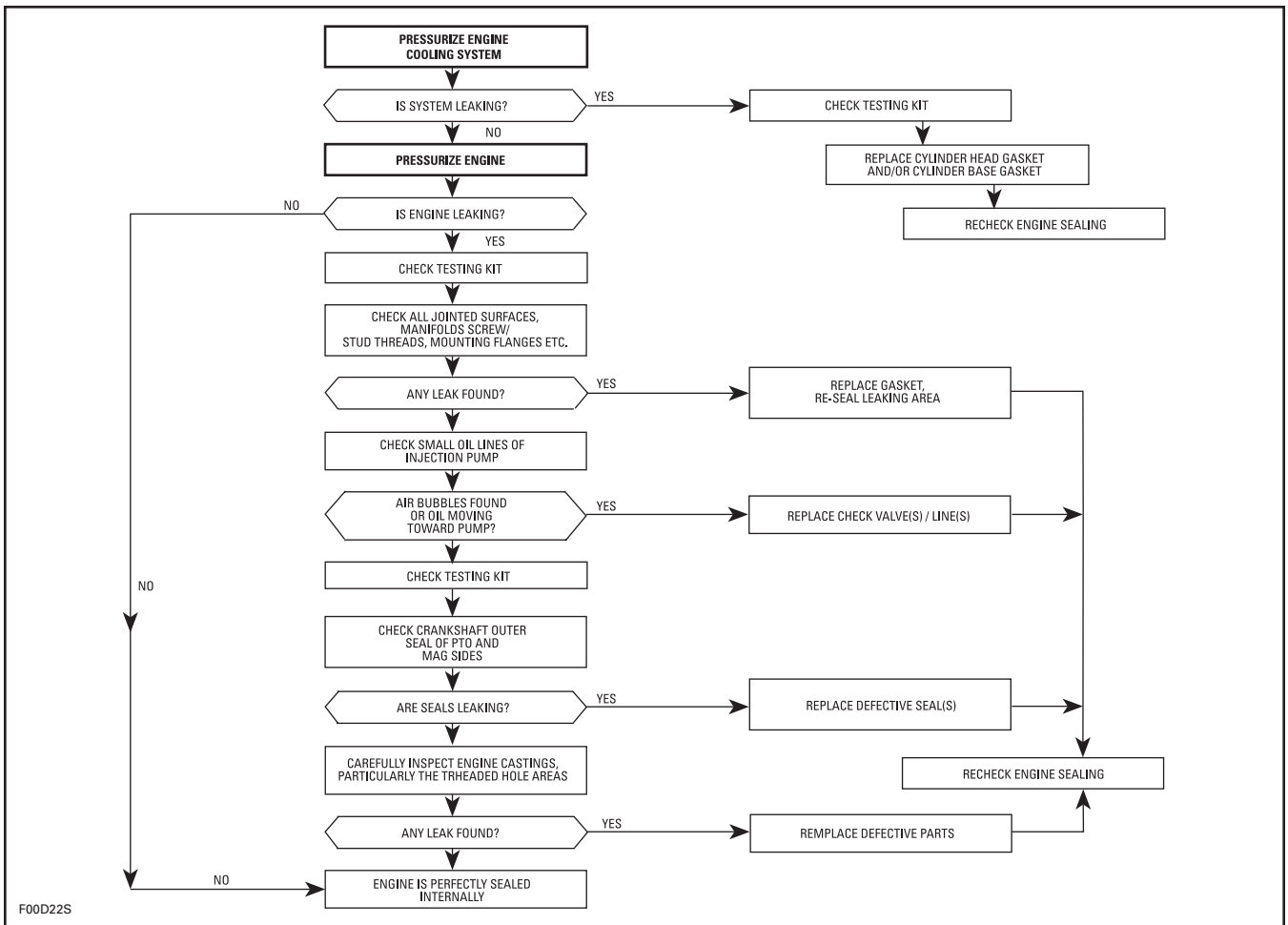
ENGINE LEAKAGE DIAGNOSTIC FLOW CHART

717 and 787 RFI Engines



F00D07S

947 Engine



REMOVAL AND INSTALLATION

GENERAL

On some models, it is not necessary to remove engine from watercraft to service TOP END, PTO FLYWHEEL or MAGNETO. However, engine removal is necessary to repair BOTTOM END.

ENGINE REMOVAL

All Models

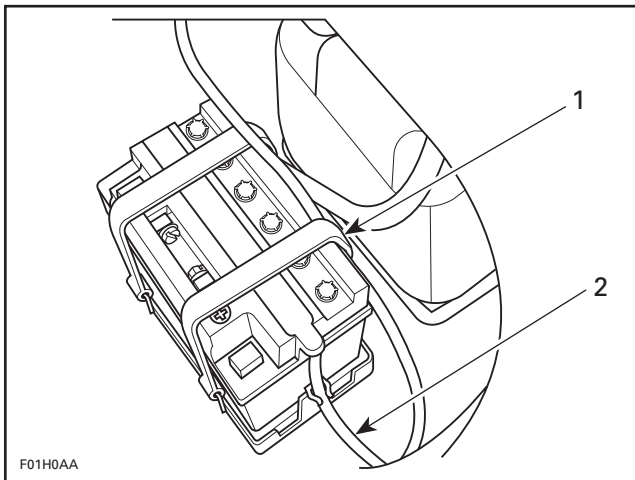
In order to remove engine from watercraft proceed as follows.

First, disconnect battery cables from battery.

WARNING

Always disconnect battery cables exactly in the specified order, BLACK negative cable first then the RED positive battery cable last.

On GTS model, disconnect vent tube from battery and remove battery from watercraft.



GTS MODEL

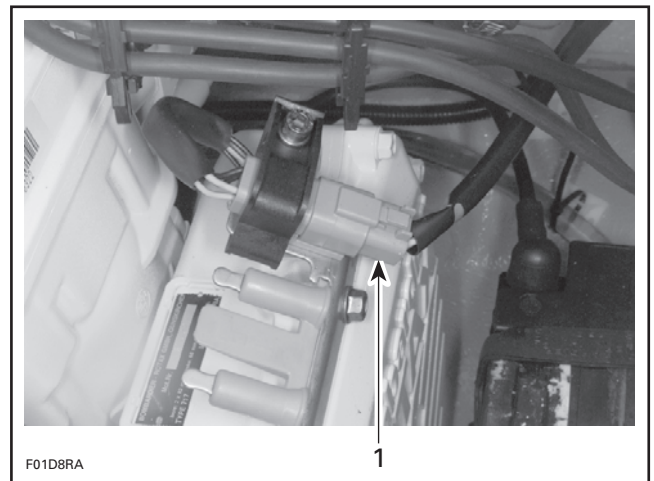
1. Strap retaining RED positive cable
2. Vent tube connected and secured in support

Electrical Connections

It is recommended to disconnect electrical connections prior to disconnecting fuel lines.

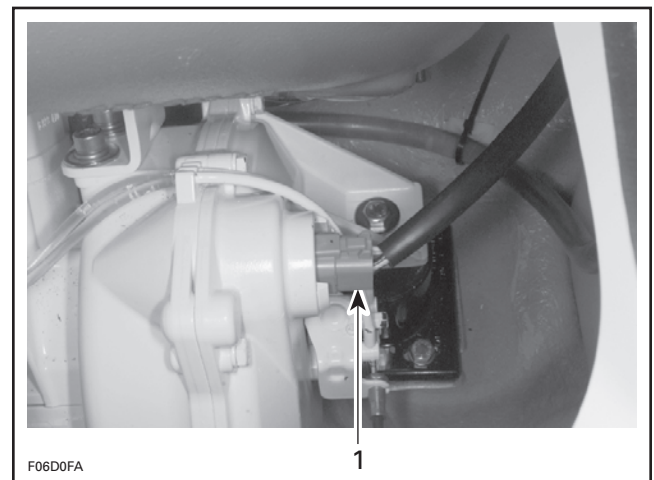
Disconnect temperature switch wire and spark plug cables.

Disconnect magneto wiring harness.



717 ENGINE

1. Unplug connector

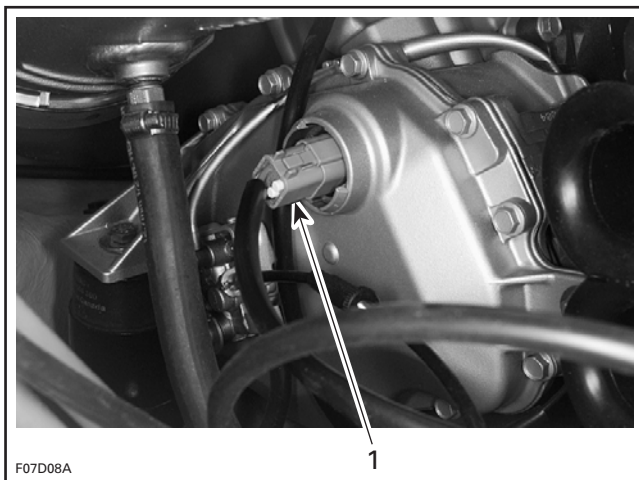


787 RFI ENGINE

1. Unplug connector

Section 04 ENGINE

Subsection 03 (REMOVAL AND INSTALLATION)



F07D08A

947 ENGINE

1. Unplug connector

GSX RFI and GTX RFI Models

Disconnect throttle position sensor (TPS), air pressure sensor (APS) and air temperature sensor (ATS).

Disconnect crankshaft position sensor (CPS).

Disconnect connectors from fuel injectors.

Refer to FUEL INJECTION for location of sensors and connectors.

Jet Pump Removal

To withdraw jet pump, refer to JET PUMP.

CAUTION: Whenever removing engine from watercraft, engine/jet pump alignment must be performed at reinstallation.

Drive System

To withdraw driveshaft(s), refer to DRIVE SYSTEM.

Cooling System

Disconnect the engine water supply hose.

Disconnect the engine water return hose.

NOTE: Engine will have to be raised inside bilge to disconnect drain hose before removing from bilge.

Refer to COOLING SYSTEM for proper water hose location.

Tuned Pipe

To remove tuned pipe, refer to EXHAUST SYSTEM.

Air Intake Silencer

To remove air intake silencer, refer to AIR INTAKE.

Carburetor

All Models Except GSX RFI and GTX RFI

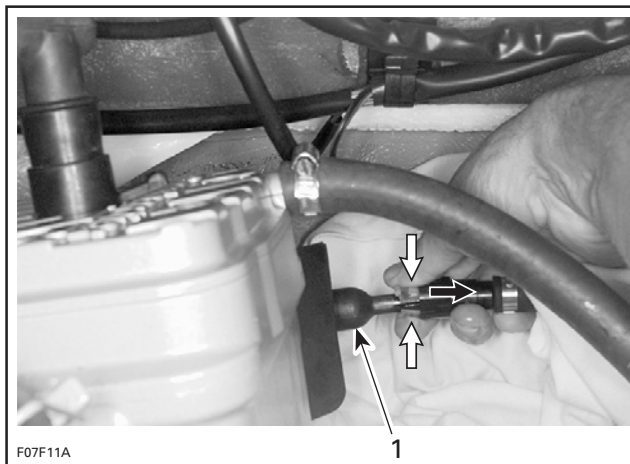
Turn fuel valve to OFF.

Disconnect fuel supply and fuel return hoses.

To remove carburetor(s), refer to CARBURETOR for proper procedure.

GSX RFI and GTX RFI

Disconnect fuel supply hose from fuel rail.



F07F11A

PRESS TABS AND PULL CONNECTOR

1. Fuel rail

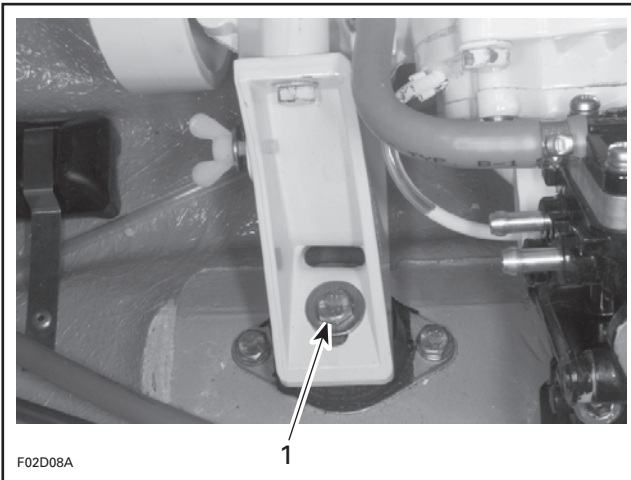
WARNING

The fuel hose may be under pressure. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to release the pressure. Wipe off any fuel spillage inside bilge.

Engine Support

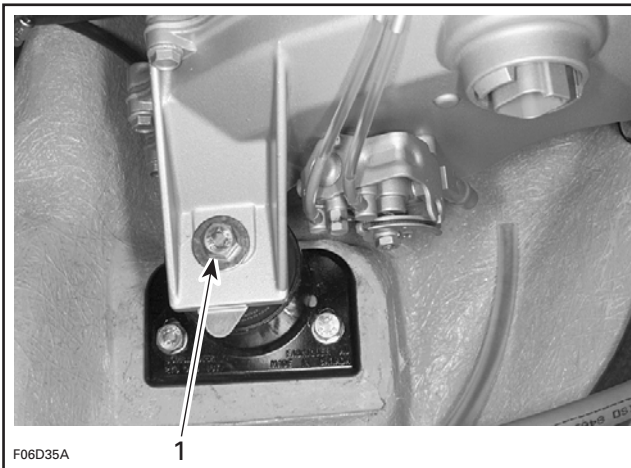
NOTE: Be careful when removing engine support(s) or rubber mount adapters, shims could have been installed underneath. Shims control engine/jet pump alignment. Always note position of shims for reinstallation, to avoid altering engine alignment.

Remove engine support mount screws.



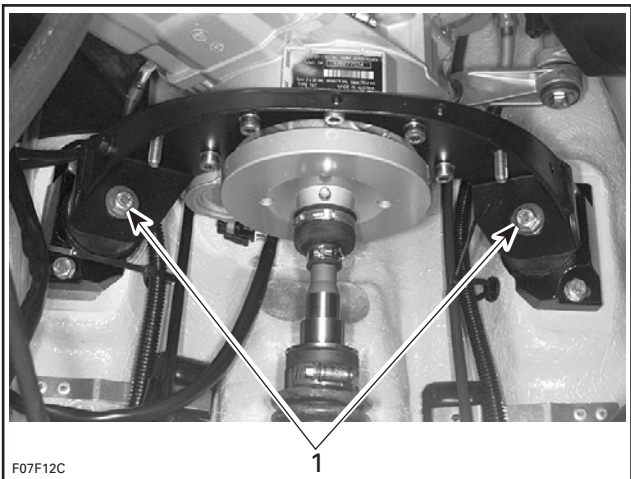
717 ENGINE

1. Remove screw of each engine support



787 RFI AND 947 ENGINES — FRONT SUPPORT

1. Remove screw



787 RFI AND 947 ENGINES — REAR SUPPORT

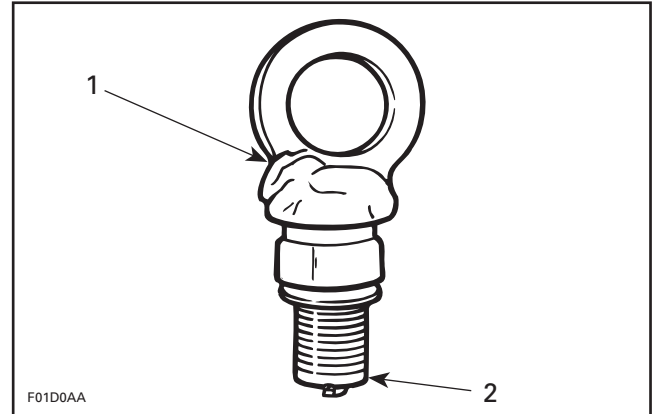
1. Remove screws

Lifting Engine

717 Engine

Engine can be easily lifted using the following suggested tools:

- Cut porcelain from two old spark plugs.
- Weld a lock washer approximately 20 mm (3/4 in) diameter on each spark plug as shown.



1. Weld a lock washer
2. Old spark plug

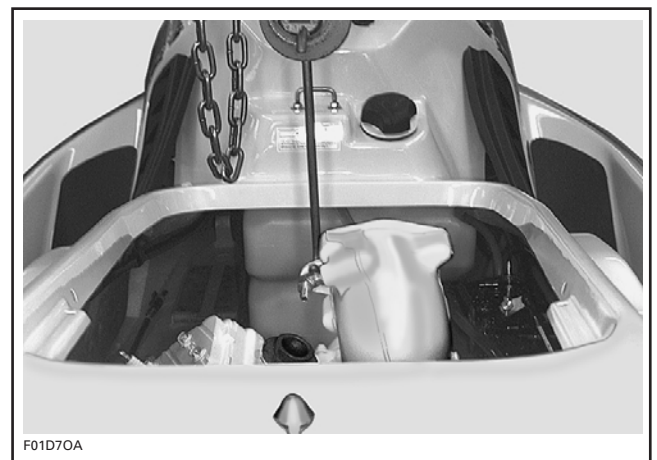
Remove spark plugs and replace by special tools. Hook a sling into holes of special tools.

Using a chain block, a hoist or other suitable equipment, slightly lift engine to ease the remaining component removal.

CAUTION: Take care not to damage cable or oil injection hoses.

787 RFI and 947 Engines

Engine can be easily lifted by inserting a hook into exhaust manifold eyelet.



TYPICAL

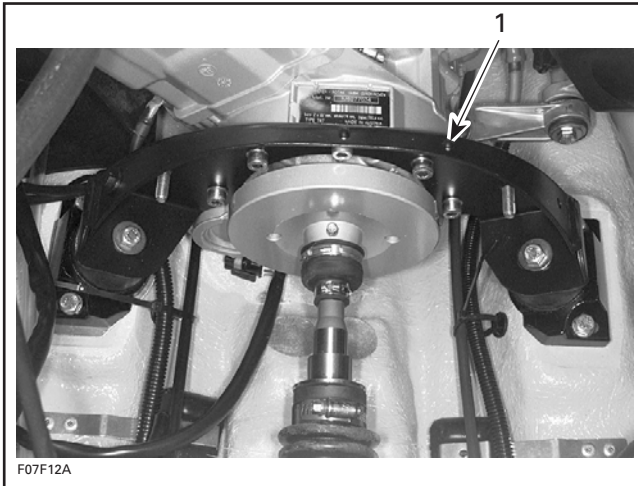
Section 04 ENGINE

Subsection 03 (REMOVAL AND INSTALLATION)

Using a chain block, a hoist or other suitable equipment, slightly lift engine to ease the remaining component removal.

CAUTION: Take care not to damage cable or oil injection hoses.

Remove rear engine support.



TYPICAL

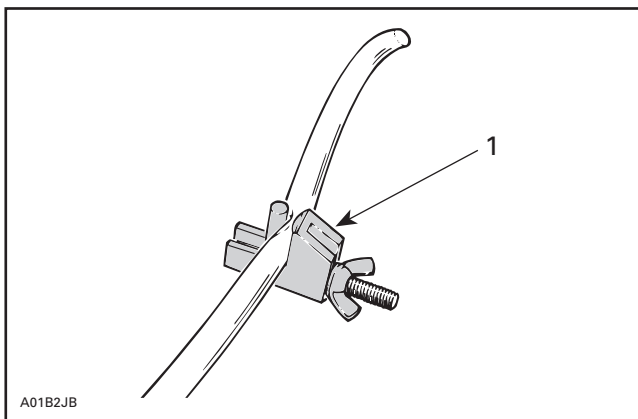
1. Rear support

Removal of Remaining Components

Lift up engine slowly until oil injection hoses can be reached.

All Engines

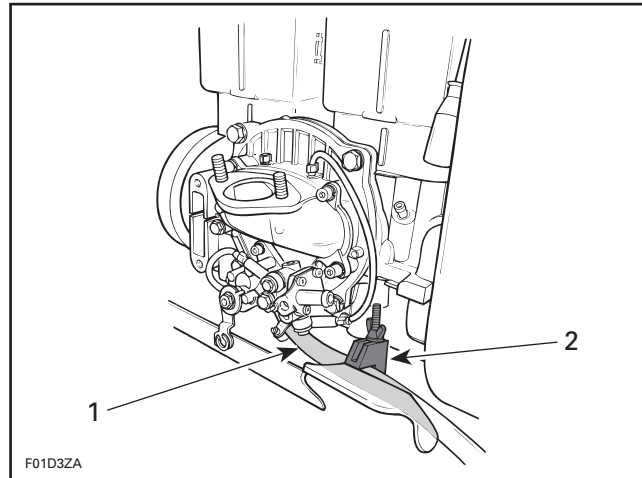
Install a hose pincher to oil supply hoses of oil injection pump and rotary valve shaft (except the 947 engine); then, disconnect hoses.



TYPICAL

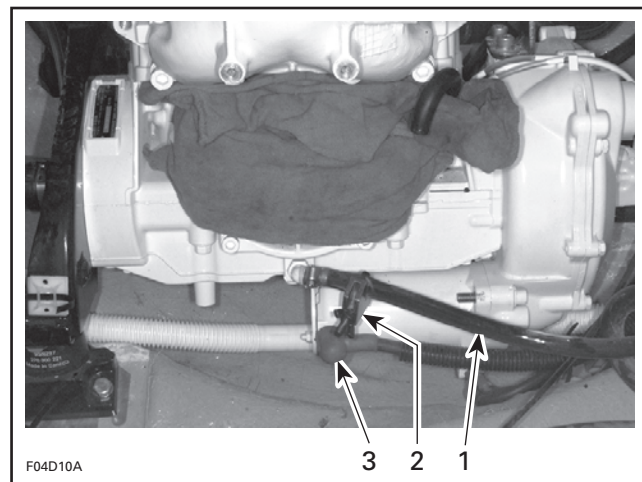
1. Hose pincher (P/N 295 000 076)

Install a hose pincher to oil return hose of rotary valve shaft (except the 947 engine); then, disconnect hose.



TYPICAL — 717 ENGINE

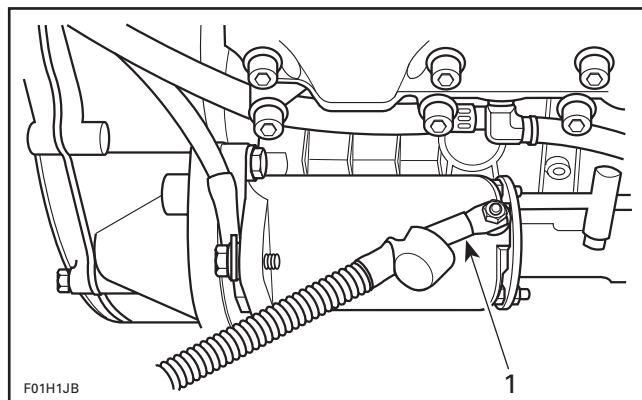
1. Rotary valve oil supply line
2. Hose pincher installed



TYPICAL — 787 RFI ENGINE

1. Rotary valve oil supply line
2. Hose pincher installed
3. Disconnect RED positive cable

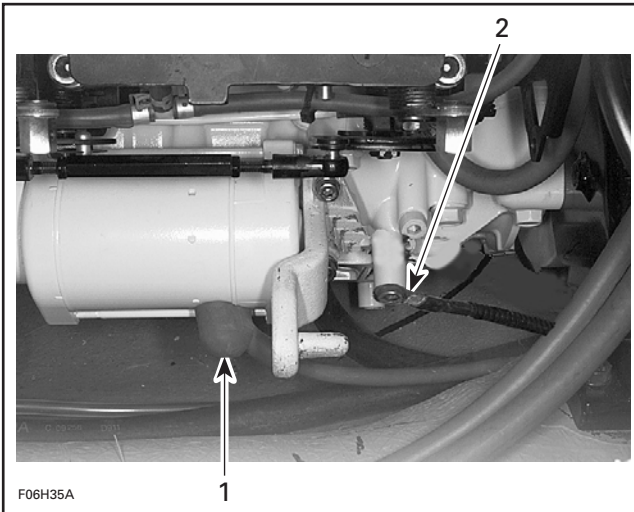
Disconnect RED positive cable from starter post.



TYPICAL

1. Disconnect RED positive cable

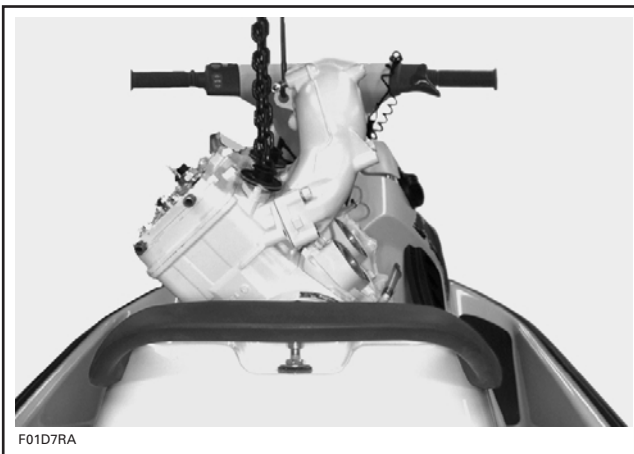
Disconnect black negative cable from engine crankcase.



- 1. Positive starter cable
- 2. Ground cable

Carry on engine lifting then tilt engine so that it can be removed from the body opening.

CAUTION: Be careful not to scratch body or to hit any component.



TYPICAL

CLEANING

Wipe off any spillage in bilge. Clean with a bilge cleaner.

Clean external parts of engine.

INSTALLATION

Installation of engine in watercraft is essentially the reverse of removal procedures. However pay particular attention to the following.

Rubber Mount, Shim and Screw

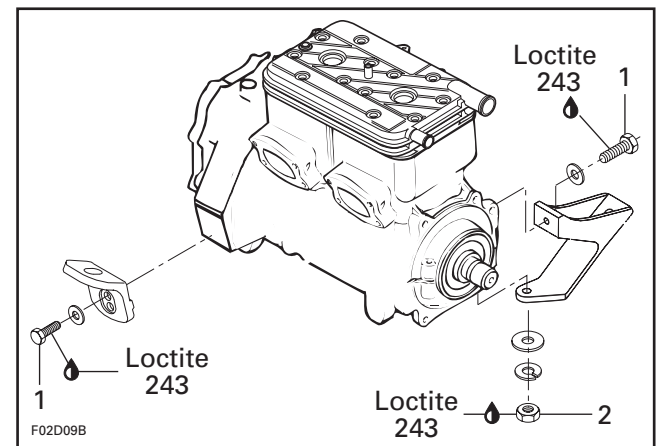
Check tightness and condition of rubber mounts. If they have been removed, apply Loctite 243 (blue) on screw threads. Torque screws to 25 N•m (18 lbf•ft).

CAUTION: Strict adherence to this torque is important to avoid damaging threads of aluminum insert in bilge.

Engine Support

717 Engine

Torque front and rear engine supports as shown in the following illustration.



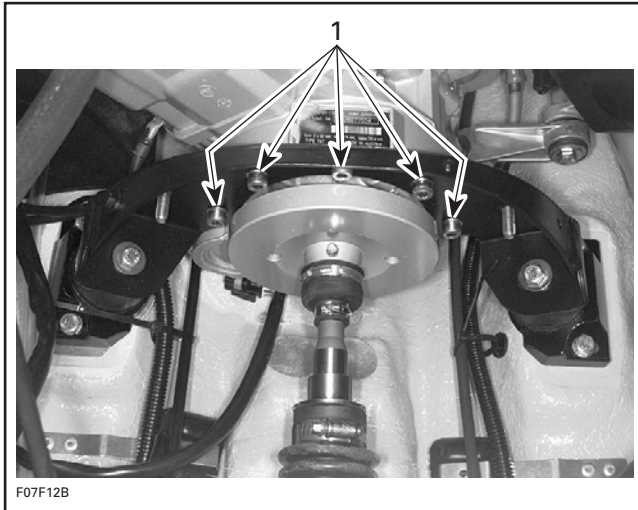
- 1. Torque screws to 22 N•m (16 lbf•ft)
- 2. Torque nuts to 39 N•m (29 lbf•ft)

Section 04 ENGINE

Subsection 03 (REMOVAL AND INSTALLATION)

787 RFI and 947 Engines

Apply Loctite 243 (blue) to rear engine support screws and torque to 24 N•m (17 lbf•ft).



TYPICAL

1. Torque engine support screws to 24 N•m (17 lbf•ft)

Oil Injection Hoses

717 and 787 RFI Engines

Make sure to reinstall hoses before completely lowering engine in bilge.

Positive Starter Cable

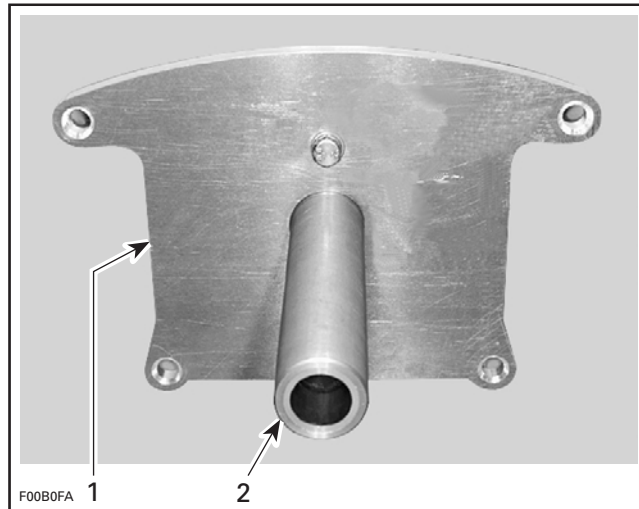
Torque nut of positive starter cable to 6 N•m (53 lbf•in). Apply dielectric grease on nut.

Engine/Jet Pump Alignment

Alignment is necessary to eliminate possible vibration and/or damage to components. Check alignment of engine using the following alignment tools.

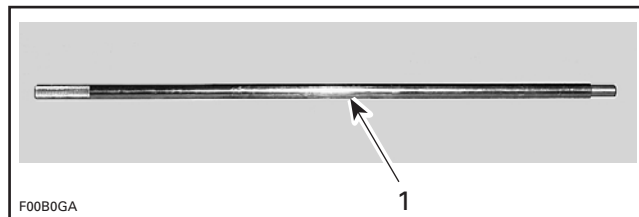
Support plate kit (P/N 529 035 506).

NOTE: Use plate (P/N 529 035 508) for the 139.5 mm (5-1/2 in) jet pump and plate (P/N 529 035 507) for the 155.6 mm (6-1/8 in) jet pump.



1. Plate
2. Support

Alignment shaft (P/N 295 000 141).



1. Alignment shaft

All Models (except XP)

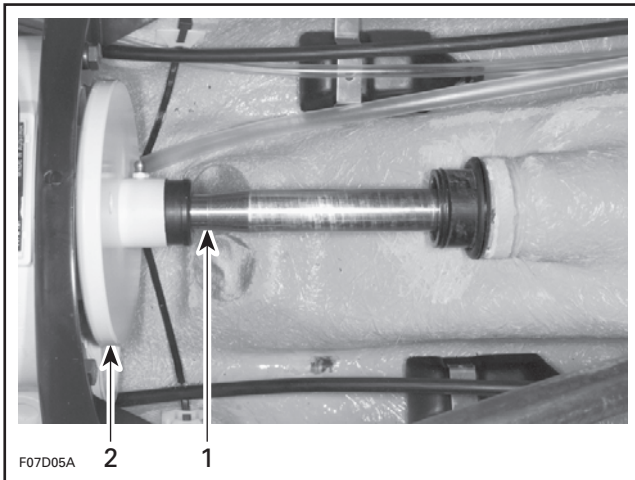
To verify alignment proceed as follows:

- Install the appropriate plate with the support to hull with four nuts.



- Carefully slide shaft through support.
- Insert shaft end into PTO flywheel.

NOTE: Ensure the protective hose and carbon ring (or seal carrier) is removed to check engine alignment. If the alignment is correct, the shaft will slide easily without any deflection in PTO flywheel.

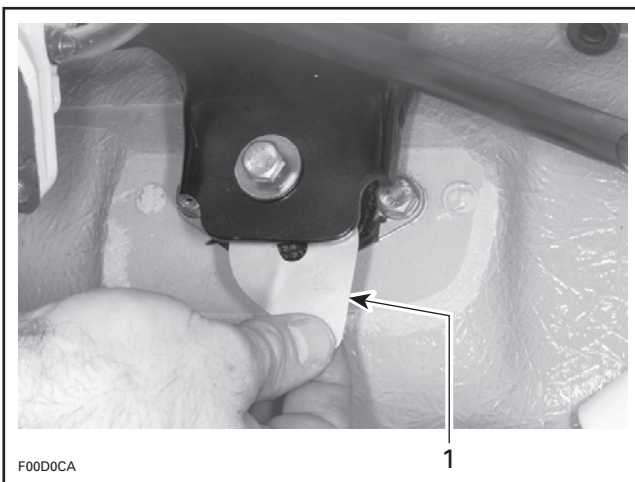


TYPICAL

1. Alignment shaft
2. PTO flywheel

If the alignment is incorrect loosen engine support screws to enable to align PTO flywheel with shaft end.

NOTE: Use shim(s) (P/N 270 000 024 or P/N 270 000 025) as necessary between engine supports and rubber mounts to correct alignment.



TYPICAL

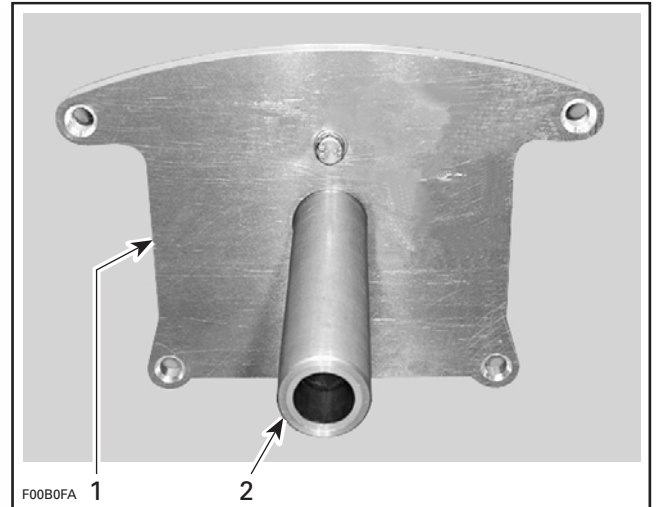
1. Shim

CAUTION: Whenever shims are used to correct alignment, never install more than 1.3 mm (0.051 in) shim thickness.

XP Model

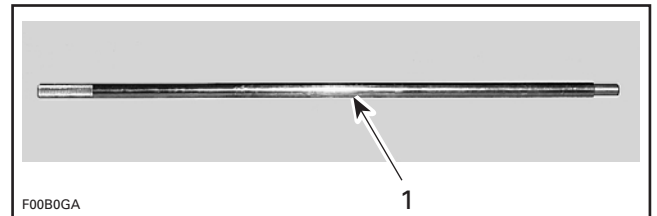
Use:

- plate (P/N 529 035 507) for the 155.6 mm (6-1/8 in) jet pump



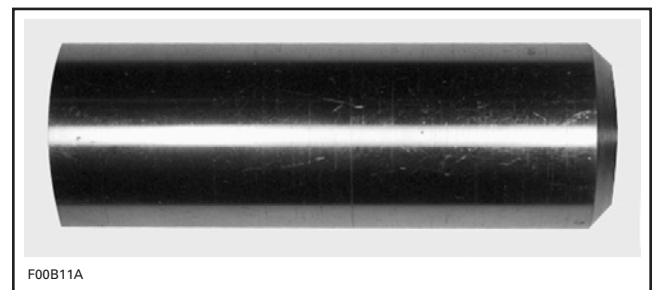
1. Plate
2. Support

- alignment shaft (P/N 529 035 590)



1. Alignment shaft

- PTO flywheel adapter (P/N 529 035 590).

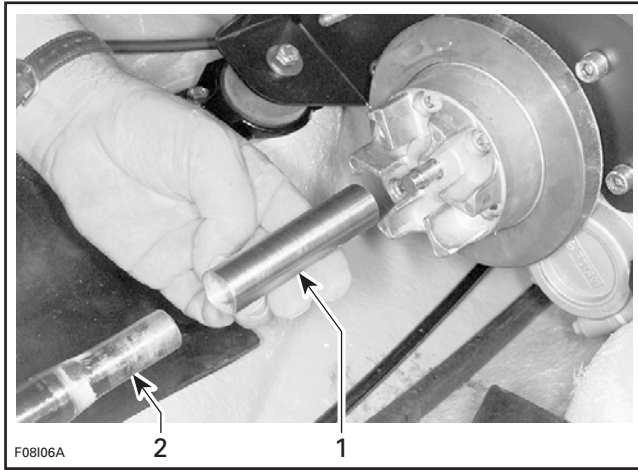


1. Adapter

Install support plate at rear of watercraft.
Install adapter on shaft.

Section 04 ENGINE

Subsection 03 (REMOVAL AND INSTALLATION)



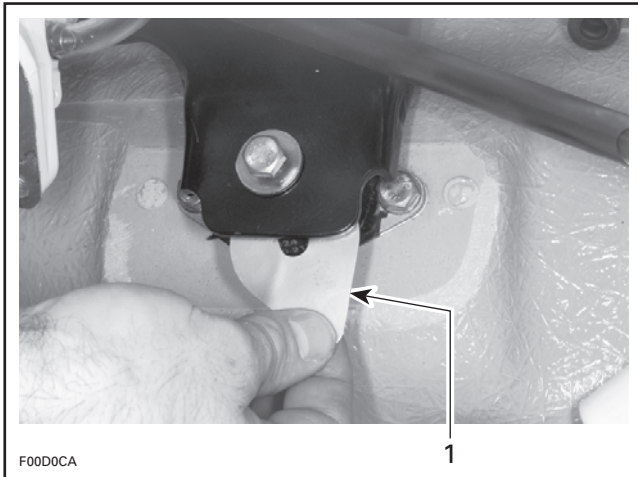
1. Alignment shaft
2. Adaptor

Carefully slide shaft through support plate and seal carrier. Insert adapter end into PTO flywheel.

NOTE: Ensure the mid bearing is loosened to check engine alignment.

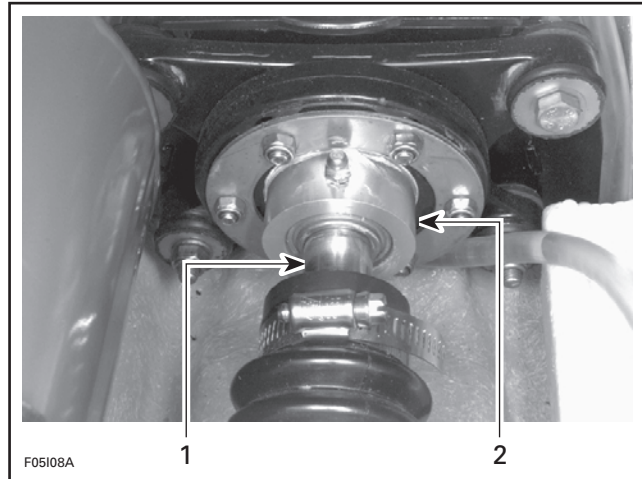
If the alignment is incorrect loosen engine support screws to enable to align PTO flywheel with shaft end.

NOTE: Use shim(s) (P/N 270 000 024 or P/N 270 000 025) as necessary between engine supports and rubber mounts to correct alignment.



- TYPICAL**
1. Shim

CAUTION: Whenever shims are used to correct alignment, never install more than 1.3 mm (0.051 in) shim thickness.

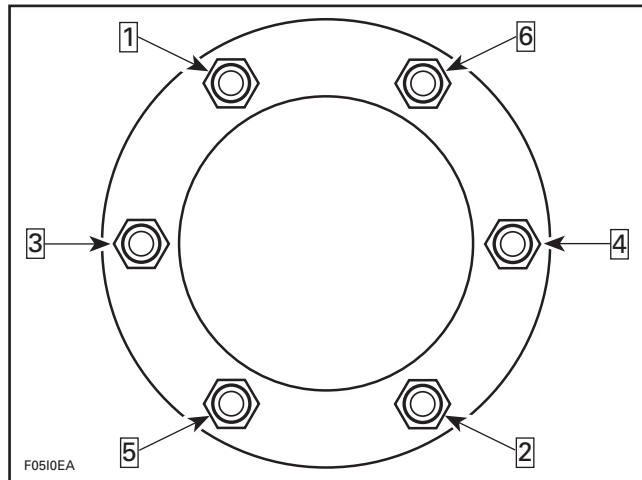


TYPICAL

1. Alignment tool
2. Seal carrier

Place grease fitting on the top and torque seal carrier nuts in a criss-cross sequence in two steps as per following illustration.

NOTE: It is very important to tighten nuts of seal carrier in a criss-cross sequence to maintain its alignment.



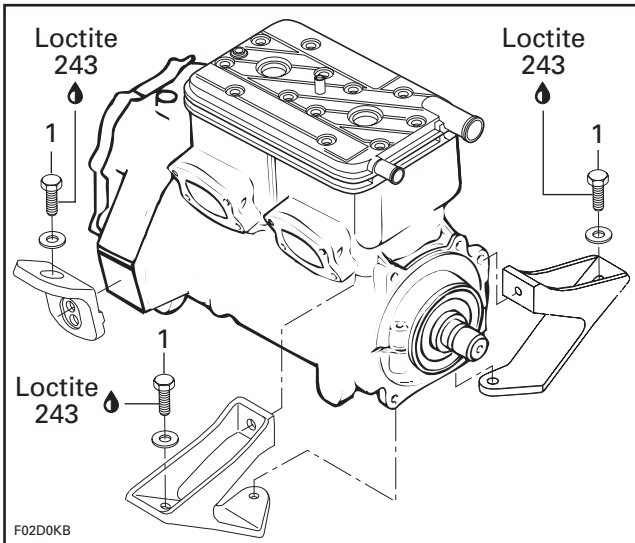
- Step **1**: Torque to 3 N•m (26 lbf•in) as per sequence
Step **2**: Torque to 10 N•m (88 lbf•in) as per sequence

Engine Support Screws

All Models

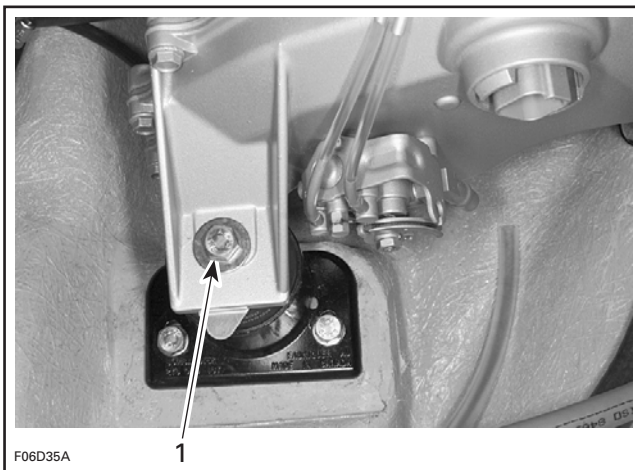
Apply Loctite 243 (blue) on screw threads.

Torque engine support screws to 25 N•m (18 lbf•ft) when procedure is completed.



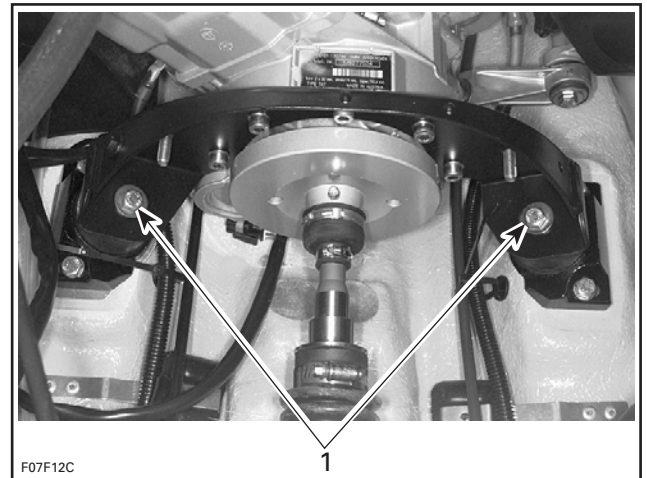
717 ENGINE

1. Torque to 25 N•m (18 lbf•ft)



FRONT ENGINE SUPPORT — 787 RFI AND 947 ENGINES

1. Torque to 25 N•m (18 lbf•ft)



REAR ENGINE SUPPORT — 787 RFI AND 947 ENGINES

1. Torque to 25 N•m (18 lbf•ft)

Final Inspection

Check throttle cable condition and lubricate cable with BOMBARDIER LUBE lubricant.

After its installation, properly adjust and bleed oil injection pump as specified in OIL INJECTION PUMP.

Check hose condition and pressure test fuel system, refer to FUEL CIRCUIT.

WARNING

Whenever doing any type of repair on watercraft or if any components of the fuel system are disconnected, a pressure test must be done before starting engine.

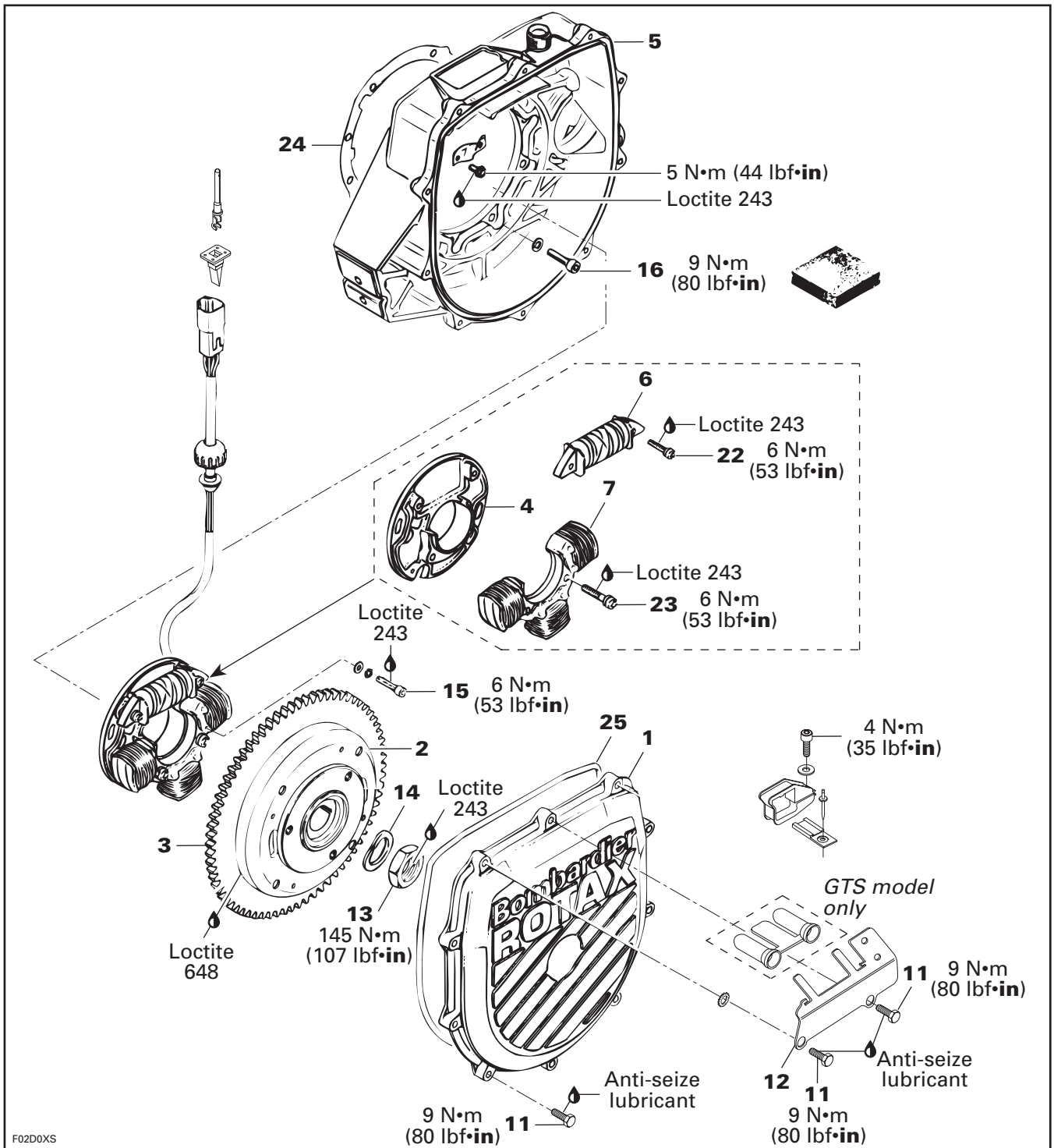
Verify all electrical connections.

Run engine and ensure there is no leakage.

CAUTION: If watercraft is out of water, engine must be cooled using the flush kit.

MAGNETO SYSTEM

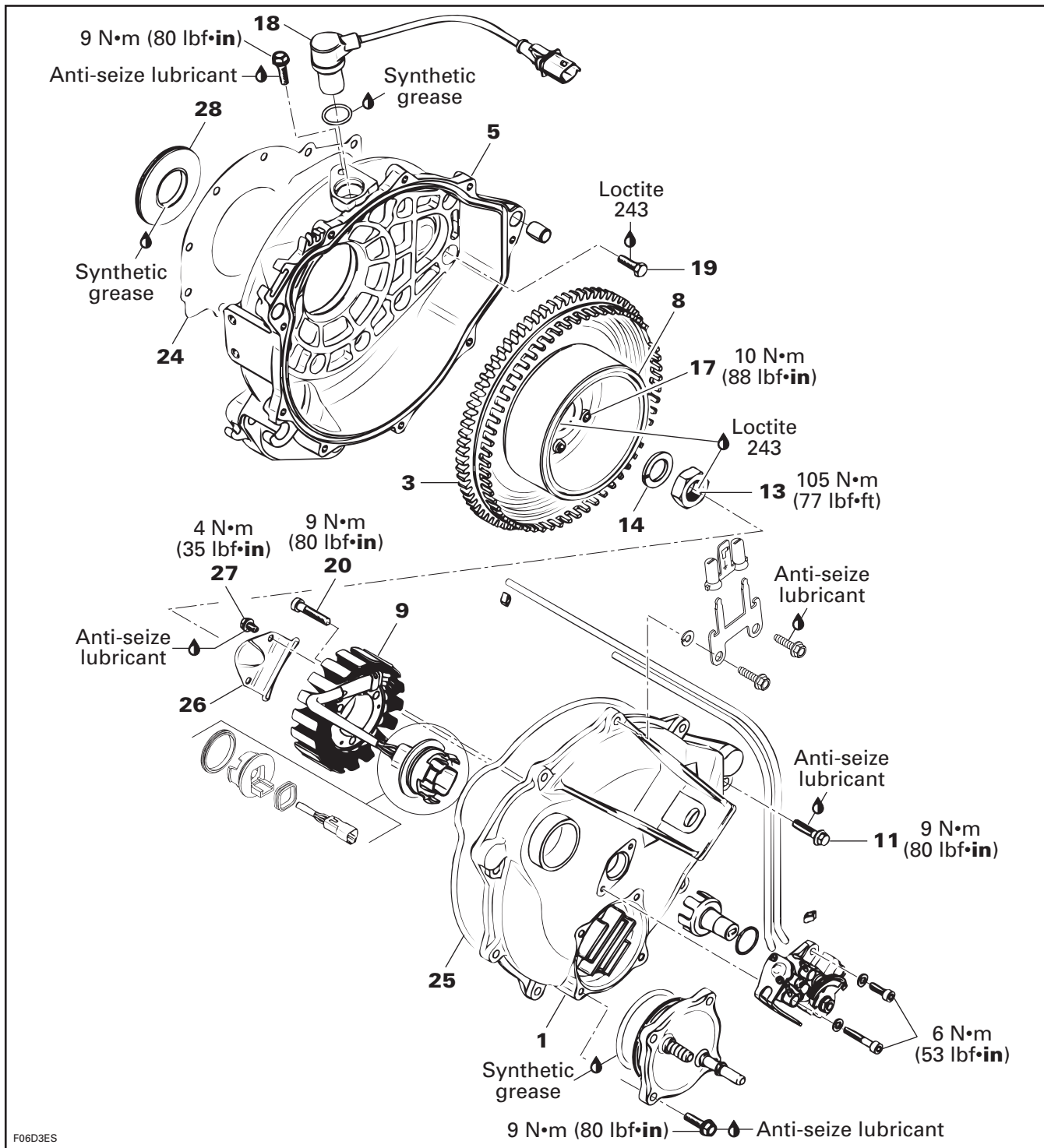
717 Engine



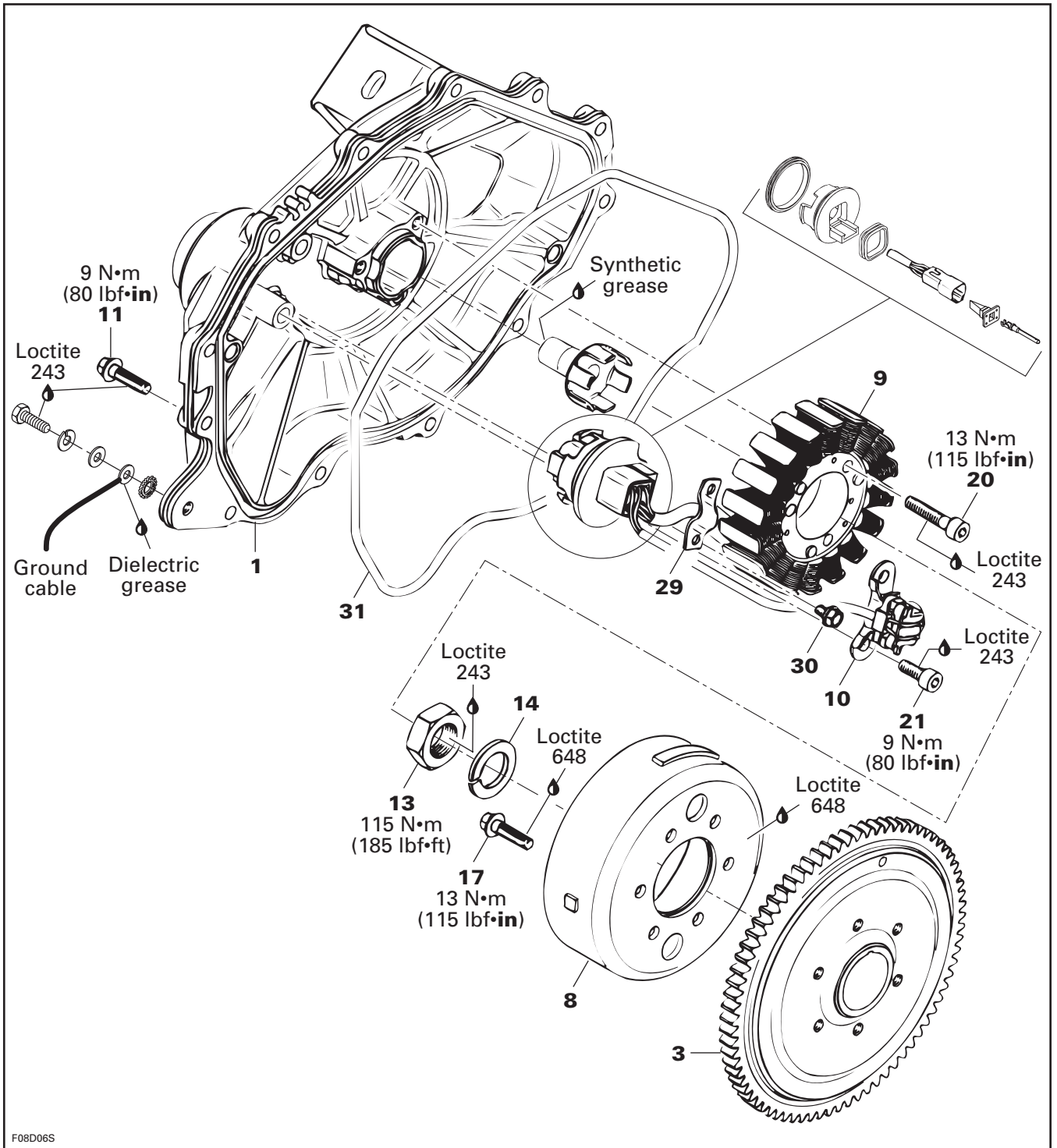
Section 04 ENGINE

Subsection 04 (MAGNETO SYSTEM)

787 RFI Engine



947 Engine



Section 04 ENGINE

Subsection 04 (MAGNETO SYSTEM)

DISASSEMBLY

717 Engine

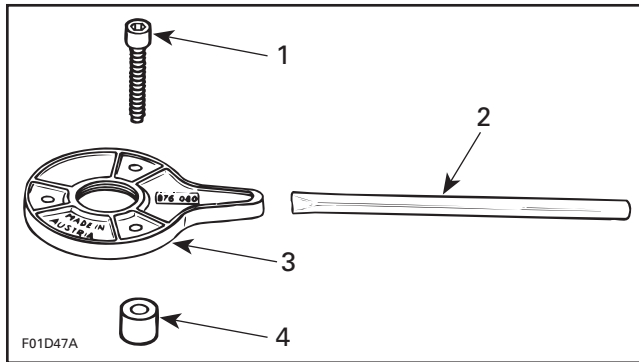
NOTE: On 717 engine, the magneto system can be disassembled without removing the engine from the watercraft.

1, Magneto Cover

Remove screws **no. 11** and wire support **no. 12**, then withdraw cover.

2,3, Magneto Flywheel and Ring Gear

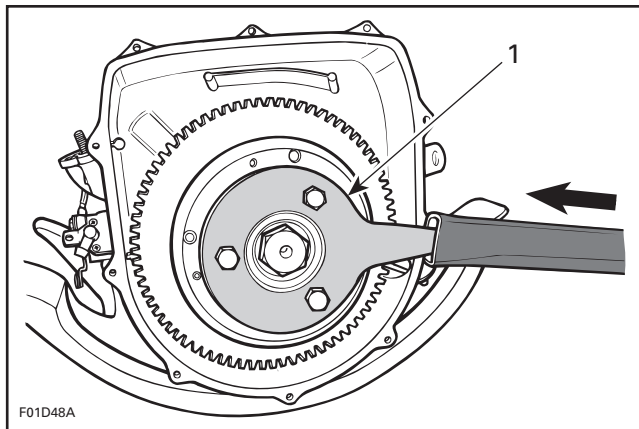
Magneto flywheel is locked with puller plate (P/N 420 876 080), sleeves (P/N 290 847 220) and extension handle (P/N 295 000 111).



1. Screw
2. Extension handle
3. Puller plate
4. Sleeve

Using three M8 x 35 screws (P/N 420 841 591), install screws through puller plate and slide sleeves on screws then secure puller plate on magneto flywheel so that sleeves are against flywheel.

Install extension handle on end of puller plate.

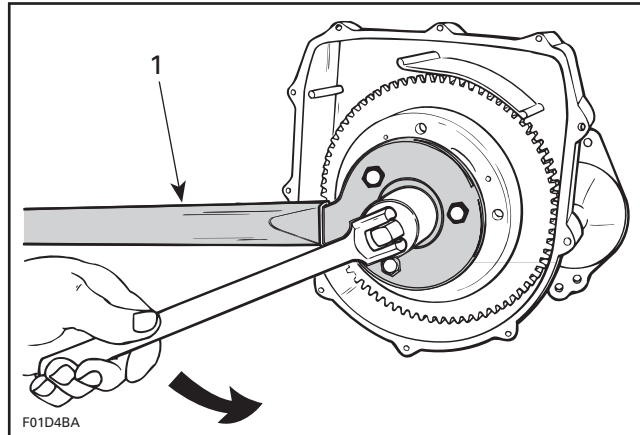


TYPICAL

1. Sleeves on opposite side

Using a suitable socket, unscrew retaining nut **no. 13** COUNTERCLOCKWISE when facing it.

NOTE: If socket is found too large to be inserted in puller plate, machine or grind its outside diameter as necessary.

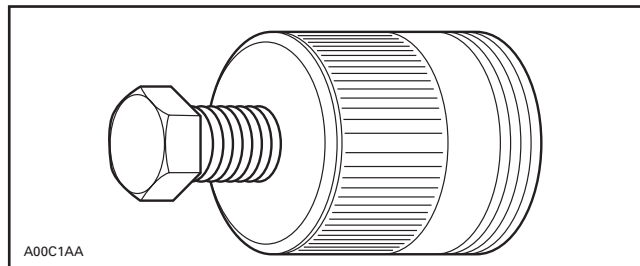


TYPICAL

1. Extension handle locking crankshaft

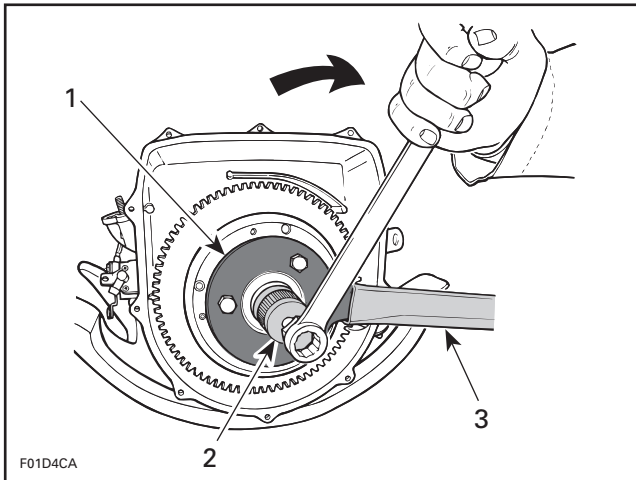
Remove nut **no. 13** and lock washer **no. 14** from magneto flywheel.

Magneto flywheel is easily freed from crankshaft with puller (P/N 529 035 547).



Fully thread on puller in puller plate.

Tighten puller bolt and at the same time, tap on bolt head using a hammer to release magneto flywheel from its taper.



1. Puller plate
2. Puller
3. Extension handle

4, Armature Plate

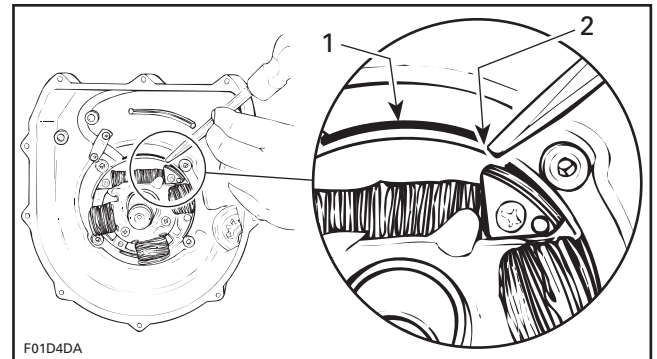
Before removing, locate the manufacturer's reference mark on the armature plate and ensure there is a corresponding indexing mark on the crankcase housing.

NOTE: Since replacement crankcases do not have timing mark for armature plate location, indexing marks should be made on armature plate and crankcase to ease reassembly and further ignition timing.

The following procedure is to find a common reference point on both crankcases (old and new) to position armature plate.

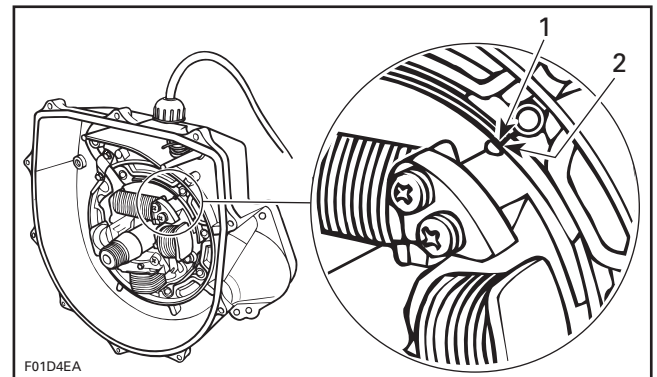
Proceed as follows:

- Before removing the armature plate, find a crankcase locating lug (the top one in this example).
- Place a cold chisel at the end of chosen lug, then punch a mark on armature plate at this point.



1. Crankcase locating lug
2. Mark armature plate at the end of lug

- At assembly, align armature plate mark (previously punched) with the end of the corresponding locating lug on the new crankcase.



TYPICAL

1. Lug end of crankcase
2. Align mark and lug end here

- Remove three retaining screws no. 15 and withdraw armature plate.

5, Magneto Housing

To remove magneto housing, starter has to be removed. Refer to STARTING SYSTEM.

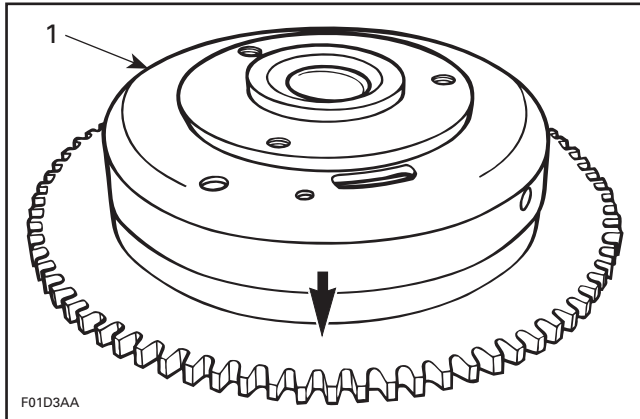
Unscrew retaining screws no. 9, then withdraw housing.

Section 04 ENGINE

Subsection 04 (MAGNETO SYSTEM)

Magneto Flywheel and Ring Gear

Lay magneto flywheel no. 2 on a steel plate. Tap lightly on ring gear no. 3 using a hammer to release it from magneto flywheel.

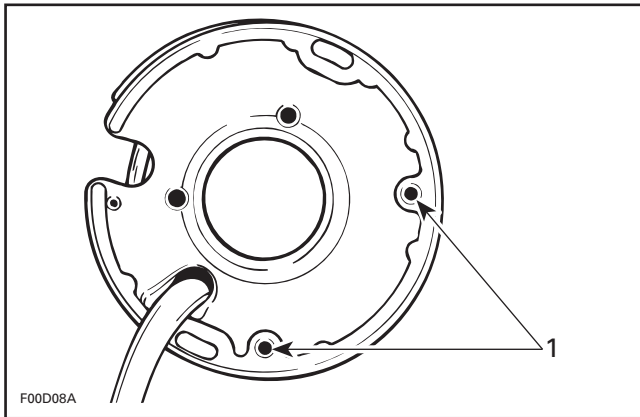


1. Magneto flywheel

6, Generating Coil

To replace generating coil:

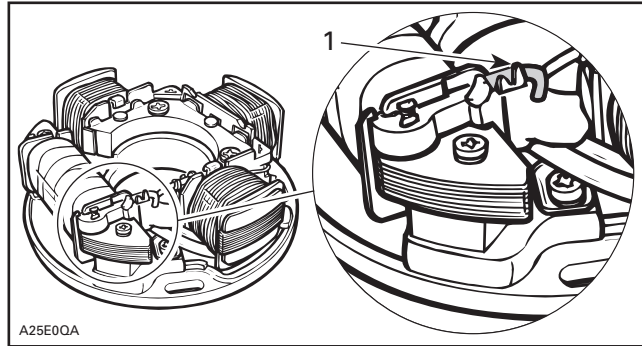
- Heat the armature plate to 93°C (200°F) around the screw holes to break the threadlocker bond.



1. Heat the armature plate

CAUTION: Protect harness from flame.

- Remove screws.
- Uncrimp and unsolder BLACK/RED wire from coil.

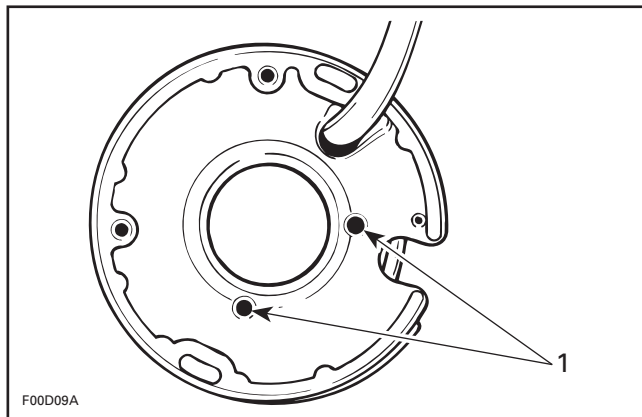


1. Uncrimp and unsolder wire here

7, Battery Charging Coil

To replace battery charging coil:

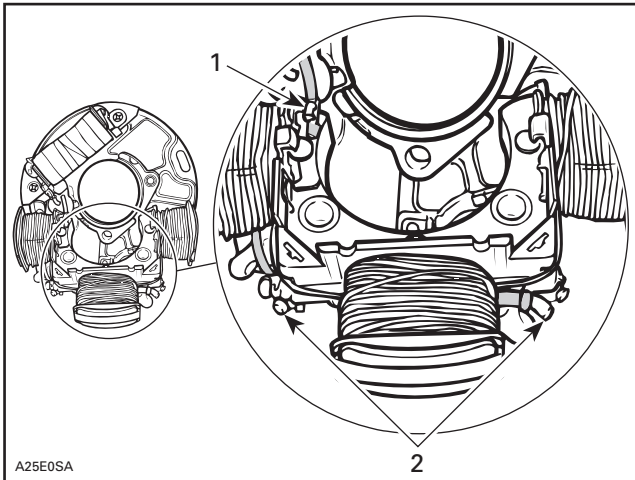
- Heat the armature plate to 93°C (200°F) around the screw holes to break the threadlocker bond.



1. Heat the armature plate

CAUTION: Protect harness from flame.

- Remove screws.
- Uncrimp and unsolder YELLOW and YELLOW/BLACK wires from coil.
- Uncrimp and unsolder ground wire (BLACK) from coil core.

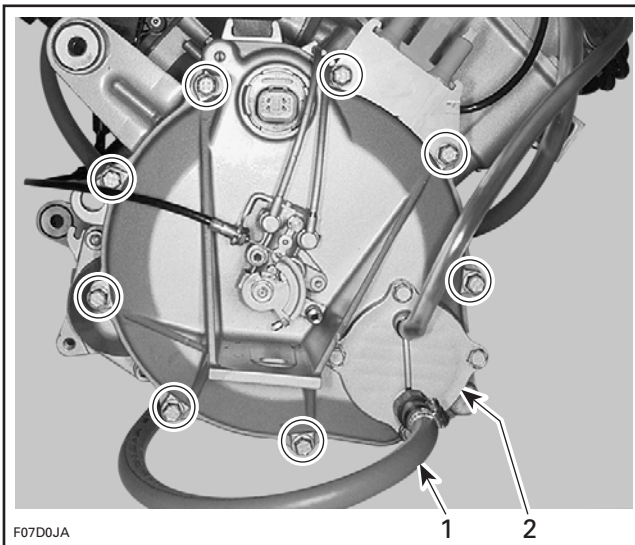


1. Uncrimp and unsolder ground wire (BLACK)
2. Uncrimp and unsolder YELLOW and YELLOW/BLACK wires

787 RFI Engine

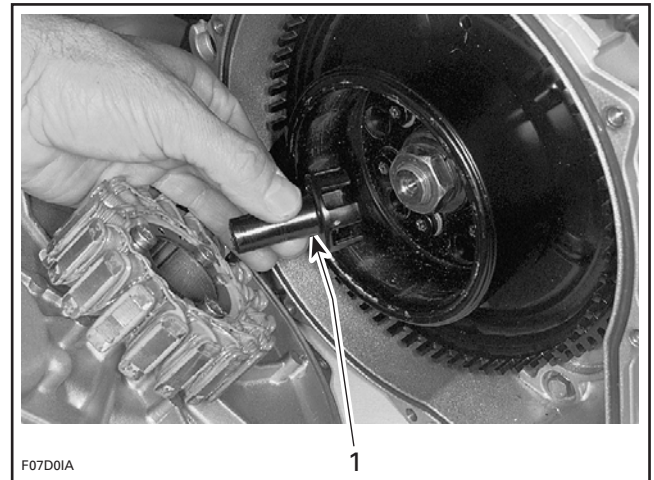
Magneto Housing Cover

Disconnect water hoses from heat exchanger cover. Loosen screws no. 11. Remove engine magneto cover no. 1.



- 787 RFI ENGINE**
1. Disconnect water inlet hose
 2. Heat exchanger cover

Remove oil pump shaft from flywheel nut.

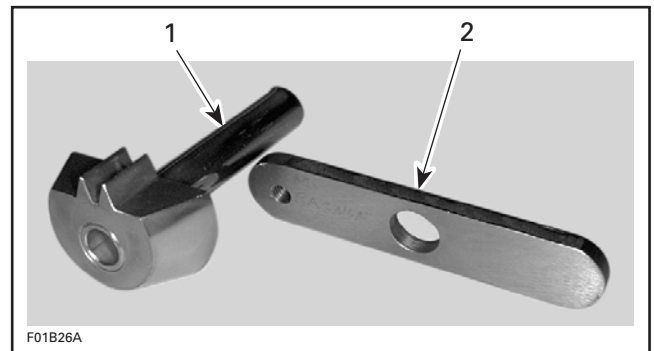


1. Oil pump shaft

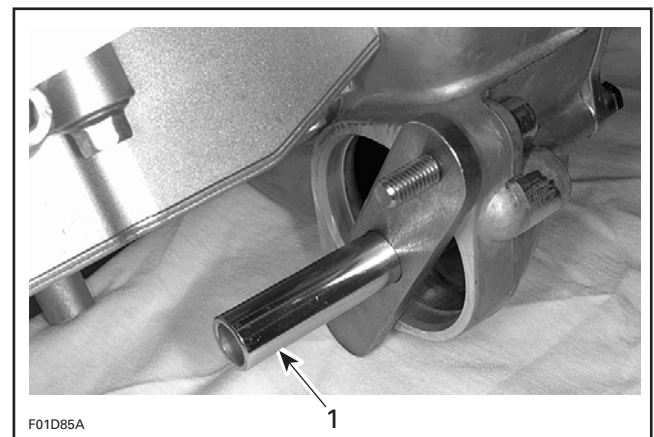
Rotor and Flywheel

Remove starter. Refer to STARTING SYSTEM.

NOTE: Crankshaft can also be locked by using the PTO flywheel. For procedure, refer to BOTTOM END. Lock ring gear using special tool.



1. Ring gear blocking tool (P/N 295 000 134)
2. Retaining plate (P/N 295 000 154)

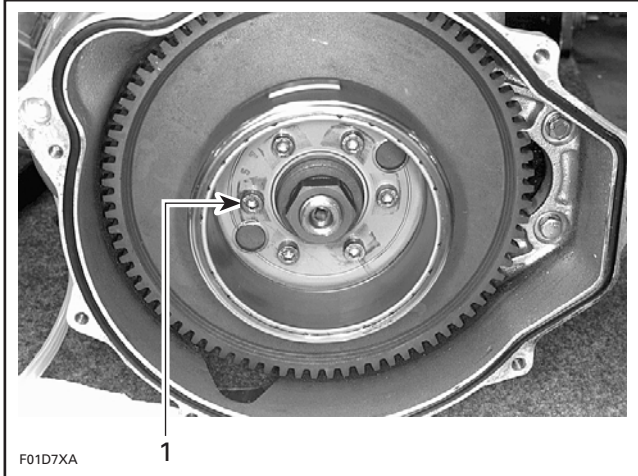


1. Ring gear blocking tool with retaining plate

Section 04 ENGINE

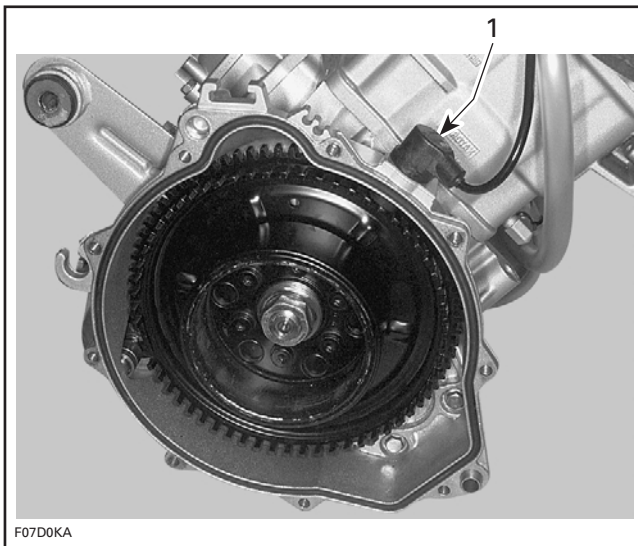
Subsection 04 (MAGNETO SYSTEM)

If desired, magneto rotor no. 8 can be removed without removing the engine flywheel no. 3. Remove the six screws no. 17.



1. Screw

NOTE: Remove crankshaft position sensor no. 18 before removing the flywheel.



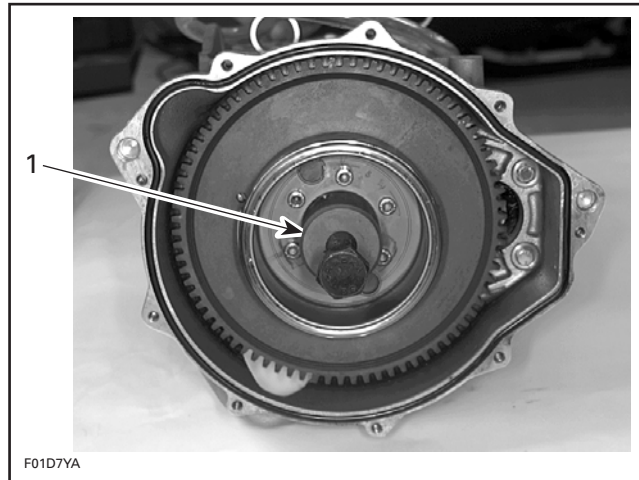
1. Crankshaft position sensor

Using a suitable socket, unscrew retaining nut of engine flywheel COUNTERCLOCKWISE when facing it.

Remove special tool locking ring gear.

Engine flywheel is easily freed from crankshaft with puller (P/N 420 976 235) and crankshaft protective cap (P/N 420 876 557).

Insert crankshaft protector to outer end of crankshaft and fully thread puller in engine flywheel.



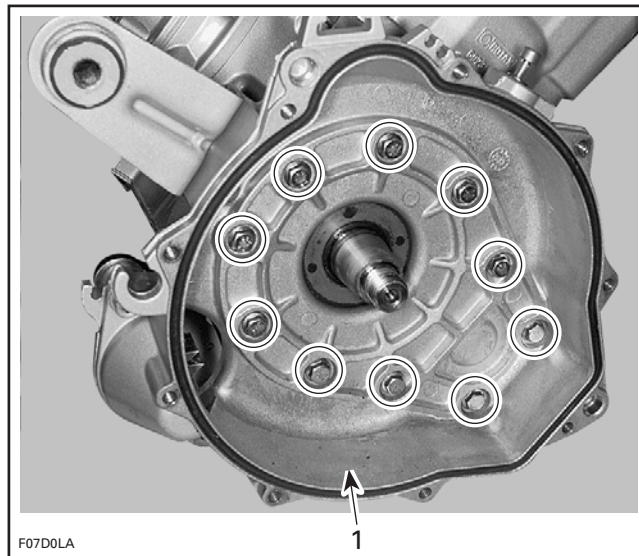
1. Puller

Tighten puller screw and at the same time, tap on screw head using a hammer to release engine flywheel from its taper.

Magneto Housing

To remove magneto housing no. 5, starter has to be removed. Refer to STARTING SYSTEM.

Unscrew retaining screws no. 19, then withdraw housing.



REMOVE SCREWS

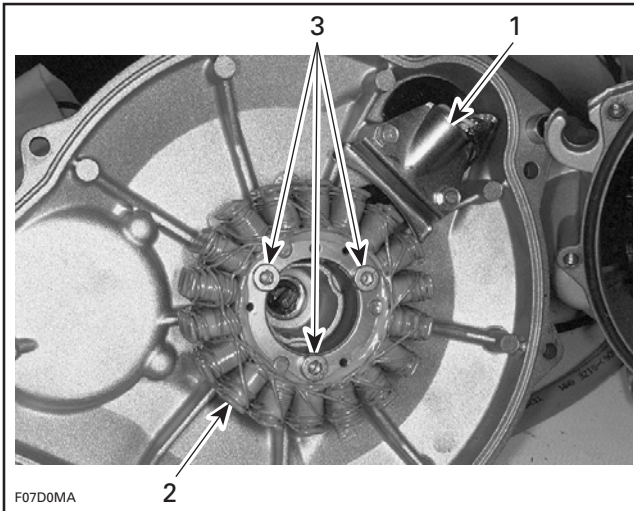
1. Magneto housing

Stator Assembly

787 RFI Engine

Remove holding plate and withdraw plug from cover.

Unscrew bolts **no. 20** and remove stator **no. 9** from magneto cover.

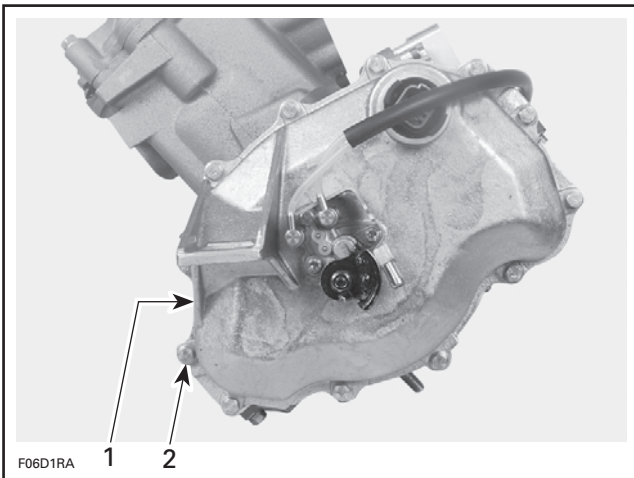


- 787 RFI ENGINE**
1. Holding plate
 2. Stator assembly
 3. Remove screws

947 Engine

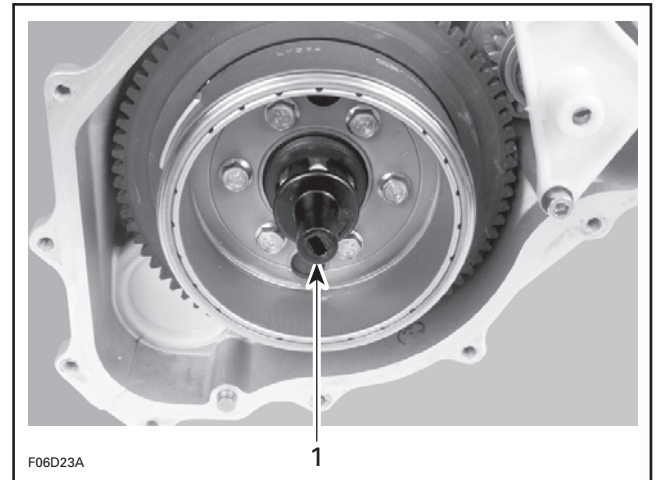
Cover

Loosen screws **no. 11**. Remove engine magneto cover **no. 1**.



- TYPICAL**
1. Cover
 2. Screw

Remove oil pump shaft from flywheel nut.

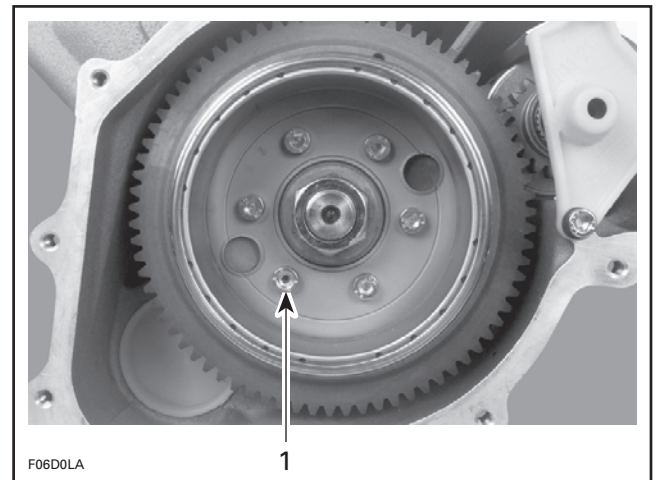


1. Remove oil pump shaft

Rotor and Flywheel

To remove the rotor **no. 8** or the flywheel **no. 3**, the crankshaft must be locked. For procedure, refer to **BOTTOM END**.

If necessary, the magneto rotor can be removed without removing the engine flywheel. Remove the six screws **no. 17**.

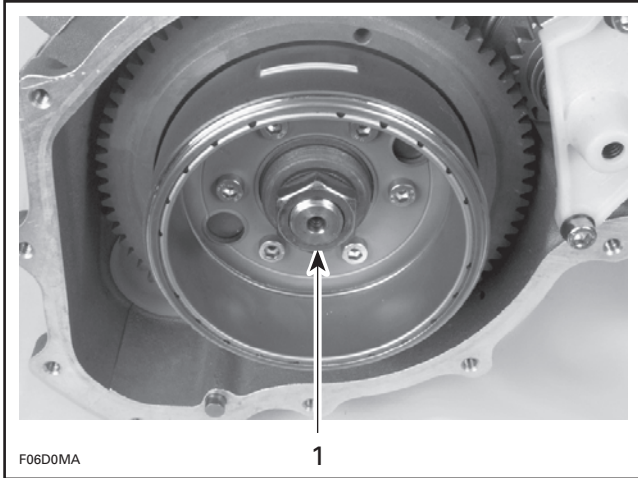


1. Screw

Section 04 ENGINE

Subsection 04 (MAGNETO SYSTEM)

To remove the flywheel/rotor assembly, unscrew nut no. 13 counterclockwise when facing it.

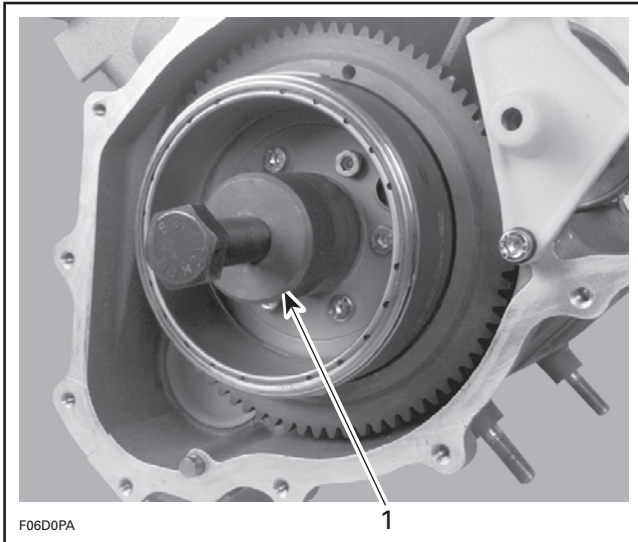


1. Nut

The flywheel is easily freed from crankshaft with puller (P/N 420 976 235).

Install protective cap (P/N 290 877 414) to crankshaft.

Fully thread puller in engine flywheel.

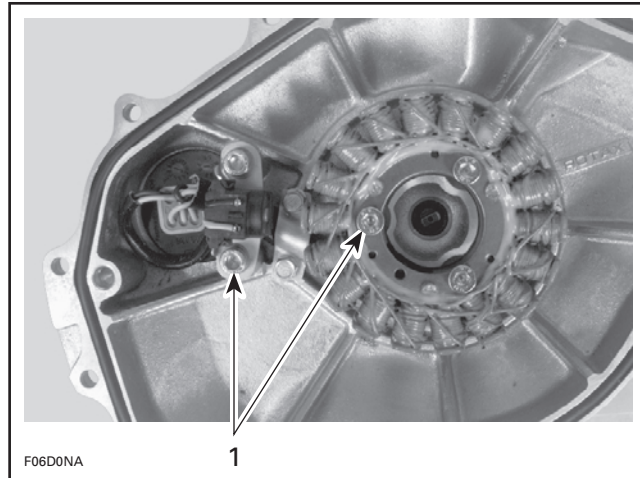


1. Puller

Tighten puller screw and at the same time, tap on screw head using a hammer to release engine flywheel from its taper.

Stator and Trigger Coil

Loosen screws no. 20 and no. 21 to remove the stator no. 9 and trigger coil no. 10 from the engine magneto cover.



1. Remove screws

CLEANING

Clean all metal components in a solvent.

CAUTION: Clean coils and magnets using only a clean cloth.

Clean crankshaft taper and threads.

ASSEMBLY

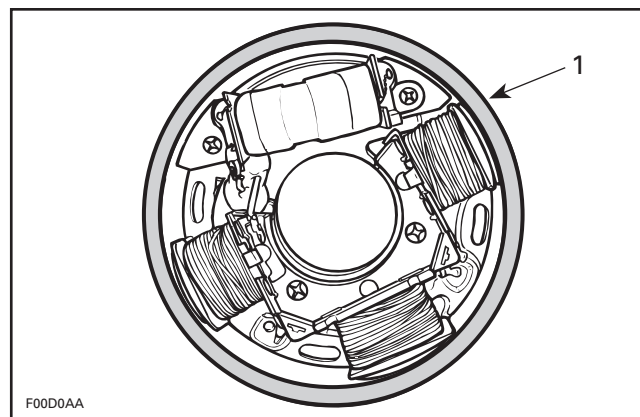
717 Engine

Generating Coil

Strip end of old wire then crimp and solder on new coil.

Apply Loctite 243 (blue) to screws no. 22 and install the new coil on armature plate.

Use magneto coil centering tool (P/N 420 876 922) and install so that it fits around armature plate before tightening screws.



1. Magneto coil centering tool (P/N 420 876 922)

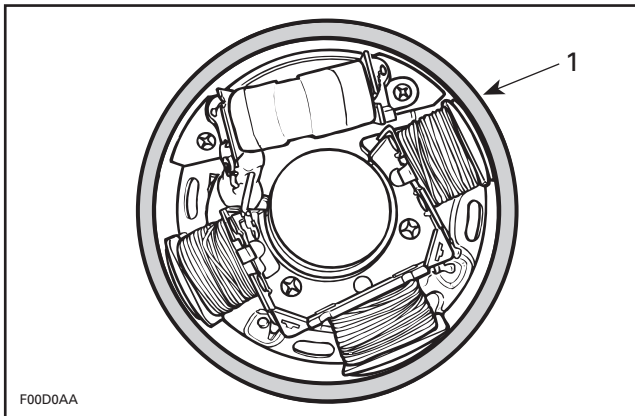
CAUTION: Before reinstalling the magneto, remove the loose epoxy from harness.

Battery Charging Coil

Position new coil, crimp and solder all wires.

Prior to assembly, apply Loctite 243 (blue).

Use magneto coil centering tool (P/N 420 876 922) and install it so that it fits around armature plate before tightening screws **no. 23**.

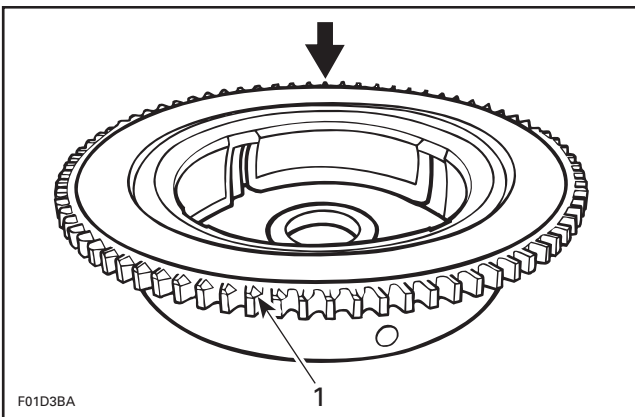


1. Magneto coil centering tool (P/N 420 876 922)

Magneto Flywheel and Ring Gear

Apply Loctite 648 (green) to magneto flywheel mating surface. Lay ring gear on a steel plate, then heat with a propane torch in order to install it on magneto flywheel.

Pay particular attention to position ring gear teeth chamfer side as per following illustration.



1. Teeth chamfer

NOTE: Ensure that ring gear contacts magneto flywheel flange.

Whenever replacing either ring gear or magneto flywheel, Gun Kote must be applied to prevent possible corrosion.

CAUTION: Always assemble magneto flywheel and ring gear prior to apply Gun Kote. If not done correctly, ring gear won't contact magneto flywheel flange.

To apply Gun Kote proceed as follows:

1. Clean thoroughly and degrease replacement part using a non oil base solvent.
2. Apply coating in light thin coats using a spray gun.

NOTE: Do not spray Gun Kote into magneto flywheel threaded holes.

3. Bake parts in oven at 175°C (350°F) for 1 hour to cure Gun Kote.

CAUTION: Do not eliminate Gun Kote heat curing time because it will lose all its resistance and it will not give any protection.

Magneto Housing

Install gasket **no. 24** between magneto housing **no. 5** and engine crankcase.

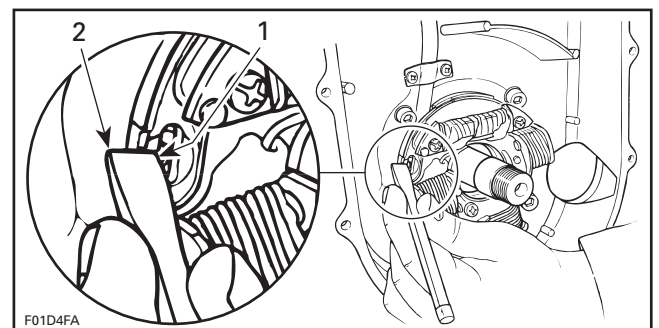
Install magneto housing and torque screws **no. 16** to 9 N•m (80 lbf•in).

Armature Plate

Position the armature plate on the crankcase, aligning the marks on both parts.

When reinstalling armature plate on a new crankcase housing, proceed as follows.

Find manufacturer's mark on armature plate. In line with this mark, punch another mark on adjacent crankcase lug.



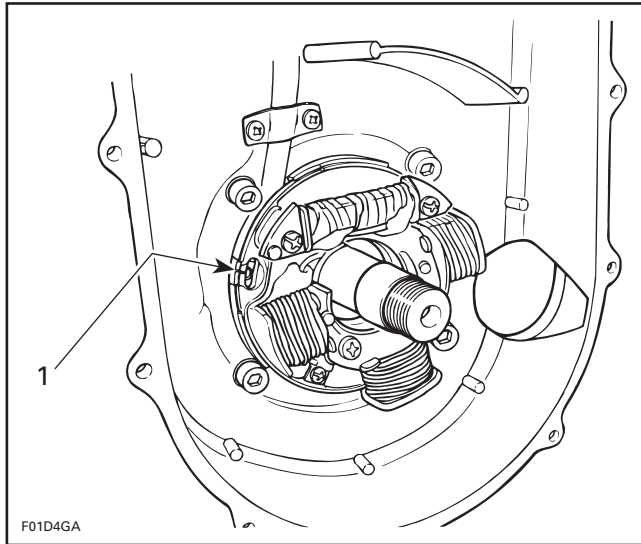
TYPICAL

1. Manufacturer's mark on armature plate
2. Punch a mark on crankcase lug aligned with plate mark

Section 04 ENGINE

Subsection 04 (MAGNETO SYSTEM)

The new mark on crankcase will be used for further assembly positioning as a pre-timing position.



TYPICAL

1. For further assembly, use these marks

Apply a drop of Loctite 243 (blue) on threads of screws no. 15 and torque to 6 N•m (53 lbf•in).

Magneto Flywheel

Apply Loctite 243 (blue) on crankshaft taper.

Position Woodruff key and magneto flywheel. Apply Loctite 243 (blue) on nut no. 13. Install nut with lock washer and torque to 145 N•m (107 lbf•ft).

CAUTION: Never use any type of impact wrench at magneto installation.

Ignition Timing

For ignition timing procedures of the 717 engine, refer to IGNITION SYSTEM.

Magneto Housing Cover

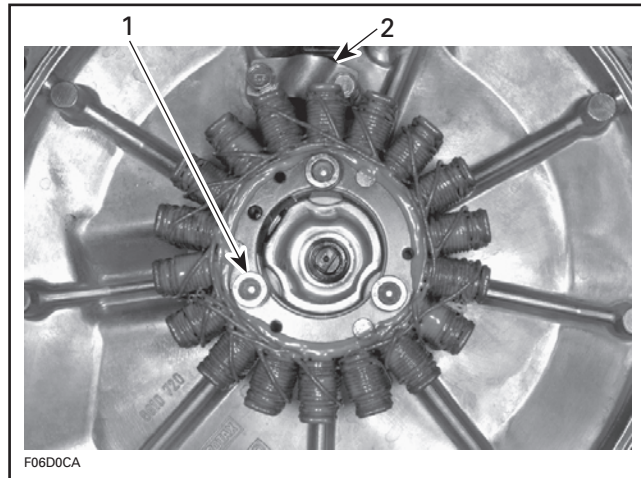
Properly install O-ring no. 25 in magneto housing. Apply Loctite 767 anti-seize on screws no. 11, install cover and wire support no. 12. Torque screws no. 11 in a criss-cross sequence to 9 N•m (80 lbf•in).

787 RFI Engine

Stator

Install the stator no. 9 in magneto housing cover no. 1 and torque screws no. 20 to 10 N•m (88 lbf•in).

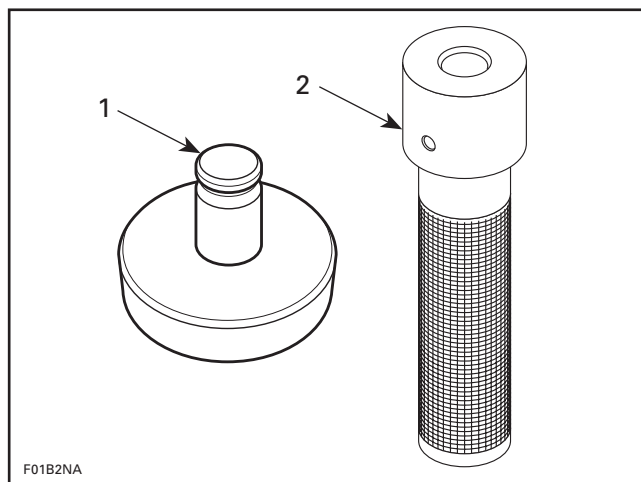
Install wiring harness bracket no. 26 of stator and torque screws no. 27 to 4.5 N•m (40 lbf•in).



1. Stator screws
2. Bracket

Magneto Housing

To install oil seal no. 28 of magneto housing no. 5, use pusher (P/N 290 877 740) and handle (P/N 290 877 650).



1. Pusher
2. Handle



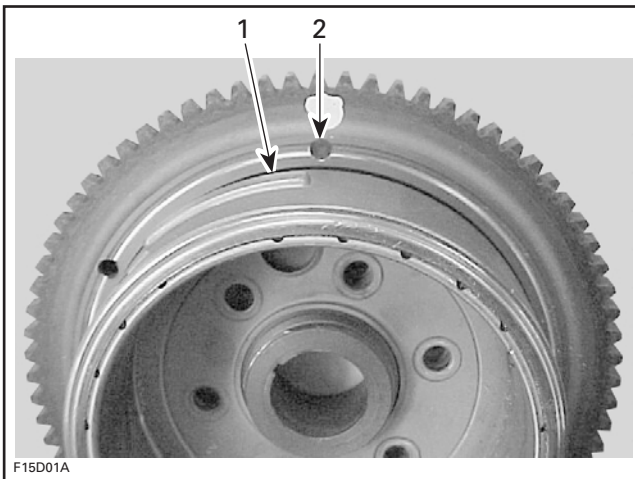
Install gasket **no. 24** between magneto housing and engine crankcase.

Install magneto housing and torque screws **no. 19** to 9 N•m (80 lbf•in).

Rotor and Flywheel

When reinstalling magneto rotor **no. 8** to engine flywheel **no. 3**, apply Loctite 648 to mating surfaces.

The leading edge of the long protrusion must align with hole of engine flywheel.



1. Protrusion
2. Hole

Apply Loctite 648 (green) on screws **no. 17** and torque to 10 N•m (88 lbf•in).

Apply Loctite 243 (blue) on crankshaft taper.

Apply Loctite 243 (blue) on nut **no. 13**. Install nut with lock washer **no. 14** and torque to 105 N•m (77 lbf•ft).

CAUTION: Never use any type of impact wrench at magneto installation.

Crankshaft Position Sensor

Install crankshaft position sensor **no. 18** on magneto housing. Torque screw to 9 N•m (80 lbf•in).

NOTE: The throttle position sensor is not adjustable.

Cover

Before installing cover, make sure oil pump shaft is properly positioned.

Before installation, properly install O-ring **no. 25** in engine magneto cover **no. 1**.

Apply Loctite 767 anti-seize compound on screws **no. 11**. Torque screws in a criss-cross sequence to 9 N•m (80 lbf•in).

947 Engine

Stator and Trigger Coil

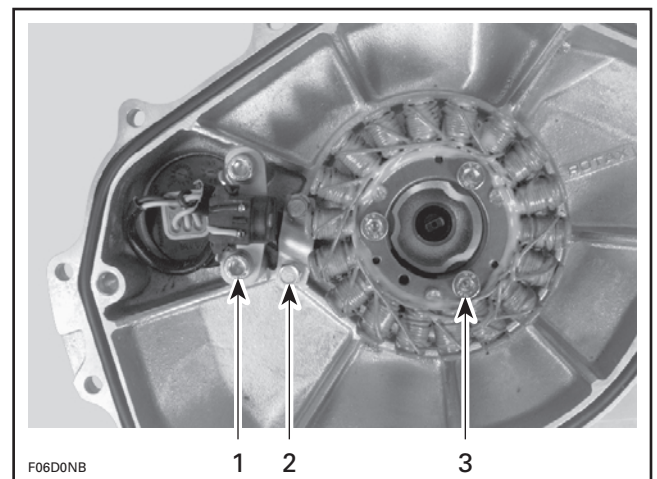
Install the stator **no. 9** and trigger **no. 10** coil in engine magneto cover. Torque screws to 9 N•m (80 lbf•in).

Reinstall wiring harness bracket **no. 29** using tap-tite screws **no. 30**.

Torque trigger coil screws **no. 21** to 9 N•m (80 lbf•in).

Torque stator screws **no. 20** to 13 N•m (115 lbf•in).

NOTE: The trigger coil is not adjustable.



1. Torque to 9 N•m (80 lbf•in)
2. Tap-tite screws
3. Torque to 13 N•m (115 lbf•in)

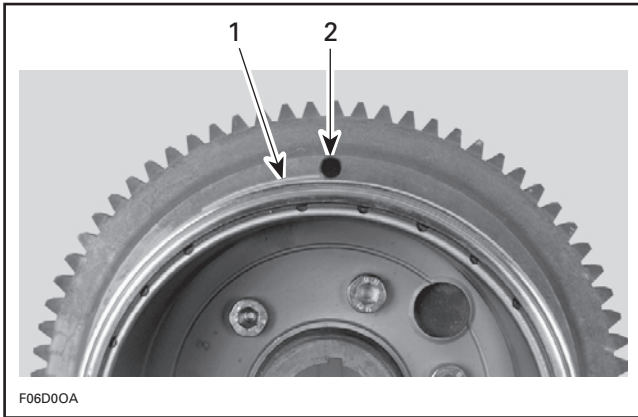
Section 04 ENGINE

Subsection 04 (MAGNETO SYSTEM)

Rotor and Flywheel

Apply Loctite 648 (green) on mating surface of the rotor **no. 8**.

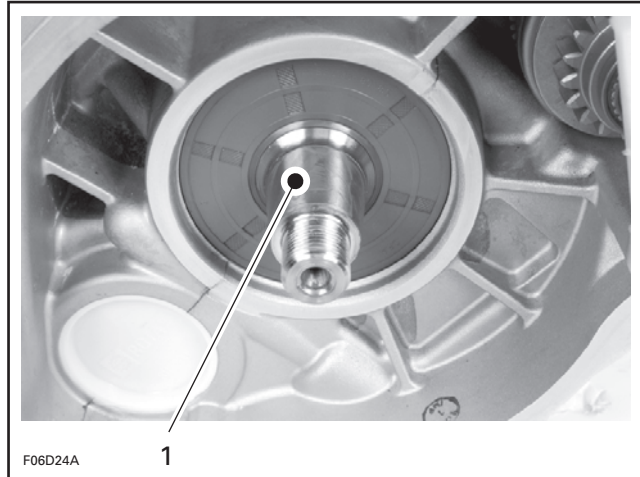
When reinstalling rotor to flywheel **no. 3**, one of the protrusion end of rotor must be aligned with hole in flywheel.



1. Protrusion
2. Hole

Apply Loctite 648 (green) on screws **no. 17** retaining rotor to flywheel and torque screws in a criss-cross sequence to 13 N•m (115 lbf•in).

Apply Loctite 243 (blue) on crankshaft taper.



1. Loctite 243 (blue) on crankshaft taper

Install flywheel and make sure to align keyway with the crankshaft Woodruff key.

Apply Loctite 243 (blue) on nut **no. 13**. Install nut with lock washer and torque to 115 N•m (85 lbf•ft).

CAUTION: Never use any type of impact wrench.

Unlock crankshaft. Reinstall pulse fitting with washer and torque to 19 N•m (14 lbf•ft).

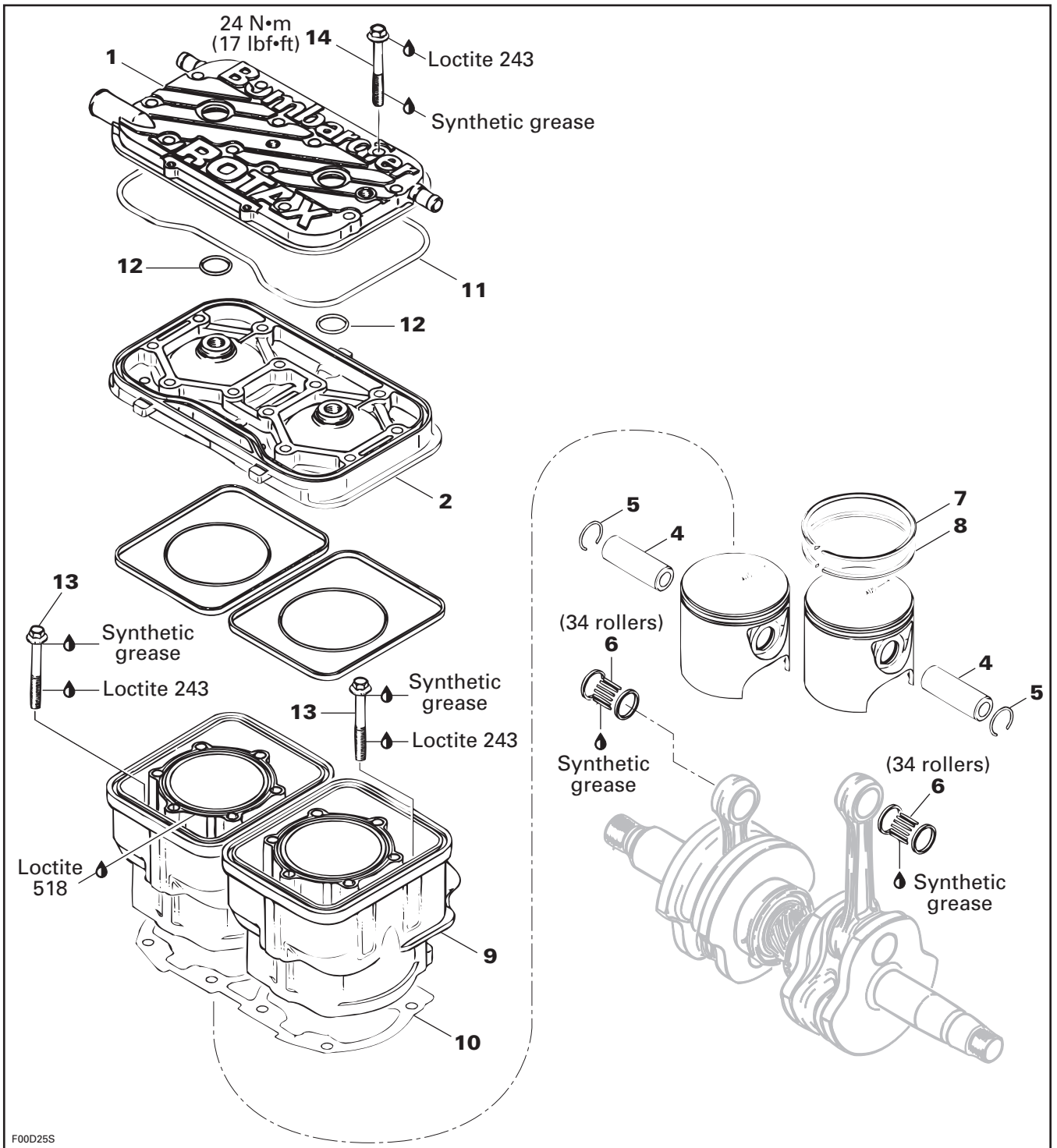
Cover

Before installation, properly install O-ring **no. 31** in engine magneto cover **no. 1**.

Apply Loctite 767 anti-seize compound on screws **no. 11**. Torque screws in a criss-cross sequence to 9 N•m (80 lbf•in).

TOP END

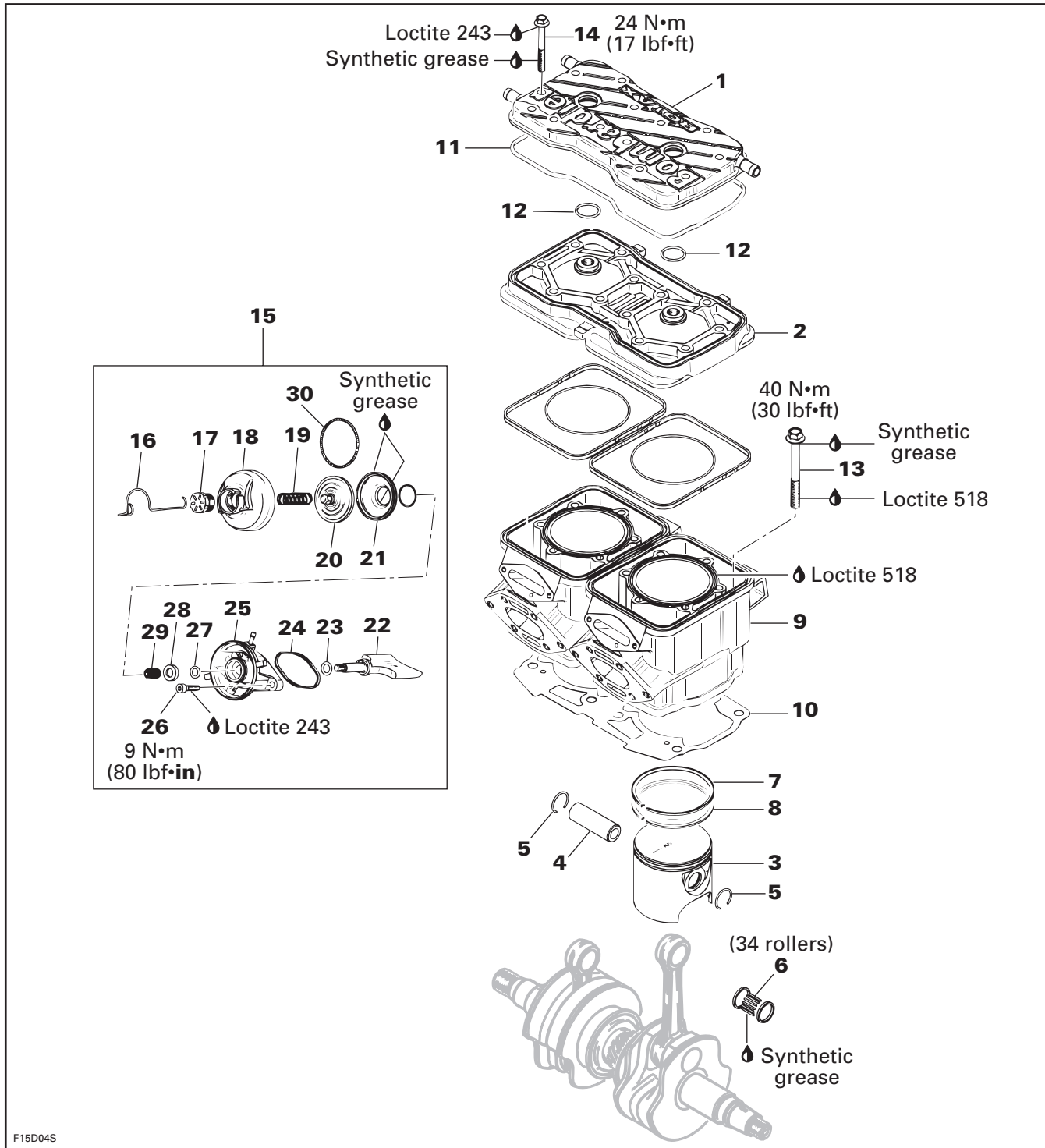
717 Engine



Section 04 ENGINE

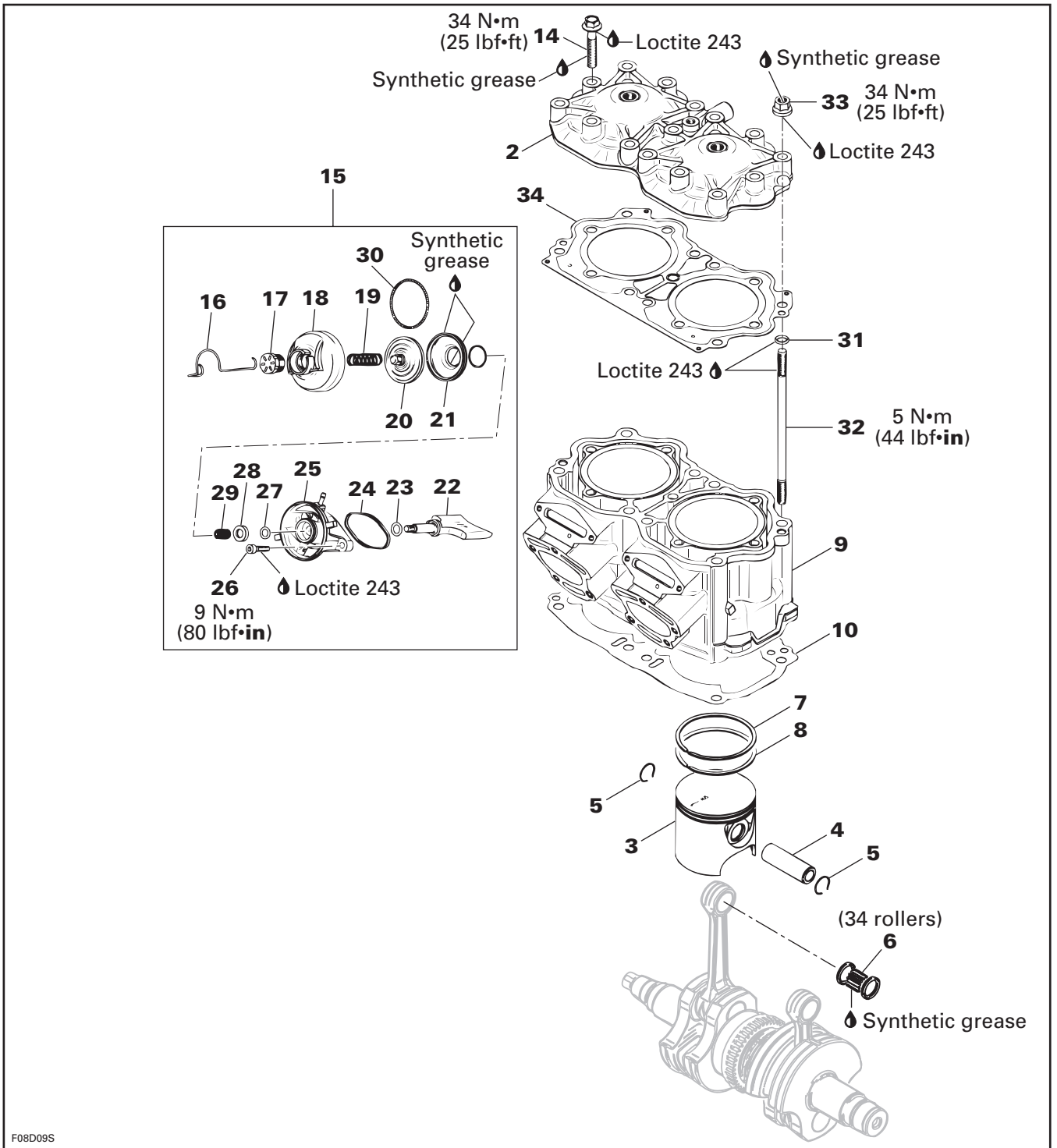
Subsection 05 (TOP END)

787 RFI Engines



F15D04S

947 Engine



F08D09S

Section 04 ENGINE

Subsection 05 (TOP END)

GENERAL

The 2-stroke ROTAX engine rotates counterclockwise seen from the rear (PTO flywheel).

The 717 and 787 RFI engines have a rotary valve to control opening and closing of the intake. The 947 engine uses reed valves in the crankcase.

The 787 RFI and 947 engines are also equipped with the RAVE system (Rotax Adjustable Variable Exhaust).

CAUTION: No engine components can be interchanged between engines.

787 RFI and 947 Engines

These engines are canted at a 30 degree angle (they are not canted on the same side), lowering the center of gravity of the watercraft. Cylinder exhaust ports are located on the same side of the intake, allowing a high volume tuned pipe design.

RAVE System (Rotax Adjustable Variable Exhaust)

BASIC OPERATION

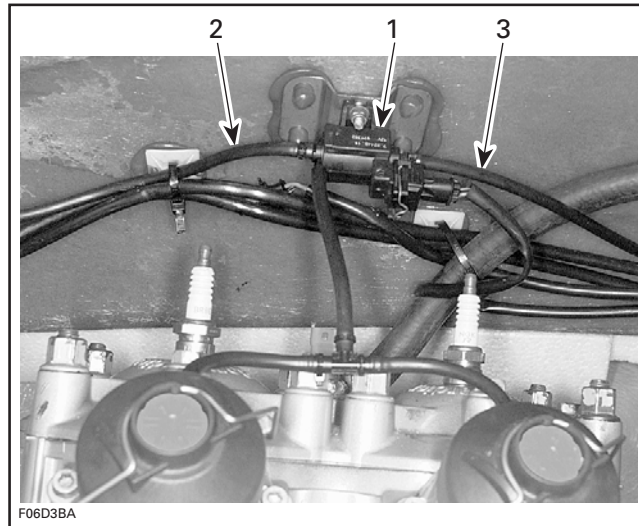
The RAVE system automatically changes the exhaust port height based on pressure in the exhaust system. On 787 RFI and 947 engines, the exhaust port height is controlled by the MPEM according to the engine RPM.

On top of the RAVE, there is a red plastic adjustment knob. Turning the adjustment in or out changes the preload on the return spring which, in turn, will change the RPM at which the RAVE valve opens and closes.

787 RFI and 947 Engines

On these engines, the RAVE valves are controlled by the Multi-Purpose Electronic Module (MPEM).

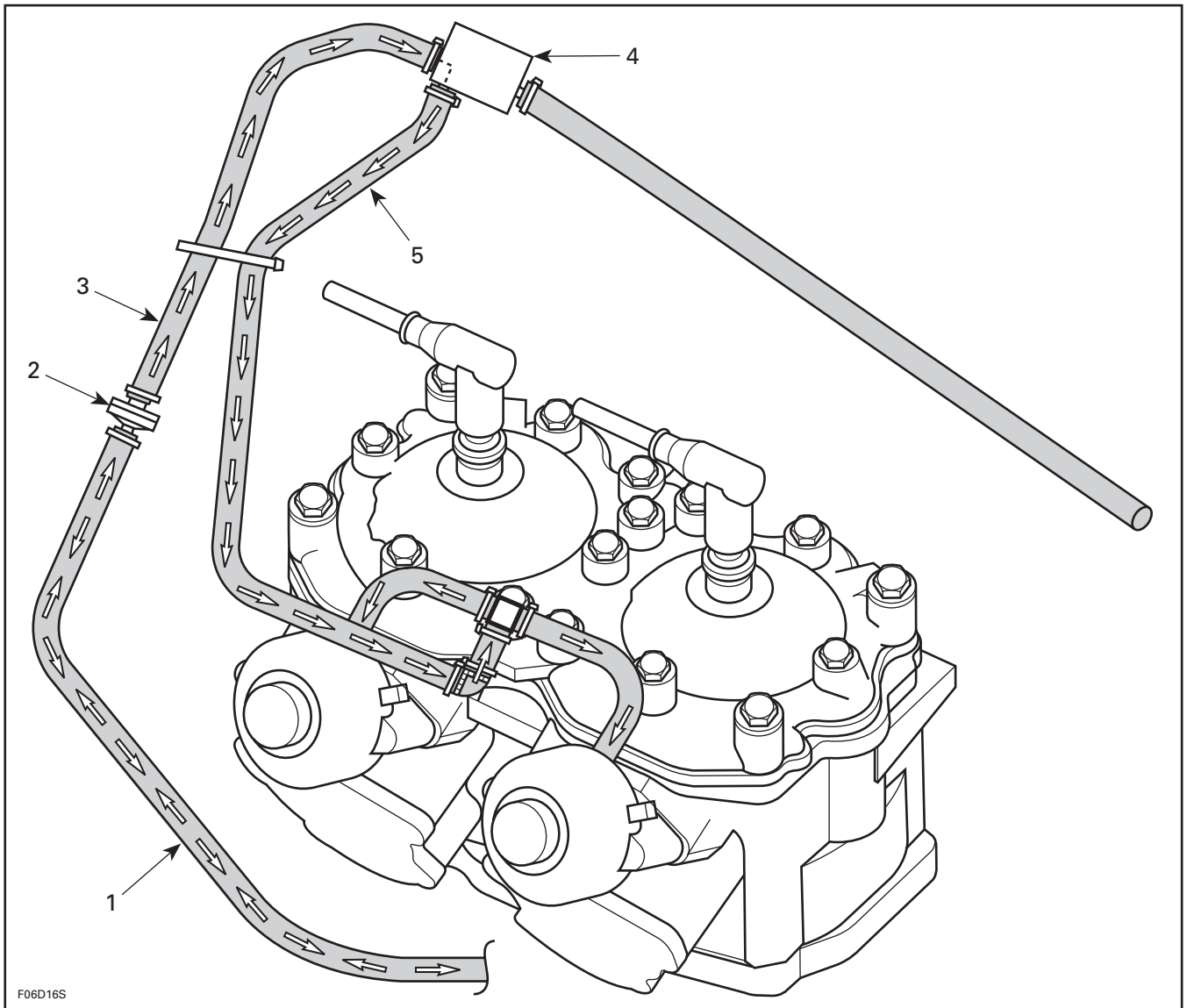
To open the RAVE valves, the MPEM activates a solenoid which directs the positive pressure from engine crankcase to the valves.



1. Solenoid
2. Pressure hose from crankcase
3. To atmospheric pressure

NOTE: A check valve on the pressure line eliminates the negative pressure from the crankcase.

To close the RAVE valves, the MPEM deactivates the solenoid which blocks the crankcase positive pressure. The RAVE valves are opened to the atmosphere.



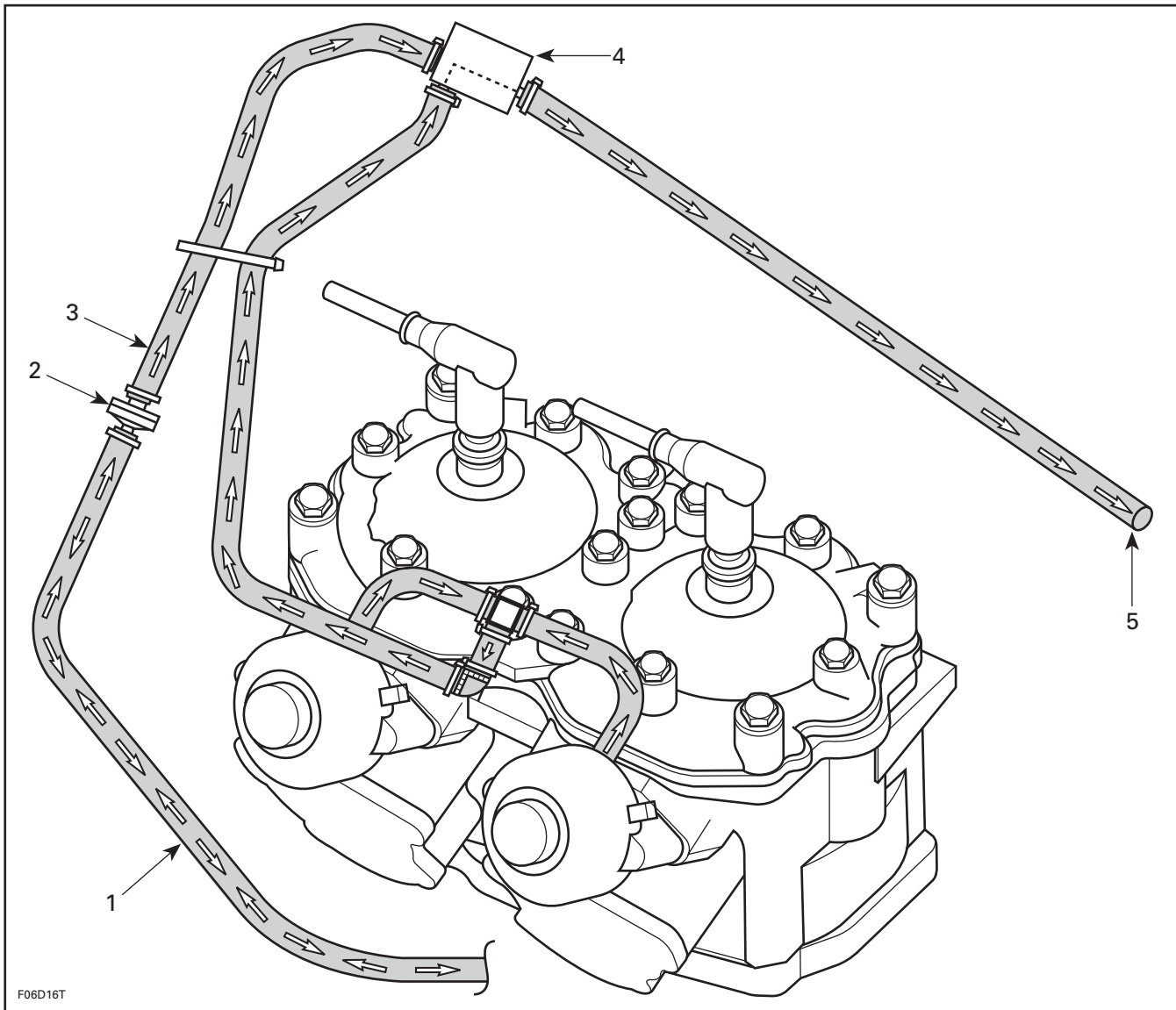
F06D16S

RAVE VALVES OPENED

1. Pulse from crankcase
2. Check valve
3. Positive pressure to solenoid
4. Solenoid activated
5. Positive crankcase pressure to RAVE valves

Section 04 ENGINE

Subsection 05 (TOP END)



RAVE VALVES CLOSED

1. Pulse from crankcase
2. Check valve
3. Positive pressure blocked by the solenoid
4. Solenoid deactivated
5. RAVE valves are opened to atmosphere

MAINTENANCE

There are no wear parts anywhere in the system and there are no adjustments to be periodically checked. The only possible maintenance required would be cleaning of carbon deposits from the guillotine slide. Cleaning intervals would depend upon the user's riding style and the quality of the oil used. Using FORMULA XP-S synthetic injection oil, we would suggest annual cleaning of the valve. If a customer uses a lower quality oil, more frequent cleaning may be required.

No special solvents or cleaners are required when cleaning the valve.

BORING PRECAUTION

In its stock configuration the RAVE valve guillotine has a minimum of 0.5 mm (.020 in) clearance to the cylinder bore measured at the center line of the cylinder. This is the minimum production clearance.

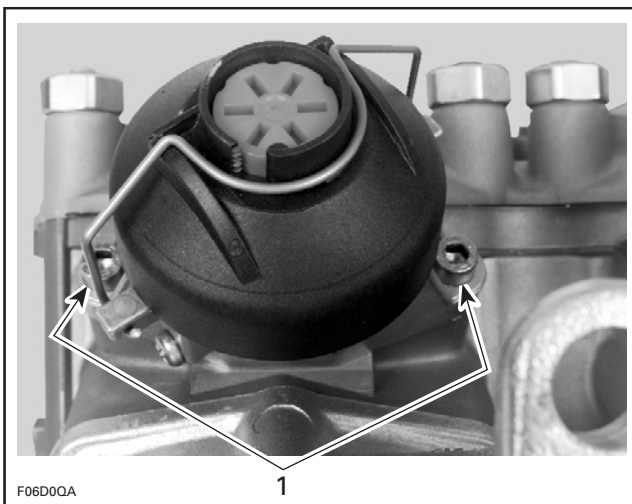
There is only a first oversize piston available for the 787 RFI and 947 engines. That piston is 0.25 mm (.010 in) larger in diameter than the stock piston. When the oversize is installed, the guillotine will have a minimum clearance of 0.375 mm (.015 in) with the cylinder bore. This is the minimum operating clearance the guillotine should be used with. Clearance less than 0.375 mm (.015 in) will require reworking of the guillotine to achieve the proper clearance and radius.

DISASSEMBLY

RAVE Valve

787 RFI and 947 Engines

Loosen Allen screws no. 26 each side of RAVE valve.



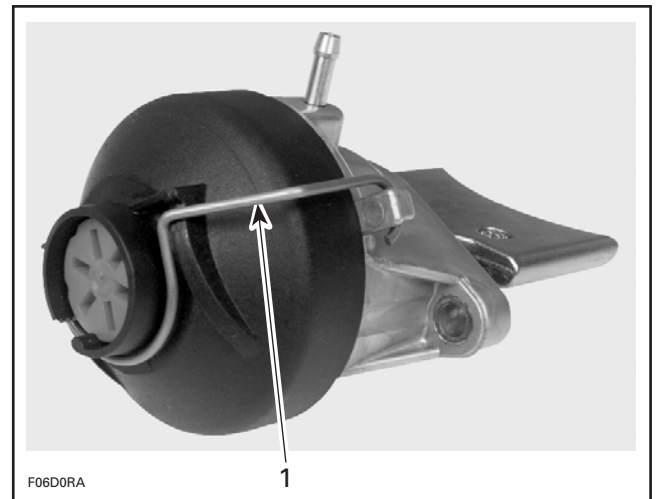
1. Remove screws

Remove RAVE valve no. 15.

Remove the cover no. 18 of the valve by releasing the spring no. 16.

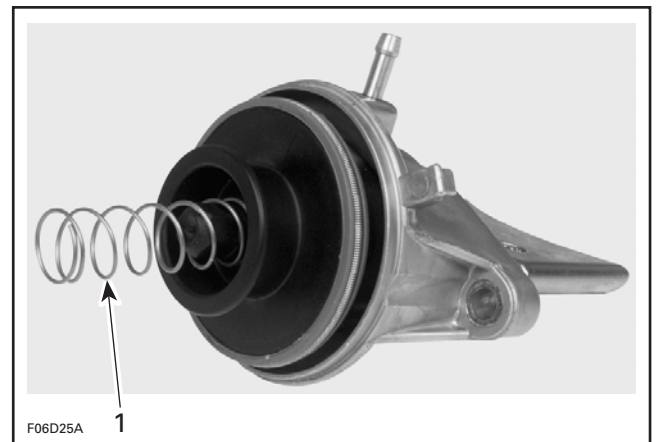
WARNING

Firmly hold cover to valve base. The compression spring inside the valve is applying pressure against the cover.



1. Spring

Remove the compression spring no. 19.

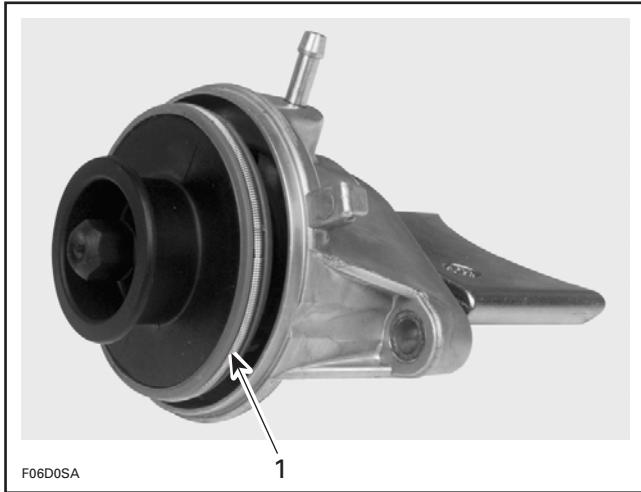


1. Remove spring

Section 04 ENGINE

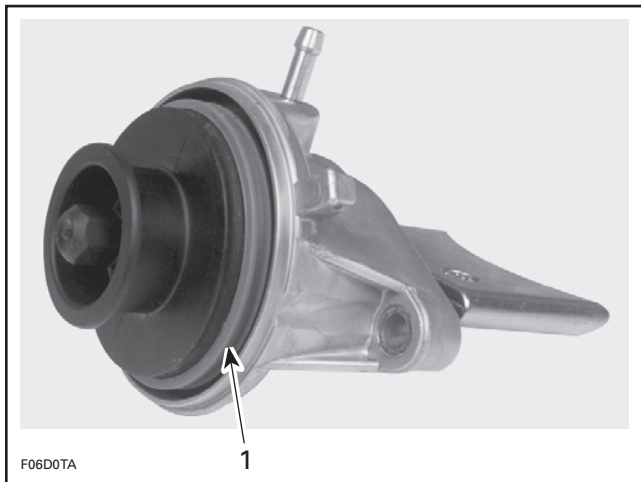
Subsection 05 (TOP END)

Remove spring no. 30 retaining bellows no. 21 to valve piston no. 20.



1. Spring

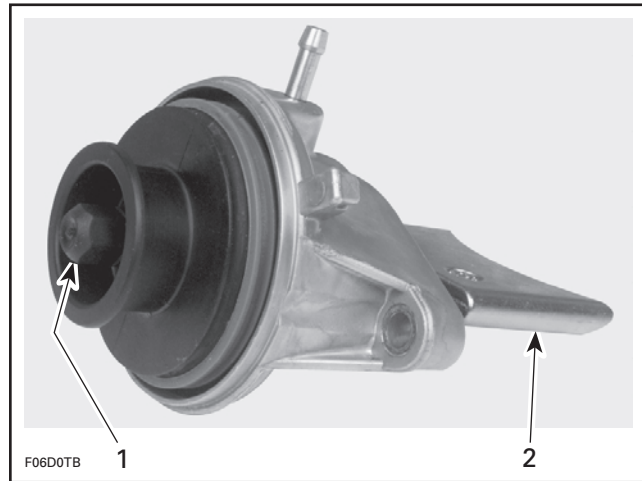
Free bellows no. 21 from valve piston no. 20.



1. Bellows removed from piston

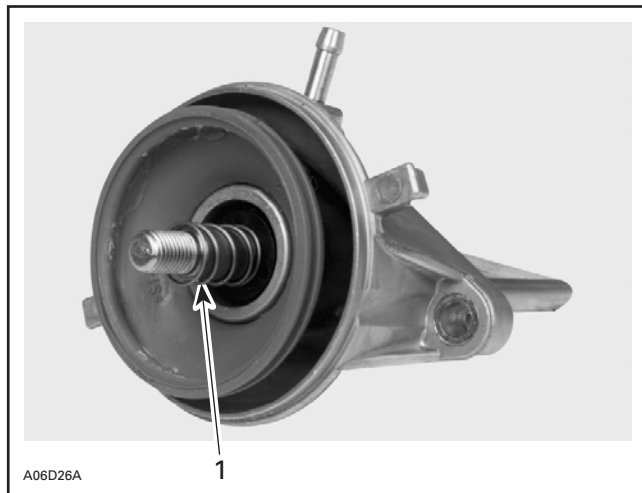
Unscrew valve piston no. 20 from sliding valve no. 22.

NOTE: Hold the sliding valve to prevent it from turning.



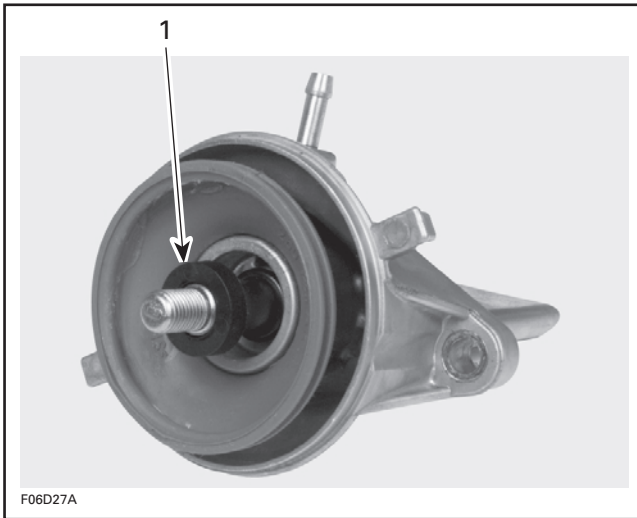
1. Unscrew piston
2. Hold sliding valve

Remove compression spring no. 29.



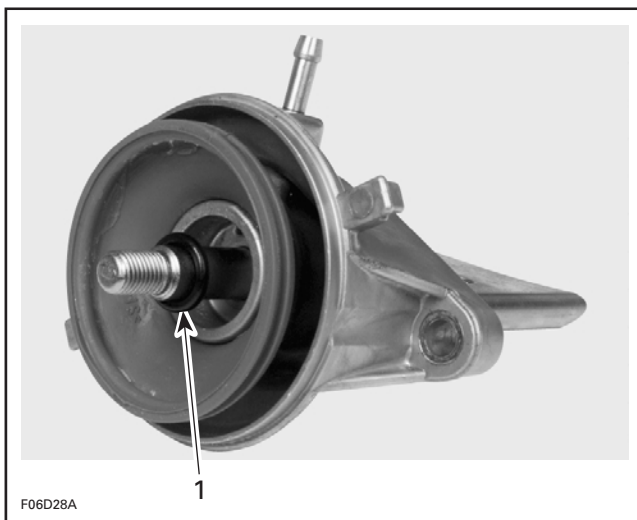
1. Remove spring

Remove supporting ring no. 28.



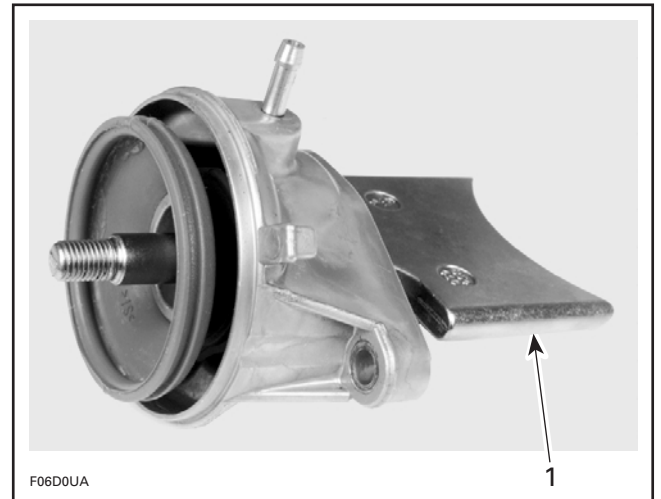
1. Remove supporting ring

Remove O-ring no. 23.



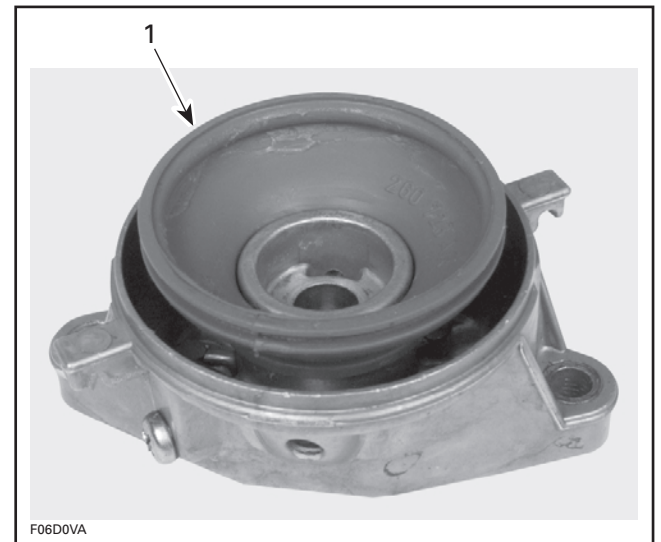
1. Remove O-ring

Remove sliding valve no. 22.



1. Remove sliding valve

Remove bellows no. 21.



1. Remove bellows

Section 04 ENGINE

Subsection 05 (TOP END)

Cylinder Head Cover and Cylinder Head

Disconnect temperature sensor wire and spark plug cables.

Connect spark plug cables on grounding device.

717 Engine

Remove air intake silencer and support, refer to AIR INTAKE.

717 and 787 RFI Engines

Remove screws no. 14.

Remove cylinder head cover no. 1.

If shells, sand, salt or any other particles are present in cylinder head, clean with a vacuum cleaner.

Remove cylinder head no. 2.

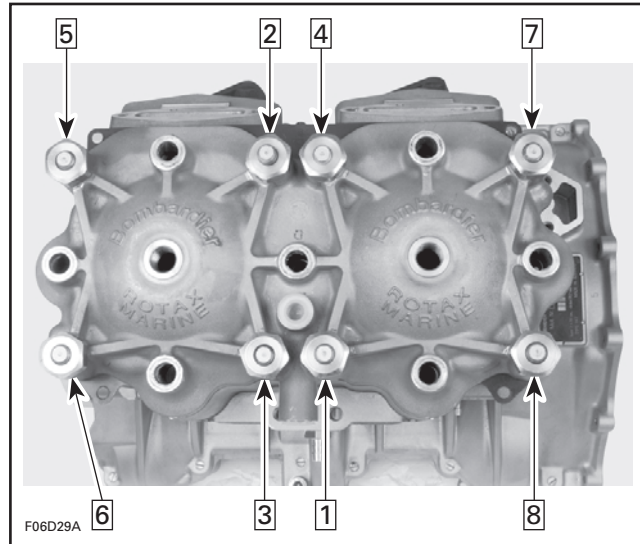
If shells, sand, salt water or any other particles are present in cylinder cooling jacket, clean with a vacuum cleaner.

947 Engine

Disconnect hose of RAVE valves.

Loosen cylinder head bolts no. 14 following the sequence shown in the next photo.

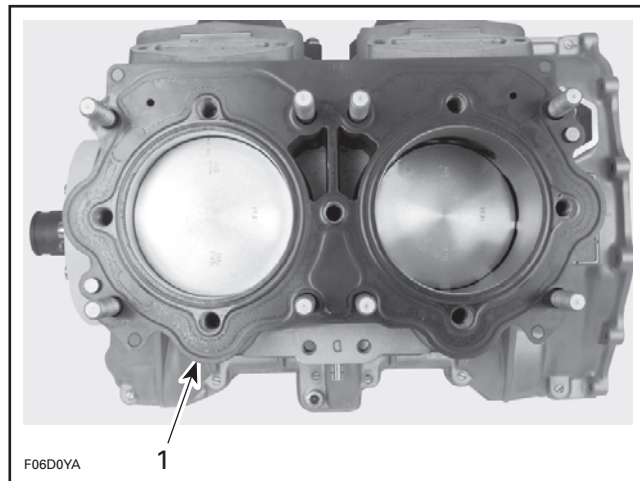
Loosen nuts no. 33 following the sequence shown in the next photo.



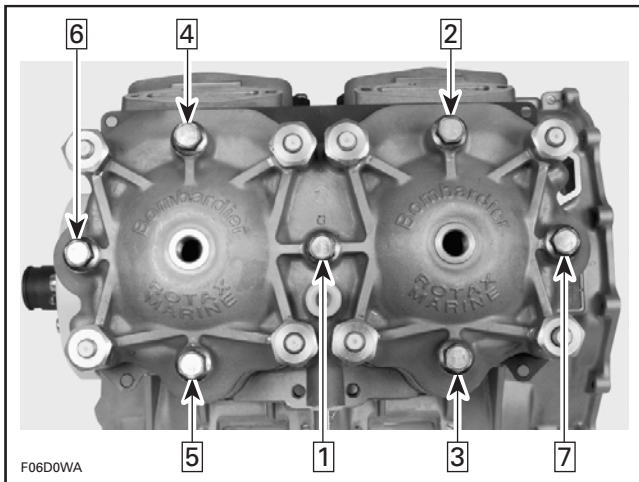
UNTORQUING SEQUENCE FOR THE NUTS

Remove cylinder head no. 2.

Remove cylinder head gasket no. 34.



1. Remove gasket



UNTORQUING SEQUENCE FOR THE CYLINDER HEAD BOLTS

Cylinder

787 RFI Engine

Remove air intake silencer and support, refer to AIR INTAKE.

717 and 787 RFI Engines

Remove tuned pipe and exhaust manifold, refer to EXHAUST SYSTEM.

Remove screws no. 13.

Remove cylinders no. 9, being careful that connecting rods do not hit crankcase edge.

WARNING

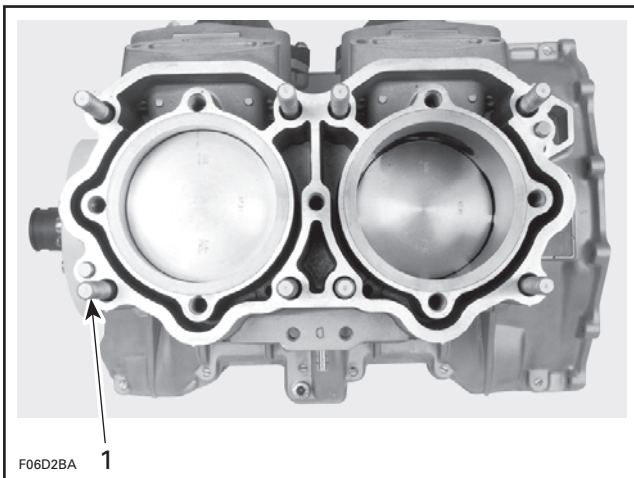
If screws need to be heated for removal when engine is in watercraft, fuel system pressurization must be done first. Do not use open flame; use a heat gun.

NOTE: Even if only 1 cylinder needs repair, both cylinders should be lifted to allow 1-piece cylinder base gasket replacement.

947 Engine

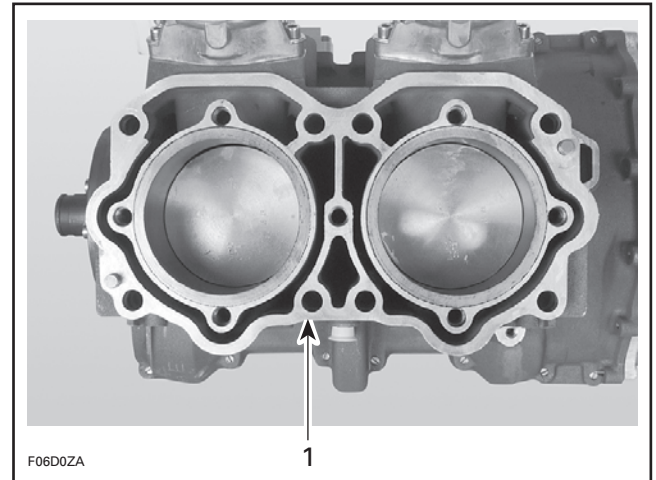
Remove studs no. 32. Take two head cover nuts. Screw nuts onto stud. Lock both nuts together and unscrew the stud. Repeat this operation for the other studs.

NOTE: Studs must be removed prior cylinder block.



1. Remove studs

Remove cylinder block no. 9.



1. Remove cylinder block

NOTE: To ease removal, a plastic tip hammer can be used.

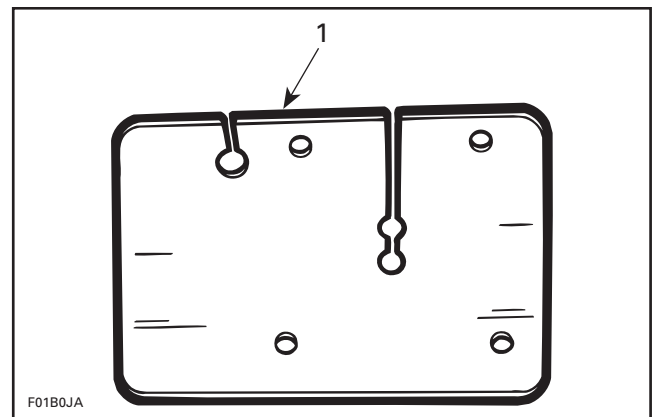
Remove cylinder base gasket no. 10.

Piston

NOTE: All engines feature cageless piston pin bearings.

717 and 787 RFI Engines

Bring piston to Top Dead Center and install rubber pad (P/N 295 000 101) over crankcase opening. Secure with screws. Lower piston until it sits on pad.

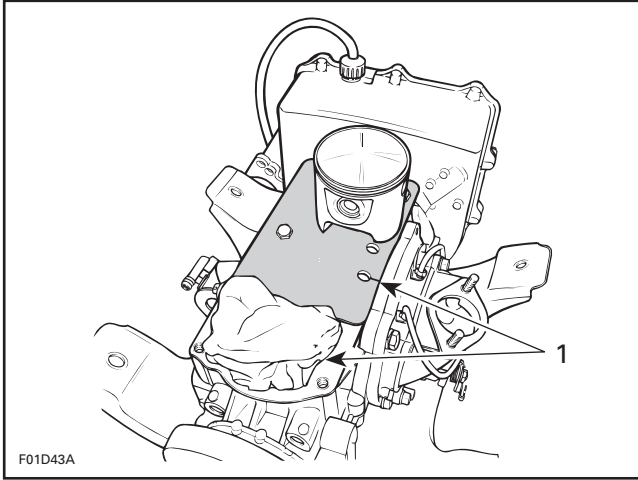


1. Rubber pad (P/N 295 000 101)

Section 04 ENGINE

Subsection 05 (TOP END)

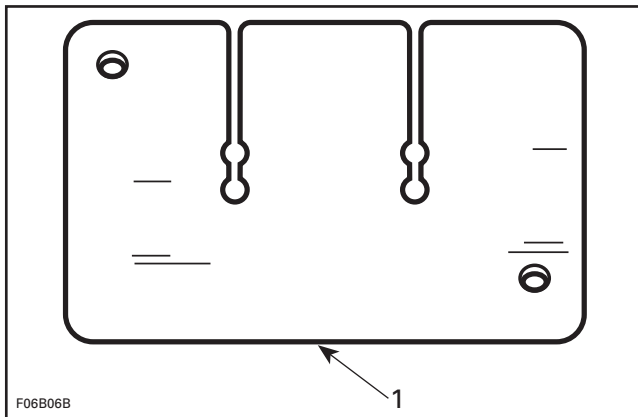
If the other cylinder has been removed, completely cover its opening with a clean rag.



1. Openings covered with rag and rubber pad

947 Engine

Install rubber pad (P/N 290 877 032) to crankcase. Secure with screws. Lower piston to be removed until it sits on pad.



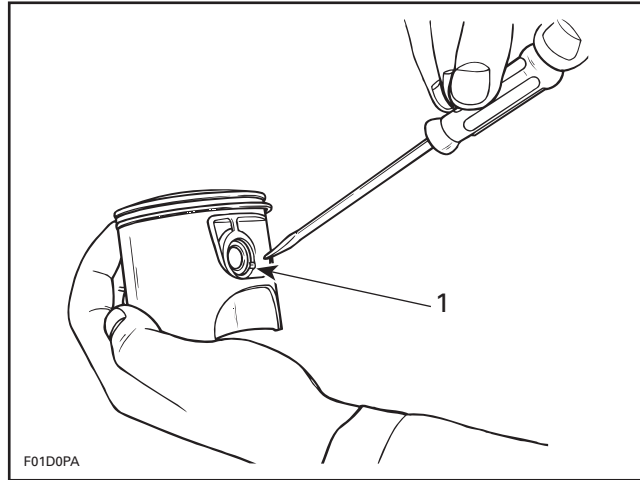
1. Rubber pad (P/N 290 877 032)

All Engines

To remove circlip no. 5, insert a pointed tool in piston notch then pry it out and discard.

⚠ WARNING

Always wear safety glasses when removing piston circlips.

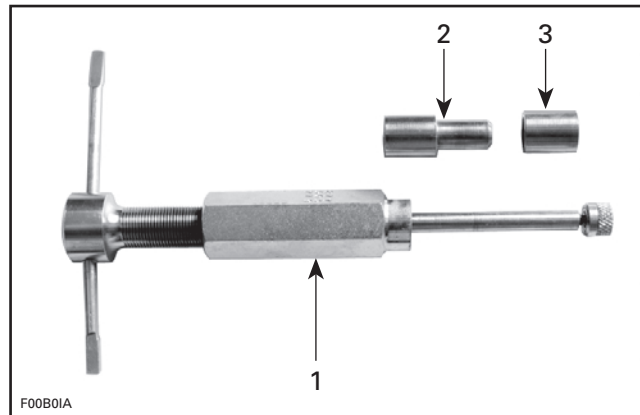


TYPICAL

1. Piston notch

To extract piston pin no. 4, use piston pin puller (P/N 529 035 503) with the appropriate set of sleeves.

ENGINE	SLEEVE SET
717/787 RFI	P/N 529 035 542
947	P/N 529 035 543

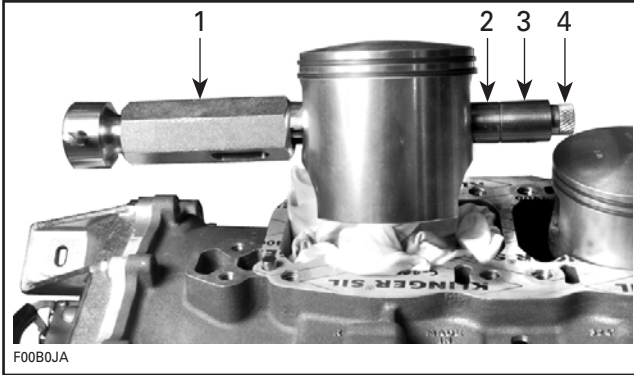


1. Puller
2. Shoulder sleeve
3. Sleeve

- Fully thread on puller handle.
- Insert extractor spindle into the piston pin.
- Slide the sleeve and shoulder sleeve onto the spindle.

Section 04 ENGINE
Subsection 05 (TOP END)

- Screw in extracting nut with the movable extracting ring towards spindle.



1. Puller
2. Sleeve
3. Shoulder sleeve
4. Extracting nut

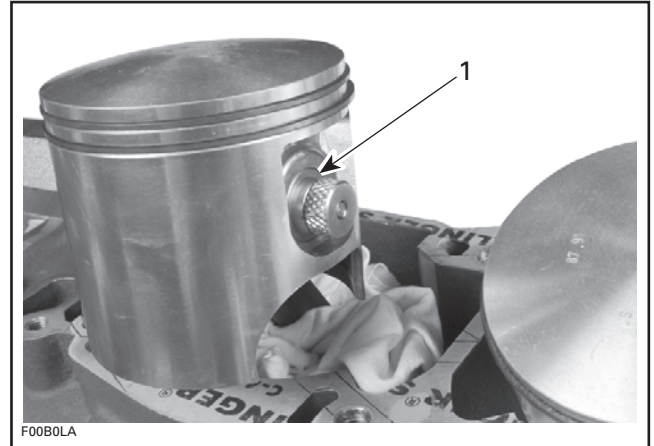
NOTE: The tool cutout must be positioned toward the bottom of the piston.



1. Tool cutout toward bottom of piston

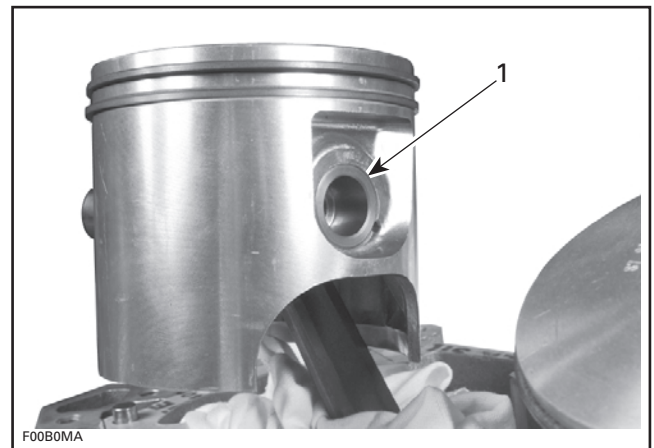
- Firmly hold puller and rotate handle to pull piston pin no. 4.

- Rotate spindle until the shoulder sleeve is flushed with the piston recess.



1. Shoulder sleeve flush with piston recess

- Loosen the extracting nut and remove puller.
- Remove the shoulder sleeve from piston.



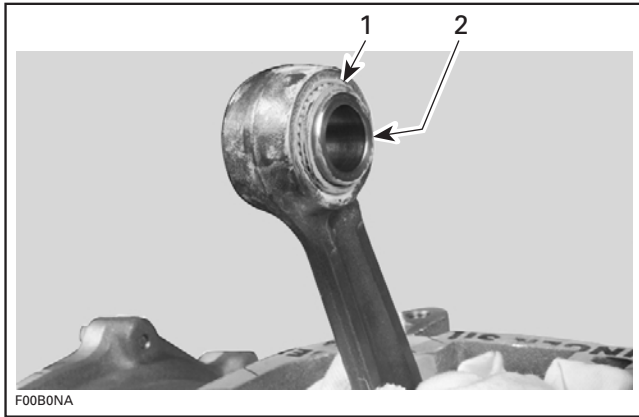
1. Remove shoulder sleeve

- Carefully remove the piston no. 3.

Section 04 ENGINE

Subsection 05 (TOP END)

- The needles, thrust washers and the sleeve remain in the connecting rod bore and may be used again.



1. Needles and thrust washer
2. Sleeve

CLEANING

Discard all gaskets and O-rings.

Clean all metal components in a solvent.

Clean water passages and make sure they are not clogged.

Remove carbon deposits from cylinder exhaust port, RAVE valve (787 RFI and 947 engines), cylinder head and piston dome.

Clean piston ring grooves with a groove cleaner tool, or a piece of broken ring.

INSPECTION

Visually inspect all parts for corrosion damage.

Inspect piston for damage. Light scratches can be sanded with a fine sand paper.

NOTE: When repairing a seized engine, connecting rods should be checked for straightness and crankshaft for deflection/misalignment. Refer to BOTTOM END for procedures.

Inspect plane surfaces for warpage. Small deformation can be corrected by grinding surface with a fine sand paper. Install sand paper on a surface plate and rub part against oiled sand paper.

The inspection of engine top end should include the following measurements.

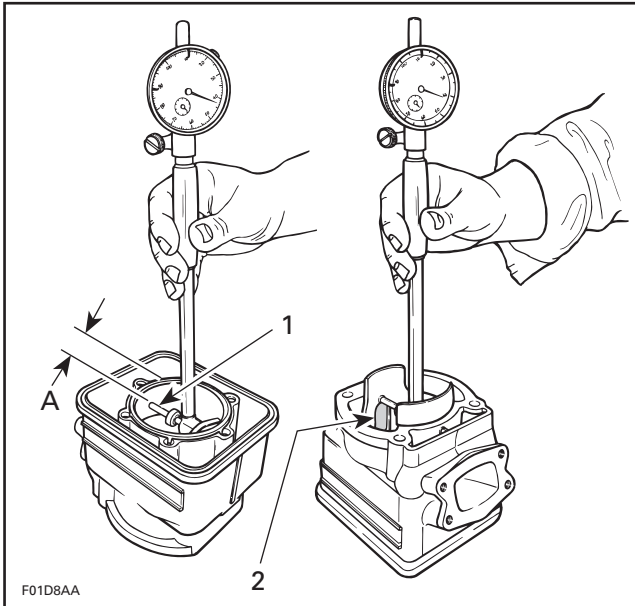
ENGINE MEASUREMENT	TOLERANCES		
	NEW PARTS (MIN.) (MAX.)	WEAR LIMIT	
Cylinder taper	N.A.	0.05 mm (.002 in)	0.1 mm (.004 in)
Cylinder out of round	N.A.	0.008 mm (.0003 in)	0.08 mm (.003 in)
Piston/cylinder wall clearance for the 717 engine	0.10 mm (.0039 in)	N.A.	0.20 mm (.008 in)
Piston/cylinder wall clearance for the 787 RFI engine	0.13 mm (.005 in)	N.A.	0.22 mm (.009 in)
piston/cylinder wall clearance for the 947 engine	0.09 mm (.0035 in)	N.A.	0.20 mm (.008 in)
Ring/piston groove clearance for the 717 engine	0.025 mm (.001 in)	0.07 mm (.003 in)	0.20 mm (.008 in)
Ring/piston groove clearance for the 787 RFI engine	0.025 mm (.001 in)	0.07 mm (.003 in)	0.24 mm (.009 in)
Ring/piston groove clearance for the 947 engine	0.048 mm (.002 in)	0.075 mm (.003 in)	0.20 mm (.008 in)
Ring end gap for the 717 engine	0.25 mm (.001 in)	0.40 mm (.016 in)	1.0 mm (.039 in)
Ring end gap for the 787 RFI engine	0.40 mm (.016 in)	0.55 mm (.022 in)	1.0 mm (.039 in)
Ring end gap for the 947 engine	0.45 mm (.018 in)	0.60 mm (.024 in)	1.0 mm (.039 in)

N.A.: Not Applicable

NOTE: Replacement cylinder sleeves are available if necessary. Also, oversize pistons of 0.25 mm (.010 in) are available for all engines and oversize pistons of 0.5 mm (.020 in) are available for the 717 engine.

Cylinder Taper

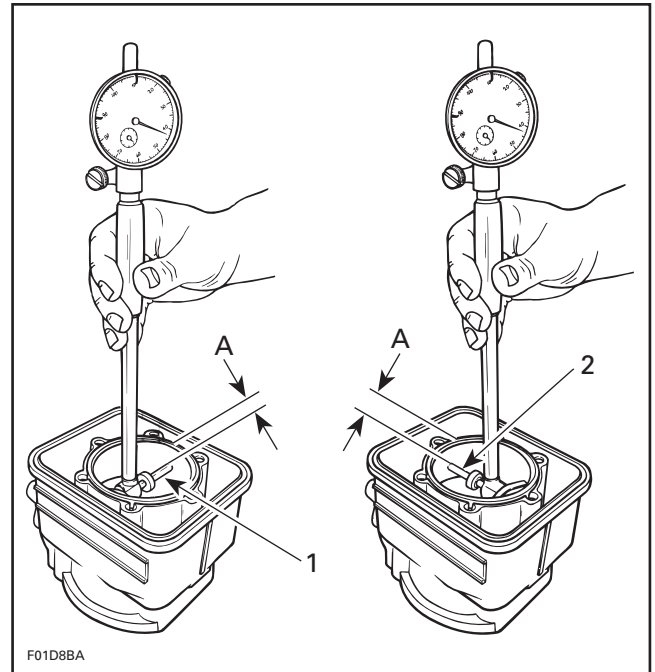
Using a cylinder bore gauge, measure cylinder diameter at 16 mm (5/8 in) from top of cylinder just below auxiliary transfer port, facing exhaust port. If the difference between readings exceed specification, cylinder should be rebored and honed or replaced.



1. Measuring perpendicularly (90°) to piston pin axis
2. Auxiliary transfer port
- A. 16 mm (5/8 in)

Cylinder Out of Round

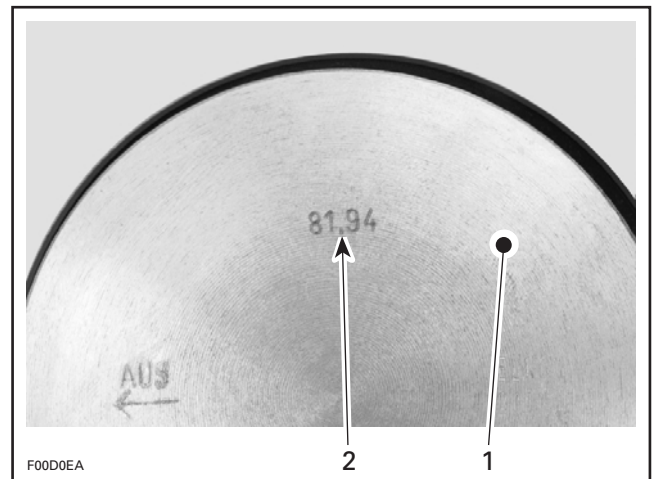
Using a cylinder bore gauge, measure cylinder diameter at 16 mm (5/8 in) from top of cylinder. Measure diameter in piston pin axis direction then perpendicularly (90°) to it. If the difference between readings exceed specification, cylinder should be rebored and honed or replaced.



1. Measuring in piston pin axis
2. Measuring perpendicularly (90°) to piston pin axis
- A. 16 mm (5/8 in)

Piston/Cylinder Wall Clearance

To determine the piston dimension, take the measurement on the piston dome.

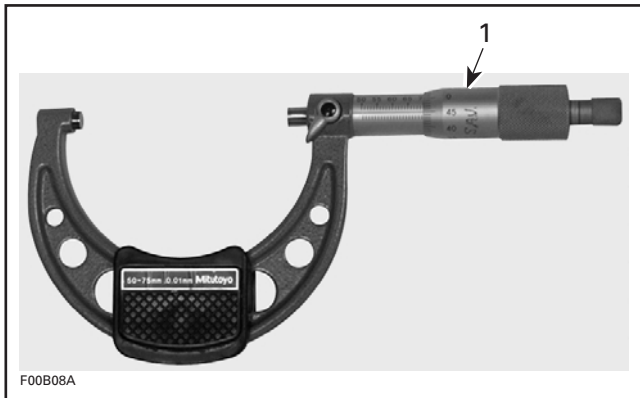


1. Piston dome
2. Piston measurement

Section 04 ENGINE

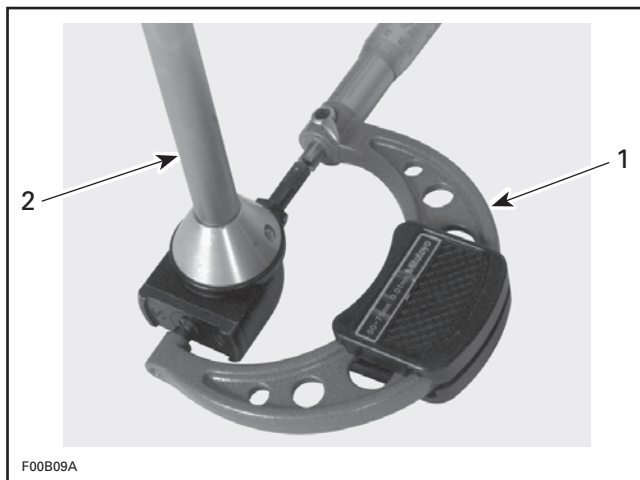
Subsection 05 (TOP END)

Adjust and lock a micrometer to the specified value on the piston dome.



1. Micrometer set to the piston dimension

With the micrometer set to the piston dimension, adjust a cylinder bore gauge to the micrometer dimension and set the indicator to zero.

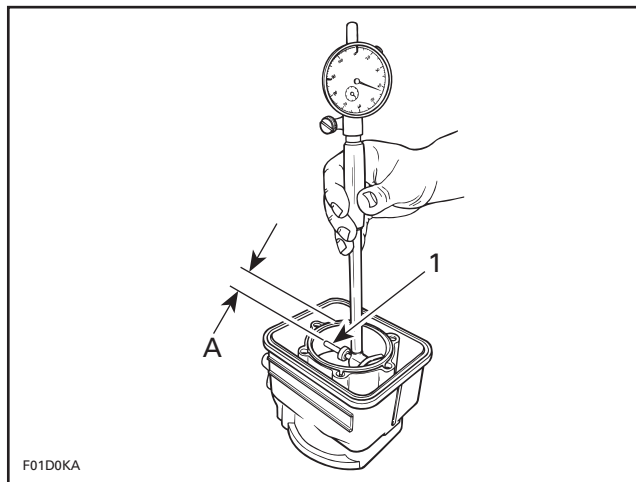


1. Use the micrometer to set the cylinder bore gauge
2. Dial bore gauge



1. Indicator set to zero

Position the dial bore gauge at 16 mm (5/8 in) below cylinder top edge.



1. Measuring perpendicularly (90°) to piston pin axis
A. 16 mm (5/8 in)

Read the measurement on the cylinder bore gauge. The result is the exact piston/cylinder wall clearance.

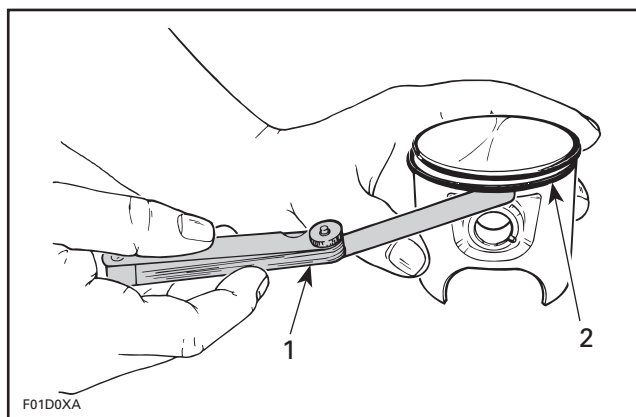
NOTE: Make sure the cylinder bore gauge indicator is set exactly at the same position as with the micrometer, otherwise the reading will be false.

Ring/Piston Groove Clearance

717 and 787 RFI Engines

Using a feeler gauge, check clearance between rectangular ring and groove. If clearance exceeds specified tolerance, replace piston.

NOTE: Ring/piston groove clearance can be correctly measured only on rectangular ring which is bottom ring.



1. Feeler gauge
2. Rectangular ring (bottom)

947 Engine

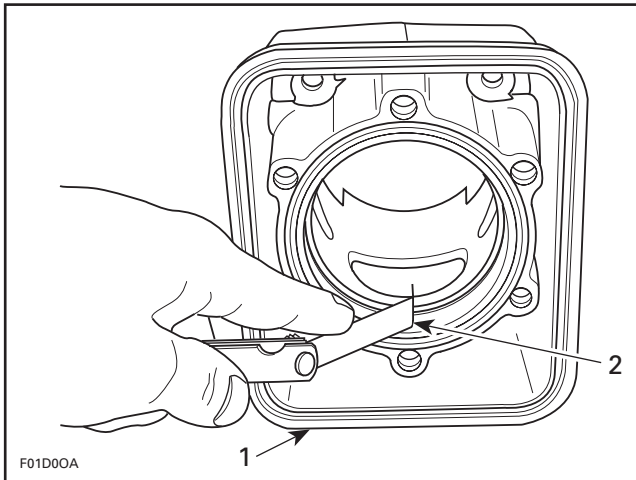
Due to the semi-trapez rings, it is not possible to accurately measure ring/piston groove clearance.

Ring End Gap

Position ring halfway between exhaust port and top of cylinder.

NOTE: In order to correctly position ring in cylinder, use piston as a pusher.

Using a feeler gauge, check ring end gap. If gap exceeds specified tolerance, rings should be replaced.

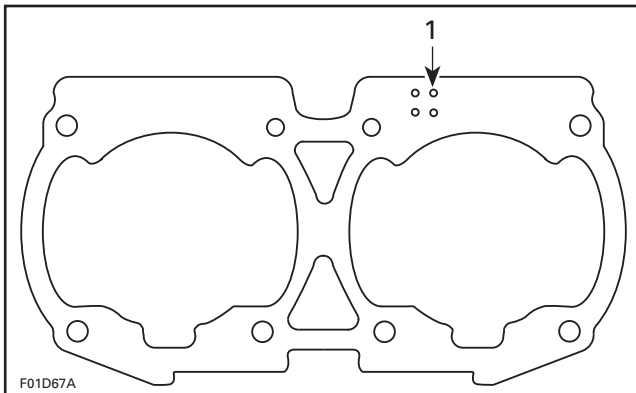


1. Top of cylinder
 2. Ring end gap

Cylinder Base Gasket

Different thicknesses of cylinder base gaskets are used for a precise adjustment of the combustion chamber volume.

To identify gasket thickness, refer to the identification holes on the gasket.



TYPICAL

1. Identification holes

All Engines

GASKET THICKNESS	IDENTIFICATION HOLES
0.3 mm (.012 in)	3
0.4 mm (.016 in)	4
0.5 mm (.020 in)	5
0.6 mm (.024 in)	6
0.8 mm (.031 in)	8

RAVE Valve

787 RFI and 947 Engines

Check RAVE valve bellows no. 21 for cracks.

ASSEMBLY

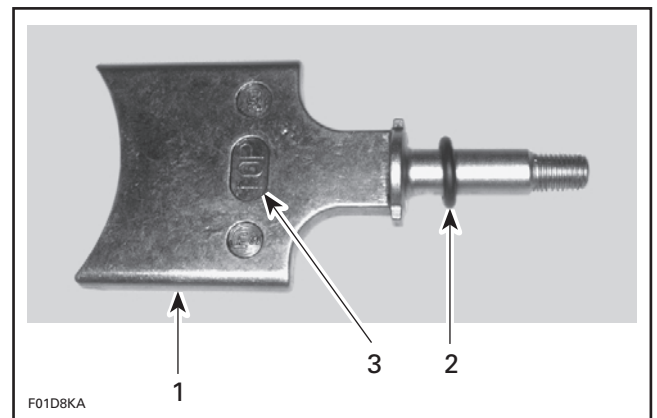
Assembly is essentially the reverse of disassembly procedures. However pay particular attention to the following.

RAVE Valve

787 RFI Engine

Make sure to insert O-ring no. 23 onto rod of sliding valve no. 22.

The TOP position of the sliding valve no. 22 is indicated on one side.



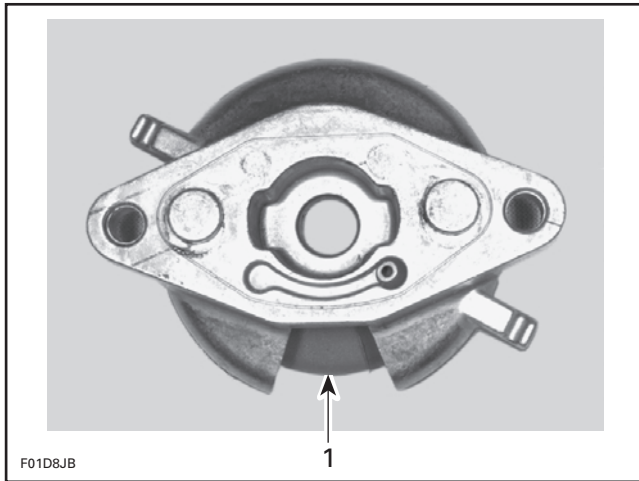
1. Sliding valve
 2. O-ring
 3. TOP

Section 04 ENGINE

Subsection 05 (TOP END)

Install a new gasket no. 24. It must be installed at the same time as the sliding valve no. 22.

Position the valve housing no. 25 onto the cylinder so that its opening is toward the bottom.



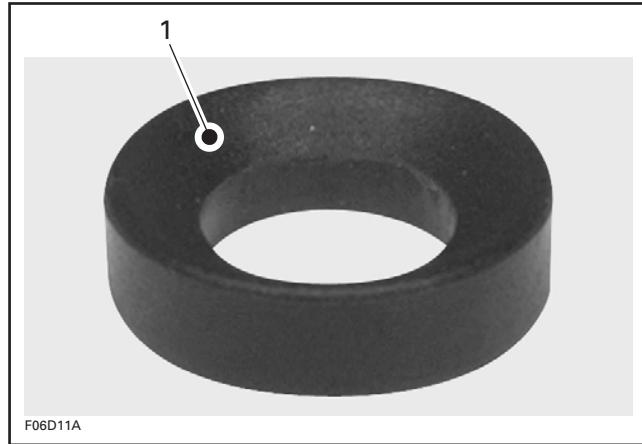
1. Bottom of valve housing

When the valve is mounted onto the cylinder, move the valve piston no. 20 to ensure the sliding valve no. 22 moves easily and doesn't stick.



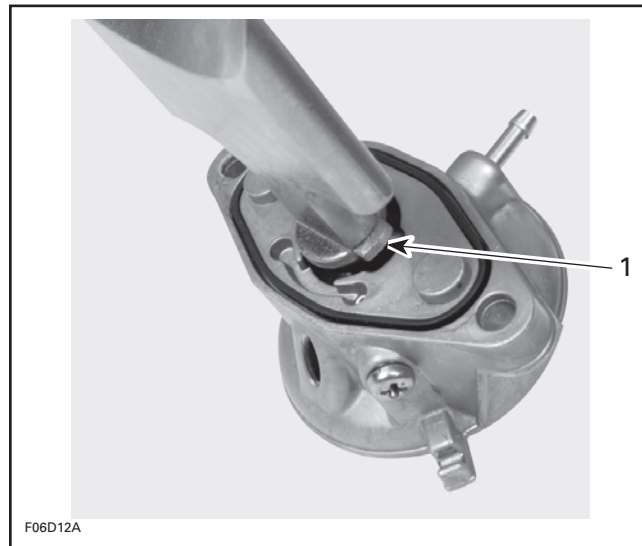
947 Engine

Install the supporting ring no. 28 with the bevel side facing the O-ring no. 27.



1. Bevel facing the O-ring

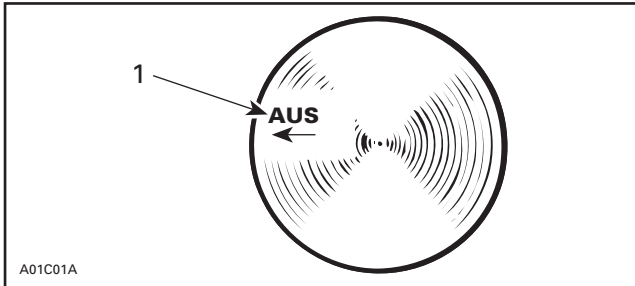
There is only one way to insert the sliding valve no. 22 in valve housing no. 25.



1. Sliding valve ridge toward housing groove

Piston

At assembly, place the pistons **no. 3** with the letters "AUS" (over an arrow on the piston dome) facing in direction of the exhaust port.



1. Exhaust side

NOTE: On the 787 RFI and 947 engines, the exhaust ports are located on the same side as the intake.

Carefully cover crankcase opening as for disassembly.

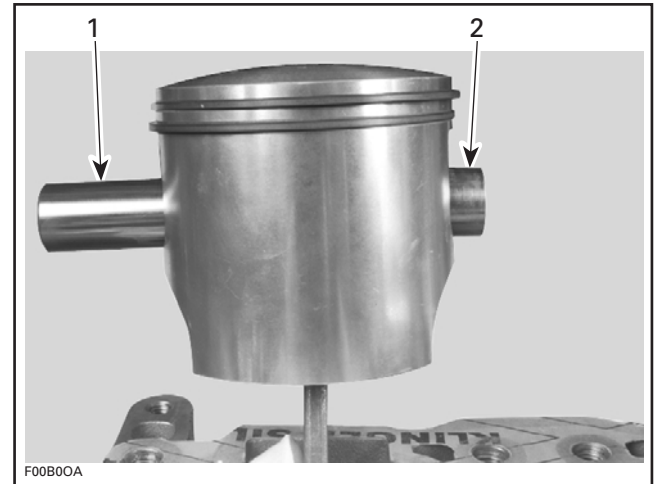
Piston Pin and Roller Bearing

To install roller bearing **no. 4** and piston pin **no. 6** use, piston pin puller (P/N 529 035 503) with the appropriate set of sleeves as for disassembly.

- Replacement bearings are held in place by a locating sleeve outside and 2 plastic cage halves inside.
- Push needle bearing together with inner halves out of the locating sleeve into the connecting rod bore.
- Replace the inner halves by the appropriate sleeve tool in the connecting rod bore.
- Insert piston pin into piston until it comes flush with inward edge of piston hub.
- Warm piston to approximately 50-60°C (122-140°F) and install it over connecting rod.

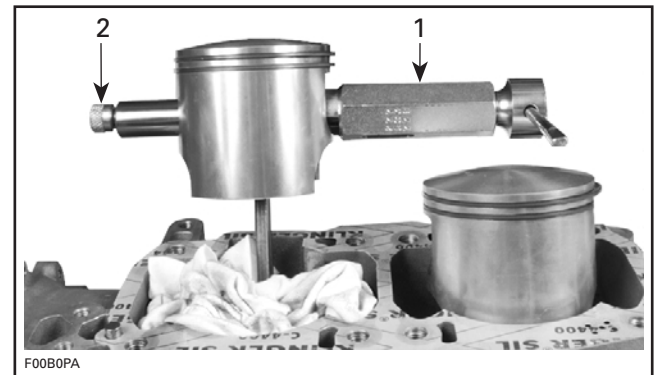
NOTE: Make sure thrust washers are present each side of needles.

- Install the shoulder sleeve tool on the opposite side of the piston pin.



1. Piston pin
 2. Shoulder sleeve

- Insert extractor spindle into the piston pin, screw on extracting nut.



1. Puller installed on the opposite side of the piston pin
 2. Tighten extracting nut

- Rotate handle to pull piston pin carefully into the piston.

Plastic Mounting Device Method

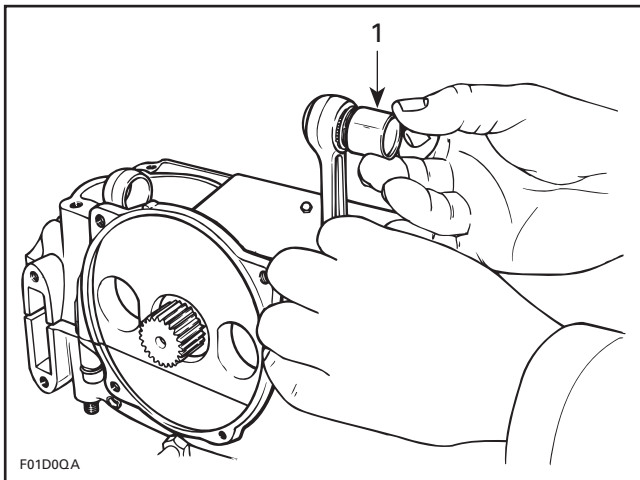
This is an alternate method when no service tool is available.

Replacement roller bearings are delivered in a convenient plastic mounting device. For installation, proceed as follows:

- Align replacement roller bearing with connecting rod bore.
- Carefully push inner plastic sleeve into connecting rod bore; outer plastic ring will release rollers.

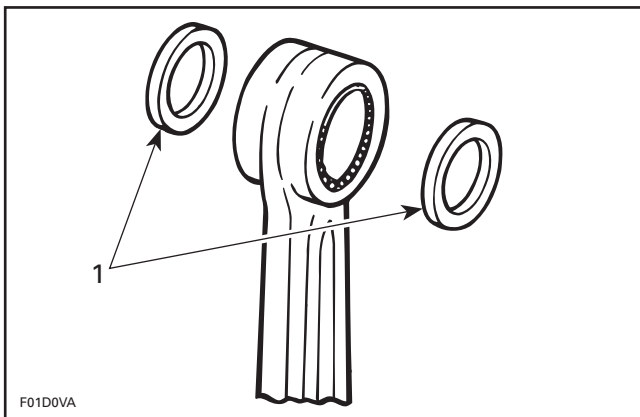
Section 04 ENGINE

Subsection 05 (TOP END)



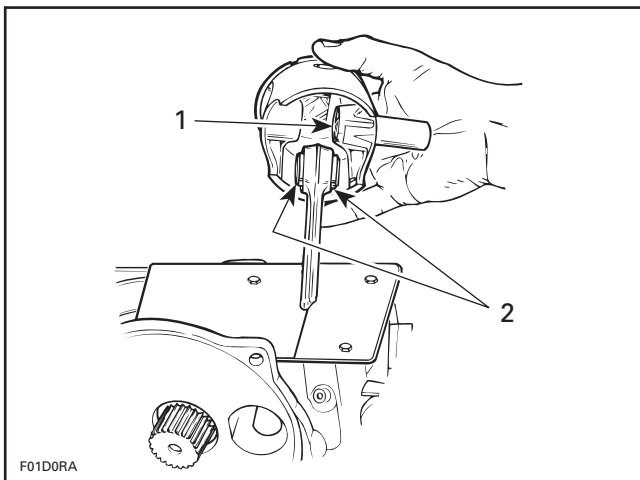
1. Outer ring removal after inner sleeve insertion into bore

- Make sure thrust washers are present each side of rollers.



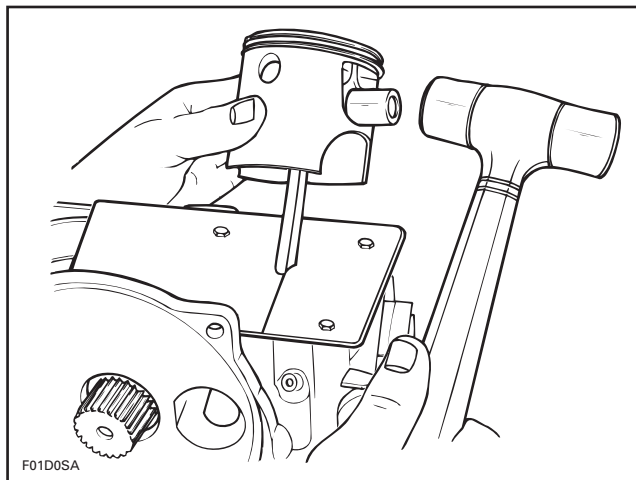
1. Thrust washer each side

- Insert piston pin into piston until it comes flush with inward edge of piston hub.

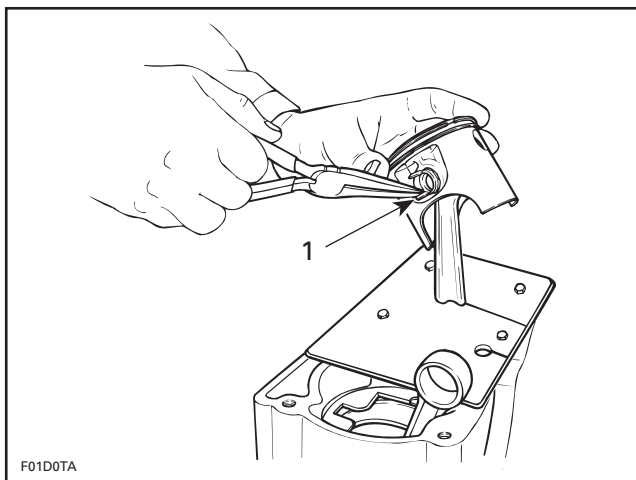


1. Piston pin flush here
2. Thrust washers

- Place piston over connecting rod and align bores, then gently tap piston pin with a fiber hammer to push out inner plastic ring on opposite side. Support piston from opposite side.



- As necessary, pull halves of inner sleeve with long nose pliers.



1. Pulling inner sleeve half

Circlip

Always use new circlips.

⚠ WARNING

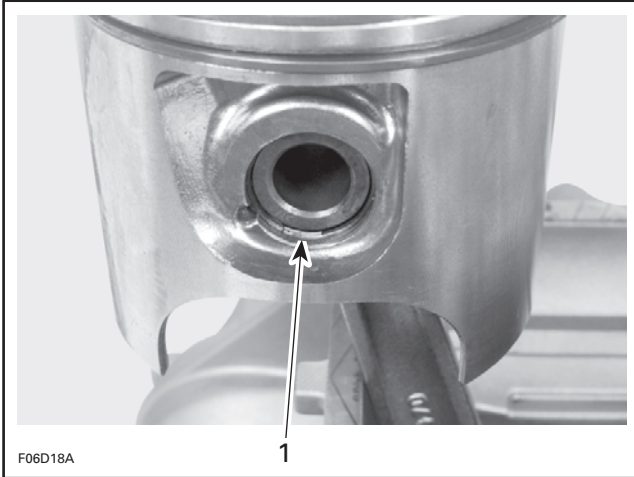
Always wear safety glasses when installing piston circlips.

CAUTION: Always use new circlips. At installation, take care not to deform them. Circlips must not move freely after installation.

717 and 787 RFI Engines

Secure circlip with its opening located at the bottom of the piston.

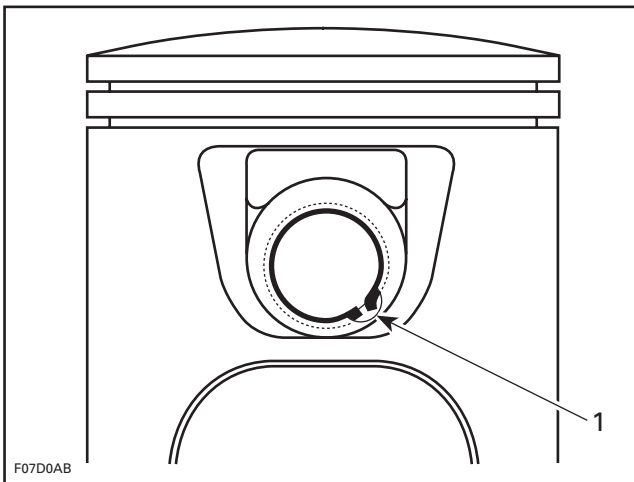
CAUTION: To minimize the stress on the circlips, it is important to install them as described.



1. Circlip opening at 6 o'clock (at bottom)

947 Engine

Secure circlip in piston groove with its bent end in piston notch as shown.

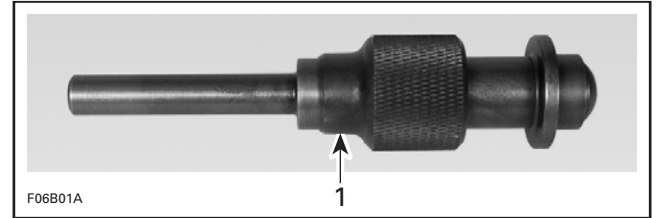


1. Circlip end in piston notch

All Engines

To easily insert circlip into piston, use circlip installer.

ENGINE	TOOL P/N
717 and 787 RFI	290 877 016
947	290 877 517



1. Circlip installer

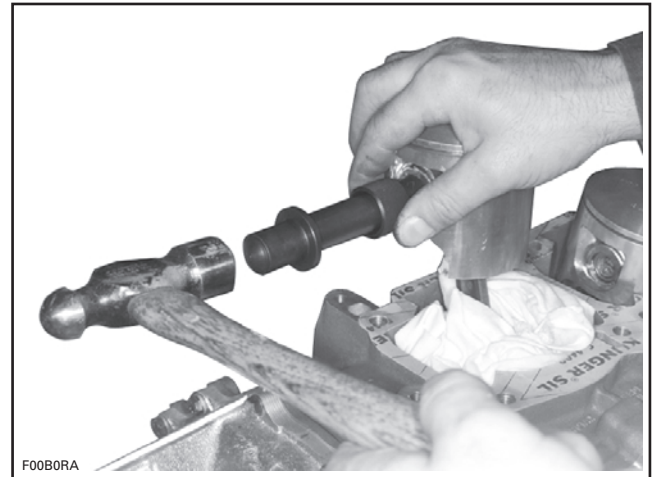
- Remove sleeve from pusher then insert circlip into its bore.
- Reinstall sleeve onto pusher and push until circlip comes in end of tool.



TYPICAL

1. Circlip near end of tool

- Position end of tool against piston pin opening.
- Firmly hold piston against tool and tap tool with a plastic tip hammer to insert circlip into its groove.



CAUTION: The hand retaining the piston should absorb the energy to protect the connecting rod.

Section 04 ENGINE

Subsection 05 (TOP END)

Cylinder Base Gasket

Install new base gasket.

NOTE: The general procedure is to install a new gasket of the same thickness. However, if you do not know the gasket thickness that was installed or if a crankshaft and/or crankcase repair or replacement was involved, refer to the COMBUSTION CHAMBER VOLUME MEASUREMENT to properly determine the required gasket thickness.

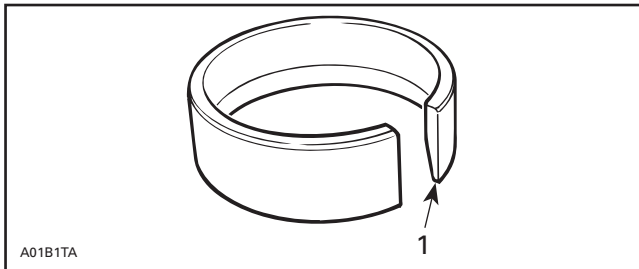
Five thicknesses of cylinder base gaskets are available for a precise adjustment of the squish gap.

To identify gasket thickness, refer to the identification holes on the gasket.

Cylinder

717 and 787 RFI Engines

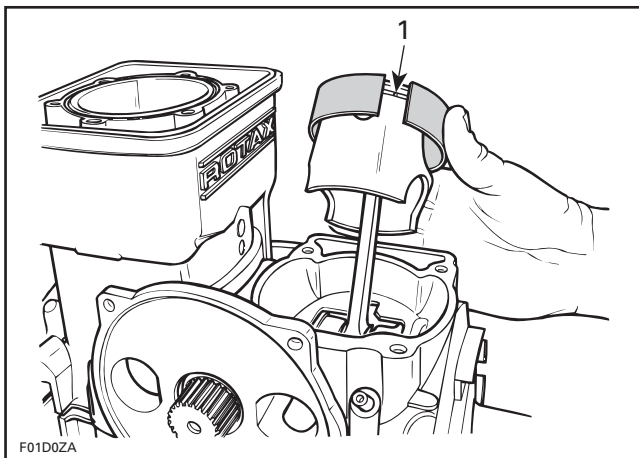
To easily slide cylinder no. 9 over piston, install on piston ring compressor (P/N 290 876 979).



1. Slide this edge

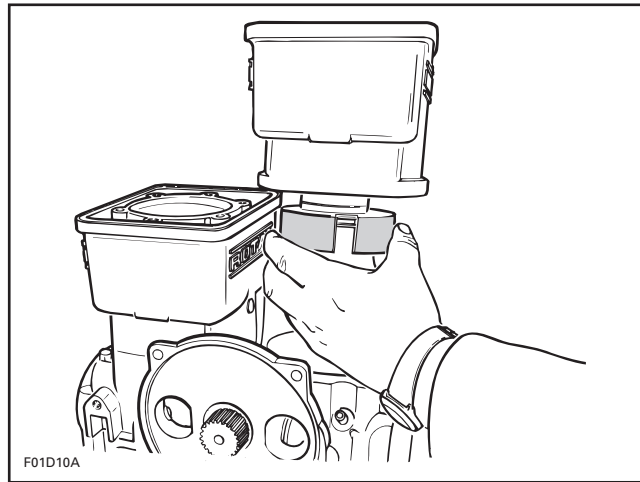
NOTE: Ring compressor will not fit on oversize parts.

Make sure to align ring end gap with piston locating pin. Slide tool over rings.



1. Ring end gap aligned with piston locating pin

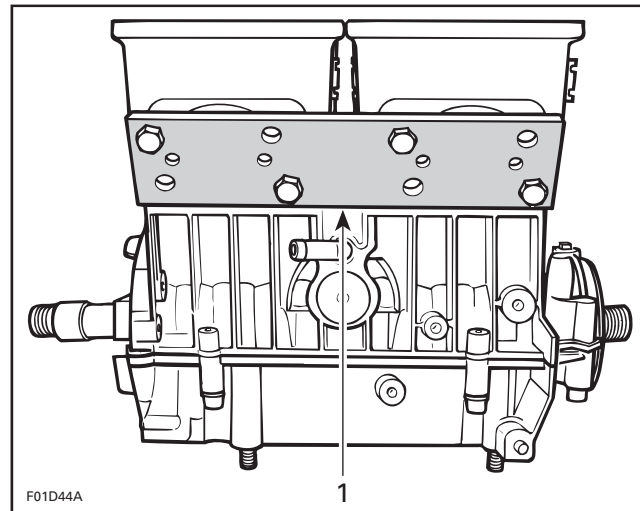
Slide cylinder over piston.



When reassembling cylinders to crankcase, it is important to have them properly aligned so that exhaust flanges properly match up with exhaust manifold.

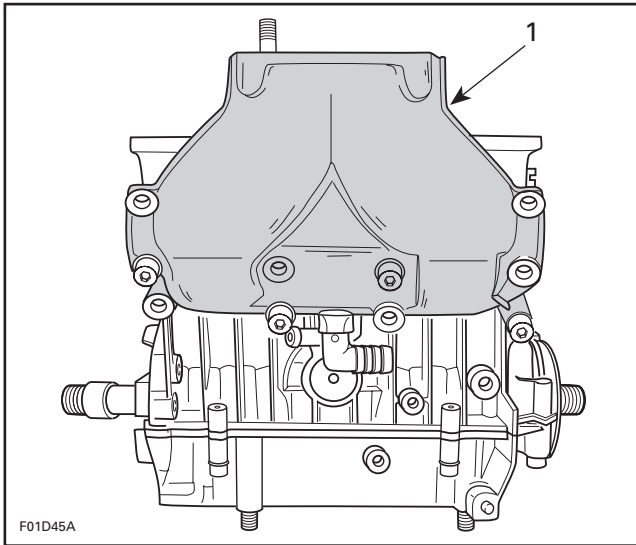
717 Engine

The aligning tool (P/N 290 876 902) or the exhaust manifold can be used to align cylinders.



717 ENGINE

1. Exhaust flange aligning tool

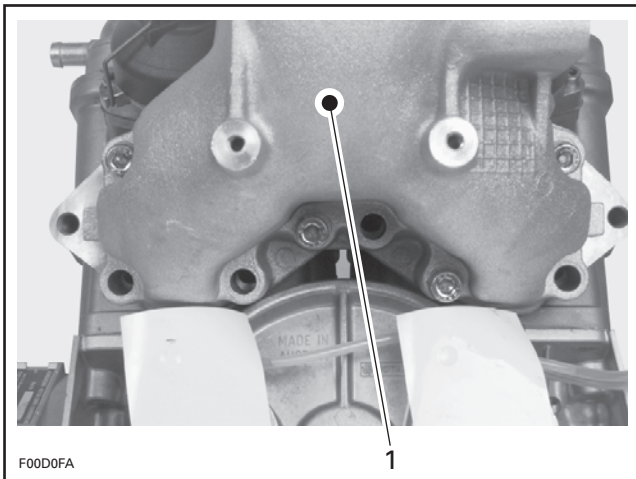


717 ENGINE

1. Aligning cylinders using exhaust manifold

787 RFI Engine

The exhaust manifold is used to align cylinders.



787 RFI ENGINE

1. Aligning cylinders using exhaust manifold

Cylinder Block

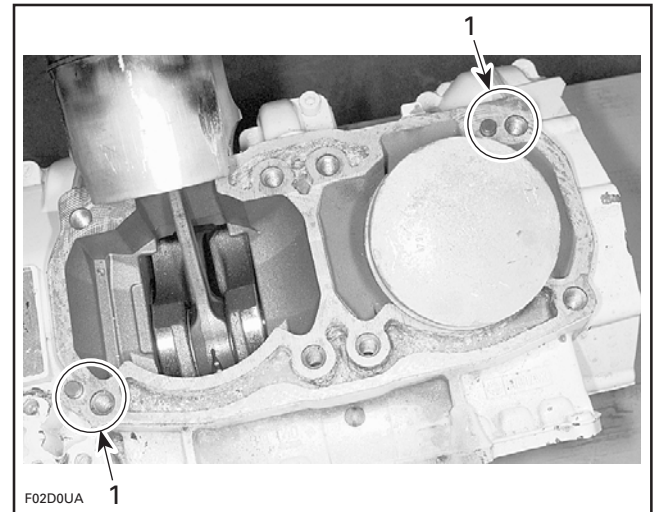
947 Engine

Install studs **no. 32**. Apply Loctite 243 to threads and torque studs to 5 N•m (44 lbf•in).

Install cylinder base gasket **no. 10**. There is only one way to install gasket.

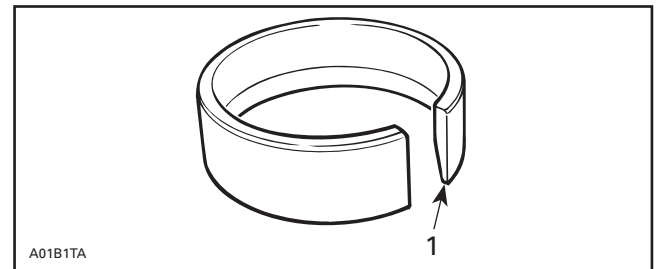
The cylinder block is positioned with locating dowels.

Line up dowels with corresponding holes in cylinder block.



1. Dowel

To easily slide cylinder block over pistons, use ring compressor (P/N 290 876 965).



1. Slide this edge

NOTE: For each ring, make sure to align ring end gap with piston locating pin.

Install cylinder block.

Install O-rings **no. 31**.

CAUTION: The O-rings must be installed and properly positioned in the cylinder block. The O-rings are meant to dampen stud vibration.

Cylinder Screw

717 Engine

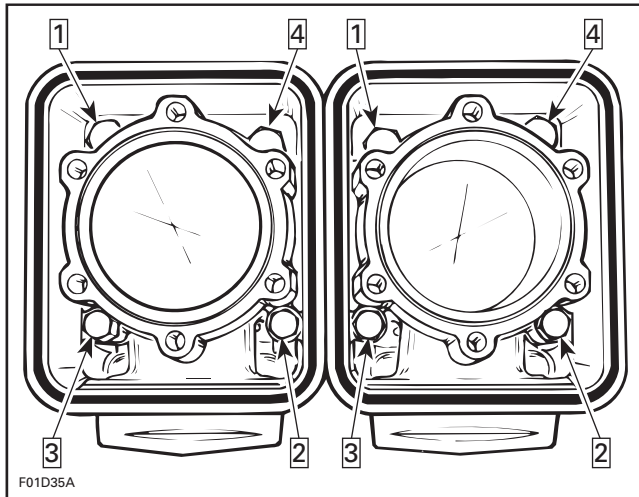
Apply synthetic grease below the screw head.

Apply also Loctite 243 (blue) on screw threads.

Install and torque screws in a criss-cross sequence for each cylinder to 24 N•m (17 lbf•ft). Refer to the following illustration.

Section 04 ENGINE

Subsection 05 (TOP END)

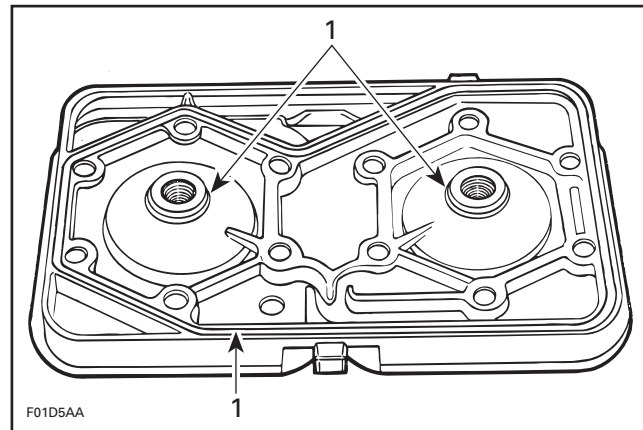


787 Engine

Prior installation, apply synthetic grease below screw head and Loctite 518 on screw threads.

Install M10 x 105 screws on exhaust side and the M10 x 73.5 on opposite side.

Torque screws in a criss-cross sequence for each cylinder to 20 N•m (15 lbf•ft). Repeat the procedure, retightening all cylinder screws to 40 N•m (30 lbf•ft).



1. O-rings

Apply Loctite 518 in O-ring groove of cylinder sleeves.

Install cylinder head.

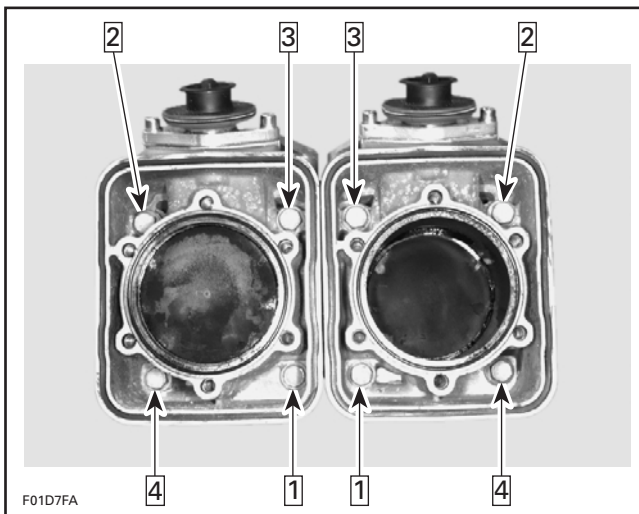
947 Engine

Apply Loctite 243 (blue) on the threads of the cylinder block studs **no. 32**.

Apply Loctite 243 (blue) below head of cylinder head bolts **no. 14**.

Apply synthetic grease on threads of cylinder head bolts **no. 14**.

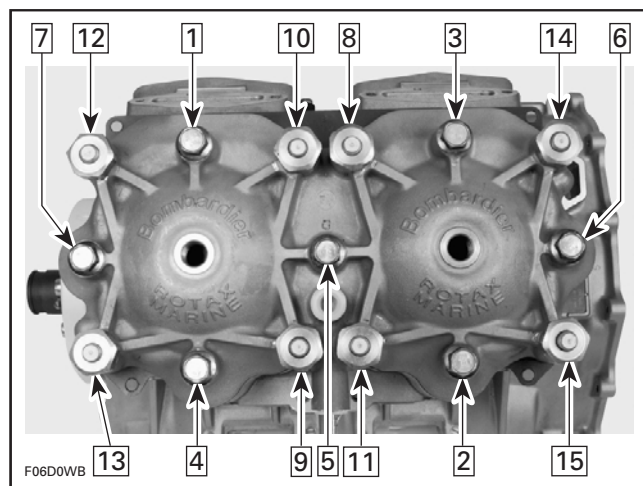
Torque bolts and nuts to 15 N•m (11 lbf•ft) as per following sequence in the next picture. Repeat the torquing sequence by retightening to 34 N•m (25 lbf•ft).



Cylinder Head

717 and 787 RFI Engines

Make sure to install O-rings **no. 12** around spark plug holes and O-ring **no. 11** of cylinder head as shown in the following illustration.



TORQUING SEQUENCE

Cylinder Head Cover

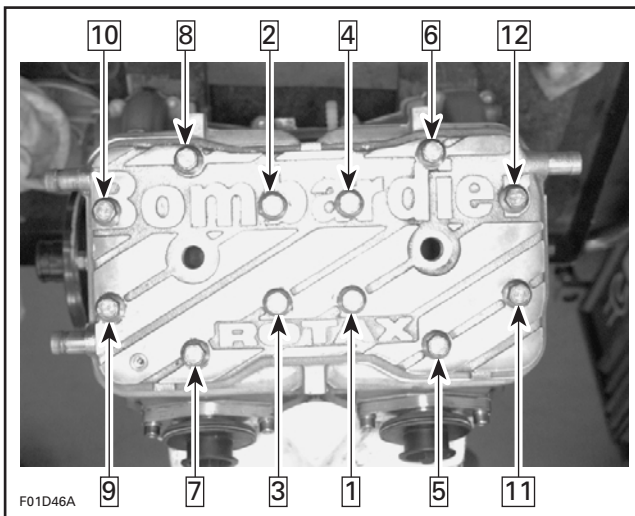
717 and 787 Engines

Install cylinder head cover no. 1.

Apply Loctite 243 (blue) below head of screws no. 14.

Apply also synthetic grease on threads of screws no. 14.

Torque cylinder head screws no. 14 to 12 N•m (9 lbf•ft) as per following illustrated sequence. Repeat the procedure, retightening all screws to 24 N•m (17 lbf•ft).



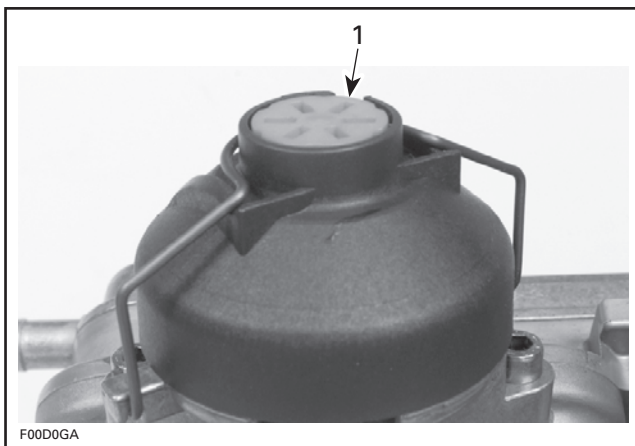
TORQUING SEQUENCE

ADJUSTMENT

RAVE Valve

787 RFI Engine

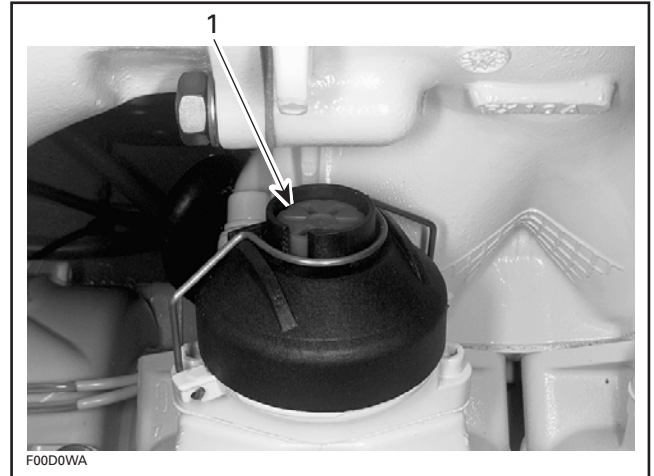
Turn the red plastic knob no. 17 until it is flush to the valve cover.



1. Knob flush with the cover

947 Engine

Turn the red plastic knob no. 17 until it is fully tightened.



1. Knob fully tightened

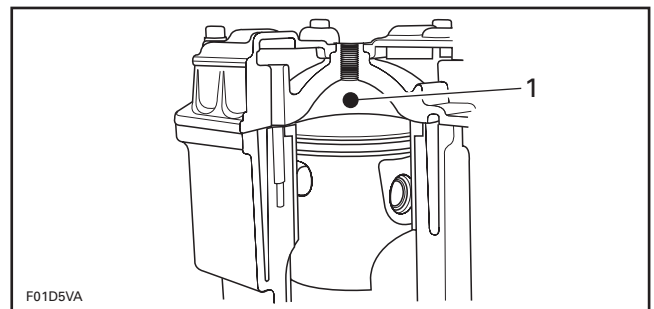
This will ensure the correct preload on the return spring no. 19 in order to open and close the RAVE valve at the proper RPM.

Combustion Chamber Volume Measurement

All Engines

NOTE: This procedure is required to determine the thickness of the cylinder base gasket to be installed if a crank repair has involved replacement of connecting rods or if you are experiencing repetitive engine seizure.

The combustion chamber volume is the region in the cylinder head above the piston at Top Dead Center. It is measured with the cylinder head installed on the engine.



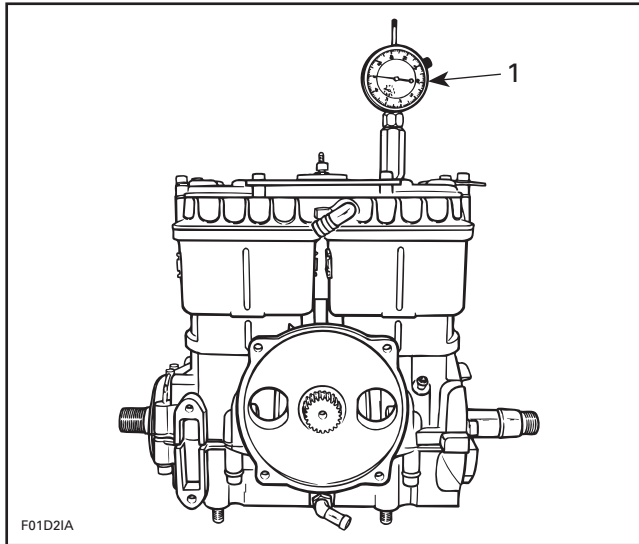
1. Combustion chamber

NOTE: When checking the combustion chamber volume, engine must be cold, piston must be free of carbon deposit and cylinder head must be leveled.

Section 04 ENGINE

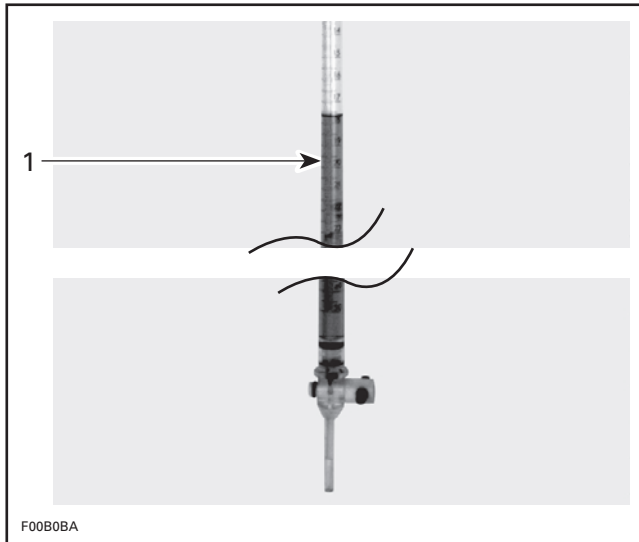
Subsection 05 (TOP END)

1. Remove both spark plugs and bring one piston to Top Dead Center a using a TDC gauge.



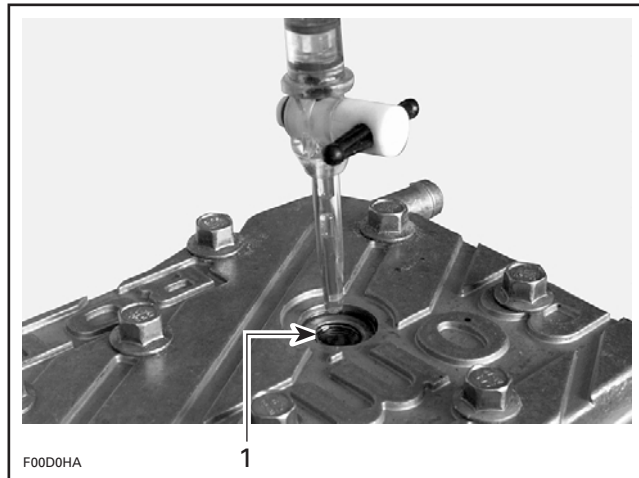
1. Bring piston to TDC

2. Obtain a graduated burette (capacity 0-50 cc) and fill with an equal part (50/50) of gasoline and injection oil.



1. Graduated burette (0-50 cc)

3. Open burette valve to fill its tip. Add liquid in burette until level reaches 0 cc.
4. Inject the burette content through the spark plug hole until liquid touches the top spark plug hole.



1. Top of spark plug hole

NOTE: The liquid level in cylinder must not drop for a few seconds after filling. If so, there is a leak between piston and cylinder. The recorded volume would be false.

5. Let burette stand upward for about 10 minutes, until liquid level is stabilized.
6. Read the burette scale to obtain the quantity of liquid injected in the combustion chamber.

Compare the obtained value with the table below. The volume should be within the allowable range.

If the volume of the combustion chamber is not within specifications, change cylinder base gasket thickness as follow.

To increase the volume of the combustion chamber, use a thicker gasket.

To decrease the volume of the combustion chamber, use a thinner gasket.

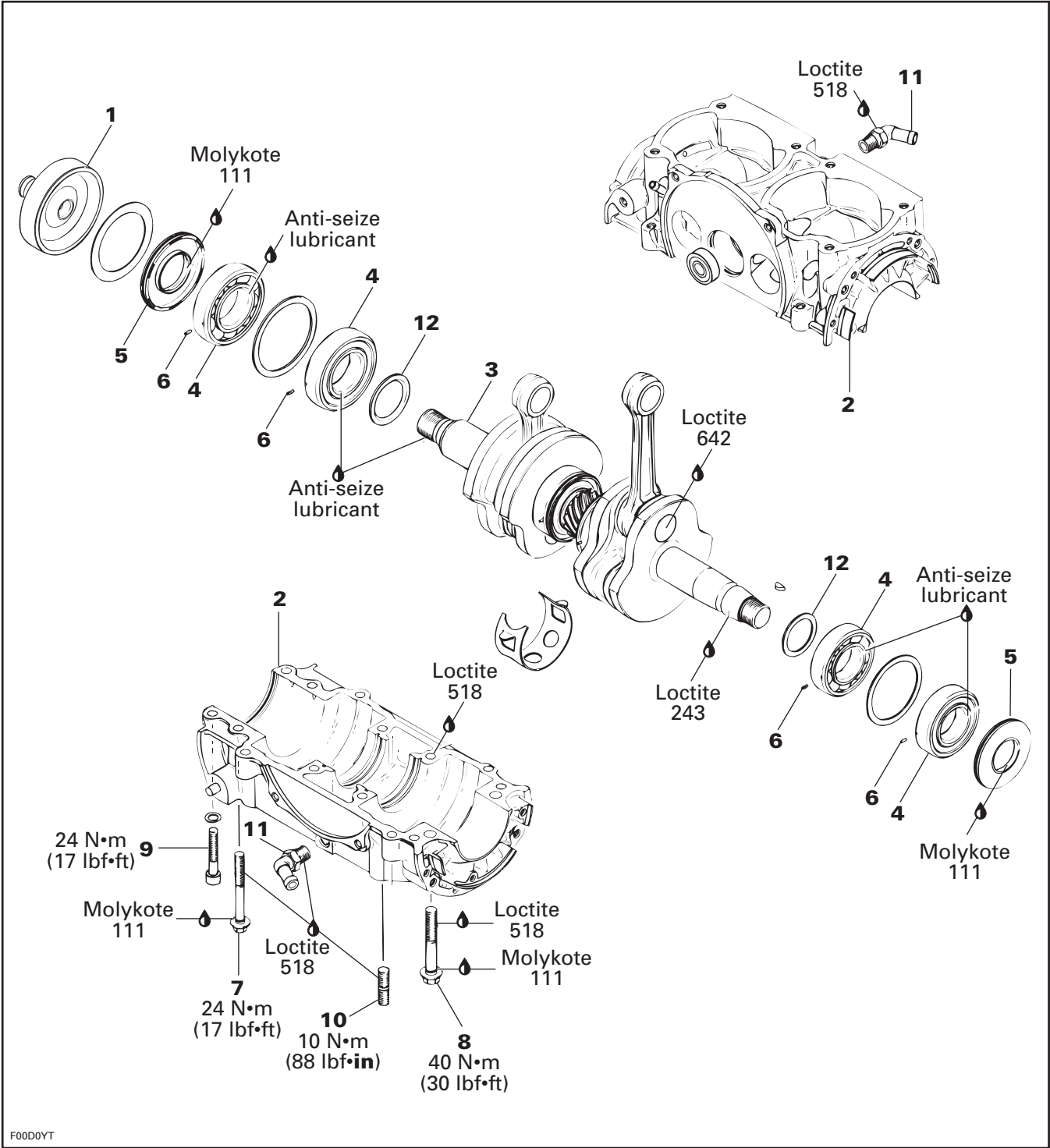
NOTE: When the combustion chamber is filled to top of spark plug hole, it includes an amount of 2.39 cc corresponding to the spark plug tip. The following table of combustion chamber volume includes this value.

ENGINE	COMBUSTION CHAMBER VOLUME
717	31.2 - 34.0 cc
787 RFI	34.7 - 37.9 cc
947	43.3 - 47.3 cc

7. Repeat the procedure for the other cylinder(s).

BOTTOM END

717 Engine



F00D0YT

Section 04 ENGINE

Subsection 06 (BOTTOM END)

DISASSEMBLY

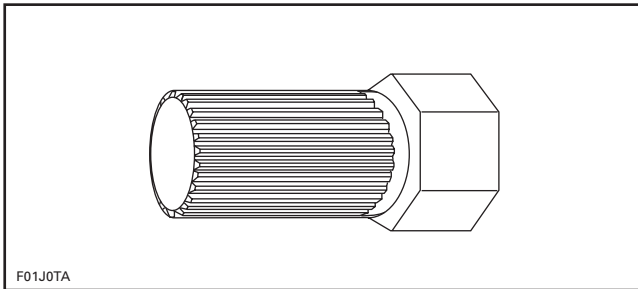
Engine has to be removed from watercraft and top end has to be disassembled to open bottom end. Refer to REMOVAL AND INSTALLATION and TOP END.

PTO Flywheel

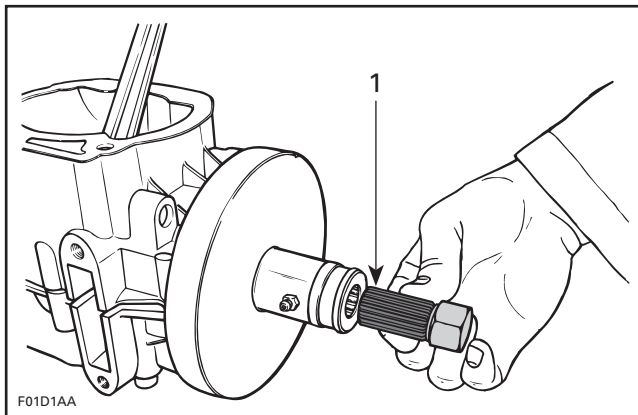
717 Engine

To remove PTO flywheel **no. 1**, the crankshaft must be locked. Refer to MAGNETO SYSTEM and follow the procedure to lock the magneto flywheel.

PTO flywheel is loosened using PTO flywheel remover (P/N 295 000 001).



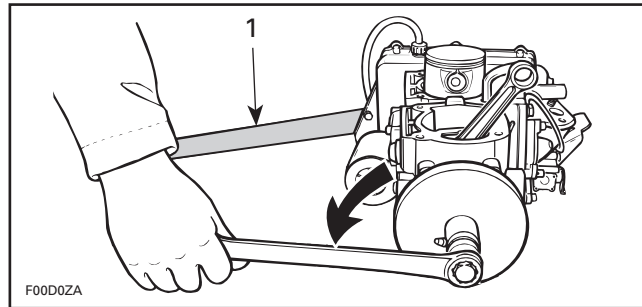
Insert special tool in PTO flywheel splines.



TYPICAL

1. PTO flywheel remover (P/N 295 000 001)

Using a suitable wrench or socket with a breaker bar, unscrew PTO flywheel COUNTERCLOCKWISE when facing it and hold extension handle locking the magneto flywheel.

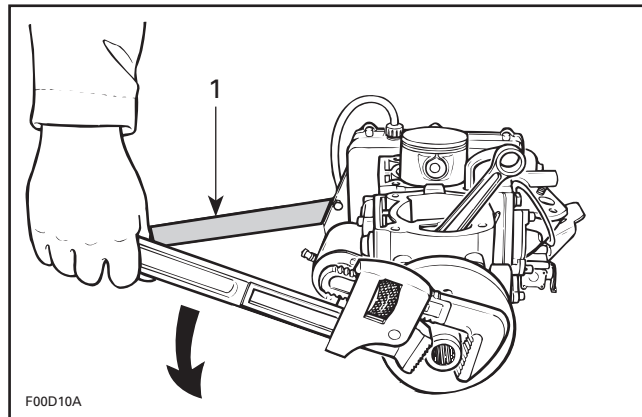


TYPICAL

1. Extension handle locking crankshaft

NOTE: When splines of PTO flywheel are worn out and special tool cannot be used, proceed with the following alternate method.

Use a pipe wrench and install it on PTO flywheel as illustrated.

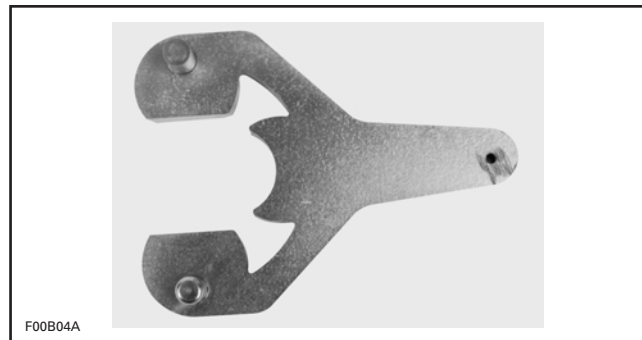


TYPICAL

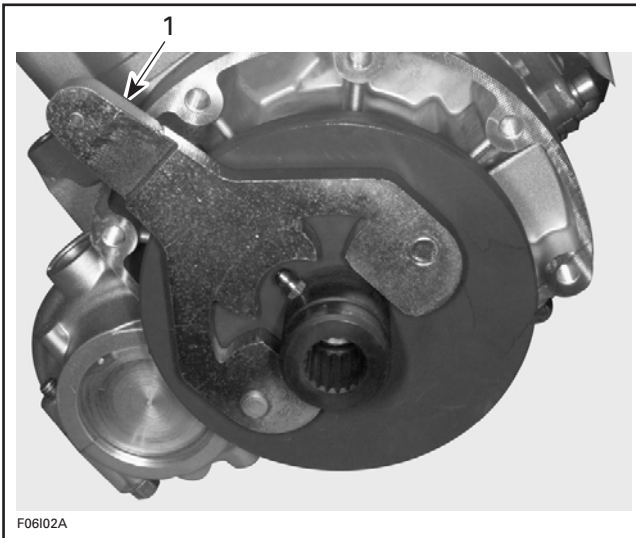
1. Extension handle locking crankshaft

787 RFI Engine

PTO flywheel is loosened using PTO flywheel extractor (P/N 295 000 156).



Install special tool.



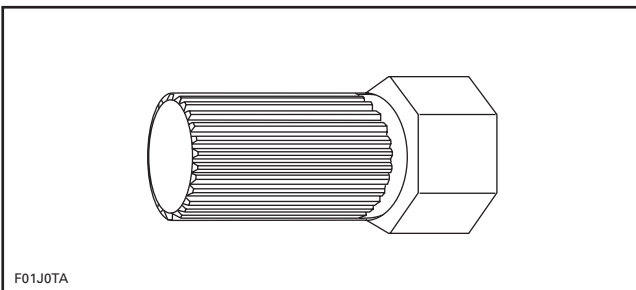
TYPICAL

1. PTO flywheel extractor

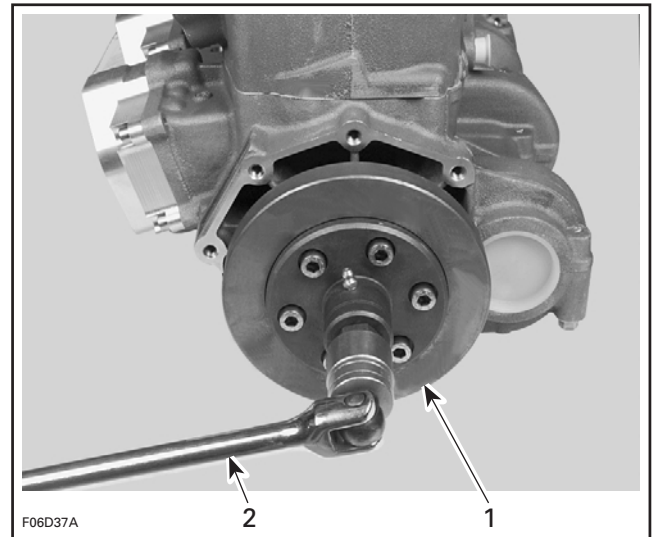
Install the extension handle (P/N 295 000 125) on the PTO flywheel extractor. Loosen PTO flywheel COUNTERCLOCKWISE when facing it.

947 Engine Except XP

Use PTO flywheel remover (P/N 295 000 001) to hold flywheel and remove Allen screws no. 21 retaining coupler no. 20 to PTO flywheel.



PTO FLYWHEEL REMOVER TOOL



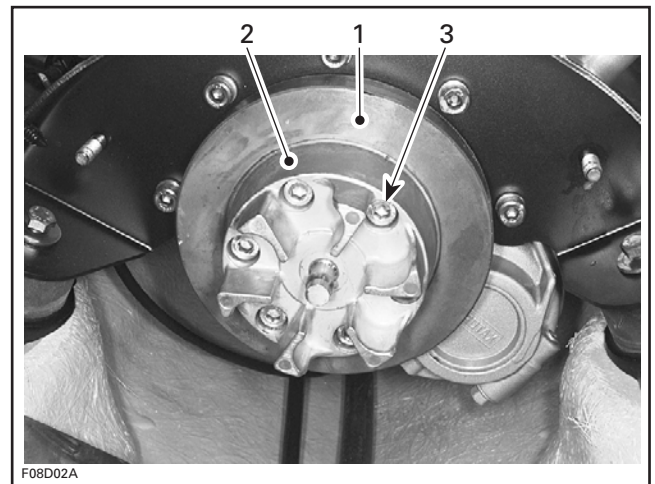
GSX AND GTX MODELS

1. Loosen Allen screws
2. Breaker bar locking crankshaft

Remove the coupler no. 20.

XP Model

Remove Allen screws no. 21.



XP MODEL

1. PTO flywheel
2. Coupler
3. Loosen Allen screw

Section 04 ENGINE

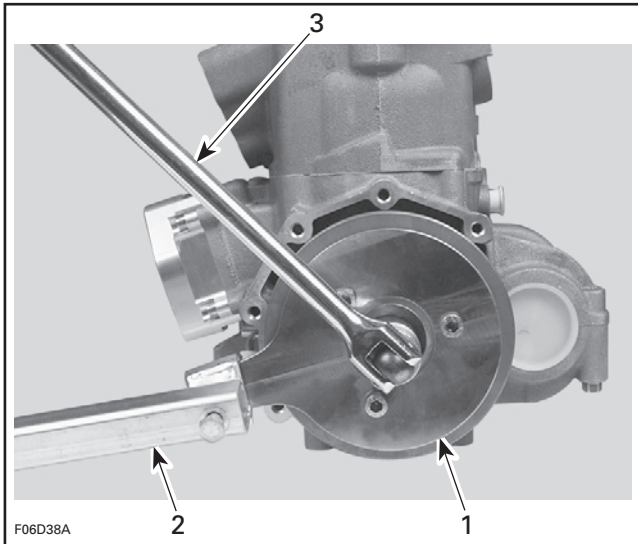
Subsection 06 (BOTTOM END)

Remove coupler no. 20.

Install puller plate (P/N 529 035 533) and extension handle (P/N 295 000 125) to PTO flywheel.

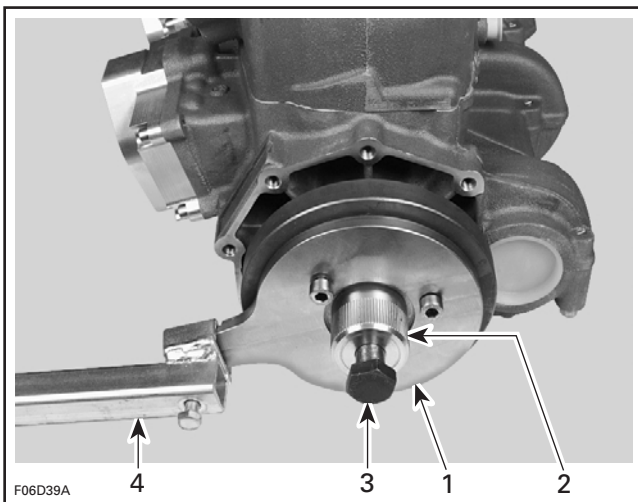
NOTE: Puller plate can be used without the extension handle.

Loosen bolt no. 22 retaining the PTO flywheel to the crankshaft using a suitable socket and breaker bar.



1. Puller plate
2. Extension handle
3. Loosen bolt with socket and breaker bar

Remove the PTO flywheel using puller plate (P/N 529 035 533) and puller (P/N 529 035 547) and bolt (P/N 529 035 549).

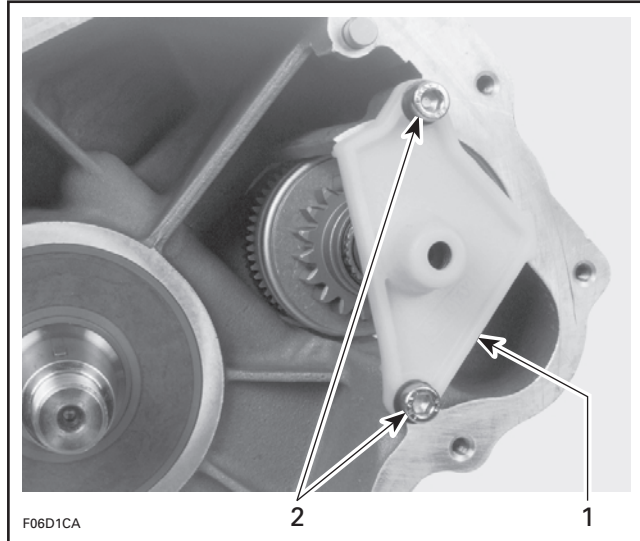


1. Puller plate
2. Puller
3. Bolt
4. Extension handle

Starter Drive Assembly

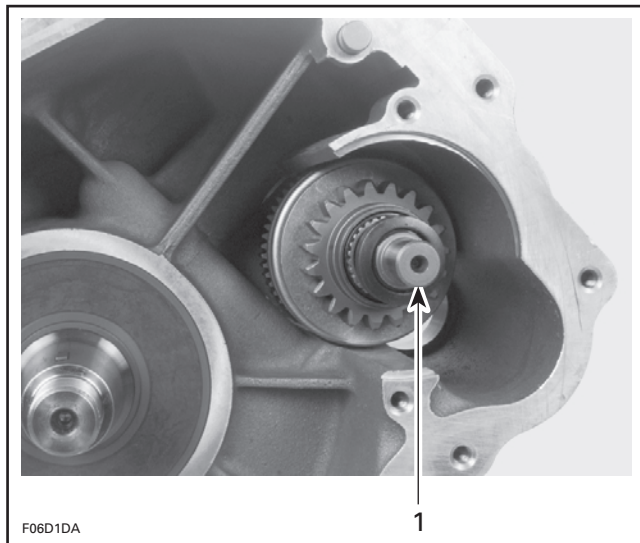
947 Engine Only

Loosen 2 Allen screws no. 24 retaining starter drive cover no. 25.



1. Cover
2. Allen screw

Remove starter drive cover no. 25 and spring no. 9.
Remove starter drive assembly no. 27.



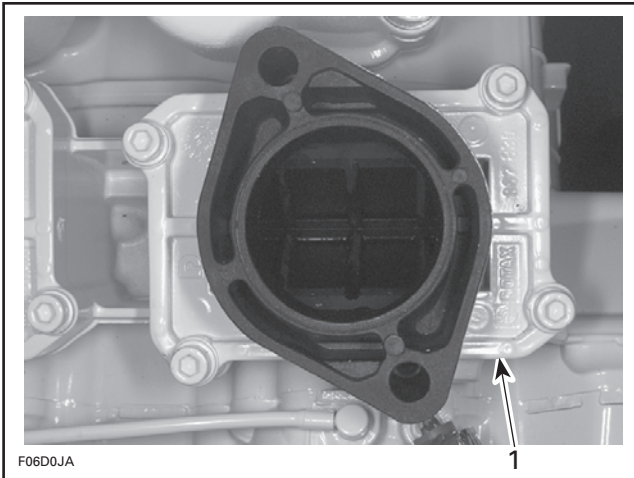
947 ENGINE

1. Starter drive assembly

Reed Valve

947 Engine Only

Remove both carburetor flanges.



1. Carburetor flange

Remove reed valves no. 28 from crankcase.

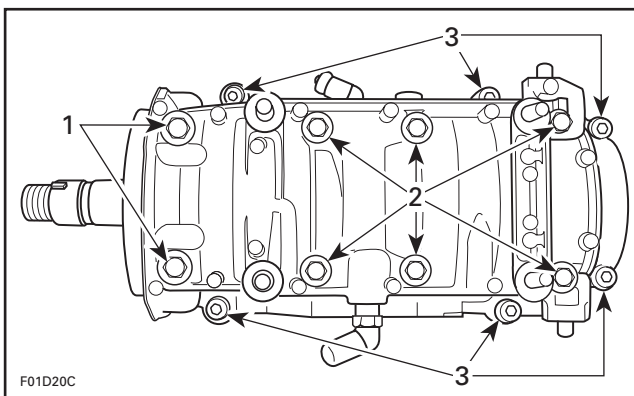
Crankcase

Before opening the bottom end, remove the following parts:

- engine supports (717 engine)
- magneto flywheel, refer to MAGNETO SYSTEM
- magneto housing (except 947 engine)
- starter
- rotary valve cover and valve (except 947 engine)
- starter drive assembly (947 engine)
- reed valves (947 engine).

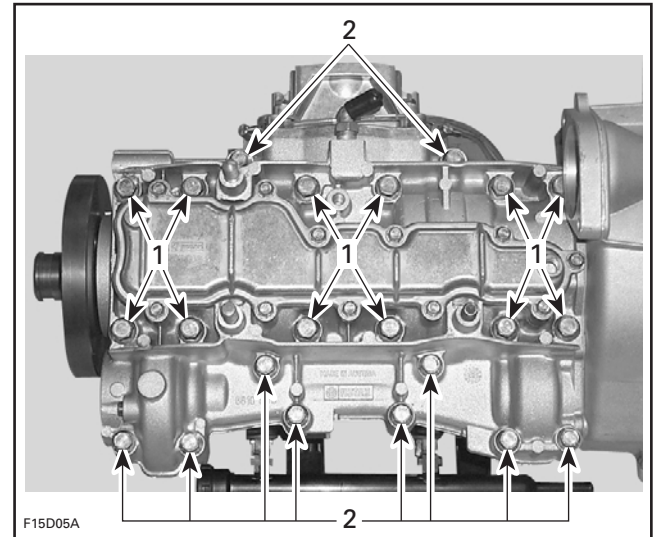
717 and 787 RFI Engines

Put engine on a trestle. Loosen crankcase screws.



717 ENGINE

1. M10 x 73.5 flanged screws
2. M8 x 68.5 flanged screws
3. M8 x 45 Socket head screws

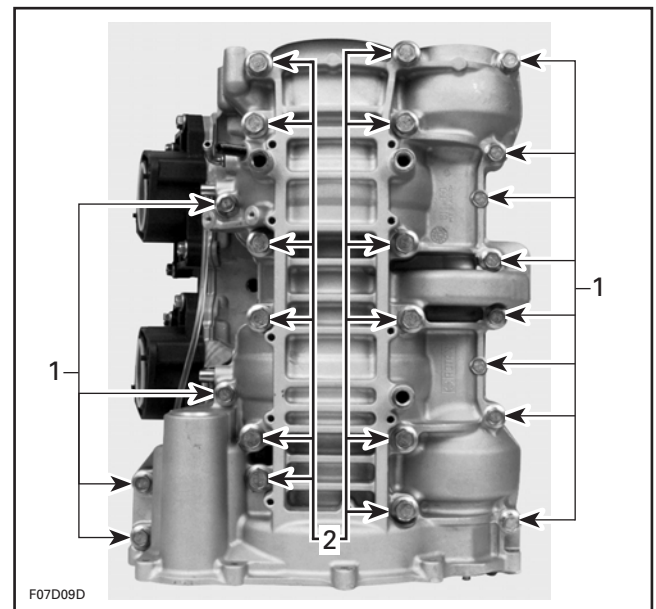


787 RFI ENGINE

1. M10 x 75 flanged screws
2. M8 x 55 flanged screws

947 Engine

Place engine upright on crankcase magneto side. Loosen crankcase screws.



947 ENGINE

1. M8 x 45 flanged screws
2. M10 x 73.5 flanged screws

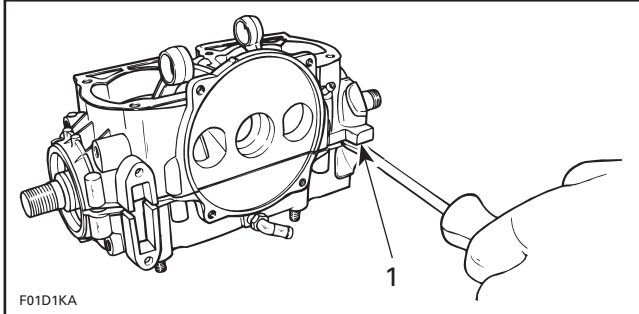
Section 04 ENGINE

Subsection 06 (BOTTOM END)

All Engines

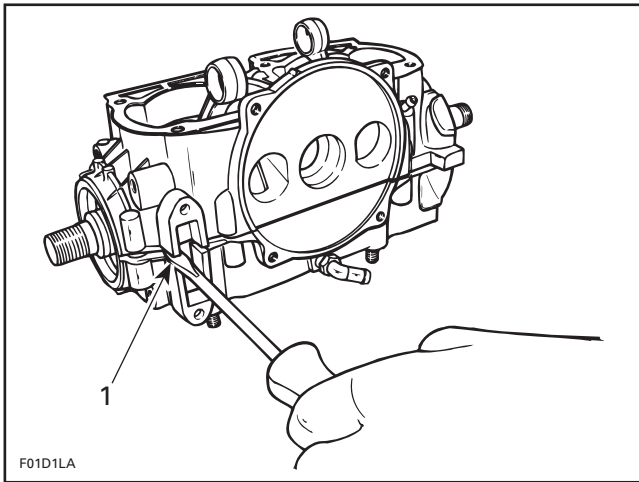
Put engine back on a support. Insert a pry bar between crankcase lugs to separate halves.

CAUTION: Be careful to precision machined surfaces.



TYPICAL

1. Separate halves by prying at provided lugs



TYPICAL

1. Separate halves by prying at provided lugs

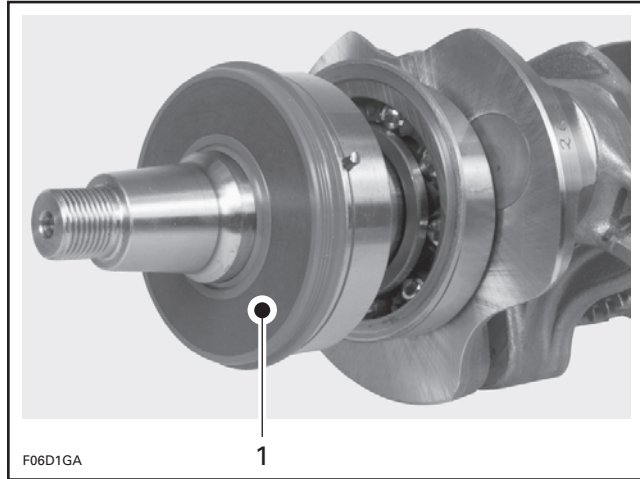
Remove crankshaft and counterbalance shaft (787 RFI and 947 engines).

Crankshaft Bearing and Seal

If a crankshaft end seal no. 5 has to be replaced, bottom end must be opened (except for the MAG side seal on the 787 RFI engine, which is mounted on the magneto housing).

NOTE: Do not needlessly remove crankshaft bearings.

Remove end seal(s).

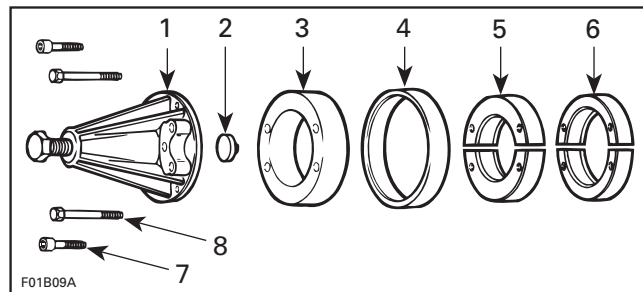


TYPICAL

1. End seal

717 Engine

To remove end bearings no. 4 from crankshaft, use the following tools.



717 ENGINE

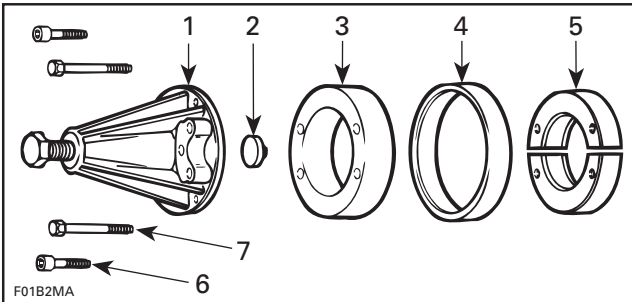
1. Puller (P/N 420 877 635)
2. Protective cap (P/N 420 876 557)
3. Distance ring, MAG side only (P/N 420 876 569)
4. Ring (both sides) (P/N 420 977 490)
5. MAG side ring halves (P/N 420 276 025)
6. PTO side ring halves (P/N 420 977 475)
7. Screw M8 x 40 (P/N 420 840 681)
8. Screw M8 x 70 (P/N 420 841 201)

NOTE: To facilitate ring or distance ring installation, lubricate their inside diameters.

787 RFI Engine

To remove end bearings no. 4 from crankshaft, use the following tools.

NOTE: The outer PTO bearing and crankshaft gear can be removed in one step using another puller. See **Crankshaft Gear no. 18**.



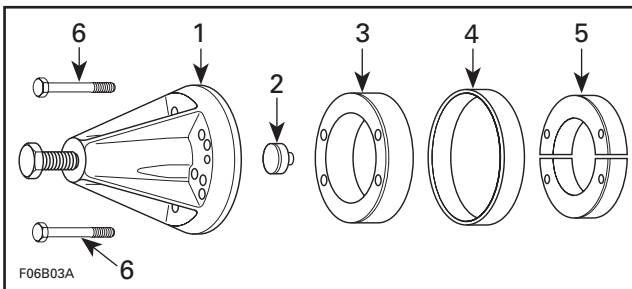
787 RFI ENGINE

1. Puller (P/N 420 877 635)
2. Protective cap (P/N 420 876 557)
3. Distance ring (P/N 420 876 569)
4. Ring (P/N 420 977 490)
5. Ring halves (P/N 420 977 475)
6. Screw M8 x 40 (P/N 420 840 681)
7. Screw M8 x 70 (P/N 420 841 201)

NOTE: To facilitate ring or distance ring installation, lubricate their inside diameters.

947 Engine

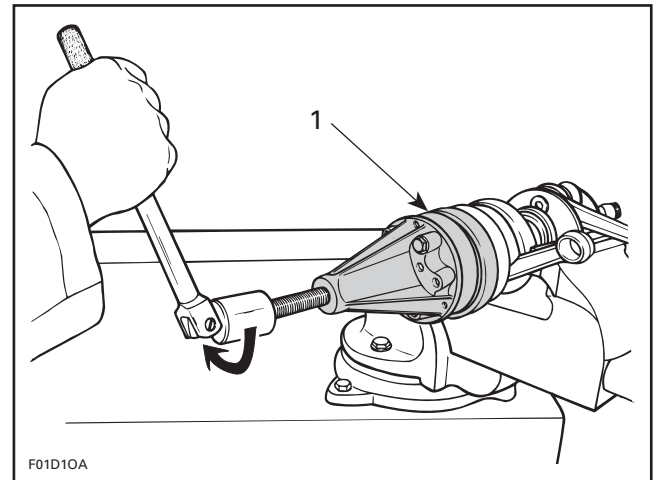
To remove end bearings from crankshaft, use the following tools.



947 ENGINE

1. Puller (P/N 420 877 635)
2. Protective cap (P/N 290 877 414)
3. Distance ring (P/N 420 876 569)
4. Ring (P/N 420 977 480)
5. Ring halves (P/N 420 876 330)
6. Screw (P/N 420 940 755)

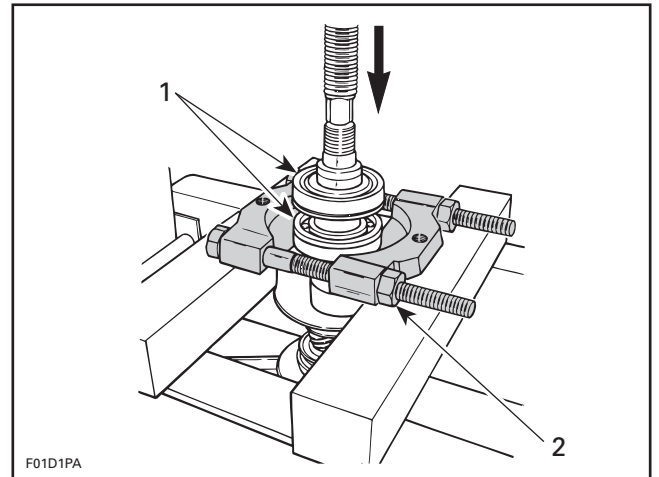
All Engines



TYPICAL

1. Removing crankshaft bearing

Or, use a bearing extractor such as Proto no. 4332 and a press to remove two bearings at a time (except on PTO side for the 787 RFI engine).



1. Press bearings out
2. Bearing extractor

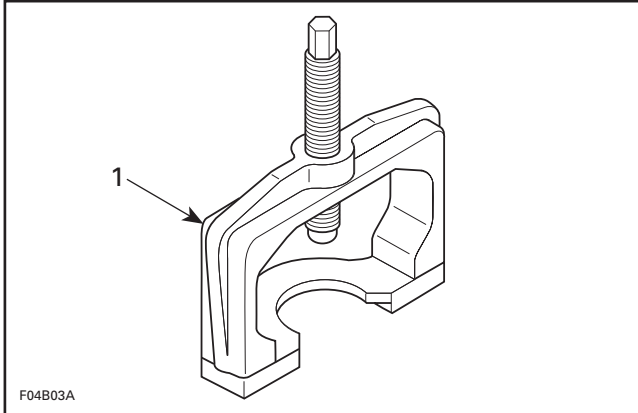
Section 04 ENGINE

Subsection 06 (BOTTOM END)

Crankshaft Gear

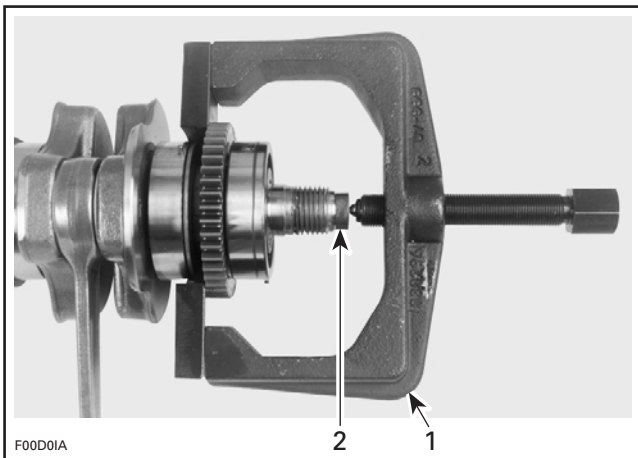
787 RFI Engine

The crankshaft gear no. 18 and bearing no. 5 can be removed in one step using the following puller.



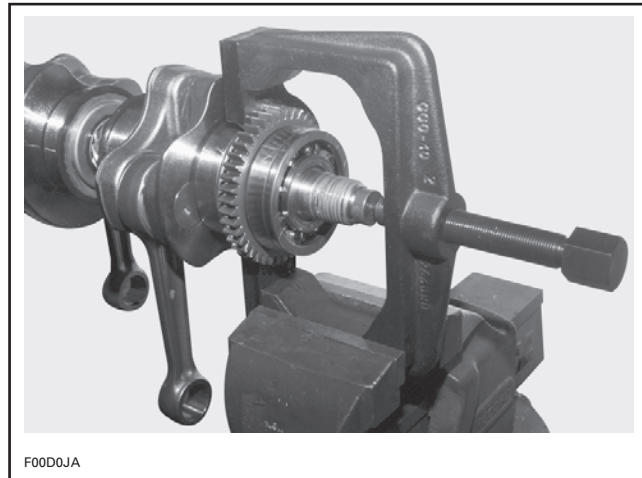
1. Puller (P/N 290 877 665)

Install the puller as per following illustration.



1. Puller
2. Protective cap

Secure puller in a vise and remove gear and bearing.

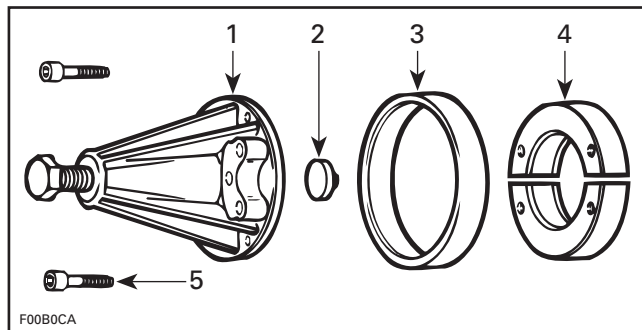


NOTE: If the inner PTO bearing needs to be replaced, remove the Woodruff key on the crankshaft.

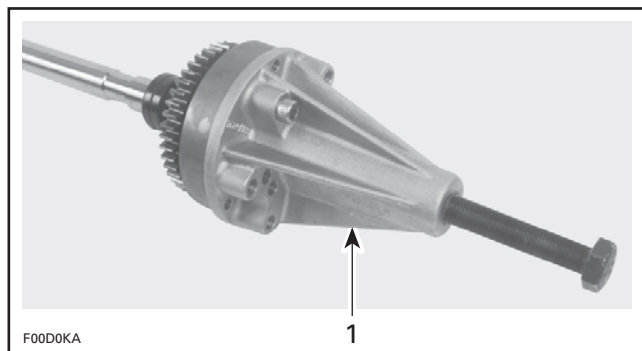
Counterbalance Shaft

787 RFI Engine

Bearings no. 15 on counterbalance shaft no. 13 can be removed by using the following tools:



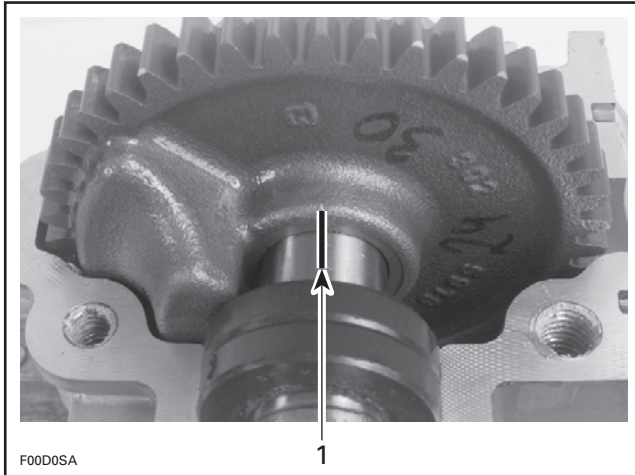
1. Puller (P/N 420 877 635)
2. Protective cap (P/N 420 876 557)
3. Ring (P/N 420 977 480)
4. Ring halves (P/N 420 876 330)
5. Screw M8 x 40 (P/N 420 840 681)



1. Tool installed

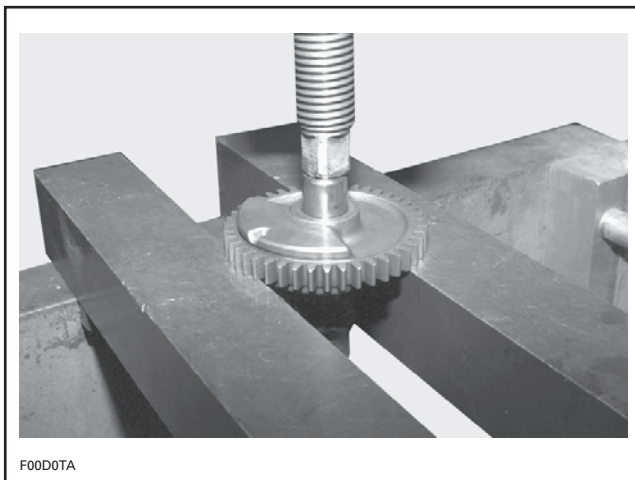
To remove gear no. 14, first trace an index mark on the gear and counterbalance shaft.

NOTE: There is no Woodruff key to position the gear on the counterbalance shaft. An index mark must be traced to ease assembly procedure.



1. Index mark

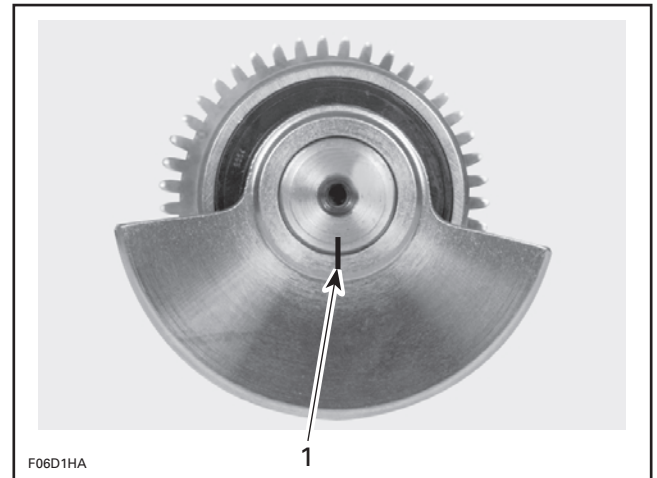
Use a press to remove the gear no. 14 from the counterbalance shaft.



947 Engine

Use a press to remove counterweights no. 16 and bearings no. 15.

CAUTION: There is no woodruff key to position the counterweights. An index mark must be traced to retain the proper position of the counterweight.



1. Trace an index mark

Remove seals no. 17.

Remove bearing no. 31 and washer no. 32.

Use a press to remove gear no. 14.

CLEANING

Discard all oil seals, gaskets, O-rings and sealing rings.

Clean oil passages and make sure they are not clogged.

Clean all metal components in a solvent.

Remove old Loctite from crankcase mating surfaces with gasket remover (P/N 413 708 500).

CAUTION: Be careful not to spray cleaner on the painted surface of the engine. Never use a sharp object to scrape away old sealant as score marks incurred are detrimental to crankcase sealing.

INSPECTION

Assembled Engine

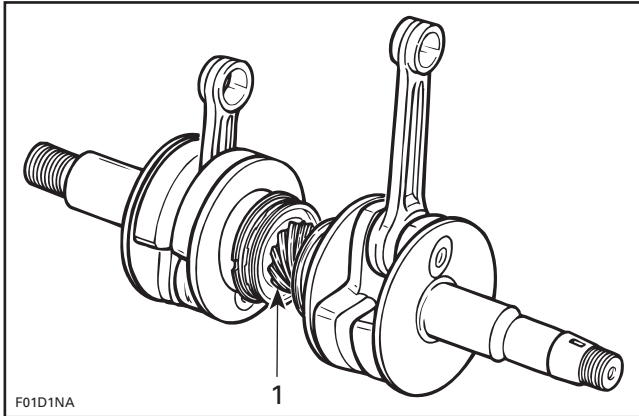
The following checks can be performed with engine in watercraft without overhauling engine.

Crankshaft Alignment at Center Main Journal

Since it is an assembled crankshaft it can become misaligned or deflected. Crankshaft can be twisted on center main journal, changing timing of one cylinder in relation with the other.

Section 04 ENGINE

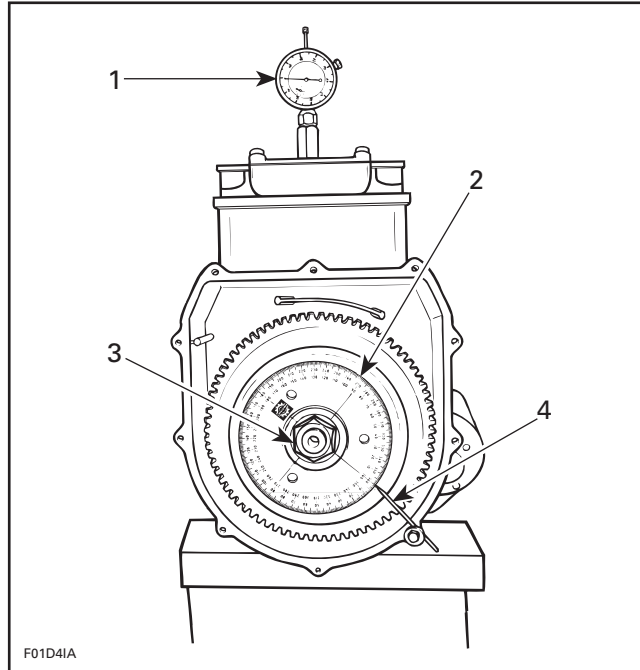
Subsection 06 (BOTTOM END)



1. Main journal alignment here

To accurately check if crankshaft is twisted on center main journal, proceed as follows:

- Remove magneto housing cover.
- Remove flywheel nut (and magneto rotor for the 787 RFI and 947 engines). Refer to MAGNETO SYSTEM for procedures.
- Install Bombardier degree wheel (P/N 295 000 007) on crankshaft end. Hand-tighten nut only.
- Remove both spark plugs.
- Install a TDC gauge in spark plug hole on **MAG side**.
- Bring **MAG** piston at Top Dead Center.
- As a needle pointer, secure a wire with a cover screw and a washer.
- Rotate degree wheel (NOT crankshaft) so that needle pointer reads 360°.



TYPICAL

1. TDC gauge
2. Degree wheel
3. Hand tighten nut
4. Needle pointer

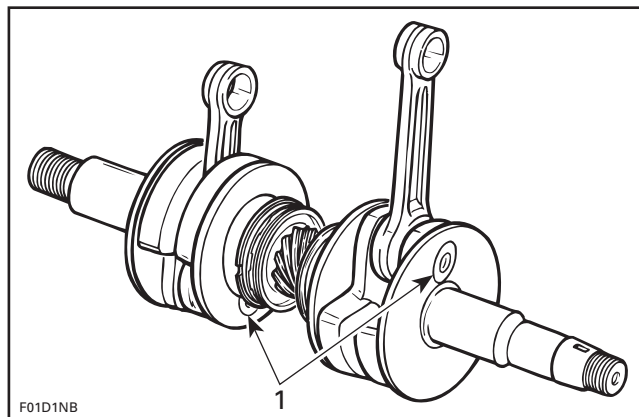
- Remove TDC gauge and install on **PTO side**.
- Bring **PTO** piston at Top Dead Center.

Interval between cylinders must be exactly 180° therefore, needle pointer must indicate 180° on degree wheel ($360^\circ - 180^\circ = 180^\circ$).

Any other reading indicates a misaligned crankshaft.

Crankshaft Alignment at Connecting Rod Journal

Counterweights can also be twisted on connecting rod journal on any or both cylinder(s).



1. Connecting rod journal alignment here

Such misalignment may cause a crankshaft hard to be manually turned. Verification can be done by measuring deflection each end of crankshaft.

If deflection is found greater than specified tolerance, this indicates worn bearing(s), bent and/or disaligned crankshaft. Proceed with the disassembly of the engine.

Disassembled Engine

The following verifications can be performed with the engine disassembled.

Crankcase

Inspect plane surfaces for warpage. Small deformation can be corrected by grinding surface with a fine sandpaper. Install sandpaper on a surface plate and rub part against oiled sand paper.

Bearing

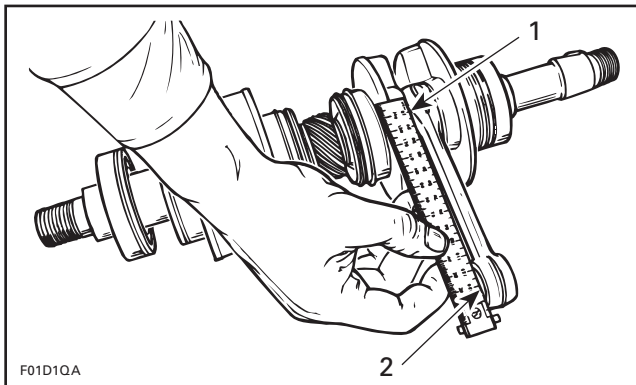
Inspect crankshaft bearings **no. 4**. Check for corrosion, scoring, pitting, chipping or other evidence of wear. Make sure plastic cage is not melted. Rotate and make sure they turn smoothly.

Crankshaft

NOTE: If crankshaft and/or components are found defective, it must be repaired by a specialized shop or replaced.

Connecting Rod Straightness

Align a steel ruler on edge of small end connecting rod bore. Check if ruler is perfectly aligned with edge of big end.



1. Ruler must be aligned with edge of connecting rod here
2. Align ruler here

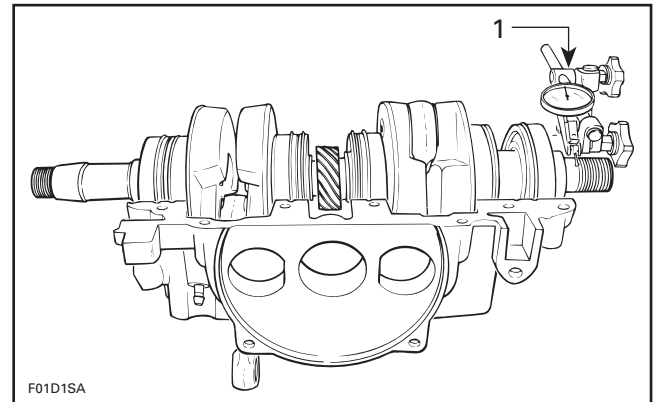
Crankshaft Deflection

All Models

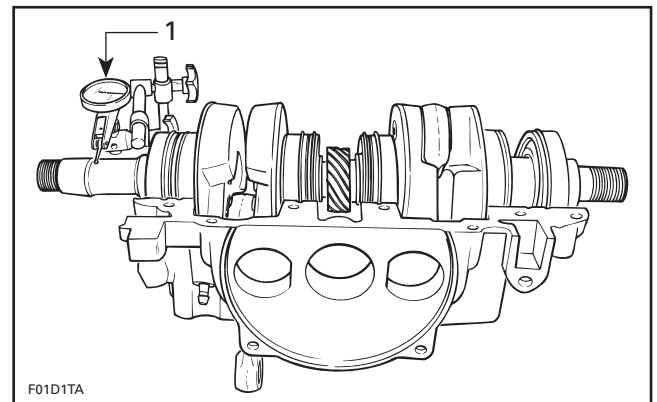
MEASUREMENT	MAG SIDE	PTO SIDE
Crankshaft deflection (max.)	0.050 mm (.002 in)	0.030 mm (.001 in)

Crankshaft deflection is measured each end with a dial indicator.

First, check deflection with crankshaft in crankcase. If deflection exceeds the specified tolerance, it can be either ball bearings wear, bent or twisted crankshaft at connecting rod journal.



1. Measuring PTO side deflection in crankcase

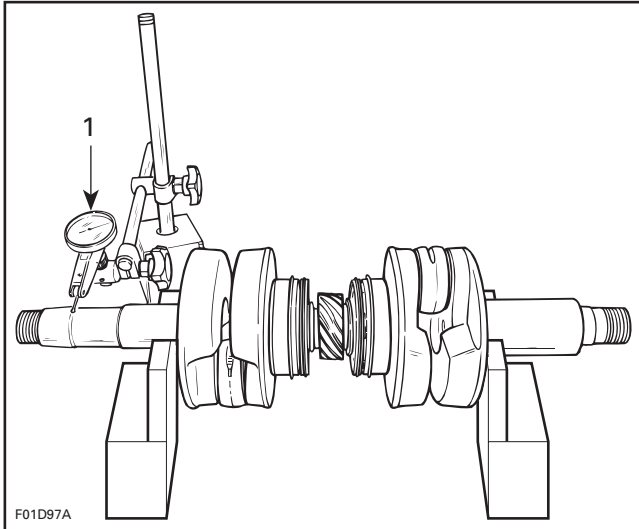


1. Measuring MAG side deflection in crankcase

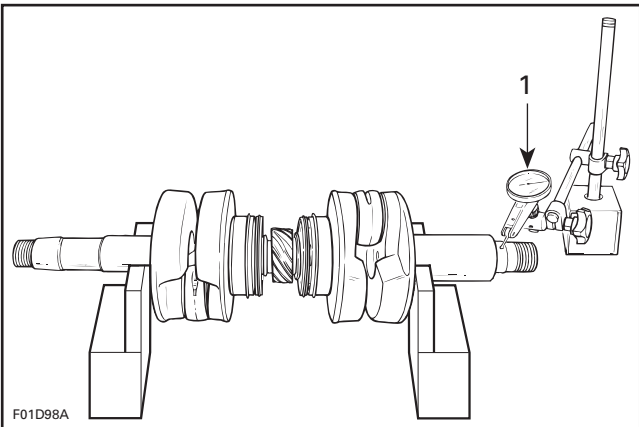
Section 04 ENGINE

Subsection 06 (BOTTOM END)

Remove crankshaft bearings and check deflection again on V-shaped blocks as illustrated.



1. Measuring MAG side deflection on V-shaped blocks



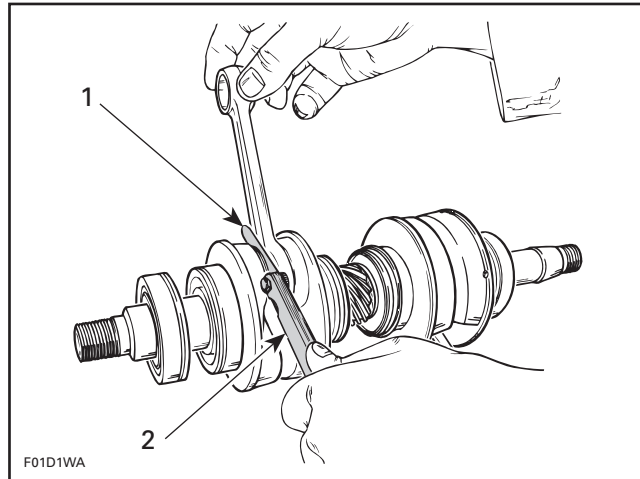
1. Measuring PTO side deflection on V-shaped blocks

NOTE: Crankshaft deflection cannot be correctly measured between centers of a lathe.

Connecting Rod Big End Axial Play

CONNECTING ROD BIG END AXIAL PLAY			
MODEL	NEW PARTS (MIN.) (MAX.)		WEAR LIMIT
947 engine	0.390 mm (.015 in)	0.737 mm (.029 in)	1.2 mm (.047 in)
787 RFI engine	0.230 mm (.008 in)	0.617 mm (.024 in)	1.2 mm (.047 in)
717 engine	0.311 mm (.012 in)	0.677 mm (.026 in)	1.2 mm (.047 in)

Using a feeler gauge, measure distance between thrust washer and crankshaft counterweight.

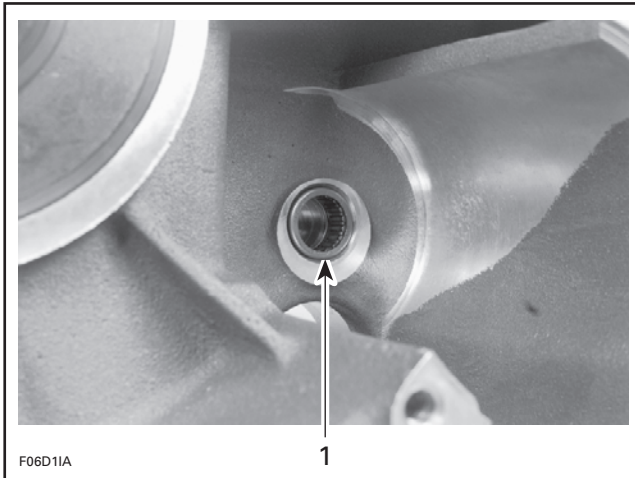


1. Measuring big end axial play
2. Feeler gauge

Starter Drive Bearing

947 Engine Only

Check bearing no. 23 of starter drive assembly no. 27 in crankcase.

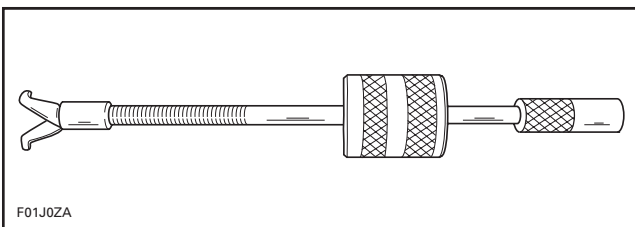


1. Bearing of starter drive assembly

Removal

Starter drive bearing can be easily removed from lower crankcase half using the following suggested tool or equivalent:

- Snap-on hammer puller including:
- handle CJ93-1
- hammer CJ125-6
- claws CJ93-4.



Close puller claws so that they can be inserted in end bearing. Holding claws, turn puller shaft clockwise so that claws open and become firmly tight against bearing.

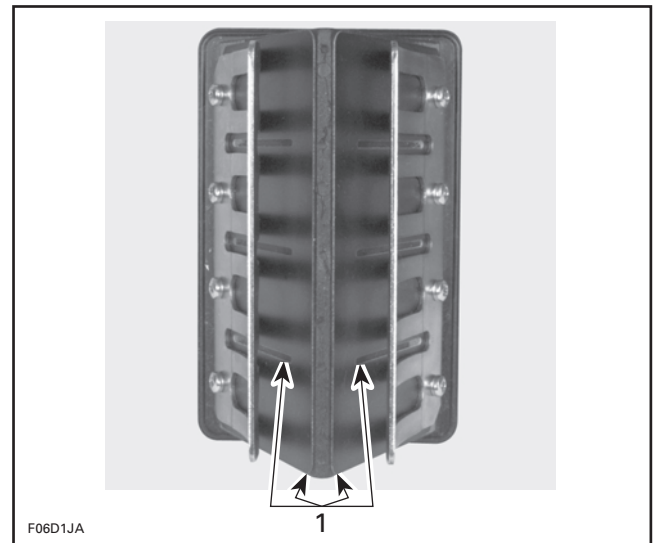
Slide puller hammer outwards and tap puller end. Retighten claws as necessary to always maintain them tight against bearing. Continue this way until bearing completely comes out.

For installation, see below in this section.

Reed Valve

947 Engine Only

Check reed valve petals no. 29 for cracks or other defects. The reed petals must lie completely flat against the reed valve body no. 30. To check, hold against light.

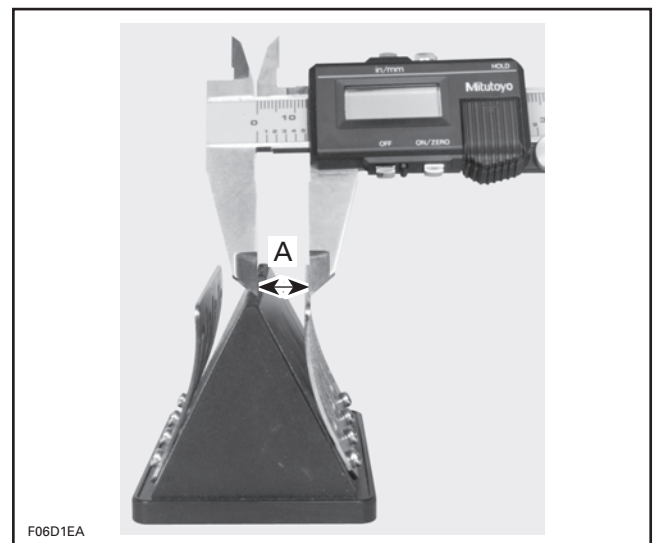


1. No play

In case of a play, turn reed petals upside down and recheck. If there is still a play, replace petals.

Check perfect condition of rubber coating on reed valve body.

Check stopper distance from center of reed valve block.



A. $13 \pm 0.25 \text{ mm}$ ($.512 \pm .010 \text{ in}$)

Section 04 ENGINE

Subsection 06 (BOTTOM END)

NOTE: Distance should be the same on both sides.
Bent stopper as required to obtain the proper distance.

ASSEMBLY

Assembly is essentially the reverse of disassembly procedures. However pay particular attention to the following.

NOTE: It is recommended to spray BOMBARDIER-ROTAX injection oil on all moving parts when re-assembling the engine.

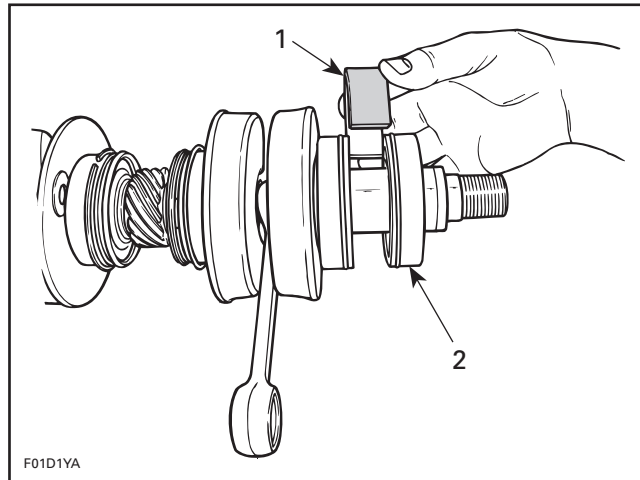
Crankshaft and Bearing

Apply Loctite 767 anti-seize on part of crankshaft where bearing fits.

Prior to installation, place bearings **no. 4** into a container filled with oil, previously heated to 75°C (167°F). This will expand bearing and ease installation.

To properly position the outer bearing(s), a distance gauge must be temporarily installed against the inner bearing. Slide the outer bearing until stopped by the distance gauge, then remove it.

ENGINE	DISTANCE GAUGE
717	P/N 529 034 800 (PTO)
787 RFI	P/N 529 034 900 (MAG)
947	P/N 529 035 100 (MAG) P/N 529 035 000 (PTO)



TYPICAL

1. Distance gauge
2. Outer bearing

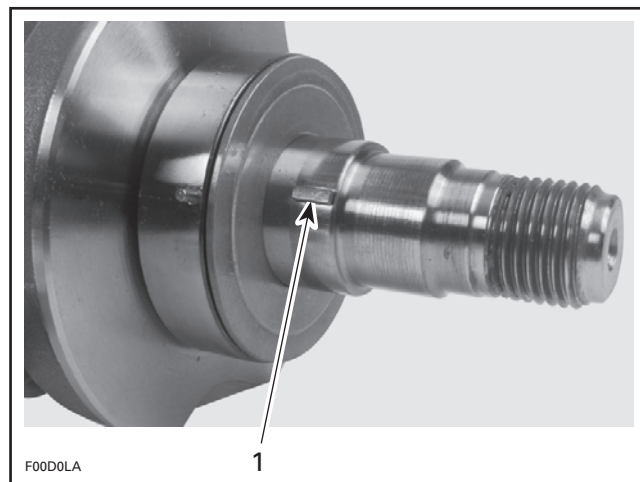
Distance Ring

When installing the distance ring **no. 12**, make sure to position it with its chamfer toward the counterweight of the crankshaft.

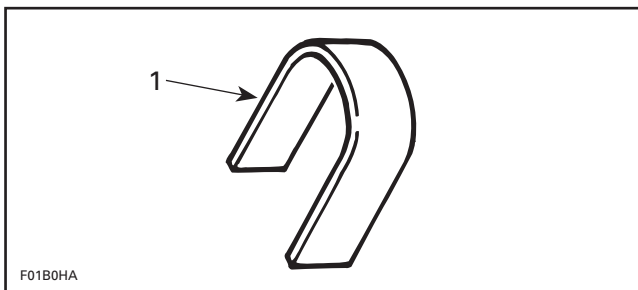
Crankshaft Gear

787 RFI Engine

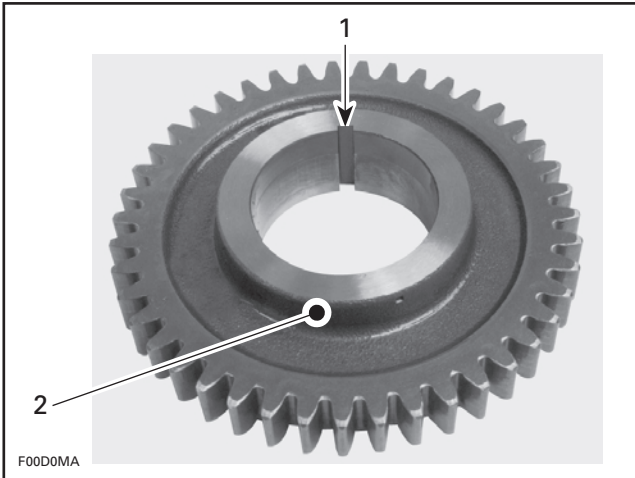
Position the long flange of the gear **no. 18** toward the counterweight of the crankshaft. Also, make sure to align the gear keyway with the Woodruff key on the crankshaft.



1. Woodruff key on the crankshaft



1. Distance gauge



1. Keyway
2. Long flange toward the crankshaft counterweight

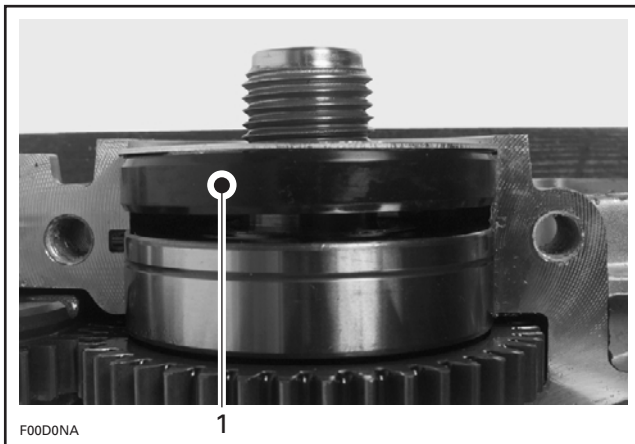
Crankshaft Seal

All Models

When installing seal assembly **no. 5**, apply a light coat of lithium grease on seal lips.

787 RFI Engine

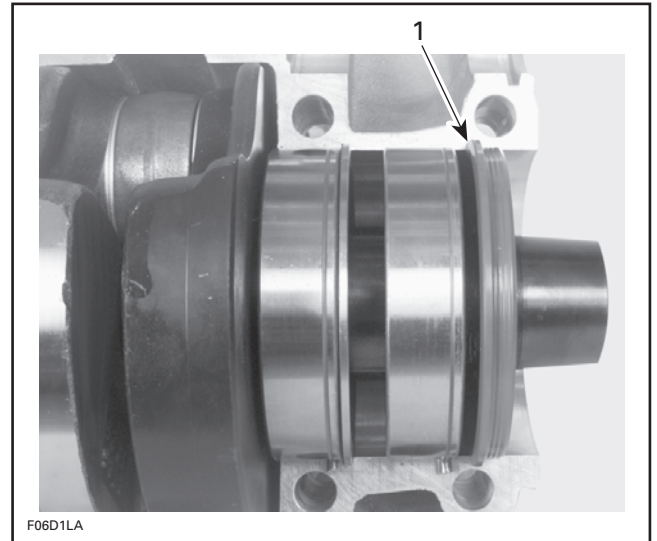
Position PTO seal against the retaining shim; the gap between the seal **no. 5** and bearing **no. 4** will ensure proper lubrication of the bearing.



1. Seal against the retaining shim

947 Engine

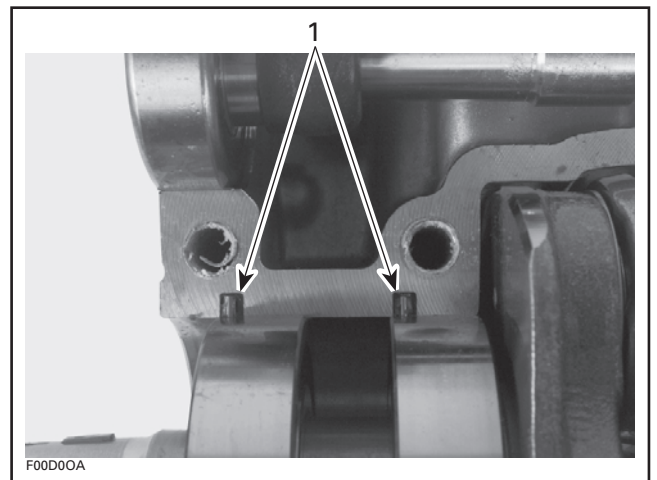
Seals are positioned with the outer lip in the crankcase recess.



1. Seal lip in crankcase recess

Drive Pin

Make sure drive pins **no. 6** of bearings are properly installed in crankcase recesses at assembly.



1. Drive pins

Section 04 ENGINE

Subsection 06 (BOTTOM END)

Counterbalance Shaft

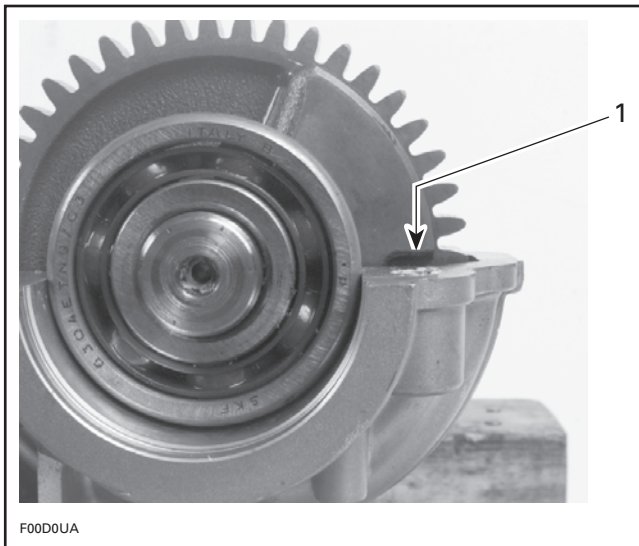
787 RFI Engine

Press gear no. 14 onto counterbalance shaft no. 13 taking care to align both marks previously traced.

CAUTION: Counterbalance shaft must be properly assembled, otherwise engine will vibrate and premature wear will occur.

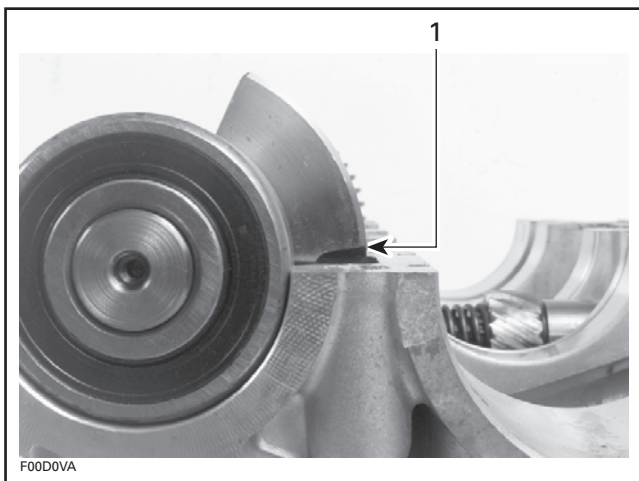
Proceed as follows to check if the gear no. 14 is properly positioned on the counterbalance shaft:

- Temporarily install the counterbalance shaft in the crankcase.
- Rotate the counterbalance shaft to align the notch of the gear with the crankcase.



1. Gear notch aligned with the crankcase

- The notch of the counterweight on the opposite end of the counterbalance shaft must also be aligned with the crankcase.



1. Counterweight notch aligned with the crankcase

If notches are not aligned with the crankcase, remove the gear and repeat the procedure until the notches are properly aligned.

947 Engine

Install bearing no. 31 and washer no. 32.

When installing seals no. 17, apply a light coat of Molykote 111 on seal lips.

Prior to installation, place bearings no. 15 into a container filled with oil, previously heated to 75°C (167°F). This will expand bearings and ease their installation.

Reinstall counterweights no. 16 using a press and take care to align index marks previously traced.

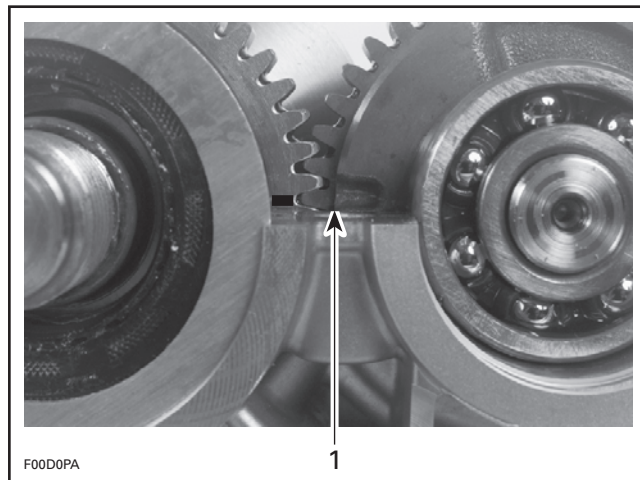
Crankshaft and Counterbalance Shaft

787 RFI and 947 Engines

Install crankshaft no. 3 first in crankcase.

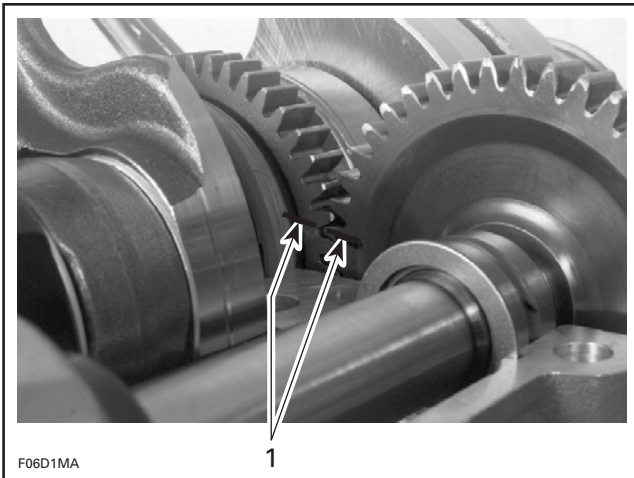
After crankshaft installation, install counterbalance shaft no. 13. Make sure to properly index crankshaft and counterbalance shaft by aligning marks of gears.

CAUTION: Marks on the crankshaft and counterbalance shaft must be aligned, otherwise engine will vibrate and premature wear will occur.



787 RFI ENGINE

1. Marks must be aligned



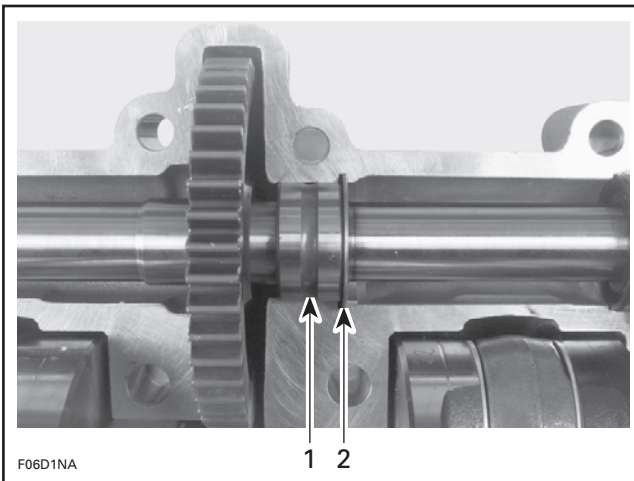
947 ENGINE

1. Marks must be aligned

Turn by hand the crankshaft and counterbalance shaft. Make sure they do not interfere with the crankcase.

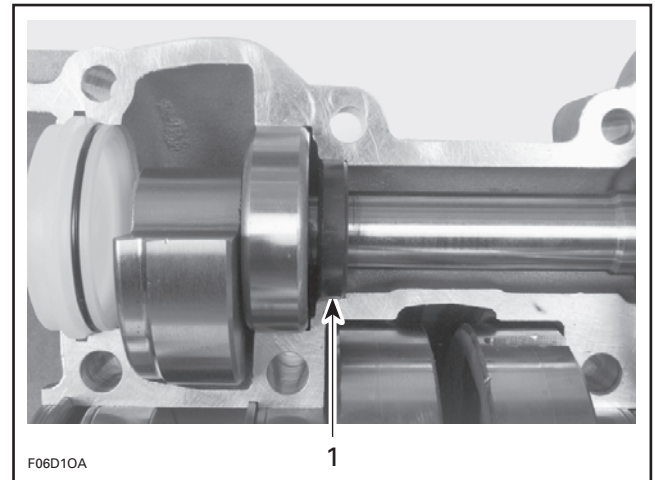
947 Engine

Properly position bearing no. 31 and washer no. 32.



1. Bearing
2. Washer in crankcase groove

Place seals no. 17 in their respective positions.



1. Seal in place

Crankcase

All Engines

Crankcase halves are factory matched and therefore, are not interchangeable or available as single halves.

Prior to joining crankcase halves, apply a light coat of Loctite 518 on mating surfaces. Do not apply in excess as it will spread out inside crankcase.

NOTE: On aluminum material it is recommended to use Loctite Primer N to reduce curing time and increase gap filling capability. Refer to manufacturer's instructions.

717 and 787 RFI Engines

Rotary valve shaft must be installed in crankcase before closing halves.

CAUTION: Before joining crankcase halves, make sure that crankshaft gear is well engaged with rotary valve shaft gear.

717 Engine

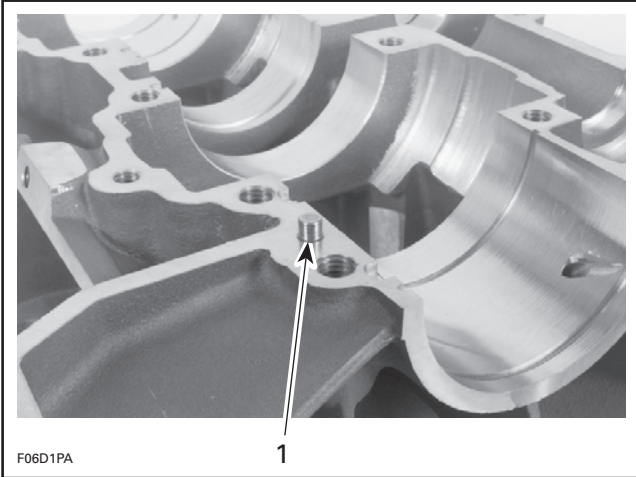
Temporarily install armature plate to align crankcase halves with each other.

Section 04 ENGINE

Subsection 06 (BOTTOM END)

947 Engine

Make sure all locating dowels are in place.

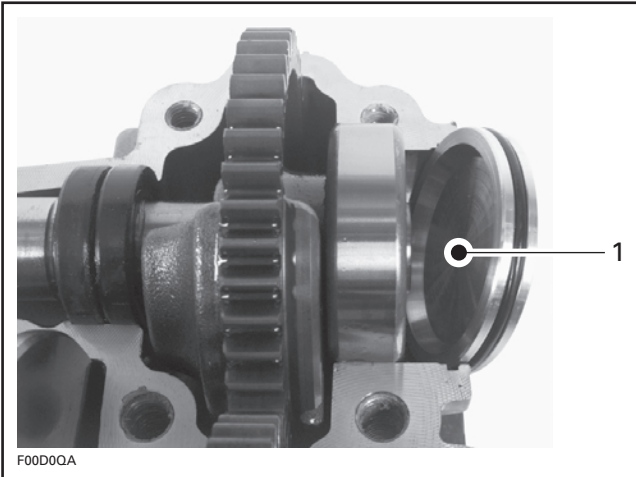


1. Dowel

Counterbalance Shaft Bearing Cover

787 RFI Engine

Install the bearing cover no. 19 with its hollow side toward the bearing.



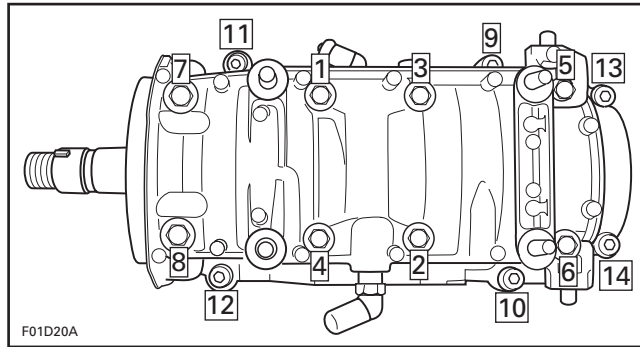
1. Hollow side facing bearing

Crankcase Screws

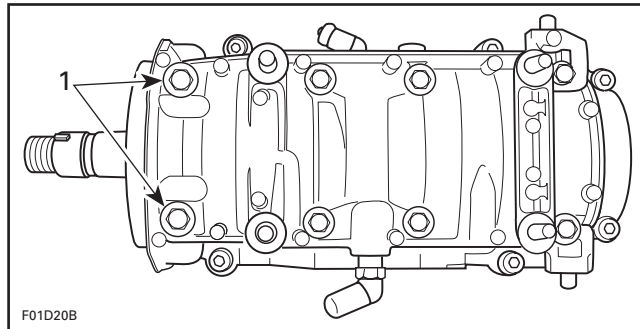
717 Engine

Apply Loctite 518 on screw threads and Molykote 111 below head screws.

Torque crankcase screws to 24 N•m (17 lbf•ft) as per following illustrated sequence.



Torque 2 M10 crankcase screws to 40 N•m (30 lbf•ft).

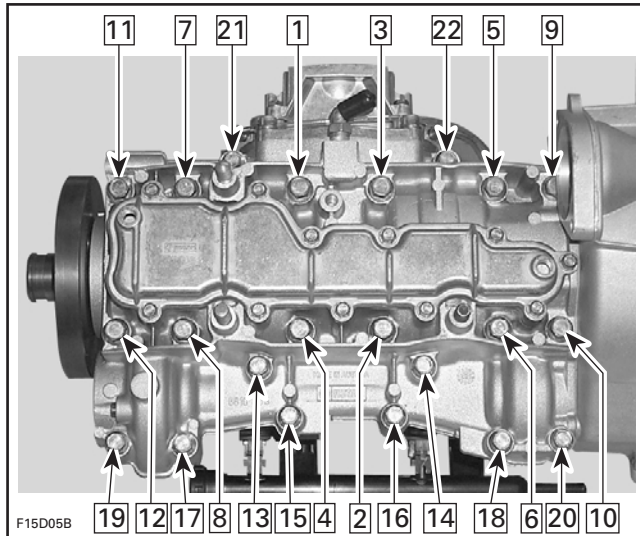


1. Torque to 40 N•m (30 lbf•ft)

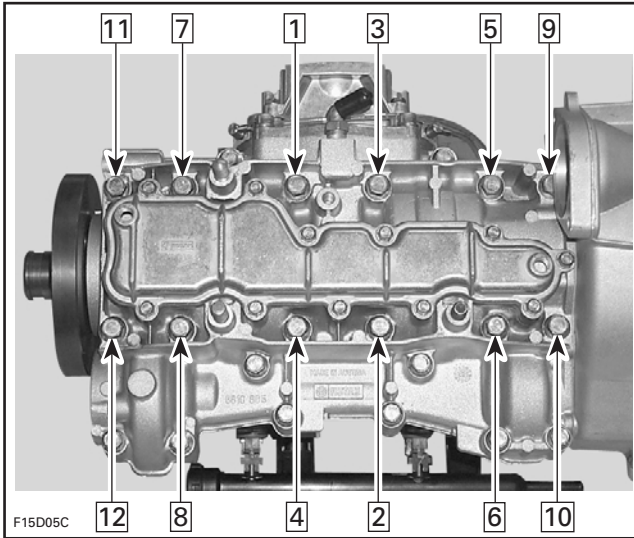
787 RFI Engine

Apply Loctite 518 on screw threads and Molykote 111 below head screws.

Torque crankcase screws to 12 N•m (9 lbf•ft) as per following sequence. Repeat procedure, re-tightening all screws to 24 N•m (17 lbf•ft).



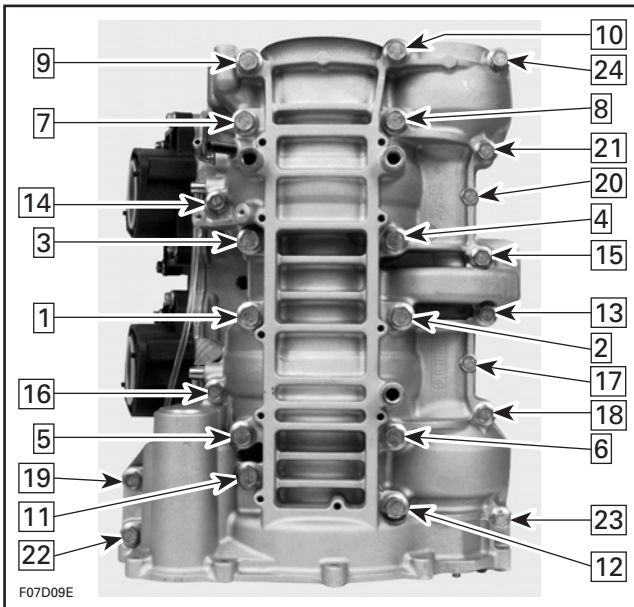
As a final step, torque only M10 screws **no. 8** of crankcase to 40 N•m (30 lbf•ft) as per following sequence.



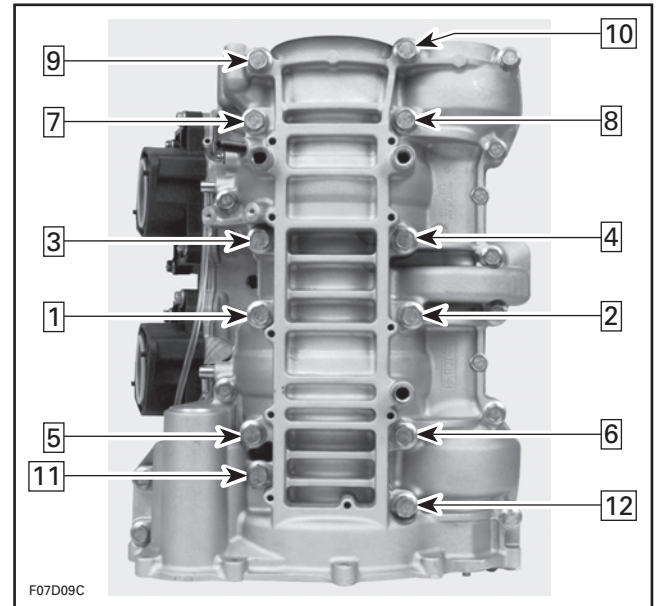
947 Engine

Apply Molykote 111 below head of screws and Loctite 518 on threads.

Torque crankcase screws to 12 N•m (9 lbf•ft) as per following sequence. Repeat procedure, re-tightening all screws to 27 N•m (20 lbf•ft).



As a final step, torque only the M10 x 73.5 bolts to 40 N•m (30 lbf•ft) as per following sequence.



Oil Fittings

717 and 787 RFI Engines

If inlet and outlet oil fittings **no. 11** of rotary valve shaft have been removed from crankcase, reinstall them with their end pointing toward ignition housing. Apply Loctite 518 on threads of fittings.

Stud

717 Engine

At assembly in crankcase, apply Loctite 518 on threads of studs **no. 10**. Torque to 10 N•m (88 lbf•in).

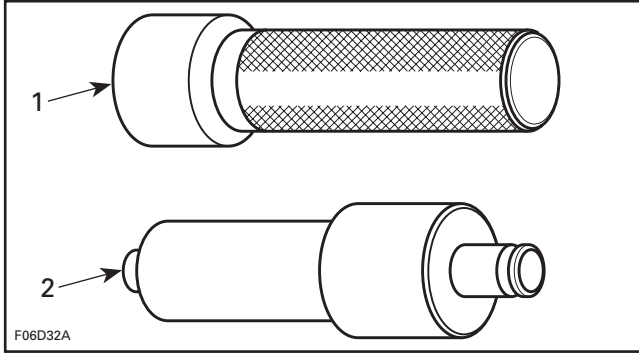
Section 04 ENGINE

Subsection 06 (BOTTOM END)

Starter Drive Bearing

947 Engine

To install bearing no. 23 of starter drive assembly, use pusher (P/N 290 876 502) and handle (P/N 420 877 650).

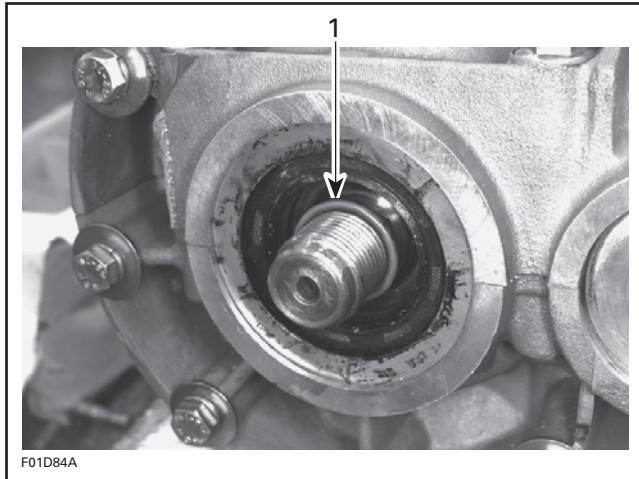


1. Handle
2. Pusher

PTO Flywheel

787 RFI Engine

Install O-ring onto crankshaft.



1. O-ring

717 and 787 Engines

Apply Loctite anti-seize lubricant (P/N 293 800 023) to crankshaft threads.

Using the same tools as for disassembly procedure, torque PTO flywheel to 110 N•m (81 lbf•ft).

947 Engine

Apply Loctite 243 (blue) on bolt no. 22.

Using the same tools as for disassembly procedure, torque bolt no. 22 to 115 N•m (85 lbf•ft).

Apply Loctite 648 on mating surface of PTO flywheel and coupler.

Apply Loctite 243 (blue) to Allen screws no. 21 of coupler and torque to 23 N•m (17 lbf•ft).

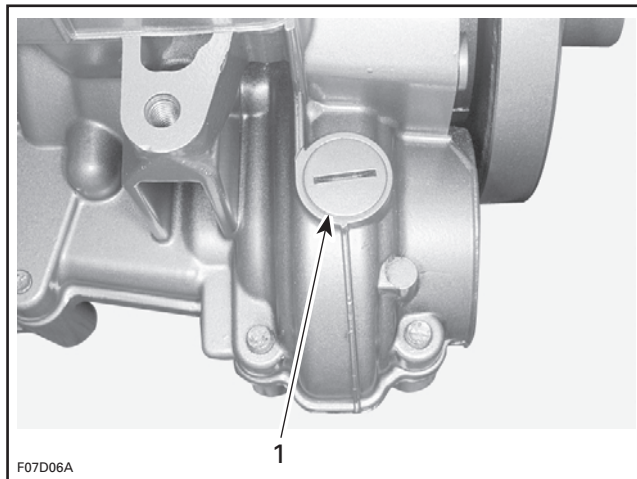
Final Assembly

717 and 787 RFI Engines

For rotary valve timing and assembly procedures, refer to ROTARY VALVE.

787 RFI Engine

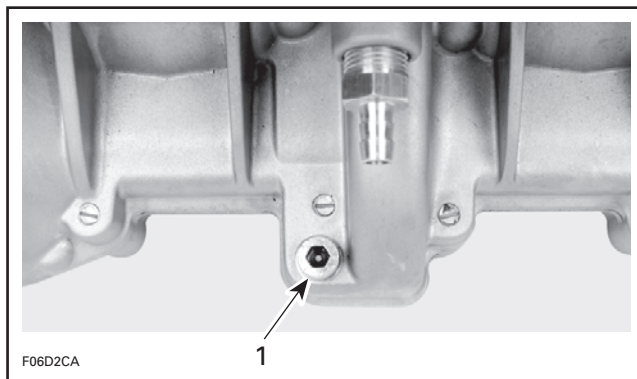
When engine assembly is completed, add 30 mL (1oz) of motor oil SAE 30 to the counterbalance shaft gear through the crankcase filler plug.



1. Remove plug and add SAE 30 motor oil

947 Engine

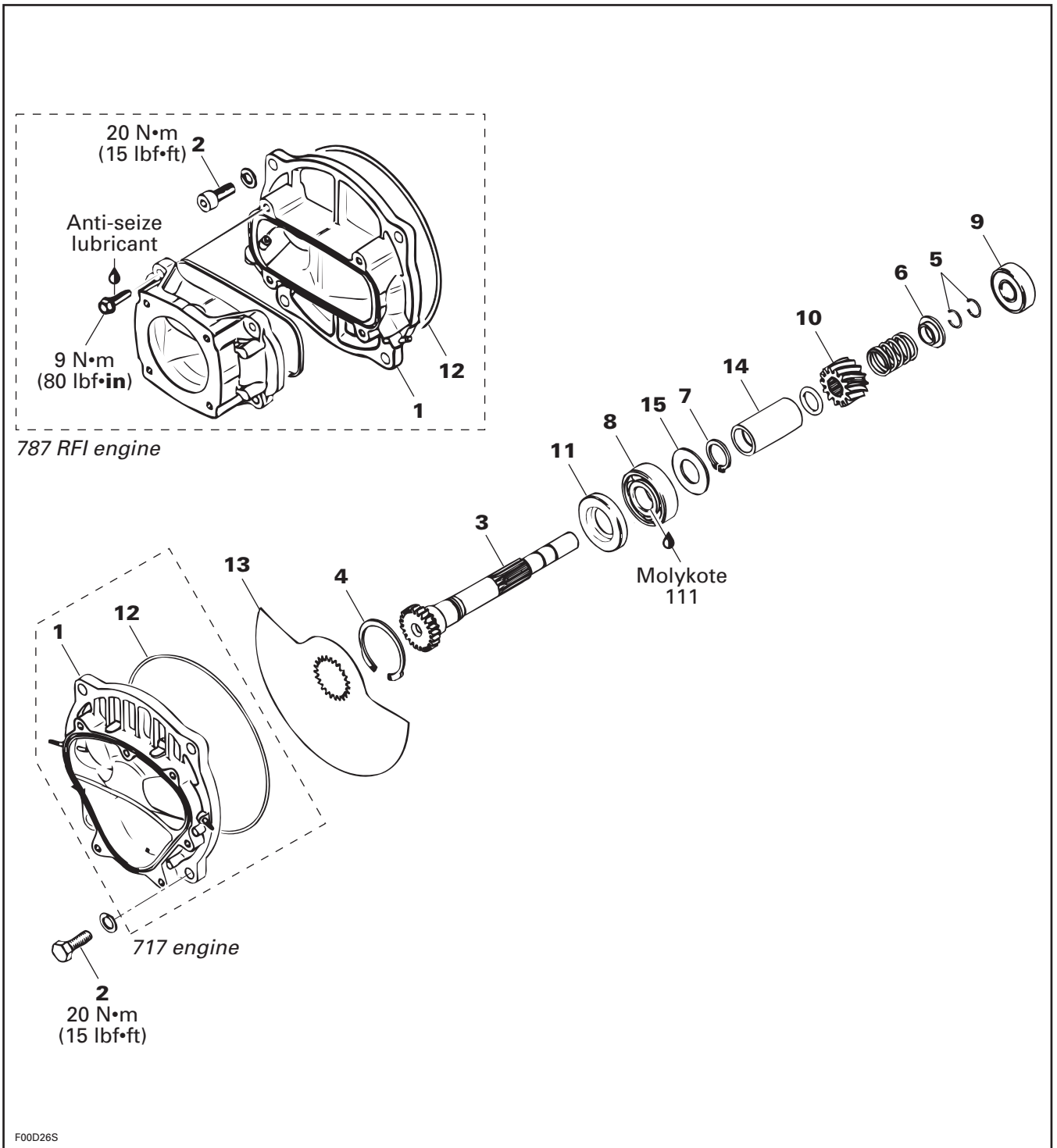
When engine assembly is completed, add 40 mL (1.35 oz) of motor oil SAE 30 to the counterbalance shaft gear through the crankcase filler plug.



1. Remove plug and add SAE 30 motor oil

ROTARY VALVE

717 and 787 RFI Engines



Section 04 ENGINE

Subsection 07 (ROTARY VALVE)

GENERAL

The following verification procedures such as clearance of rotary valve cover or rotary valve shaft gear backlash can be performed without removing engine from watercraft.

However engine must be removed from watercraft to work on rotary valve shaft/components. Refer to REMOVAL AND INSTALLATION for engine removal procedure.

Bottom end must be opened to remove rotary valve shaft. Refer to BOTTOM END.

INSPECTION ON WATERCRAFT

Remove carburetor(s). Refer to CARBURETOR.

Rotary Valve Cover

Unscrew 4 screws **no. 2** and withdraw rotary valve cover **no. 1**.

Remove rotary valve **no. 13**.

Rotary Valve/Cover Clearance

The clearance between the rotary valve and the cover must be 0.30 ± 0.05 mm ($.012 \pm .002$ in).

NOTE: If the clearance is below 0.25 mm (.010 in) this could create an overheating situation and if the clearance is over 0.35 mm (.014 in) this could create a hard starting situation.

There are 2 methods to verify rotary valve/cover clearance:

- the 45° feeler gauge method
- the soldering wire method.

45° FEELER GAUGE METHOD

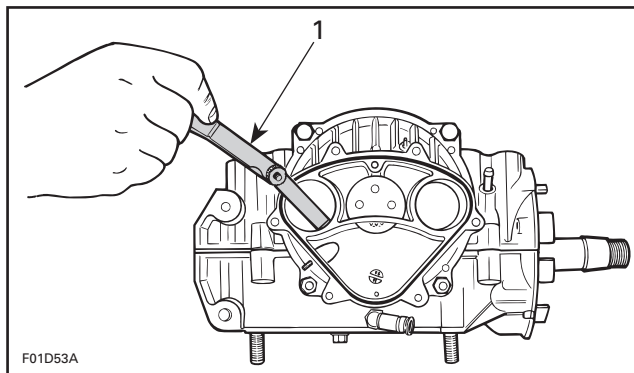
Remove O-ring **no. 12** from rotary valve cover **no. 1**.

Remove intake manifold from rotary valve cover (except **787 engine**).

Reinstall cover **no. 1** in place **WITHOUT** its O-ring and torque screws to 20 N•m (15 lbf•ft).

Insert feeler gauge blade through cover inlet ports to verify clearance. At least verify clearance at two different places in each port.

Feeler gauge blade from 0.25 mm (.010 in) to 0.35 mm (.014 in) thickness should fit between rotary valve and cover.



1. 45° feeler gauge

If rotary valve cover clearance is out of specifications, machine rotary valve cover seating surface or replace the cover.

SOLDERING WIRE METHOD

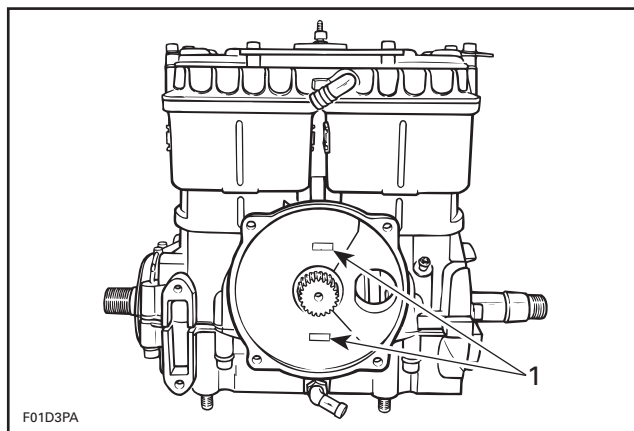
Remove O-ring from rotary valve cover.

Use the following type of solder:

- resin core
- diameter: 0.8 mm (.032 in)
- electronic application (available at electronic stores).

Install 2 soldering wire pieces of 13 mm (1/2 in) long directly on rotary valve, one above and one below rotary valve gear. Apply grease to hold solder in position.

Refer to the following illustration for proper position of rotary valve and pieces of soldering wire.



TYPICAL

1. Soldering wire

Reinstall cover in place **WITHOUT** its O-ring and torque screws to 20 N•m (15 lbf•ft).

Remove cover then clean and measure compressed soldering wire thickness, it must be within the specified tolerance 0.30 ± 0.05 mm ($.012 \pm .002$ in).

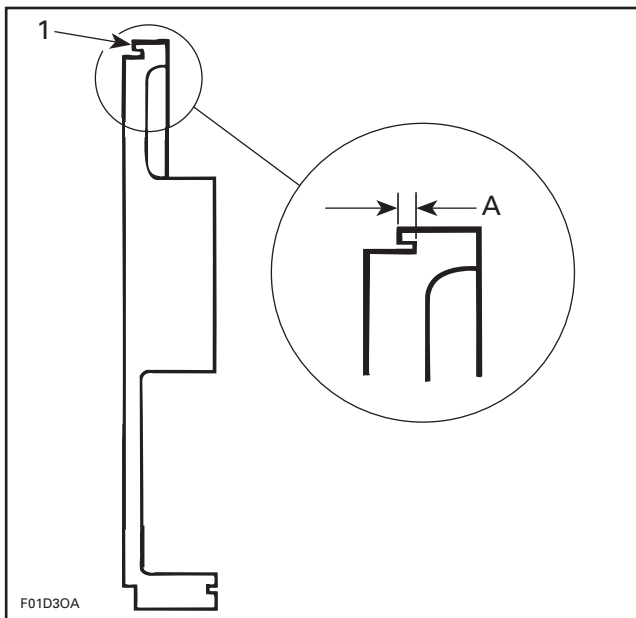
If rotary valve cover clearance is over specified tolerances, machine rotary valve cover seating surface or replace the cover.

MACHINING INFORMATION

The amount of material over tolerance must be removed from the rotary valve cover seating surface.

Also cut the O-ring groove the same amount to keep the 1.00 ± 0.03 mm ($.039 \pm .001$ in) depth between the bottom of the groove and the seating surface.

Remove burrs on the edges of the seating surface and O-ring groove.



SAME AMOUNT REMOVED FROM COVER SEATING SURFACE AND O-RING GROOVE BASE

- 1. Cover seating surface
- A. O-ring groove depth must be 1.00 ± 0.03 mm ($.039 \pm .001$ in)

Reverify the clearance.

At assembly the rotary valve timing must remain as per original setting.

NOTE: If rotary valve crankcase surface is worn, it is possible to have it reworked at the factory. Contact your dealer or distributor.

Rotary Valve Shaft Gear Backlash

Remove PTO flywheel guard.

Remove spark plugs, rotary valve cover and valve.

Manually feel backlash at one position, then turn crankshaft about 1/8 turn and recheck. Continue this way to complete one revolution.

Backlash must be even at all positions. Otherwise overhaul engine to find which part is faulty (gear, rotary valve shaft or crankshaft with excessive deflection).

DISASSEMBLY

Rotary Valve Cover

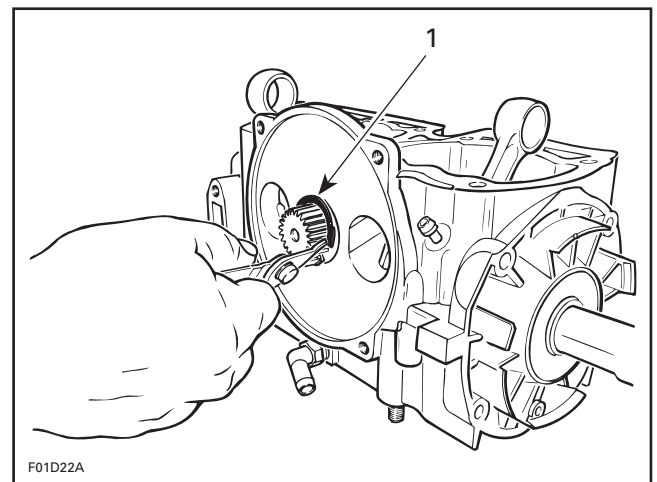
Unscrew 4 retaining screws and withdraw rotary valve cover no. 1 and rotary valve no. 13.

Rotary Valve Shaft

To remove the rotary valve shaft assembly, the engine must be removed from watercraft (refer to ENGINE).

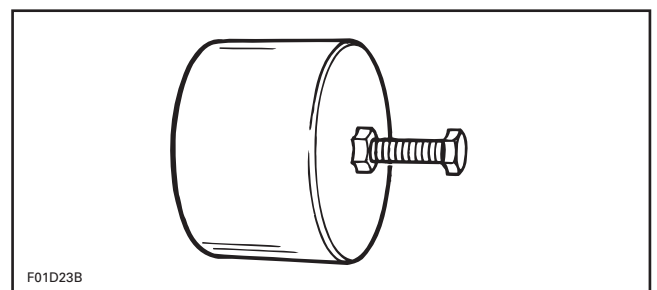
Open bottom end and remove crankshaft (refer to BOTTOM END).

First remove snap ring no. 4 from crankcase.



1. Removing snap ring

To remove rotary valve shaft assembly, use the appropriate puller (P/N 290 876 488).

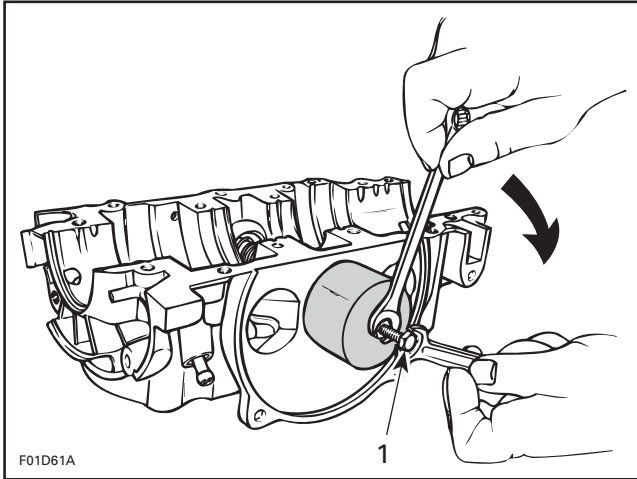


PULLER (P/N 290 876 488)

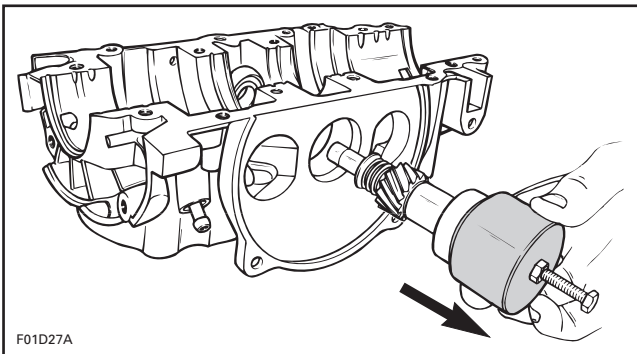
Section 04 ENGINE

Subsection 07 (ROTARY VALVE)

Place puller over rotary valve shaft end and screw on puller bolt into shaft. While retaining bolt with a wrench, turn puller nut **CLOCKWISE** until shaft comes out.

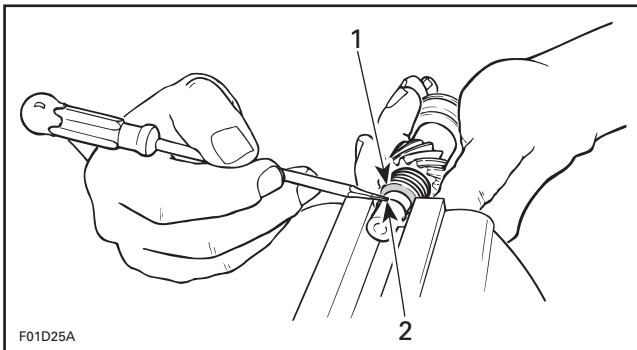


1. Hold bolt



Circlip and Spring Seat

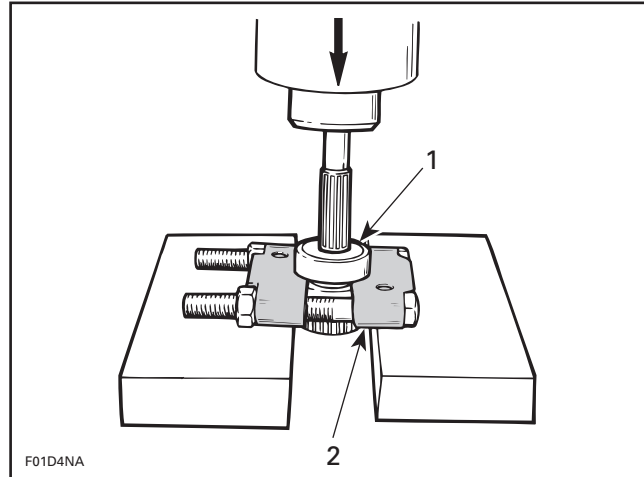
If it is necessary to disassemble components of rotary valve shaft assembly, use seat **no. 6** to compress spring and remove circlips **no. 5**.



1. Compress seat
2. Remove circlips

Shaft Bearing

To remove bearing **no. 8** use a bearing extractor such as Snap-on **no. CJ-950** (or equivalent) as illustrated. Slide off distance sleeve **no. 14**, remove snap ring **no. 7** and washer **no. 15** then press shaft out.

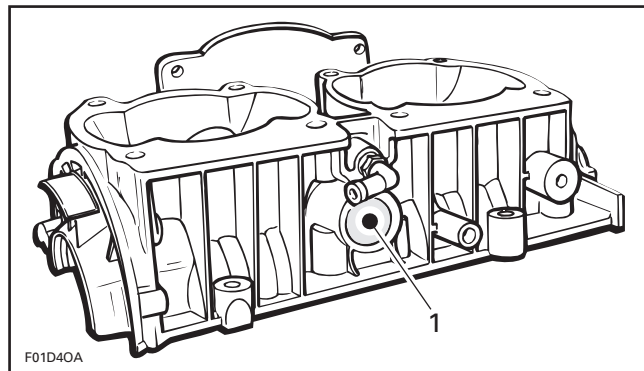


1. Bearing
2. Bearing extractor Snap-on CJ-950

CAUTION: Ensure that rotary valve shaft is perfectly perpendicular with press tip.

End Bearing

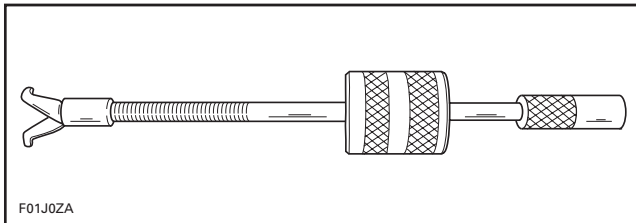
CAUTION: Do not remove plug against bearing in upper crankcase half.



1. Do not remove this plug

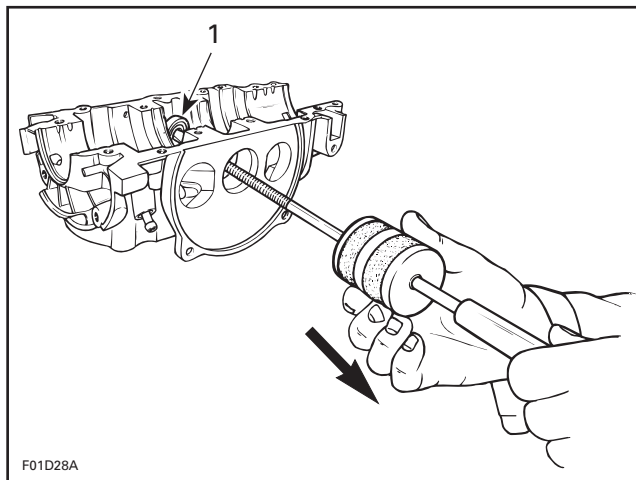
End bearing **no. 9** can be easily removed from upper crankcase half using the following suggested tool (or equivalent):

- Snap-on hammer puller including:
 - handle CJ93-1
 - hammer CJ125-6
 - claws CJ93-4.



Close puller claws so that they can be inserted in end bearing. Holding claws, turn puller shaft clockwise so that claws open and become firmly tight against bearing.

Slide puller hammer outwards and tap puller end. Retighten claws as necessary to always maintain them tight against bearing. Continue this way until bearing completely comes out.



1. End bearing

CLEANING

Discard all seals and O-rings.
Clean all metal components in a solvent.
Clean oil passages and make sure they are not clogged.
Clean rotary valve shaft and inside of distance sleeve **no. 14**.

INSPECTION

Rotary Valve Cover

Inspect rotary valve cover **no. 1** for warpage. Small deformation can be corrected by surfacing with fine sand paper on a surface plate. Surface part against oiled sand paper.

Bearings

Inspect bearings **no. 8** and **no. 9**. Check for scoring, pitting, chipping or other evidence of wear. Make sure plastic cage (on bigger bearing) is not melted. Rotate them and make sure they turn smoothly.

Gear

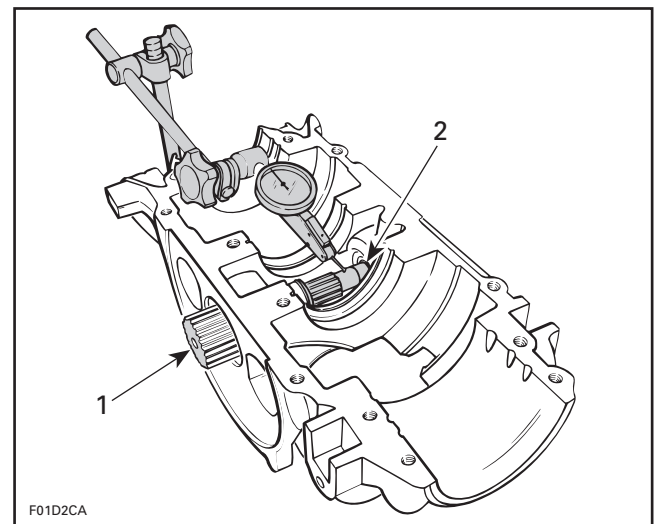
Visually check gear wear pattern. It should be even on tooth length all around. Otherwise it could indicate a bent shaft, check deflection. Replace gear if damaged.

Check for presence of brass filings in gear housing.

Rotary Valve Shaft Deflection

Deflection is measured with a dial gauge. Install rotary valve shaft in crankcase half, without its gear.

NOTE: End bearing must be in crankcase half. Measure shaft deflection next to gear splines.



1. Rotary valve shaft
2. End bearing in place

Deflection must not exceed 0.08 mm (.003 in). Replace shaft as necessary.

Section 04 ENGINE

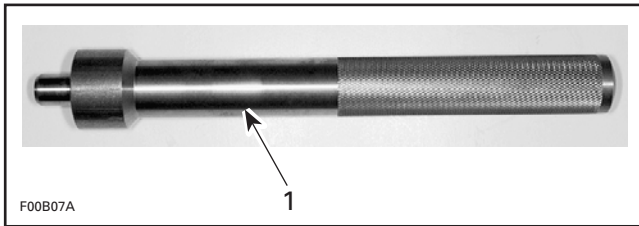
Subsection 07 (ROTARY VALVE)

ASSEMBLY

Assembly is essentially the reverse of disassembly procedures. However pay particular attention to the following.

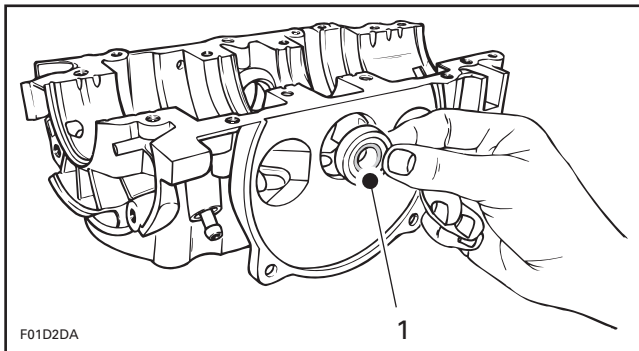
Bearing

To install end bearing **no. 9** in crankcase, use pusher (P/N 420 876 501).



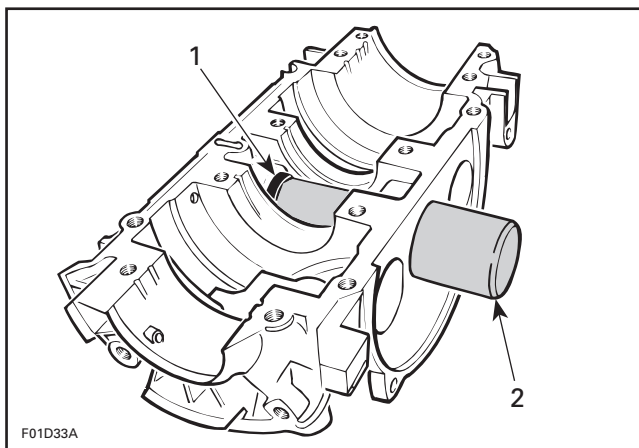
1. Pusher (P/N 420 876 501)

Position ball bearing shielded side towards rotary valve.



1. Shield side (toward gear)

Push bearing until it stops on its seat.



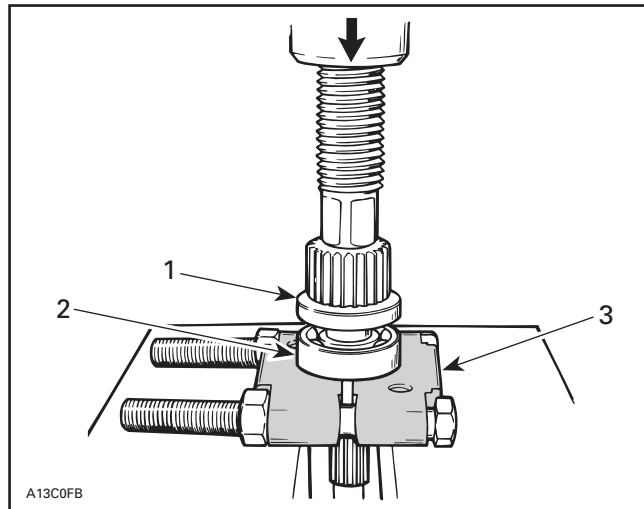
1. Bearing
2. Pusher

Seal

Apply lithium grease on seal lips. Position seal **no. 11** with shielded portion against shaft splines.

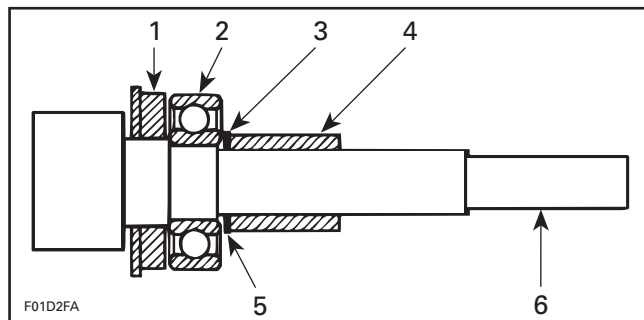
Bearing

Install ball bearing as illustrated.



1. Seal
2. Ball bearing
3. Bearing extractor Snap-on CJ-950

Install washer **no. 15**, snap ring **no. 7** and slide distance sleeve **no. 14** on shaft.



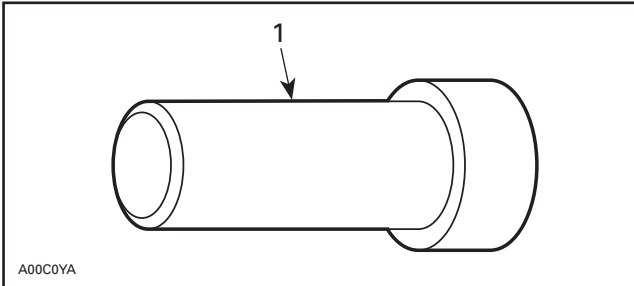
1. Seal
2. Ball bearing
3. Snap ring
4. Distance sleeve
5. Washer 0.5 mm (.020 in)
6. Rotary valve shaft

Rotary Valve Shaft Assembly

CAUTION: Crankcase halves must be separated and crankshaft must not be present to install rotary valve shaft assembly in crankcase.

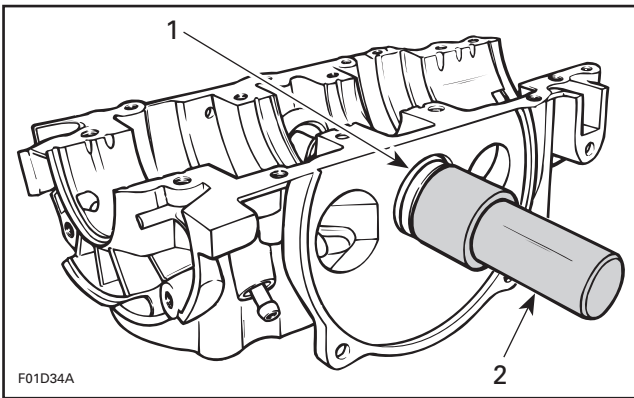
717 Engine

To install rotary valve shaft in crankcase, use a pusher (P/N 420 876 605).



1. Pusher

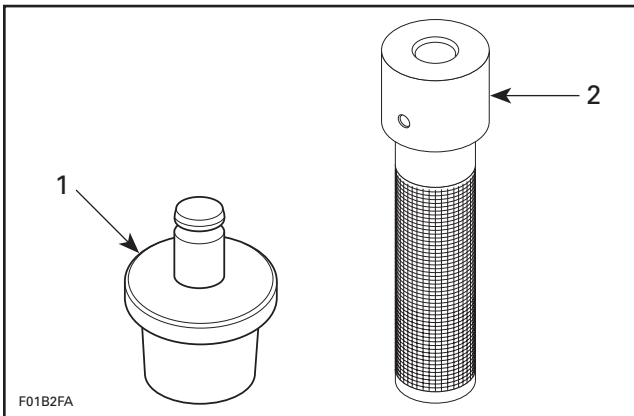
Push shaft until its stops on bearing seat.



1. Rotary valve shaft
2. Push shaft until it stops

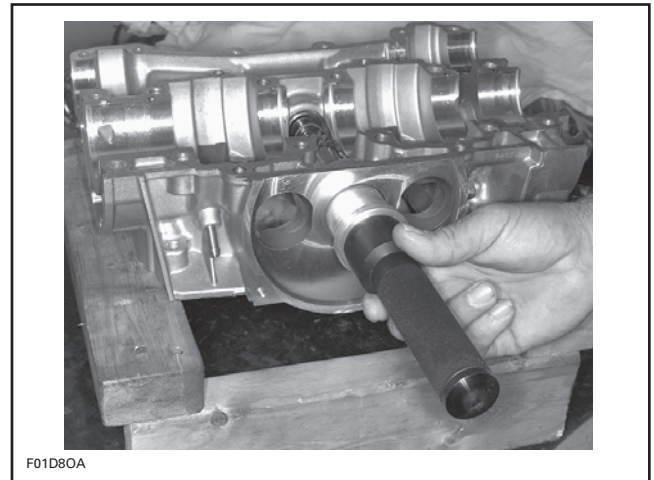
787 RFI Engine

To install rotary valve shaft in crankcase, use a pusher (P/N 290 876 609) and handle (P/N 290 877 650).



1. Pusher
2. Handle

Push shaft until it stops on bearing seat.



F01D80A

717 and 787 RFI Engines

Snap Ring

Position snap ring no. 4 so that its sharp edge faces outwards.

Rotary Valve

The rotary valve no. 13 controls the opening and closing of the inlet ports. Therefore its efficiency will depend on the precision of its installation.

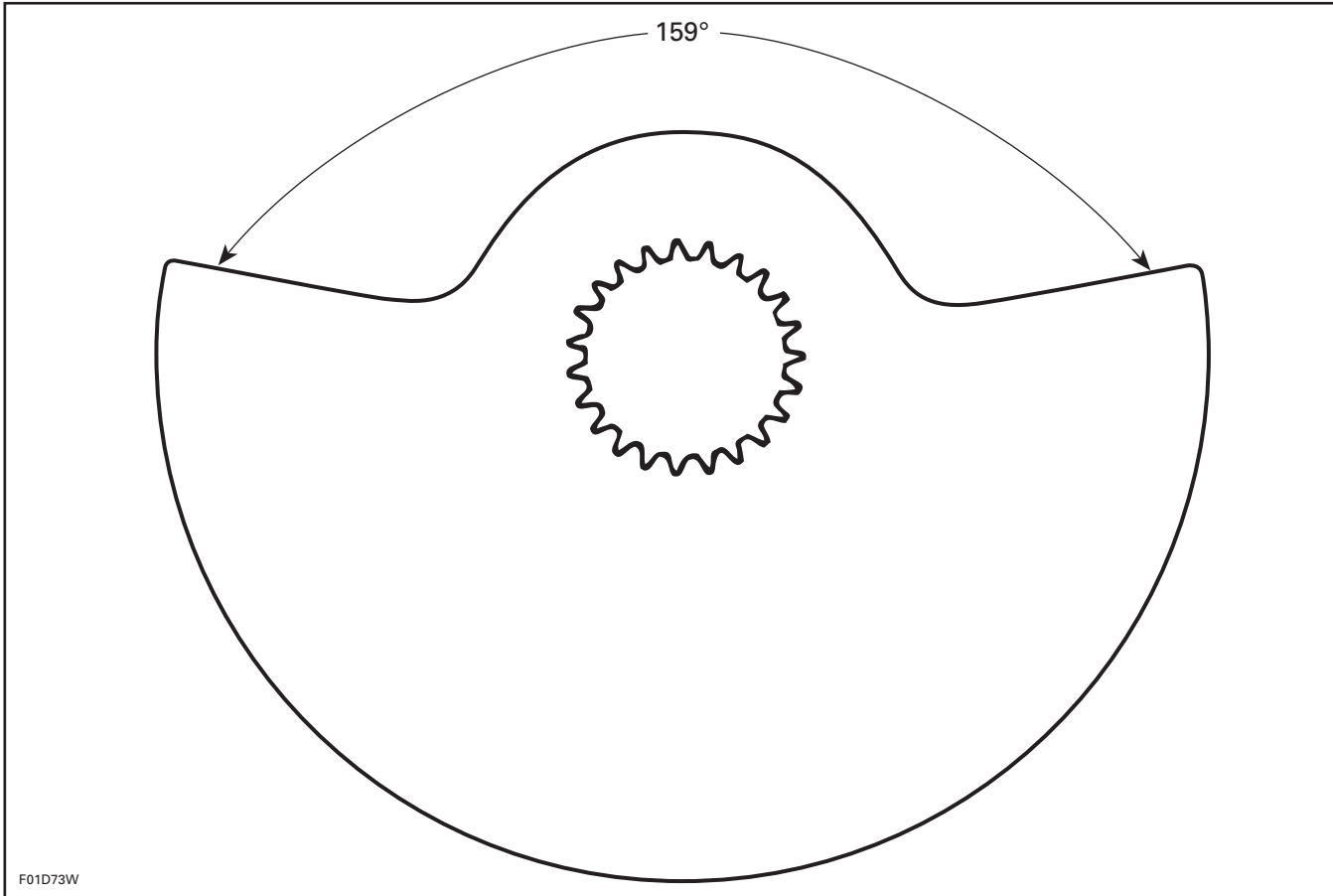
IDENTIFICATION OF THE ROTARY VALVE

ENGINE	ROTARY VALVE P/N	VALVE DURATION
717/787 RFI	420 924 502	159°

Section 04 ENGINE

Subsection 07 (ROTARY VALVE)

There is no identification code on the valve. To find out the duration, place an angle finder on the valve and measure the valve cut-out angle or use the following template.

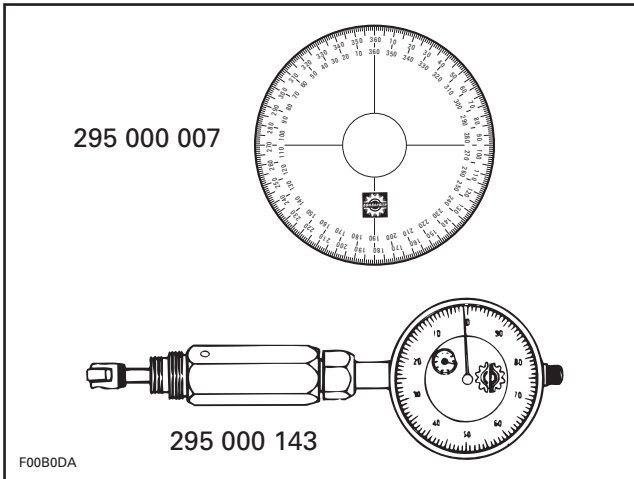


F01D73W

ROTARY VALVE TIMING

CAUTION: Never use the ridge molded in crankcase as a timing mark.

The following tools are required to measure rotary valve opening and closing angles in relation with MAG side piston.



Rotary valve must be set so that timing occurs as follows:

ENGINE	TIMING	
	OPENING BTDC	CLOSING ATDC
717	147° ± 5	65.5° ± 5
787 RFI	147° ± 5	63.5° ± 5

Timing Procedure

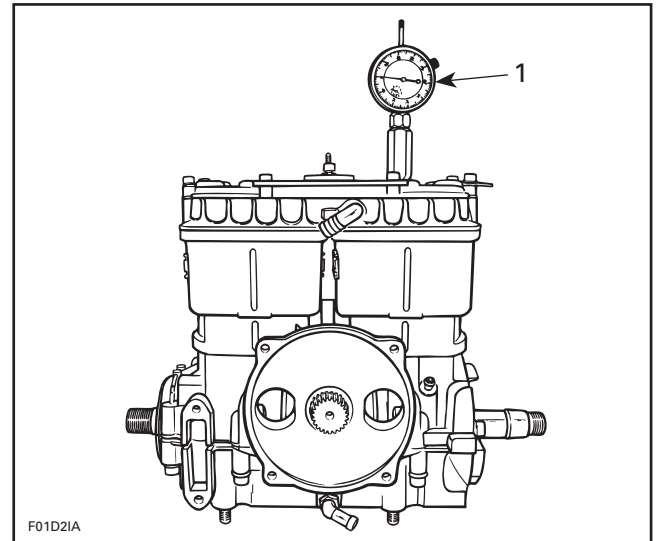
The following specifications are used in this procedure:

OPENING: 147° BTDC

CLOSING: 65° ATDC

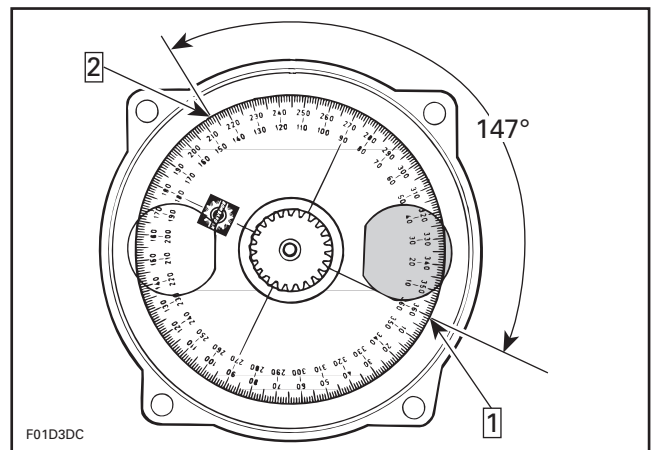
Proceed as follows:

- Turning crankshaft, bring **MAG side** piston to Top Dead Center using a TDC gauge.



1. Bring piston to TDC

- For **opening mark**, first align 360° line of degree wheel with **BOTTOM** of **MAG side** inlet port. Then, find 147° line on inner scale of degree wheel and mark crankcase at this point.



OPENING MARK

Step 1: Bottom of MAG inlet port.

Align 360° line of degree wheel

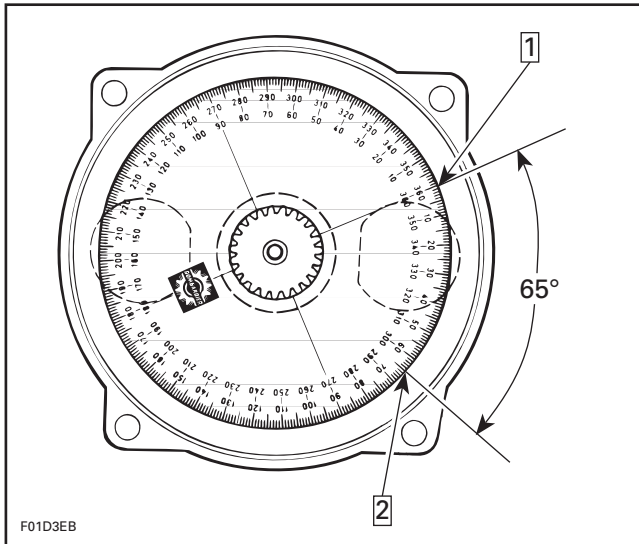
Step 2: Find 147° on inner scale of degree wheel and mark here

NOTE: Do not rotate the crankshaft.

Section 04 ENGINE

Subsection 07 (ROTARY VALVE)

- For **closing** mark, first align 360° line of degree wheel with TOP of **MAG side** inlet port. Then, find 65° line on outer scale of degree wheel and mark crankcase at this point.



CLOSING MARK

- Step **1**: Top of MAG inlet port.
Align 360° line of degree wheel
- Step **2**: Find 65° on outer scale of degree wheel and mark here

- Remove degree wheel.
- Position rotary valve on shaft splines to have edges as close as possible to these marks with the MAG piston at TDC.

NOTE: Rotary valve is asymmetrical. Therefore, try flipping it over then reinstall on splines to obtain best installation position.

Apply BOMBARDIER injection oil on rotary valve before reassembling rotary valve cover.

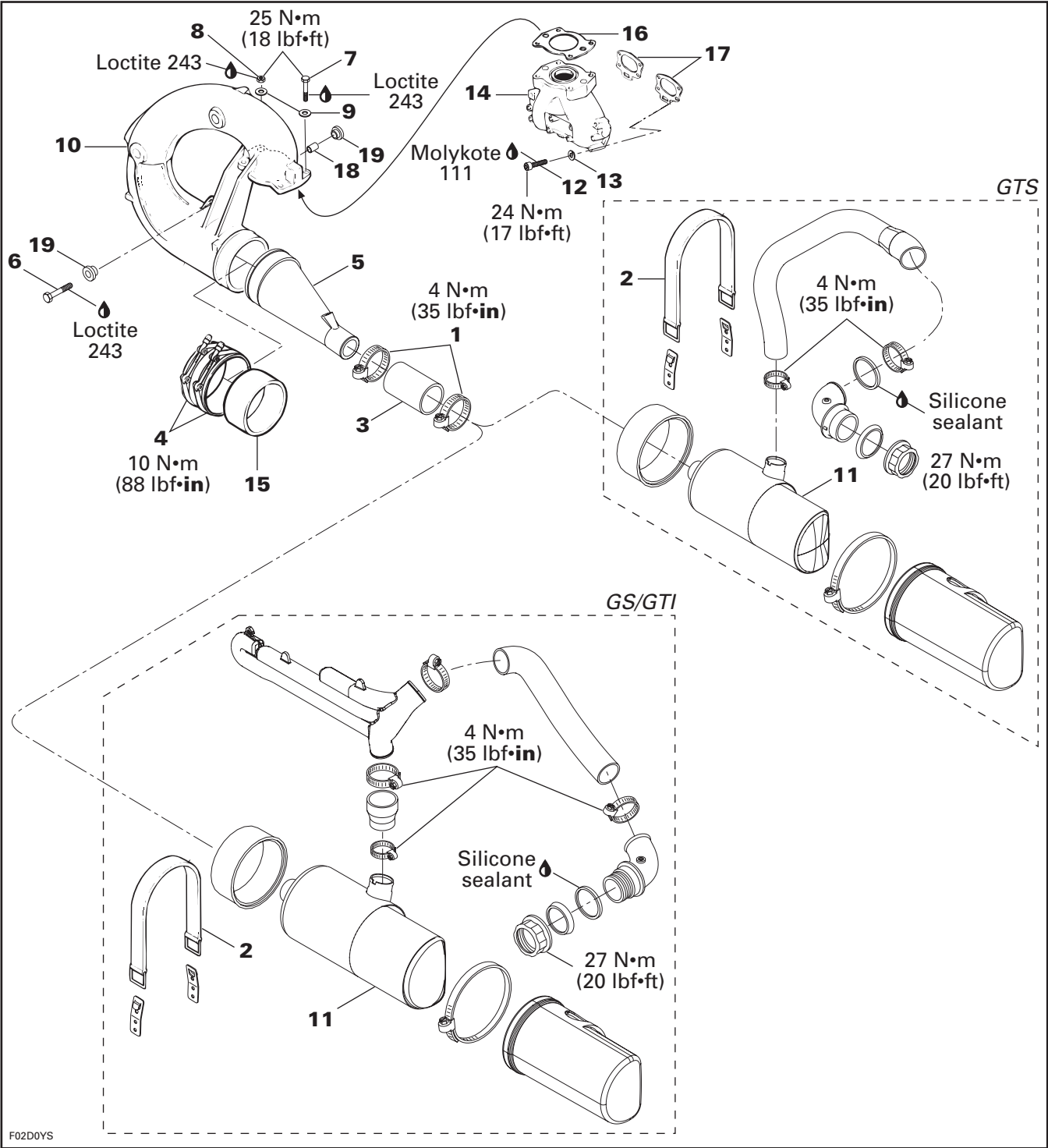
- Remove TDC gauge.

Rotary Valve Cover

Install O-ring **no. 12** and rotary valve cover **no. 1** then torque screws **no. 2** to 20 N•m (15 lbf•ft) in a criss-cross sequence.

EXHAUST SYSTEM

717 Engine

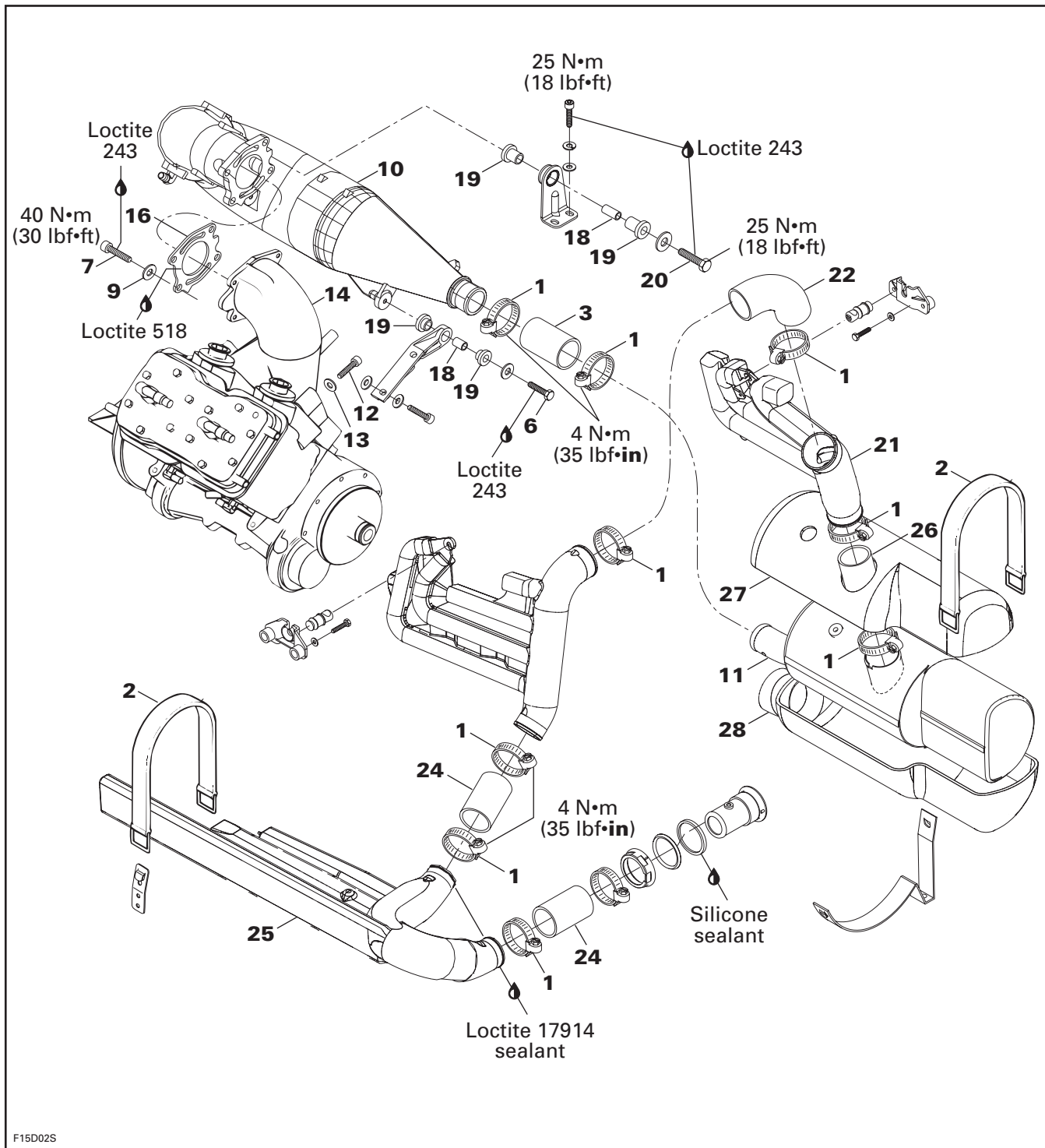


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Section 04 ENGINE

Subsection 08 (EXHAUST SYSTEM)

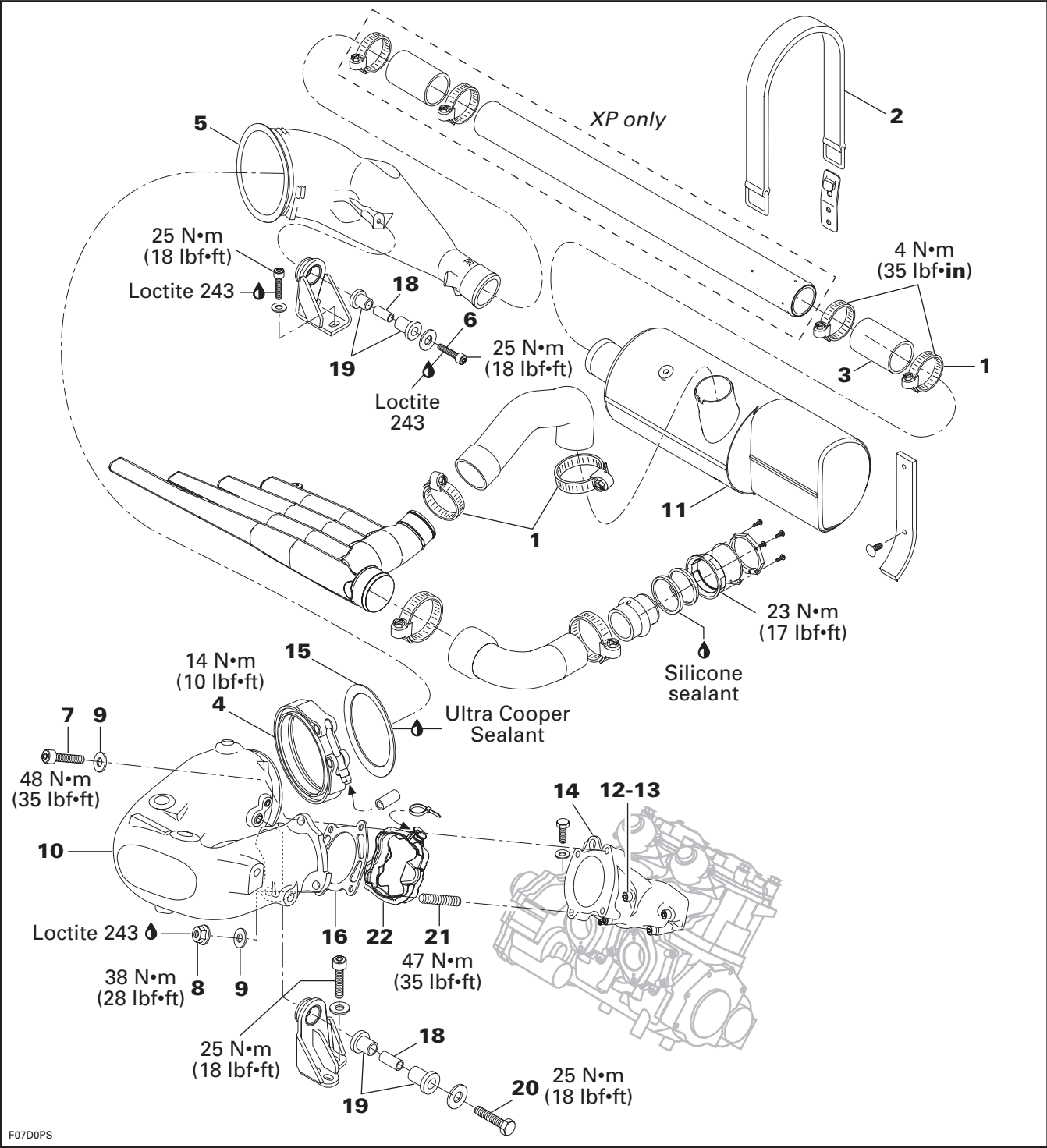
787 RFI Engine



F15D02S

Section 04 ENGINE
Subsection 08 (EXHAUST SYSTEM)

947 Engine



F07D0PS

Section 04 ENGINE

Subsection 08 (EXHAUST SYSTEM)

REMOVAL

All Models Except XP

Remove seat(s).

Remove rear vent hose support from body opening.



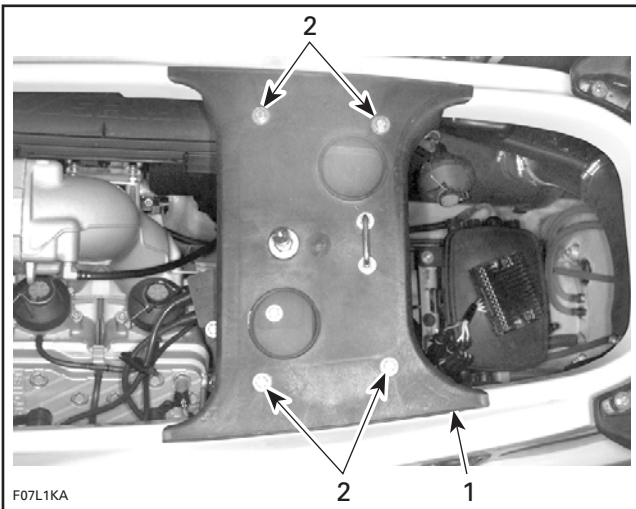
F06L0WA

1

GS AND GSX RFI

1. Rear vent hose support

Remove seat support (GTI, GTX RFI and GTX).



F07L1KA

2

1

GTI, GTX RFI AND GTX

1. Seat support
2. Remove screws

XP Model

Open engine compartment cover.

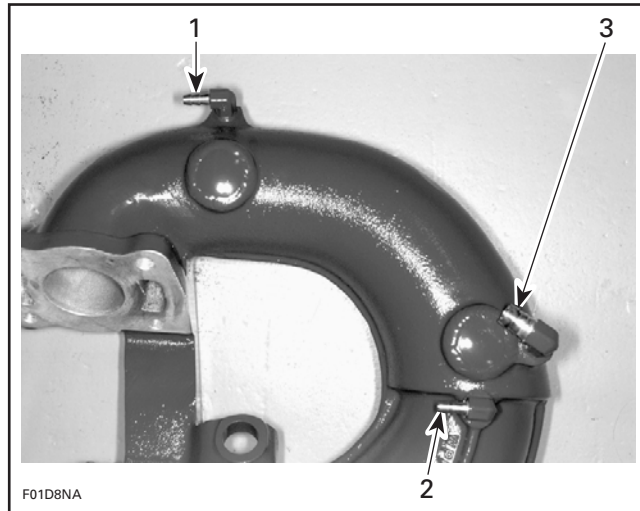
Remove storage basket.

Tuned Pipe

717 Engine

Disconnect water supply hose and water injection hose.

Disconnect tuned pipe bleed hose.



F01D8NA

2

3

TYPICAL

1. Bleed hose removed
2. Injection hose removed
3. Supply hose removed

Loosen exhaust hose collar **no. 1** at tuned pipe outlet.

Disconnect strap **no. 2** retaining muffler **no. 11**.

Remove exhaust hose **no. 3** from tuned pipe by pulling muffler.

Remove clamp **no. 4** from tuned pipe.

Remove tuned pipe cone **no. 5**.

Remove tuned pipe retaining screw **no. 6** from exhaust manifold side.

Remove screws **no. 7**, nut **no. 8** and flat washers **no. 9** from tuned pipe flange.

NOTE: Slightly lift tuned pipe to release nut as necessary. Take care not drop nut and flat washer.

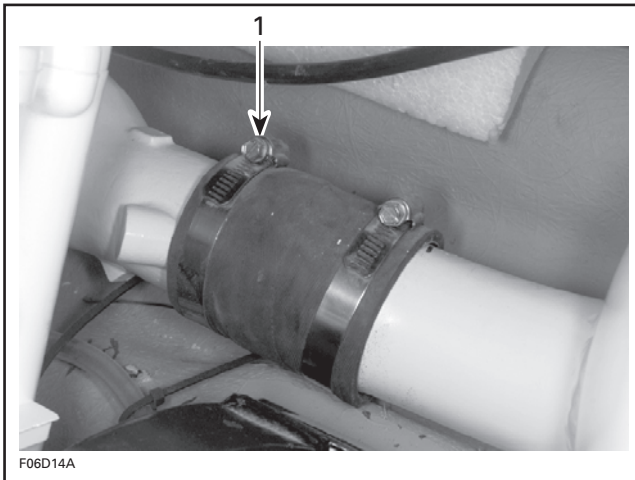
Withdraw tuned pipe head **no. 10** in a forward and rotating movement.

787 RFI Engine

Remove air intake silencer.

Disconnect water supply hose and water injection hose at tuned pipe.

Loosen hose clamp **no. 1** retaining exhaust hose **no. 3** to tuned pipe cone.



1. Loosen clamp

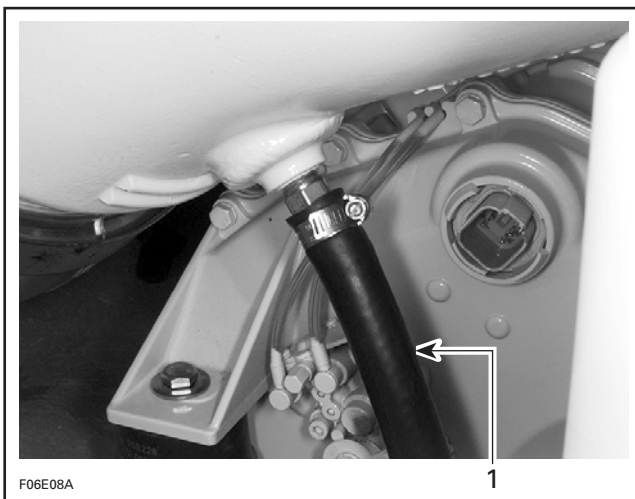
Remove screws **no. 7** and washers **no. 9** at tuned pipe head flange.

Remove screw **no. 6** and screw **no. 20** retaining tuned pipe to engine.

Remove tuned pipe from watercraft.

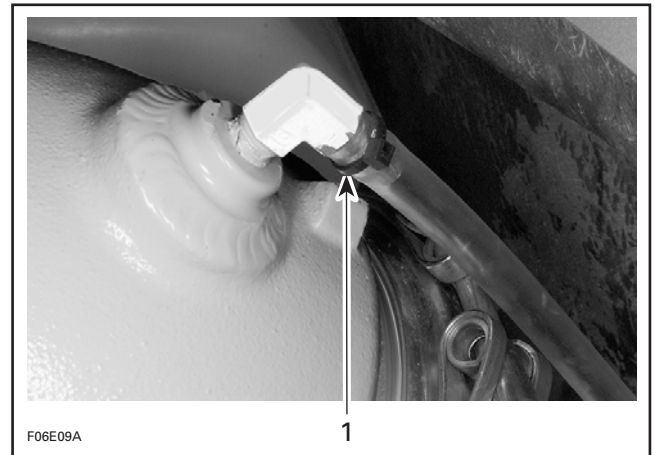
947 Engine

Disconnect water return hose at tuned pipe head **no. 10**.



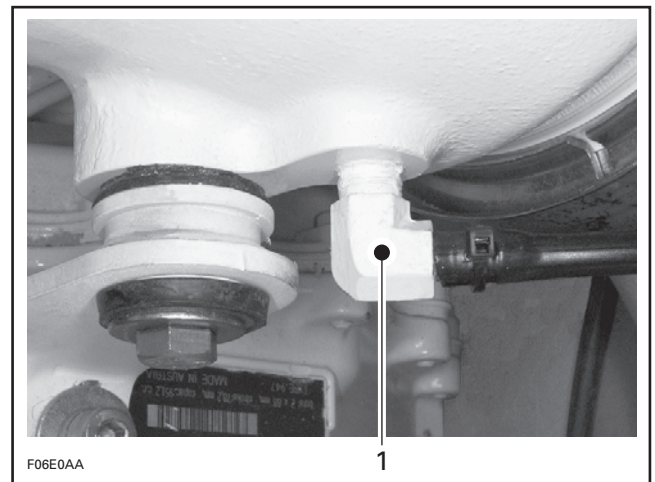
1. Water return hose

Disconnect small hose from water outlet fitting at the tuned pipe head **no. 10**.



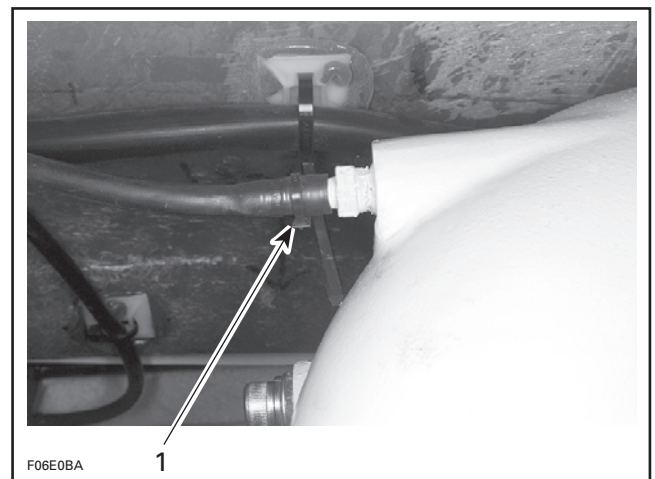
1. Disconnect hose from outlet fitting

Disconnect the water injection hose at tuned pipe head **no. 10**.



1. Water injection hose

Disconnect the water bleed hose.

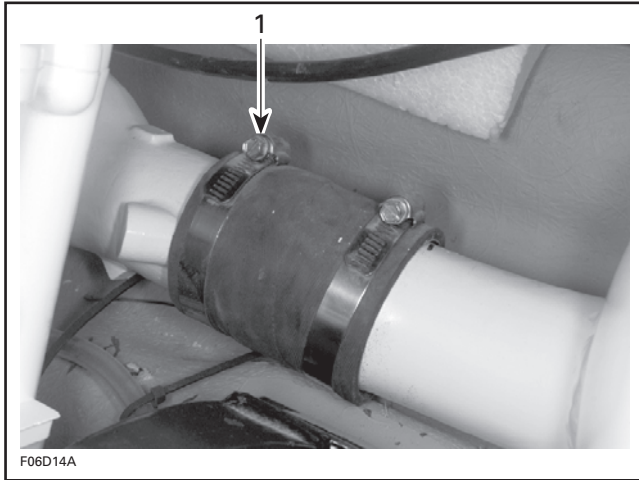


1. Water bleed hose

Section 04 ENGINE

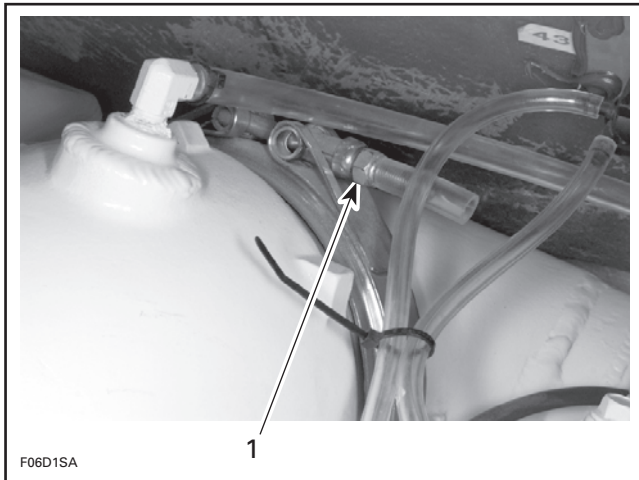
Subsection 08 (EXHAUST SYSTEM)

Loosen clamp no. 1 retaining exhaust hose no. 3 to tuned pipe cone no. 5.



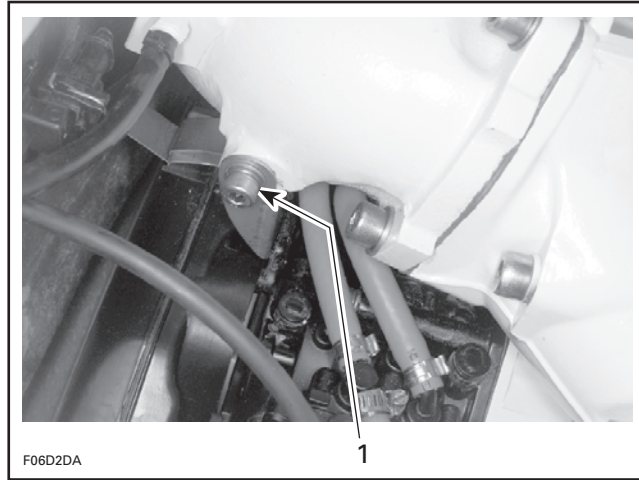
1. Loosen clamp

Loosen and remove clamp no. 4 retaining tuned pipe head no. 10 to tuned pipe cone no. 5.



1. Loosen and remove clamp

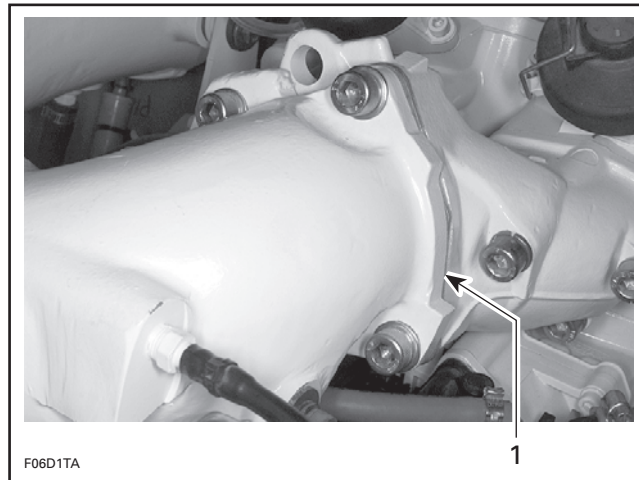
Loosen Allen screw retaining carburetor bracket to tuned pipe head.



1. Loosen Allen screw

Loosen Allen screws no. 7 and nut no. 8 at tuned pipe flange.

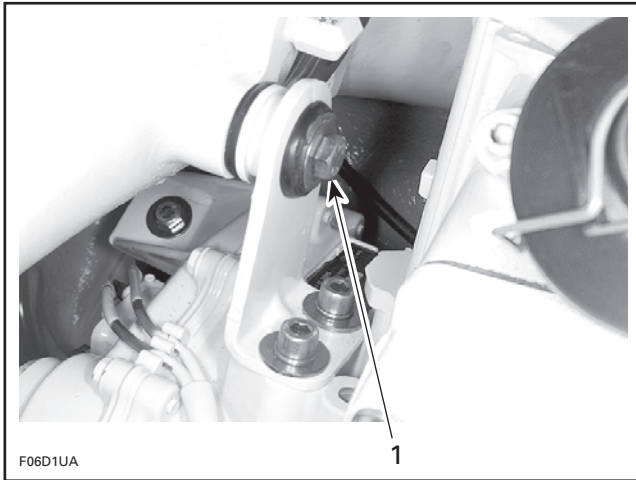
NOTE: To loosen nut, use polygonal wrench (P/N 529 035 505).



1. Tuned pipe flange

Section 04 ENGINE
Subsection 08 (EXHAUST SYSTEM)

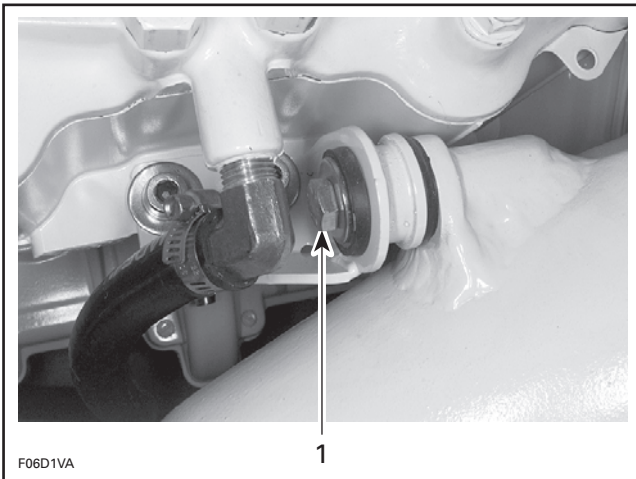
Loosen bolt no. 20 of tuned pipe head above the engine magneto.



1. Remove bolt

Remove tuned pipe head no. 10.

Loosen bolt no. 6 of tuned pipe cone beside the engine water return hose.



1. Loosen bolt

Remove tuned pipe cone no. 5.

Block exhaust opening in the manifold to keep debris from entering cylinder during threads cleaning procedure.

Remove the stud no. 21 from "Y" manifold.

Use a M10 x 1.5 screwtap to clean the 4 threaded holes on the "Y" manifold and the 2 threaded holes on tuned pipe. Clean out the debris with a spray cleaner and air pressure.

CAUTION: It is very important that the threads are free of debris before installing new self-locking fasteners.

Exhaust Manifold

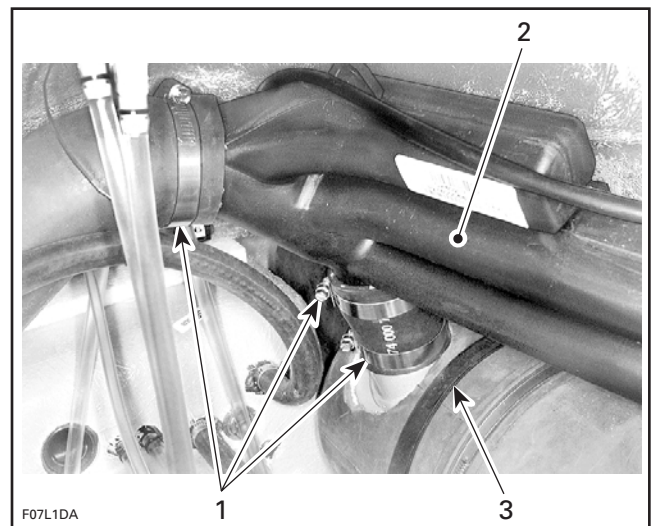
Remove 8 Allen screws no. 12 and lock washers no. 13 then withdraw exhaust manifold.

Resonators

Upper Type Resonators

Detach resonator from body.

Loosen clamps and disconnect hoses. Withdraw resonator from watercraft.



TYPICAL

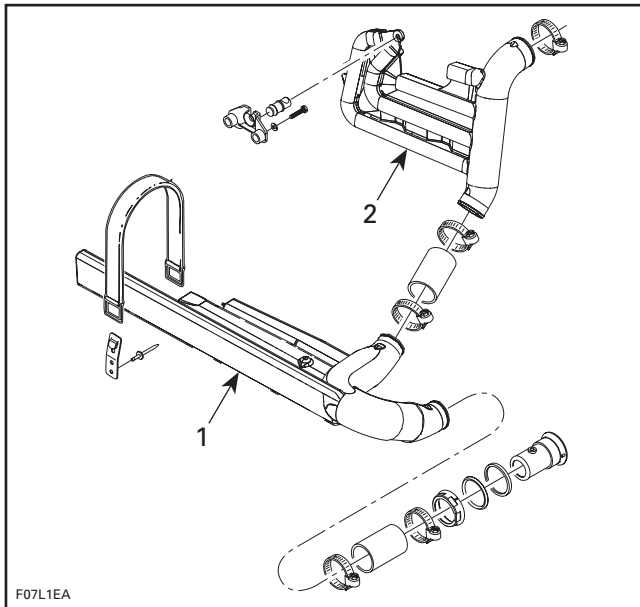
1. Loosen hose clamps
2. Upper type resonator
3. Muffler holding strap

Section 04 ENGINE

Subsection 08 (EXHAUST SYSTEM)

Footwell Type Resonators

NOTE: Some models are equipped with both types or resonators (GTX RFI and GTX).



TYPICAL

1. Footwell type resonator
2. Upper type resonator

Loosen clamps retaining exhaust hose going from resonator to muffler.

Loosen clamps retaining exhaust hose to exhaust outlet.

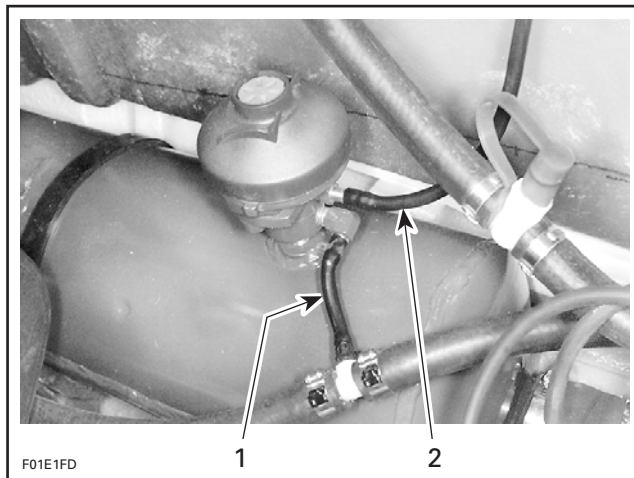
Detach holding strap retaining resonator inside bilge.

Pull resonator out of bilge.

Muffler

Disconnect hoses from muffler **no. 11**.

Disconnect hoses of the water flow regulator valve (except 717 engine).



TYPICAL

1. Water supply hose
2. To injection fitting on tuned pipe

Disconnect retaining strap **no. 2** of muffler.

Pull muffler **no. 11** out of bilge.

NOTE: On GSX and XP, remove the VTS motor. Refer to VARIABLE TRIM SYSTEM.

TUNED PIPE REPAIR

This procedure is given to repair tuned pipe cracks using T.I.G. welding process.

Procedure

- Sand the cracked area to obtain bare metal.
- Perform a 1.50 mm (1/16 in) depth chamfer over crack.
- Use pure argon gas with 5.55 mm (3/32 in) tungsten electrode (puretung "green", zirtung "brown") and AC current.
- Use a 5.55 mm (3/32 in) aluminum welding rod (no. 4043), to fill crack.
- Sand welding slightly to remove material surplus.

Test

– Use compressed air at 124 kPa (18 PSI) to pressurize tuned pipe.

CAUTION: Always ensure water passages are not blocked partially or completely while welding tuned pipe.

NOTE: Prior to verify leaks, plug all holes and pressurize tuned pipe while immersing it in water.

INSTALLATION

Installation is essentially the reverse of removal procedures. However, pay particular attention to the following.

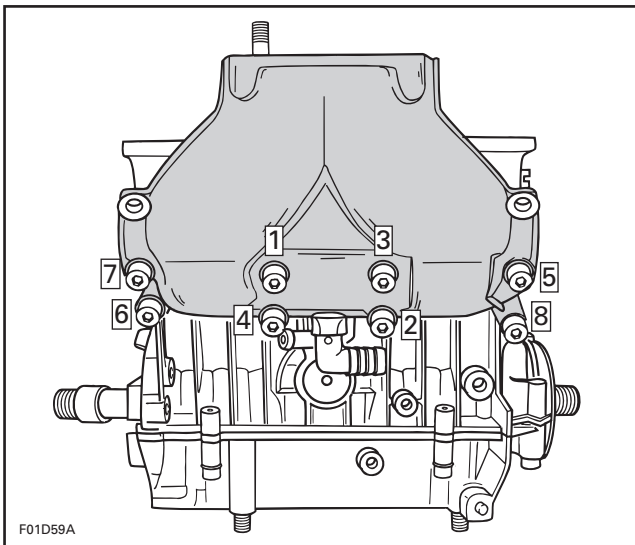
Exhaust Manifold

Make sure gasket(s) no. 17 are properly positioned prior to finalizing manifold installation.

717 Engine

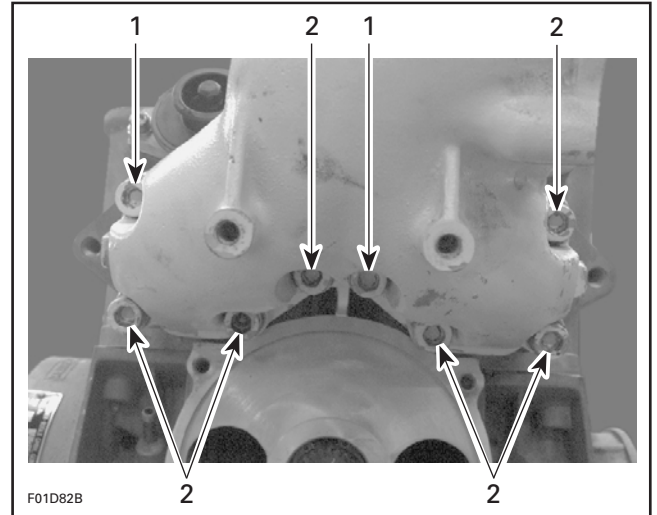
Apply Molykote 111 on threads of screws no. 12.

Install exhaust manifold no. 14 and torque screws no. 12 to 24 N•m (17 lbf•ft) as per following illustrated sequence.



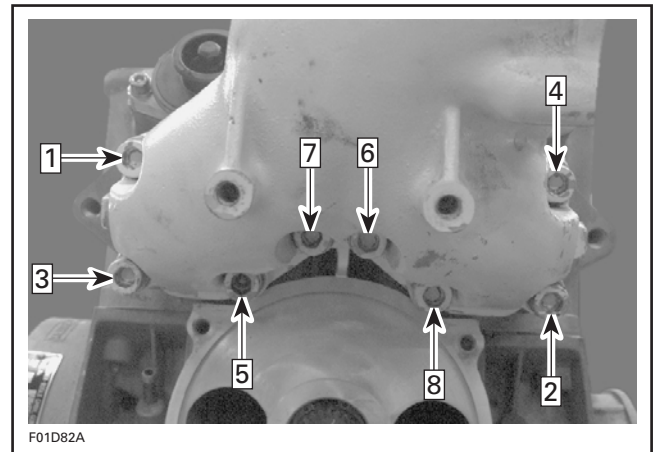
787 RFI Engine

Apply Loctite 518 on 2 screws no. 12. On the other screws no. 12, apply Molykote 111 on threads. Install screws. Refer to the following illustration for proper position of screws.



- 1. Screw with Loctite 518
- 2. Screw with Molykote 111

Torque exhaust manifold screws to 24 N•m (17 lbf•ft) as per following illustrated sequence. Repeat the procedure, retightening screws to 40 N•m (30 lbf•ft).



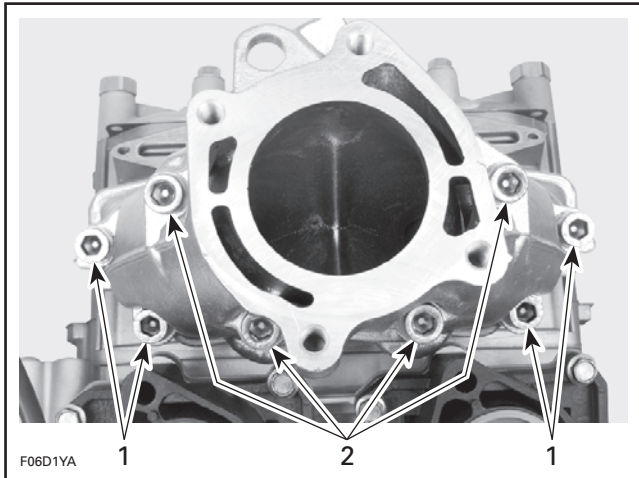
Section 04 ENGINE

Subsection 08 (EXHAUST SYSTEM)

947 Engine

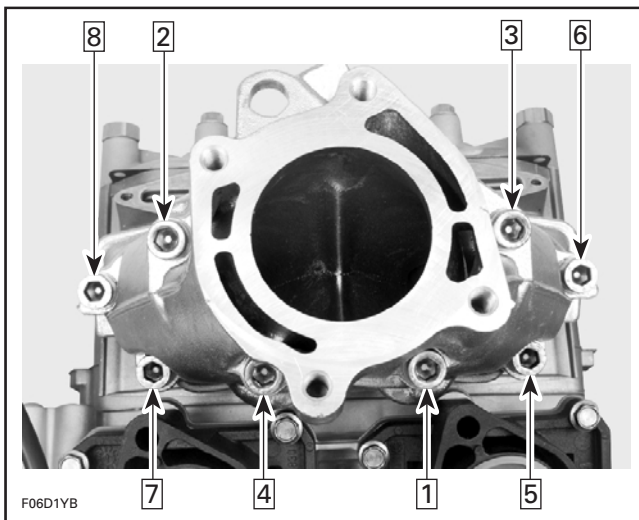
Apply Molykote 111 on threads of Allen screws no. 12.

Install and hand tighten Allen screws no. 12 as per following picture.



1. M10 x 60 Allen screws
2. M10 x 110 Allen screws

Torque Allen screws to 24 N•m (17 lbf•ft) as per following illustrated sequence. Repeat the procedure, retightening Allen screws to 40 N•m (30 lbf•ft).



Tuned Pipe

717 Engine

Ensure rubber bushings no. 19 and sleeve no. 18 are not damaged and are properly installed into tune pipe support(s).

CAUTION: Damage to bushings and/or sleeve will eventually cause stress to tune pipe and may cause cracking.

Make sure that gasket no. 16 is properly located on exhaust manifold prior to finalizing pipe installation.

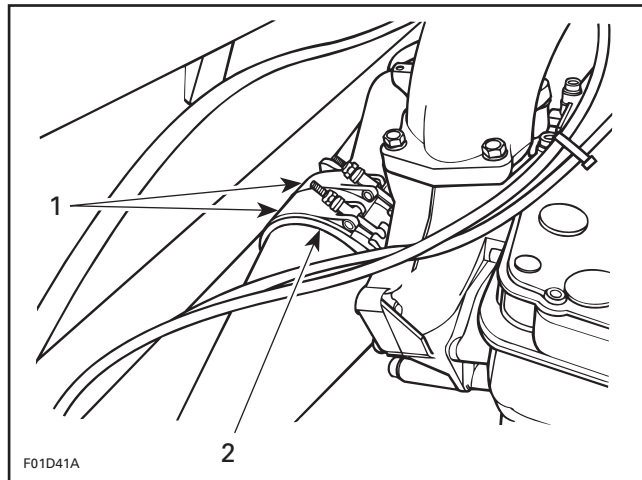
Apply Loctite 243 (blue) on nut no. 8 and screws no. 6 and no. 7.

Hand tighten all fasteners before torquing any of them.

For torquing specifications, see the main illustrations at the beginning of this subsection.

Install tuned pipe cone no. 5 with collar no. 15 and clamp no. 4.

Position clamp no. 4 as illustrated. Do not tighten clamp yet.



1. Clamp
2. Exhaust collar

With hose removed, align cone outlet with muffler inlet.

NOTE: Due to exhaust cone angle, it may have to be rotated to obtain alignment.

Push cone no. 5 until it touches tuned pipe, then tighten exhaust clamp no. 4 and torque to 10 N•m (88 lbf•in).

CAUTION: There must be no gap between tuned pipe cone and tuned pipe head.

NOTE: Exhaust clamp nuts should be tightened alternately to assure no leakage and to obtain specified torque.

787 RFI

Ensure rubber bushings **no. 19** and sleeve **no. 18** are not damaged and are properly installed into tune pipe support(s).

CAUTION: Damage to bushings and/or sleeve will eventually cause stress to tuned pipe and may cause cracking.

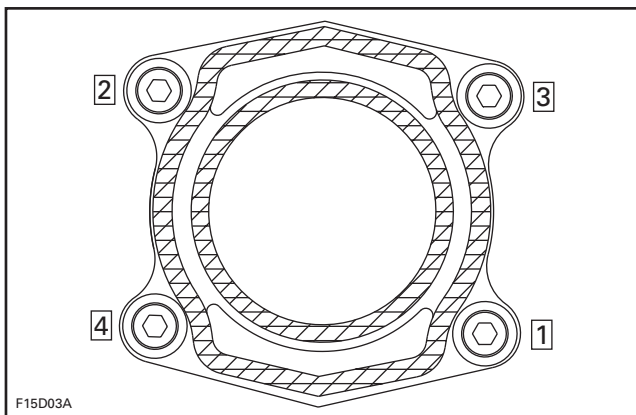
Make sure that gasket **no. 16** is properly located on exhaust manifold prior to finalizing pipe installation.

Install the tuned pipe end into exhaust hose **no. 3**. Do not torque yet.

CAUTION: Torque the tuned pipe in accordance with the following sequence, otherwise serious engine damage may occur.

Torquing Sequence:

Torque Allen screws **no. 7** at tuned pipe head flange to 6 N•m (53 lbf•in), as per the following illustration.

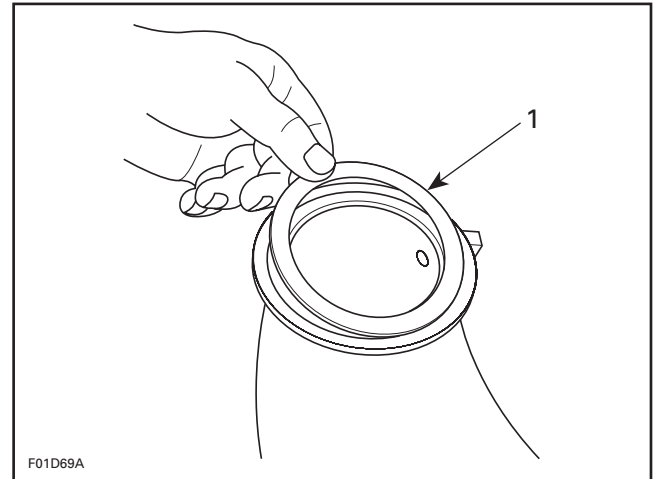


Retorque the Allen screws **no. 7** to 47 N•m (35 lbf•ft), using the same sequence that the previous step.

First, torque screw **no. 20** to 25 N•m (18 lbf•ft) then torque screw **no. 6** to 25 N•m (18 lbf•ft).

947 Engine

Make sure to install the sealing ring **no. 15** on tuned pipe cone if it was removed.



TYPICAL

1. Sealing ring

Apply a thin layer of Ultra Copper heat resistant sealant (P/N 413 710 300) all around sealing ring **no. 15**.

CAUTION: It is very important that the threads are free of debris before installing new self-locking fasteners. Refer to removal procedure for the proper thread cleaning procedure.

Clean the "Y" manifold and tuned pipe surfaces.

Screw stud **no. 21** into the "Y" manifold. Torque to 47 N•m (35 lbf•ft).

Install gasket **no. 15** on the "Y" manifold.

Install the new bushing **no. 18**.

CAUTION: Torque the tuned pipe in accordance with the following sequence, otherwise serious engine damage may occur.

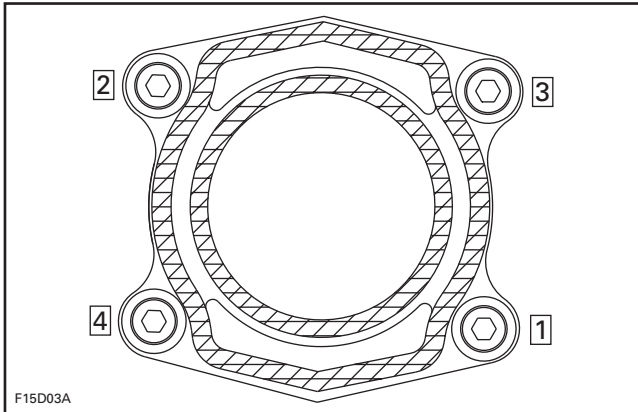
Section 04 ENGINE

Subsection 08 (EXHAUST SYSTEM)

Torquing Sequence:

Torque all screws by hand. Do not torque yet.

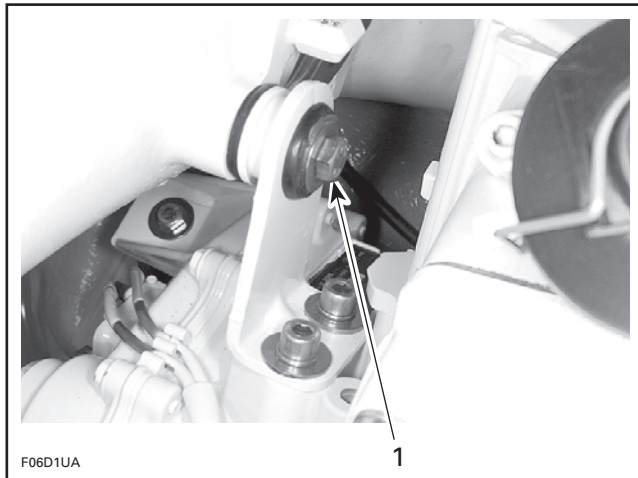
Torque the 3 screws **no. 7** to $6 \text{ N}\cdot\text{m}$ ($53 \text{ lbf}\cdot\text{in}$) and the nut **no. 8** to $3 \text{ N}\cdot\text{m}$ ($27 \text{ lbf}\cdot\text{in}$), using the polygonal key (P/N 529 035 505), as per the following illustration.



NOTE: Apply Loctite 243 on the stud threads.

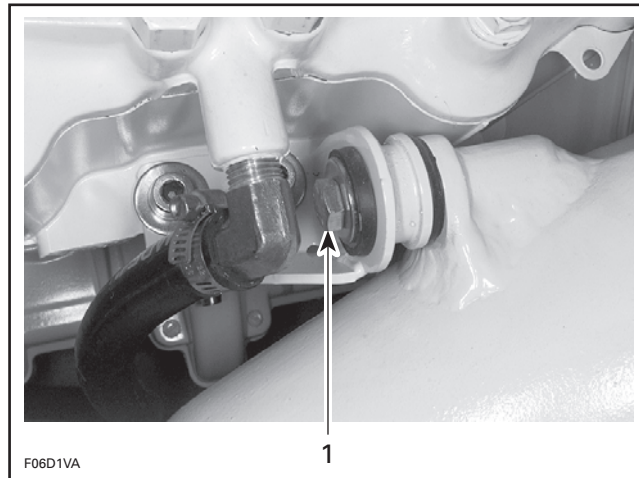
Retorque the 3 screws **no. 7** to $48 \text{ N}\cdot\text{m}$ ($35 \text{ lbf}\cdot\text{ft}$) and the nut **no. 8** to $38 \text{ N}\cdot\text{m}$ ($28 \text{ lbf}\cdot\text{ft}$). Use the same order as the previous step.

Torque bolt of tuned pipe head above the engine magneto to $40 \text{ N}\cdot\text{m}$ ($29 \text{ lbf}\cdot\text{ft}$).



1. Torque bolt to $40 \text{ N}\cdot\text{m}$ ($29 \text{ lbf}\cdot\text{ft}$)

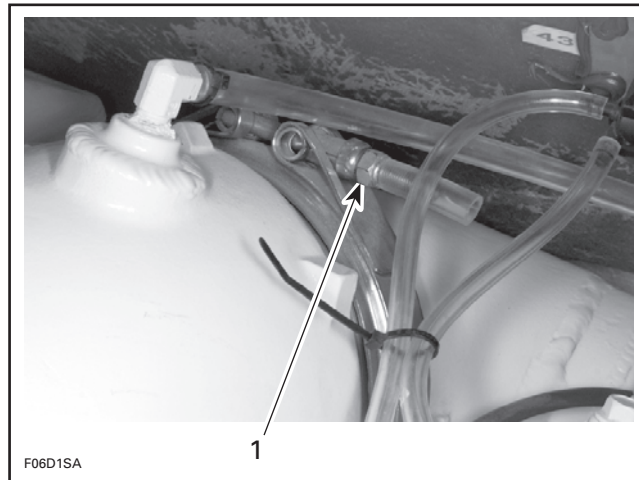
Torque bolt of tuned pipe cone beside the engine water return hose to $40 \text{ N}\cdot\text{m}$ ($29 \text{ lbf}\cdot\text{ft}$).



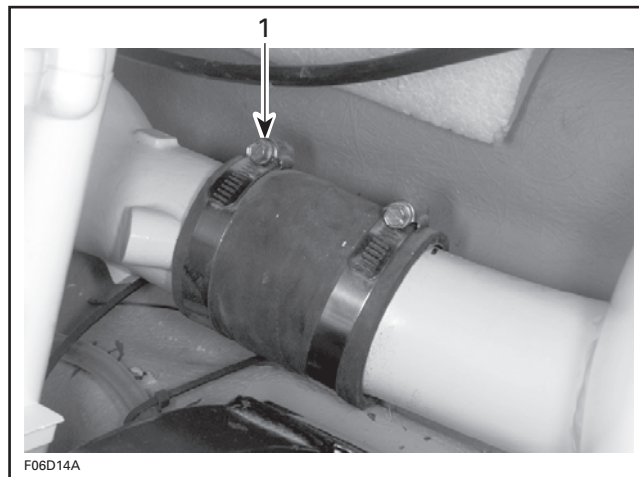
1. Torque bolt to $40 \text{ N}\cdot\text{m}$ ($29 \text{ lbf}\cdot\text{ft}$)

Install the recovery envelope **no. 22** and secure with a tie rap.

Torque clamp of tuned pipe head to $14 \text{ N}\cdot\text{m}$ ($10 \text{ lbf}\cdot\text{ft}$).



1. Torque clamp to $14 \text{ N}\cdot\text{m}$ ($10 \text{ lbf}\cdot\text{ft}$)



1. Torque clamp to $4 \text{ N}\cdot\text{m}$ ($35 \text{ lbf}\cdot\text{in}$)

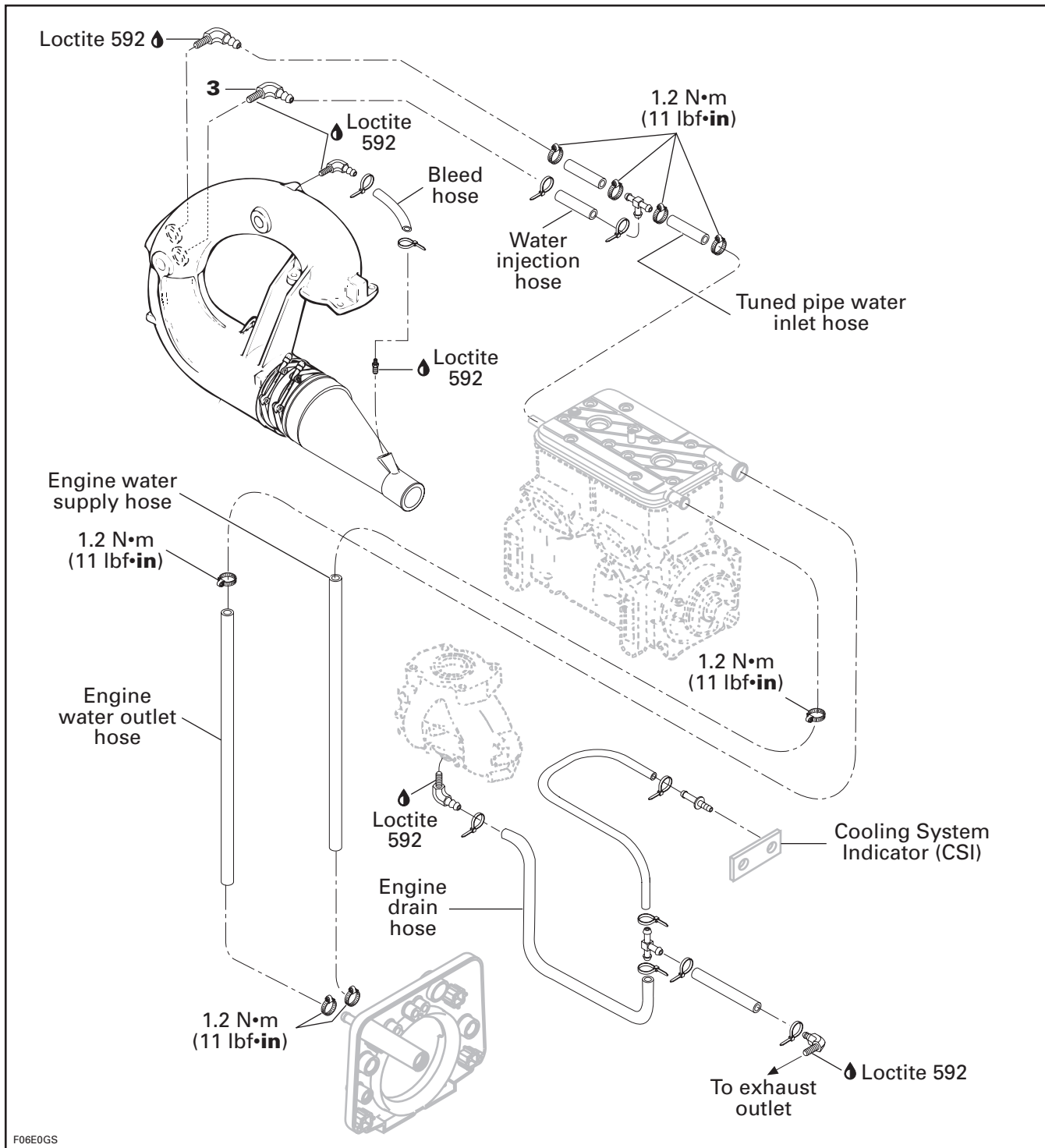
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Section 05 COOLING SYSTEM

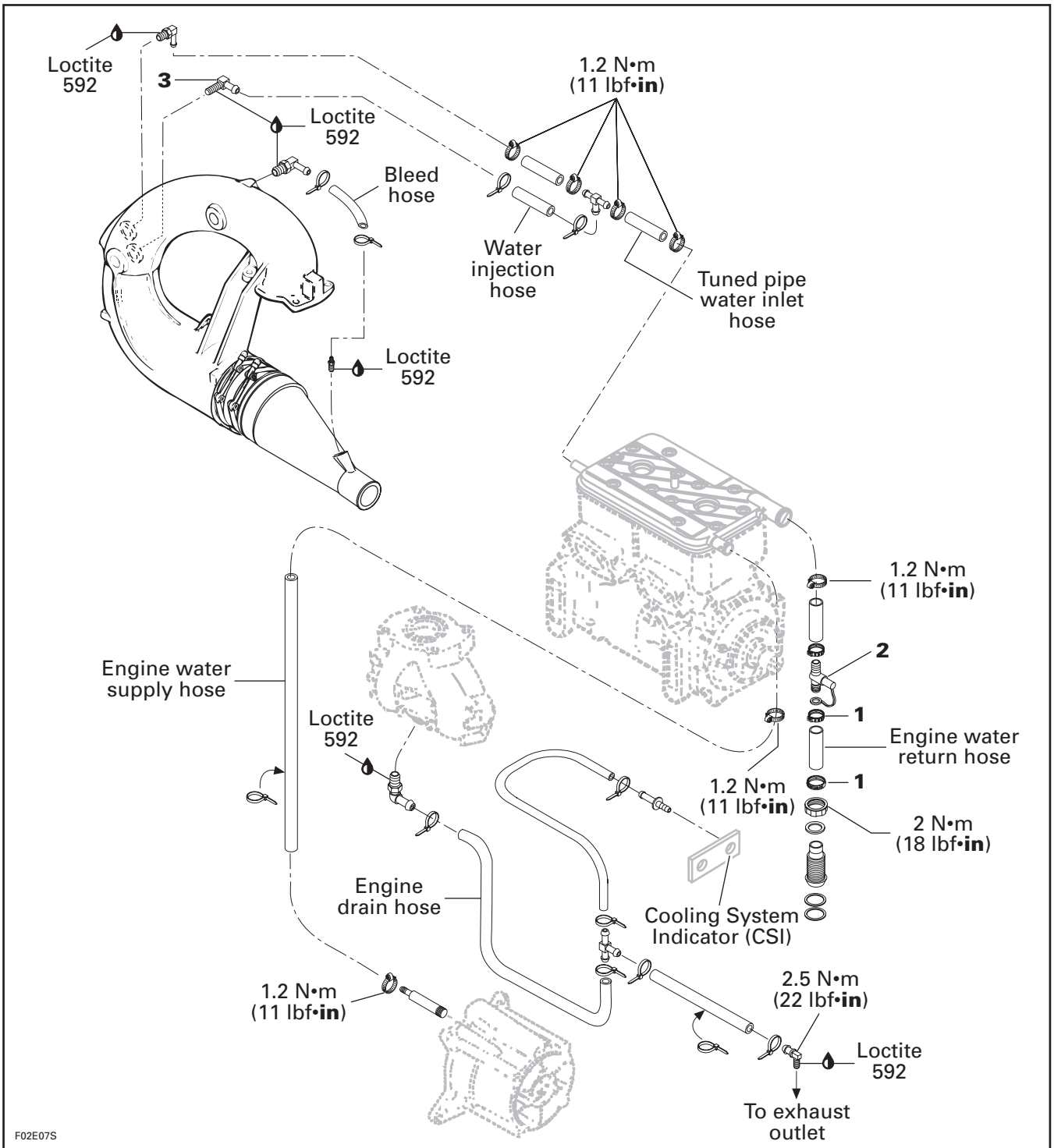
Subsection 02 (CIRCUIT, COMPONENTS AND CARE)

GS and GTI Models



Section 05 COOLING SYSTEM
 Subsection 02 (CIRCUIT, COMPONENTS AND CARE)

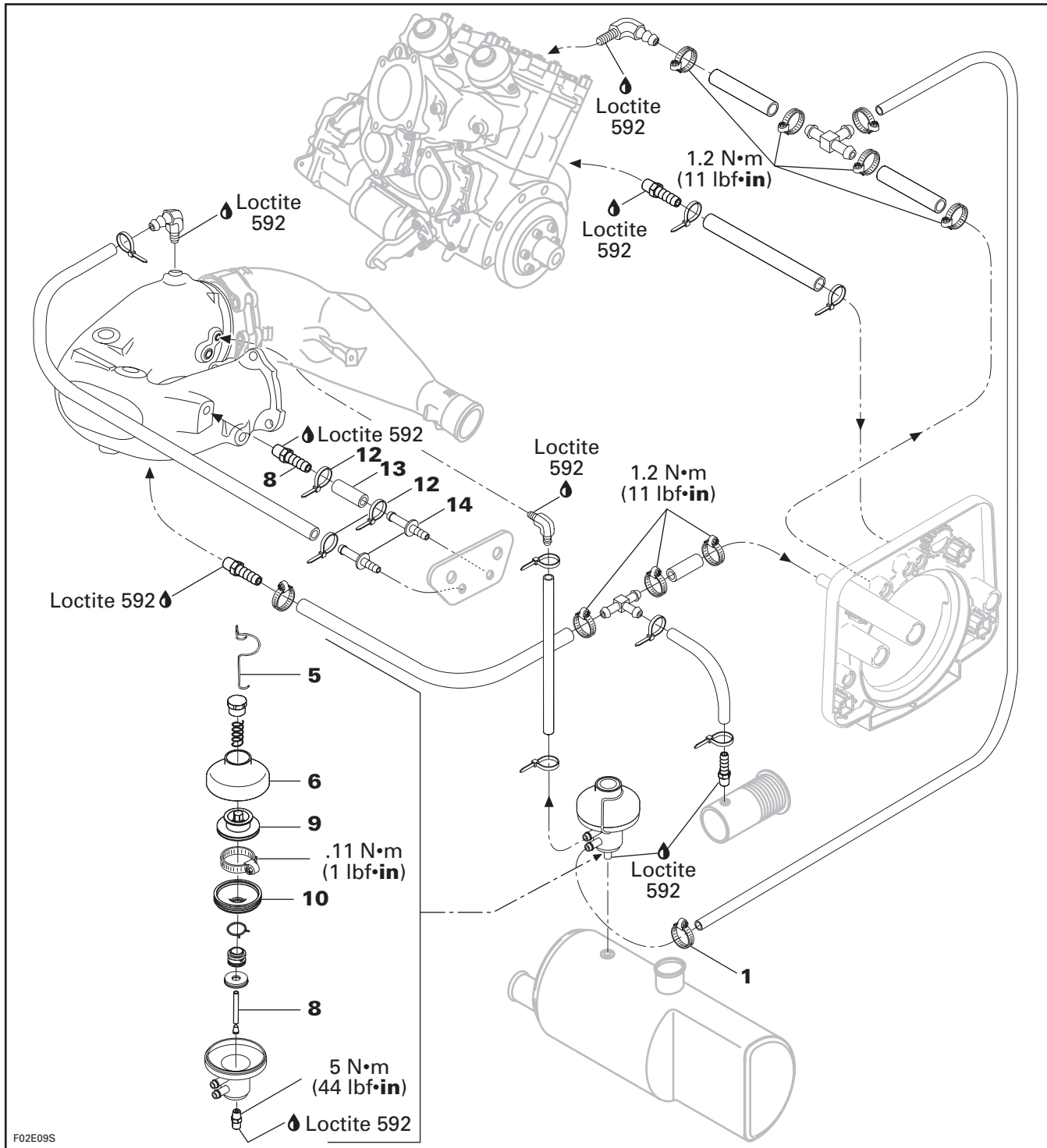
GTS Model



Section 05 COOLING SYSTEM

Subsection 02 (CIRCUIT, COMPONENTS AND CARE)

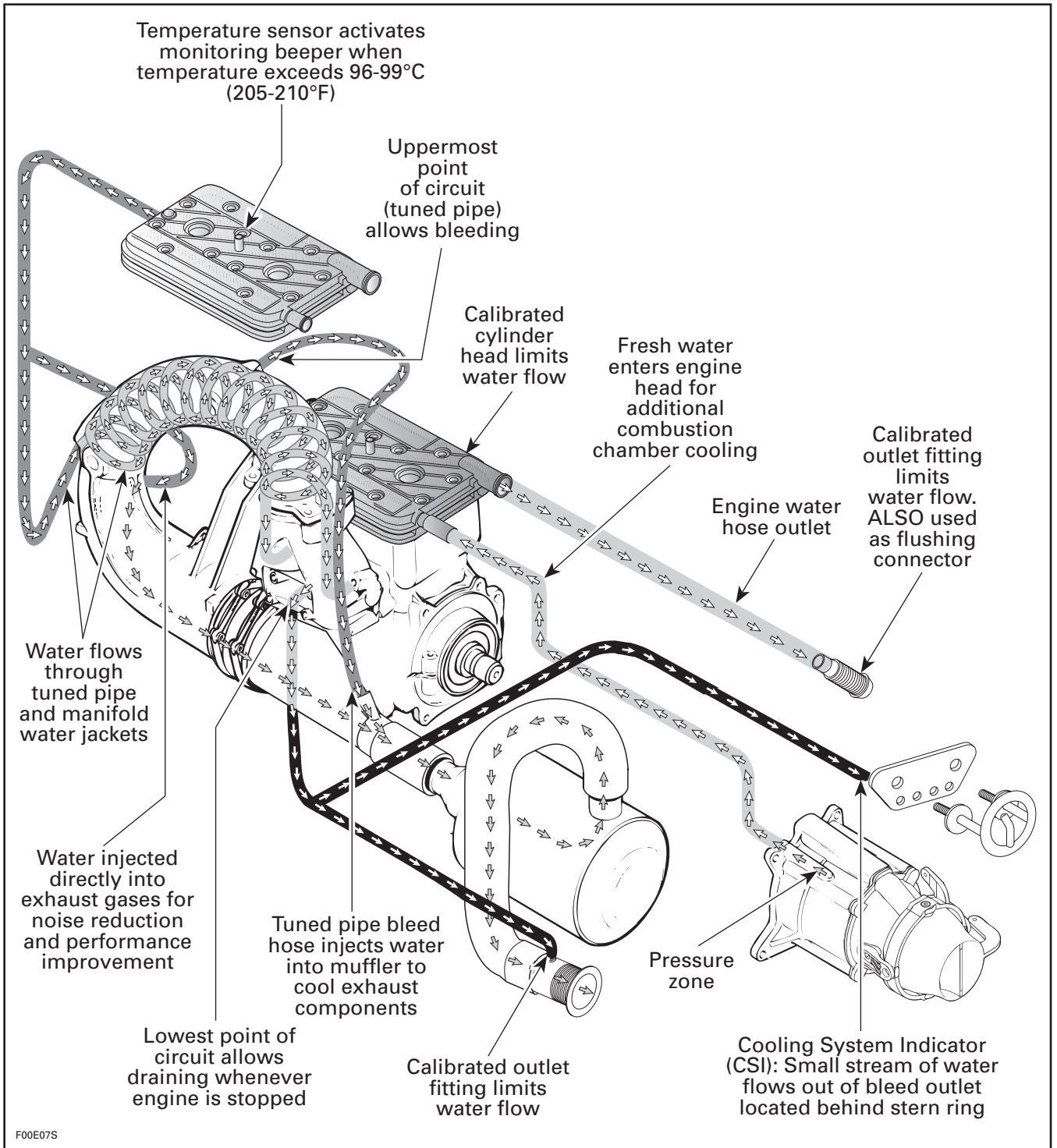
XP and GTX Models



F02E09S

Section 05 COOLING SYSTEM
Subsection 02 (CIRCUIT, COMPONENTS AND CARE)

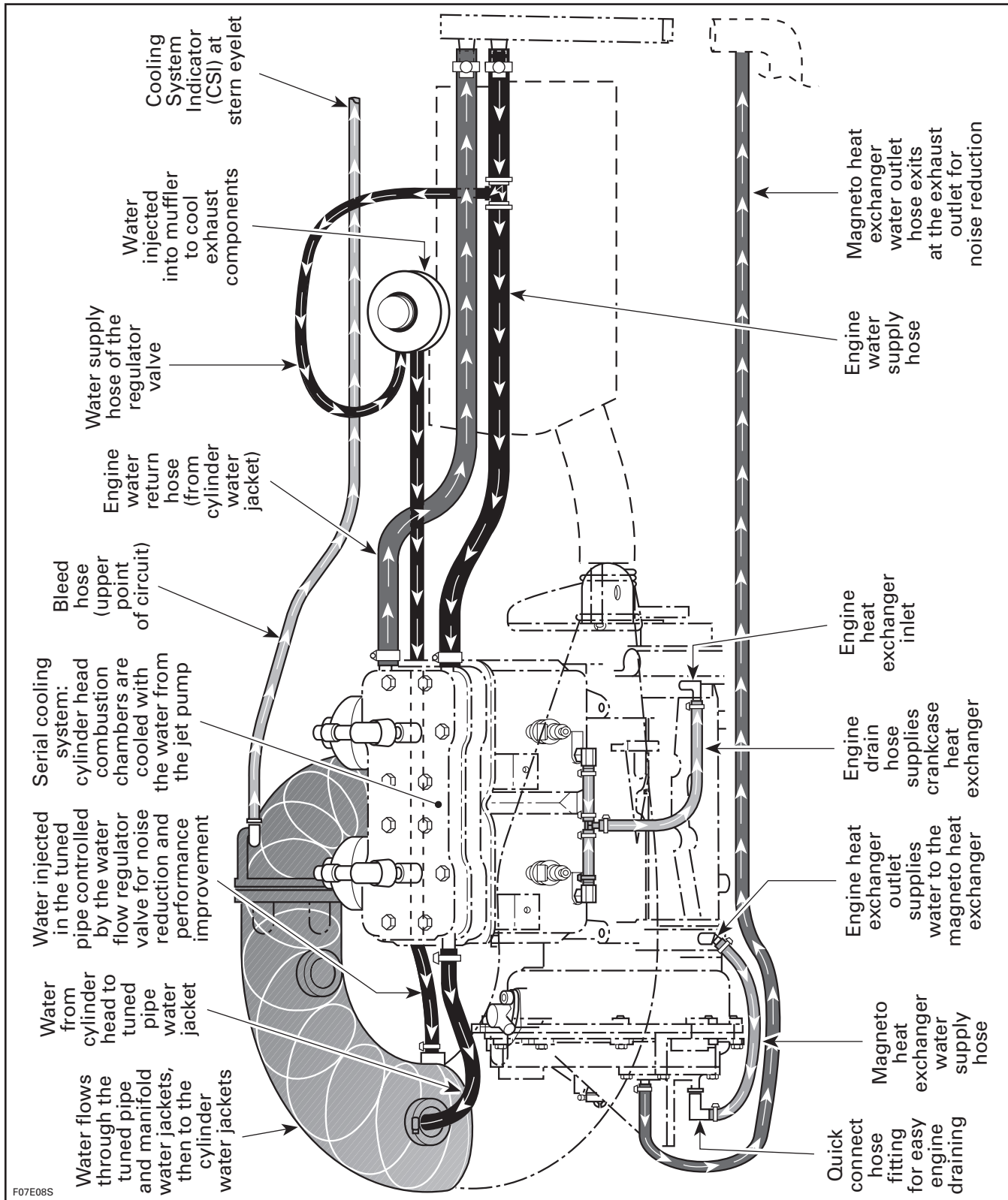
717 Engine



Section 05 COOLING SYSTEM

Subsection 02 (CIRCUIT, COMPONENTS AND CARE)

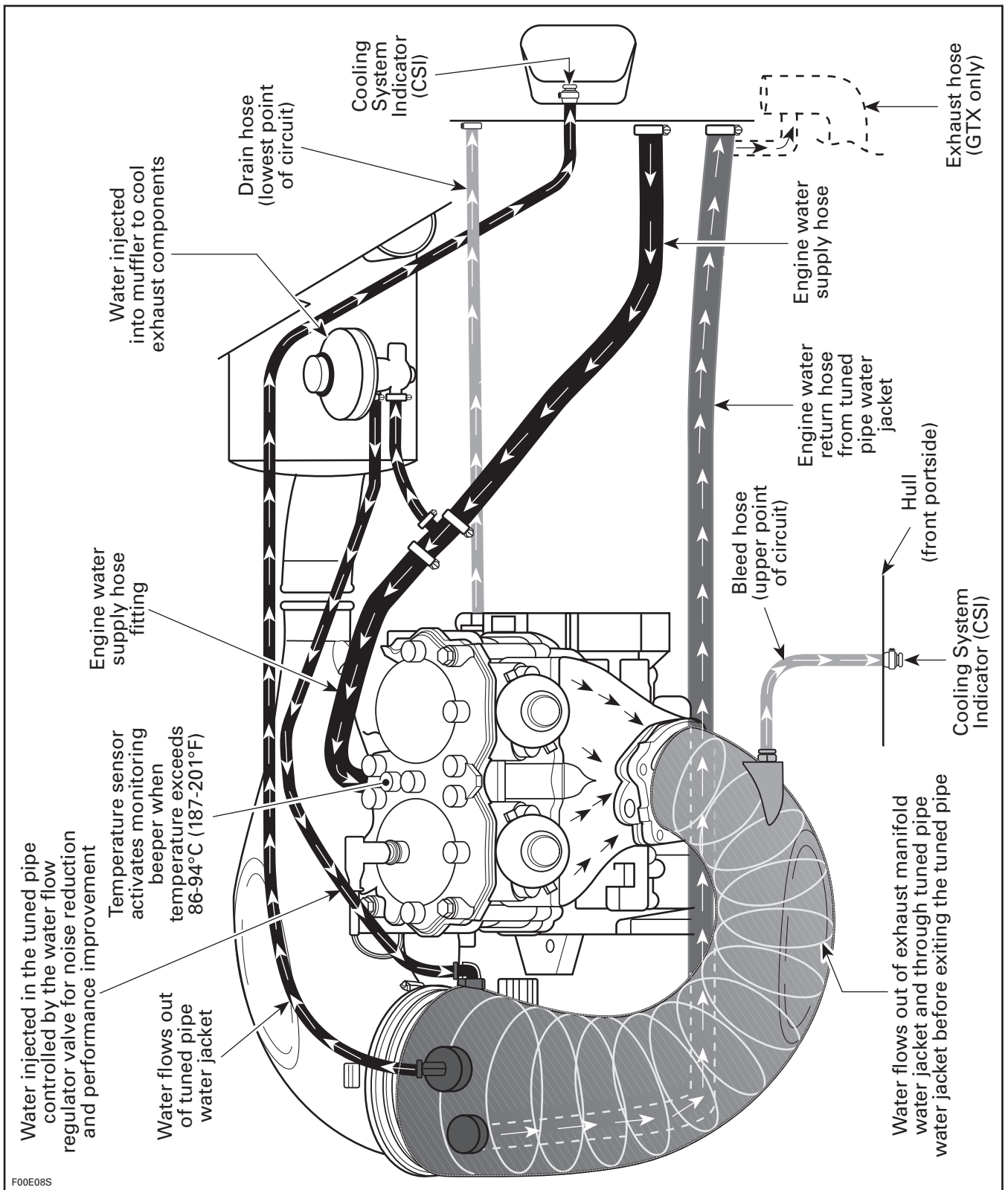
787 RFI Engine



Section 05 COOLING SYSTEM

Subsection 02 (CIRCUIT, COMPONENTS AND CARE)

947 Engine



Section 05 COOLING SYSTEM

Subsection 02 (CIRCUIT, COMPONENTS AND CARE)

CIRCUIT

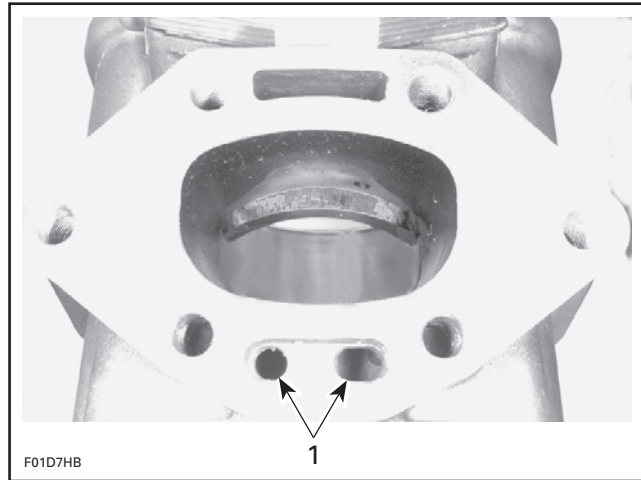
CAUTION: All hoses and fittings of the cooling system have calibrated inside diameters to assure proper cooling of the engine. Always replace using appropriate Bombardier part number.

717 Engine

A Serial Cooling System is utilized on the 717 engine, which offers an efficient cooling of the combustion chamber to prevent the possibilities of detonation.

The water supply is taken from a pressurized area in the jet pump between the impeller and venturi.

Water enters the cylinder head, cooling the combustion chamber to prevent detonations. Then, water exits cylinder head toward tuned pipe.



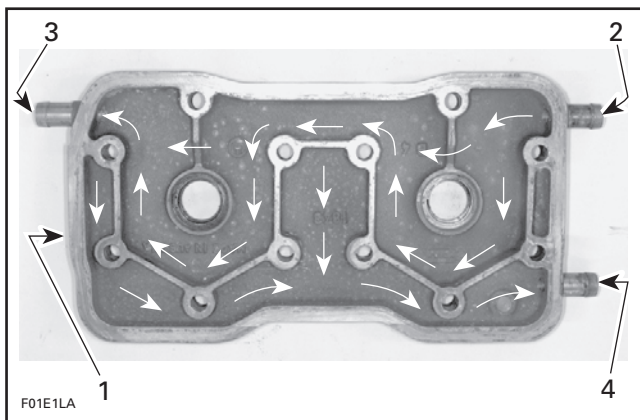
1. Water passages

No water enters crankcase.

When engine is running, water must flow from bleed outlet indicating that water circulates.

CAUTION: When investigating for no water flow in the cooling system, check all elbows and straight fittings as well as all hoses for blockage.

For a minimum back pressure in the exhaust, engine water outlet hose is not connected to the exhaust. It has its own outlet at the rear of the hull.

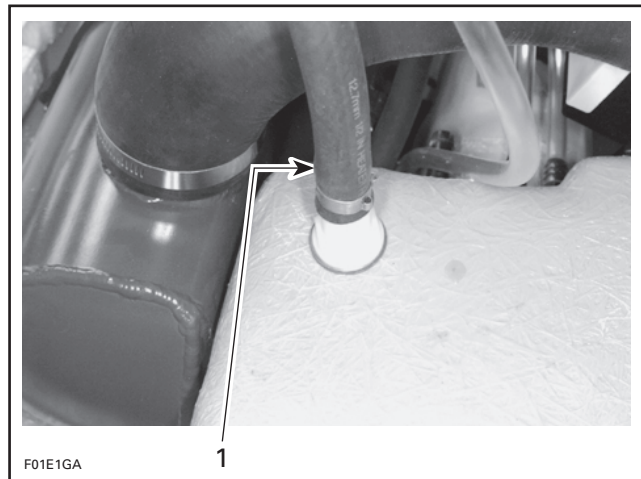


1. Cylinder head cover
2. Fresh water from jet pump
3. Water exiting head assembly to tuned pipe, exhaust manifold and cylinders
4. Water from cylinder water jackets exiting engine

The tuned pipe and exhaust manifold are designed with a double wall to allow water circulation.

Water is pre-heated by the exhaust system before entering the cylinder cooling jackets.

Water enters cylinder cooling jacket through passages located below exhaust ports from tuned pipe.



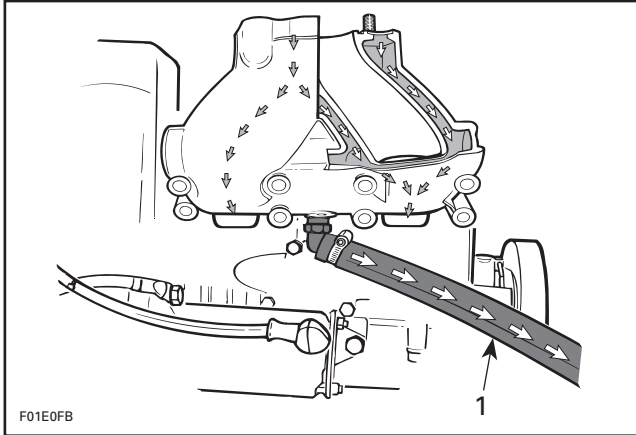
TYPICAL

1. Engine water outlet hose

Section 05 COOLING SYSTEM

Subsection 02 (CIRCUIT, COMPONENTS AND CARE)

Draining of the cooling system is accomplished by a drain hose located at the lowest point of the circuit.

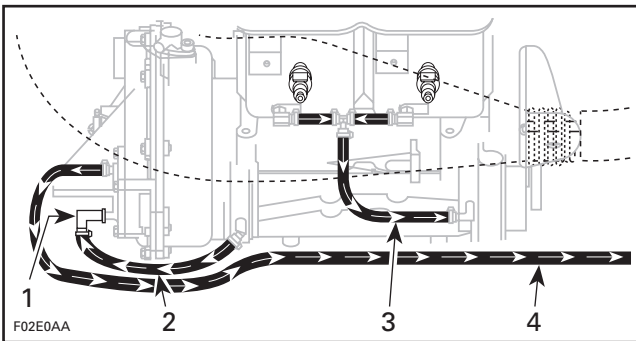


717 ENGINE

1. Drain hose

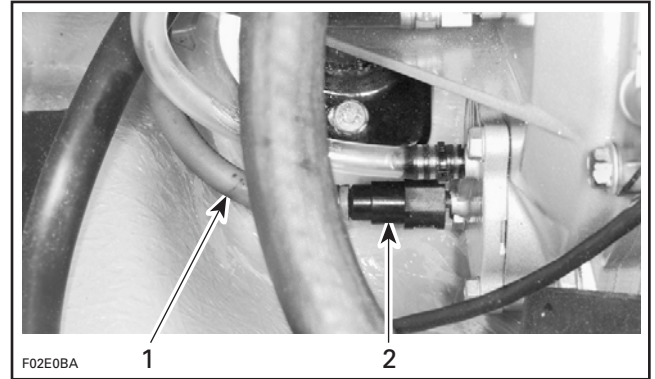
787 RFI Engine

The 787 RFI engine features a heat exchanger system. This system allows water coming out of the engine drain hose to circulate through a crankcase heat exchanger and the magneto heat exchanger.



1. Quick connect hose fitting
2. Magneto heat exchanger water supply hose
3. Engine drain hose supplies crankcase heat exchanger
4. Water outlet hose to exhaust outlet

The magneto heat exchanger supply hose has a quick connect hose fitting to facilitate engine draining.



1. Heat exchanger water supply hose
2. Quick connect hose fitting

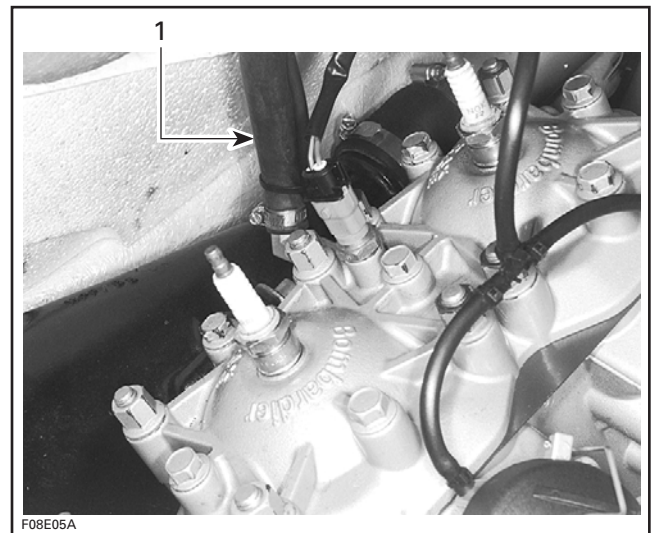
The water coming out of the magneto heat exchanger is evacuated at the exhaust outlet for noise reduction.

947 Engine

The 947 engine has a conventional cooling system. The water is entering the engine by the water inlet fitting at the cylinder head.

As with other models, the water supply is provided by a pressurized area in the jet pump between the impeller and venturi.

Water is directed to the water inlet fitting at cylinder head.

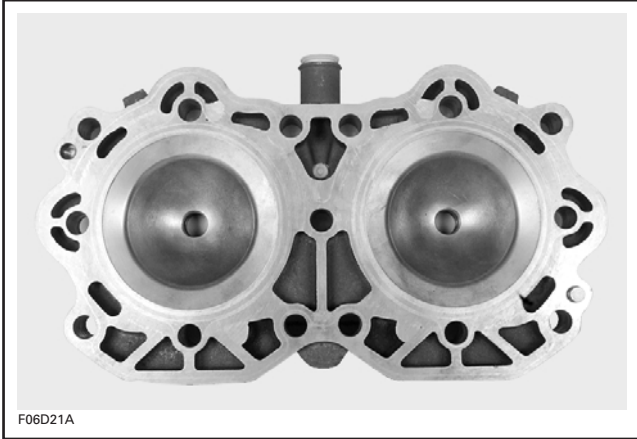


1. Water supply hose

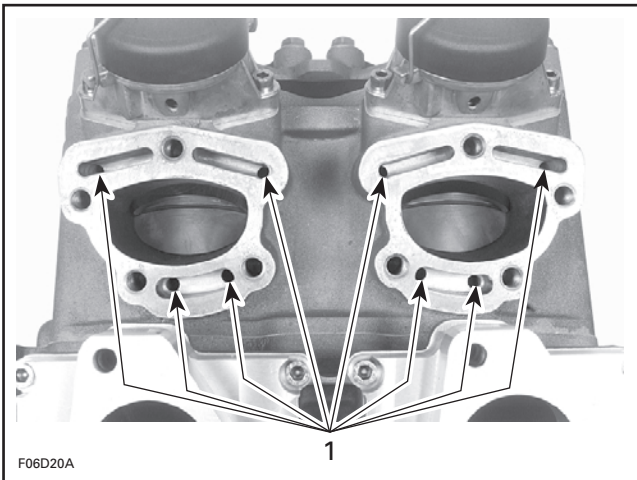
Section 05 COOLING SYSTEM

Subsection 02 (CIRCUIT, COMPONENTS AND CARE)

Water circulates through the one piece cylinder head which features improved combustion chamber and better spark plug cooling.

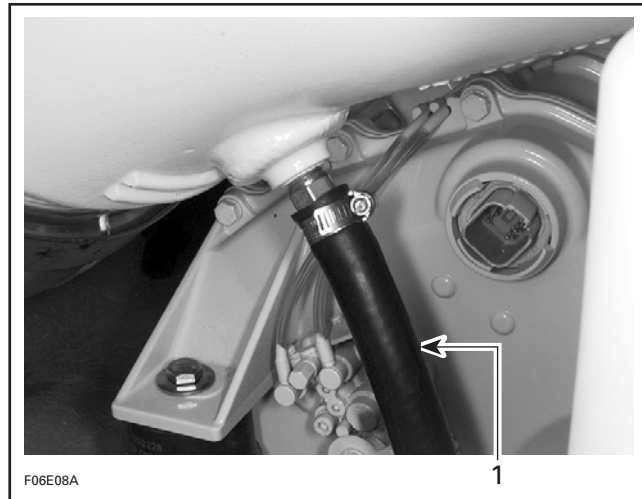


Water enters cylinder block water jackets and is directed to the water jackets of the exhaust manifold and tuned pipe head through passages located above and below exhaust ports.



1. Water passages

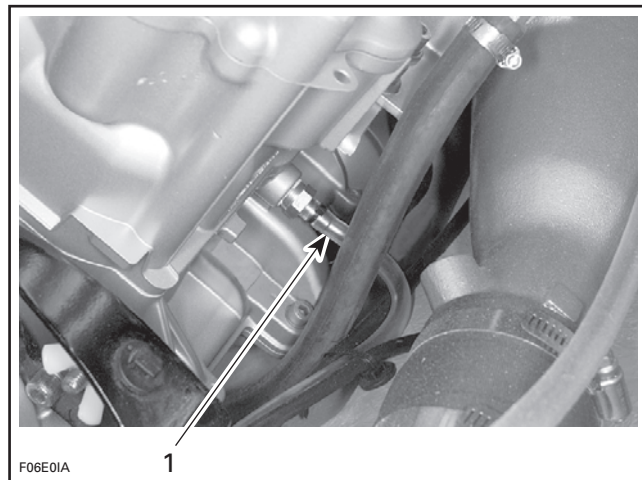
Water exits tuned pipe water jackets through an outlet fitting.



1. Engine water outlet

Water circulates in the water outlet hose and is expelled out of the cooling system through a fitting located in the jet pump support on the transom of the watercraft.

Draining of the cooling system is accomplished by the drain hose connected to a fitting at the bottom of the cylinder-block, on tuned pipe side.

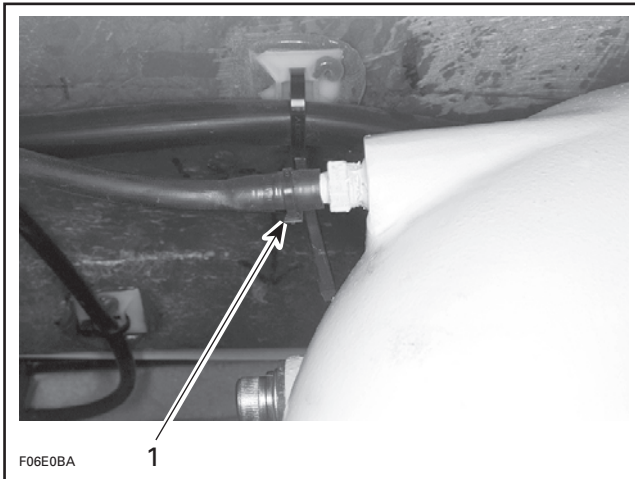


1. Drain hose

Section 05 COOLING SYSTEM

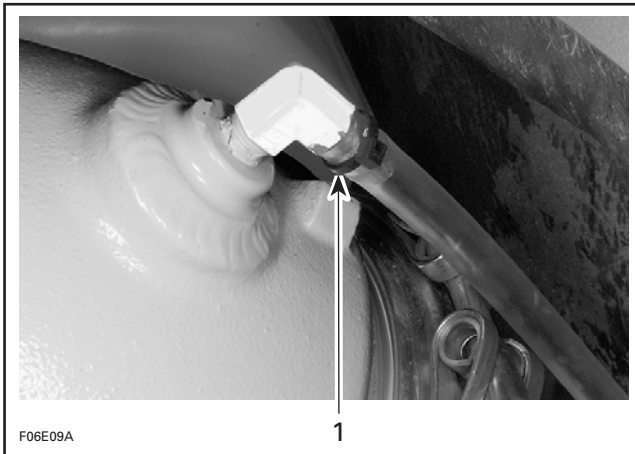
Subsection 02 (CIRCUIT, COMPONENTS AND CARE)

Bleeding of the cooling system is accomplished by the bleed hose located at the uppermost point of the circuit at the tuned pipe. The bleed hose also serves as the Cooling System Indicator (CSI).



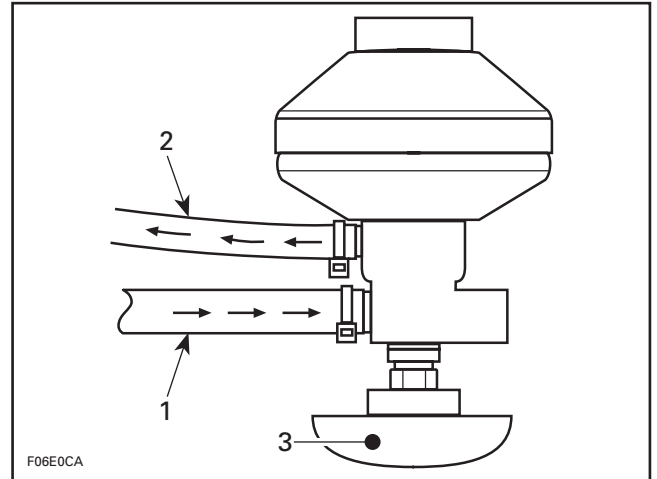
1. Bleed hose

The water supply of the water flow regulator is provided by the water supply hose coming from the pump.



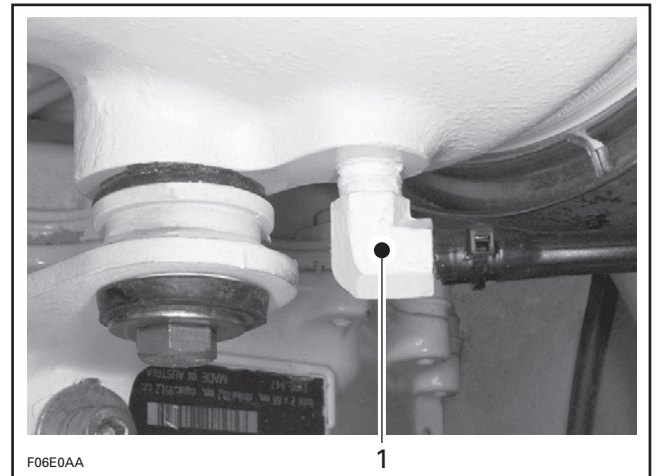
1. Water flow going to CSI

The lower hose of the valve is the water supply and the upper hose is the regulated injection water for the tuned pipe.



1. Water from engine water supply hose
2. Regulated injection water to the tuned pipe
3. Muffer

Regulated water is injected in the tuned pipe by a calibrated fitting.



1. Injection fitting

Section 05 COOLING SYSTEM

Subsection 02 (CIRCUIT, COMPONENTS AND CARE)

All Models

CAUTION: Never modify cooling system arrangement, otherwise serious engine damage could occur.

TECHNICAL DATA

TYPE:

TLCS (Total Loss Cooling System).

COOLANT FLOW:

Pressure build-up at impeller housing (no water pump).

TEMPERATURE CONTROL:

Calibrated outlet fittings (no thermostat).

SYSTEM BLEEDING:

Self-bleed type (hose at uppermost point of circuit).

SYSTEM DRAINING:

Self-drain type (hose at lowest point of circuit).

SYSTEM FLUSHING:

Fitting spigot or hose adapter.

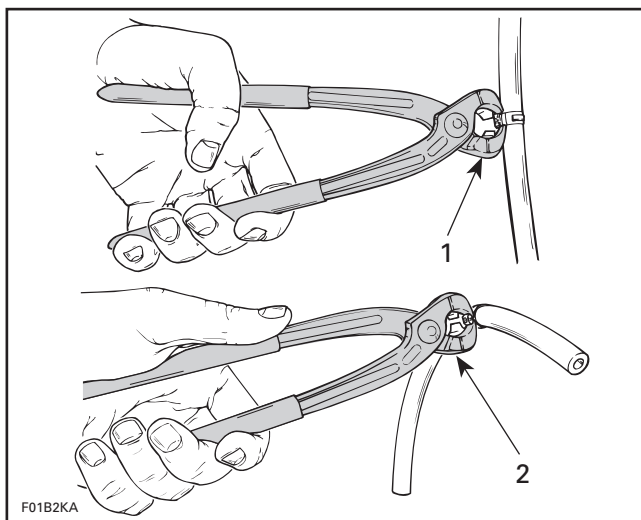
MONITORING BEEPER:

Turns on at 86-94°C (187-201°F).

COMPONENTS

Clamp

To cut or secure non-reusable Oetiker clamps of cooling system hoses, use pliers (P/N 295 000 070).



1. Cutting clamp
2. Securing clamp

Fitting Spigot

On some models, the fitting spigot no. 2 installed on the water outlet hose is used to flush cooling system. A coupler hose (P/N 295 500 258) is available to connect a garden hose.

Refer to FLUSHING AND LUBRICATION.

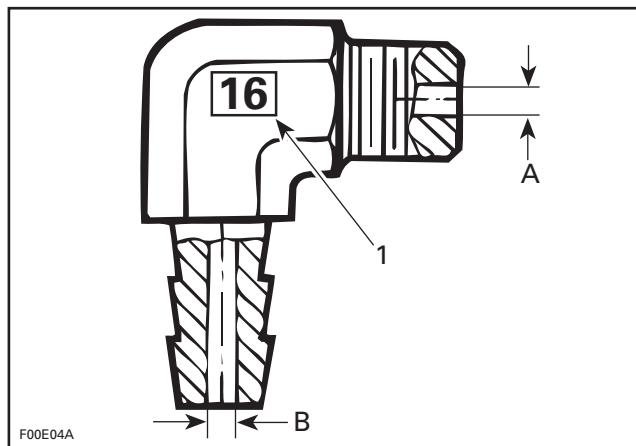
Elbow Fitting

Water injection used on exhaust system cools the exhaust gases to obtain maximum performance from the tuned pipe. The elbow fitting no. 3 has a calibrated inside diameter to optimize water flow in tuned pipe.

The water injection also helps in reducing noise level and cools components of the exhaust system.

CAUTION: The elbow fittings are calibrated and can not be interchanged with one of a different size as severe engine damage could result.

The elbow fitting can be identified by using the number stamped onto the fitting or by measuring its inside diameter. Refer to the following illustration and chart.



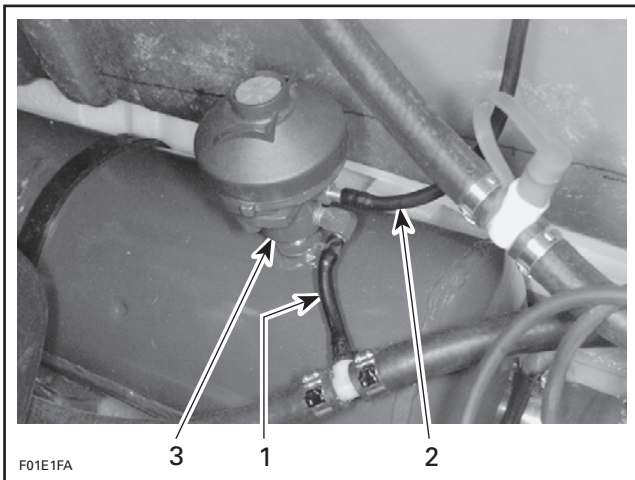
1. Stamped number
- A. Outlet diameter = 4.6 mm (.181 in)
- B. Inlet diameter = 5.5 mm (.219 in)

STAMPED NUMBER ON FITTING	FITTING P/N	INLET DIAMETER	OUTLET DIAMETER
16	293 700 016	5.5 mm (.219 in)	4.6 mm (.181 in)
48	293 710 048	4.0 mm (.157 in)	3.5 mm (.139 in)

Water Flow Regulator Valve

A water flow regulator valve is mounted on models with the 787 RFI and 947 engines so that they can produce the maximum horsepower output and yet maintain the necessary diameter of the injection fitting at the tuned pipe head for unobstructed water flow.

The water flow regulator valve **no. 4** is mounted directly onto the muffler.



TYPICAL

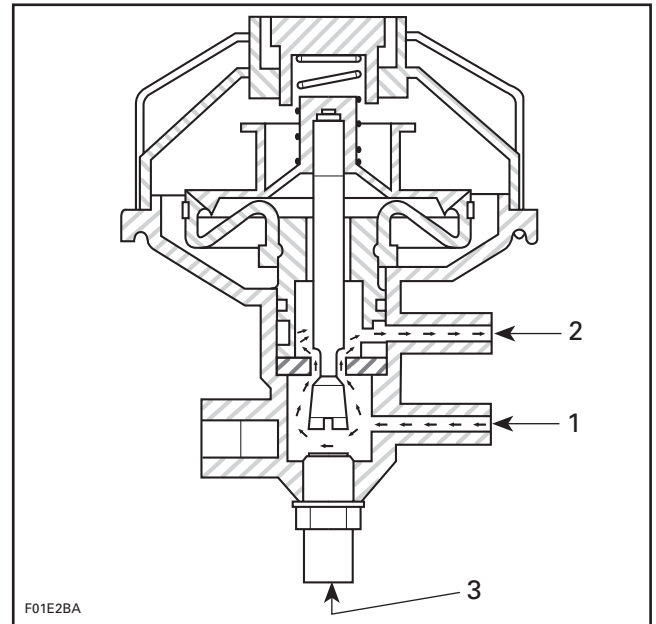
- 1. Water supply hose of regulator valve
- 2. Regulated water to injection fitting
- 3. Water injected into the muffler

NOTE: The water injected into the muffler is not regulated by the valve. A calibrated water injection fitting of 3.0 mm (.118 in) inside diameter limits water flow into the muffler.

The water flow regulator valve has a calibrated spring and a tapered needle which regulate the injected water in the tuned pipe.

CAUTION: Do not change the calibration of the spring, otherwise serious engine damage can occur.

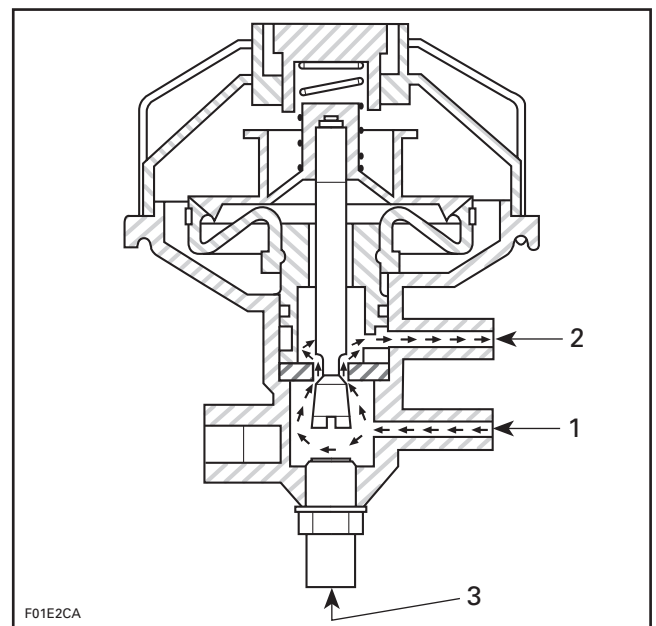
At low speed, water pressure in the supply hose of the regulator valve is not sufficient to overcome the spring of the regulator valve; more water is being delivered to the injection fitting at the tuned pipe.



LOW SPEED OPERATION

- 1. Water entering regulator valve
- 2. Water exiting regulator valve (less restriction)
- 3. Water injected in the muffler

At higher speed, water pressure increases in the supply hose of the regulator valve and gradually overcomes the return spring of the regulator valve. Less water is being delivered to the injection fitting at the tuned pipe.



HIGH SPEED OPERATION

- 1. Water entering regulator valve
- 2. Water exiting regulator valve (more restriction)
- 3. Water injected in the muffler

Section 05 COOLING SYSTEM

Subsection 02 (CIRCUIT, COMPONENTS AND CARE)

Adjustment

The water flow regulator valve has been calibrated at the factory and should not be modified.

NOTE: Water flow regulator valves ordered from the parts channel are also calibrated.

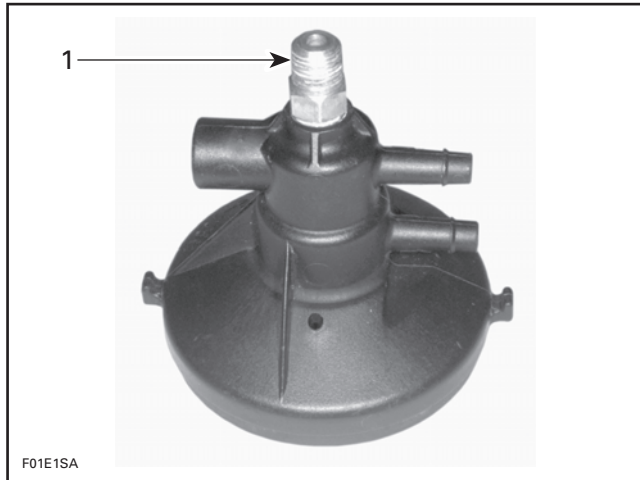
If the maximum engine speed cannot be attained or if the engine has poor performance, the water flow regulator valve should be considered in the troubleshooting of the problem.

Disassembly

Remove the cover no. 6 of the valve by releasing the spring no. 5.

WARNING

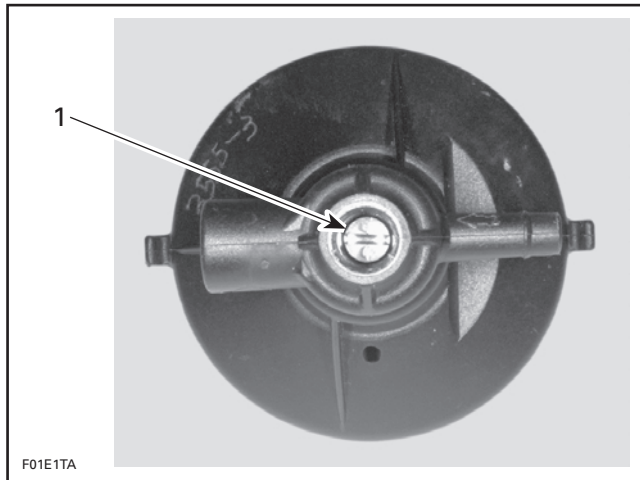
Firmly hold cover to valve base. The spring inside the valve is applying a pressure against the cover.



1. Fitting

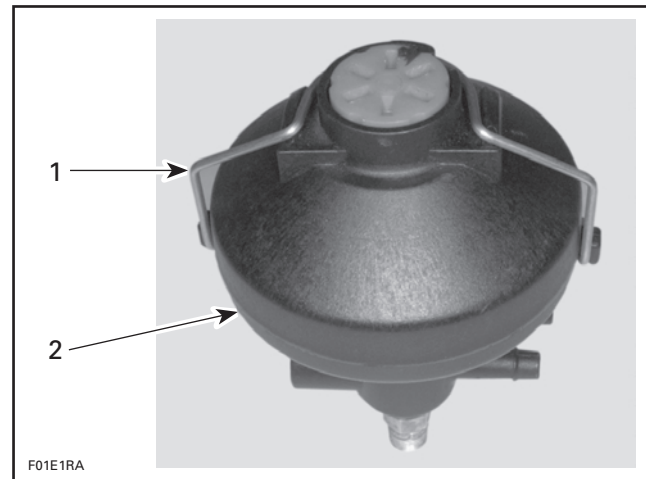
Unscrew the tapered needle no. 8.

NOTE: Hold the valve to prevent it from turning.



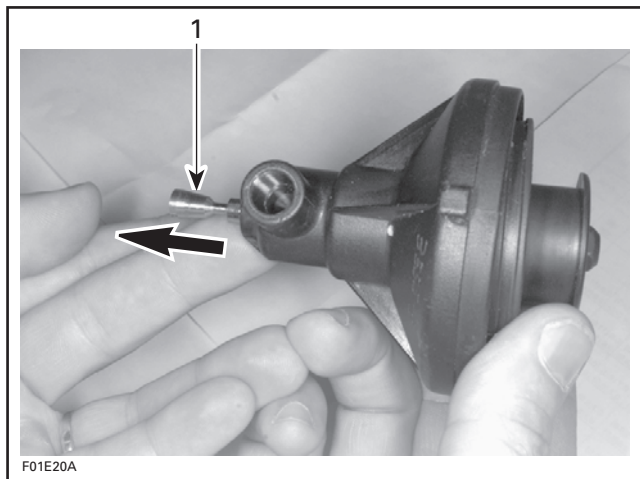
1. Tapered needle

Remove the tapered needle from valve housing.



1. Spring
2. Cover

Remove fitting no. 7 from valve housing.



1. Remove tapered needle

Section 05 COOLING SYSTEM

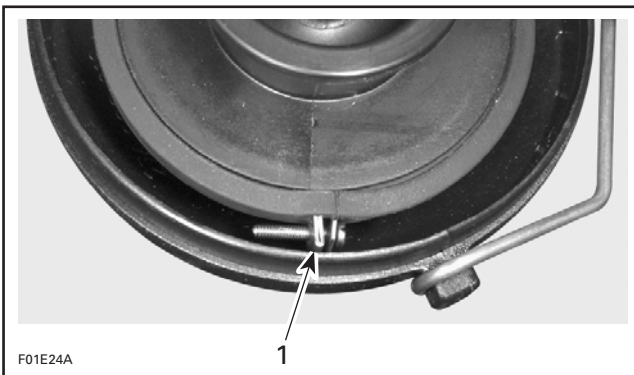
Subsection 02 (CIRCUIT, COMPONENTS AND CARE)

Pull the valve slightly. Using pliers, release the clamp which retains the bellows no. 10.

Remove valve no. 9 and bellows no. 10.



Loosen clamp to separate valve from bellows.



1. Clamp

Inspection

Inspect parts for damage. Verify especially bellows for cracks.

Assembly

Assembly is essentially the reverse of disassembly procedures.

CARE

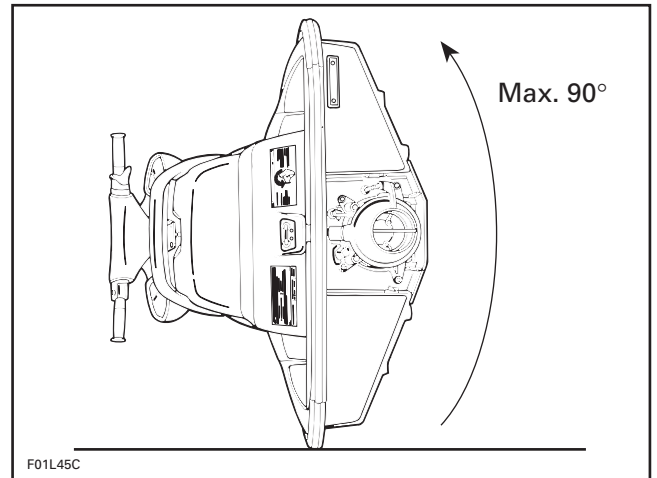
For flushing purposes, the cooling system is equipped with either a fitting spigot or a hose adapter depending upon the model.

For flushing operation, a coupler hose is available (unnecessary for models with the hose adapter) to connect to the fitting spigot. A garden hose is used to flush the whole system by backwash. For flushing procedure, refer to FLUSHING AND LUBRICATION.

For winterization of cooling system, refer to STORAGE.

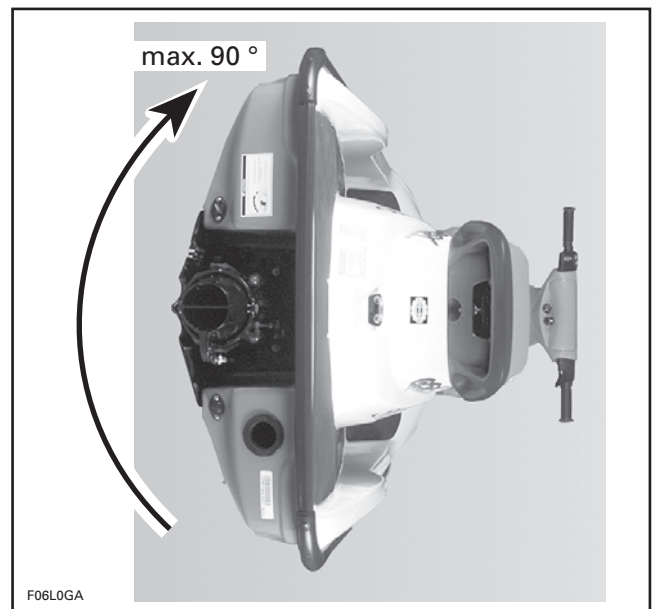
GS, GTS and GTI Models

When servicing the hull, always rotate watercraft counterclockwise (seen from the rear). Rotating watercraft on the opposite side could allow residual water in tuned pipe to enter the engine and cause damage.



XP and GTX Models

When servicing the hull, always rotate watercraft clockwise (seen from the rear). Rotating watercraft on the opposite side could allow residual water in tuned pipe to enter the engine and cause damage.



TYPICAL

Section 05 COOLING SYSTEM

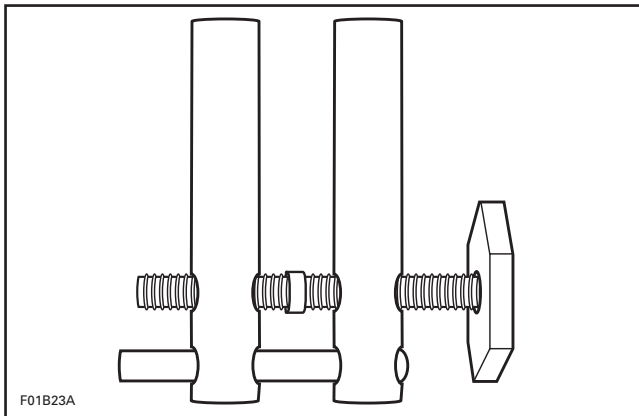
Subsection 02 (CIRCUIT, COMPONENTS AND CARE)

Towing the Watercraft in Water

Special precautions should be taken when towing a Sea-Doo watercraft in water.

Maximum recommended towing speed is 24 km/h (15 MPH).

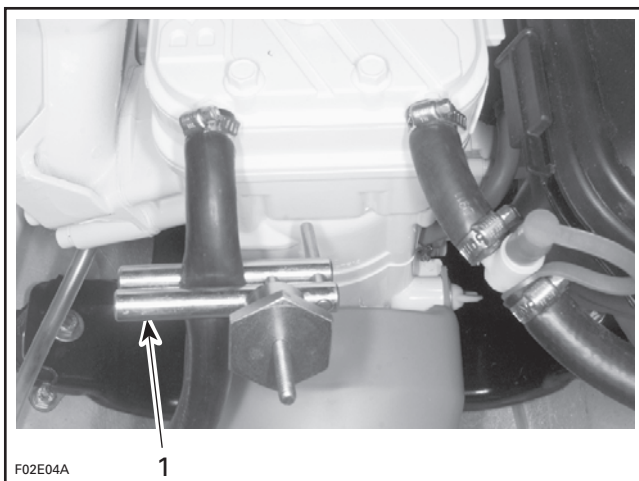
When towing your watercraft in water, pinch the water supply hose from the jet pump housing to the engine with a large Hose Pincher (P/N 529 030 400).



This will prevent the cooling system from filling which may lead to water being injected into and filling the exhaust system. Without the engine running there isn't any exhaust pressure to carry the water out the exhaust outlet.

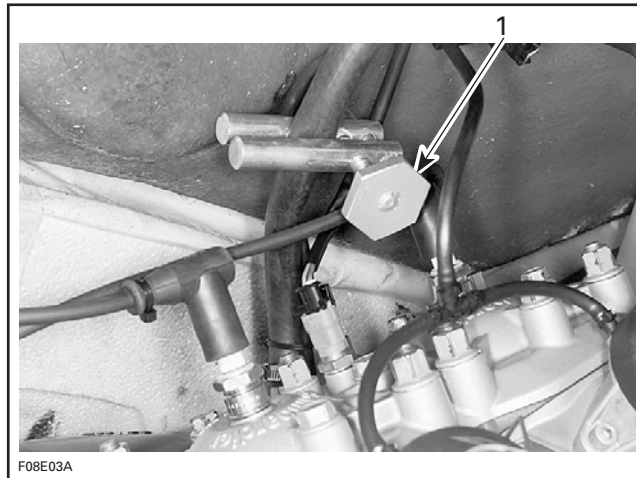
CAUTION: Failure to do this may result in damage to the engine. If you must tow a stranded watercraft in water and do not have a hose pincher be sure to stay well below the maximum towing speed of 24 km/h (15 MPH).

Snugly install the hose pincher on the water supply hose as shown in the following illustrations.



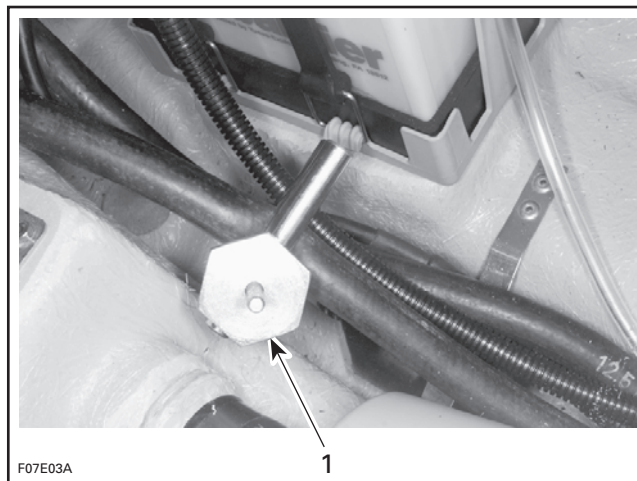
GS, GTS AND GTI MODELS

1. Hose pincher on water supply hose



XP MODEL

1. Hose pincher on water supply hose



GTX MODEL

1. Hose pincher

CAUTION: When finished towing the watercraft, the hose pincher must be removed before operating it.

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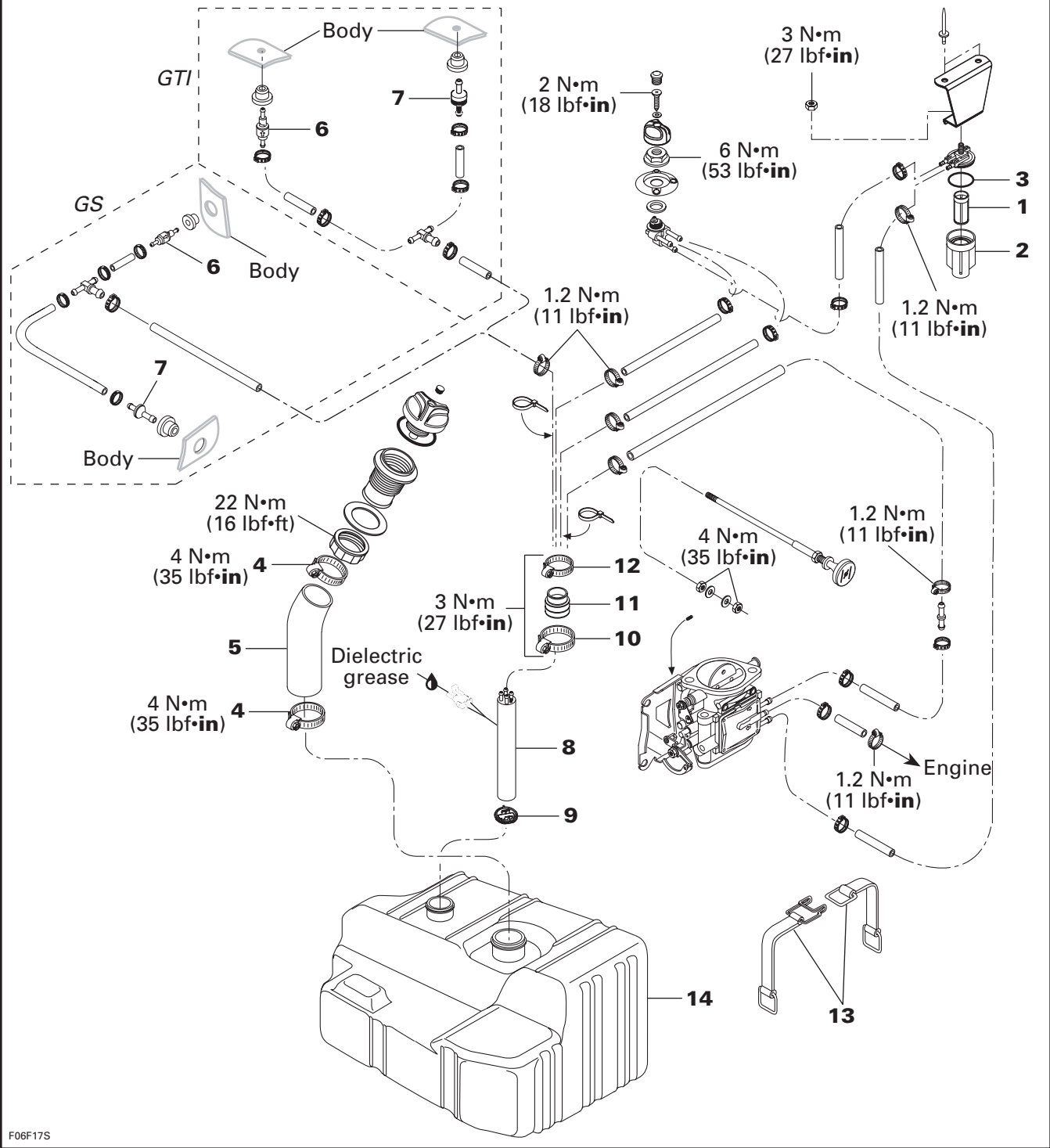
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FUEL CIRCUIT

GS and GTI Models

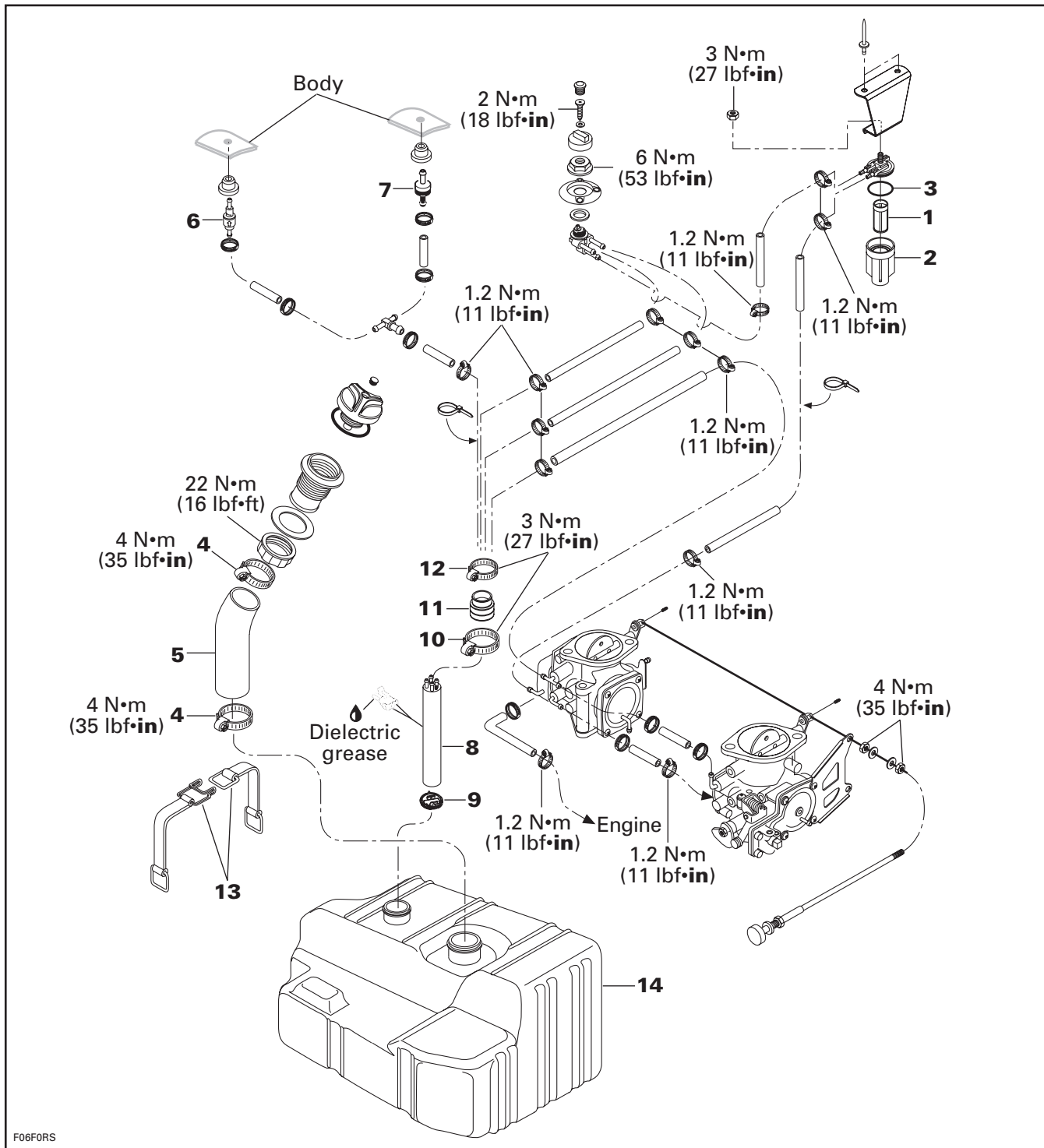


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Section 06 FUEL SYSTEM

Subsection 02 (FUEL CIRCUIT)

GTX Model

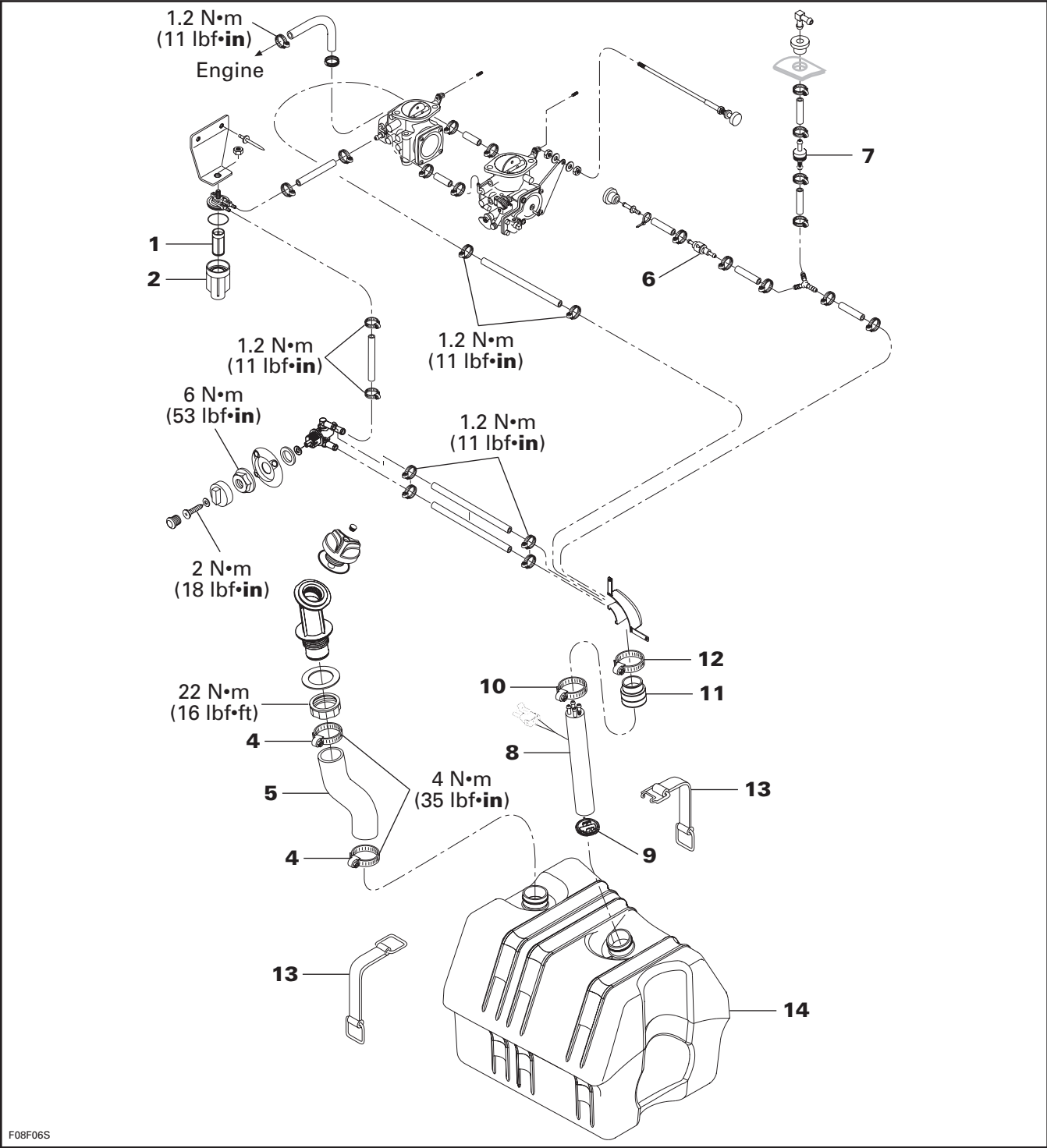


F06FORS

Section 06 FUEL SYSTEM

Subsection 02 (FUEL CIRCUIT)

XP Model



Section 06 FUEL SYSTEM

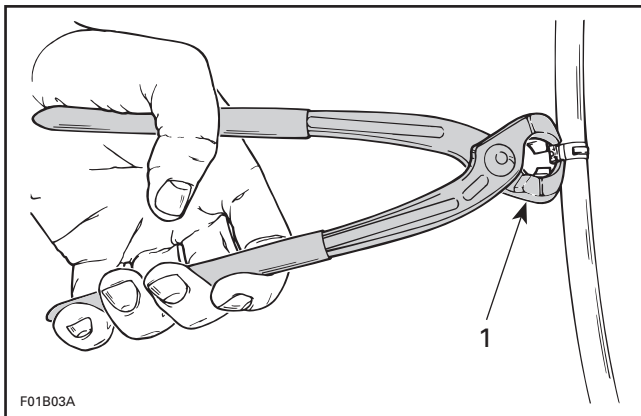
Subsection 02 (FUEL CIRCUIT)

GENERAL

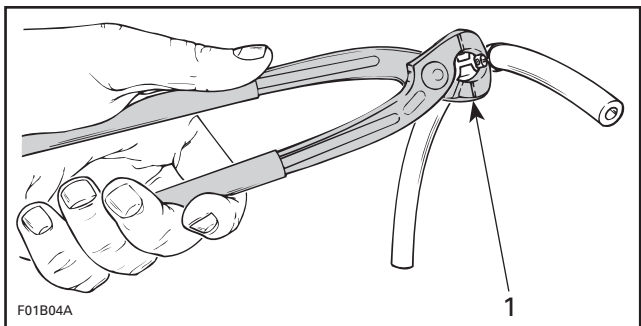
⚠ WARNING

Whenever repairing the fuel system, always verify for water infiltration in reservoir. Replace any damaged, leaking or deteriorated fuel lines.

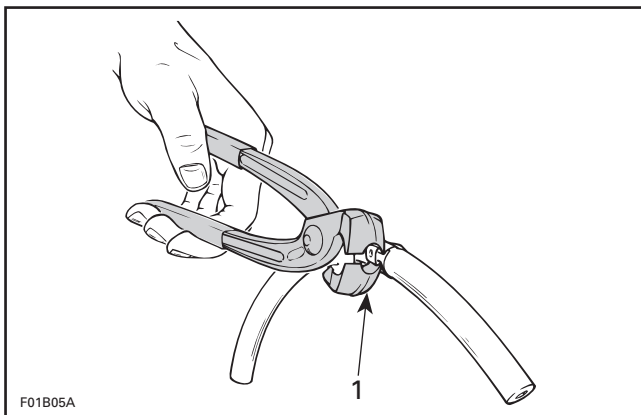
To secure or cut Oetiker clamps on fuel lines, use pliers (P/N 295 000 070).



1. Cutting clamp



1. Securing clamp



1. Securing clamp in limited access

When replacing fuel lines on SEA-DOO watercraft, be sure to use "B1" hoses as available from Bombardier parts department. This will ensure continued proper and safe operation.

⚠ WARNING

Use of improper fuel lines could compromise fuel system integrity.

REMOVAL

Fuel Filter

All Models Except XP and RFI Models

Open storage compartment cover.

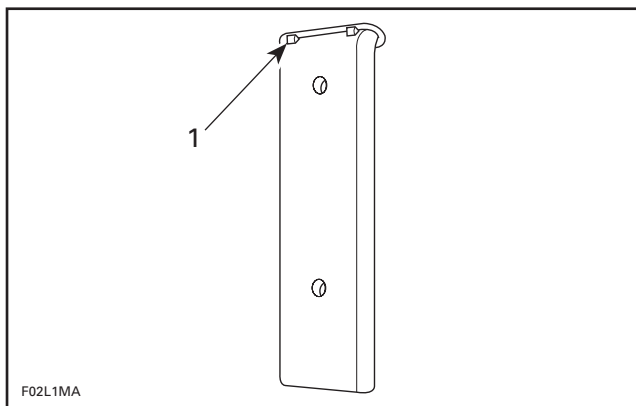
Remove basket.

XP Model

Open engine cover and remove basket.

GTS Model

Press on vent tube upper part to enable to withdraw tube from body.



TYPICAL

1. Press on vent tube

All Models

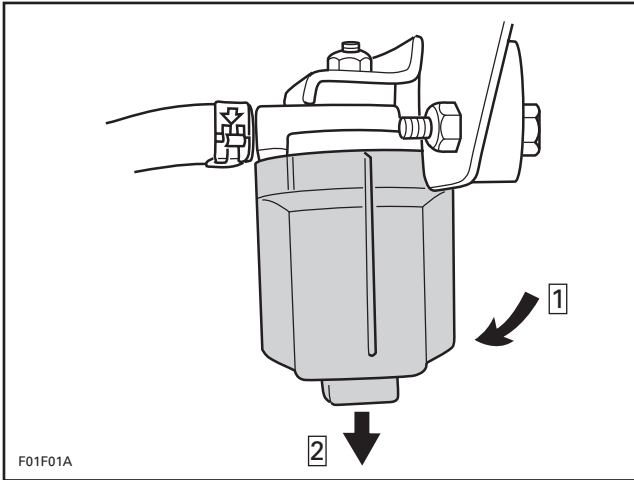
Turn the fuel valve to OFF position.

⚠ WARNING

The engine must not be running and fuel valve must be set to OFF position. Gasoline is flammable and explosive under certain conditions. Always work in a well ventilated area.

Unscrew fuel filler cap to remove any fuel pressure in system.

Unscrew the fuel filter bowl no. 2 counterclockwise then pull toward the bottom.

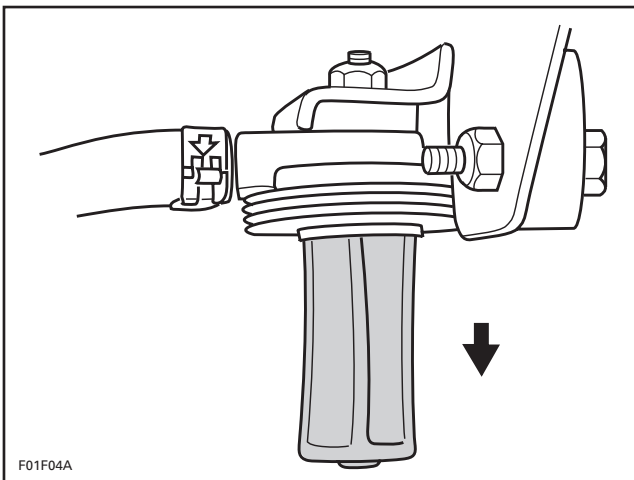


TYPICAL

Step 1: Loosen counterclockwise

Step 2: Pull

Pull fuel filter no. 1 toward the bottom.



TYPICAL

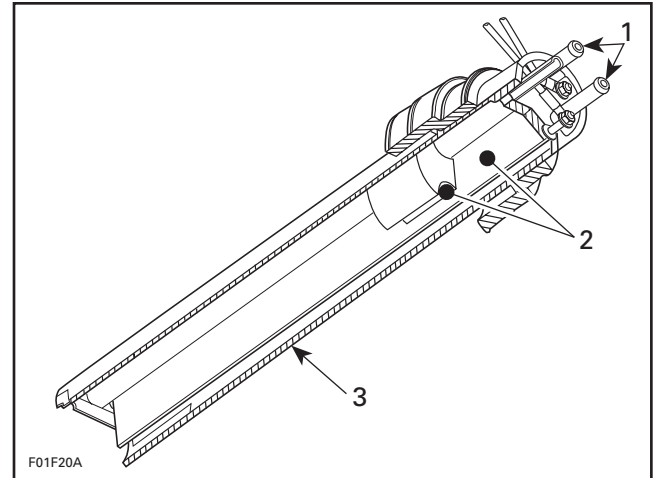
GSX RFI and GTX RFI Models

On GSX RFI and GTX RFI, the fuel pump assembly has to be removed from the fuel tank to have access to the fuel filter. Refer to FUEL INJECTION.

Fuel Baffle Pick Up

All Models Except GSX RFI and GTX RFI

NOTE: The baffle pick up has an integrated fuel sender for the fuel gauge.



1. Pick up tube
2. Fuel sensor
3. Baffle pick up

Disconnect BLACK negative cable, then RED positive cable of battery.

⚠ WARNING

Always disconnect battery cables exactly in the specified order, BLACK negative cable first.

GTS Model

Open storage compartment cover.

Remove storage basket from watercraft.

Siphon fuel tank.

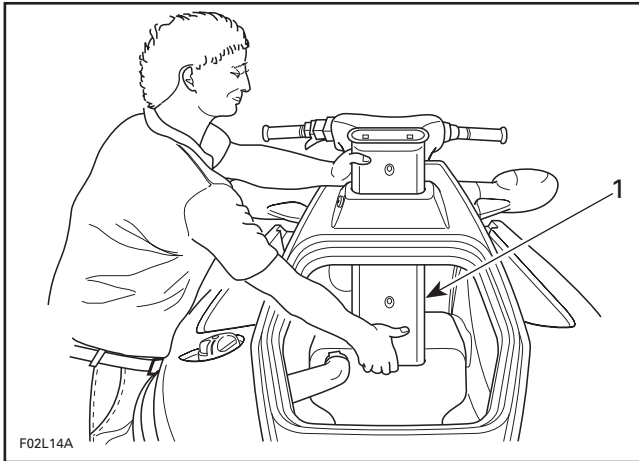
⚠ WARNING

Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area. Always wipe off any fuel spillage from the watercraft.

Section 06 FUEL SYSTEM

Subsection 02 (FUEL CIRCUIT)

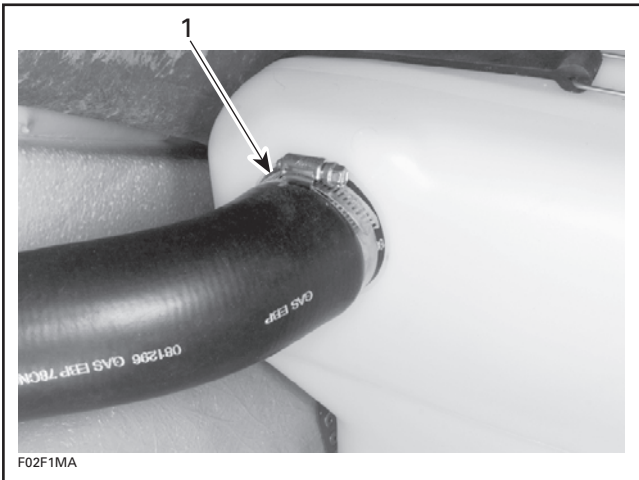
Remove vent tube.



F02L14A

1. Remove vent tube

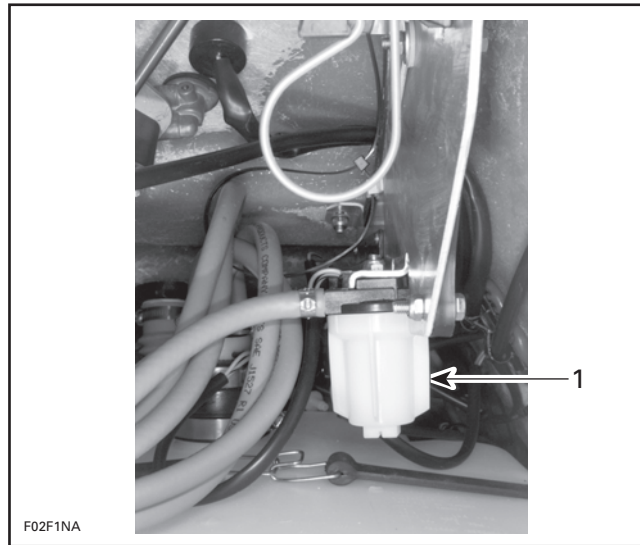
Disconnect fuel filler hose no. 5 from fuel tank.



F02F1MA

1. Disconnect fuel filler hose

Loosen lock nut and remove fuel filter from reverse system support.

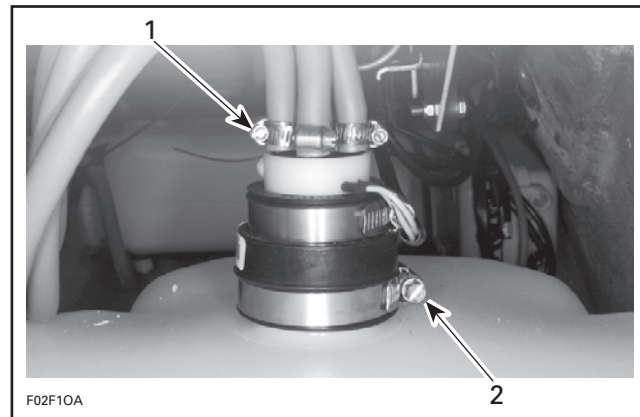


F02F1NA

1. Remove fuel filter

Disconnect the fuel lines from baffle pick up and loosen lower clamp no. 10.

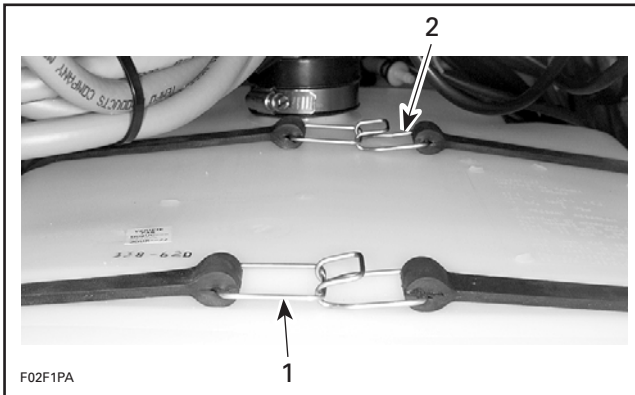
NOTE: Identify fuel line positions to ease reassembly.



F02F10A

1. Disconnect fuel hoses
2. Loosen lower clamp

Disconnect the middle and front fuel tank straps no. 13.



1. Front fuel tank strap
2. Middle fuel tank strap

From the engine compartment, disconnect the strap retaining the oil injection reservoir and fuel tank.

NOTE: It is not necessary to remove the oil injection reservoir.

Move fuel tank forward until the fuel baffle pick up can be removed from the storage compartment opening.

GS Model

Open storage compartment cover.

Remove storage basket from watercraft.

Siphon fuel tank.

WARNING

Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area. Always wipe off any fuel spillage from the watercraft.

Remove steering assembly. Refer to STEERING SYSTEM for procedure.

GTI and GTX Models

Siphon fuel tank.

WARNING

Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area. Always wipe off any fuel spillage from the watercraft.

Remove glove box.

XP Model

Tilt seat. Refer to HULL/BODY for procedure.

Remove access plug on body.

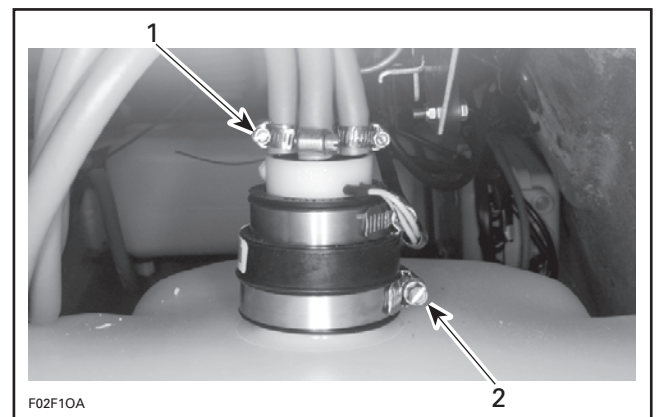
Siphon fuel tank.

WARNING

Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area. Always wipe off any fuel spillage from the watercraft.

GS, GTI and GTX Models

Disconnect fuel lines from baffle pick up and loosen lower clamp no. 10.



TYPICAL

1. Disconnect fuel hoses
2. Loosen lower clamp

Disconnect wiring harness of fuel sender.

Remove baffle from fuel tank.

All Models

Remove upper clamp no. 12 from adapter no. 11 and slide adapter from baffle.

Push inward on the 3 clips at the base of the baffle in order to remove the filter. Pry base off using a small slotted screwdriver (if necessary).

Fuel tank

All Models

NOTE: On GS and GSX RFI, it is necessary to remove the engine. Refer to REMOVAL and INSTALLATION section.

Section 06 FUEL SYSTEM

Subsection 02 (FUEL CIRCUIT)

Siphon fuel tank.

⚠ WARNING

Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area. Always wipe off any fuel spillage from the watercraft.

Remove fuel baffle pick up. Refer to the above section.

Detach all fuel tank straps.

Pull out fuel tank.

INSPECTION

Fuel Filter

All Models Except GSX RFI and GTX RFI

Inspect fuel filter condition. Carefully use low pressure compressed air to clean fuel filter. Replace filter if permanently clogged or damaged.

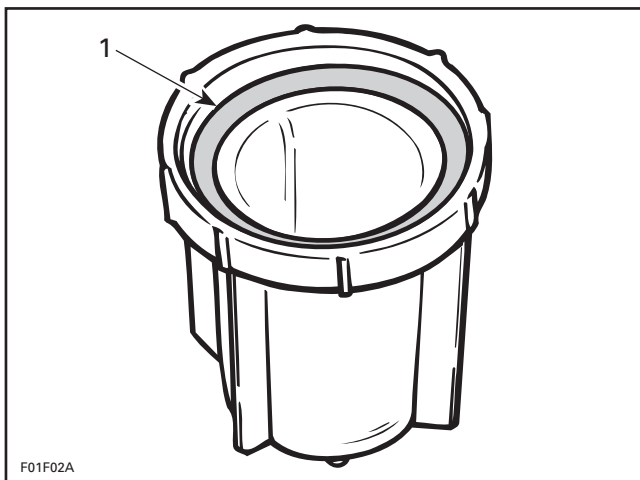
NOTE: On GSX RFI and GTX RFI, the fuel pump assembly must be removed to have access to the fuel filter. Refer to FUEL INJECTION.

Fuel Filter Bowl

Check filter bowl for water contamination.

Gasket

Inspect gasket condition. Make sure gasket no. 3 is well positioned into the filter bowl no. 2.



1. Gasket in bowl

⚠ WARNING

Ensure that there is no leakage from the fuel filter.

Fuel Filler Hose

Verify fuel filler hose no. 5 for damage. Always ensure that clamps no. 4 are well positioned and tightened. Torque clamps to 4 N•m (35 lbf•in).

Pressure Relief Valve

All Models

This valve will eliminate fuel spillage when the watercraft is upside down. If pressure is built up in fuel system the valve should open at 10 kPa (1.5 PSI) to release the pressure.

⚠ WARNING

If pressure relief valve is stuck, the pressure in fuel system will build up and it may cause fuel leakage in engine compartment.

NOTE: It is a one-way valve with an arrow to indicate the air flow.

Check Valve

Black side of the one-way check valve no. 7 is the valve outlet. It allows air to get in reservoir.

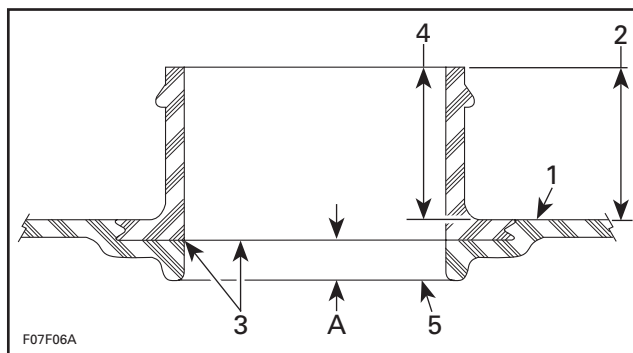
Baffle Pick Up Filter

Inspect filter no. 9 of baffle pick up. Clean or replace as necessary.

Fuel Tank

Visually inspect the inside and outside of the fuel tank necks for crack(s). If crack(s) are existing, replace fuel tank no. 14.

Check with your finger to feel the inside and outside surfaces of fuel tank. Flex fuel tank necks to ensure there are no hidden cracks.



1. Tank upper surface
2. Inspect outside, above upper surface
3. Normal molding seam
4. Inspect inside, above upper surface
5. Base of the neck
- A. Approx. 4 mm (5/32 in)

NOTE: A fuel tank is comprised of 3 components: the tank, the fuel pick up neck and the filler neck. The necks are injection molded and the tank is then blow molded over the necks. During the molding process, a **small molding seam** may appear on the inner side of the necks at approximately 4 mm (5/32 in) from the base of the neck. It is a normal situation to have a molding seam and it should not be confused with a crack.

ASSEMBLY

Assembly is essentially the reverse of disassembly procedures. However pay particular attention to the following.

Baffle Pick Up

Slide adapter **no. 11** onto baffle pick up **no. 8** until it stops on rib. Install clamp **no. 12**.

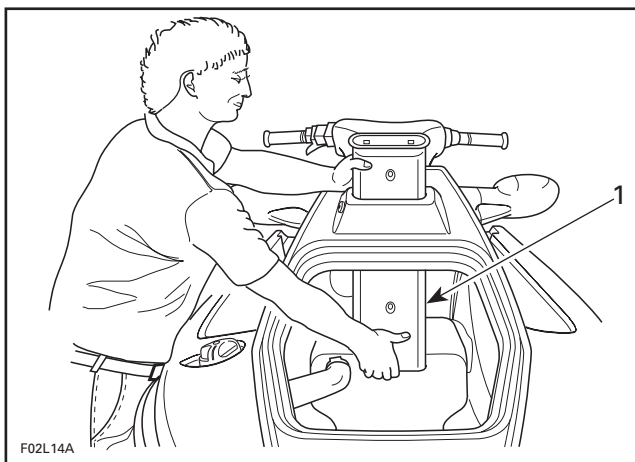
Install baffle pick up **no. 8** into fuel tank and push it until it sits on fuel tank neck. Install clamp **no. 10** and torque both clamps to 3 N•m (27 lbf•in).

GTS Model Only

Insert vent tube in body and clip it in place.

WARNING

Vent tube must be in place to provide proper bilge ventilation.



1. Install vent tube

FUEL SYSTEM PRESSURIZATION

WARNING

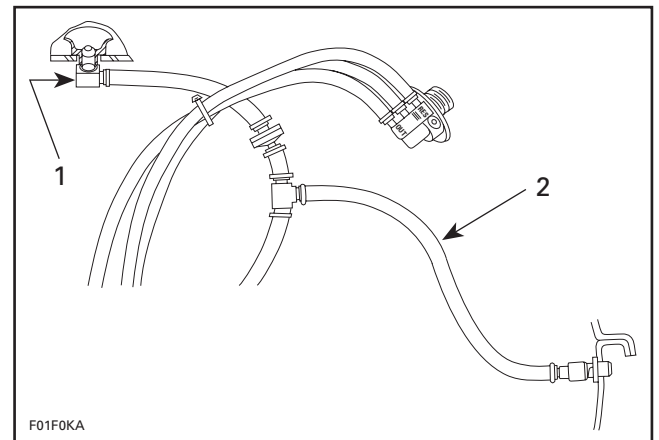
Whenever doing any type of repair on watercraft or if any components of the fuel system are disconnected, a pressure test must be done before starting engine. Ensure to verify fuel line ends for damage. Always cut damaged end before reinstallation.

Pressure Test

All Models

Proceed as follows:

- Fill up fuel tank.
- Disconnect air inlet hose of fuel tank from body.
- Install a hose pincher (P/N 295 000 076) on fuel tank vent hose.



TYPICAL

1. Disconnect air inlet hose
2. Install a hose pincher to vent hose

- Connect pump gauge tester (P/N 529 021 800) to air inlet hose.

NOTE: This pump is included in the ENGINE LEAK TESTER KIT (P/N 295 500 352).

- Turn fuel valve to OFF position (except GSX RFI and GTX RFI).
- Pressurize fuel system to 34 kPa (5 PSI).
- If no leaks are found, turn fuel valve to ON position and pressurize once more.

Section 06 FUEL SYSTEM

Subsection 02 (FUEL CIRCUIT)

- If pressure is not maintained locate leak and repair/replace component leaking. To ease leak search spray a solution of soapy water on components, bubbles will indicate leak location.

NOTE: The system must maintain a pressure of 34 kPa (5 PSI) during 10 minutes. Never pressurize over 34 kPa (5 PSI).

Reconnect air inlet hose of fuel tank to body.

WARNING

If any leak is found, do not start the engine and wipe off any fuel leakage. Do not use electric powered tools on watercraft unless system has passed pressure test.

NOTE: Before removing the hose pincher, block with your finger the outlet fitting to feel if air is coming out when removing hose pincher. This will indicate that pressure relief valve and the outlet fitting are not blocked.

Remove hose pincher from fuel tank vent hose.

High Pressure Test

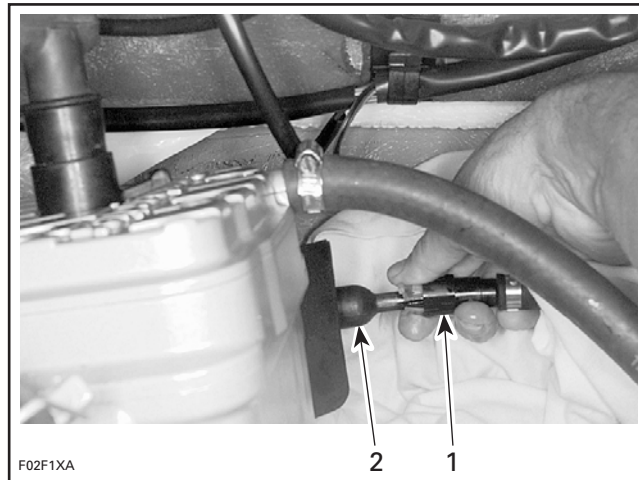
GSX RFI and GTX RFI Models Only

Before proceeding to the pressure test ensure the battery is fully charged. Battery voltage must be over 12 volts.

WARNING

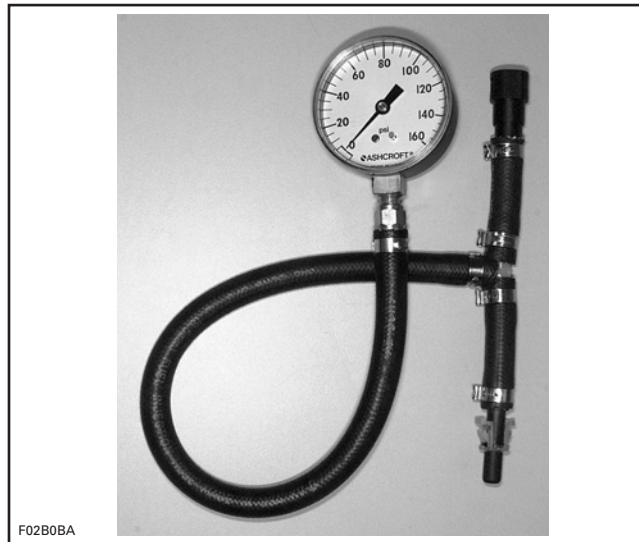
The fuel hose may be under pressure. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to release the pressure. Wipe off any fuel spillage inside bilge.

Press on both tabs and pull quick connect fitting to disconnect the fuel hose from fuel rail.



1. Quick connect fitting
2. Fuel rail

Install fuel pressure gauge (P/N 529 035 591) between fuel rail and fuel hose from fuel tank.



FUEL PRESSURE GAUGE P/N 529 035 591

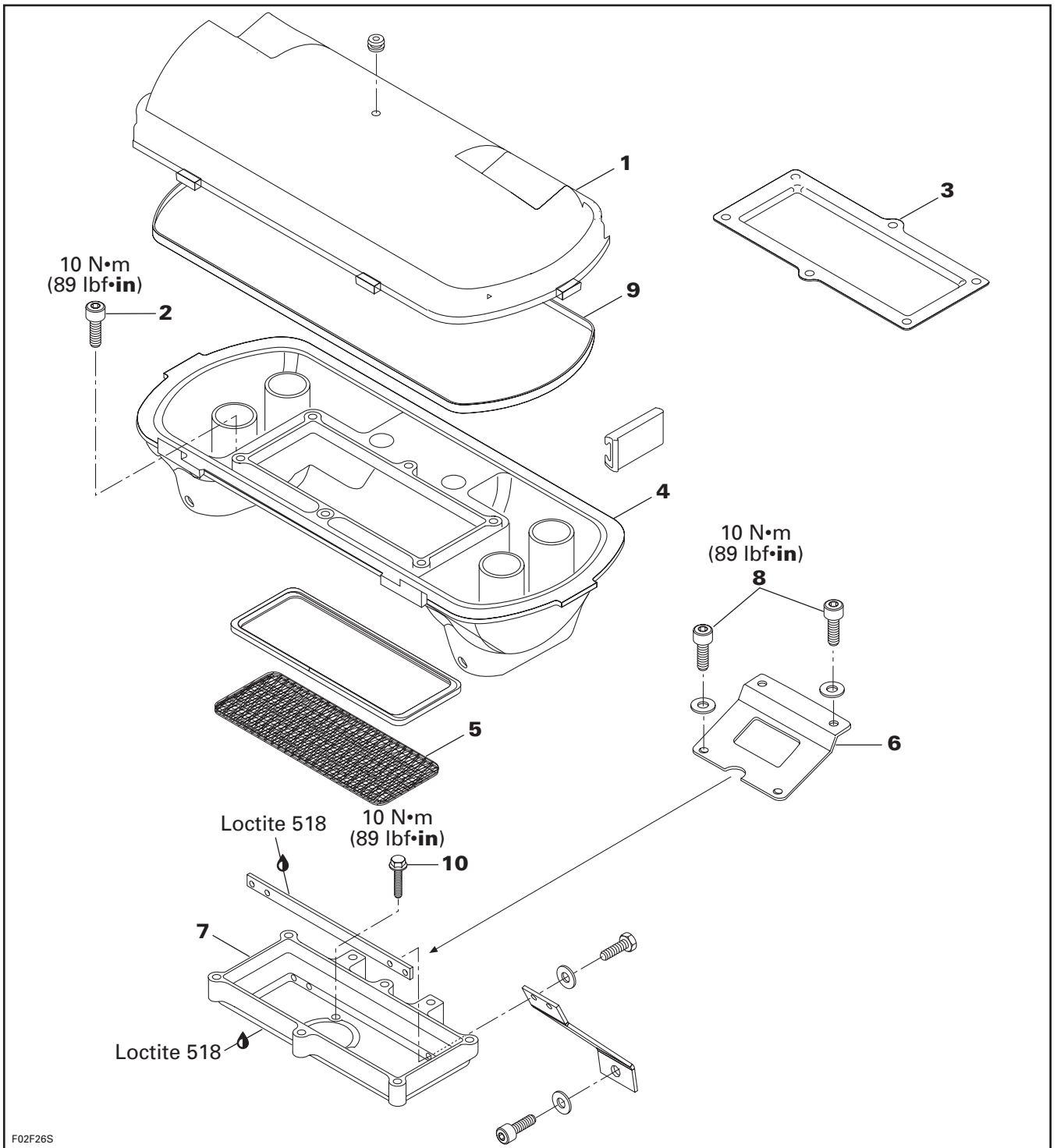
Install the safety lanyard cap on the switch to activate the fuel pump.

The fuel pump should run for approximately 1 second and the fuel pressure should be between 386-414 kPa (56-60 PSI).

Check hose connections at fuel pump and at fuel rail.

AIR INTAKE

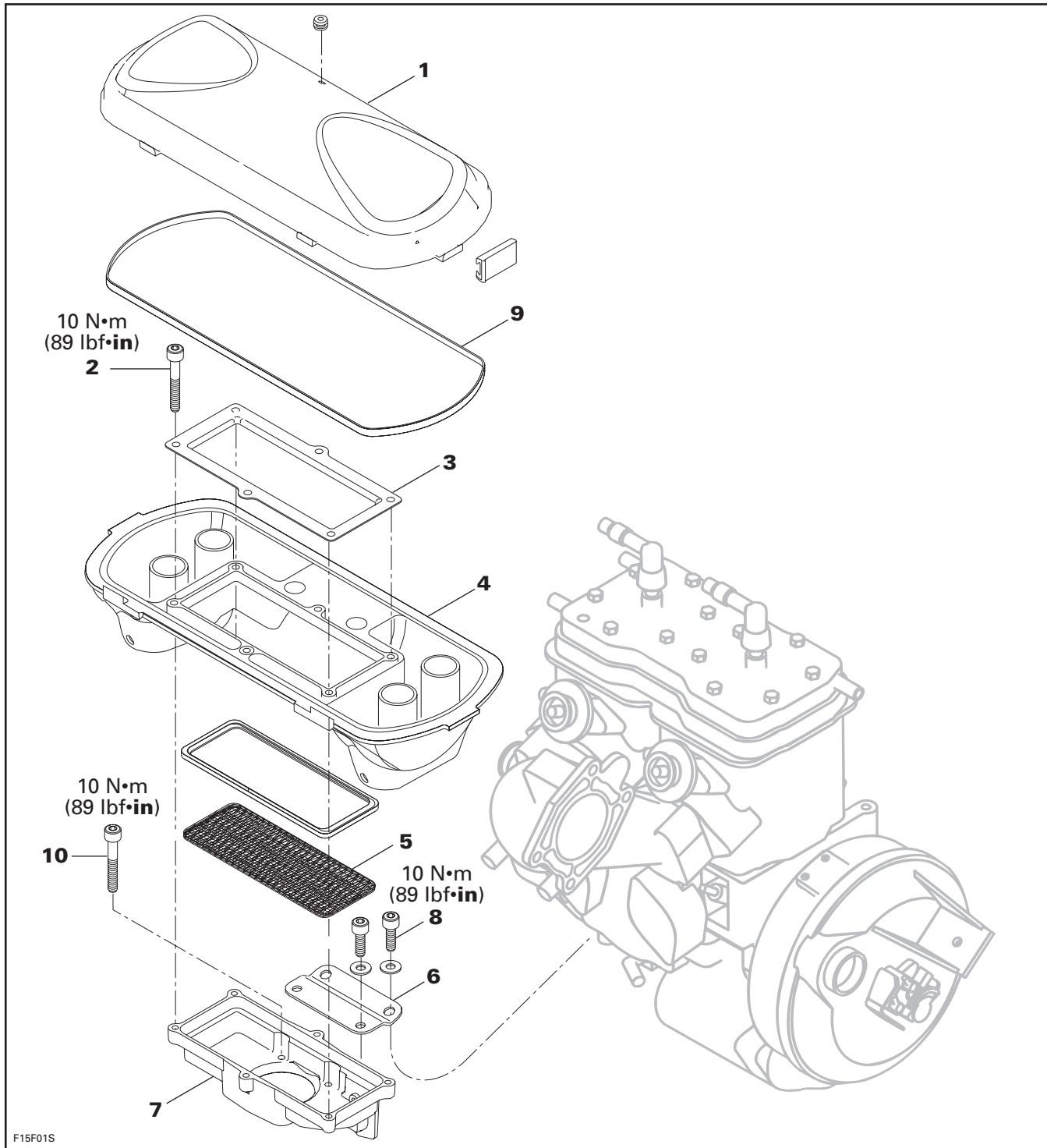
GS, GTS and GTI Models



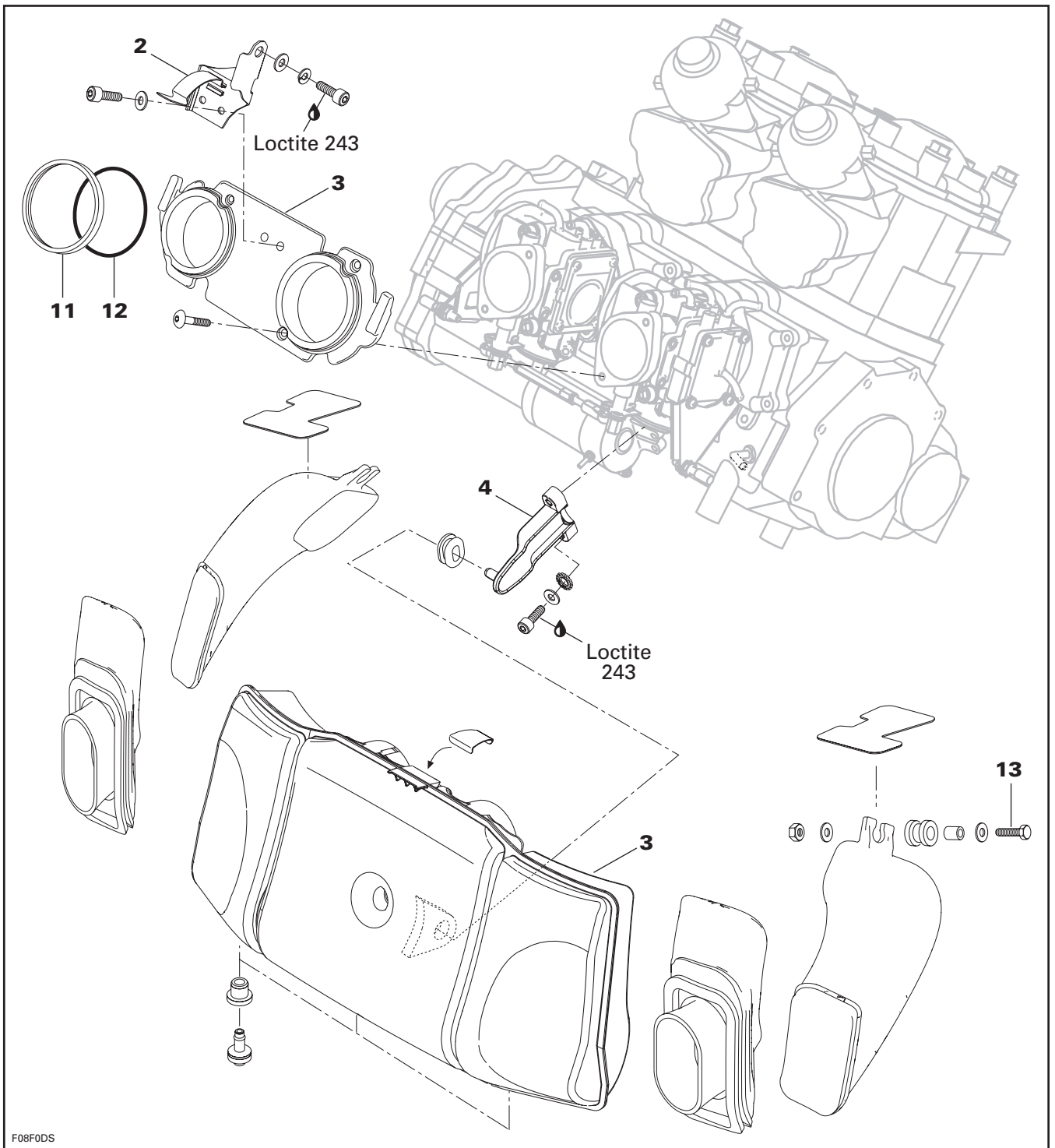
Section 06 FUEL SYSTEM

Subsection 03 (AIR INTAKE)

GSX RFI and GTX RFI Models



XP and GTX Models



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Section 06 FUEL SYSTEM

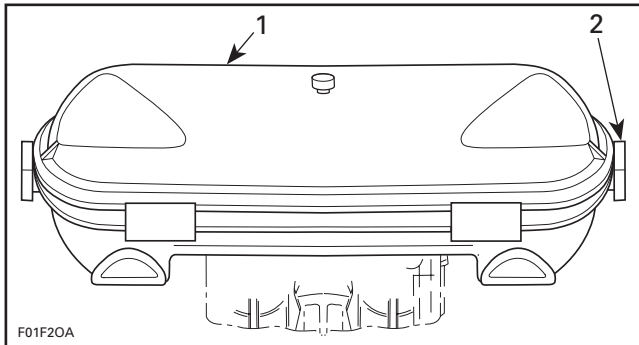
Subsection 03 (AIR INTAKE)

REMOVAL

717 and 787 RFI engines

Air Intake Silencer Cover

Unlock the 6 retaining slides holding air intake silencer cover no. 1 and remove cover.



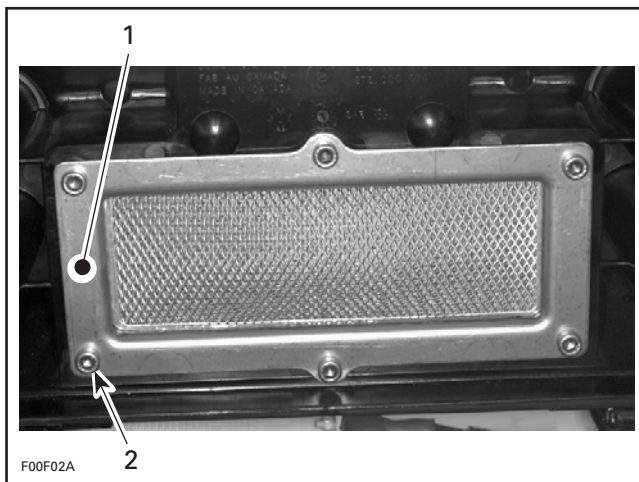
TYPICAL

1. Air intake silencer cover
2. Unlock

Air Intake Silencer Base

Remove screws no. 2 of retaining plate no. 3.

Pull out retaining plate no. 3 and air intake silencer base no. 4.

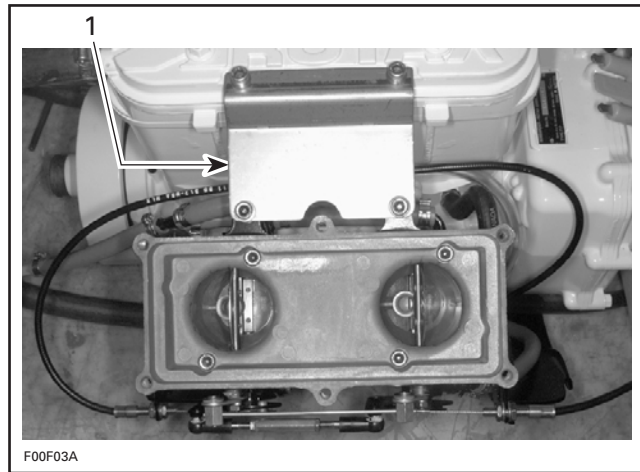


1. Retaining plate
2. Remove screws

Flame Arrester Base

Remove flame arrester no. 5.

Remove screws no. 8 retaining support no. 6 of flame arrester base to the cylinder head cover (717 engine) or to the exhaust manifold (787 engine).



TYPICAL

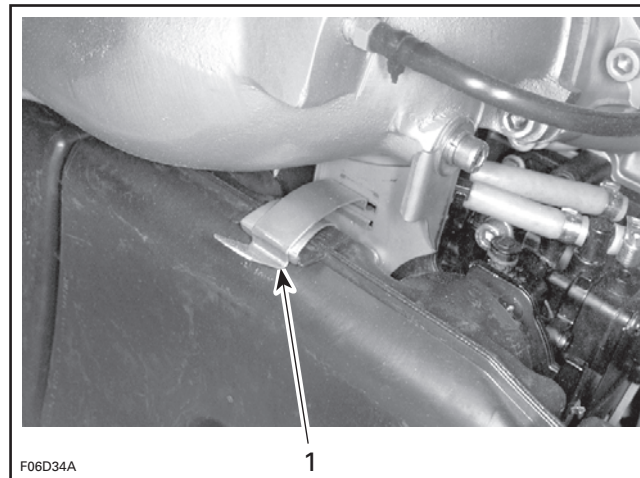
1. Remove support

Remove screws no. 10 from flame arrester base then withdraw base.

947 Engine

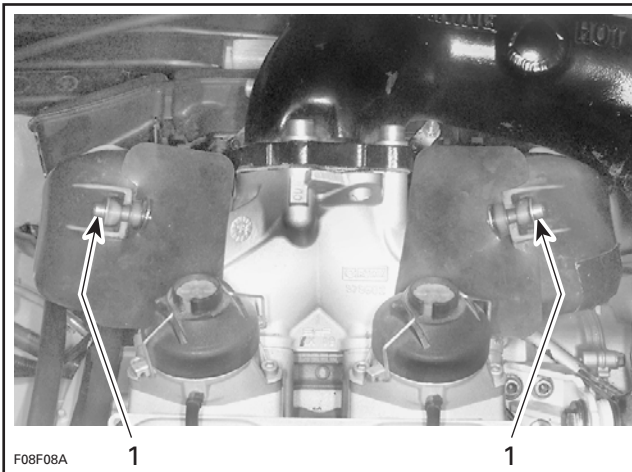
Air Intake Silencer

Unlock the clip no. 2 on top of air intake silencer.



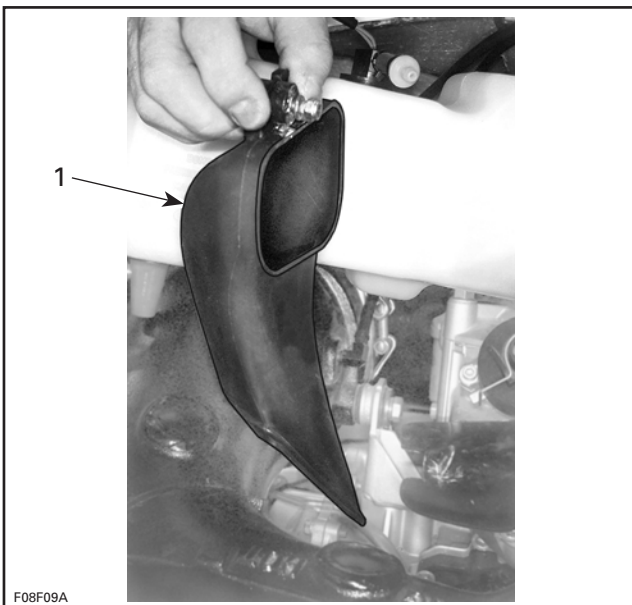
1. Clip

Remove bolts retaining both air ducts to engine (both sides).



1. Remove bolts

Pull air ducts out.



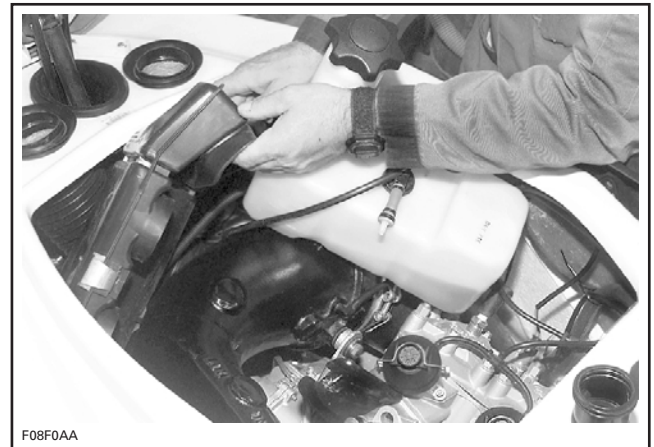
1. Air duct

On XP model, detach retaining straps and pull oil reservoir out.

NOTE: Do not disconnect oil lines.

Push the air intake silencer out of the carburetor adapter **no. 3**.

Pull the air intake silencer rearward to remove it from the lower bracket **no. 4** and remove it in a rotating movement.



XP MODEL

The air intake silencer is a molded piece and it can not be opened. It has an integrated flame arrester.

ASSEMBLY

Assembly is essentially the reverse of removal procedures. However pay particular attention to the following.

CAUTION: Do not modify air intake system, otherwise calibration will be affected.

GS, GTS and GTI Models

Flame Arrester Base

Apply Loctite 518 on mating surfaces of flame arrester base **no. 7**.

Apply Loctite 243 (blue) on screws **no. 10** and torque to 10 N•m (88 lbf•in).

Flame Arrester

Inspect condition of flame arrester **no. 5**. Replace or clean as necessary.

⚠ WARNING

Do not operate watercraft without flame arrester.

Section 06 FUEL SYSTEM

Subsection 03 (AIR INTAKE)

Gasket

Inspect condition of gasket **no. 9**. Make sure to properly install gasket.

XP and GTX Models

Air Intake Silencer

Make sure than gaskets **no. 11** are installed into carburetor holes of air intake silencer.

Check O-rings **no. 12** on carburetor intake adapters and change them if necessary.

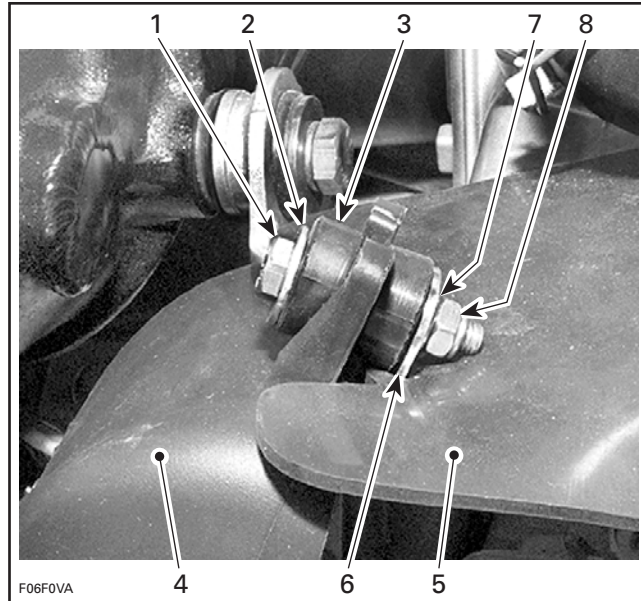
NOTE: Apply Super Lube grease (P/N 293 550 014) to mating surface of air intake silencer **no. 1**.

Install air intake silencer on carburetor intake adaptor and latch in place.

NOTE: Make sure the air intake silencer is retained by the lower bracket **no. 4**.

Place protector pads on duct supports. Use slot in rubber to insert pad on bracket eyelet. Side tongue of protector pad should be toward outside of vehicle and bent downward toward the exhaust flange.

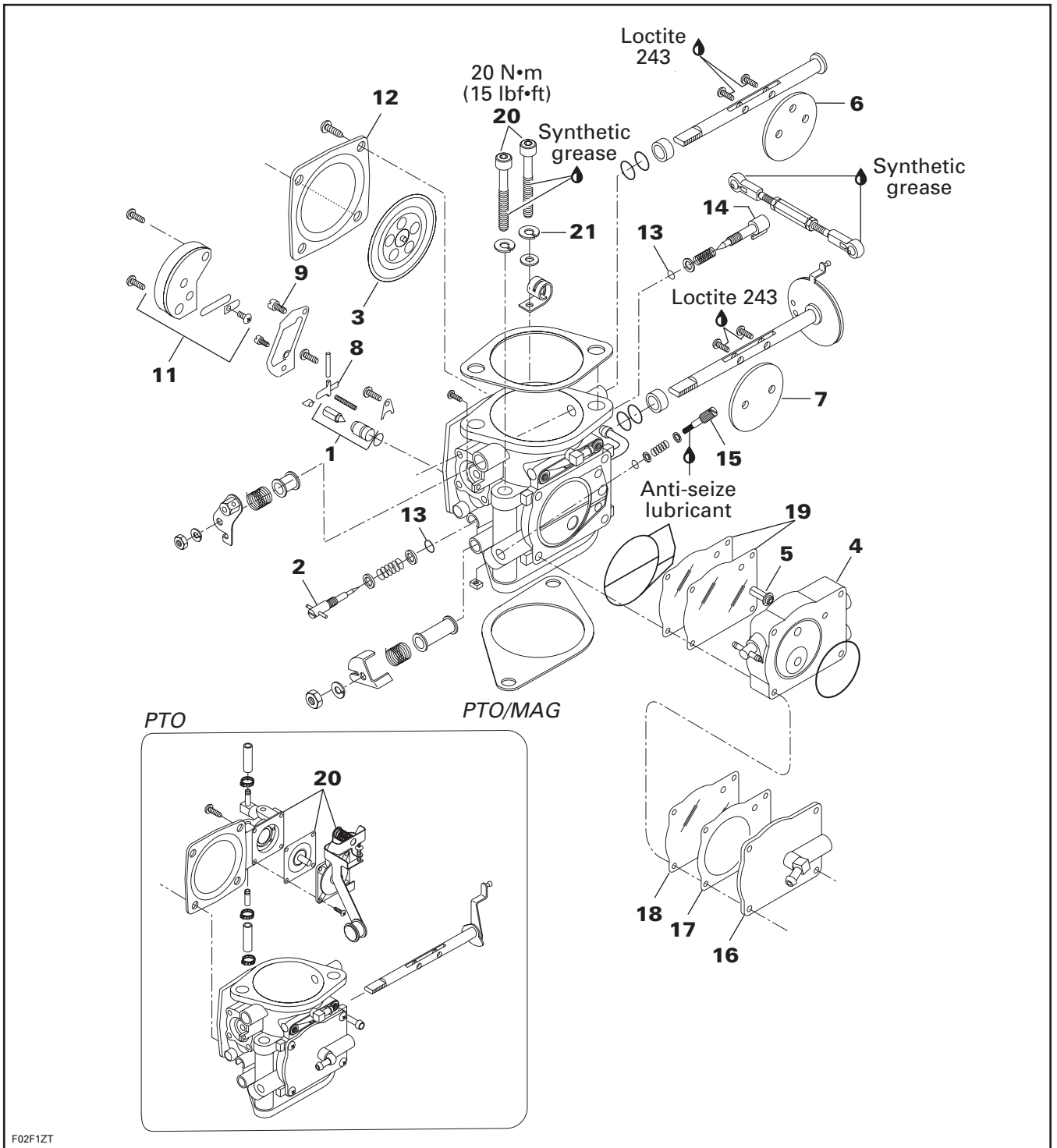
Put air ducts in intake adapters and secure them on duct supports with hexagonal screws **no. 13**, wide washers, narrow washers and elastic stop nuts. A slight lift will be required to make the bolts line up with brackets.



1. Hexagonal screw M6
2. Wide flat washer
3. Insulator
4. Air duct
5. Protector pad
6. Duct support eyelet
7. Narrow flat washer
8. Hexagonal stop nut M6

CARBURETOR

Mikuni BN-40i and BN-46i

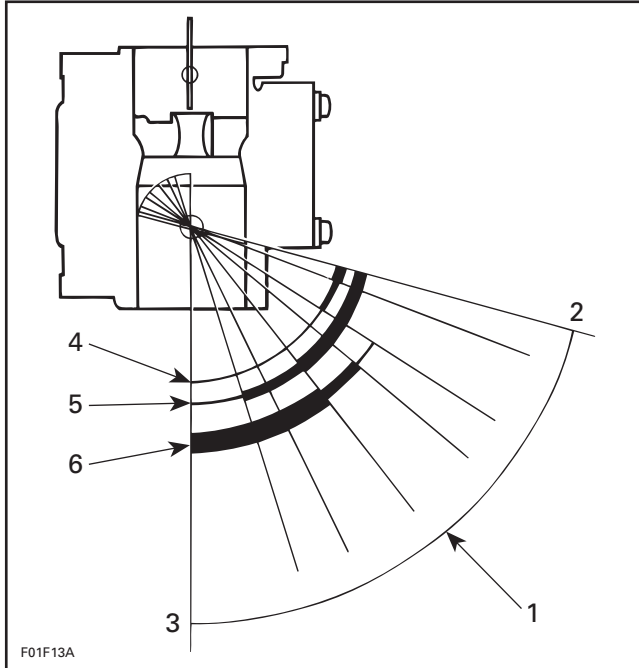


Section 06 FUEL SYSTEM

Subsection 04 (CARBURETOR)

GENERAL

The following illustration shows which part of the carburetor begins to function at different throttle plate openings.



VIEW FROM AIR INTAKE OPENING

1. Throttle plate openings
2. Throttle plate closed
3. Throttle plate wide opened
4. Low-speed screw
5. Pilot jet
6. Main jet and high-speed screw

The carburetor(s) is (are) equipped with a fuel accelerator pump.

The fuel accelerator pump is linked to the throttle valve via a linkage.

A metering jet in the fuel inlet hose controls fuel flow to the pump.

A check valve on the fuel outlet hose helps to prime the system.

REMOVAL

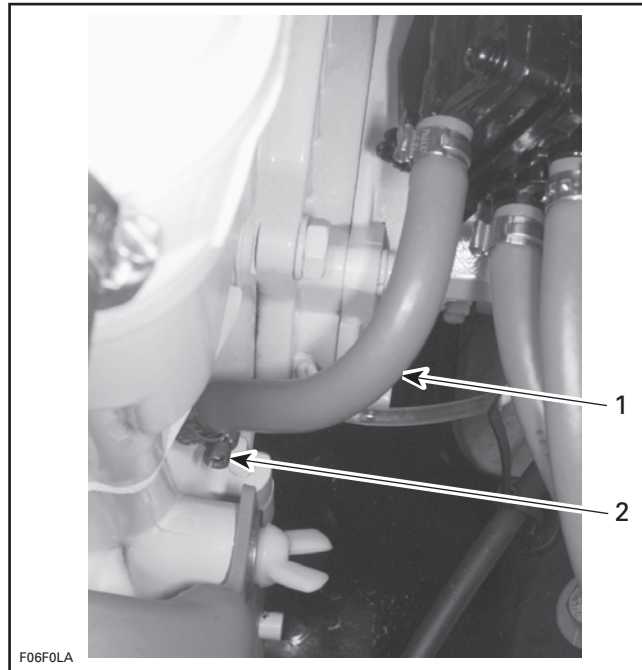
To remove carburetor(s) from engine, proceed as follows:

Remove air vent tube support (GTI only).

Remove air intake silencer. Refer to AIR INTAKE.

Turn fuel valve to OFF position (except RFI models).

Disconnect pulse line.



TYPICAL

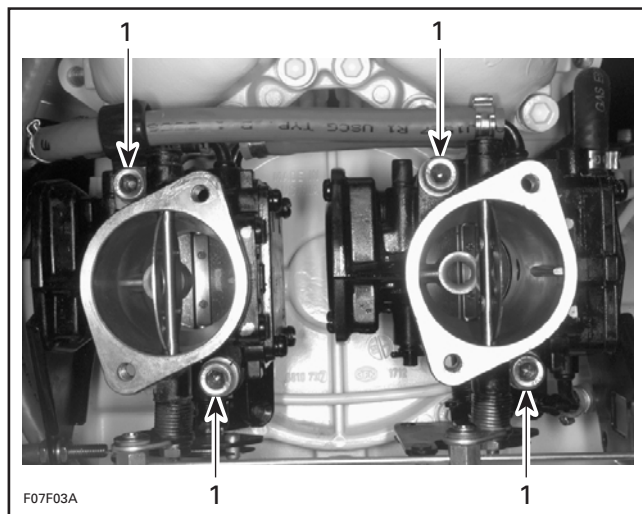
1. Pulse line
2. Loosen gear clamp

Disconnect fuel supply line from fuel pump.

Disconnect fuel return line.

Disconnect oil injection pump cable, throttle cable and choke cable.

Remove screws **no. 20** and lock washers **no. 21** retaining carburetor(s).



TYPICAL

1. Remove screws

Remove carburetor(s).

CLEANING

The carburetor exterior surfaces should be cleaned with a general solvent and dried with compressed air before disassembly.

CAUTION: Be careful at carburetor cleaning not to remove paint. Paint removal will cause carburetor to rust very rapidly. Repaint if necessary.

Carburetor body and jets should be cleaned with a carburetor cleaner. Follow manufacturer's instructions.

⚠ WARNING

Solvent with a low flash point such as gasoline, naphtha, benzol, etc., should not be used as they are flammable and explosive.

CAUTION: Heavy duty carburetor cleaner may be harmful to the rubber parts, O-rings, etc. Therefore, it is recommended to remove these parts prior to cleaning.

Inspect O-rings, diaphragms and gaskets.

DISASSEMBLY AND INSPECTION

Inspect parts for corrosion damage (shaft, throttle plate, spring, screw, check valve housing, etc.).

Needle Valve

Inspect needle valve tip for a grooved condition. If worn, needle and seat must be replaced as a matched set.

Low Speed Screw

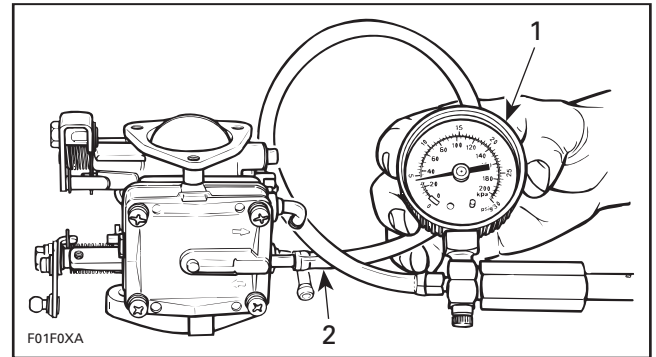
Check tip of low speed screw **no. 2** for a grooved condition. Replace if necessary.

Diaphragm

Pump Diaphragm Leak Test

Using a suitable pump gauge tester, perform the following test proceeding as follows:

- Install pump gauge tester (P/N 295 000 114) on pulse nipple.
- Pump tester until it reaches 28 kPa (4 PSI).



TYPICAL

1. Pump gauge tester
2. Install on pulse nipple

Diaphragm must stand pressure for 10 seconds. If pressure drops, replace diaphragm **no. 3**.

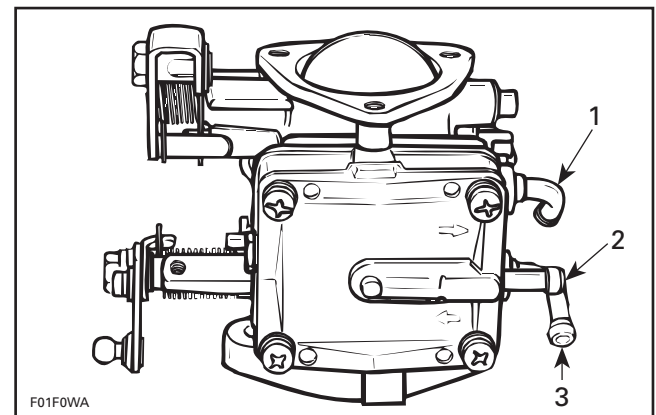
Fuel Pump Valve

Check fuel pump valve operation as follows:

Connect a clean plastic tubing to the inlet nipple of the fuel pump body **no. 4** and alternately apply pressure and vacuum with the mouth. The inlet valve should release with pressure and hold under vacuum.

⚠ WARNING

Some fuel may be present in fuel pump. Be careful not to swallow fuel when under vacuum.



TYPICAL

1. Fuel outlet nipple
2. Pulse nipple
3. Inlet nipple

Repeat the same procedure at the outlet nipple of the fuel pump body **no. 4**. This time the outlet valve should hold with pressure and release under vacuum.

Inspect valves. The pumping area should be free of holes, tears or imperfections. Replace as needed.

Section 06 FUEL SYSTEM

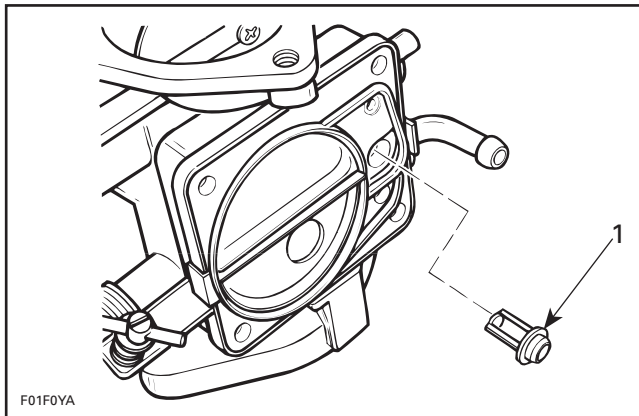
Subsection 04 (CARBURETOR)

Internal Fuel Filter

To verify condition of filter **no. 5**, proceed as follows:
Remove pump cover **no. 16**, gasket **no. 17**, diaphragm **no. 18** and then pump body **no. 4** and diaphragm **no. 19**.

Remove filter **no. 5** from carburetor body then clean filter and blow carefully with compressed air (low pressure).

Replace filter if damaged.



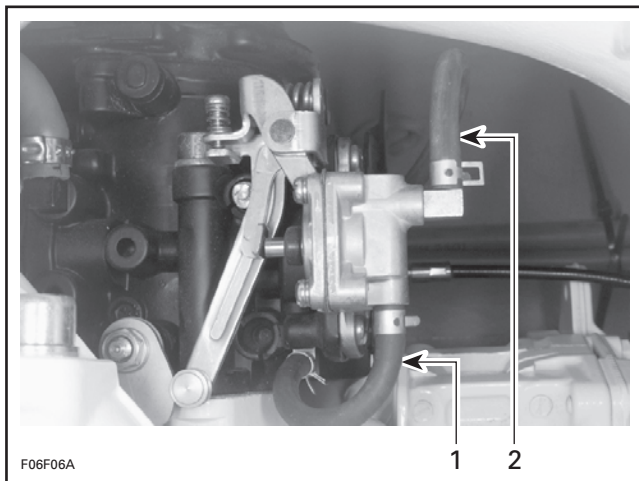
F01F0YA

TYPICAL

1. Filter

Fuel Accelerator Pump

Disconnect inlet and outlet hoses from accelerator pump nipples.



F06F06A

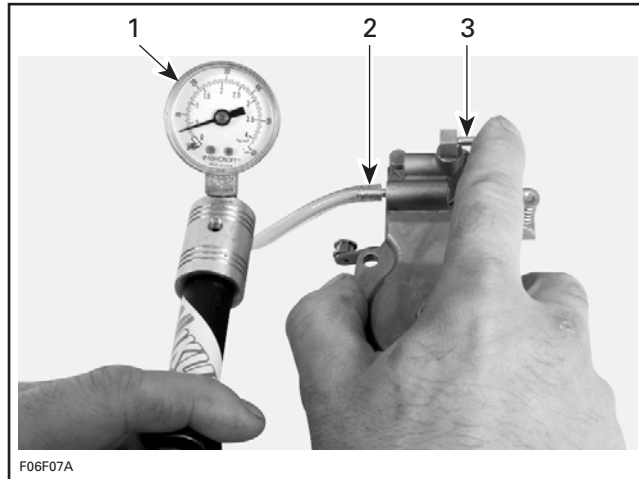
TYPICAL

1. Fuel inlet hose
2. Fuel outlet hose

Using a suitable pump gauge tester, perform the following test proceeding as follows:

- Install pump gauge tester (P/N 295 000 083) on inlet nipple of accelerator pump **no. 20**.

- Obstruct outlet nipple with a finger and hold while pumping.
- Pump tester until it reaches 28 kPa (4 PSI).



F06F07A

1. Pump gauge tester
2. Hose installed to inlet nipple
3. Outlet nipple obstructed

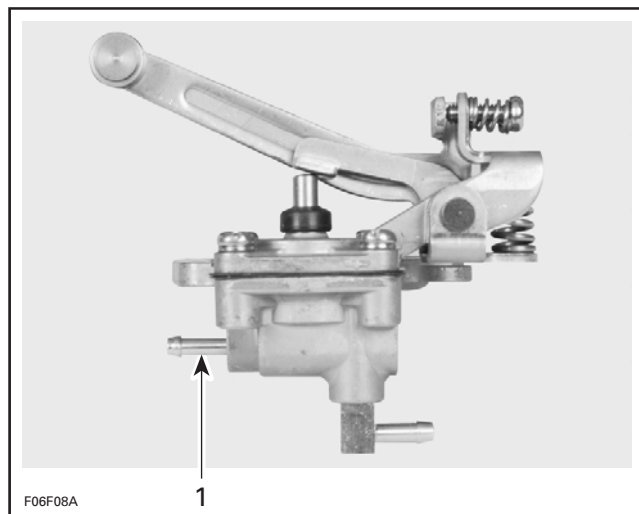
Diaphragm must stand pressure for 10 seconds. If pressure drops, replace accelerator pump diaphragm.

Verify accelerator pump check valves operation as follows:

Connect a clean plastic tubing to the valve inlet nipple and alternately apply pressure and vacuum. The check valve should release with pressure and hold under vacuum.

⚠ WARNING

Some fuel may be present in fuel pump.



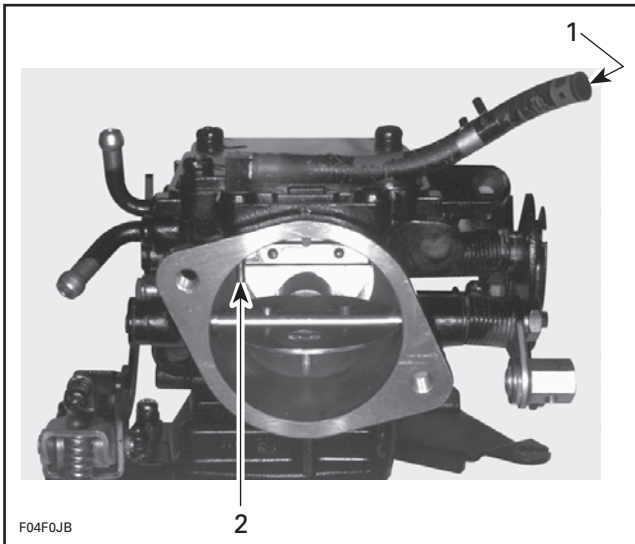
F06F08A

TYPICAL

1. Apply pressure and vacuum at inlet nipple

To check the injector, install pump gauge tester to the injector hose.

NOTE: Injectors are also equipped with check valves.



TYPICAL

1. Install pump gauge tester to injector hose
2. Injector

Pump tester. Injector check valve should open at 13 ± 3 PSI.

NOTE: If the obtained pressure is too low, the check valve is leaking. If it is too high, less fuel will be delivered which may lead to engine hesitation under acceleration.

ASSEMBLY

When assembling pump, ensure to properly position components together. Refer to previous illustrations if necessary.

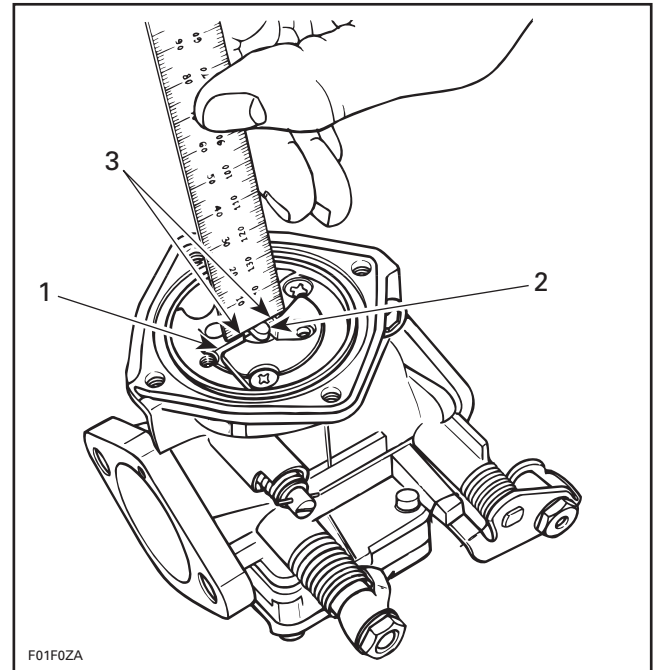
Choke Plate and Throttle Plate

When installing plate no. 6 onto shaft no. 7, close plate so that it centers into carburetor bore. Firmly tighten screws.

CAUTION: Always apply Loctite 243 (blue) on screw threads prior to installing screws.

Needle Valve Lever

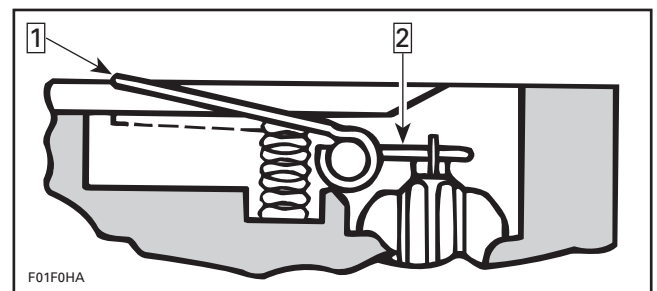
Rounded end of needle valve lever no. 8 must be flush with surrounding metering chamber floor and not with body assembly. Place the end of a ruler over lever to check adjustment.



1. Metering chamber floor
2. Lever end
3. Flush

To adjust, bend lever very slightly to change its height.

CAUTION: When adjusting lever, do not pry it so that it applies pressure on needle. This could damage valve seat/needle.

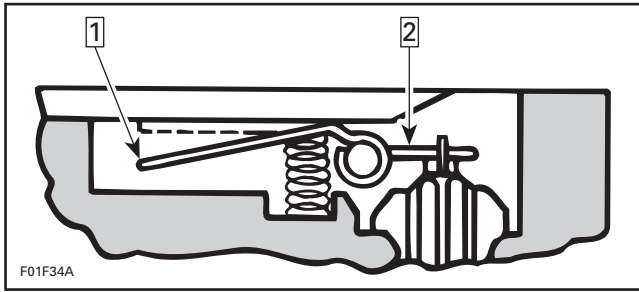


HIGH LEVER

- Step 1: Depress here
- Step 2: Push tab down

Section 06 FUEL SYSTEM

Subsection 04 (CARBURETOR)



LOW LEVER

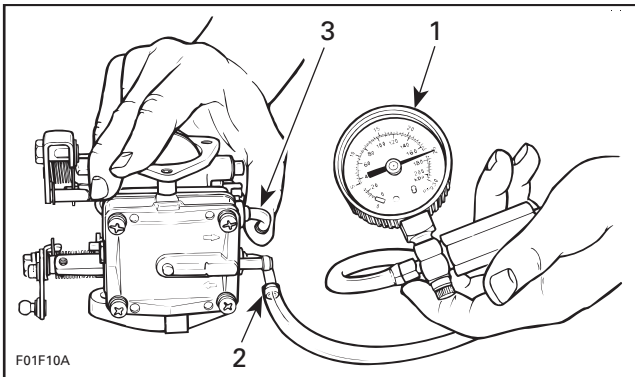
Step 1: Depress here

Step 2: Pry up here

POP-OFF Pressure Test

Proceed as follows:

- Install pump gauge tester on carburetor fuel inlet nipple.
- Obstruct fuel return nipple with a finger.
- Pump tester until inlet release pressure is reached (seen by a sudden pressure drop).



TYPICAL

1. Pump gauge tester
2. Install on inlet nipple
3. Obstruct outlet nipple

Refer to the following table for pop-off pressure specifications:

MODELS	POP OFF PRESSURE min./max. (PSI)
GS, GTS, GTI	36/40
XP, GTX	19/23

NOTE: Pressure test should be performed three times to obtain a valid reading.

If pop-off pressure is not within specification, check control lever adjustment. Replace spring as necessary.

CAUTION: Do not stretch or cut spring.

LEAK TEST

Needle valve must stand a pressure of 69 kPa (10 PSI) for 30 seconds. Otherwise, hold carburetor upside down, pour oil over needle valve and apply pressure.

Check for bubbles. If they come from seat or O-ring, bubbles will exit around seat. Retighten as necessary.

If it still leaks remove needle and seat and replace O-ring.

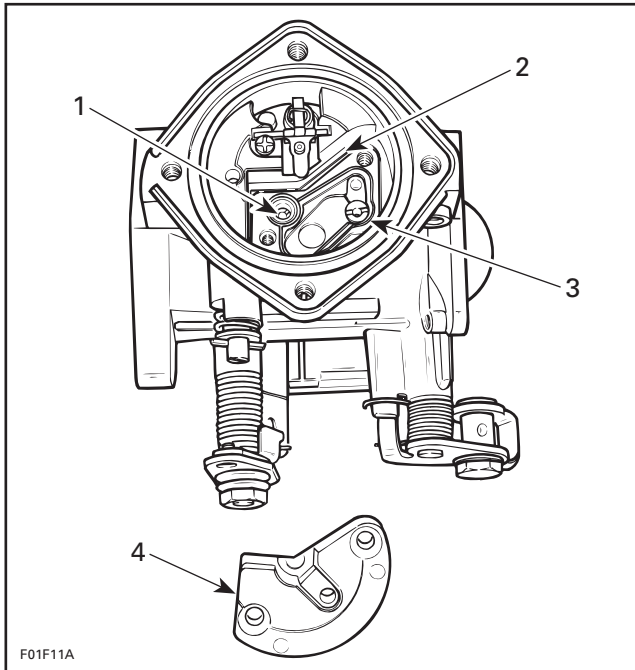
If bubbles come from needle, replace needle and seat.

Main Jet and Pilot Jet

Pilot jet no. 10 and main jet no. 9 are replaceable. Different jet sizes are available to suit temperature and altitude conditions. Always inspect spark plug tip condition when dealing with pilot jet and main jet. Spark plug tip condition gives a good indication of carburetor mixture setting.

CAUTION: Adjustments vary with temperature and altitude. Always observe spark plug condition for proper jetting.

NOTE: To have access to pilot jet no. 10 or main jet no. 9, check valve housing must be removed.



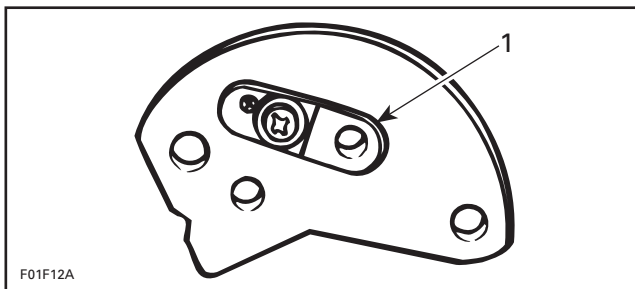
TYPICAL

1. Pilot jet
2. Gasket
3. Main jet
4. Check valve housing removed

Check Valve Assembly

The check valve is needed if a back pressure occurs into carburetor. It will prevent fuel from flowing back into carburetor lower portion.

Inspect check valve no. 11. It should be free of holes, tears or imperfections. Replace as needed.



1. Check valve

NOTE: Prior to check valve assembly installation, remember to set gasket.

Diaphragm and Cover

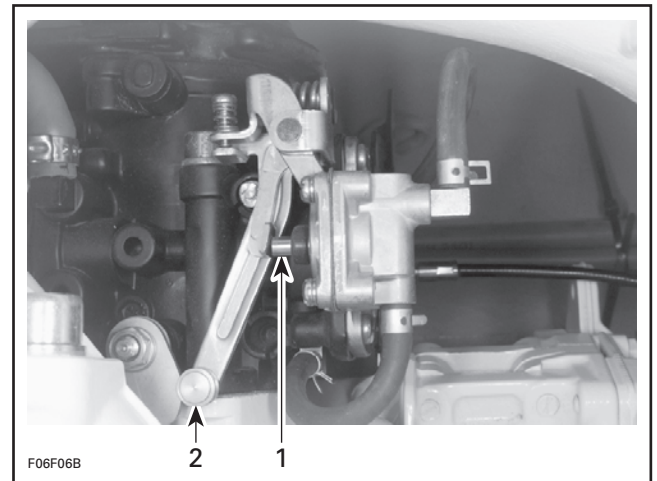
Install diaphragm no. 3 with its integrated O-ring into carburetor groove. Make sure that the tab of cover no. 12 is inserted into carburetor notch.

O-Ring

When installing O-rings no. 13 of low speed and high speed screws, apply some BOMBARDIER LUBE (P/N 293 600 016) to prevent sticking.

Fuel Accelerator Pump

Lubricate pump plunger, roller and cam with synthetic grease (P/N 293 550 010) and roller shaft with BOMBARDIER LUBE (P/N 293 600 016).



TYPICAL

1. Apply synthetic grease to plunger
2. Apply BOMBARDIER LUBE on roller shaft

INSTALLATION

Carburetors

At installation, pay attention to the following:

Install carburetor(s) with gasket(s) to intake manifold (rotary valve cover for the 787 engine).

Apply synthetic grease on screws no. 20. Then, install screws no. 20 with lock washers no. 21 and torque to 20 N•m (15 lbf•ft).

Fuel Lines and Hose Clamps

If fuel line ends are damaged, cut damaged end before reinstallation.

Properly install clamps.

⚠ WARNING

Make sure there is no leak in fuel system.

For fuel system pressurization, refer to FUEL CIRCUIT.

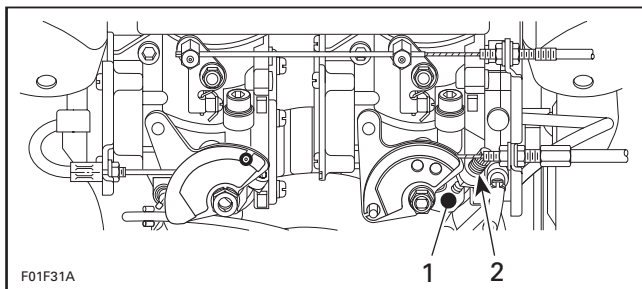
Section 06 FUEL SYSTEM

Subsection 04 (CARBURETOR)

ADJUSTMENTS

Twin Carburetor Synchronization

With idle speed screw not touching throttle lever stopper on MAG carburetor, both throttle plates are in closed position.

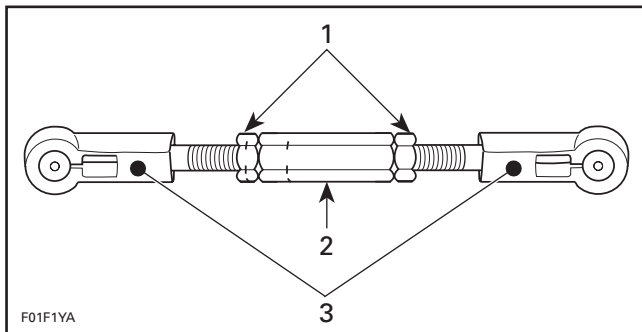


TYPICAL

1. Stopper
2. Idle speed screw

Loosen jam nuts on carburetor linkage and adjust linkage with adjustment nut.

Make sure threads length is the same on each side of linkage and flat surfaces of both ends are parallel with each other.



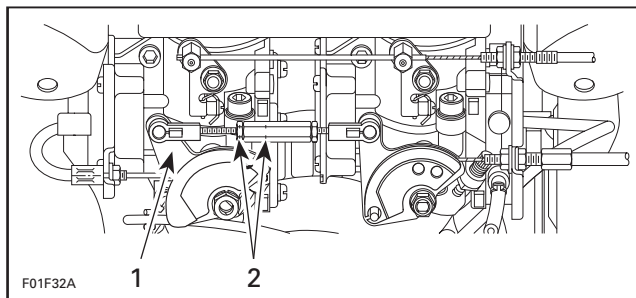
1. Jam nuts
2. Adjustment nut
3. Flat surfaces

Tighten jam nuts and torque to 3 N•m (27 lbf•in).

NOTE: Grease carburetor linkage at both ends with synthetic grease (P/N 293 550 010).

Connect linkage between both carburetor levers. Ensure both throttle plates are still in closed position.

NOTE: The linkage installation is done with the marks located near PTO carburetor throttle lever to ease adjustment if to be performed in the watercraft.



TYPICAL

1. Throttle lever PTO side
2. Marks

CAUTION: Throttle plates must open simultaneously, otherwise this will cause engine to vibrate and/or misfire.

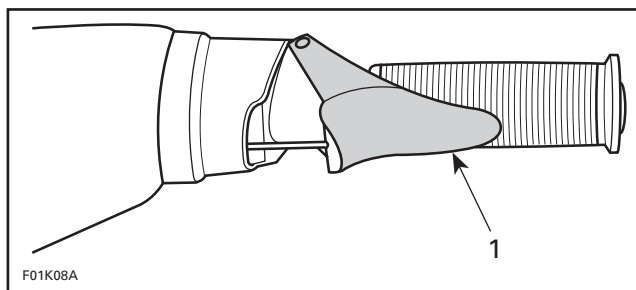
Throttle Cable Adjustment

NOTE: Do not activate throttle lever unnecessarily. Carburetors are equipped with fuel accelerator pump. This pump is injecting fuel into carburetors each time throttle lever is depressed.

717 Engine

Lubricate cable with BOMBARDIER LUBE lubricant.

Throttle lever must reach handlebar grip without causing strain to cable or carburetor cable bracket.



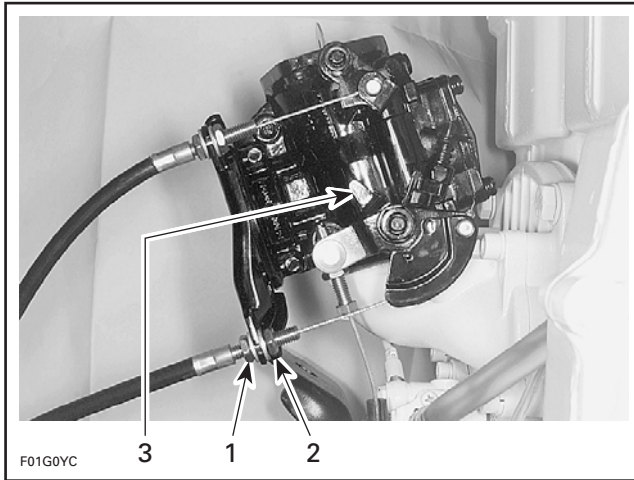
1. Must touch handlebar grip

Ensure carburetor throttle plate(s) is (are) fully open at full throttle position. At this position, throttle lever stopper is almost in contact (0.5 mm (1/64 in)) with carburetor body.

NOTE: Apply a light pressure on the throttle plate(s), a slight play should be obtained.

CAUTION: Improper cable adjustment will cause strain on cable and/or damage cable bracket or throttle lever at handlebar.

To adjust, loosen jam nut then turn adjustment nut as necessary.



717 ENGINE

1. Adjustment nut
2. Jam nut
3. Throttle lever stopper

Tighten jam nut and recheck adjustment.

⚠ WARNING

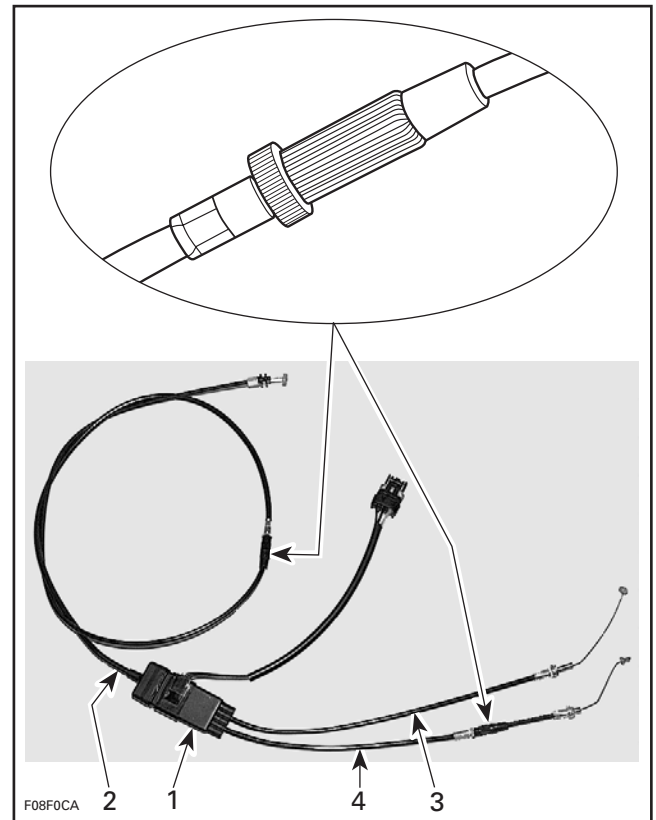
Make sure idle speed screw contacts stopper when throttle lever is fully released at handlebar.

After throttle cable adjustment, always proceed with the oil injection pump cable adjustment. Refer to OIL INJECTION PUMP.

CAUTION: Improper oil injection pump synchronization with carburetor can cause serious engine damage.

947 Engine

Throttle cable is equipped with a sensor which will send a signal to the MPEM at 80% throttle opening in order to control the spark advance.

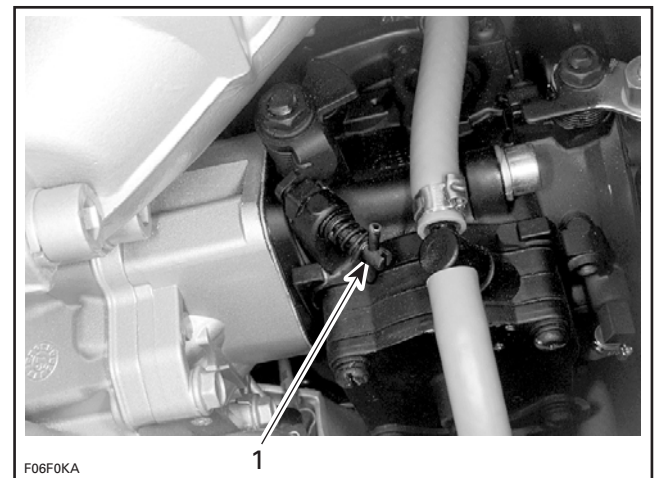


THROTTLE CABLE ASSEMBLY

1. Sensor
2. Throttle lever section
3. Carburetor section
4. Oil pump section

NOTE: Always perform the throttle cable adjustment in the specified order, as described in following procedure.

Unscrew idle adjustment screw to obtain a small gap between stopper and screw.



1. Idle speed screw

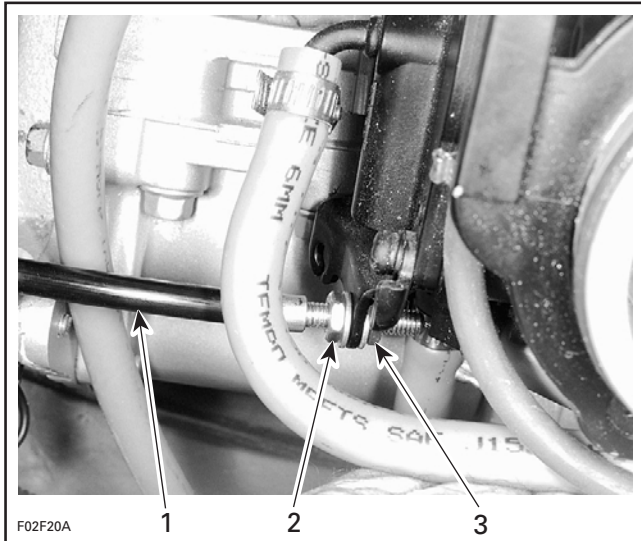
Section 06 FUEL SYSTEM

Subsection 04 (CARBURETOR)

Ensure throttle plates are completely closed on both carburetors.

Loosen jam nut and turn adjustment nut to eliminate all the slack in the throttle cable between sensor and carburetor.

Tighten jam nut.



947 ENGINE

1. Throttle cable
2. Adjustment nut
3. Jam nut

Turn idle adjustment screw clockwise until it comes in contact with stopper. Refer to LOW SPEED SCREW ADJUSTMENT section for the proper adjustment.

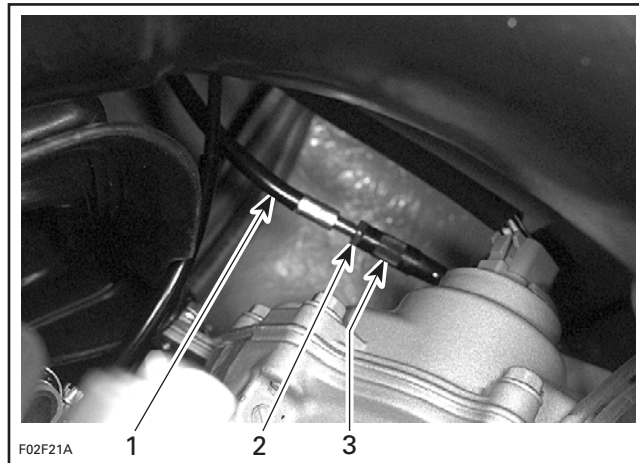
Adjust oil pump cable. Refer to OIL INJECTION PUMP.

NOTE: It is important to adjust oil pump cable prior to finalize adjustment of throttle cable.

CAUTION: Improper oil injection pump synchronization with carburetor throttle opening can cause serious engine damage.

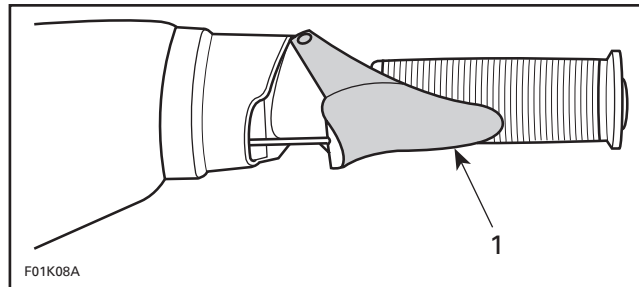
Adjust throttle cable to obtain proper lever position at full throttle.

Turn adjuster knob as required to obtain proper throttle lever adjustment.



1. Jam nut
2. adjustment nut
3. Throttle cable

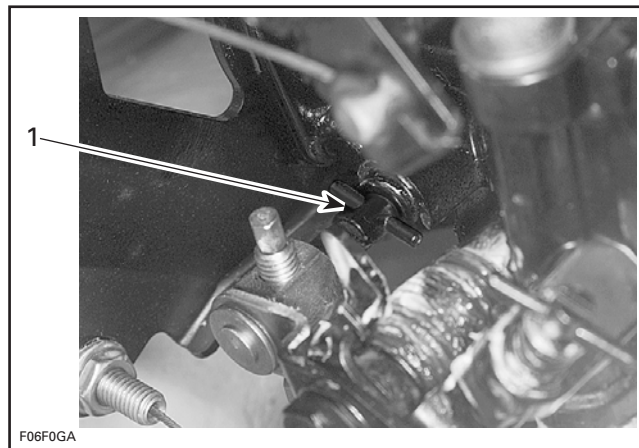
Throttle lever must reach handlebar grip without causing strain to cable or carburetor cable bracket.



1. Lever must touch handlebar grip

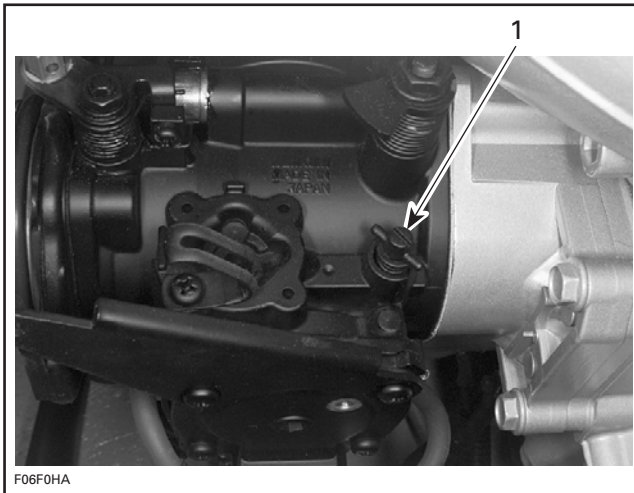
CAUTION: Improper cable adjustment will cause strain on cable and/or damage cable bracket or throttle lever at handlebar.

Low Speed Screw Adjustment



717 ENGINE

1. Low speed screw



947 ENGINE

1. Low speed screw (PTO side shown)

CAUTION: Do not attempt to set engine idle speed with low-speed screw.

Tighten low speed screw until a slight resistance is felt. Then, back it off to the specification as per following chart.

WATERCRAFT MODEL	LOW SPEED SCREW
GS/GTS/GTI	1.0 ± 0.25 turns
XP/GTX	1.5 ± 0.25 turns

NOTE: Turning screw clockwise leans mixture and turning screw counterclockwise enriches mixture.

Start and warm up engine.

CAUTION: If watercraft is out of water, engine must be cooled using the flush kit.

Check that engine idles and runs smoothly. Make sure engine reacts quickly to throttle lever depression. If necessary, readjust low speed screw (± 1/4 turn).

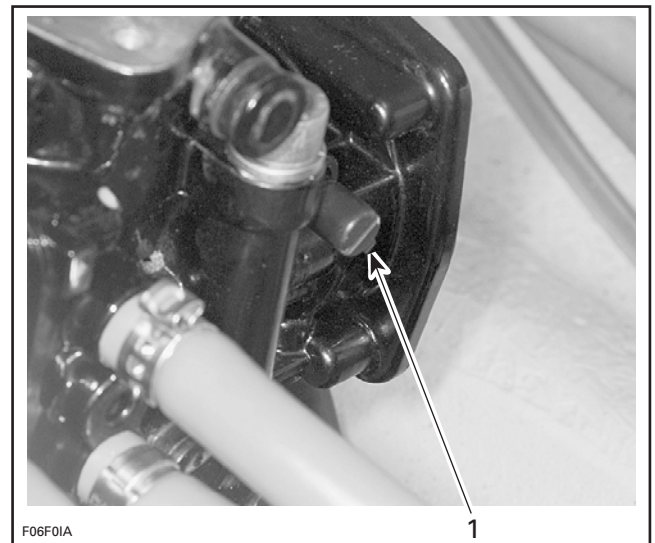
NOTE: On twin carburetor engines, both low speed screws must be adjusted exactly the same way. Never adjust screws more than 1/4 turn at a time.

High Speed Screw

The high speed screw no. 14 is sealed with a plastic cap that allows an adjustment of 1/4 turn.

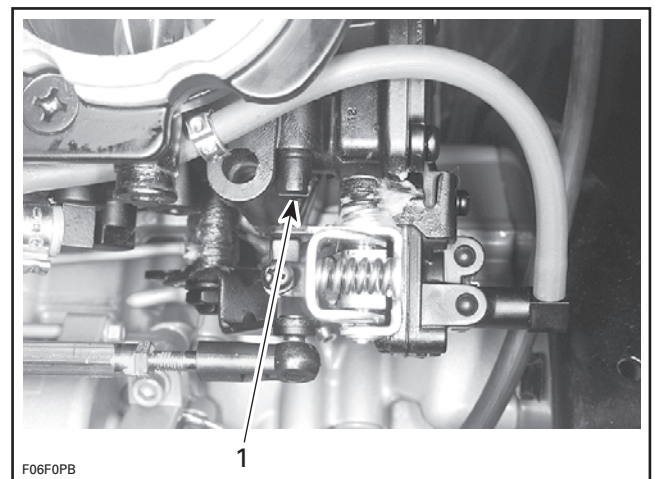
NOTE: Turning screw 1/4 turn counterclockwise enriches mixture and turning screw clockwise leans mixture.

CAUTION: Do not attempt to adjust high speed screw by removing plastic cap.



717 ENGINE

1. High speed screw



947 ENGINE

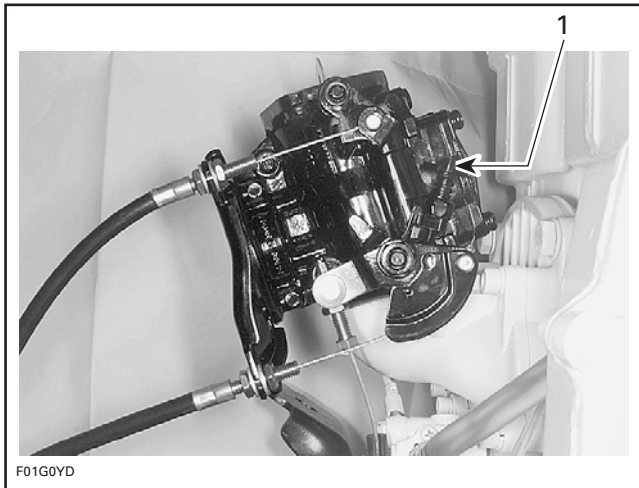
1. High speed screw (PTO side shown)

Section 06 FUEL SYSTEM

Subsection 04 (CARBURETOR)

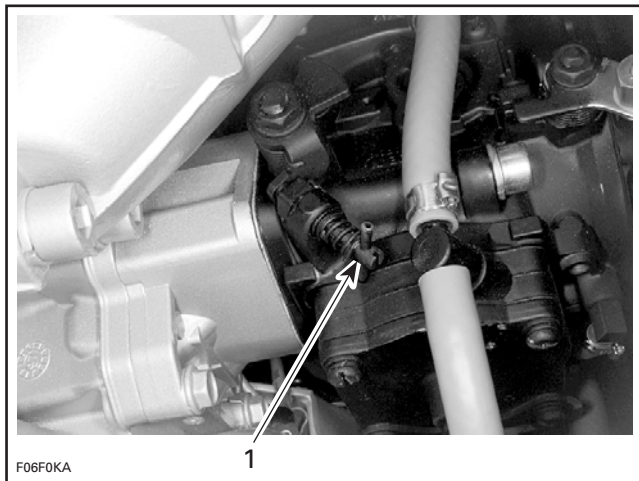
Idle Speed Screw

Turning screw no. 15 clockwise increases engine idle speed and turning screw counterclockwise decreases engine idle speed.



717 ENGINE

1. Idle speed screw



947 ENGINE

1. Idle speed screw

NOTE: On twin carburetor engines, there is only one idle speed screw.

Connect an induction-type tachometer (P/N 529 014 500) on spark plug cable of magneto side to measure engine speed.

NOTE: To adjust idle speed, ensure flame arrester and air intake silencer are installed.

Start engine and bring to normal operating temperature.

CAUTION: If watercraft is out of water, engine must be cooled using the flush kit.

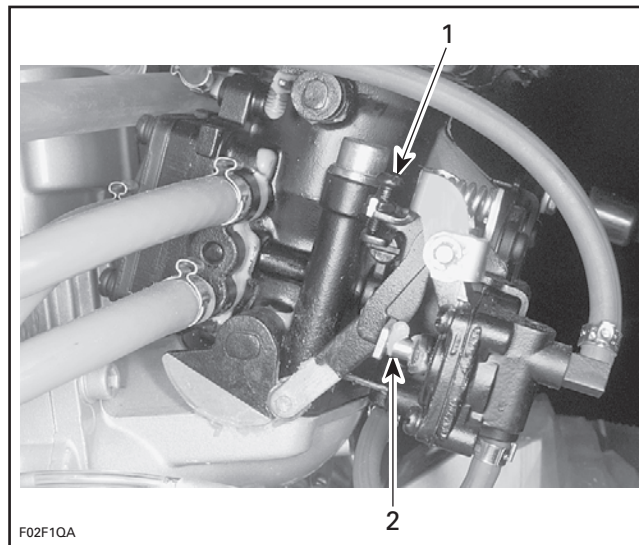
Turn screw so that engine idles at 1500 RPM in water or 3000 RPM out of water.

Fuel Accelerator Pump

All Models Except 787 RFI

Ensure throttle cable is properly adjusted and idle speed is set at 1500 RPM in water.

With the engine not running, loosen adjustment screw lock nut. Use a feeler gauge between lever tab and pump plunger. Turn adjustment screw to achieve approximately 0.05 - 0.15 mm (.002 - .005 in) gap. Tighten adjustment screw lock nut.



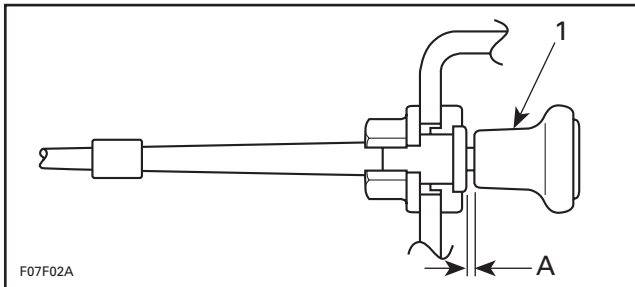
TYPICAL

1. Adjustment screw
2. Small gap

NOTE: Turning the adjustment screw clockwise will increase the gap.

Choke Cable

Ensure choke lever has a free-play of 0.5 to 2.0 mm
(1/64 to 5/64 in).



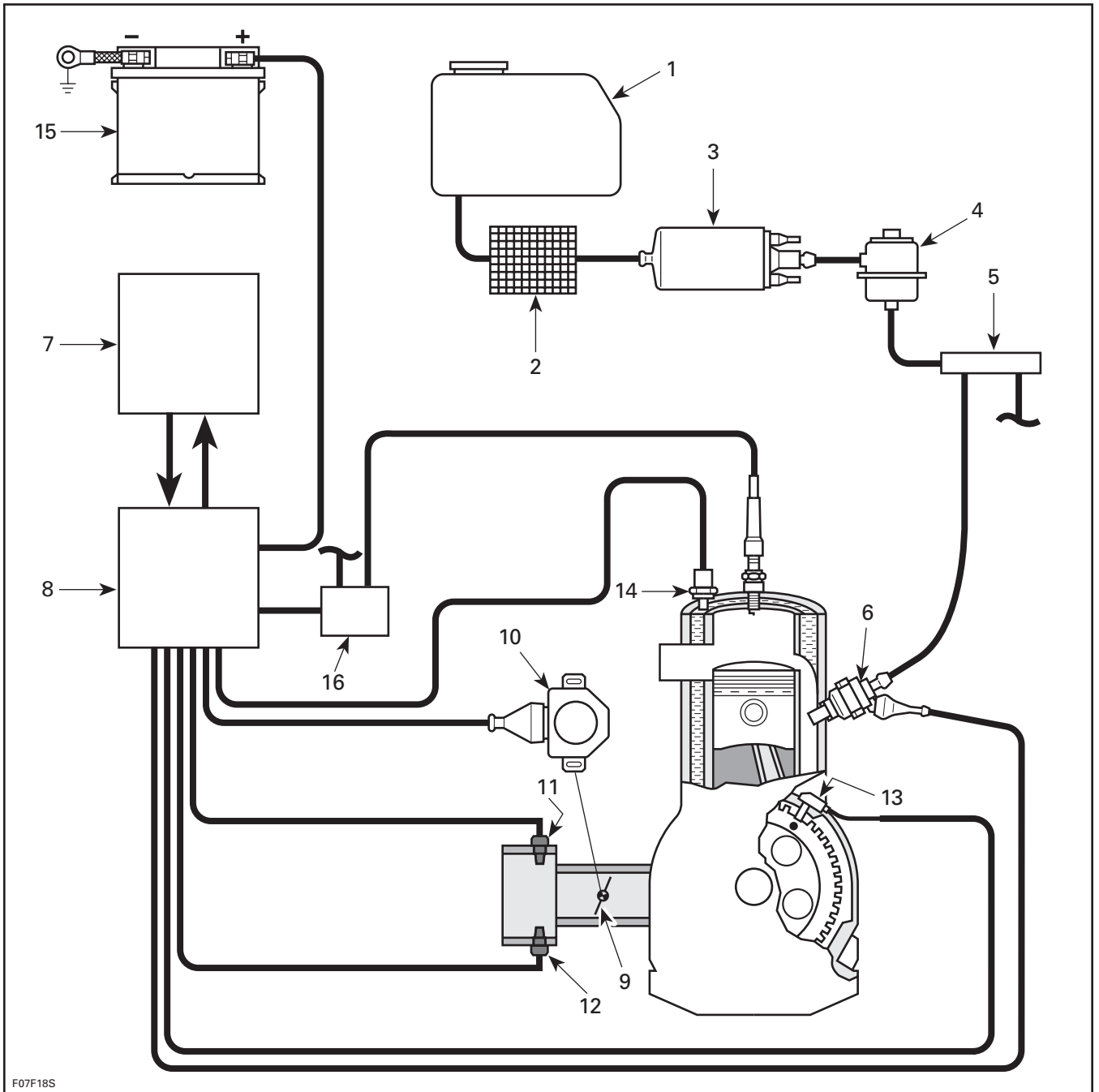
TYPICAL

- 1. Choke lever
- A. Free play of 0.5 to 2.0 mm (1/64 to 5/64 in)

To adjust, loosen jam nut on carburetor bracket,
then turn adjustment nut as necessary.

Tighten jam nut and recheck adjustment.

FUEL INJECTION



F07F18S

DESCRIPTION OF THE FUEL INJECTION SYSTEM

- | | |
|---|--------------------------------------|
| 1. Fuel tank | 9. Throttle plate |
| 2. Fuel filter | 10. Throttle Position Sensor (TPS) |
| 3. Fuel pump | 11. Air Pressure Sensor (APS) |
| 4. Regulator | 12. Air Temperature Sensor (ATS) |
| 5. Fuel rail | 13. Crankshaft Position Sensor (CPS) |
| 6. Fuel injector | 14. Water Temperature Sensor (WTS) |
| 7. Electronic Control Unit (ECU) | 15. Battery |
| 8. Multi-Purpose Electronic Module (MPEM) | 16. Ignition coil |

Section 06 FUEL SYSTEM

Subsection 05 (FUEL INJECTION)

INTRODUCTION

The Rotax Fuel Injection (RFI) is a semi-direct electronic fuel injection system.

Fuel is injected into each cylinder through the rear transfer port. With this design, the injector is not exposed to high combustion pressure, temperature and contaminants.

This system delivers the following benefits:

- easier cold engine starting (no choke)
- easier hot engine starting
- improved idling
- better throttle response
- better fuel economy
- no fuel valve.

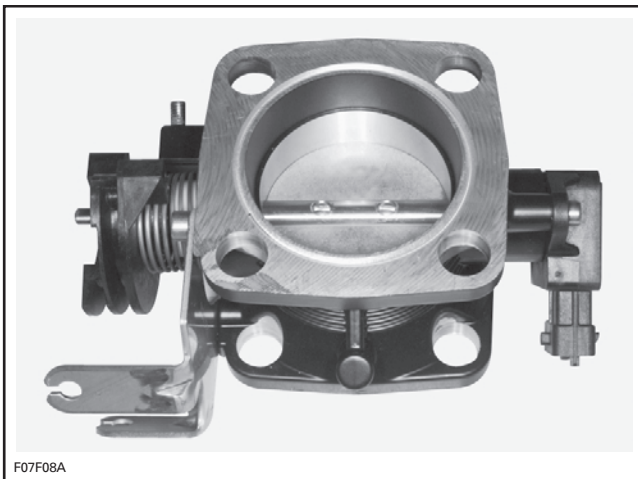
This system has the advantage of optimizing the engine power, fuel economy and emission controls under all engine operating conditions by managing both the fuel injection duration and ignition timing.

The Rotax Fuel Injection (RFI) is composed of the 3 following basic systems:

1. Air Induction
2. Fuel Delivery
3. Electronic Management.

AIR INDUCTION

A single throttle body (56 mm) breath through the air intake silencer to provide a sufficient amount of air for the engine operation.

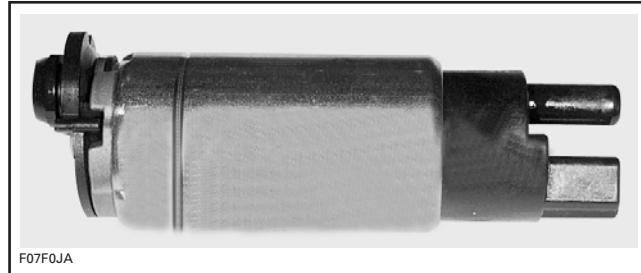


THROTTLE BODY

FUEL DELIVERY

Fuel Pump

An electric fuel pump provides fuel pressure and flow rate to the system.



FUEL PUMP

Fuel Pressure Regulator

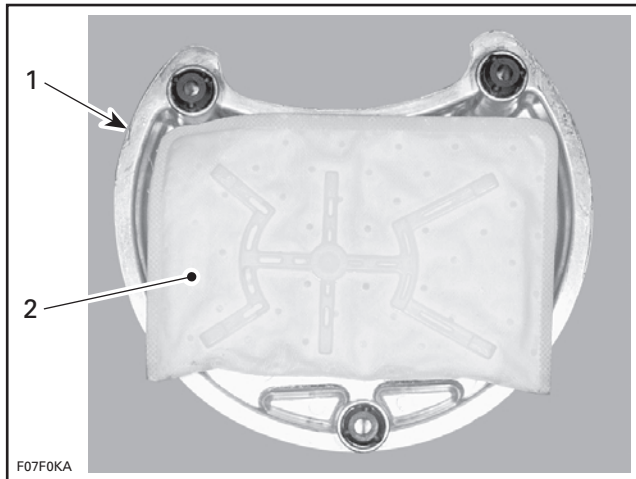
A regulator maintains a constant fuel pressure of 386 - 414 kPa (56 - 60 PSI).



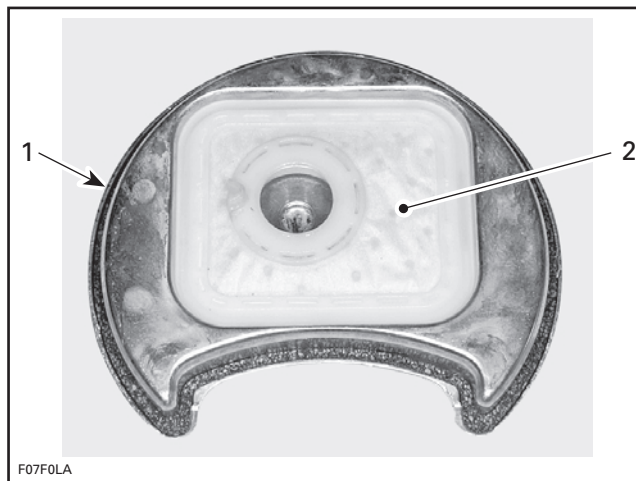
REGULATOR

Fuel Filters

A dual piece fuel filter protects the fuel pump, regulator and injectors.



- 1. Fuel pump assembly
- 2. External fuel filter



- 1. End cap of fuel pump assembly removed
- 2. Internal fuel filter

Fuel Pump Module

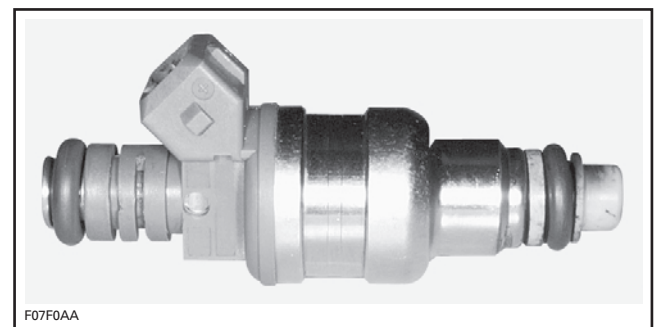
All these components are comprised in a single module mounted in the fuel tank. The fuel gauge sender is also mounted on this module.



FUEL PUMP ASSEMBLY

Fuel Injectors

The injectors inject a metered quantity of fuel from the fuel rail into the cylinder rear transfer port in accordance with the signal from the Electronic Control Unit (ECU).



INJECTOR

Section 06 FUEL SYSTEM

Subsection 05 (FUEL INJECTION)

ELECTRONIC MANAGEMENT

Electronic Control Unit (ECU)

The electronic fuel injection is equipped with a Bosch Electronic Control Unit (ECU).



ELECTRONIC CONTROL UNIT (ECU)

The ECU is mounted behind the MPEM in the front of the watercraft, in a watertight box.

The ECU controls the following functions:

Basic Operating Function

1. Electronic Fuel Injection

The ECU receives the signals from 5 sensors which indicate engine operating conditions at milli-second intervals.

- Throttle Position Sensor (TPS)
- Crankshaft Position Sensor (CPS)
- Air Temperature Sensor (ATS)
- Water Temperature Sensor (WTS)
- Air Pressure Sensor (APS)

These signals are used by the ECU to determine the injection duration required for optimum air-fuel ratio.

2. Ignition Timing

The ECU is programmed with data for optimum ignition timing under all operating conditions. Using data provided by the sensors, the ECU controls the ignition timing for optimum engine operation.

3. Maximum Engine Speed

The ECU limits the maximum allowable engine speed. The RPM rev limiter is set at 7200 ± 50 RPM.

4. Fail-Safe Function

In the event of a sensor malfunction, the ECU will use a default operating mode to ensure driveability to shore. A message may be displayed on the Info Center to inform the operator.

5. Diagnostic Mode

The ECU is able to detect malfunctions in the sensor network. The malfunction is recorded in the memory of the ECU. The memory of the ECU can be checked using the MPEM programmer tool.

MPEM (Multi-Purpose Electronic Module)

The MPEM is also used with the Rotax Fuel Injection system.



MPEM

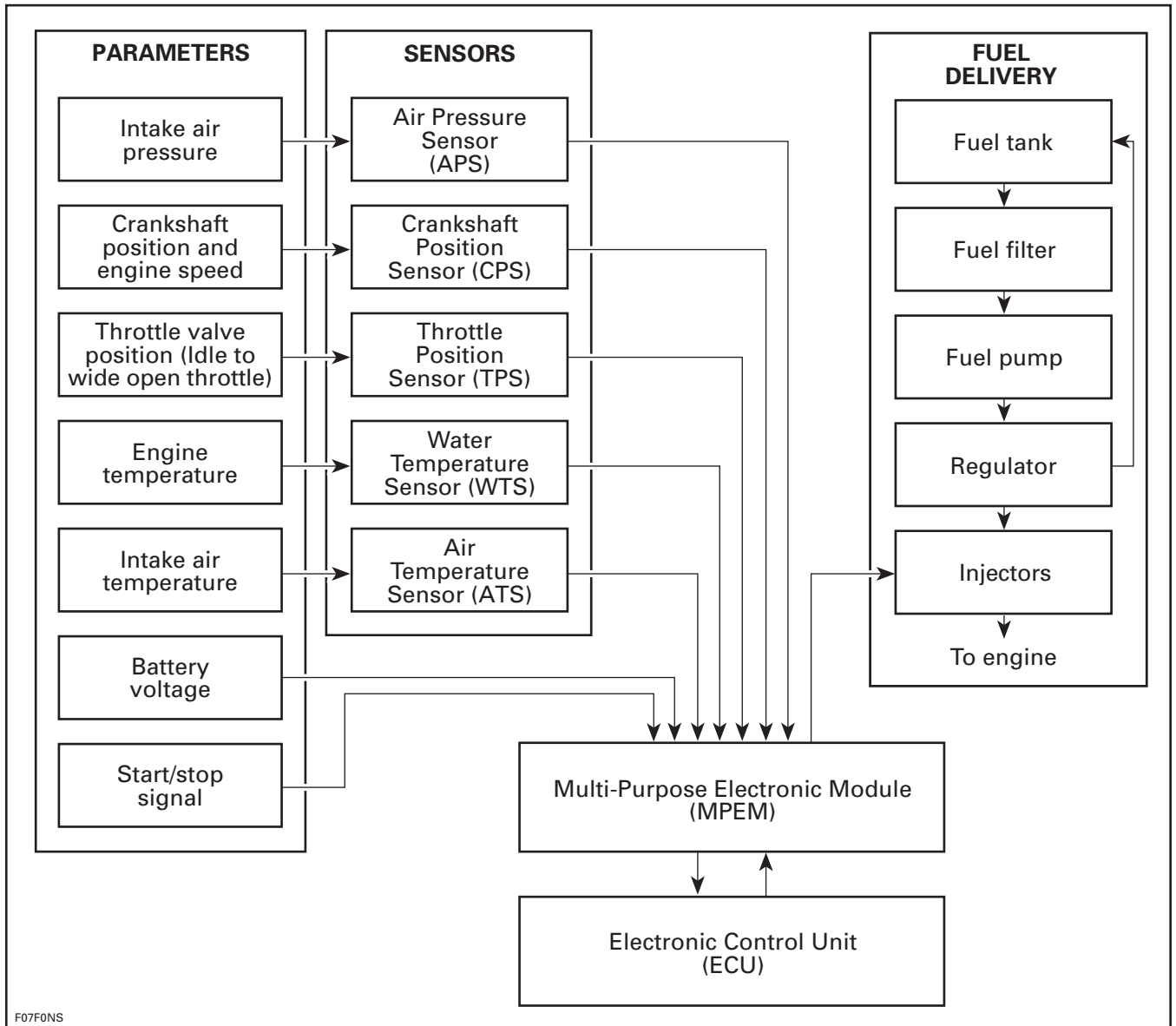
It is responsible of the following electrical functions:

- interpreting information
 - distributing information
 - start/stop function
 - timer
 - vehicle hours
 - Digitally Encoded Security System (DESS).
- The MPEM has a special safety feature to limit engine revolutions when the battery voltage is too low.

For example, when the battery voltage reaches 8.9 volts for at least 30 seconds, engine revolutions are limited to 4480 RPM.

When voltage reaches 7 volts for at least 30 seconds, the engine is automatically shut off by the MPEM.

Section 06 FUEL SYSTEM
Subsection 05 (FUEL INJECTION)



SIGNAL MANAGEMENT

Section 06 FUEL SYSTEM

Subsection 05 (FUEL INJECTION)

DIAGNOSTIC PROCEDURES

The MPEM programmer is the primary tool to diagnose fuel injection related problems.

The latest software designed for the RFI model allows sensor inspection, diagnostic options and adjustment such as the Throttle Position Sensor (TPS).

NOTE: Make sure your MPEM programmer is updated with the latest software version. For a complete overview of the programmer, refer to the *MPEM Programmer Guide* (P/N 219 700 090).

Diagnostic Option Example

Turn on the programmer and enter your password.

Select **VEHICLE INFO** from the main menu and press **ENTER**.

1. CHECK KEYS
2. PROGRAM KEY
3. **VEHICLE INFO**
4. START VEH.
5. OTHERS

By selecting the **VEHICLE INFO** you will access a 9-line sub-menu. Select **BOSCH SYSTEM** from the sub-menu and press **ENTER**.

1. CUSTOMER NAME
2. DELIVERY DATE
3. VEH. SERIAL #
4. ENGINE PARAM.
5. PROGRAM KEY
6. HOUR INFO
7. MPEM INFO
8. **BOSCH SYSTEM**
9. SAVE + QUIT

By selecting **BOSCH MENU** you will enter a second sub-menu. Select **DIAGNOSIS** and press **ENTER**.

1. **DIAGNOSIS**
2. START VEHICLE

By selecting **DIAGNOSIS** the following message "INITIALIZING IN PROCESS" will be displayed a few seconds, then a new menu will appear on the screen.

Select **READ FAULT** and press **ENTER**.

1. BOSCH INFO
2. **READ FAULT**
3. ERASE FAULT
4. ADJUSTMENT
5. REAL TIME
6. END DIAGNOSIS

NOTE: Line no. 1 **BOSCH INFO** will display the identification of the watercraft and the MPEM/ECU.

By selecting **READ FAULT**, the MPEM programmer will display the number of faults in the ECU memory and the codes related with the fault(s).

The programmer will offer **PRESS ANY KEY**. If there is more than 1 fault in the ECU memory, the next fault code will be displayed.

NOTE: On this model, there is always at least the 04 FC fault code. Ignore this fault code. Also, when the engine is NOT operating, the fault code 02 01 03 will be displayed for the CPS (crankshaft position sensor). It should not be considered as a fault in the static mode.

Refer to the tables on next page for the explanation of the fault codes.

After reading the fault codes in the memory of the ECU, **PRESS ANY KEY** will return the programmer to the latest menu.

By selecting **ERASE FAULT** in the menu, it will allow you to erase the faults in the ECU memory.

NOTE: The programmer will not allow fault code erasing without first viewing in the **READ FAULT**.

FAULT CODE TABLES

ECU Faults

FAULT DETECTION	FAULT CODE	TYPE OF FAULT
No fault detected	FF FF	88 = no defect
Electronic Control Unit Internal memory	FF FF	00 = internal defect 1B = not plausible = EEPROM defect
Electronic Control Unit EEPROM	FF FE	2B = EEPROM not programmed
EEPROM Data Setting	FF FD	10 = data in EEPROM out of range (1 of 3 bytes) 25 = data in EEPROM out of range (all 3 bytes different)

Input Signal Faults

FAULT DETECTION	FAULT CODE	TYPE OF FAULT
Supply voltage to ECU	02 14	07 = Voltage from the battery too low
Engine Water Temperature Sensor (WTS)	02 0A	1D = sensor circuit shorted to ground 1E = signal interruption or short circuit to battery 1B = non plausible signal
Throttle Position Sensor (TPS)	02 06	1F = sensor circuit shorted to ground 1C = sensor circuit shorted to battery
Crankshaft Position Sensor (CPS)	02 1F	06 = signal exceeding RPM limits
Crankshaft Position Sensor (CPS)	02 01	03 = no signal detected (fault code active when engine is not running and ignition is on) 1B = synchronization error (sensor/toothed wheel)
Air Intake Temperature Sensor (ATS)	02 0F	1D = sensor circuit shorted to ground 1E = signal interruption or short circuit to battery
Air Pressure Sensor (APS)	02 10	1D = sensor circuit shorted to ground 1E = signal interruption or short circuit to battery

Output Signal Faults

FAULT DETECTION	FAULT CODE	TYPE OF FAULT
Injector 1	04 E1	1C = short circuit to battery 1D = short circuit to ground 1E = interruption or open circuit
Injector 2	04 E2	1C = short circuit to battery 1D = short circuit to ground 1E = interruption or open circuit
Fuel pump	04 EB	1C = short circuit to battery
Not applicable	04 FC	Not applicable
RAVE vacuum solenoid	04 DB	1C = short circuit to battery 1D = short circuit to ground 1E = interruption or open circuit

Section 06 FUEL SYSTEM

Subsection 05 (FUEL INJECTION)

B.U.D.S. Fault Codes Versus RFI Fault Codes

B.U.D.S. CODES	RFI CODES
P 0604	FF FF 00
P 0605	FF FF 1B
P 1600	FF FF 2B
P 1601	FF FD 10
P 1602	FF FD 25
P 0562	02 14 07
P 0563	02 14 06
P 0117 and P 0118	02 0A 1D
P 0116	02 0A 1B
P 0122 and P 0123	02 06 1F
P 0219	02 1F 06
P 0335	02 01 03
P 0336	02 01 1B
P 0112	02 0F 1D
P 0113	02 0F 1E
P 0107	02 10 1D
P 0108	02 01 1E
P 0262	04 E1 1C
P 0261	04 E1 1D
P 1200	04 E1 1E
P 0265	04 E2 1C
P 0264	04 E2 1D
P 1201	04 E2 1E
P 0230	04 EB 1C
P 0478	04 DB 1C
P 0477	04 DB 1D
P 0479	04 DB 1E

COMPONENT INSPECTION

Engine problems are not necessarily related to the electronic fuel injection system.

It is important to check that the electrical system is functioning properly:

- battery
- fuses
- DESS
- ignition (spark)
- ground connections
- wiring connectors.

If all of the above mentioned items are functioning correctly, the following verifications can be performed to detect any faulty components.

NOTE: Troubleshooting should be performed using the MPEM programmer tool. See TROUBLESHOOTING in this subsection.

AIR INDUCTION SYSTEM

Throttle Body

Check that the throttle plate moves freely and smoothly when depressing throttle lever.

FUEL DELIVERY

Fuel Filter

To inspect the fuel filter, the fuel pump assembly has to be removed from the fuel tank. See REMOVAL in this subsection for the procedure.

Fuel Pump

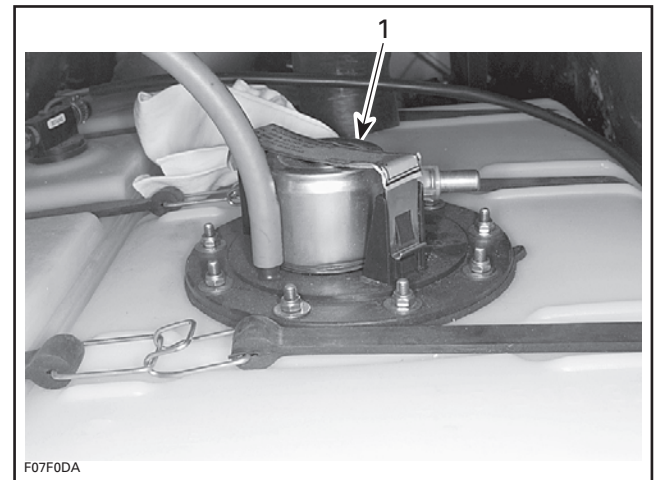
The fuel pump operation can be checked as follows.

Install the safety lanyard cap on the switch. The fuel pump should run for approximately 1 second and then shut off.

If not, check the electrical circuit and the 10 A fuse on the MPEM module.

Regulator

The regulator is mounted on top of the fuel pump assembly.



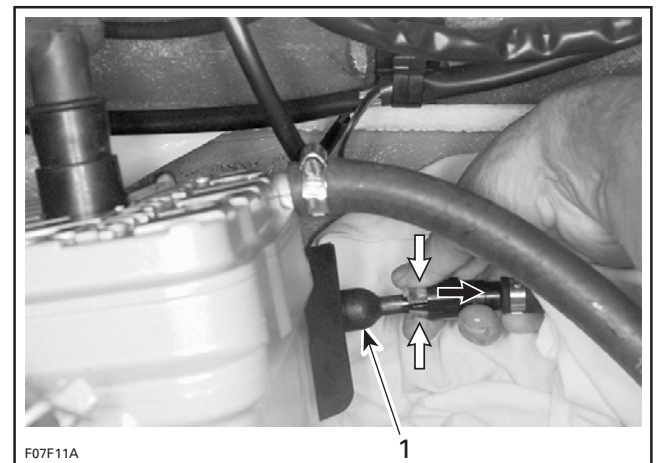
1. Regulator

To inspect the regulator, a fuel pressure test must be done.

Check that battery voltage is above 12 volts.

Place a suitable container below the quick connect fitting of the fuel rail.

Cover the quick connect fitting with a shop towel. Press on both tabs and disconnect the quick connect fitting.



1. Fuel rail

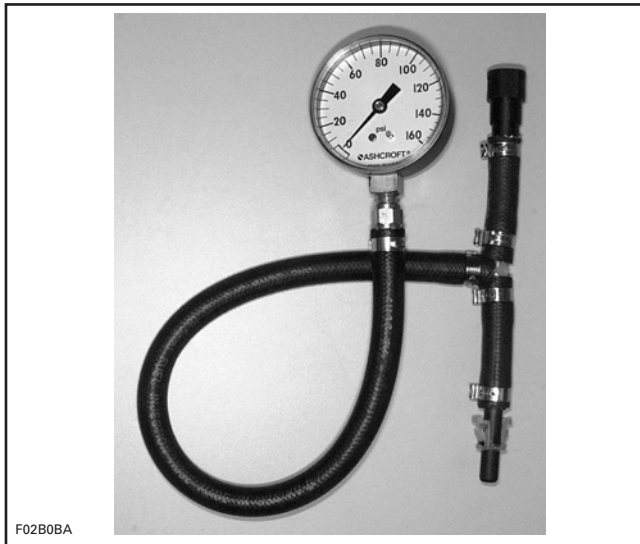
⚠ WARNING

Fuel is under pressure. Wipe off any fuel spillage in the bilge.

Section 06 FUEL SYSTEM

Subsection 05 (FUEL INJECTION)

Install a fuel pressure gauge (P/N 529 035 591) to the quick connect fitting of the fuel hose.



FUEL PRESSURE GAUGE (P/N 529 035 591)

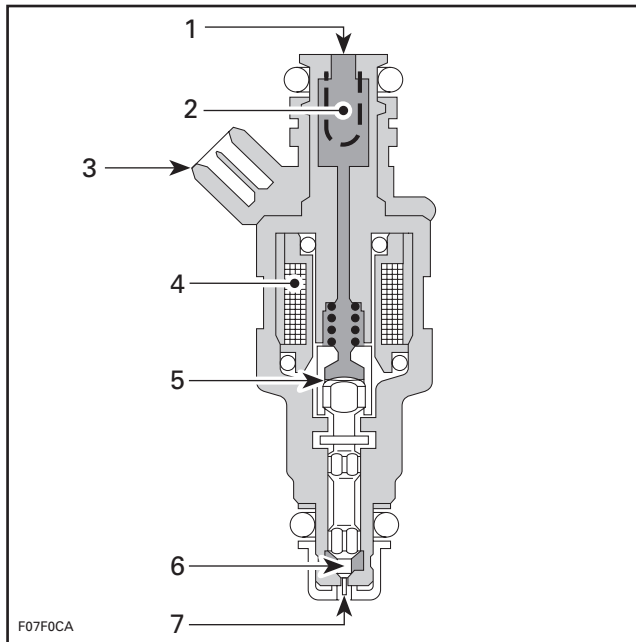
Install the safety lanyard cap on the switch to activate the fuel pump. The fuel pressure should be between 386 - 414 kPa (56 - 60 PSI).

If the pressure is too high, replace the fuel pump module.

If the pressure is too low, check the following components:

- fuel hoses and connections
- fuel filter
- fuel pump
- regulator
- voltage at fuel pump (minimum 8 Vdc).

Fuel Injector



1. Inlet side
2. Filter
3. Wiring terminal
4. Coil
5. Plunger
6. Needle valve
7. Injection side

Touch the injector while cranking the engine to feel the operation of the injector.

If there is no signal detected from the injector, disconnect the plug connector from the injector and check the signal from the MPEM.

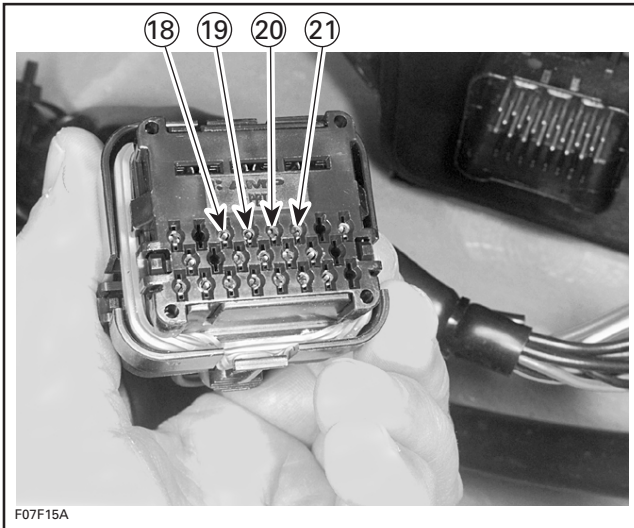
To check the signal, verify voltage at the plug connector. There should be at least 6 Vdc while cranking engine.

Check the resistance of the fuel injector circuits.

Disconnect the AMP plug connector number 4 on the MPEM.

Using a multimeter, check resistance value between terminal as follows.

	CONTACT LOCATION
Injector no. 1	18 and 20
Injector no. 2	19 and 21



The resistance should be between 2.3 Ω and 2.5 Ω at temperature of 20°C (68°F).

If resistance value is incorrect, check wiring harness between AMP plug connector and fuel injectors for damaged wires or bad connections. Repair if necessary.

Recheck resistance value at AMP plug connector number 4.

If not within specification, replace the fuel injector.

Leakage Test

To perform a leakage test, the injectors and fuel rail have to be removed from engine. See REMOVAL in this subsection for the procedure.

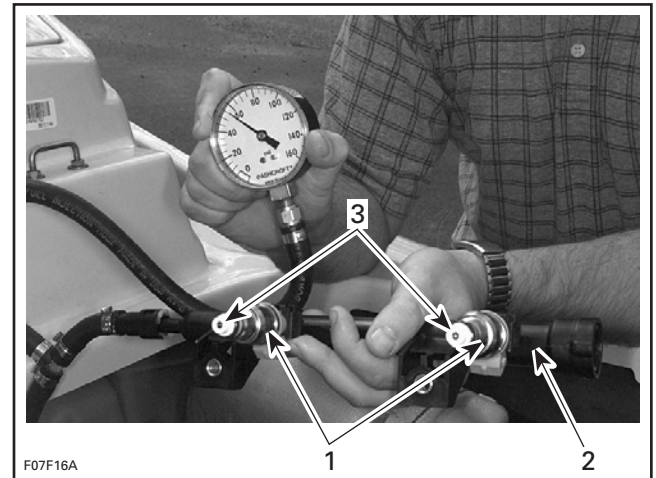
NOTE: Do not detach injectors from fuel rail.

Reconnect the wire connector of the injector.

Place each injector in a clean bowl.

Install the safety lanyard cap on the switch to activate the fuel pump.

Check for fuel leakage from the injector nozzle. There should be less than 1 drop of fuel per minute.



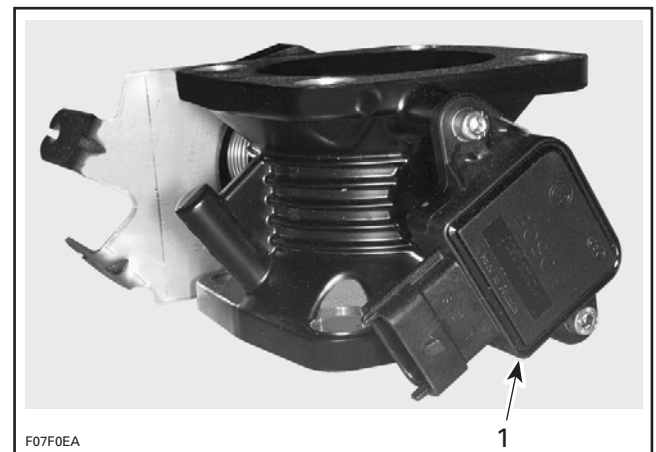
1. Fuel injectors
2. Fuel rail
3. Injector nozzles

If not within specification, replace the fuel injector(s).

ELECTRONIC MANAGEMENT

Throttle Position Sensor (TPS)

Check the resistance value of the throttle position sensor.



1. Throttle position sensor (TPS)

Disconnect the AMP plug connector number 4 on the MPEM.

Using a multimeter, check the resistance between terminal 3 (PURPLE/BROWN wire) and terminal 4 (BLACK/BROWN wire) on the AMP plug connector.

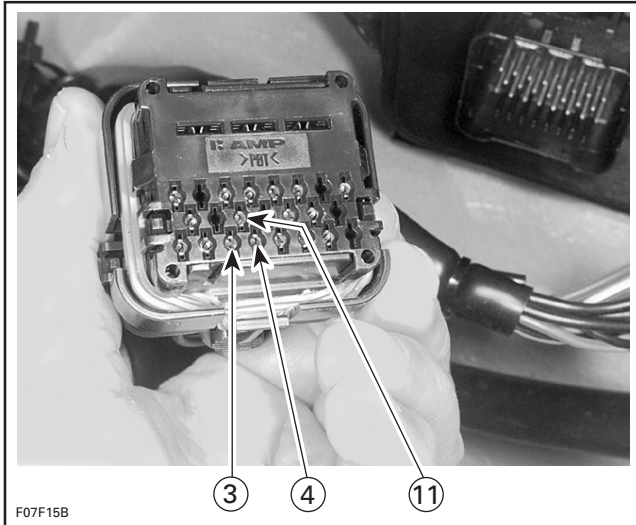
The resistance should be between 1.6 k Ω and 2.4 k Ω .

Section 06 FUEL SYSTEM

Subsection 05 (FUEL INJECTION)

Check also the resistance between terminal 4 (BLACK/BROWN wire) and terminal 11 (WHITE/BROWN wire) with the throttle plate in idle position.

The resistance should be between 710 Ω and 1380 Ω .



If resistance is below specifications, replace the throttle position sensor (TPS).

If resistance is above specifications, disconnect the connector of the throttle position sensor and check resistance of wiring harness and terminals between AMP plug connector and TPS sensor connector.

If there is an open circuit, repair or replace the defective wire or terminal.

Reconnect the throttle position sensor connector and recheck resistance values at AMP plug connector number 4.

If not within specification, replace the throttle position sensor.

NOTE: Whenever the TPS is replaced, removed or adjusted, the TPS closed position must be re-adjusted.

Voltage Test

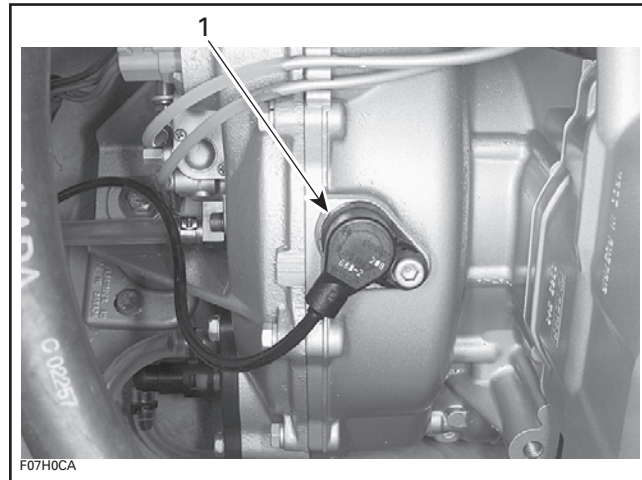
If the sensor resistance value is good, check the voltage output from MPEM to throttle position sensor.

Disconnect plug connector from throttle position sensor and connect a voltmeter between the PURPLE/BROWN wire and the BLACK/BROWN wire in the wiring harness.

Depress the start/stop button with the safety lanyard removed to activate the timer. There should be 5 Vdc.

Crankshaft Position Sensor (CPS)

Check the resistance of the crankshaft position sensor.

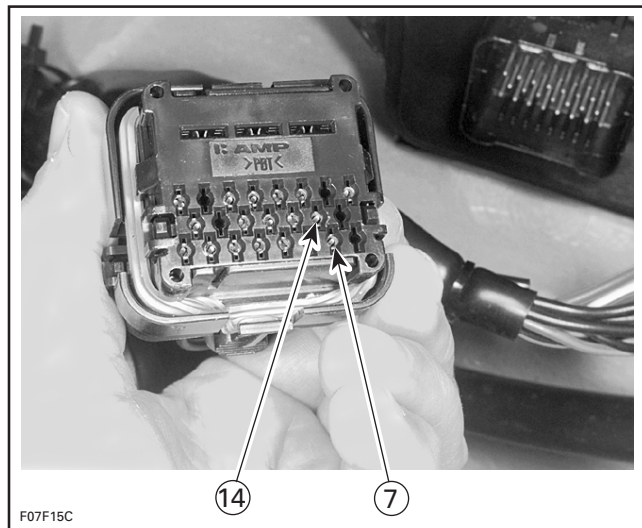


1. Crankshaft position sensor (CPS)

Disconnect the AMP plug connector number 4 from the MPEM module.

Using a multimeter, check the resistance between terminal 7 (GREY/YELLOW wire) and terminal 14 (GREY/RED wire) on the plug connector.

The resistance should be between 774 Ω and 946 Ω at temperature above 20°C (68°F).

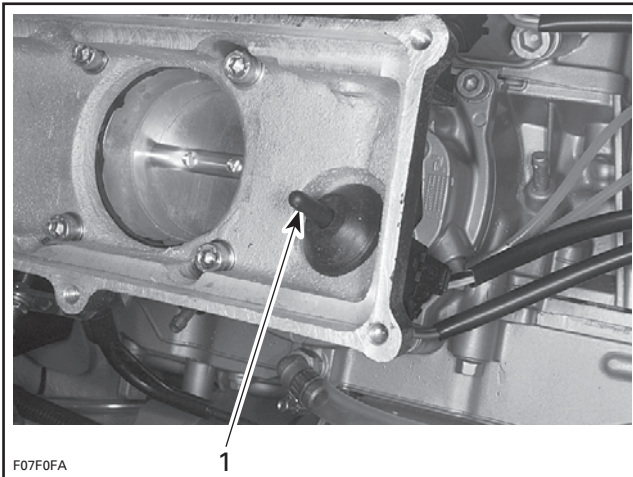


If not within specification, replace the crankshaft position sensor.

Air Temperature Sensor (ATS)

NOTE: When testing the resistance of the air temperature sensor (ATS), it is important to check the ambient temperature. The resistance values for the sensor will be different according to the temperature.

Check the air temperature sensor resistance.

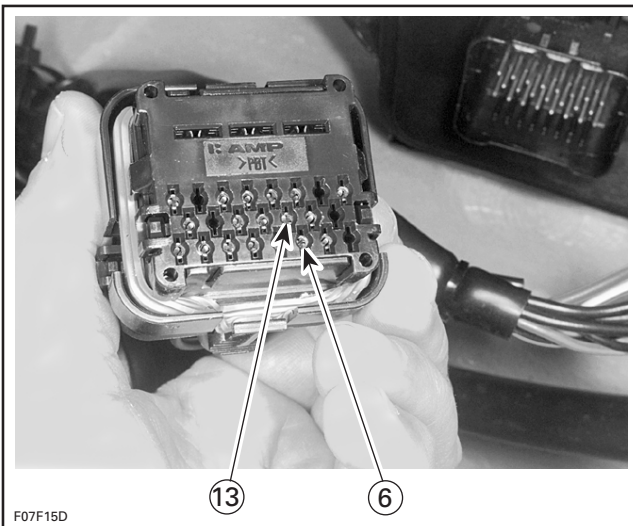


1. Air temperature sensor (ATS)

Disconnect the AMP plug connector number 4 from the MPEM module.

Using a multimeter, check the resistance between terminal 6 (BLACK/WHITE wire) and terminal 13 (WHITE/GREY wire) on the plug connector.

The resistance should be between 2.280 k Ω and 2.736 k Ω at temperature of 19°C to 21°C (66°F to 70°F).



If resistance is below specifications, replace air temperature sensor (ATS).

If resistance is above specifications, disconnect the connector of the air temperature sensor and check resistance of wiring harness and terminals between AMP plug connector and ATS sensor connector.

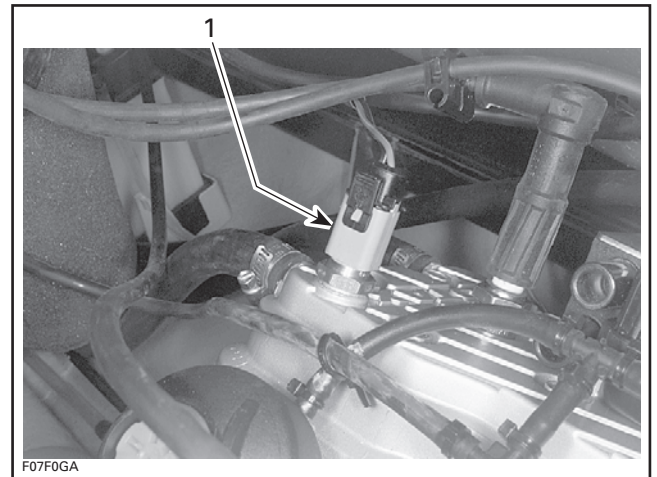
If there is an open circuit, repair or replace the defective wire or terminal.

Reconnect the air temperature sensor connector and recheck the resistance between terminal 6 and terminal 13 in the AMP plug connector number 4.

If not within specification, replace the air temperature sensor.

Water Temperature Sensor (WTS)

Check the water temperature sensor resistance.



1. Water temperature sensor (WTS)

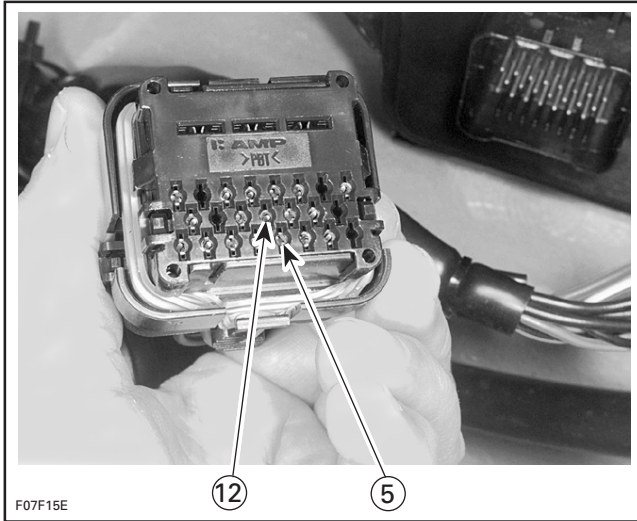
Disconnect the AMP plug connector number 4 from the MPEM module.

Using a multimeter, check the resistance between terminal 5 (BLACK/ORANGE wire) and terminal 12 (TAN/ORANGE wire) on the plug connector.

Section 06 FUEL SYSTEM

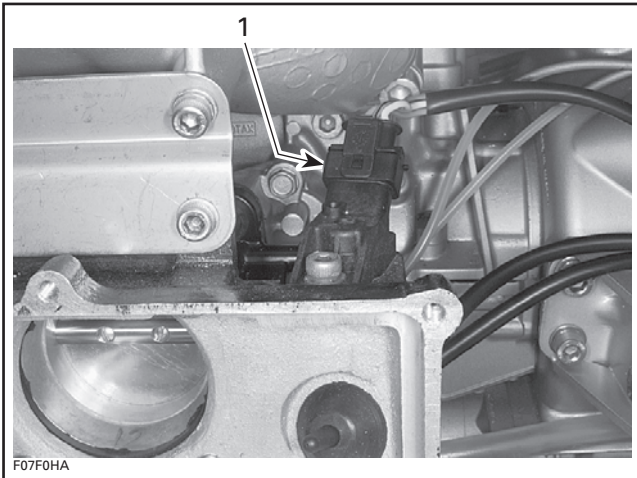
Subsection 05 (FUEL INJECTION)

The resistance should be between 2.280 k Ω and 2.736 k Ω at temperature of 19°C to 21°C (66°F to 70°F).



If not within specification, replace the water temperature sensor.

Air Pressure Sensor (APS)

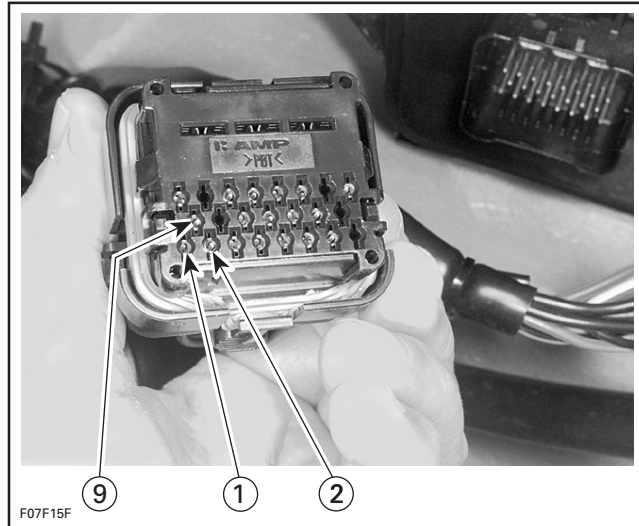


1. Air pressure sensor (APS)

Check the air pressure sensor resistance.

Disconnect the AMP plug connector number 4 from the MPEM module.

Using a multimeter, check the resistance between terminal 9 (WHITE/BLUE wire) and terminal 2 (BLACK/BLUE wire) on the plug connector.



The resistance should be between 3.4 k Ω and 8.2 k Ω .

Check also the resistance between terminal 2 (BLACK/BLUE wire) and terminal 1 (PURPLE/BLUE wire) of the plug connector.

The resistance should be between 2.4 k Ω and 8.2 k Ω .

If not within specification, disconnect the connector of the water temperature sensor and check resistance of wiring harness and terminals between AMP plug connector and APS sensor connector.

Reconnect the air pressure sensor connector and recheck the resistance value between terminals in the AMP plug connector number 4.

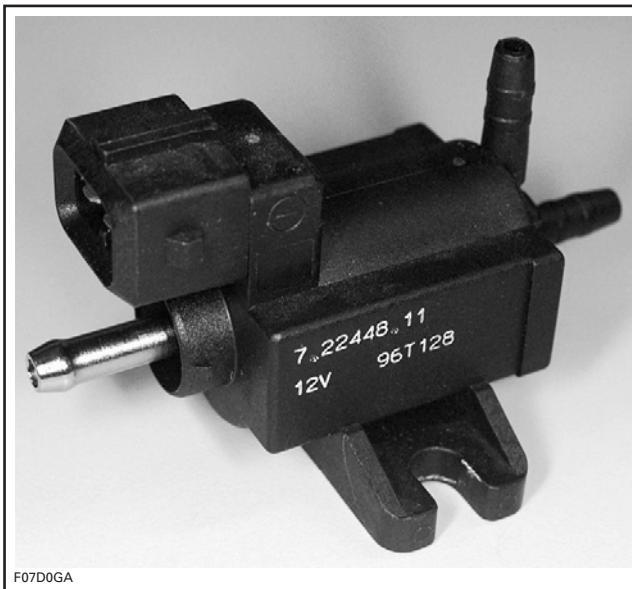
If not within specification, replace the air temperature sensor.

Voltage Test

If the sensor resistance value is within specifications, disconnect the plug connector from the APS sensor and check the voltage between the PURPLE/BLUE wire and the BLACK/BLUE wire in the wiring harness from the MPEM.

Depress the start/stop button with the safety lanyard removed to activate the timer. There should be 5 Vdc.

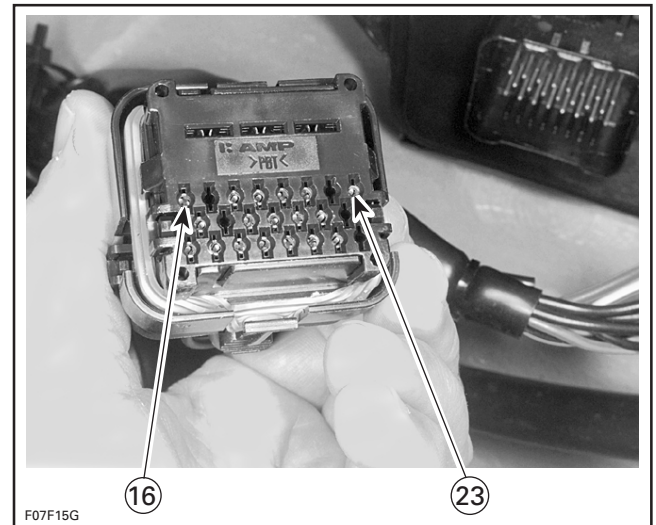
Rave Solenoid



RAVE SOLENOID

Disconnect the AMP plug connector number 4 from the MPEM module.

Check resistance value between terminal 16 and terminal 23 on the plug connector.



The resistance value should be 30 Ω .

Section 06 FUEL SYSTEM

Subsection 05 (FUEL INJECTION)

RFI SENSORS RESISTANCE VALUES

COMPONENT	TERMINAL NUMBER	WIRE COLOR	RESISTANCE VALUE	VOLTS
Air pressure sensor	1 and 2	PU/BL and BK/BL	2.4 k - 8.2 k ohms	5 Vdc between PU/BL and BK/BL
	9 and 2	WH/BL and BK/BL	3.4 k - 8.2 k ohms	
Throttle position sensor	3 and 4	PU/BW and BK/BW	1.6 k - 2.4 k ohms	5 Vdc between PU/BW and BK/BW
	4 and 11	BK/BW and WH/BW	710 - 1380 ohms	
Water temperature sensor	5 and 12	BK/OR and TA/OR	2280 - 2736 ohms	N.A.
Air temperature sensor	6 and 13	BK/WH and WH/GY	2280 - 2736 ohms	N.A.
Crankshaft position sensor	7 and 14	GY/YL and GY/RE	774 - 946 ohms	N.A.
Rave solenoid	16 and 23	PU/GY and BK/GY	30 ohms	N.A.
Injector no. 1	18 and 20	BL/PU and BL/BK	2.3 - 2.5 ohms	6 Vdc at the plug connector
Injector no. 2	19 and 21	GR/PU and BK/GR	2.3 - 2.5 ohms	

TROUBLESHOOTING SUMMARY

ENGINE DOES NOT START

If the engine does not start, the following items should be verified in this order:

- fuses
- ignition (spark)
- fuel pump
- check fault codes in the ECU memory.

Flooded Engine Feature

If the engine does not start and it is flooded, proceed as follows:

Remove spark plug cables and connect them on the grounding device.

Remove spark plugs and dry them using a rag.

Cover spark plug holes with a rag.

Depress and hold the throttle lever at full throttle position.

Install the safety lanyard cap on the switch. Press the start/stop button. Crank the engine for approximately 10 seconds.

NOTE: Proceeding in this order, no fuel is injected and the accumulated fuel in the engine will be expelled.

Reinstall spark plugs and connect cables.

Start engine normally without applying the throttle.

Spark Plug Inspection

Whenever replacing the spark plugs, always use NGK BR8ES with the resistor feature. The spark plug gap is set at 0.5 - 0.6 mm (.02 - .024 in).

To check for ignition, attach an inductive timing light to the high tension lead while turning the engine with the starter.

Reversed high tension cables will not allow the RFI to run. Unlike other Sea-Doo models, the spark plugs spark independently on each piston stroke. Reversed high tension cables will cause backfires.

ECU Fault Codes

Fault codes in the ECU memory will identify potential problems with the RFI system. When checking fault codes without engine in operation, the CPS fault code will always appear. Also, the 04 FC fault code will always appear.

Disconnecting the battery will erase the fault codes in the ECU memory.

ENGINE STARTS BUT RUNS POORLY

If the engine starts but runs poorly, the following items should be verified in this order:

- Check spark plug condition.
- Check fault codes in the ECU memory.
- Check fuel pressure.
- Check TPS adjustment.

If some work has been performed on the unit, make sure injector wire connectors were not mixed. It is also possible that the RAVE solenoid connector be mixed with one of the injector connector. Refer to the wiring diagram for wire colors and positions.

ENGINE STARTS BUT STALLS AFTER APPROXIMATELY 30 SECONDS

The RPM signal (GREY wire) is short circuit to the ground. Check wire condition. If the wire test good, either the tachometer or Info Center is defective.

ENGINE CANNOT REACH MAXIMUM REVOLUTIONS

Check battery voltage. When voltage is too low, the MPEM limits the engine revolutions.

Recharge or replace battery.

The RAVE system is not functioning properly. The sliding valves do not open. Check pressure hoses and check valve from crankcase to RAVE solenoid.

Check RAVE solenoid.

Section 06 FUEL SYSTEM

Subsection 05 (FUEL INJECTION)

ADJUSTMENT

THROTTLE POSITION SENSOR (TPS)

This adjustment is very important. The setting of the TPS will determine the basic parameters for all fuel mapping.

NOTE: Adjustment must be done each time the throttle position sensor (TPS) is loosened or removed.

CAUTION: An improperly adjusted TPS may lead to serious engine damage.

The adjustment of the TPS is performed using the MPEM programmer.

Closed TPS

To perform this adjustment, proceed as follows:

Access the **BOSCH SYSTEM** in the MPEM programmer. Then, select **ADJUSTMENT** in the sub-menu.

Choose **CLOSE TPS** in the **ADJUSTMENT** menu.

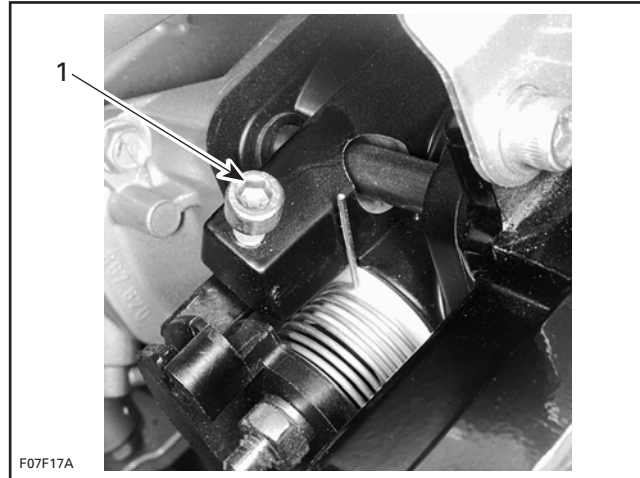
The screen will display the actual adjustment of the TPS in degrees and it will also offer to adjust it.

CAUTION: Do not select "YES" until the idle speed screw is loosened to allow the throttle plate to close.

Loosen the lock nut of the idle speed screw.

Loosen the idle speed screw until it does not contact the throttle plate stopper.

Loosen the adjustment of the throttle cable.



1. Idle speed screw

Depress throttle lever a few times and ensure throttle plate is completely closed.

Selecting "YES" will instantly readjust the close throttle position adjustment to the new setting.

NOTE: If the ECU is replaced, the TPS closed position must be readjusted.

Idle Speed

Access the **BOSCH SYSTEM** in the MPEM programmer. Then, select **REAL TIME** in the sub-menu.

Turn idle speed screw approximately 2 turns or until the TPS idle position reaches 6 - 7.

For a precise adjustment of the idle speed, it should be finalized in water.

Idle speed in water is 1500 ± 100 RPM.

REMOVAL AND INSTALLATION

THROTTLE POSITION SENSOR (TPS)

Remove the air intake silencer.
Remove the flame arrester.
Remove the air temperature sensor to ease removal of the TPS.
Disconnect the connector of the TPS.
Loosen 2 Allen screws retaining the TPS.
Remove TPS.

AIR TEMPERATURE SENSOR (ATS)

Remove the air intake silencer.
Remove the flame arrester.
Disconnect the connector of the ATS.
Pull the ATS from the grommet retaining it.

AIR PRESSURE SENSOR (APS)

Remove the air intake silencer.
Disconnect the connector of the APS.
Loosen Allen screw retaining the APS.
Remove the APS.
At installation, apply Loctite 243 (blue) on screw threads.

WATER TEMPERATURE SENSOR (WTS)

Disconnect the connector of the WTS.
Loosen the WTS from the cylinder head.
At installation, apply Loctite 518 on threads of the WTS.

CRANKSHAFT POSITION SENSOR (CPS)

Disconnect the connector of the CPS.
Loosen Allen screw retaining the CPS.
Remove the CPS.
At installation, apply Loctite 243 (blue) on the Allen screw.
NOTE: Clean threads prior installing screw.

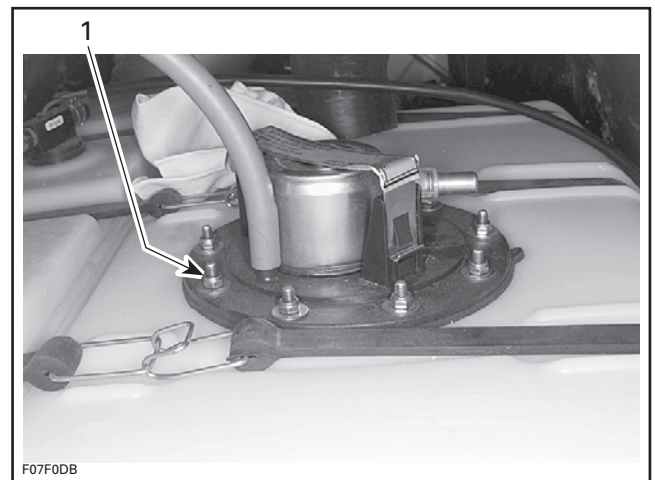
FUEL PUMP ASSEMBLY

Open the front storage compartment cover.
Remove the storage basket.
Remove the glove box.
Disconnect the wire connector from the fuel pump assembly.
Disconnect fuel vent hose from fuel pump assembly.
Cover the quick connect fitting with a shop towel.
Press on both tabs and disconnect the quick connect fitting.

WARNING

Fuel is under pressure. Wipe off any fuel spillage in the bilge. Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area.

Loosen nuts retaining the fuel pump assembly to the fuel tank.



1. Loosen nuts

Remove fuel pump assembly from fuel tank.

GSX RFI Model

Remove straps retaining fuel tank. Move fuel tank forward then remove fuel pump assembly from fuel tank.

Regulator

The regulator is not serviceable. Replace the fuel pump assembly if the regulator is defective.

Section 06 FUEL SYSTEM

Subsection 05 (FUEL INJECTION)

Fuel Filter

The fuel filter is not serviceable. Replace the fuel pump assembly if the fuel filter must be replaced.

FUEL INJECTOR

Place a suitable container below the quick connect fitting of the fuel rail.

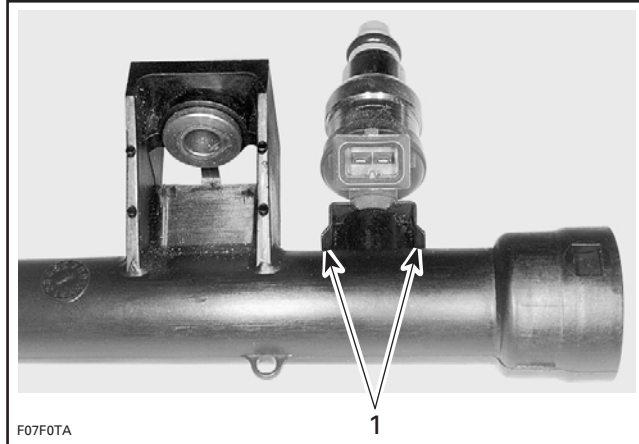
Cover the quick connect fitting of the fuel rail with a shop towel.

Press on both tabs and disconnect the quick connect fitting.

Disconnect the wire connectors of both fuel injectors.

Remove the fuel rail with both fuel injectors.

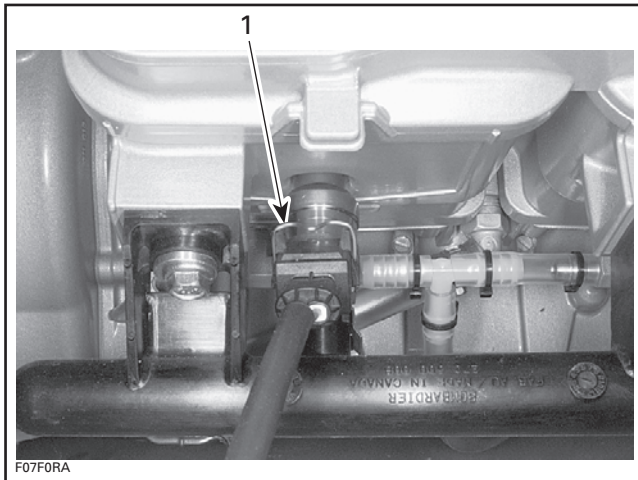
To remove the fuel injector from the fuel rail, pry off the retaining clip.



1. Pry the clip

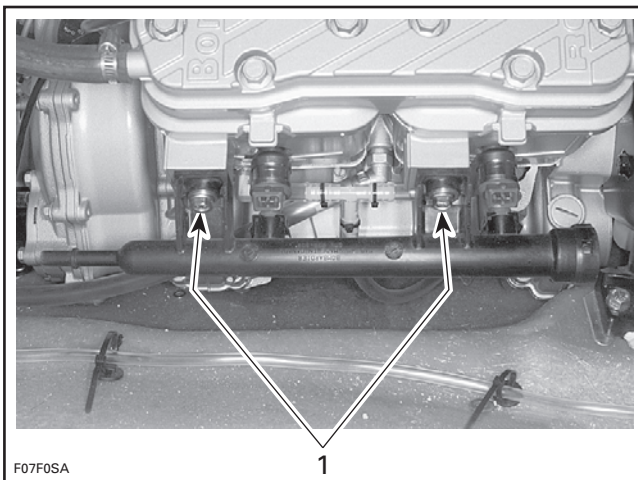
When reinstalling the fuel injector, install the retaining clip to the injector, then insert the injector to the fuel rail.

CAUTION: Whenever removing fuel injector, always replace both injector O-rings with new ones.



1. Press retaining clip to unlock the connector

Loosen both screws retaining the fuel rail to the cylinders.



1. Loosen screws retaining the fuel rail

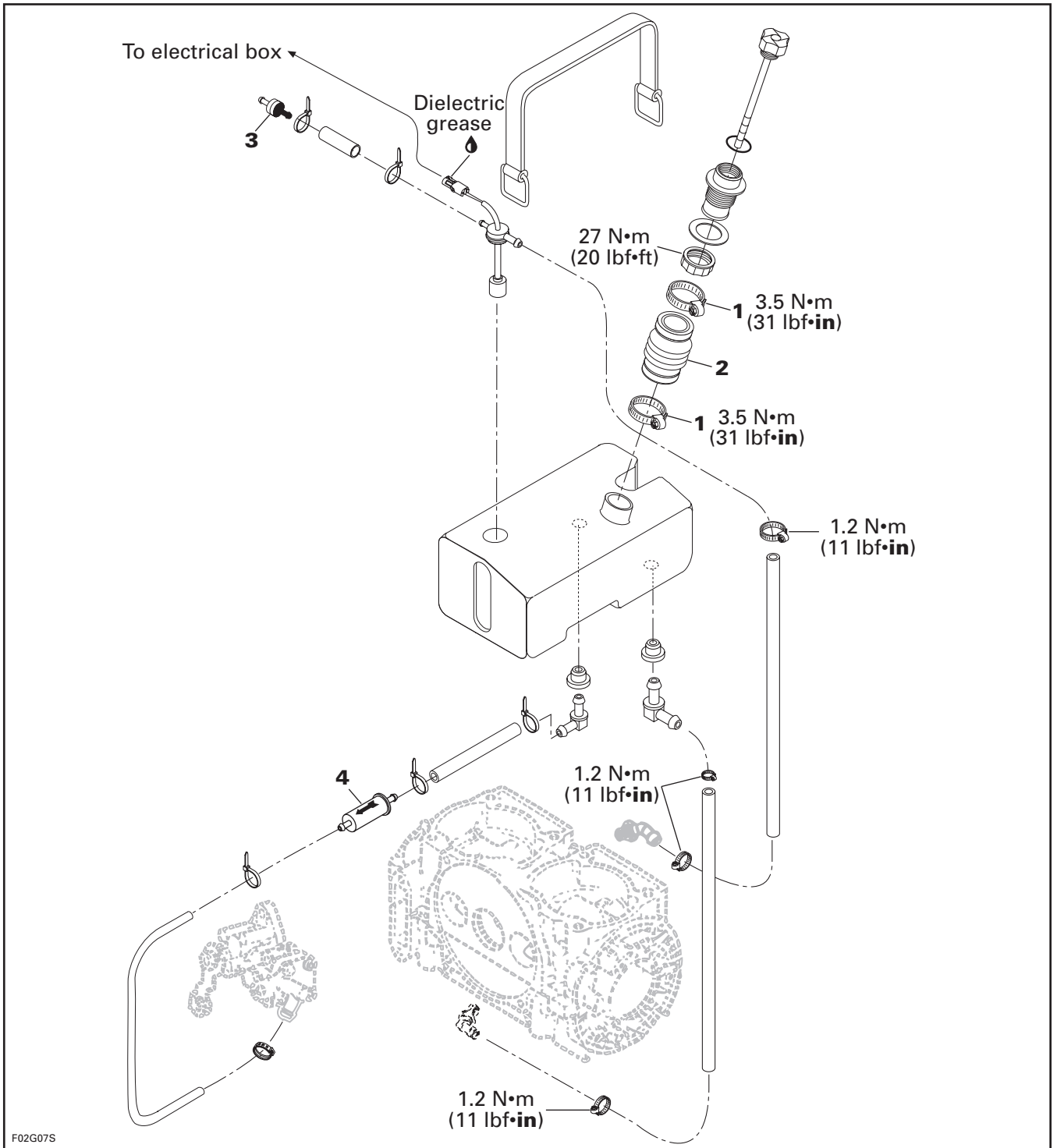
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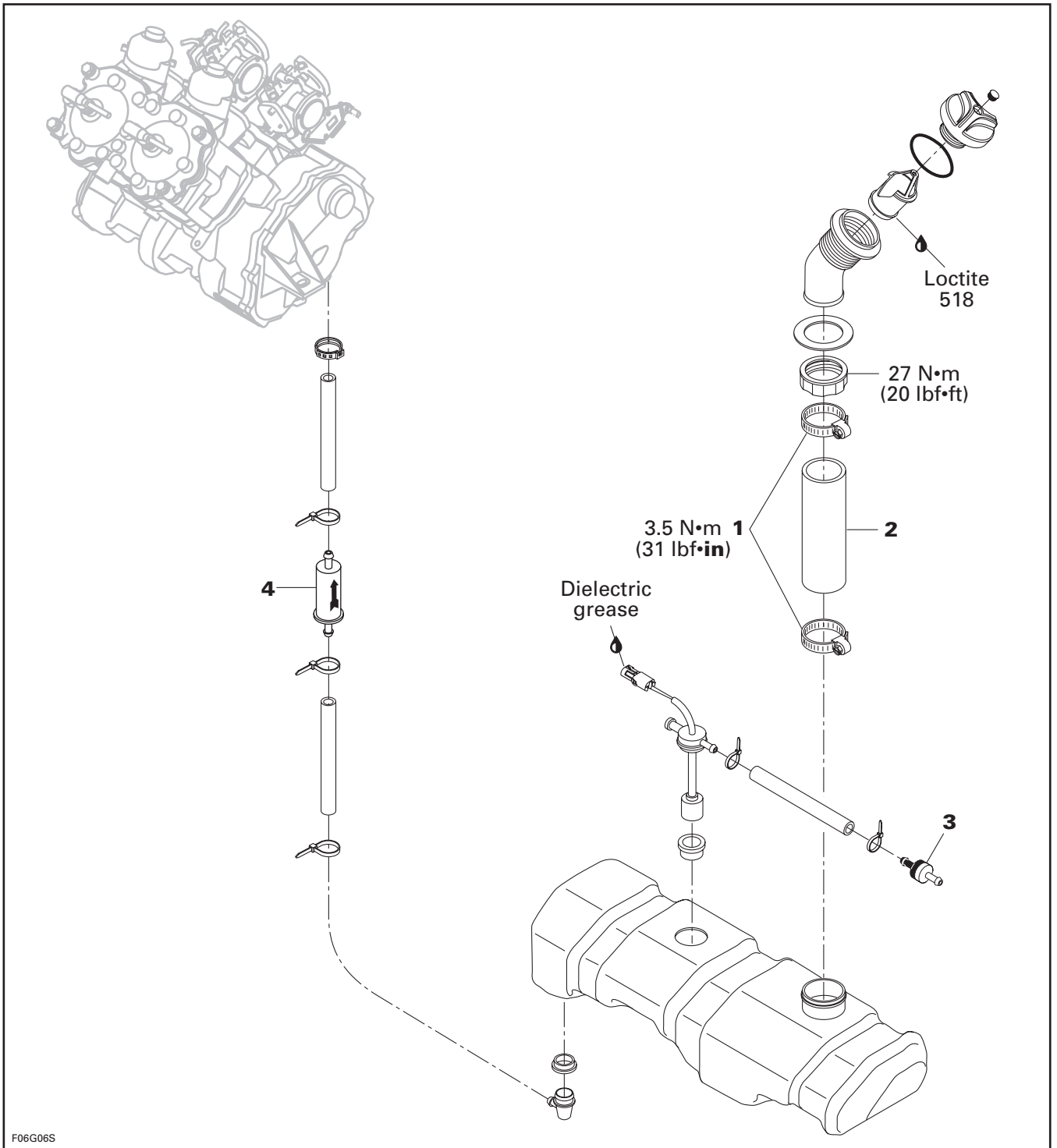
OIL INJECTION SYSTEM

GTS Model



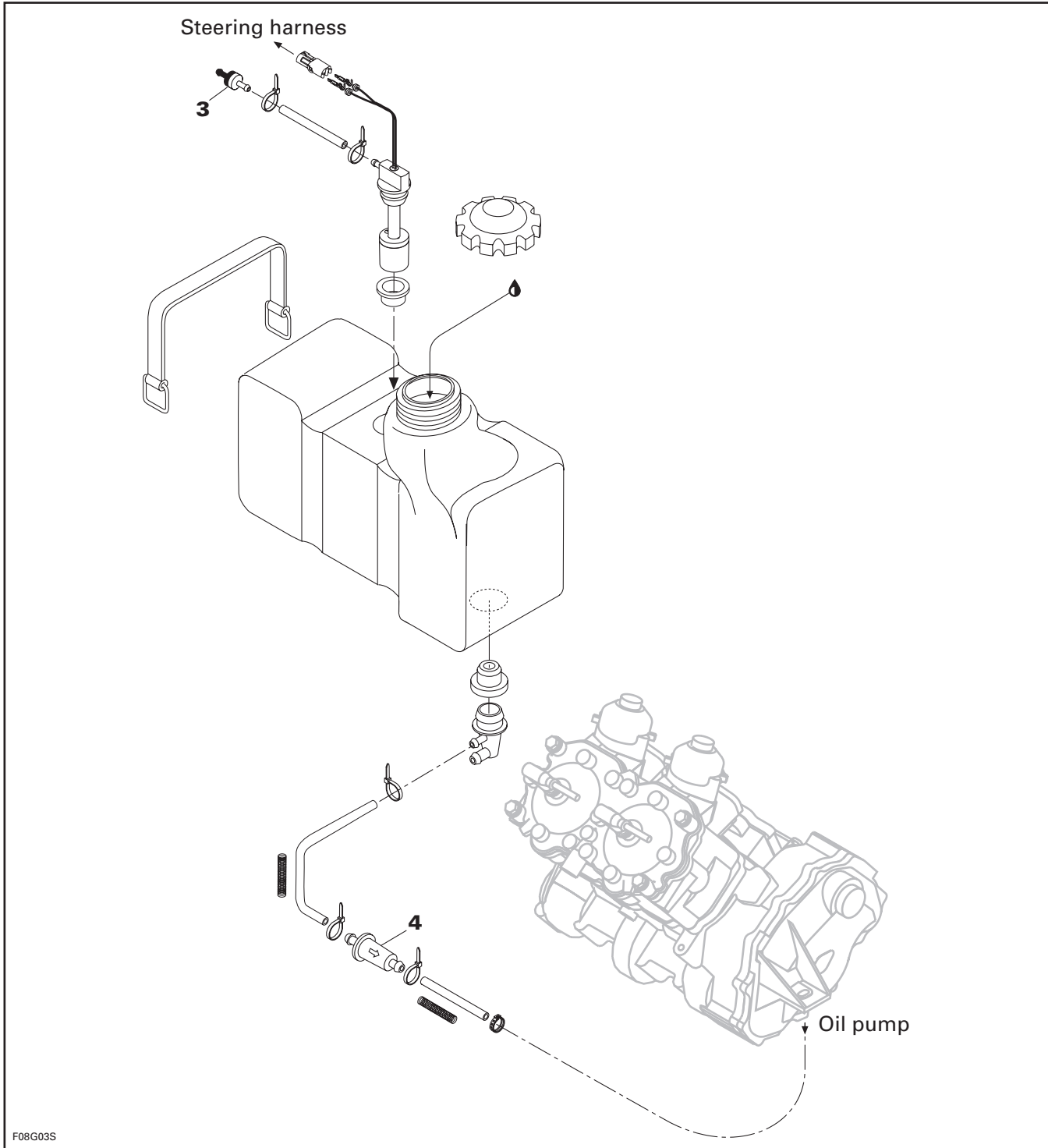
Section 07 LUBRICATION SYSTEM
Subsection 02 (OIL INJECTION SYSTEM)

GSX Model



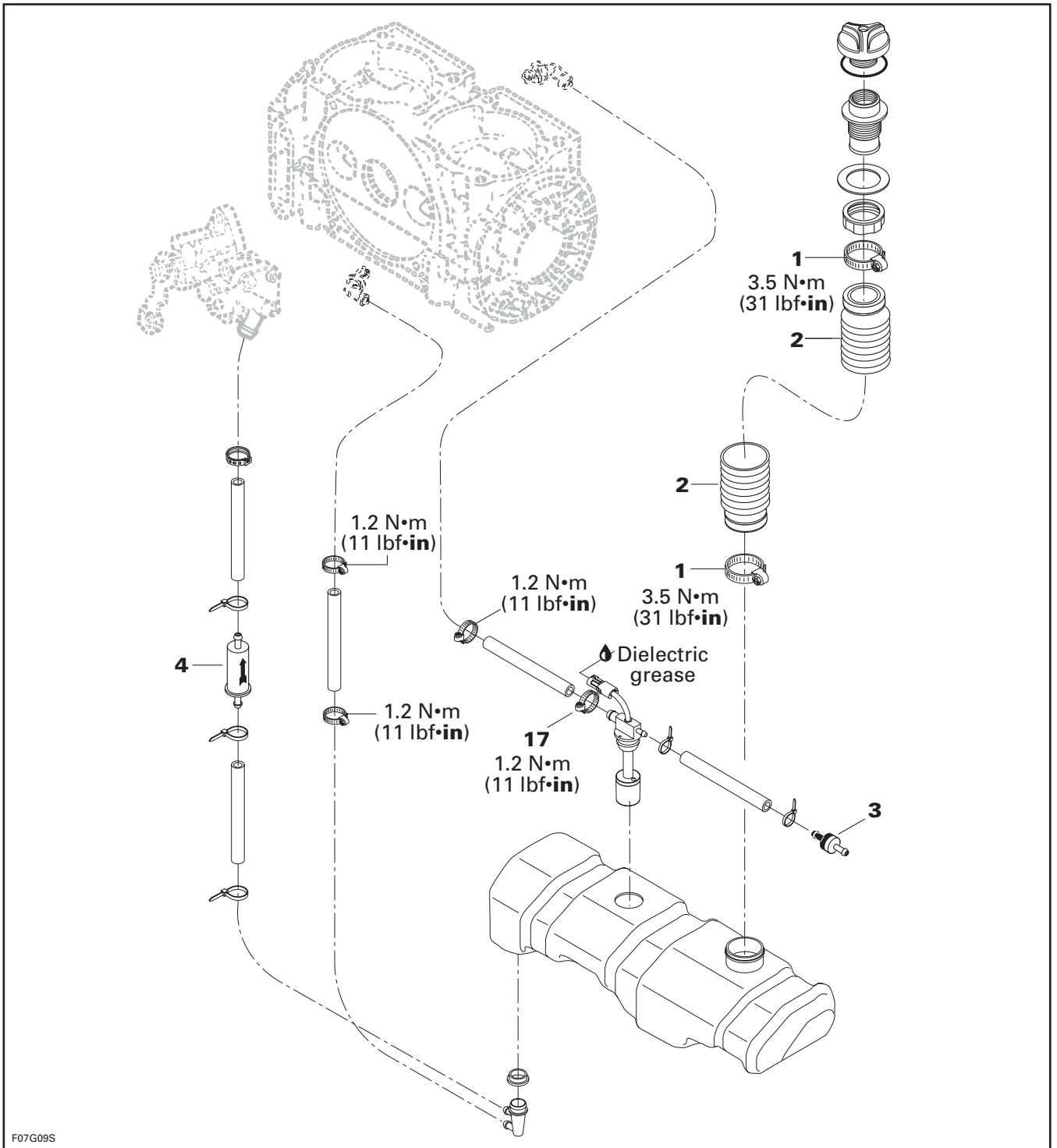
Section 07 LUBRICATION SYSTEM
Subsection 02 (OIL INJECTION SYSTEM)

XP Model



Section 07 LUBRICATION SYSTEM
Subsection 02 (OIL INJECTION SYSTEM)

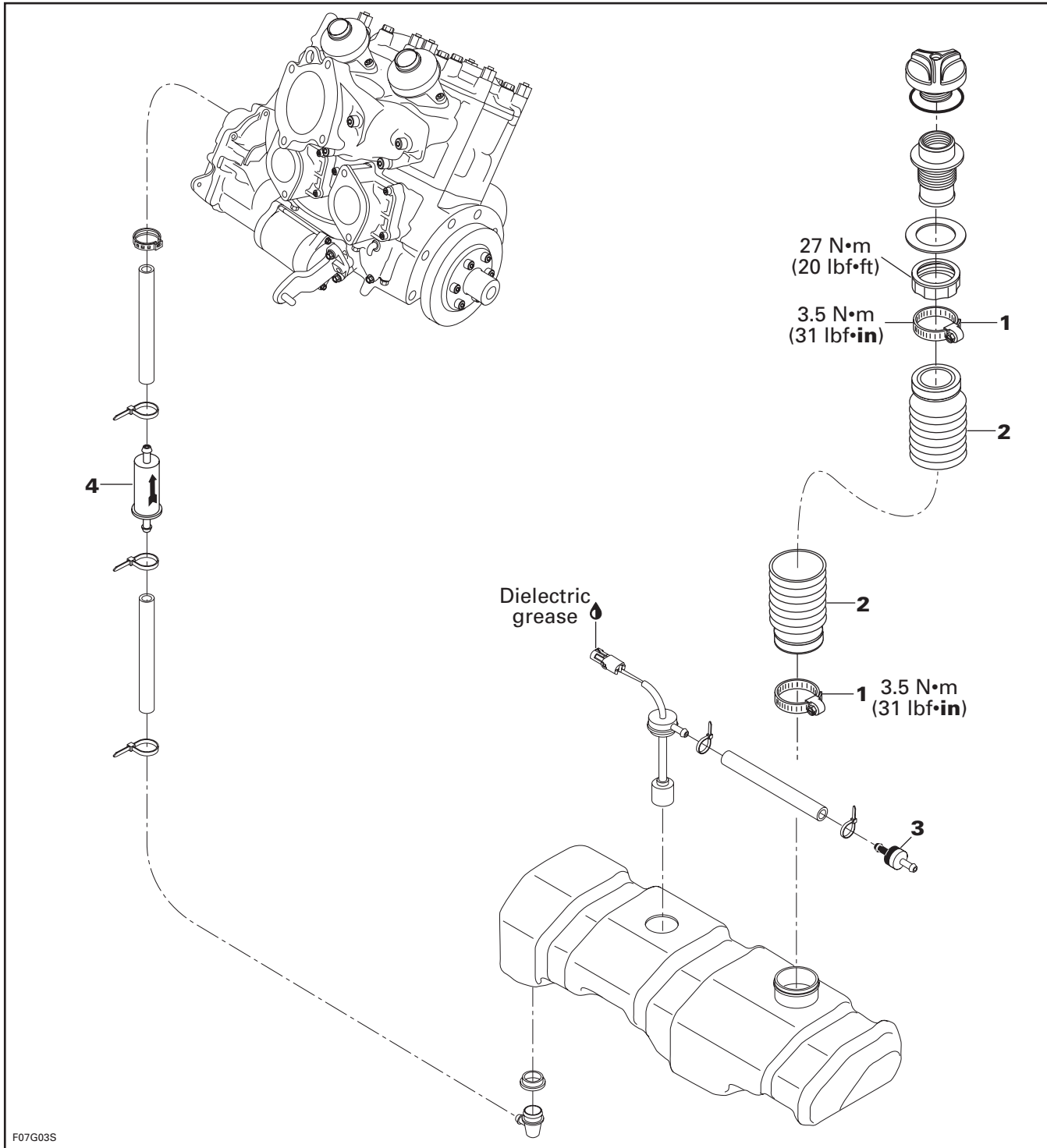
GTI Model



Section 07 LUBRICATION SYSTEM

Subsection 02 (OIL INJECTION SYSTEM)

GTX Model



Section 07 LUBRICATION SYSTEM

Subsection 02 (OIL INJECTION SYSTEM)

GENERAL

Whenever repairing the oil injection system, always verify for water infiltration in reservoir.

Perform also a pressure test of the oil injection system.

All Models Except the XP

Clamp and Hose

Verify oil filler neck hose no. 2 for damage. Always ensure that clamps no. 1 are well positioned and tightened. Torque clamps to 3.5 N•m (31 lbf•in).

All Models

Check Valve

Black side of the one-way check valve no. 3 is the valve outlet. It allows air to get in reservoir.

Oil Filter

Oil filter no. 4 should be replaced annually.

OIL SYSTEM PRESSURIZATION

WARNING

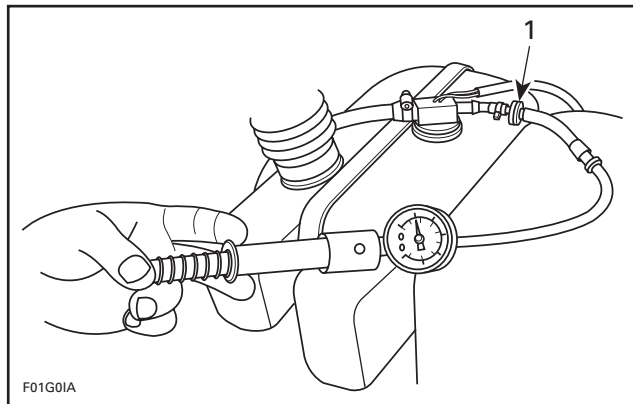
Whenever oil system components are disconnected or replaced, a pressure test must be done before starting engine. Ensure to verify oil line ends for damage. Always cut damaged end before reinstallation.

Pressure Test

Proceed as follows:

- Fill up oil reservoir.
- Install a hose pincher to rotary valve shaft oil supply hose (except the 947 engine).
- Install a hose pincher to rotary valve shaft oil return hose (except the 947 engine).
- Install a hose pincher to oil injection pump supply hose.
- Connect pump gauge tester (P/N 529 021 800) to check valve of oil injection reservoir vent.

NOTE: Use the same pump included in the ENGINE LEAK TESTER KIT (P/N 295 500 352).



TYPICAL

1. Connect pump to check valve

- Pressurize oil system to 21 kPa (3 PSI). If pressure is not maintained, locate leak and repair/replace component leaking. To ease leak search spray a solution of soapy water on components, bubbles will indicate leak location.

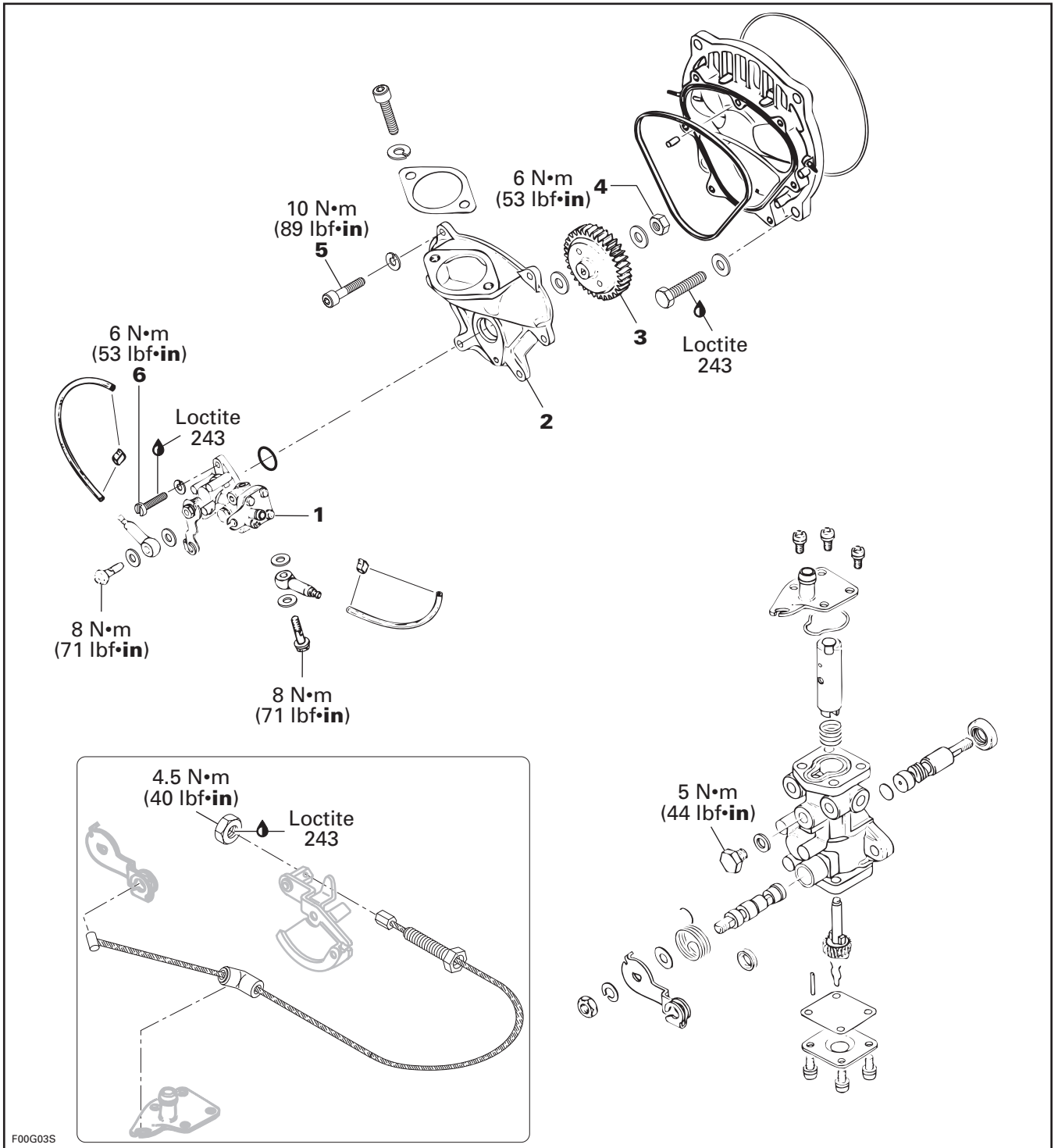
NOTE: The system must maintain a pressure of 21 kPa (3 PSI) for at least 10 minutes. Never pressurize over 21 kPa (3 PSI).

CAUTION: If any leak is found, do not start the engine and wipe off any oil leakage.

- Disconnect pump gauge tester and remove hose pinchers.

OIL INJECTION PUMP

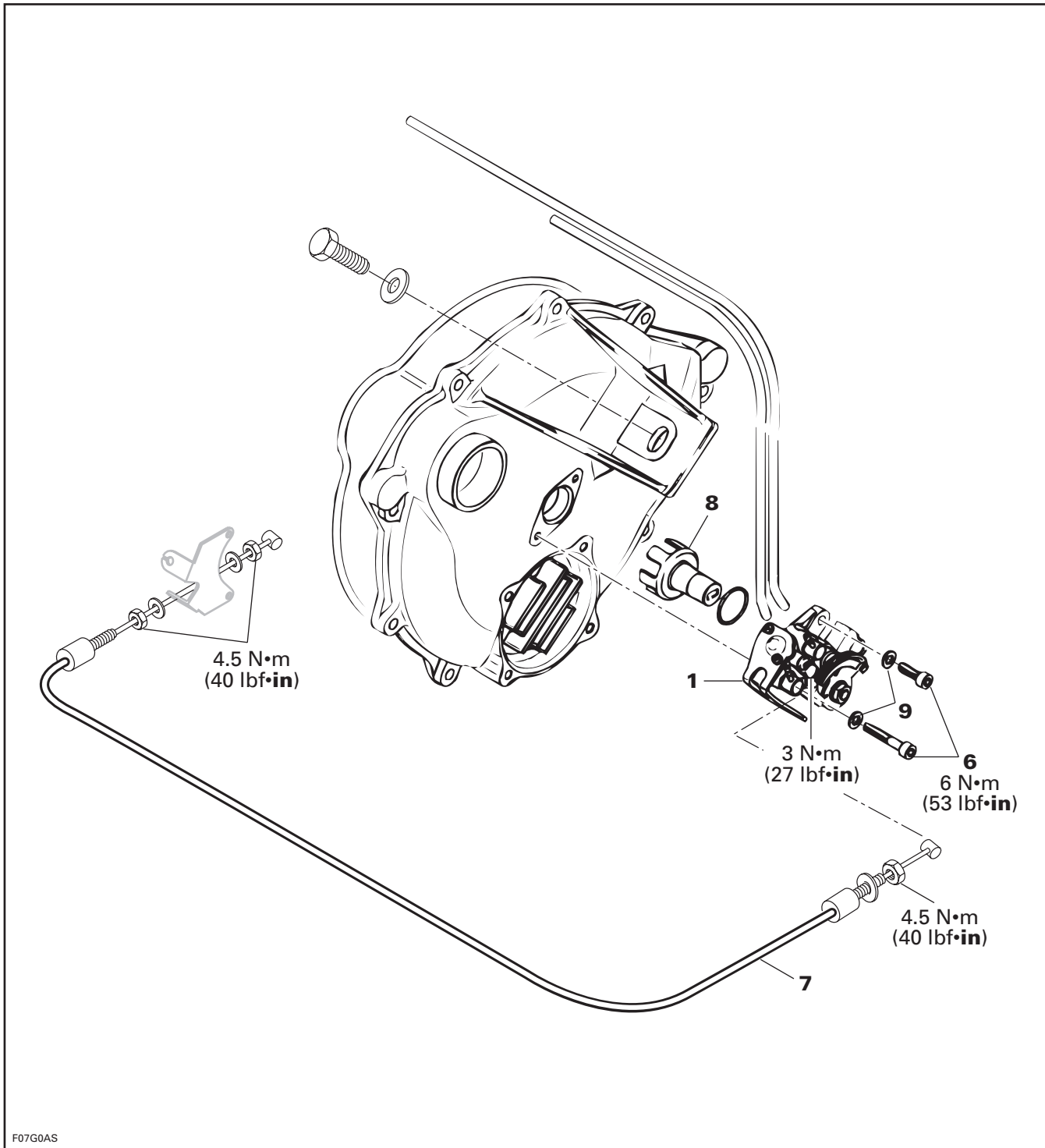
717 Engine



Section 07 LUBRICATION SYSTEM

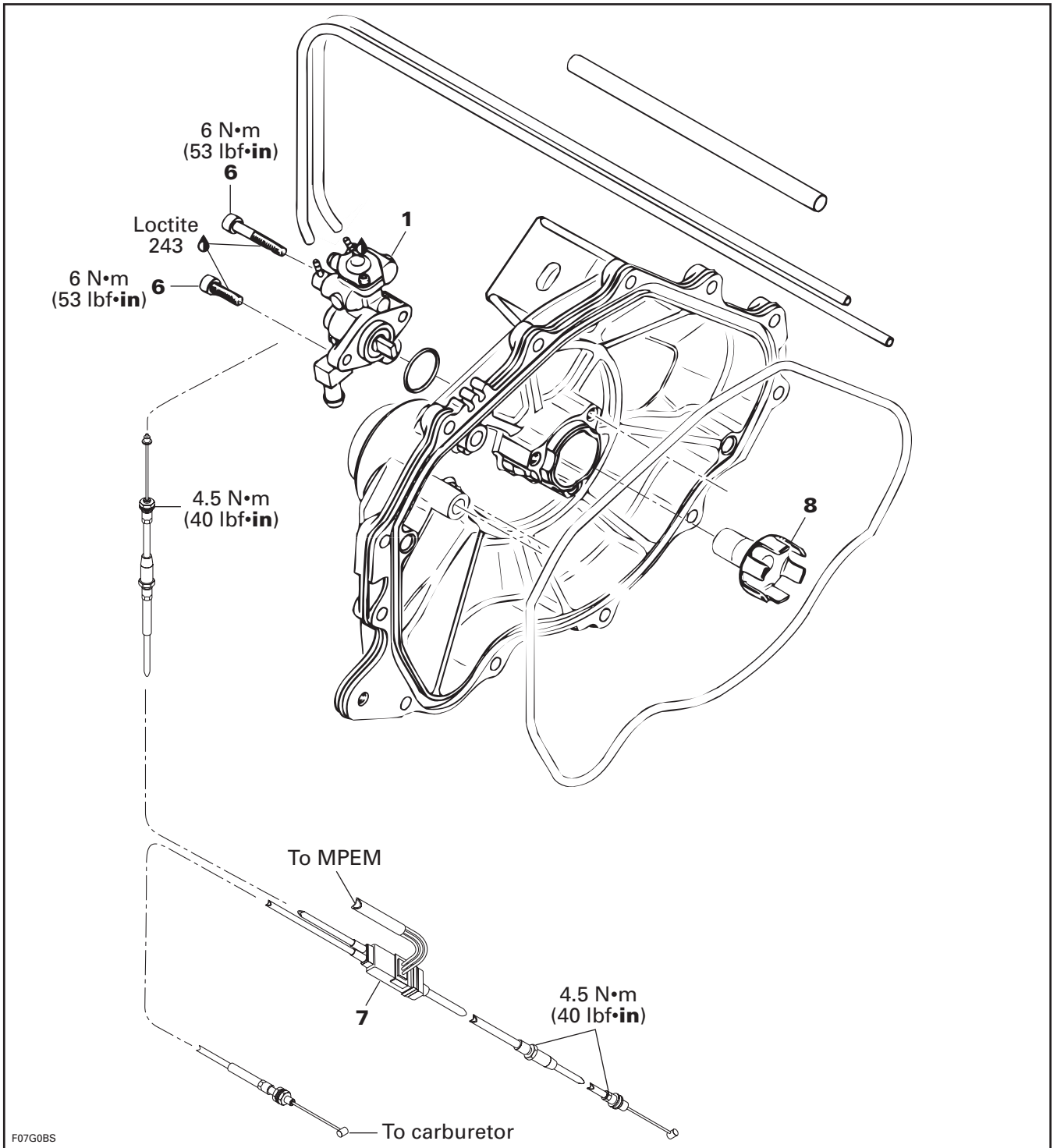
Subsection 03 (OIL INJECTION PUMP)

787 RFI Engine



Section 07 LUBRICATION SYSTEM
Subsection 03 (OIL INJECTION PUMP)

947 Engine



Section 07 LUBRICATION SYSTEM

Subsection 03 (OIL INJECTION PUMP)

OIL PUMP IDENTIFICATION

Pump Lever

Different engines need different pumps. See identification on lever.

CAUTION: Always mount proper pump on engine.

ENGINE TYPE	OIL PUMP IDENTIFICATION
717	105Q-5
787 RFI	06
947	09

NOTE: The following procedures can be done without removing the engine from hull.

REMOVAL

Oil Injection Pump

717 Engine

Remove air intake silencer (refer to AIR INTAKE).

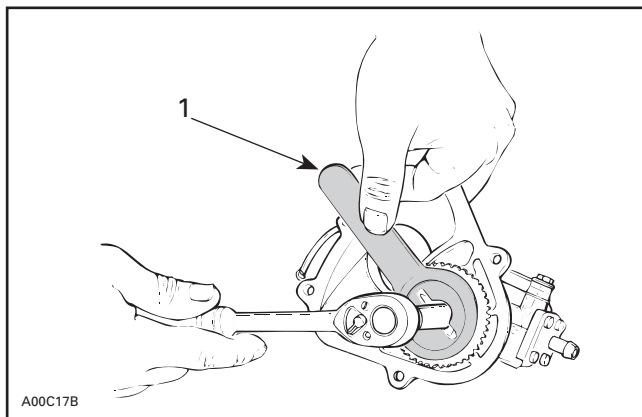
Remove carburetor (refer to CARBURETOR).

Remove rotary valve cover (refer to ROTARY VALVE).

Remove Allen screws **no. 5** retaining intake manifold **no. 2** to rotary valve cover.

Separate intake manifold from rotary valve cover.

To separate oil pump from intake manifold **no. 2**, remove oil pump gear **no. 3** using gear holder (P/N 420 277 905) and unscrew lock nut **no. 4**.



1. Gear holder

Remove 2 Allen screws **no. 6** with flat washers retaining oil injection pump to intake manifold **no. 2**.

Remove pump.

947 Engine

Remove tuned pipe head. Refer to EXHAUST SYSTEM.

787 RFI and 947 Engines

Disconnect oil injection pump cable **no. 7**.

Remove 2 Allen screws **no. 6** with flat washers retaining oil injection pump to magneto housing cover.

Pull pump.

Disconnect oil hoses from fittings of oil injection pump.

DISASSEMBLY

NOTE: Some oil pump parts are not available in single parts. A gasket set is available for the pump. If the pump is found defective, it should be replaced by a new one.

CLEANING

Discard all seals and O-rings. Clean metal components in a solvent.

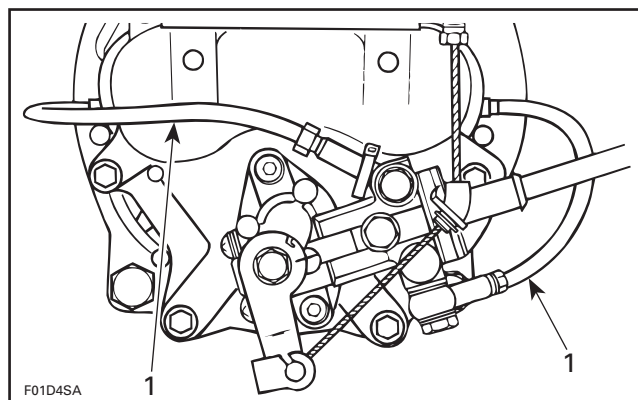
ASSEMBLY

717 Engine

Oil Injection Pump and Intake Manifold

Install oil injection pump **no. 1** to intake manifold **no. 2**. Torque screws **no. 6** to 6 N•m (53 lbf•in).

CAUTION: Whenever oil injection lines are removed, always make the routing as shown.



TYPICAL

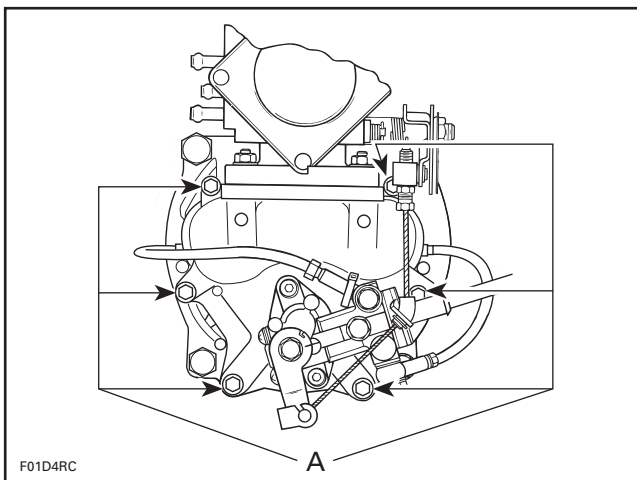
1. Small oil line

Oil Pump Gear

Install gear no. 3 to oil injection pump shaft. Torque lock nut no. 4 to 6 N•m (53 lbf•in).

NOTE: Make sure 1 washer is installed on each side of gear.

Install intake manifold no. 2 to rotary valve cover and torque screws no. 5 to 10 N•m (89 lbf•in).



TYPICAL

A. 10 N•m (89 lbf•in)

787 and 947 Engines

Oil Injection Pump and Shaft

Make sure shaft no. 8 is installed in crankshaft end.

Install pump. Secure with flat washers and screws no. 6. Torque to 6 N•m (53 lbf•in).

Install oil injection pump cable.

ADJUSTMENT

CAUTION: As oil injection pump adjustment is dependent on throttle cable position, make sure to perform throttle cable adjustment first except if otherwise specified.

Preliminary Synchronization

NOTE: To check synchronization of pump as a routine maintenance, see **Final Synchronization**. Make sure idle speed screw on carburetor is properly set.

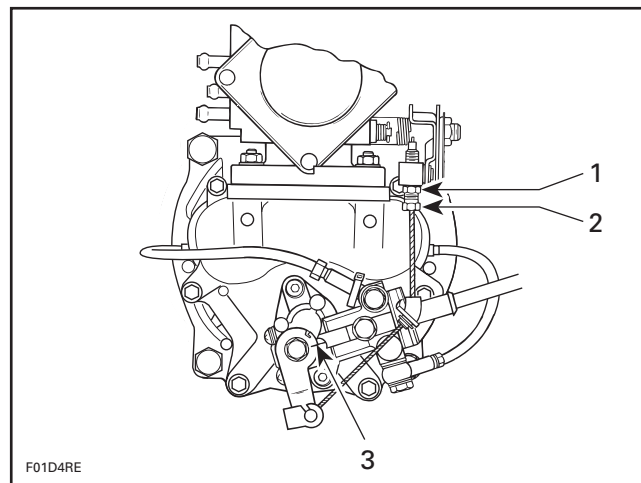
Refer to CARBURETOR for throttle cable adjustment procedure.

NOTE: On a twin carburetor engine, make sure carburetors are properly synchronized.

Turn oil pump cable adjustment nut to align reference marks on pump.

NOTE: A mirror may be used to facilitate this verification.

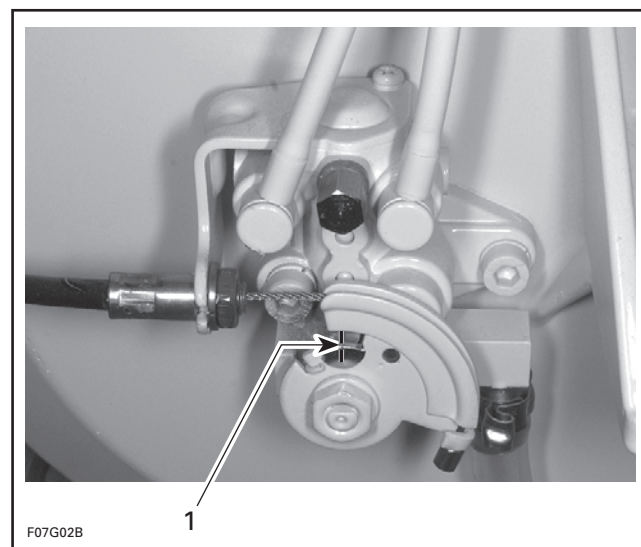
717 Engine



TYPICAL

1. Jam nut
2. Adjustment nut
3. Aligned marks

787 RFI Engine



1. Aligned marks

Section 07 LUBRICATION SYSTEM

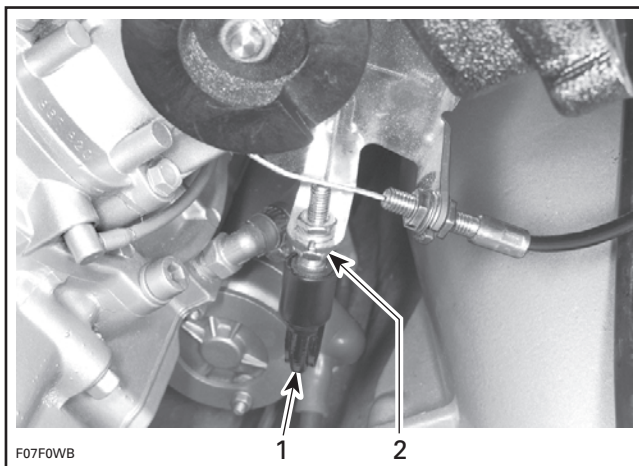
Subsection 03 (OIL INJECTION PUMP)

787 RFI Engine

CAUTION: As oil injection pump adjustment is dependent on throttle cable position, make sure to perform throttle cable adjustment first.

Loosen jam nut and turn cable adjustment nut to obtain proper pump setting.

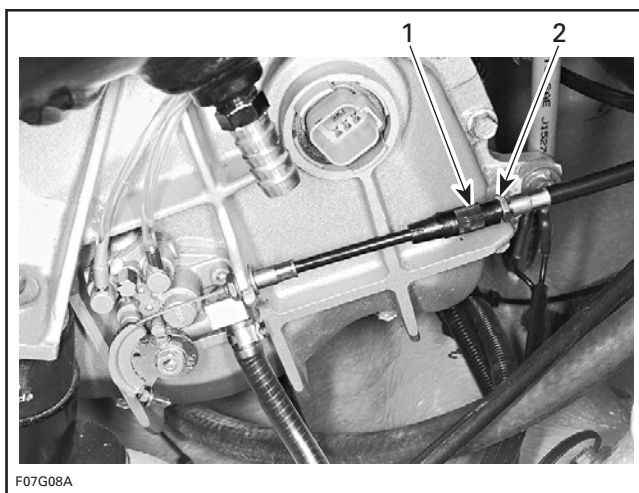
The adjustment nut and jam nut for the oil injection pump cable are located at the cable support on the throttle body.



1. Oil pump cable
2. Adjustment nut

947 Engine

NOTE: The adjuster knob and jam nut for the oil injection pump cable are located on the oil pump cable.



1. Adjuster knob
2. Jam nut

All Engines

Start and bring engine to normal operating temperature.

CAUTION: If watercraft is out of water, engine must be cooled using the flush kit. If air bubbles are present in the oil injection system, bleed system before operating engine.

Adjust idle speed to specification. Refer to CARBURETOR.

NOTE: On RFI engines, refer to FUEL INJECTION for idle speed adjustment procedure.

Stop engine.

Final Synchronization

Eliminate throttle cable free-play by depressing throttle lever until a slight resistance is felt. In this position, marks on pump body and lever must align.

NOTE: A mirror may be used to facilitate this verification.

If necessary, turn cable adjustment nut to obtain pump mark alignment. Refer to above illustrations.

Tighten jam nut and recheck alignment marks.

CAUTION: Proper oil injection pump adjustment is very important. Any delay in the opening of pump can result in serious engine damage.

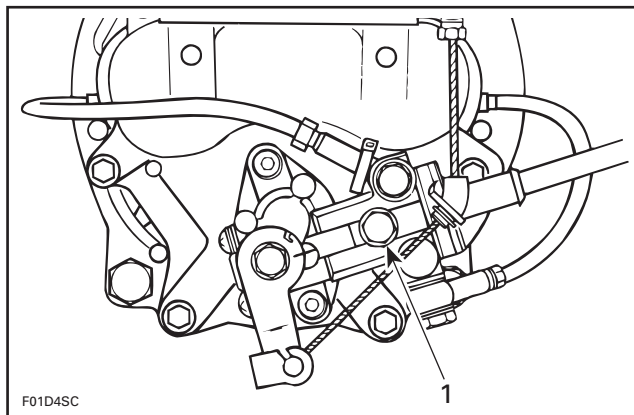
Bleeding

CAUTION: Oil injection system must be bled and adjustment checked before operating engine.

Ensure oil injection reservoir is sufficiently filled.

Install a dry rag below oil injection pump.

Loosen bleed screw to allow oil to flow.

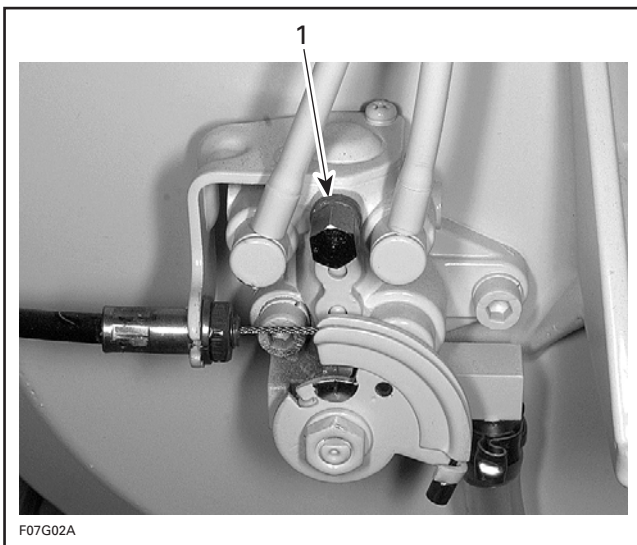


717 ENGINE

1. Bleed screw

Section 07 LUBRICATION SYSTEM

Subsection 03 (OIL INJECTION PUMP)



F07G02A
787 RFI ENGINE

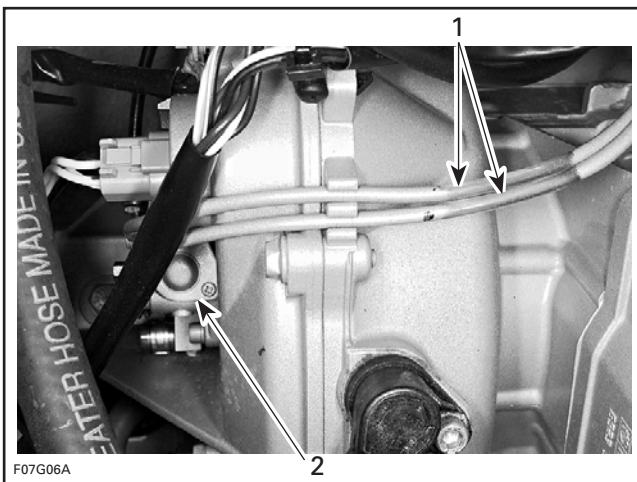
1. Bleed screw

Keep bleeding until all air has escaped from line. Make sure no air bubbles remain in oil supply line.

Tighten bleed screw.

Wipe any oil spillage.

Check small oil lines of pump. They must be full of oil.



- F07G06A
1. Lines must be full of oil
2. Oil pump

If not, run engine at idle speed while manually holding pump lever in fully open position. Do not activate throttle lever.

CAUTION: If watercraft is out of water, engine must be cooled using the flush kit.

CHECKING OPERATION

On Watercraft

NOTE: Oil line supply must be full of oil. See bleeding procedure above.

Start engine and run at idle while holding the pump lever in fully open position. Oil must advance into small oil lines.

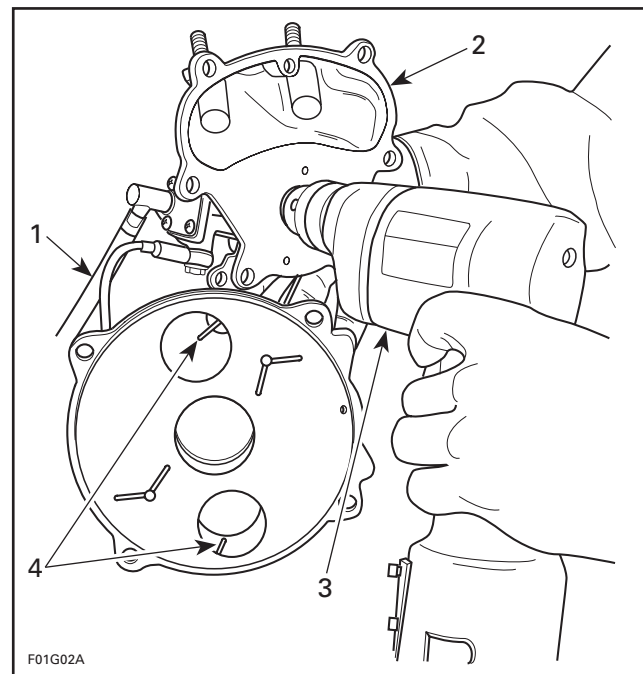
NOTE: The engine should have a rich mixture, idling irregularly and emitting smoke at exhaust outlet.

If not, remove pump assembly and check the pump gear (717 engine) or shaft (787 RFI and 947 engines) for defects, replace as necessary. Test pump as describes below:

NOTE: Through normal use, oil level must not drop in small tubes. If oil drops, verify check valve operation. Replace as necessary.

Bench Test

Connect a hose filled with injection oil to main line fitting. Insert other hose end in an injection oil container. Using a counterclockwise (reverse position) rotating drill rotate pump shaft. Oil must drip from fittings in parts of rotary valve cover while holding lever in a fully open position.



F01G02A
TYPICAL

1. Supply oil line to an oil container
2. Hold lever in fully open position
3. Counterclockwise (reverse) rotating drill
4. Oil must drip here

Section 07 LUBRICATION SYSTEM

Subsection 03 (OIL INJECTION PUMP)

For an accurate test, each port should be checked separately to ensure equal delivery on both ports.

To obtain a precise result of the oil pump delivery rate, rotate it counterclockwise at 1500 RPM for a total time of 5 minutes.

NOTE: To ensure accuracy of test, oil lines should be completely filled before starting test.

Compare the results with the chart below. If oil pump is out of specification, replace it.

ENGINE	OIL PUMP FLOW RATE AT 1500 RPM (5 MINUTES)
717	9.9 - 12.1 mL (each port)
787 RFI	5.7 - 6.9 mL (each port)
947	8.3 - 10.1 mL (each port)

NOTE: Test can also be done at 3000 RPM. Double quantities in chart.

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GENERAL	08-06-1

IGNITION SYSTEM

GENERAL

The ignition system consist of different sub-systems where some are interrelated.

Unregulated AC current is produced by the magneto for the ignition system (0 to 40 000 Vac). Part of the AC current is rectified and regulated for the charging system.

MAGNETO OUTPUT	
MODEL	WATT
GS, GTS and GTI	160 @ 6000 RPM
GTX and XP	180 @ 6000 RPM
GSX RFI and GTX RFI	270 @ 6000 RPM

A 12 Volts battery supplies the Multi-Purpose Electronic Module (MPEM) with DC current.

Refer to CHARGING SYSTEM 08-03.

Three types of ignition systems are used:

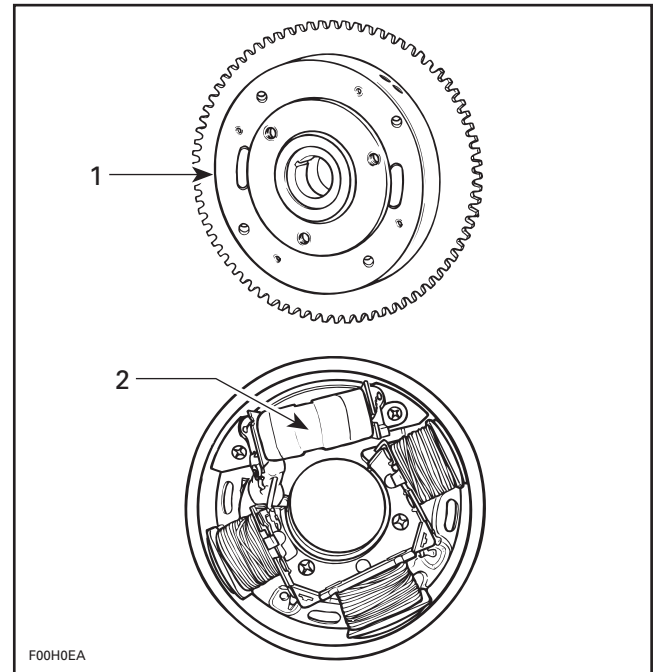
- Digital Capacitor Discharge Ignition (CDI)
- Direct Current-Digital Capacitor Discharge Ignition (DC-CDI)
- Digital Inductive System.

Magneto System

The magneto is the primary source of electrical energy. It transforms magnetic field into electric current (AC).

717 Engine

The flywheel contains 4 permanent magnets and spins around the generating coil. This electric current flows to the ignition coil (GTS model) or the Multi-Purpose Electronic Module (GS and GTI models).



1. Flywheel
 2. Generating coil

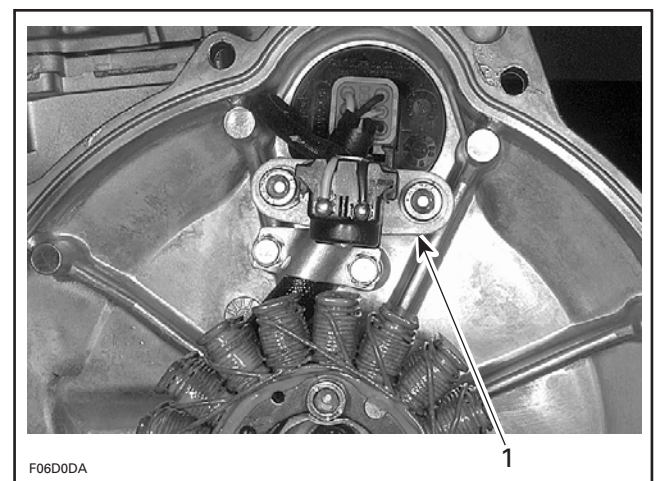
787 RFI Engine

The magneto has a 3 phases, delta wound stator on 18 poles. Capacity is 270 watts.

Trigger Coil

947 Engine

The trigger coil is mounted outside the rotor (inside the magneto housing of the engine) and is not adjustable.

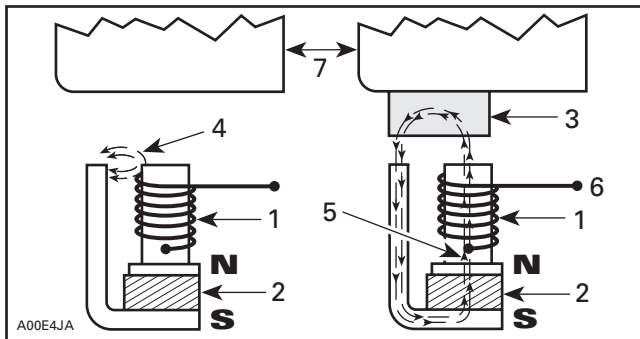


1. Trigger coil

Section 08 ELECTRICAL SYSTEM

Subsection 02 (IGNITION SYSTEM)

Its purpose is to signal the engine position to the Multi-Purpose Electronic Module. The rotor has two protrusions (180 degrees apart) that, when coupled with the trigger coil, accomplish the signaling.



1. Coil
2. Magnet
3. Rotor protrusion
4. Magnetic field outside of coil
5. Magnetic field crossing coil
6. Current to MPEM
7. Rotor

Ignition Coil

Ignition coil induces voltage to a high level in secondary windings to produce a spark at spark plug.

GTS Model

The ignition coil performs two functions:

It has an integrated capacitor discharged ignition (CDI) module, which controls the spark occurrence (ignition timing curve).

Every half revolution of the flywheel, a critical point occurs when the position of the magnets changes the polarity of the current flowing from the generating coil.

The CDI module detects the change of polarity and signals at the right time the primary winding of the ignition coil.

The secondary winding of the ignition coil steps up the low voltage input to high voltage for both spark plugs.

GS and GTI Models

The ignition coil steps up the voltage input from the Multi-Purpose Electronic Module to high voltage current for both spark plugs.

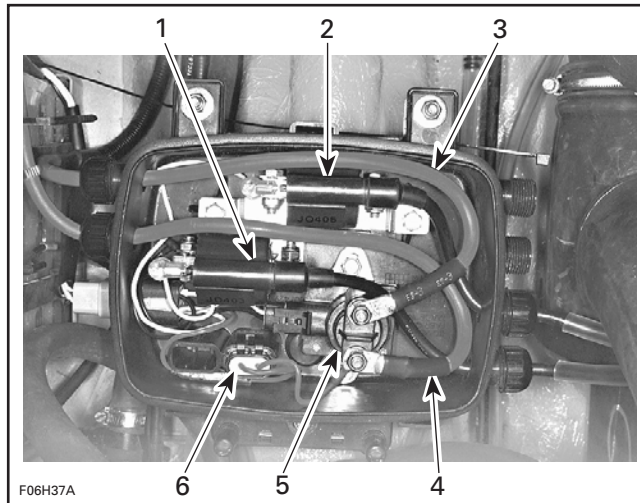
The ignition coil is located in the rear electrical box, on right side of watercraft.

GTX and XP Models

Two separate ignition coils receive input from the MPEM. Each coil will provide high voltage to its corresponding spark plug.

This ignition system allows spark plugs to spark independently.

CAUTION: Do not interchange spark plug cables. Both coils are located inside the electrical box.

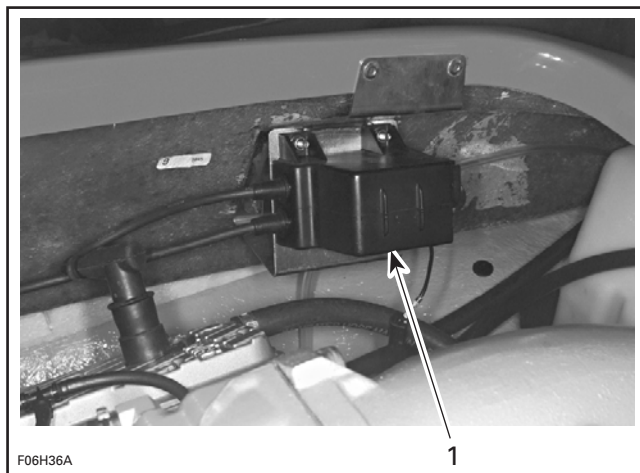


GTX AND XP MODELS

1. Ignition coil PTO
2. Ignition coil MAG
3. Starter cable
4. Positive battery cable
5. Solenoid
6. Fuse

GSX RFI and GTX RFI Models

The digital inductive ignition system on the RFI models allows the spark plugs to spark independently on each piston stroke.



1. Ignition coil

CAUTION: Do not interchange spark plug cables. Reverse spark plug cables will not allow the RFI to run and will cause backfires.

MULTI-PURPOSE ELECTRONIC MODULE (MPEM)

The MPEM is directly powered by the battery. It has a micro-processor inside of its sealed case.

The MPEM is responsible of the following electrical functions:

- interpreting information
- distributing information
- start/stop function
- timer
- Digitally Encoded Security System
- ignition timing curve
- engine rev limiter.

Some fuses are directly mounted onto the MPEM.

All the electrical system is controlled by the MPEM. It has internal micro-processor and is directly powered by the battery.

The MPEM features a permanent memory that will keep the programmed safety lanyard(s) active and other vehicle information, even when the battery is removed from the watercraft.

MPEM Functions

Automatic Power Shut-Down

The MPEM is equipped with an automatic power shut-down. This feature prevents the battery from losing its charge if the safety lanyard cap is left on the switch when the engine is not running.

After connecting the safety lanyard cap, the MPEM will remain in standby mode during the next 10 minutes, waiting for a starting. If start/stop button is not depressed, then the MPEM will be automatically powered down.

Antistart Feature

When connecting a safety lanyard cap on the switch the DESS system inside the MPEM is activated and will emit audible signals:

- 2 short beeps indicate a right safety lanyard is being used and gauges are supplied with current for 33 seconds. The MPEM will thus allow the engines to start.
- 1 long beep indicates a wrong safety lanyard is being used or that the antistart feature is defective. Current to gauges is cut after the audible signal is emitted and the engines cannot be started.

A wrong safety lanyard is a safety lanyard which is defective or not programmed in the MPEM memory.

To better understand the antistart feature, refer to DESS (DIGITALLY ENCODED SECURITY SYSTEM).

If the MPEM responds differently from what is mentioned above, refer to the troubleshooting section to find out why.

Gauges Current Supply

The purpose of this function is to allow reading of gauges without the engine running. It will give access to all the functions of the info center gauge (if equiped) without starting the engine.

Gauges are supplied with current for 33 seconds when connecting the safety lanyard cap on the switch or when pressing the start/stop switch without the safety lanyard on the DESS post.

NOTE: On the GSX RFI and GTX RFI, the fuel pump will be activated for 1 second to build up pressure in the fuel injection system, only when connecting the safety lanyard cap to the switch.

Engine Starting

If the MPEM recognizes a valid safety lanyard, it allows engine to start when the start/stop switch is pressed.

If the safety lanyard is left on the DESS post for more than 10 minutes after stopping the engine, the MPEM may send out 1 long beep when pressing the start/stop switch. The current supply to gauges will be stopped as explained in the **Anti-start Feature** section. A light pressure on the safety lanyard is required to allow the MPEM to read and validate the safety lanyard, the engines can then be started.

If start/stop button is held after engine has started, the MPEM automatically stops the starter when the engine speed reaches 1000 RPM.

Engine RPM Limiter

The MPEM will limit the maximum engine speed.

Engine Stopping

There are two ways to stop the engine.

Press and hold start/stop switch or remove the safety lanyard cap from the switch.

If the engine is stopped by removing the safety lanyard, it is possible to restart the engine as explained in the engine starting section.

Section 08 ELECTRICAL SYSTEM

Subsection 02 (IGNITION SYSTEM)

If safety lanyard cap is reconnected within 6 seconds, the current supply to gauges is cut for a brief moment and comes back on with the audible signal of safety lanyard validation.

Low-Fuel Level Warning Device

When the fuel level in the reservoir is low, the fuel level sensor transmits a signal to the MPEM. The MPEM sends out signals for the beeper (RFI models only) and to the info center gauge.

When the oil level is low in the reservoir, The MPEM sends out a signal to the info center gauge and the pilot lamp on the gauge will turn on.

Power Distribution

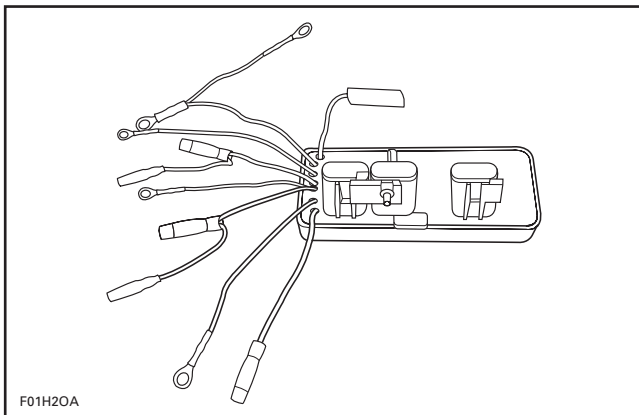
The MPEM distributes power from battery to all accessories. Accessories are protected by fuses integrated in the MPEM. For fuse identification, refer to IGNITION SYSTEM TESTING PROCEDURE farther in this section.

Overheat Sensor

When the engine temperature reaches a threshold value, the MPEM triggers a continuous beep to indicate overheating.

Diagnostic Mode

In order to facilitate the use of the watercraft, a system controls the digitally encoded security system (DESS) and sends, through a buzzer, some audible signals informing the operator of a specific situation. The diagnostic mode is divided into 2 parts: the basic mode and the advanced mode. The basic mode is automatically activated when connecting the safety lanyard cap to the switch. The advance mode can only be activated when pressing the start/stop switch. Refer DIGITALLY ENCODED SECURITY SYSTEM.



TYPICAL — GTS MODEL

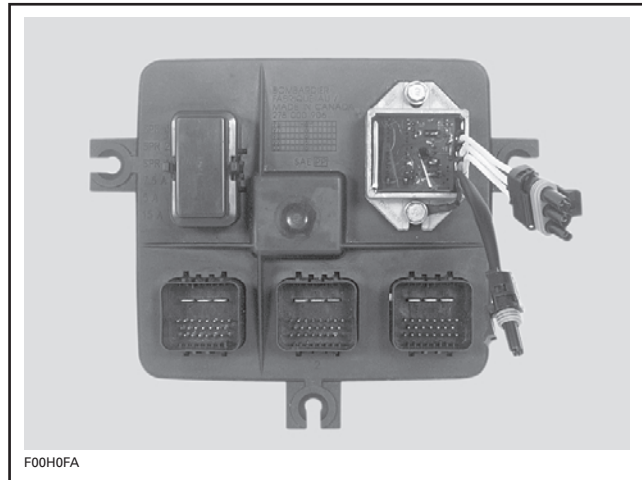
GS and GTI Models

On these models, the MPEM is also used as a junction box, eliminating the need of an electrical box.

All electrical components or accessories are directly linked to the MPEM.

Wire position are identified with a series of number on the MPEM. AMP plug connectors are used.

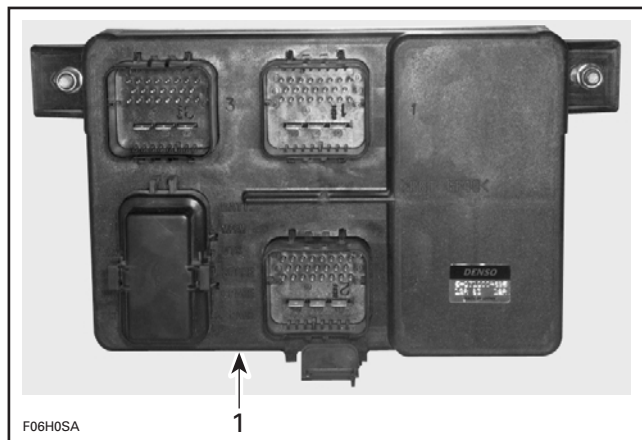
The regulator/rectifier is also mounted on the MPEM.



TYPICAL

947 Engine

The 947 engine has a digital Direct Current-Capacitor Discharge Ignition (DC-CDI) system within the MPEM which receives the input from the trigger coil and signals the ignition coil when to fire.



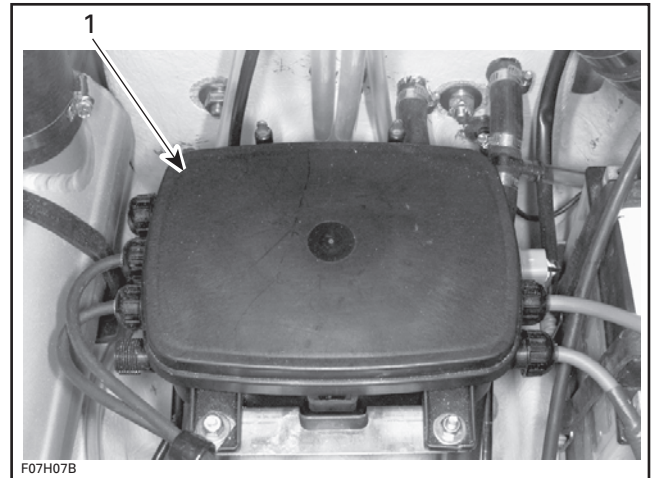
TYPICAL

1. MPEM

Compared to the magneto system, the DC-CDI system offers a more powerful and stable ignition at low RPM.

787 RFI Engine

The MPEM is also used with the Rotax Fuel Injection system.

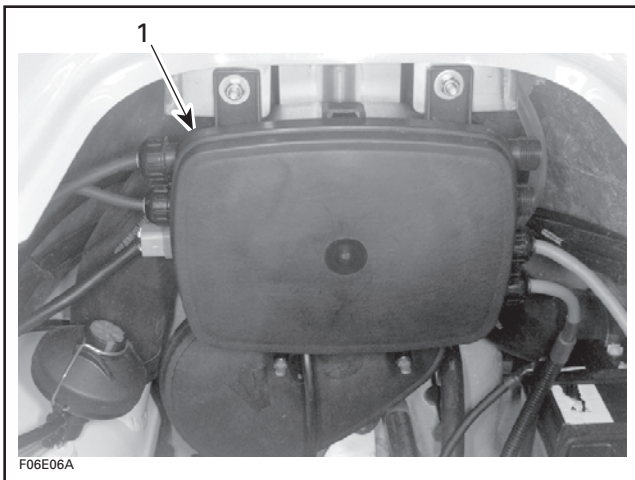


GTX
1. Electrical box

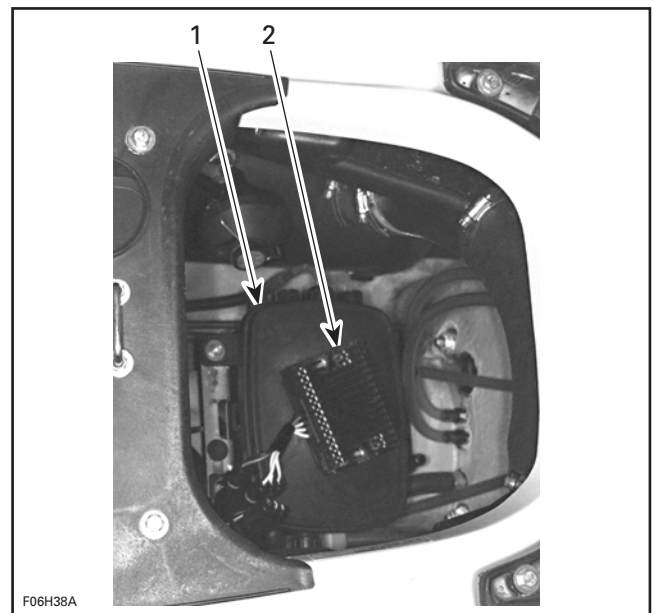
Electrical Box

The high amperage/voltage components are located into the electrical box.

The electrical box can be located either at the front or at the rear of the watercraft.



GSX RFI
1. Electrical box



GTX RFI
1. Electrical box
2. Rectifier/regulator

Section 08 ELECTRICAL SYSTEM

Subsection 02 (IGNITION SYSTEM)

IGNITION TIMING

Before checking ignition timing with a stroboscopic timing light (dynamic test), it is mandatory to scribe a timing mark on the PTO flywheel (static test) corresponding to the specific engine.

Also, the timing mark scribed on the PTO flywheel can be used to troubleshoot a broken magneto woodruff key.

CAUTION: The relation between the PTO flywheel mark position and crankshaft position may change as the PTO flywheel might tighten/loosen on the crankshaft. As an example, when the engine is accelerated out of water, PTO flywheel may tighten then loosen when the engine is decelerated. This will result in a false ignition timing reading. Always verify PTO flywheel mark position before checking ignition timing with an appropriate timing light. If mark does not align with tool, repeat static test to ensure flywheel has not loosen before changing the ignition timing.

NOTE: Do not use the factory mark found on the PTO flywheel to check ignition timing or troubleshoot any problems.

947 Engine

Normally ignition timing adjustment should not be required. It has been set at factory and it should remain correctly adjusted since every part is fixed and not adjustable. The only time the ignition timing might have to be changed would be when replacing the crankshaft, the magneto rotor, the trigger coil and the MPEM. If the ignition timing is found incorrect, you should first check for proper crankshaft alignment. This might be the indication of a twisted crankshaft.

With this DC-CDI system, the ignition timing can be checked with either the engine hot or cold. Also, the ignition timing is to be checked at 3500 RPM with the timing light.

NOTE: Between 3000 and 4000 RPM, the spark advance does not change. So when checking ignition timing at 3500 RPM, a change in engine speed within ± 500 RPM will not affect the timing mark when checked with the timing light.

Static Test

All Engines

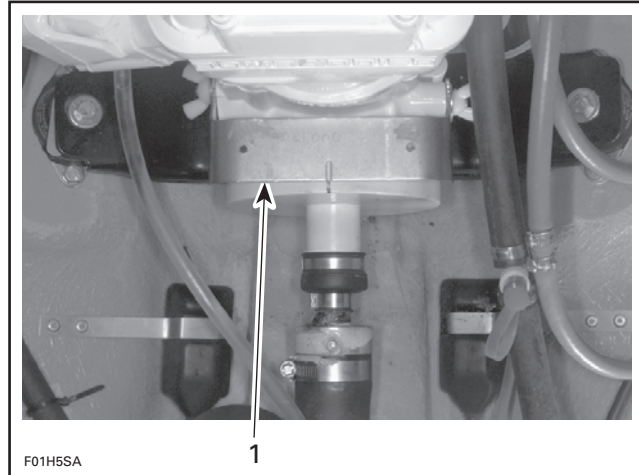
1. Disconnect MAG side spark plug wire and connect wire to grounding device then remove spark plug.

CAUTION: Never crank engine with spark plugs removed unless spark plug cables are connected to the grounding device.

2. Remove PTO flywheel guard.

717 Engine

3. Install timing mark pointer tool on engine using wing nuts previously removed.

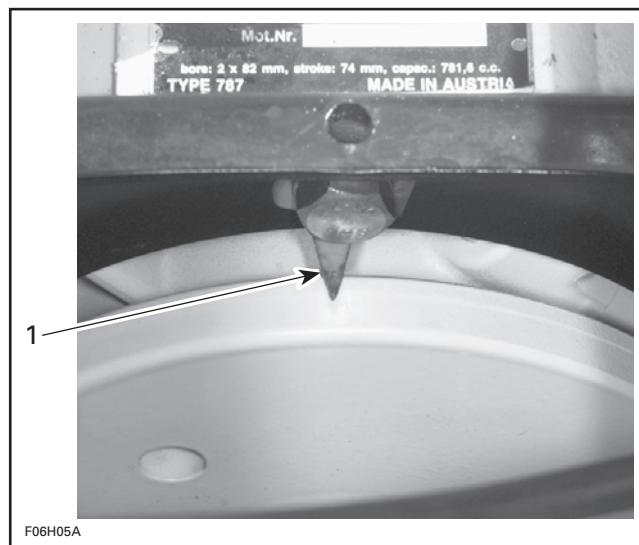


TYPICAL

1. Timing mark pointer tool (P/N 295 000 130)

947 Engine

4. Remove middle screw securing the engine to the rear engine mount. Reinstall screw with timing mark pointer tool.



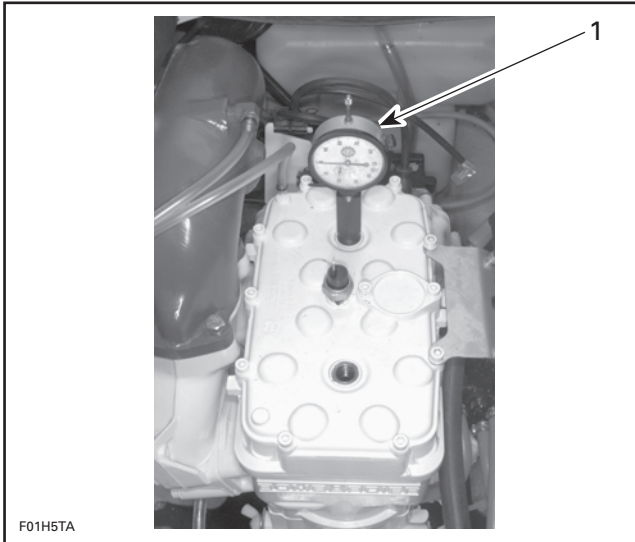
1. Timing mark pointer tool (P/N 295 000 135)

Section 08 ELECTRICAL SYSTEM

Subsection 02 (IGNITION SYSTEM)

All Engines

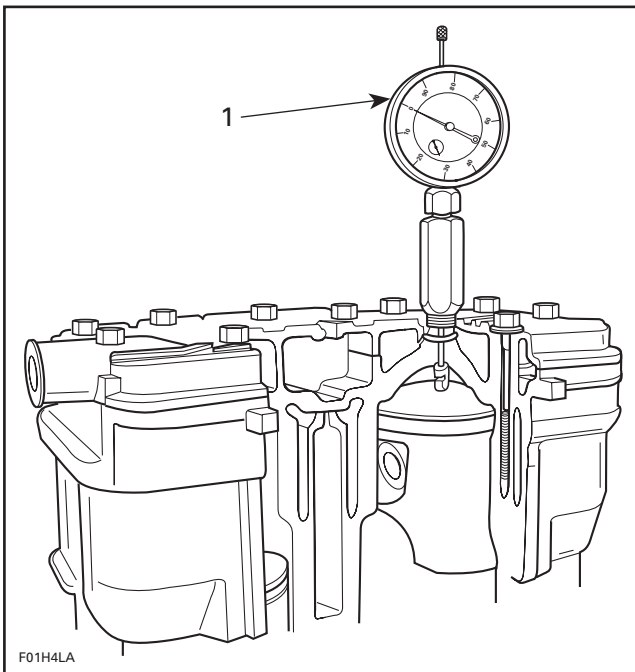
5. Install and adjust a TDC gauge (P/N 295 000 143) in MAG side spark plug hole.



TYPICAL

1. TDC gauge on MAG side

6. Rotate PTO flywheel counterclockwise (when facing it) until piston is at Top Dead Center.



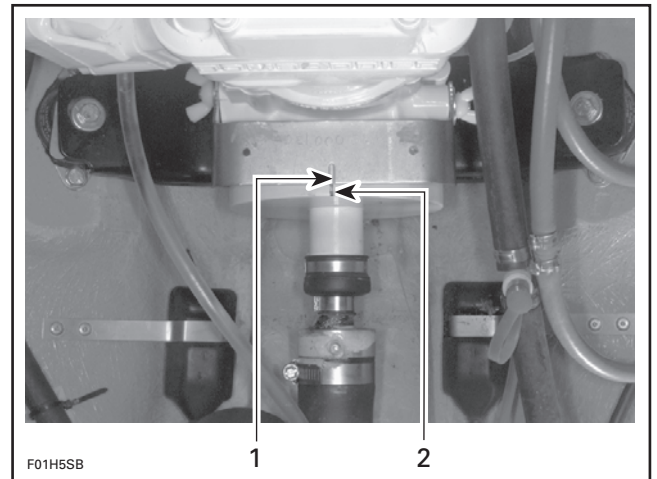
TYPICAL

1. Adjust gauge dial at zero

7. From this point, rotate flywheel clockwise to reach proper specification according to engine. Refer to the following chart.

ENGINE	IGNITION TIMING (BTDC)
717	2.59 mm (.102 in)
787 RFI	1.02 mm (.040 in)
947	2.99 mm (.118 in)

8. Scribe a thin mark on PTO flywheel in the middle of tool slot (717 engine) or aligned with timing mark pointer tool (947 engine).



TYPICAL

1. Tool slot
2. Flywheel mark

NOTE: This mark becomes the reference when using the stroboscopic timing light.

CAUTION: The static test cannot be used as a timing procedure, therefore, always check the timing with a stroboscopic timing light.

9. Remove TDC gauge.
10. Reinstall spark plug and connect wire.

Section 08 ELECTRICAL SYSTEM

Subsection 02 (IGNITION SYSTEM)

Dynamic Test

To check ignition timing, use Bombardier timing light (P/N 529 031 900).

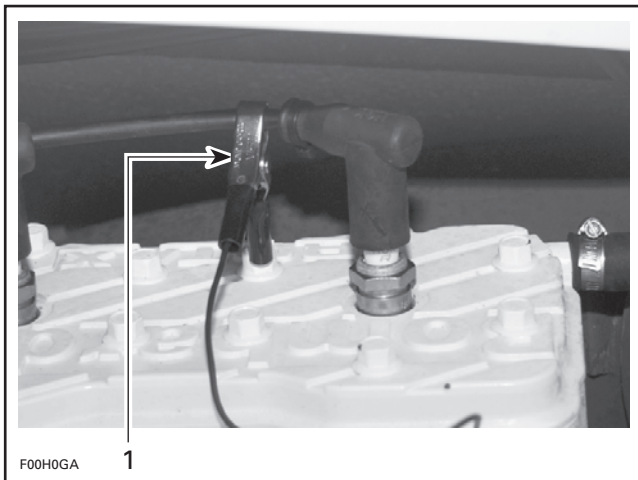


717 Engine

NOTE: To perform this procedure, make sure to use a stroboscopic timing light rated up to 6000 RPM. Otherwise, an inaccurate reading will be obtained.

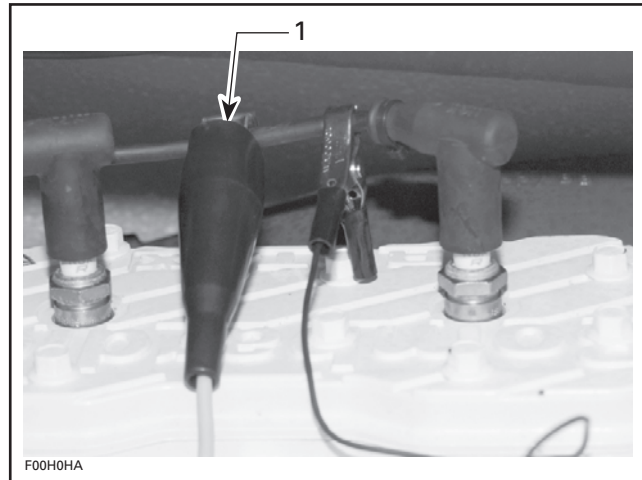
The ignition components are affected by temperature variation, therefore, timing must be checked when engine is cold, after idling for a MAXIMUM of 20 seconds.

1. Connect an induction-type tachometer (P/N 529 014 500) to spark plug wire.



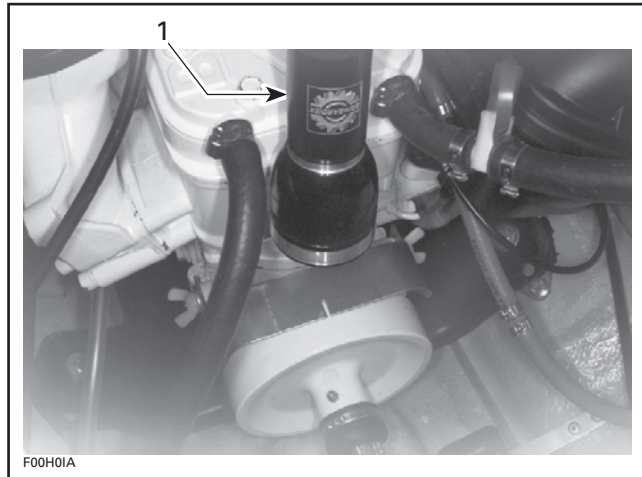
1. Tachometer pick-up

2. Connect timing light pick-up to MAG side spark plug wire.



1. Timing light pick-up

3. Start engine and point timing light straight in line with timing tool slot. Bring engine to 6000 RPM.



1. Timing light straight in line with tool slot

CAUTION: If engine is to be run more than a few seconds, engine must be cooled using the flush kit.

4. Check if PTO flywheel mark aligns with timing tool slot.

NOTE: On this system, timing advance decreases as engine speed increases.

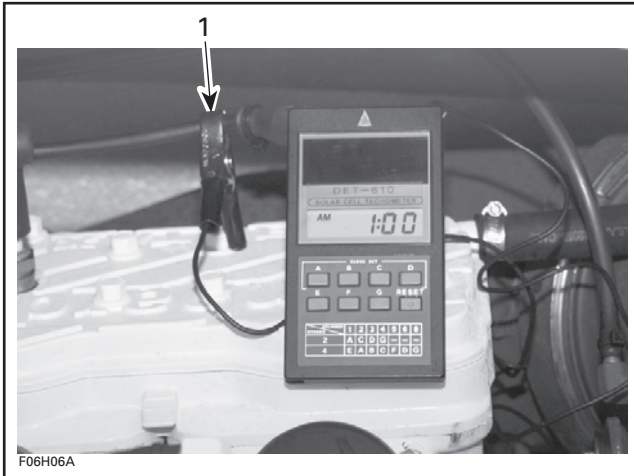
If timing mark aligns with tool slot, timing is properly set. If mark does not align with tool slot, re-check PTO flywheel mark before adjusting ignition timing to ensure PTO flywheel has not loosen.

Section 08 ELECTRICAL SYSTEM

Subsection 02 (IGNITION SYSTEM)

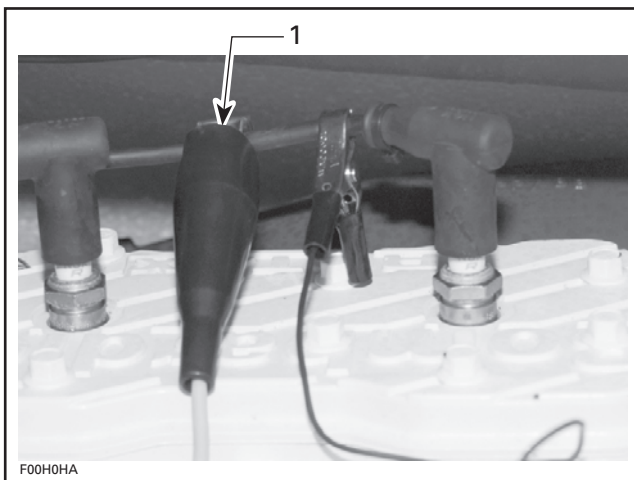
787 RFI and 947 Engines

1. Connect an induction-type tachometer (P/N 295 000 100) to spark plug wire.



1. Tachometer pick-up

2. Connect timing light pick-up to MAG side spark plug wire.

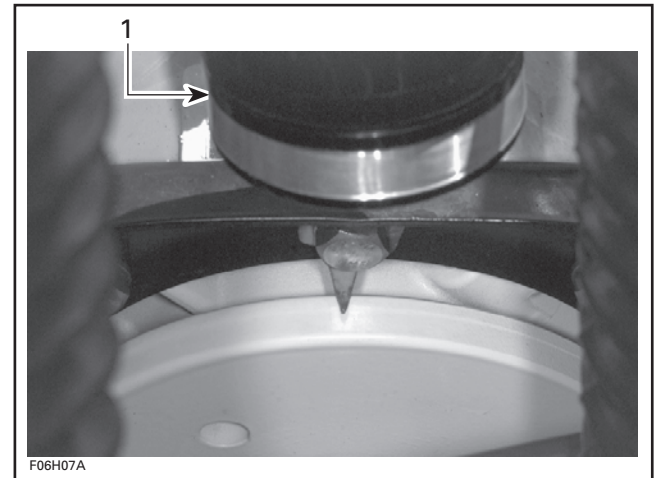


1. Timing light pick-up

IMPORTANT: To check the ignition timing on this engine, the timing advance curve must be locked first. This allows to perform ignition timing at **any RPM** by keeping the timing “frozen” so that it does not vary with engine RPM. See **Ignition Timing Adjustment** below for more information.

NOTE: **Fixed Timing** function must be activated before starting engine.

3. Start engine and rev it to 3500 RPM and point beam of timing light straight in line with timing mark pointer.



1. Timing light straight in line with tool slot

CAUTION: If engine is to be run more than a few seconds, engine must be cooled using the flush kit.

NOTE: If mark on PTO flywheel is perfectly aligned with timing mark pointer, no adjustment is required. If mark does not align with pointer, recheck PTO flywheel mark before adjusting ignition timing to ensure PTO flywheel has not loosen.

Ignition Timing Adjustment

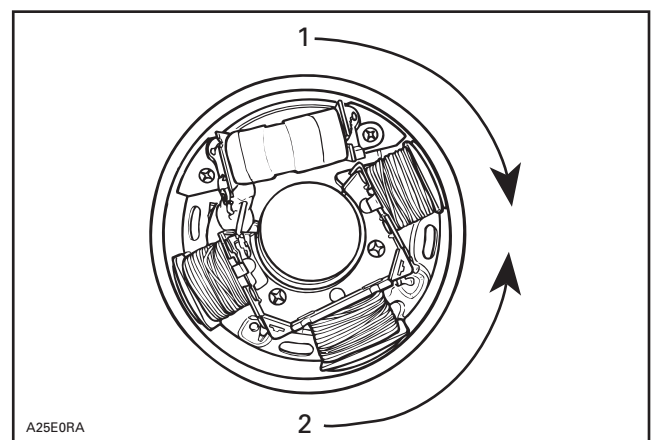
717 Engine

Remove battery (GTS model).

Remove magneto housing cover and wire support.

For removal of magneto, refer to MAGNETO SYSTEM.

Timing is performed by moving armature plate; clockwise to retard spark occurrence or counter-clockwise to advance.



TYPICAL

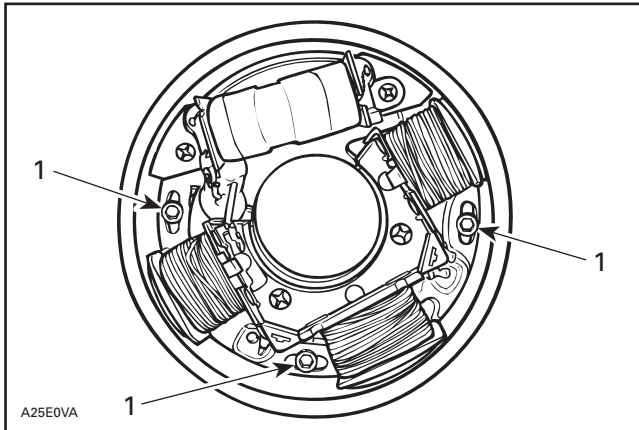
1. To retard
2. To advance

Section 08 ELECTRICAL SYSTEM

Subsection 02 (IGNITION SYSTEM)

To adjust, loosen 3 armature plate retaining screws and slightly rotate armature plate in proper direction.

NOTE: As a guideline, turn the armature plate the same amount needed to align mark on PTO flywheel.

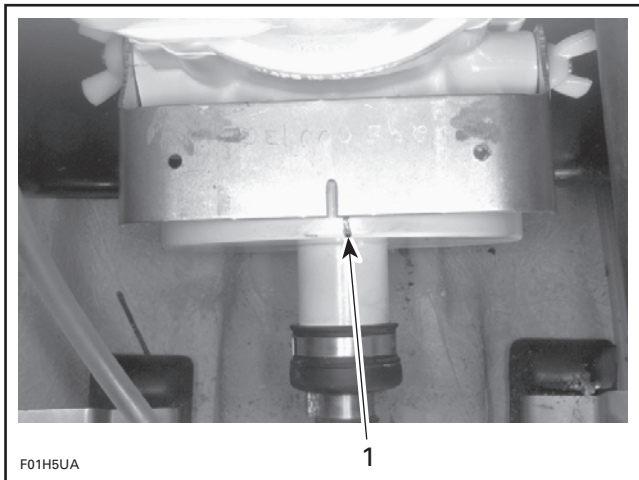


TYPICAL

1. Retaining screw

Example 1

When PTO flywheel mark is on right side of timing tool slot, it indicates advanced timing.

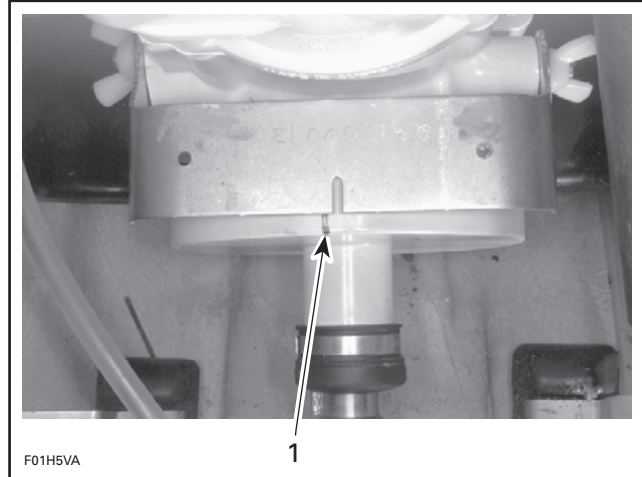


1. Too advanced timing

In this case, turn armature plate clockwise when facing it.

Example 2

When PTO flywheel mark is on left side of timing tool slot, it indicates retarded timing.



1. Retarded timing

In this case, turn armature plate counterclockwise when facing it.

After adjustment, tighten armature plate retaining screws.

CAUTION: Armature plate screws must have Loctite 243 (blue) applied before tightening. Make sure armature plate screws are well secured.

Reinstall removed parts. Refer to MAGNETO SYSTEM.

Recheck ignition timing (make sure engine is cold).

Repeat armature plate positioning procedure if timing mark position is not adequate.

947 Engine

To correct the ignition timing, the data of the MPEM is changed using the MPEM programmer (P/N 529 035 585) or the VCK (Vehicle Communication Kit) (P/N 529 035 676).

MPEM Programmer

NOTE: For more information on the programmer, refer to the MPEM programmer guide (P/N 219 700 090).

Through the MPEM programmer, the ignition timing can be advanced up to 3° or retarded up to 4°. The MPEM programmer corrects the ignition timing in 1° increments.

CAUTION: If the ignition timing is adjusted too advanced, this will cause serious damage to the engine.

The timing mark on the PTO flywheel refers to the physical component position when the spark must occur. The MPEM must be synchronized with the mark. For instance, on a particular engine, the timing correction may need to be advanced to 2° so that the mark aligns with timing mark pointer tool. This is not the real spark advance, just a correction for the tolerances of the mechanical components.

Knowing that, you select with the programmer the higher or lower number to advance or retard the actual timing correction by referring to the following chart.

TIMING CORRECTION CHART	
PROGRAMMER NUMBER (MPEM)	IGNITION TIMING CORRECTION
2	3°
3	2°
4	1°
1	0
5	- 1°
6	- 2°
7	- 3°
8	- 4°

Examples:

- a. You found the flywheel mark advanced. You must retard the ignition timing.
 - The programmer gives you the number 3. Referring to the chart, number 3 returns a correction of 2° (advanced) and this is too much in this case.

- You estimate the correction should be set to 1° (advanced) to align flywheel mark. Back in the chart, look to find 1° (advanced). This gives number 4. Enter this number with the programmer.
 - You recheck the timing with the timing light and if the mark is aligned, ignition timing is properly set.
- b. You found the flywheel mark advanced. You must retard the ignition timing.
 - The programmer gives you the number 3. Referring to the chart, number 3 returns a correction of 2° (advanced) and this is too much in this case.
 - You estimate the correction should be set to 1° (advanced) to align flywheel mark. Back in the chart, look to find 1° (advanced). This gives number 4. Enter this number with the programmer.
 - You recheck the timing with the timing light and found that the flywheel mark is still too advanced. You know now that the correction made previously was not enough and you estimate the correction should be set to - 2° (retarded) to align flywheel mark. Back in the chart, look to find - 2° (retarded). This gives number 6. Enter this number with the programmer.
 - You recheck the timing with the timing light and if the mark is aligned, ignition timing is properly set.
 - c. You found the flywheel mark retarded. You must advance the ignition timing.
 - The programmer gives you the number 4. Referring to the chart, number 4 returns a correction of 1° (advanced) and this is not enough in this case.
 - You estimate the correction should be set to 2° (advanced) to align flywheel mark. Back in the chart, look to find 2° (advanced). This gives number 3. Enter this number with the programmer.
 - You recheck the timing with the timing light and if the mark is aligned, the ignition timing is properly set.

Section 08 ELECTRICAL SYSTEM

Subsection 02 (IGNITION SYSTEM)

Proceed as Follows to Adjust the Ignition Timing with the MPEM Programmer:

1. Connect the communication cable to the MPEM programmer and the other end to the safety lanyard switch on the craft.
2. Press the **ON/C** button on programmer and enter your password.
3. Press **3** to choose **Vehicle info** in programmer.
4. Press **4** to choose **Engine param**.
5. Press **2** to choose **Timing adjust**.
6. The programmer display a number that is stored in the MPEM.
7. Press \leftrightarrow to choose **yes** for modify then press **Enter**.
8. Now punch in the number that corresponds to the degree you want for the ignition timing then press **Enter**.
9. Press **Menu** to go back one level.
10. Press **8** to choose **Save + Quit** (even if item no. 8 is not visible on the display, it is active when you select it).
11. Press **Enter** to confirm yes you want to **save modifications** to the MPEM.
12. You must see **Operation successful**. This confirms that the new timing data has been stored in the MPEM.
13. Unplug communication cable from safety lanyard switch on craft.
14. Press **Off** to close the programmer.

At this point, you can install the watercraft safety lanyard and start the engine to check the effect of the correction on the ignition timing. If further adjustment is required, repeat the procedure.

NOTE: The MPEM features a permanent (non-volatile) memory and keeps the ignition timing programmed even when the watercraft battery is disconnected.

787 RFI Engine

To adjust ignition timing on this engine, **Fixed Timing** function must be activated first. This function allows to perform ignition timing at **any RPM** due to its ignition which is speed and load independent.

NOTE: **Fixed Timing** function must be activated before starting engine.

Fixed Timing Function

1. Connect the communication cable to the MPEM programmer and the other end to the safety lanyard switch on the craft.
2. Press the **ON/C** button on programmer and enter your password.
3. Press **3** to choose **Vehicle info** in programmer.
4. Press **8** to choose **Bosch system**.
5. Press **1** to choose **Diagnosis**.
6. Press **4** to choose **Adjustment**.
7. Press **4** to choose **Fixed timing**.
8. The programmer display **Timing = XX.XX deg**.
9. Press any key to continue. Programmer will go back one level to **Adjustment**.
10. Press **Menu** to go back one level to **Diagnosis**.
11. Press **Menu** to go back one level to **Bosch system**.
12. Programmer now ask **Quit Bosch Diagnosis?** Choose **yes** to quit.

Press **2** to choose **Start Vehicle** then start engine with start/stop button.

NOTE: If engine fail to start and as soon engine stops revving (start/stop button has been released), **Fixed Timing** function is disabled. To reactivate function, repeat complete procedure.

Timing Verification

With engine running, check timing.

CAUTION: If engine is to be run more than a few seconds, engine must be cooled using the flush kit.

If timing is correct stop engine. This will automatically disable **Fixed Timing** function.

If further adjustment is required refer to following procedure.

Timing Adjustment

Unlike the other models, the ignition timing correction can be made from 4.5° (advanced) to - 2.25° (retarded).

The MPEM programmer will display correction numbers from 1 to 8. Unlike other engines, these numbers do not correspond to the ones punched on the engine. Refer to the next timing correction chart.

Access the **BOSH SYSTEM** in the MPEM programmer, then select **ADJUSTMENT** in the sub-menu.

Choose **IGNITION** in the **ADJUSTMENT** menu.

The screen will display the actual ignition timing correction in degrees and it will also offer to adjust it.

Refer to the following chart to find the number corresponding to the timing correction needed.

TIMING CORRECTION CHART 787 RFI	
PROGRAMMER NUMBER (MPEM)	IGNITION TIMING CORRECTION
1	4.50°
2	3.75°
3	3°
4	2.25°
5	.75°
6	0°
7	- 0.75°
8	- 2.25°

Ignition timing is set at 12° BTDC at any RPM.

VCK (Vehicle Communication Kit)

For the 787 RFI and 947 engines, use the VCK (Vehicle Communication Kit) (P/N 295 035 676) to adjust the ignition timing. Look the proper **Setting** section of the software B.U.D.S.

CAUTION: If the ignition timing is adjusted too advanced, this will cause serious damage to the engine.

Refer to the timing correction charts, used per **MPEM Programmer**, to find the number corresponding to the timing correction needed.

IGNITION SYSTEM TESTING PROCEDURE

When dealing with ignition problems, the following items should be verified in this order:

1. Spark occurrence/spark plug condition.
2. Battery condition.

3. Electrical connections.
4. Engine start/stop switch.
5. Safety lanyard switch.
6. Timer.
7. Multi-Purpose Electronic Module (MPEM).
8. Magneto output (717 engine).
9. Ignition coil output.

CAUTION: Whenever replacing a component in ignition system, check ignition timing.

NOTE: To perform verification, a good quality multimeter such as Fluke 73 (P/N 529 022 000) should be used.

Engine Start/Stop Switch Verification

Disconnect the YELLOW/RED wire of the start/stop switch. Using an ohmmeter, connect test probes to YELLOW/RED wire and to ground.

Measure resistance, it must be an open circuit (switch is normally open). Depress and hold switch, the ohmmeter should read close to 0 ohm.

Safety Lanyard Switch Verification

If 2 short beeps are not heard when installing the safety lanyard, refer to DIGITALLY ENCODED SECURITY SYSTEM.

The following continuity tests can also be performed using an ohmmeter:

Disconnect switch wires.

Safety Lanyard Removed

Connect test probes to switch BLACK and BLACK/YELLOW wires. Measure resistance, there should be no continuity (open circuit).

Connect one test probe to the WHITE/GRAY wire and the other test probe to the switch terminal. Measure resistance, it must be close to 0 ohm.

Connect one test probe to the BLACK wire and the other test probe to the switch ring. Measure resistance, it must be close to 0 ohm.

Safety Lanyard on Switch

Connect test probes to switch BLACK and BLACK/YELLOW wires. Measure resistance, it must be close to 0 ohm.

Section 08 ELECTRICAL SYSTEM

Subsection 02 (IGNITION SYSTEM)

Timer Verification

The timer is integrated into the MPEM.

Always confirm first that the fuses are in good condition.

To confirm operation of timer, remove safety lanyard from switch. After a 5 seconds delay, depress start/stop button once. The timer should stay on for about 33 seconds (for example, gauge(s) will be activated) and then turn off.

Rev Limiter Verification

To check engine rev limiter, connect an induction tachometer (P/N 295 000 100), start engine and check its maximum speed.

MODEL	RPM LIMITER SETTING
GS	7100 ± 50
GTS	7000 ± 50
GTI	7100 ± 50
GTX and XP	7200 ± 50
GSX RFI and GTX RFI	7200 ± 50

Multi-Purpose Electronic Module (MPEM) Verification

GTS Model

The multi-purpose electronic module testing must be done with all wires disconnected from circuit. Otherwise testing equipment (ohmmeter) could be damaged.

CAUTION: When disconnecting wires, **BLACK/RED** wire must never touch solenoid positive terminal. When replacing a MPEM, make sure to replace it with the right model.

Refer to the following chart for MPEM testing. Always respect polarity in chart.

METER (+) LEAD	METER (-)	VALUE
RED (ring terminal)	RED (female terminal)	< 1W
RED (ring terminal)	RED/PURPLE (female terminal)	< 1W
RED (ring terminal)	BLACK (ring terminal)	> 20 kW
BLACK/RED	BLACK (ring terminal)	> 10 kW
WHITE/GREY	BLACK (ring terminal)	> 100 kW
TAN/BLACK	BLACK (ring terminal)	> 200 kW
YELLOW/RED (female terminal)	BLACK (ring terminal)	> 10 kW
YELLOW/RED (male terminal)	BLACK (ring terminal)	> 50 kW
BLACK (ring terminal)	RED (ring terminal)	> 10 kW

Most of circuit can be tested with an ohmmeter but a 100% test doesn't mean the MPEM is in perfect condition.

CAUTION: Whenever connecting MPEM, always have battery disconnected from circuit. If MPEM must be connected when circuit is activated, always connect **BLACK/RED** wire first to ignition coil/CDI module to prevent wire from touching solenoid positive terminal.

All Other Models

It is not possible to accurately check the MPEM condition without specialized tools. Therefore, replace MPEM with a good known unit to conduct testing.

NOTE: Before replacing the MPEM, make sure all connectors are properly secured and there is no water in connectors. Check also the signal and power contacts in the AMP plug connectors. See **WIRING DIAGRAMS**.

Generating Coil Verification

717 Engine

STATIC TEST

Disconnect magneto wiring harness connector.

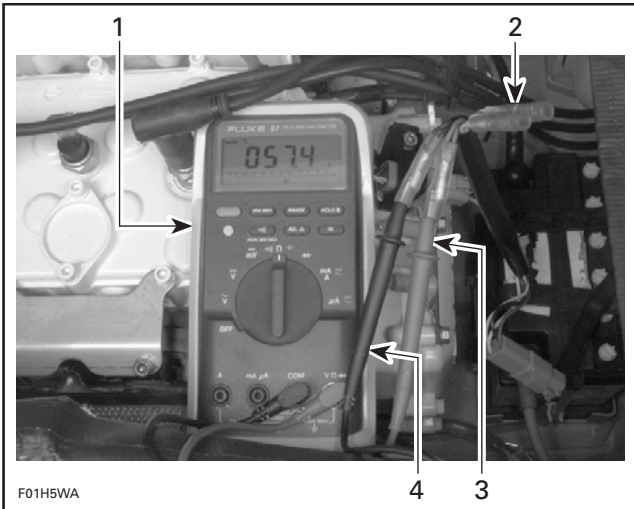
Install the 4-pin magneto harness adapter (P/N 295 000 131).



TYPICAL

Check resistance with a multimeter. Refer to the following table for values and wire colors.

PART NAME	ADAPTER WIRE	RESISTANCE
Generating coil	BLACK with RED/BLACK	40 - 76 Ω



1. Multimeter
2. Four-pin magneto harness adapter
3. RED/BLACK wire
4. BLACK wire

DYNAMIC TEST

1. Connect spark plug cables to grounding device.
2. Disconnect magneto wiring harness connector.
3. Install the 4-pin magneto harness adapter (P/N 295 000 131).
4. Connect positive test probe of the multimeter to the RED/BLACK wire of the 4-pin magneto harness adapter.
5. Connect negative test probe of the multimeter to BLACK wire of the 4-pin magneto harness adapter.
6. Set multimeter to Vac scale.
7. Crank engine and note result. The obtained value should be between 18 and 25 Vac.
8. If the generating coil is out of specification, replace it.

NOTE: If the generating coil tests good, disconnect the primary wires of the ignition coil. Crank engine and check voltage at primary wires. It should be at least 20 Vdc. If there is insufficient or no voltage, either the MPEM or wiring harness is defective.

Trigger Coil Verification

947 Engine

STATIC TEST: CONTINUITY

1. Disconnect magneto wiring harness connector.
2. Install the 6-pin magneto harness adapter (P/N 295 000 136).

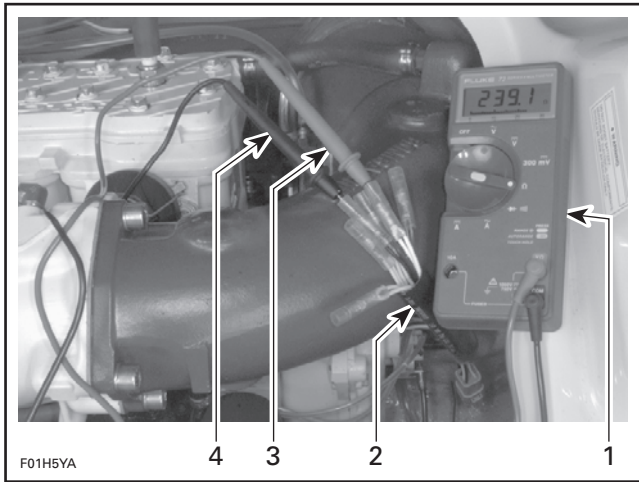


3. Connect one of the multimeter probes to the WHITE wire of the 6-pin magneto harness adapter.
4. Connect the other multimeter probe to the BLACK/YELLOW wire of the 6-pin magneto harness adapter.

Section 08 ELECTRICAL SYSTEM

Subsection 02 (IGNITION SYSTEM)

5. Measure resistance; it should be between 190-300 ohms.



1. Multimeter
2. Six-pin magneto harness adapter
3. WHITE wire
4. BLACK/YELLOW wire

DYNAMIC TEST

1. Disconnect magneto wiring harness connector.
2. Install the 6-pin magneto harness adapter (P/N 295 000 136).
3. Connect one of the multimeter probes to the WHITE wire of the 6-pin magneto harness adapter.
4. Connect the other multimeter probe to the BLACK/YELLOW wire of the 6-pin magneto harness adapter.
5. Crank engine and note result. The obtained value should be between 0.2 and 0.5 Vac.
6. If the trigger coil is out of specification, replace it.

Ignition Coil Verification

All Engines

Before conducting any testing on the ignition coil, make sure there is at least 12 Vdc at the primary wires. If there is insufficient voltage, the ignition problem is occurring before the ignition coil.

STATIC TEST

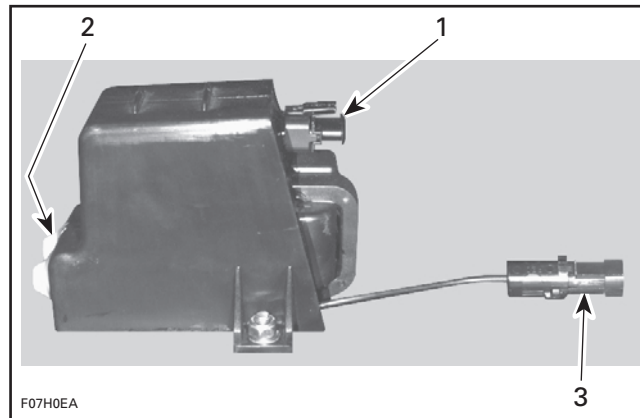
NOTE: An ignition coil with good resistance measurement can still be faulty. Voltage leak can occur at high voltage level which is not detectable with an ohmmeter.

Primary Winding

GTS Model

Due to the integrated CDI module, it is not possible to take any resistance measurement.

GSX RFI and GTX RFI



IGNITION COIL

1. Primary side
2. Secondary side
3. Ground wire

Disconnect the wire connector on the primary side of the ignition coil.

Using a multimeter, check the resistance between the terminals 1 and 2. Repeat a resistance test between terminals 2 and 3.

The resistance should be $0.41 \pm 0.05 \Omega$ at 20°C.

If not within specification, replace the ignition coil.

If the ignition coil test good, check the power supply on the primary side.

There should be 12 Vdc between the RED and WHITE/BLUE wires or between the RED and WHITE/GREEN wires while starting the engine.

If there is no voltage, either the MPEM or the wiring harness is defective.

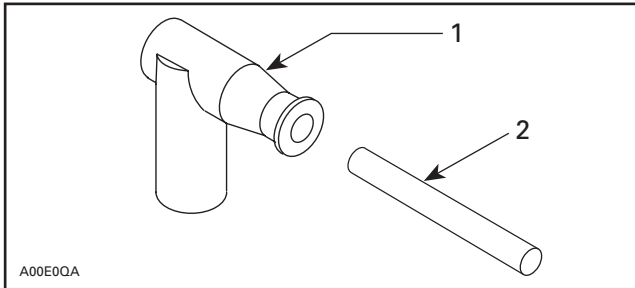
All Other Models

1. Remove the 1 female spade connector from the primary side of the ignition coil.
2. With the multimeter set on the resistance scale, connect the meter probes to the primary terminals of the coil.
3. Resistance should be between 0.29 - 0.39 ohm.

Secondary Winding

NOTE: Due to the integrated diode, it is not possible to take any resistance measurement of the secondary winding on the GSX RFI and GTX RFI models.

The spark plug caps must be removed from high tension cables, because they are resistor caps. The cap resistance is 4.48 K ohms.



- 1. Resistor cap
- 2. High-tension cable

IGNITION COIL SECONDARY WINDING		
MODEL	WIRE	RESISTANCE
GTS	End of each spark plug cable, spark plug caps removed	9 - 15 kΩ
All other models	End of each spark plug cable, spark plug caps removed	7.6 - 11.4 kΩ

NOTE: A short circuit will read 0 ohm (or close to) on ohmmeter.

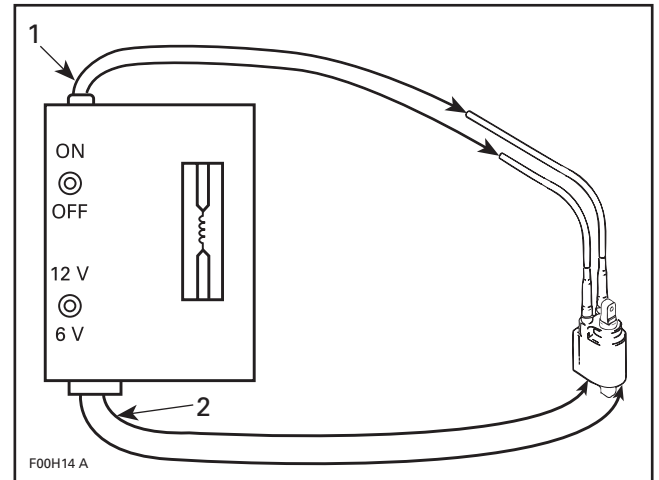
DYNAMIC TEST

All Models Except GTS

Use an ignition coil tester, available from after-market tool/equipment suppliers.

CAUTION: Do NOT use coil tester on metal work bench. Follow manufacturer instructions.

1. With ignition coil removed from craft, disconnect spark plug caps from high tension cables.
2. Hook high tension leads from tester to ignition coil high tension cables.
3. Connect 2 smaller tester leads to primary of ignition coil.



TYPICAL

- 1. Leads to secondary
- 2. Leads to primary

4. Turn power switch to 12 volts and you should observe spark jumping at a predetermined gap of 7 to 8 mm (.276 to .311 in).

If there is no spark, if it is weak or intermittent, the coil is defective and should be replaced.

SPARK PLUGS

Disassembly

First unscrew the spark plug one turn.

Clean the spark plug and cylinder head with presurize air then completely unscrew.

Heat Range

The proper heat range of the spark plugs is determined by the spark plugs ability to dissipate the heat generated by combustion.

The longer the heat path between the electrode tip to the plug shell, the hotter the spark plug operating temperature will be — and inversely, the shorter the heat path, the colder the operating temperature will be.

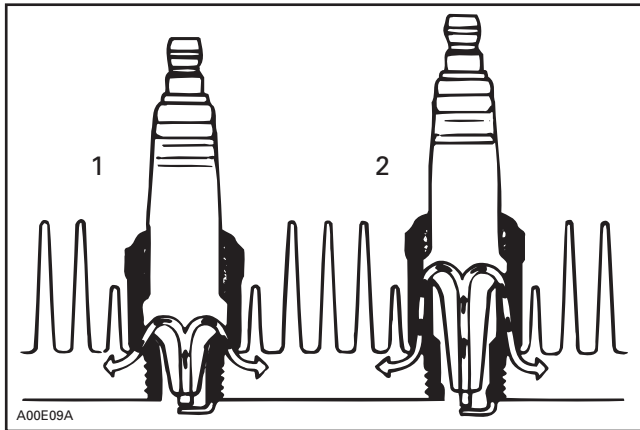
A “cold” type plug has a relatively short insulator nose and transfers heat very rapidly into the cylinder head.

Such a plug is used in heavy duty or continuous high speed operation to avoid overheating.

Section 08 ELECTRICAL SYSTEM

Subsection 02 (IGNITION SYSTEM)

The "hot" type plug has a longer insulator nose and transfers heat more slowly away from its firing end. It runs hotter and burns off combustion deposits which might tend to foul the plug during prolonged idle or low speed operation.



1. Cold
2. Hot

CAUTION: Severe engine damage might occur if a wrong heat range plug is used.

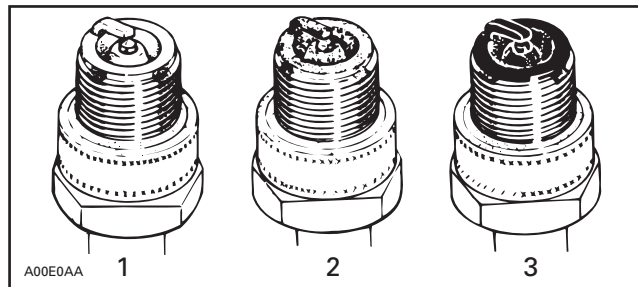
A too "hot" plug will result in overheating and pre-ignition, etc.

A too "cold" plug will result in fouling or may create carbon build up which can heat up red-hot and cause pre-ignition or detonation.

Fouling

Fouling of the spark plug is indicated by irregular running of the engine, decreased engine speed due to misfiring, reduced performance, and increased fuel consumption. This is due to a loss of compression. Other possible causes are: prolonged idling, or running on a too rich mixture due to a faulty carburetor adjustment or incorrect fuel. The plug face of a fouled spark plug has either a dry coating of soot or an oily, glossy coating given by an excess either of oil or of oil with soot. Such coatings form a conductive connection between the center electrode and ground.

Spark Plug Analysis



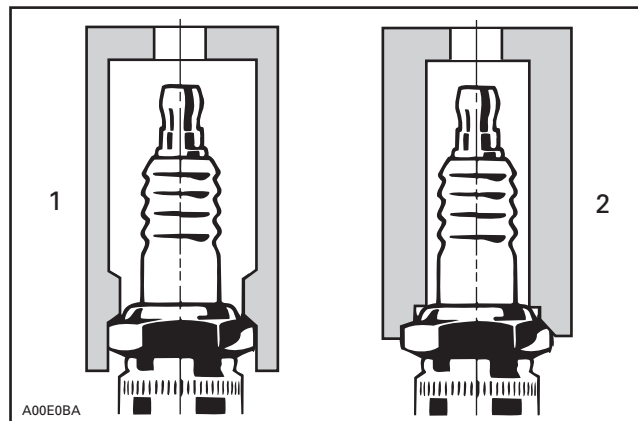
1. Overheated (light grey)
2. Normal (brownish)
3. Fouled (black)

The plug face (and piston dome) reveals the condition of the engine, operating condition, method of driving and fuel mixture. For this reason it is advisable to inspect the spark plug at regular intervals, examining the plug face (i.e. the part of the plug projecting into the combustion chamber) and the piston dome.

Spark Plug Installation

Prior to installation make sure that contact surfaces of the cylinder head and spark plug are free of grime.

1. Using a wire feeler gauge, set electrode gap according to the following chart.
2. Apply anti-seize lubricant over the spark plug threads to prevent possible seizure.
3. Hand screw spark plug into cylinder head and tighten with a torque wrench and a proper socket.



1. Proper socket
2. Improper socket

Spark Plug Chart

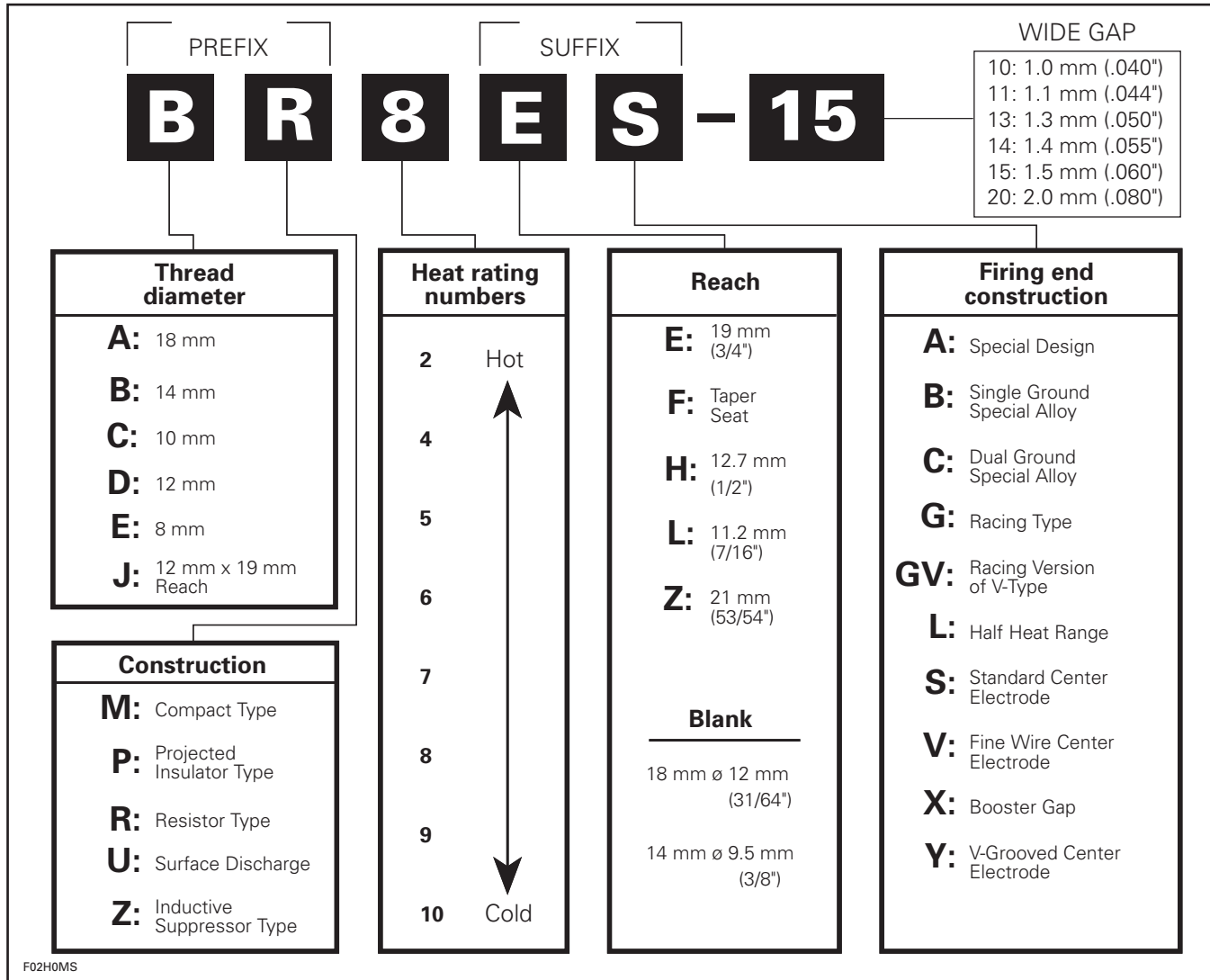
ENGINE	SPARK PLUG	TORQUE N•m (lbf•ft)	GAP mm (inch)
717 787 RFI 947	NGK BR8ES	24 (17)	0.5 - 0.6 (.020 - .024)

NOTE: Refer to next page for NGK Spark Plug Symbol Explanation.

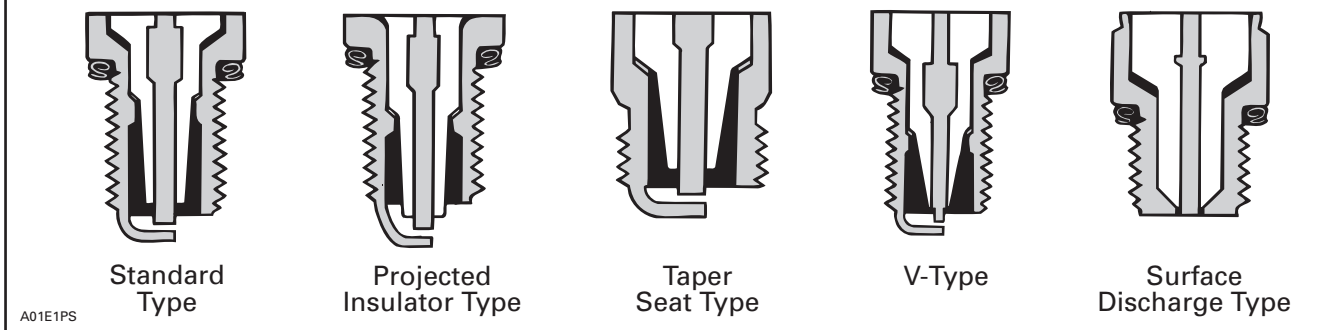
Section 08 ELECTRICAL SYSTEM

Subsection 02 (IGNITION SYSTEM)

NGK Spark Plug Symbol Explanation



CROSSCUTS AND GAP STYLES OF SPARK PLUGS



CHARGING SYSTEM

GENERAL

Magneto

The purpose of the charging system is to keep the battery at a full state of charge.

The magneto is the primary source of electrical energy. It transforms magnetic field into electric current (AC).

717 Engine

The magneto has a three-pole coil. Capacity is 160 watts.

947 Engine

The magneto has a 3 phase, "Y" wound stator on 18 poles. Capacity is 180 watts.

787 RFI Engine

The magneto has a 3 phase, delta wound stator on 18 poles. Capacity is 270 watts.

Rectifier/Regulator

All Models

The rectifier receives AC current from the magneto and transforms it into direct current (DC).

The regulator, included in the same unit, limits voltage at a maximum level (14.5 to 14.8 volts) to prevent any damage to components.

717 Engine

A half-wave rectifier receives magneto AC current and transforms it into direct current (DC) to allow battery charging.

947 Engine

A dual 1/2 wave series rectifier receives the magneto AC current and transforms it into direct current (DC) to allow battery charging.

787 RFI Engine

The unit is using a 3 phase in series rectifier/regulator which transforms (AC) from the magneto into (DC) to allow battery charging.

Battery

The battery is the DC source for the electric starter, the Multi-Purpose Electronic Module and all accessories.

Fuse

If the battery is regularly discharged, check fuse condition.

The rectifier/regulator could be the culprit of a blown fuse. To check, simply disconnect the rectifier/regulator from the circuit.

If the fuse still burns, check for a defective wire.

CAUTION: Do not use a higher rated fuse as this cause severe damage.

GSX RFI and GTX RFI

The charging system is protected by 2 fuses.

A 15 A fuse is mounted on the MPEM and a 20 A fuse is located in the rear electrical box.

GTS Model

A 15 A fuse protects the charging system. The fuse is located on the MPEM, inside the electrical box.

All Other Models

Two 15 A fuses protect the charging system. The first one is mounted on the MPEM and the other one is located in the rear electrical box.

TESTING PROCEDURE

NOTE: First, ensure that battery is in good condition prior to performing the following tests.

Rectifier/Regulator

NOTE: All models with a 947 engine, the rectifier/regulator is integrated in the MPEM.

STATIC TEST: CONTINUITY

Due to internal circuitry, there is no static test available.

DYNAMIC TEST

Current Test

Proceed as follows:

- Start engine.
- Lay an inductive ammeter on positive cable of battery.
- Bring engine to approximately 6000 RPM.

Section 08 ELECTRICAL SYSTEM

Subsection 03 (CHARGING SYSTEM)

Depending on battery charge, current reading should be approximately 4 amperes for the 717 engine, 19 amperes for the 787 RFI engine and 5 amperes for the 947 engine. If not, check magneto output prior to concluding that rectifier is faulty.

Voltage Test

Proceed as follows:

- Start engine.
- Connect a multimeter to battery posts. Set multimeter to Vdc scale.
- Bring engine to approximately 5500 RPM.

If multimeter reads over 15 volts, regulator is defective. Replace it.

NOTE: If it is continually necessary to add distilled water to the battery, this indicates an over voltage situation, requiring replacement of the rectifier/regulator. If, on the other hand, the battery will not stay charged, the problem can be any of the charging circuit components. If these all check good, you would be accurate in assuming the problem to be in the rectifier/regulator.

GS, GTS and GTI Models

If there is no charging at the battery with the preceding voltage test, the following test can also be performed.

GTS Model

Open the electrical box.

Disconnect the RED and BLACK wires of the rectifier/regulator.

GS and GTI Models

Disconnect the connector housing of the rectifier/regulator.

Using an appropriate terminal remover (Snap-on TT600-4), remove the RED and BLACK wires from the tab housing of the rectifier/regulator.

Reconnect the connector housing.

GS, GTS and GTI Models

Connect the positive probe of a multimeter to the RED wire and the negative probe to the BLACK wire.

Set multimeter to Vdc scale.

Start and rev engine to 3500 RPM. The obtained value should be between 12 and 25 Vdc.

NOTE: If the rectifier/regulator is within the specification, either the MPEM or wiring harness between the rectifier and battery is defective. If the rectifier/regulator is out of specification and the battery charging coil (or stator) test good, the rectifier/regulator is defective.

Battery Charging Coil

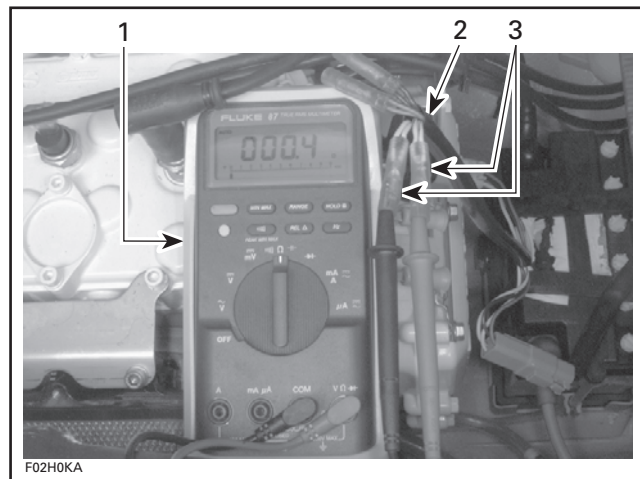
717 Engine

STATIC TEST: CONTINUITY

1. Disconnect the magneto wiring harness connector.
2. Install the 4-pin magneto harness adapter (P/N 295 000 131).
3. Check resistance between the YELLOW and YELLOW/BLACK wires of the magneto harness adapter. Refer to the following table.

PART NAME	ADAPTER WIRE COLOR	RESISTANCE (Ω)
Battery charging coil	YELLOW with YELLOW/BLACK	0.05 - 0.6

NOTE: A short circuit will read 0 ohm (or close to) on ohmmeter.



1. Multimeter
2. Magneto harness adapter
3. YELLOW and YELLOW/BLACK wires

DYNAMIC TEST

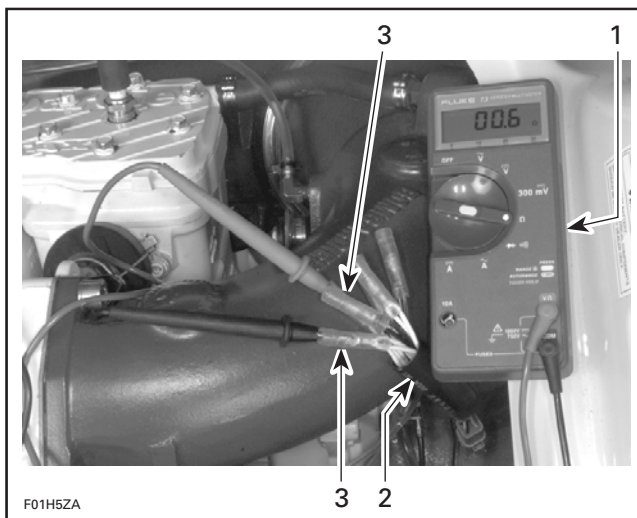
1. Disconnect the magneto wiring harness connector.
2. Install the 4-pin magneto harness adapter (P/N 295 000 131).
3. Connect test probes of the multimeter to the YELLOW and YELLOW/BLACK wires of the 4-pin magneto harness adapter.
4. Start and rev engine to 3500 RPM. The obtained value should be between 25 and 40 Vac.
5. If the battery charging coil is out of specification, replace it.

Stator

947 Engine

STATIC TEST: CONTINUITY

1. Disconnect the magneto wiring harness connector.
2. Install the 6-pin magneto harness adapter (P/N 295 000 136).
3. Check resistance between two of the YELLOW wires. The resistance should be between 0.1 to 1.0 ohm.

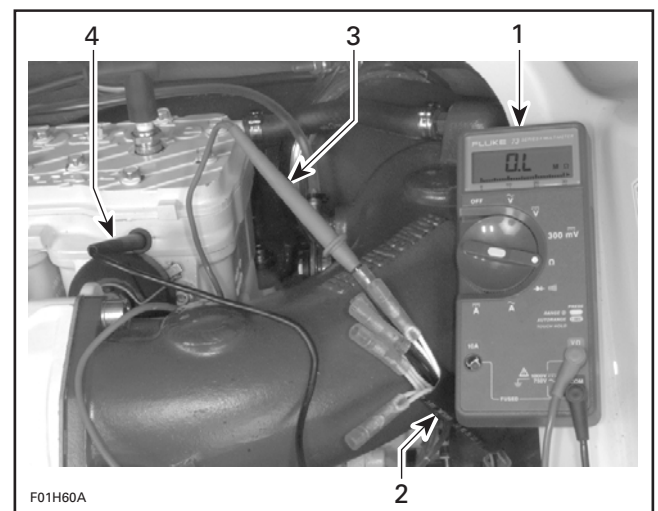


1. Multimeter
2. Magneto harness adapter
3. YELLOW wires

4. Place either meter lead into the remaining YELLOW wire and note the resistance (same as step no. 3). If the readings are out of specification, the stator will need to be replaced.

STATIC TEST: INSULATION

1. Disconnect the magneto wiring harness connector.
2. Install the 6-pin magneto harness adapter (P/N 295 000 136).
3. Insert multimeter positive (+) probe to one of the YELLOW wire of the 6-pin magneto harness adapter.
4. Ground the multimeter negative (-) probe to the engine or the stator iron core and note the reading.



1. Multimeter
2. Magneto harness adapter
3. Positive (+) probe to YELLOW wire
4. Negative (-) probe to ground

5. Repeat test with the other two YELLOW wires of the 6-pin magneto harness adapter.

NOTE: There should be no continuity (infinity) between the stator insulated coils and ground. If there is a reading, the stator coils and/or the wiring from the coils is grounded and needs to be replaced or repaired.

DYNAMIC TEST

1. Disconnect the magneto wiring harness connector.
2. Install the 6-pin magneto harness adapter (P/N 295 000 136).
3. Connect test probes of the multimeter to two of the YELLOW wires of the 6-pin magneto harness adapter.
4. Set multimeter to Vac scale.
5. Start and rev engine to 3500 RPM. The obtained value should be between 45 and 70 Vac.
6. If the stator is out of specification, replace it.

Section 08 ELECTRICAL SYSTEM

Subsection 03 (CHARGING SYSTEM)

Magneto

787 RFI Engines

STATIC TEST: CONTINUITY

1. Disconnect the magneto wiring harness connector.
2. Install the 4-pin magneto harness adapter (P/N 295 000 131).
3. Check resistance between the YELLOW/BLACK and the BLACK wires of the 4-pin magneto harness adapter. The resistance should be between 0.1 to 1.0 ohm.
4. Place either meter lead into the RED/BLACK wire and note the resistance (same as step no. 3). If the readings are out of specification, the stator will need to be replaced.

STATIC TEST: INSULATION

1. Disconnect the magneto wiring harness connector.
2. Install the 4-pin magneto harness adapter (P/N 295 000 131).
3. Insert multimeter positive (+) probe to the YELLOW/BLACK wire of the 4-pin magneto harness adapter.
4. Ground the multimeter negative (-) probe to the engine or the stator iron core and note the reading.
5. Repeat test with the other BLACK and RED/BLACK wires of the 4-pin magneto harness adapter.

NOTE: There should be no continuity (infinity) between the stator insulated coils and ground. If there is a reading, the stator coils and/or the wiring from the coils is grounded and needs to be replaced or repaired.

DYNAMIC TEST

1. Disconnect the magneto wiring harness connector.
2. Install the 4-pin magneto harness adapter (P/N 295 000 131).
3. Connect test probes of the multimeter to the YELLOW/BLACK and RED/BLACK wires of the 4-pin magneto harness adapter.
4. Set multimeter to Vac scale.
5. Start and rev engine to 3500 RPM. The obtained value should be between 45 and 70 Vac.

6. Repeat test with the BLACK wire and either the RED/BLACK or YELLOW/BLACK wires of the 4-pin magneto harness adapter.
7. If the stator is out of specification, replace it.

BATTERY

Troubleshooting

SYMPTOM: DISCHARGED OR WEAK BATTERY	
CAUSE	REMEDY
1. Battery posts and/or cable terminal oxidized.	Clean and coat with dielectric grease.
2. Loose or bad connections.	Check wiring and connector cleanliness, damaged or short circuit.
3. Faulty battery (sulfated, doesn't keep a full charge, damaged casing, loose post).	Replace.
4. 15 amp fuse(s) burnt or faulty rectifier.	First check fuse. If it is in good condition, check rectifier/regulator.
5. Faulty battery charging coil (or stator).	Replace.

Removal

WARNING

Battery BLACK negative cable must always be disconnected first and connected last. Never charge or boost battery while installed in watercraft.

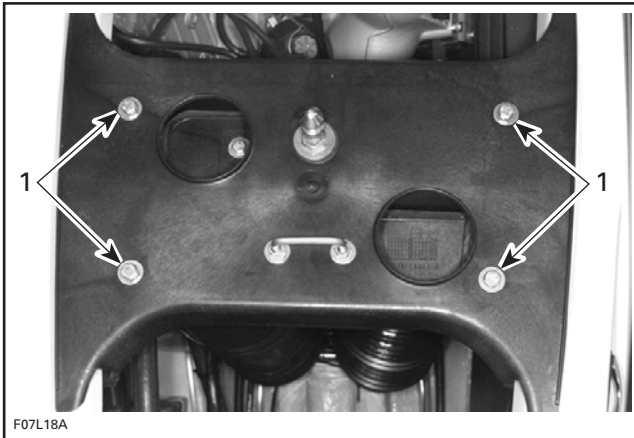
All Models Except GTX RFI

Proceed as follows:

1. Disconnect the BLACK negative cable first.
2. Disconnect the RED positive cable last.
3. Remove the vent line from the battery.
4. Remove the holding strap(s).
5. Withdraw battery from watercraft being careful not lean it so that electrolyte flows out of vent elbow.

GTX RFI Model

Remove 4 M6 bolts retaining seat support and remove upper section from watercraft.



1. Remove bolts

Pull lower section with vent tubes toward the front of the watercraft.

Disconnect battery cables and vent tube from battery.

Remove battery straps.

Release battery from support and move it toward the front of the watercraft.

Pull battery from under resonator and remove battery from watercraft.

All Models

⚠ WARNING

Electrolyte is poisonous and dangerous. Avoid contact with eyes, skin and clothing. Wear a suitable pair of non-absorbent gloves when removing the battery by hand.

CAUTION: Should any electrolyte spillage occur, immediately wash off with a solution of baking soda and water.

Cleaning

Clean the battery casing, caps, cables and battery posts using a solution of baking soda and water.

CAUTION: Do not allow cleaning solution to enter battery.

Remove corrosion from battery cable terminals and battery posts using a firm wire brush. Rinse with clear water and dry well.

Inspection

Visually inspect battery casing for cracks or other possible damage. If casing is damaged, replace battery and thoroughly clean battery tray and close area with water and baking soda.

Inspect battery posts for security of mounting.

Inspect for cracked or damaged battery caps, replace defective caps.

⚠ WARNING

Battery caps do not have vent holes. Make sure that vent line is not obstructed.

Electrolyte Level

Check electrolyte level in each cell, add distilled water up to upper level line.

CAUTION: Add only distilled water in an activated battery.

Battery Testing

There are 2 types of battery tests: electrolyte reading and load test. An electrolyte reading is made on a battery without discharging current. It is the simplest and commonly used. A loaded test gives more accuracy of the battery condition.

Electrolyte Reading

Check charge condition using either a hydrometer or multimeter.

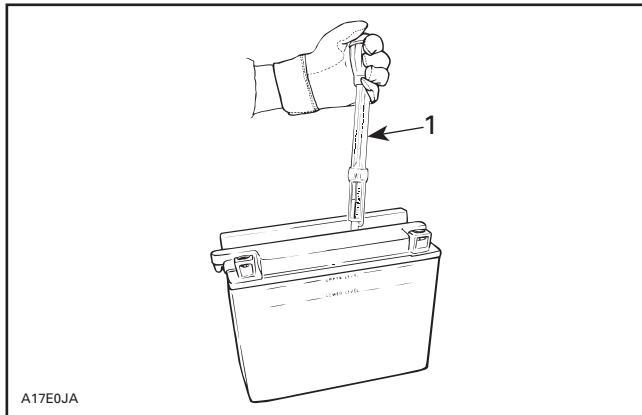
With a multimeter, voltage readings appear instantly to show the state of charge. Always respect polarity. A fully charge battery will have a reading of 12.6 Vdc.

A hydrometer measures the charge of a battery in terms of specific gravity of the electrolyte. A fully charge battery will have a specific gravity between 1.265 to 1.280.

Most hydrometers give a true reading at 21°C (70°F).

Section 08 ELECTRICAL SYSTEM

Subsection 03 (CHARGING SYSTEM)



1. Specific gravity 1.265

In order to obtain correct readings, adjust the initial reading by **adding** .004 points to the hydrometer readings for each 5.5°C (10°F) **above** 21°C (70°F) and by **subtracting** .004 point for every 5.5°C (10°F) **below** 21°C (70°F).

This chart will be useful to find the correct reading.

ELECTROLYTE TEMPERATURE		OPERATION TO PERFORM	
°C	°F		
38	100	.012	Add to the reading
32	90	.008	
27	80	.004	
21	70	CORRECT READING	
16	60	.004	Subtract from the reading
10	50	.008	
4	40	.012	
-1	30	.016	

EXAMPLE NO. 1

TEMPERATURE ABOVE 21°C (70°F):
Hydrometer reading: 1.250
Electrolyte temperature: -1°C (30°F)
Subtract .016 Sp. Gr.
Corrected Sp. Gr. is 1.234

EXAMPLE NO. 2

TEMPERATURE ABOVE 21°C (70°F):
Hydrometer reading: 1.235
Electrolyte temperature: 38°C (100°F)
Add .012 Sp. Gr.
Corrected Sp. Gr. is 1.247

Load Test

This is the best test of battery condition under a starting load. Use a load testing device that has an adjustable load.

Apply a load of 3 times the ampere-hour rating of the battery. At 14 seconds into the test, check battery voltage; if battery is in good condition, it will have at least 10.5 Vdc.

Battery Storage

Disconnect and remove battery from watercraft as explained in **Removal**.

Check electrolyte level in each cell, add distilled water up to upper level line.

CAUTION: Do not overfill.

The battery must always be stored in fully charged condition. If required, charge until specific gravity of 1.265 is obtained.

CAUTION: Battery electrolyte temperature must not exceed 50°C (122°F). The casing should not feel hot.

Clean battery terminals and cable connections using a wire brush. Apply a light coat of dielectric grease on terminals.

Clean battery casing and caps using a solution of baking soda and water.

CAUTION: Do not allow cleaning solution to enter battery.

Rinse battery with clear water and dry well using a clean cloth.

Store battery on a wooden shelf in a cool dry place. Such conditions reduce self-discharging and keep fluid evaporation to a minimum. Keep battery away from dew, high moisture and direct sunlight.

During the storage period, recheck electrolyte level and specific gravity readings at least every month. If necessary, keep the battery at its upper level line and near full charge as possible (trickle charge).

Activation of a New Battery

WARNING

Never charge or boost battery while installed in watercraft.

A new battery is factory fresh dry charged. For storage purposes, it is fitted with a temporary sealing tube.

CAUTION: Do not remove the sealing tube or loosen battery caps unless activation is desired.

NOTE: In case of accidental premature removal of caps or sealing tube, battery should be given a full charge.

Perform the following operations anytime a new battery is to be installed.

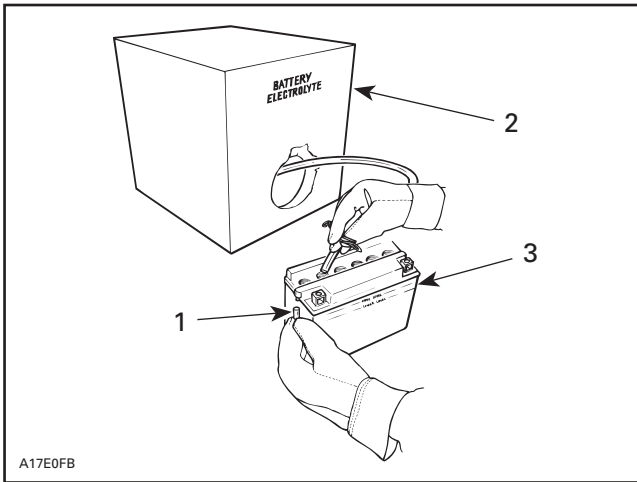
Section 08 ELECTRICAL SYSTEM
Subsection 03 (CHARGING SYSTEM)

1. Remove the sealing tube from the vent elbow.

⚠ WARNING
Failure to remove the sealing tube could result in an explosion.

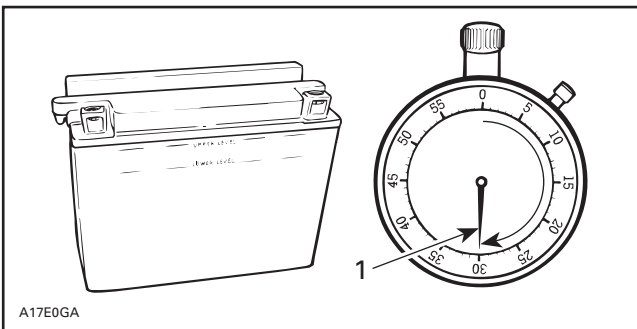
2. Remove caps and fill battery to UPPER LEVEL line with electrolyte (specific gravity: 1.265 at 21°C (70°F)).

NOTE: This battery may fill slower than others due to the anti-spill check ball design.



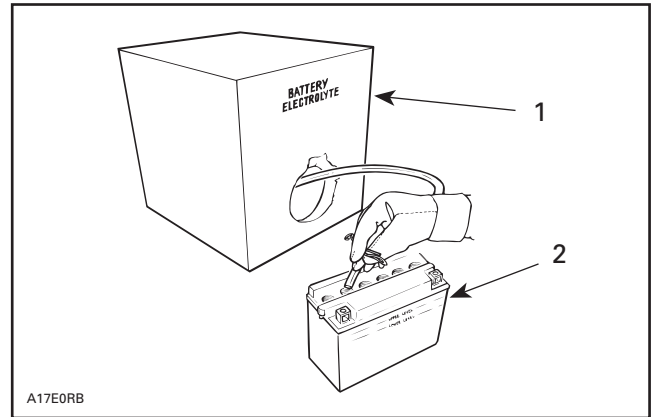
- 1. Sealing tube removed
- 2. Battery electrolyte
- 3. Upper level line

3. Allow the battery to stand for 30 minutes MINIMUM so that electrolyte soak through battery cells.



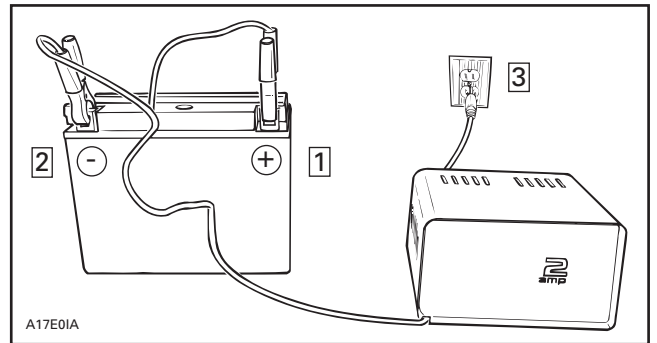
- 1. 30 minutes

4. Readjust the electrolyte level to the UPPER LEVEL line.



- 1. Battery electrolyte
- 2. Upper level line

5. Connect a 2 A battery charger for 3 to 5 hours.



- Step 1: Connect + lead to battery + post
- Step 2: Connect - lead to battery - post
- Step 3: Plug battery charger

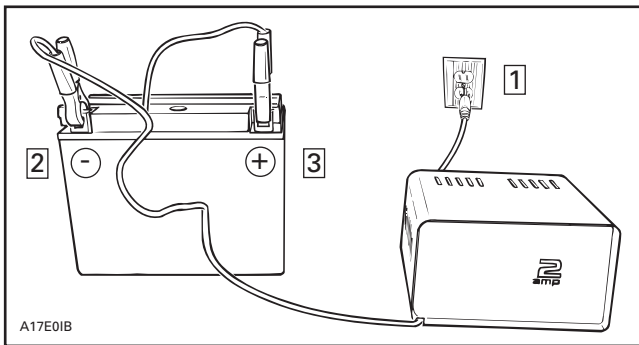
⚠ WARNING
Always charge in a well ventilated area. Always turn battery charger off prior to disconnecting cables.

CAUTION: If charging rate raises higher than 2.4 A reduce it immediately. If cell temperature rises higher than 50°C (122°F) or if the casing feels hot, discontinue charging temporarily or reduce the charging rate.

Section 08 ELECTRICAL SYSTEM

Subsection 03 (CHARGING SYSTEM)

6. Disconnect battery charger.

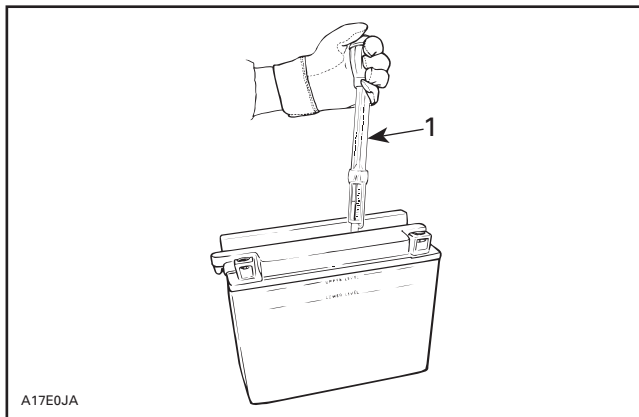


Step **1**: Unplug battery charger

Step **2**: Disconnect - lead

Step **3**: Disconnect + lead

7. Test battery state of charge. Use a hydrometer.



1. Specific gravity 1.265

8. If electrolyte level has dropped after charging, fill with distilled water to UPPER LEVEL line. After water is added, continue charging for 1 to 2 hours to mix water with electrolyte.

9. Reinstall caps and clean any electrolyte spillage using a solution of baking soda and water.

Charging a Used Battery

⚠ WARNING

Never charge battery while installed in watercraft.

For best results, battery should be charged when the electrolyte and the plates are at room temperature. A battery that is cold may not accept current for several hours after charging begun.

Do not charge a frozen battery. If the battery charge is very low, the battery may freeze. If it is suspected to be frozen, keep it in a heated area for about 2 hours before charging.

⚠ WARNING

Always charge battery in a well ventilated area.

The time required to charge a battery will vary depending on some factors such as:

- Battery temperature: The charging time is increased as the temperature goes down. The current accepted by a cold battery will remain low. As the battery warms up, it will accept a higher rate of charge.
- State of charge: Because the electrolyte is nearly pure water in a completely discharged battery, it cannot accept current as well as electrolyte. This is the reason the battery will not accept current when the charging cycle first begins. As the battery remains on the charger, the current from the charger causes the electrolytic acid content to rise which makes the electrolyte a better conductor and then, the battery will accept a higher charging rate.
- Type of charger: Battery chargers vary in the amount of voltage and current that they can supply. Therefore, the time required for the battery to begin accepting measurable current will also vary.

Charging a Very Flat or Completely Discharged Battery

The battery charger should have an adjustable charging rate. Variable adjustment is preferred, but a unit which can be adjusted in small increments is acceptable.

The battery charger must be equipped with an ammeter capable of accurately measuring current of less than 1 ampere.

Unless this procedure is properly followed, a good battery may be needlessly replaced.

- Measure the voltage at the battery posts with an accurate voltmeter. If it is below 10 volts, the battery will accept current at very low rate, in term of milliamperes, because electrolyte is nearly pure water as explained above. It could be some time before the charging rate increases. Such low current flow may not be detectable on some charger ammeters and the battery will seem not to accept any charge.
- Exceptionally for this particular case, set the charger to a high rate.

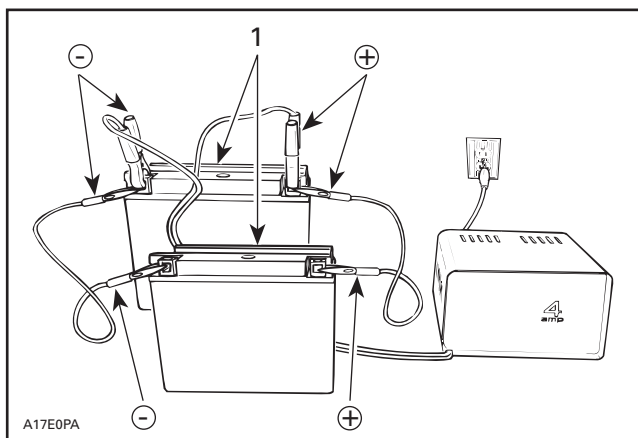
NOTE: Some chargers have a polarity protection feature which prevents charging unless the charger leads are connected to the correct battery terminals. A completely discharged battery may not have enough voltage to activate this circuitry, even though the leads are connected properly. This will make it appear that the battery will not accept a charge. Follow the charger manufacturer's instruction on how to bypass or override this circuitry so that the charger will turn on and charge a low-voltage battery.

- Since the battery chargers vary in the amount of voltage and current they provide, the time required for the battery to accept measurable charger current might be up to approximately 10 hours or more.
- If the charging current is not up to a measurable amount at the end of about 10 hours, the battery should be replaced.
- If the charging current is measurable before the end or at the end of about 10 hours, the battery is good and charging should be completed in the normal manner as specified in **Activation of a new battery**.
- It is recommended that any battery recharged by this procedure be load tested prior to returning it to service.

Charging Two or More Batteries at a Time

Connect all positive battery posts together and use a charger with a capacity (rated) equal to: number of battery to be charged multiply by 2 A.

For example: Charging 5 batteries at a time requires a 10 A rated charger ($5 \times 2 \text{ A} = 10 \text{ A}$).



TYPICAL

1. Two batteries = 4 A

⚠ WARNING

Always charge battery(ies) in a well ventilated area.

Battery Installation

⚠ WARNING

Always connect battery cables exactly in the specified order, RED positive cable first BLACK negative cable last.

Proceed as follows:

1. Install battery in its emplacement.
2. Secure vent line to the battery and support. Ensure vent line is not kinked or obstructed.

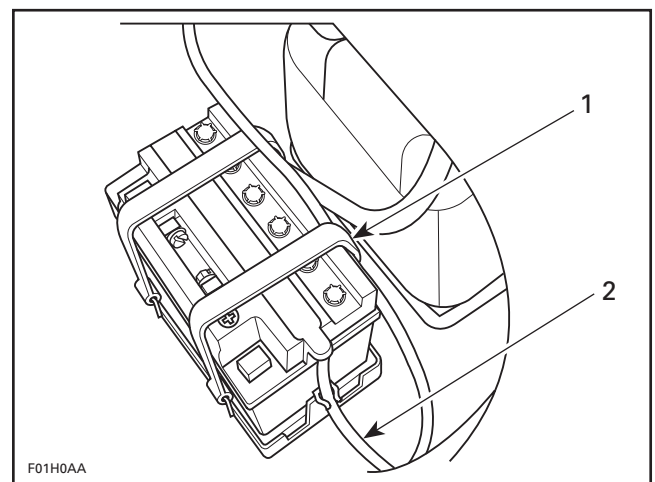
⚠ WARNING

Vent line must be free and open. Avoid skin contact with electrolyte.

3. First connect RED positive cable.
4. Connect BLACK negative cable last.
5. Apply dielectric grease on battery posts.
6. Verify cable routing and attachment.

GTS Model

Secure RED positive battery cable using right strap of battery.

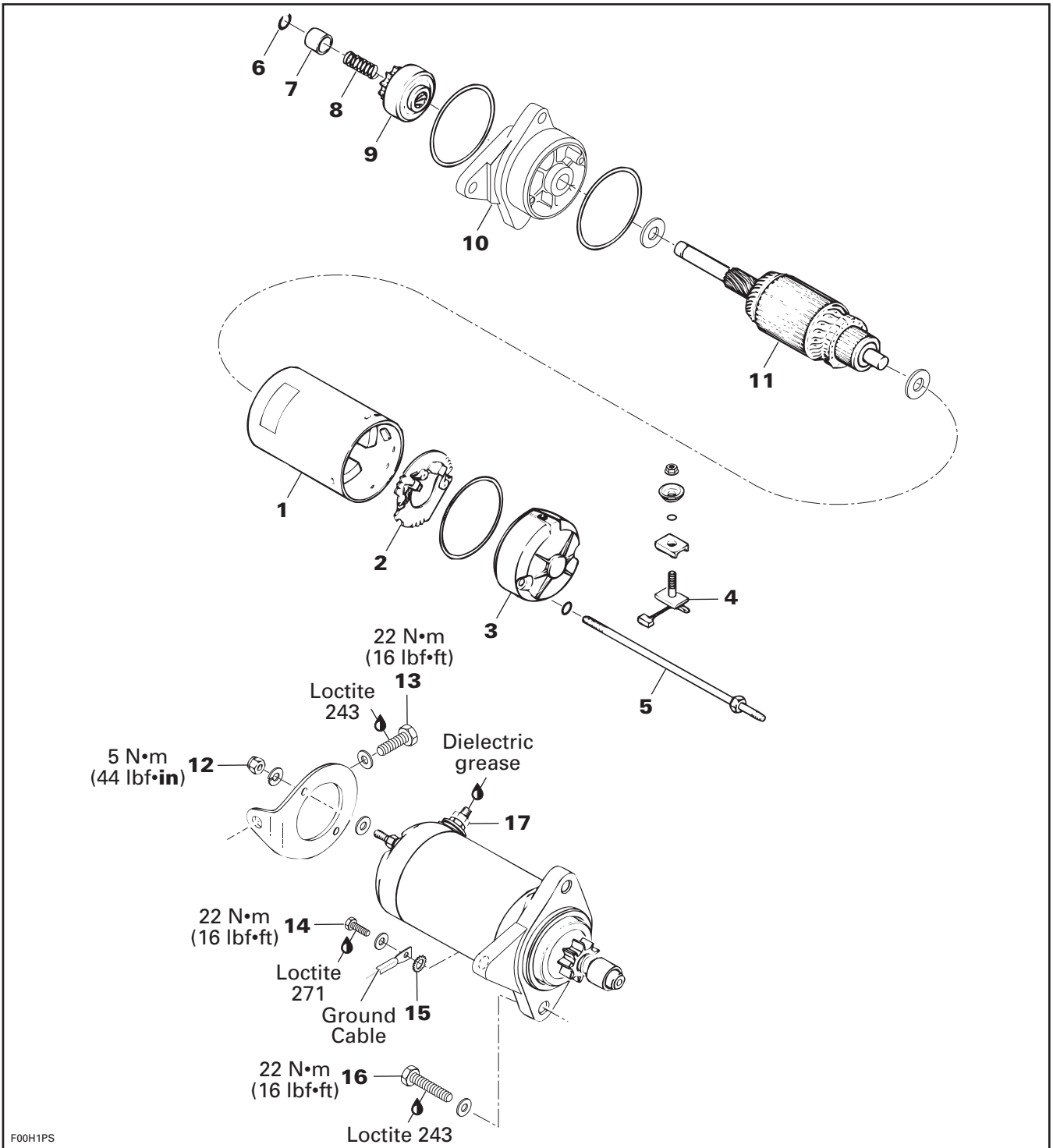


GTS MODEL

1. Strap retaining RED positive cable
2. Vent tube connected and secured in support

STARTING SYSTEM

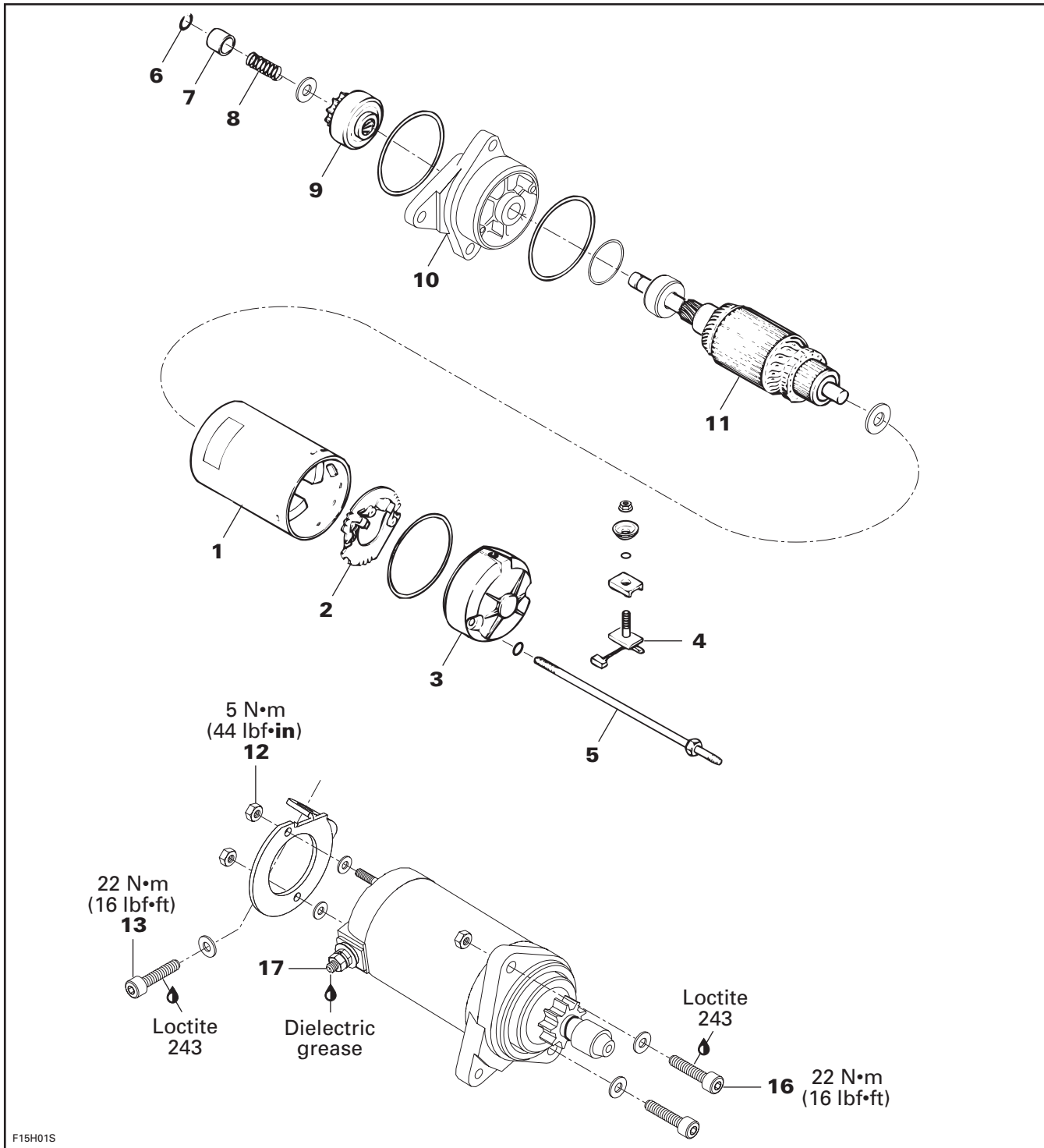
717 Engine



Section 08 ELECTRICAL SYSTEM

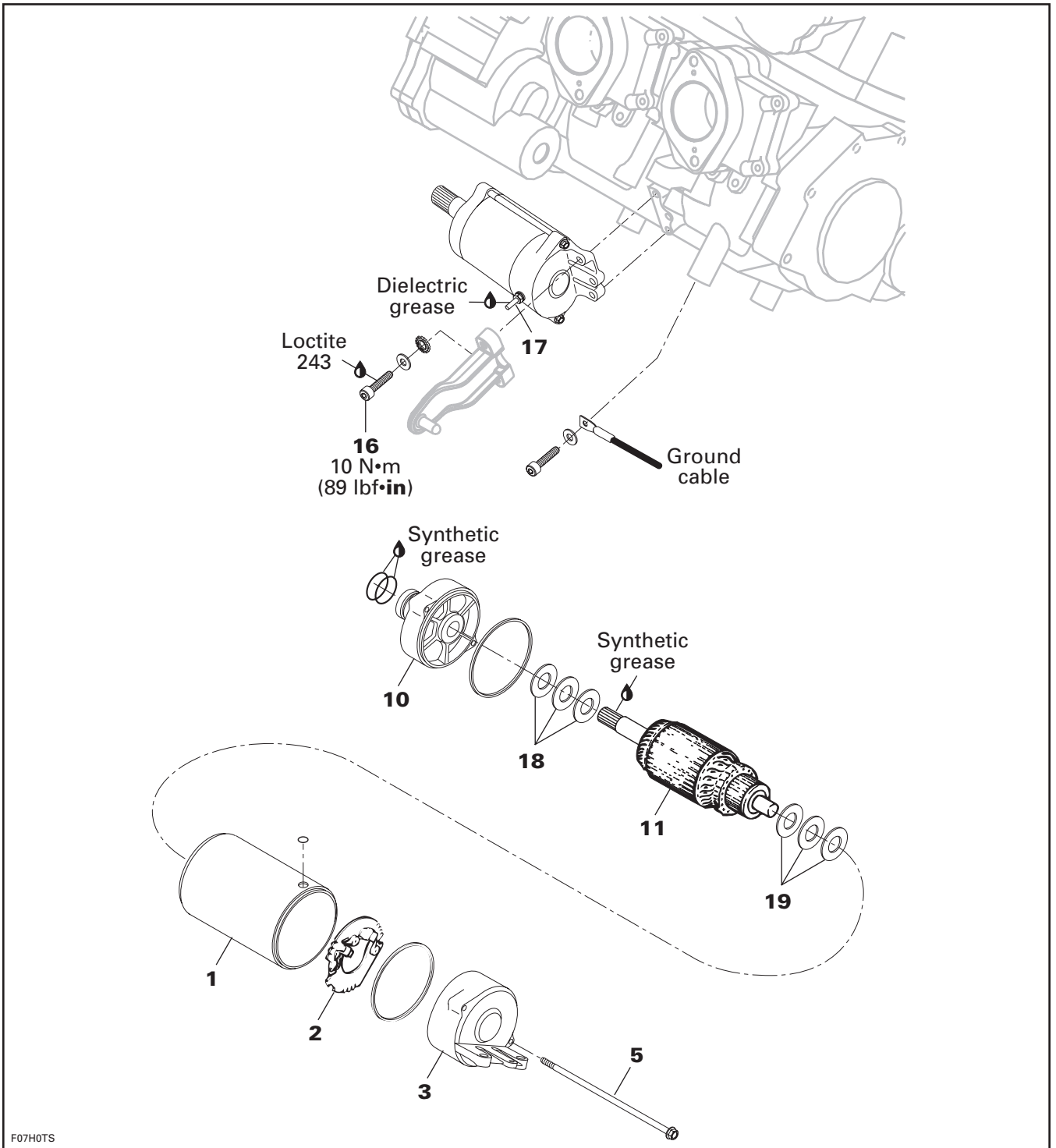
Subsection 04 (STARTING SYSTEM)

787 RFI Engine



Section 08 ELECTRICAL SYSTEM
Subsection 04 (STARTING SYSTEM)

947 Engine



F07H0TS

Section 08 ELECTRICAL SYSTEM

Subsection 04 (STARTING SYSTEM)

GENERAL

Causes of troubles are not necessarily related to starter but may be due to a burnt fuse, faulty battery, start/stop switch, safety lanyard switch, MPEM, solenoid, electrical cables or connections.

Check these components before removing starter. Consult also the starting system troubleshooting table on next page for a general view of possible problems.

WARNING

Short circuiting electric starter is always a danger, therefore disconnect the battery ground cable before carrying out any kind of maintenance on starting system. Do not place tools on battery.

Fuse

Make sure 5 A fuse on MPEM is in good condition. The solenoid may be the cause of a burnt fuse. If the solenoid checks good, one of the accessory may be defective.

Battery

To check battery condition, refer to CHARGING SYSTEM.

MPEM

If 2 short beeps are not heard when installing the safety lanyard, refer to DIGITALLY ENCODED SECURITY SYSTEM.

Engine Start/Stop Switch and Safety Lanyard Switch

Refer to IGNITION SYSTEM.

Solenoid

NOTE: Solenoid is located in the electrical box. Inspect connections and clean as necessary.

Static Test: Continuity

With a multimeter, check primary winding resistance. It should be approximately 5 ohms.

There should be no continuity between the positive posts of the solenoid.

Dynamic Test

Depress start/stop button and measure the voltage on the solenoid positive posts with a multimeter.

If there is no voltage and battery is in good condition, replace the solenoid.

Electrical Cables or Connections

Check all connections, cables and wires. Tighten any loose cables. Replace any chafed wires.

STARTING SYSTEM TROUBLESHOOTING

SYMPTOM	CAUSE	REMEDY
STARTER DOES NOT TURN.	Burnt 5 A fuse on MPEM.	Check wiring condition and replace fuse.
	Poor contact of battery terminal(s).	Clean and tighten terminal(s).
	Poor battery ground cable connection.	Clean and tighten.
	Weak battery.	Recharge or replace battery.
	Poor contact of start/stop switch, safety lanyard switch or solenoid.	Check connectors and clean contacts. Check and replace defective parts.
	Open circuit: start/stop switch or solenoid.	Check and replace.
	Safety lanyard or MPEM.	Refer to DIGITALLY ENCODED SECURITY SYSTEM.
STARTER ENGAGES; BUT DOES NOT CRANK THE ENGINE.	Poor battery cable connections.	Clean battery cable connections.
	Poor contact of brush.	Straighten commutator and brush.
	Burnt commutator.	Turn commutator on a lathe.
	Worn commutator segments.	Undercut mica.
	Shorted armature.	Repair or replace armature.
	Weak brush spring tension.	Replace brush holder or spring.
	Weak magnet.	Replace yoke assembly.
	Worn bushings.	Replace clutch.
	Weak battery.	Recharge or replace battery.
STARTER TURNS, BUT OVERRUNNING CLUTCH PINION DOES NOT MESH WITH RING GEAR.	Worn clutch pinion gear.	Replace clutch.
	Defective clutch.	Replace clutch.
	Poor movement of clutch on splines.	Clean and correct.
	Worn clutch bushing.	Replace clutch.
	Worn ring gear.	Replace ring gear.
STARTER MOTOR KEEPS RUNNING.	Shorted solenoid winding.	Replace solenoid.
	Melted solenoid contacts.	Replace solenoid.
	Sticking or defective starter clutch.	Lubricate or replace.
	Presence of salt water in the electrical box which gives continuity.	Verify electrical box watertightness.

Section 08 ELECTRICAL SYSTEM

Subsection 04 (STARTING SYSTEM)

STARTER REMOVAL

Disconnect BLACK cable ground connection from battery.

⚠ WARNING

Always disconnect ground cable first and re-connect last.

Disconnect RED cable connection from battery.

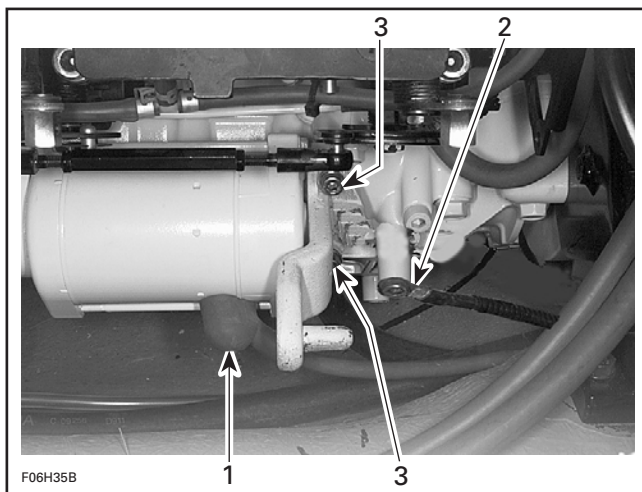
717 and 787 RFI Engines

Remove the following parts:

- cables from starter
- screw no. 13 of starter rear support
- starter mount screws no. 16.

947 Engine

Disconnect starter cables and loosen Allen screws no. 16 retaining starter bracket to engine.



1. Positive starter cable
2. Negative starter cable
3. Allen screw

Remove bracket and starter.

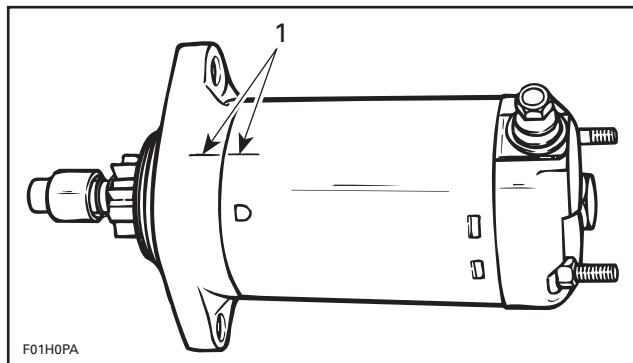
NOTE: To remove the starter drive assembly, mag-neto flywheel has to be removed. Refer to MAG-NETO SYSTEM and BOTTOM END.

To check and replace the starter end bearing, refer to BOTTOM END section.

STARTER DISASSEMBLY

717 and 787 RFI Engines

Before disassembling, trace index marks on yoke no. 1 and clutch housing no. 10 to ease further assembly.



TYPICAL

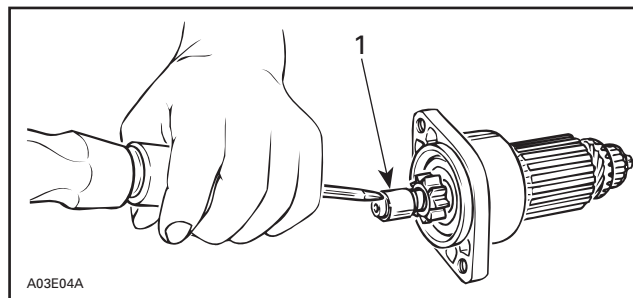
1. Trace indexing marks

Remove starter support nuts no. 12 then through bolts no. 5. Separate end frame no. 3 from yoke assembly no. 1. Withdraw yoke assembly from armature no. 11.

Brush holder no. 2 can be removed from end frame no. 3 by unscrewing nut retaining terminal.

Check that the radial play between the armature shaft and end frame is not greater than 0.20 mm (.008 in). Replace end frame if so.

Tap the pinion stop collar no. 7 using a screwdriver. Remove circlip no. 6. Disassemble pinion stop collar no. 7 and spring no. 8.



1. Pinion stop collar

Turn clutch assembly no. 9 clockwise to remove it from armature assembly no. 11.

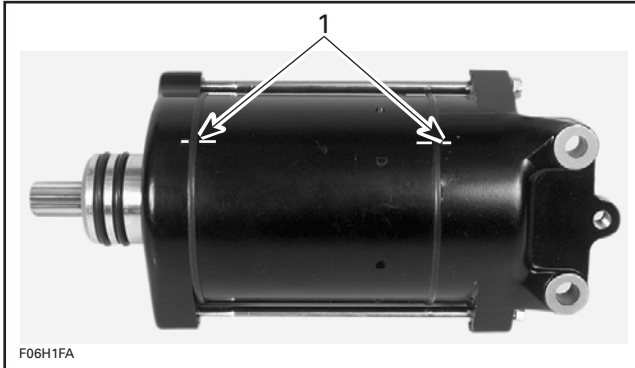
Pull housing from armature.

Section 08 ELECTRICAL SYSTEM

Subsection 04 (STARTING SYSTEM)

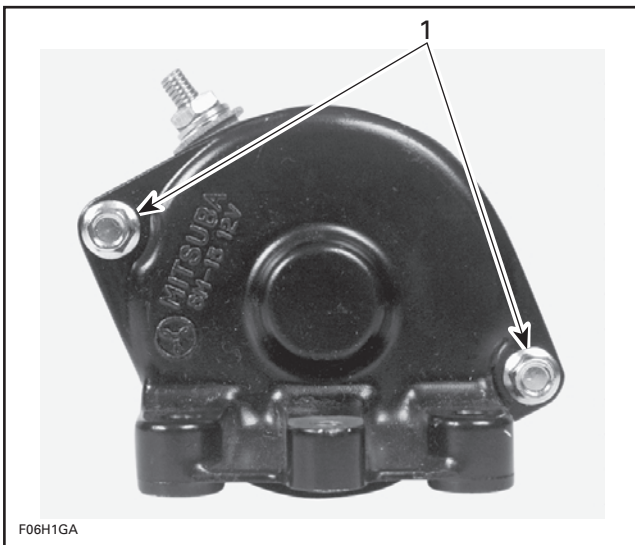
947 Engine

Locate index marks on yoke no. 1 and end covers no. 3 and no. 10.



1. Index marks

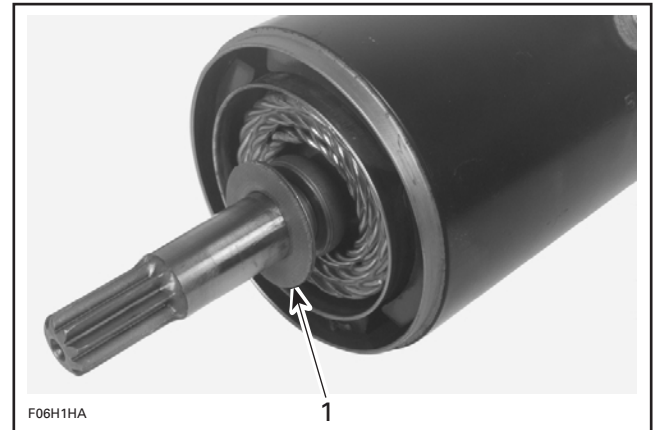
Loosen through bolts no. 5.



1. Through bolts

Remove end cover no. 3 and gasket on armature shaft side.

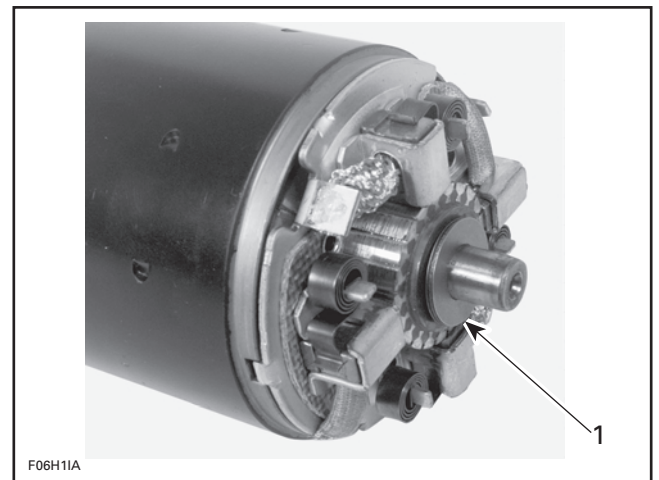
Remove thrust washers no. 19 from armature shaft.



1. Thrust washers

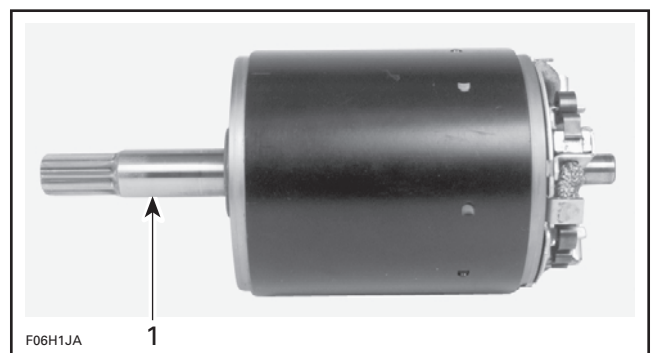
Remove the other end cover no. 10 and gasket.

Remove the three washers no. 18 from armature shaft.



1. Washers

Remove armature no. 11.



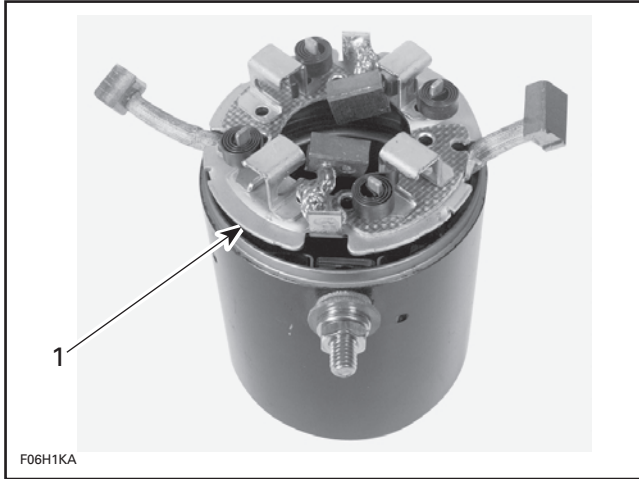
1. Pull armature shaft

Section 08 ELECTRICAL SYSTEM

Subsection 04 (STARTING SYSTEM)

Release brush wires of yoke from brush holder no. 2.

Remove brush holder no. 2.



1. Remove brush holder

To remove brushes from yoke no. 1, loosen nut and remove washers.



1. Loosen nut and remove washers

Remove brushes.

To remove bearing and seal in end cover, release tabs of retainer.



1. Retainer

CLEANING

CAUTION: Yoke ass'y and drive unit assembly must not be immersed in cleaning solvent.

Discard all O-rings.

Clean brushes and holders with a clean cloth soaked in solvent. Brushes must be dried thoroughly with a clean cloth.

Blow brush holders clean using compressed air.

WARNING

Always wear safety glasses when using compressed air.

Remove dirt, oil or grease from commutator using a clean cloth soaked in suitable solvent. Dry well using a clean, dry cloth.

Clean engine ring gear teeth and drive unit (clutch).

NOTE: Bushings or bearings must not be cleaned with grease dissolving agents.

Immerse all metal components in cleaning solution. Dry using a clean, dry cloth.

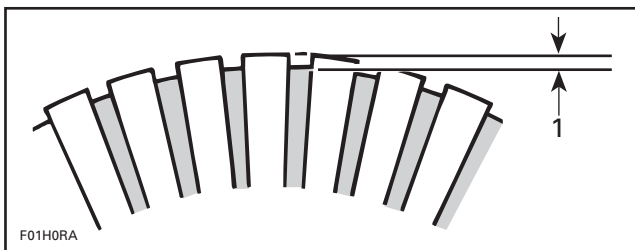
PARTS INSPECTION

Armature

NOTE: An ohmmeter may be used for the following testing procedures, except for the one concerning shorted windings in armature.

Check commutator for roughness, burnt or scored surface. If necessary, turn commutator on a lathe, enough to resurface only.

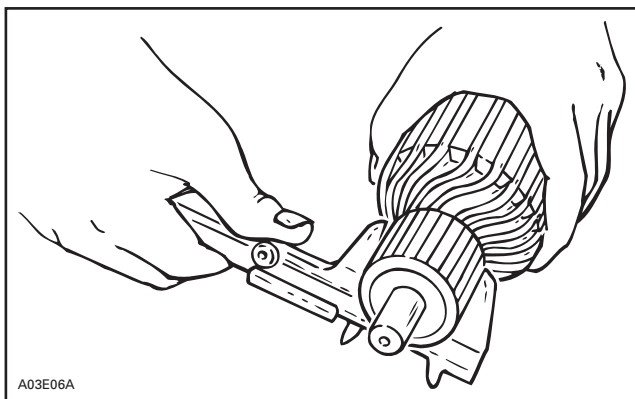
Check commutator for mica depth. If depth is less than 0.20 mm (.008 in), undercut mica. Be sure that no burrs are left and no copper dust remains between segments after undercutting operation is completed.



1. Commutator undercut 0.20 mm (.008 in)

Check commutator out of round condition with V-shaped blocks and an indicator. If commutator out of round is more than 0.40 mm (.016 in), commutator should be turned on a lathe.

Check commutator outer diameter. If less than 27 mm (1.063 in), replace.



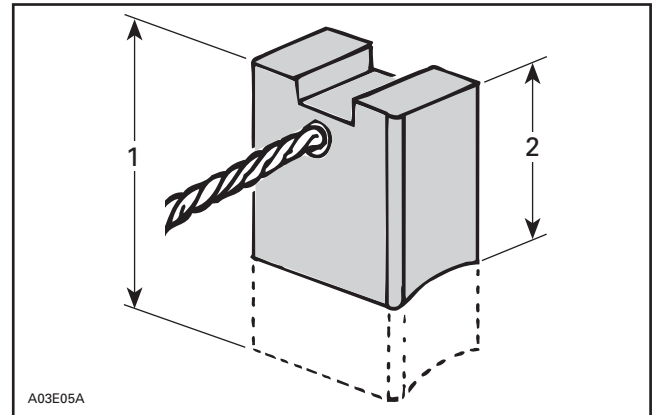
Brush Holder

Check brush holder for insulation using an ohmmeter. Place one test probe on insulated brush holder and the other test probe on brush holder plate. If continuity is found, brush holder has to be repaired or replaced.

Brush

Measure brush length. If less than 8.5 mm (.335 in), replace them.

NOTE: New brush length is 12 mm (.472 in).



1. New
2. Wear limit, 8.5 mm (.335 in)

Overrunning Clutch

Pinion of overrunning clutch should turn smoothly in clockwise direction, and should not slip in a counterclockwise direction. If defective, replace.

Check pinion teeth for wear and damage. If defective, replace.

NOTE: Always check engine ring gear teeth for wear and damage. If defective replace ring gear. Refer to MAGNETO.

STARTER ASSEMBLY

Reverse the order of disassembly to reassemble starter. However, attention should be paid to the following operations.

717 and 787 RFI Engines

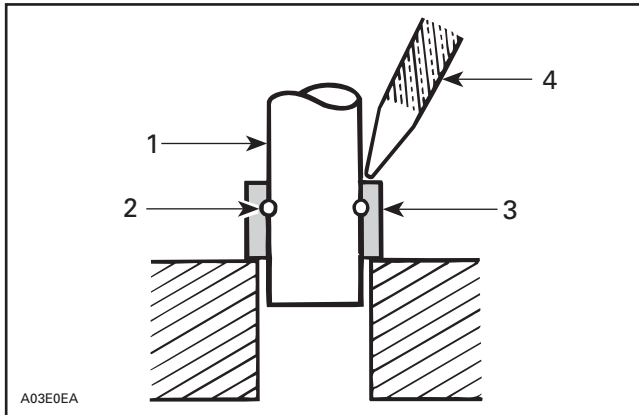
Prior to assembling, coat sliding surfaces on armature shaft splines, overrunning clutch and bushing (717 engine) with G.E. Versilube G 341 M or ESSO Beacon 325 lubricant or equivalent.

After placing pinion stop collar **no. 7** on armature shaft **no. 11**, fit circlip **no. 6** into armature shaft, then make sure that it is properly secured.

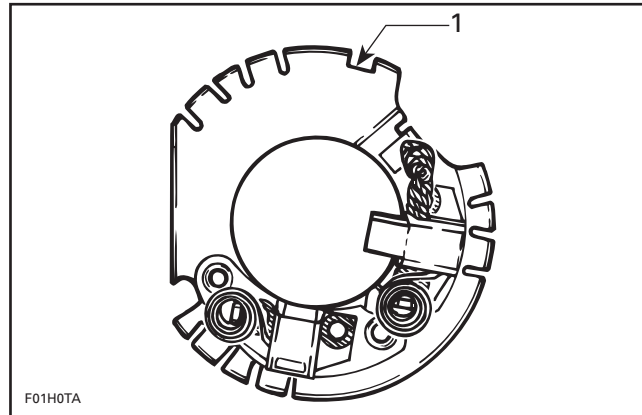
Slide stop collar **no. 7** over circlip **no. 6** and secure in place by punching it at two or three places.

Section 08 ELECTRICAL SYSTEM

Subsection 04 (STARTING SYSTEM)



1. Armature shaft
2. Circlip
3. Pinion stop collar
4. Punch

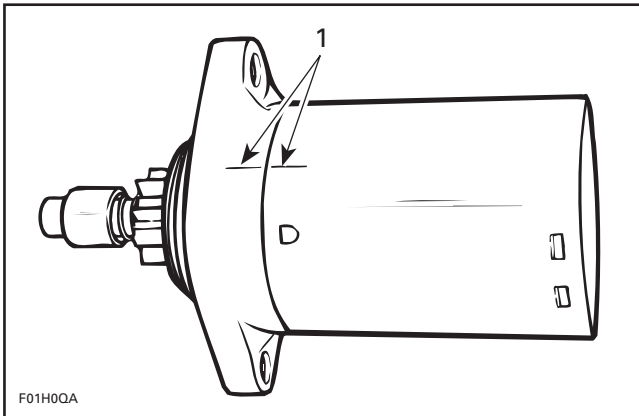


1. Brush holder locating notch

To ease end frame installation, retain brush holder with a small screwdriver while installing end frame.

Yoke Assembly and Clutch Housing

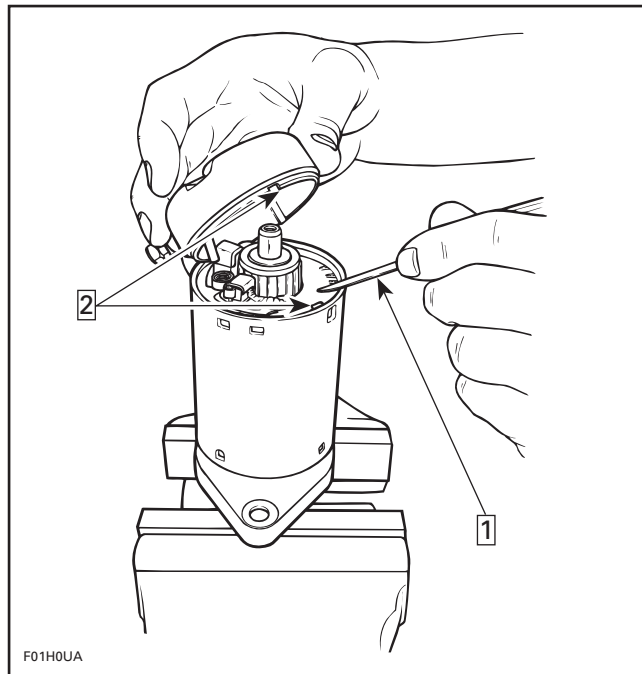
Align previously traced indexing marks.



TYPICAL

1. Align marks

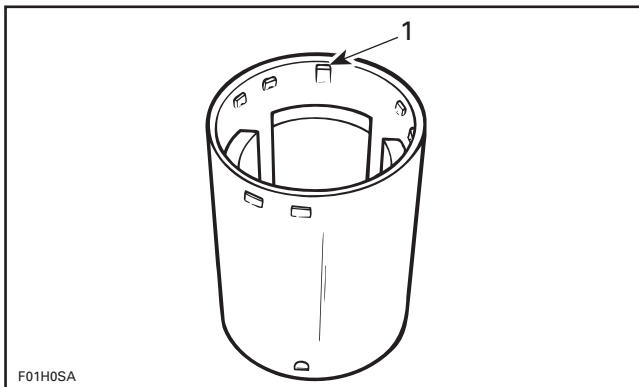
Open brushes no. 4 and slide over commutator. Align end frame locating notch with yoke locating protrusion and properly sit brush holder no. 2 into yoke no. 1.



- Step **1**: Retaining brush holder with a screwdriver
 Step **2**: Align here

Align end frame notch with brush holder notch/yoke protrusion.

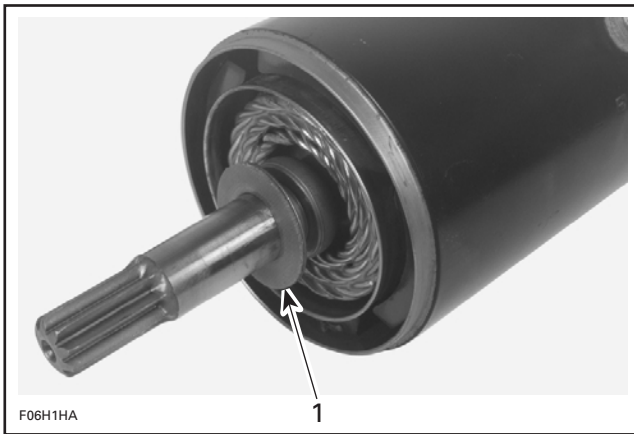
CAUTION: Make sure end frame fits perfectly on yoke.



1. Locating protrusion is the higher one

947 Engine

Install new O-rings and gaskets.
Insert thrust washers **no. 19** onto armature shaft.



1. Thrust washers

Install the three washers **no. 8** onto armature shaft.

When installing end covers **no. 3** and **no. 10** to yoke, align index marks.

Apply Loctite 271 (red) on through bolts **no. 5** and torque to 6 N•m (53 lbf•in).

STARTER INSTALLATION

Installation is essentially the reverse of removal procedure. However, pay particular attention to the following.

Make sure that starter and engine mating surfaces are free of debris. Serious trouble may arise if starter is not properly aligned.

717 Engine

Screw

Apply Loctite 243 (blue) on threads and torque starter screws **no. 13** and **no. 16** to 22 N•m (16 lbf•ft).

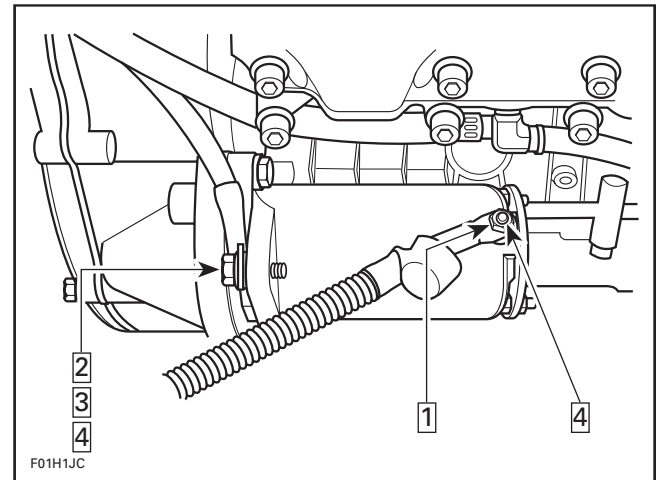
Nut

Connect the RED positive cable to the starter and torque nut **no. 17** to 6 N•m (53 lbf•in). Apply dielectric grease on terminal and nut.

Screw and Teeth Washer

Apply Loctite 271 (red) to screw.

Connect BLACK negative cable to starter using flat washer, teeth washer **no. 15** and screw **no. 14**. Torque screw to 22 N•m (16 lbf•ft). Apply dielectric grease on terminal and screw.



717 ENGINE SHOWN

- Step 1: Torque nut to 6 N•m (53 lbf•in)
- Step 2: Apply Loctite 271 on screw
- Step 3: Torque screw to 22 N•m (16 lbf•ft)
- Step 4: Apply dielectric grease

⚠ WARNING

Always connect RED positive cable first then BLACK negative cable last. Whenever connecting the RED positive cable to the starter motor make sure the battery cables are disconnected to prevent electric shock.

947 Engine

Screw

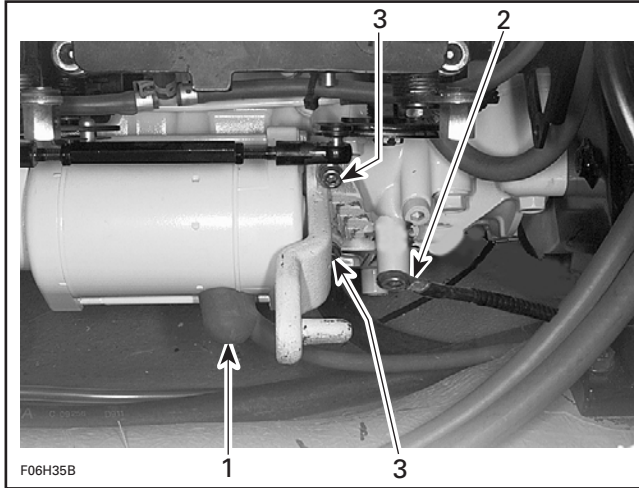
Apply Loctite 243 (blue) to Allen screws **no. 16** of starter bracket and torque to 10 N•m (89 lbf•in).

Section 08 ELECTRICAL SYSTEM

Subsection 04 (STARTING SYSTEM)

Nut

Connect the RED positive cable to the starter and torque nut no. 17 to 6 N•m (53 lbf•in). Apply dielectric grease on terminal and nut.



GTX MODEL

1. Torque nut to 6 N•m (53 lbf•in), apply dielectric grease and install protection cover
2. Negative BLACK cable
3. Apply Loctite 243 to threads and torque screw to 10 N•m (89 lbf•in)

WARNING

Always connect RED positive cable first then BLACK negative cable last. Whenever connecting the RED positive cable to the starter motor make sure the battery cables are disconnected to prevent electric shock.

STARTER SPECIFICATION

717 and 787 RFI Engines

Nominal output		0.6 kW		
Voltage		12 V		
Rated time		30 seconds		
Rotation		Counterclockwise (viewed from pinion side)		
Weight		Approx. 2 kg (4.4 lb)		
Performance specification at 20°C (68°F)	No load	11.5 V	20 A max.	5500 RPM
	Load	8.5 V	170 A max.	2200 RPM
	Stall	5 V	350 A max.	0 RPM
Battery		12 V, 19 Ah		

947 Engine

Nominal output		0.8 kW		
Voltage		12 V		
Rated time		30 seconds		
Rotation		Counterclockwise (viewed from pinion side)		
Weight		1.7 kg (3.7 lb)		
Performance specification at 20°C (68°F)	No load	10.9 V	45 A max.	8600 RPM
	Load	9 V	120 A max.	5350 RPM
	Stall	2.25 V	390 A max.	0 RPM
Battery		12 V, 19 Ah		

INSTRUMENTS AND ACCESSORIES

GENERAL

It is possible to activate the instruments when the engine is not running.

Make sure the safety lanyard is removed, then depress the start/stop button.

The timer of the MPEM will maintain the gauge(s) activated during a period of approximately 33 seconds.

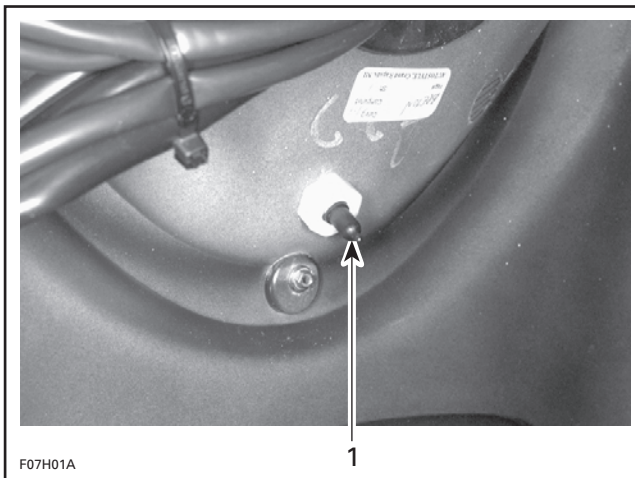
INSPECTION

Air Temperature Sensor

GTX and GTX RFI

The temperature sensor is located in the storage cover.

Remove the back panel of the storage cover to access the temperature sensor.



1. Temperature sensor

To check if the temperature sensor is operational, activate the Info Center and select the exterior temperature mode.

Use a heat gun to warm up the sensor. The temperature should raise rapidly on the gauge.

If not, replace the temperature sensor.

Water Temperature Sensor

GTX, GSX RFI and GTX RFI

The water temperature sensor is integrated with the speed sensor located on the ride plate.

To check if the water temperature sensor is operational, activate the Info Center and select the lake temperature mode.

With a garden hose, spray the speed sensor with water. The temperature reading on the Info Center should adjust to the water temperature.

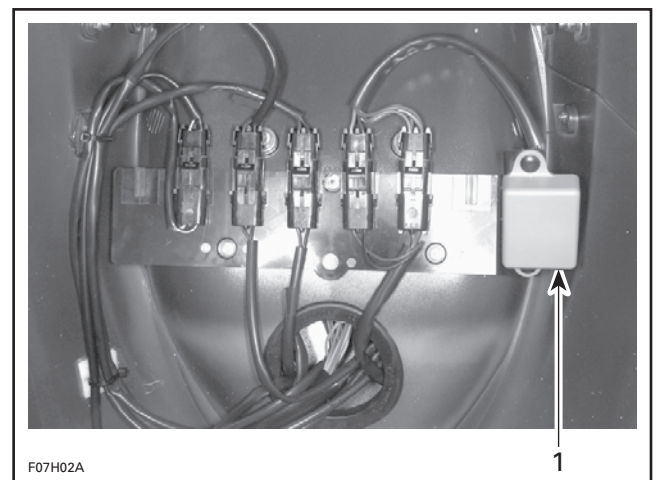
If not, replace the speed sensor.

Compass

GTX and GTX RFI

The compass is located in the storage cover.

Remove the back panel of the storage cover to access the compass.



1. Compass

Remove the compass from the support.

Activate the Info Center.

Change the direction of the compass and keep it horizontal ($\pm 10^\circ$). There should be a change of direction on the Info Center.

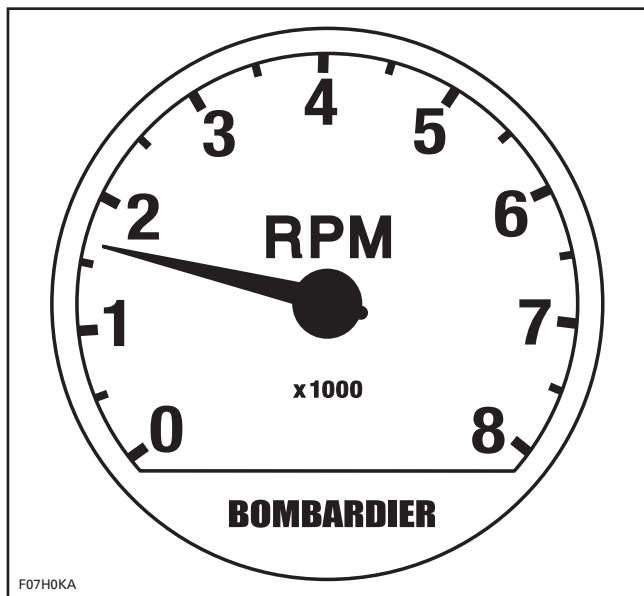
NOTE: To check the accuracy of the compass, you can use a portable compass and point it in the same direction. Compare the given directions, they should be the same.

Section 08 ELECTRICAL SYSTEM

Subsection 05 (INSTRUMENTS AND ACCESSORIES)

Tachometer (90 mm)

XP Model



The PURPLE wire is the 12 Vdc power source of the tachometer.

The BLACK wire is the ground.

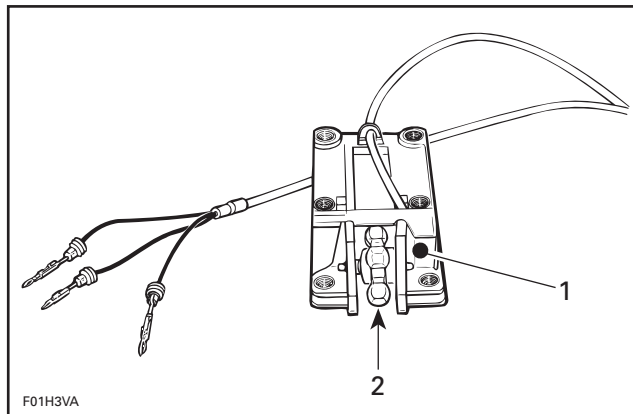
The GRAY wire is the pulse signal from the multi-purpose electronic module (MPEM).

Speed Sensor

XP, GTI, GTX RFI and GTX Models

The speedometer gives a reading through a speed sensor. Speed sensor is installed on riding plate. It works with the water flow which turns a magnetic paddle wheel that triggers an electronic pick-up that in turn sends a speed signal to the speedometer.

The paddle wheel is protected by the pick-up housing.



1. Pick-up housing
2. Paddle wheel

To check if the speed sensor is operational, disconnect the speed sensor connector housing from inside bilge.

Using an appropriate terminal remover (Snap-on TT600-4), remove the PURPLE/YELLOW and BLACK/ORANGE wires from the tab housing of the speed sensor.

Reconnect the PURPLE/YELLOW and BLACK/ORANGE wires in the receptacle housing.

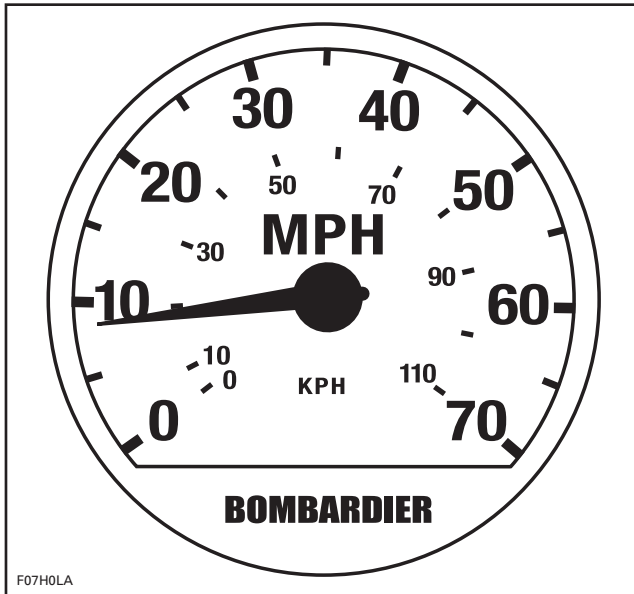
Connect the positive probe of a multimeter to speed sensor PURPLE/YELLOW wire and the negative probe to speed sensor BLACK/ORANGE wire.

With the safety lanyard removed, depress the start/stop button to activate the MPEM timer.

Slowly rotate the paddle wheel. Every 1/8 turn, the observed voltage should fluctuate between 5.5 and 8.5 Vdc.

Speedometer (90 mm)

XP, GTI, GTX RFI and GTX Models



TYPICAL

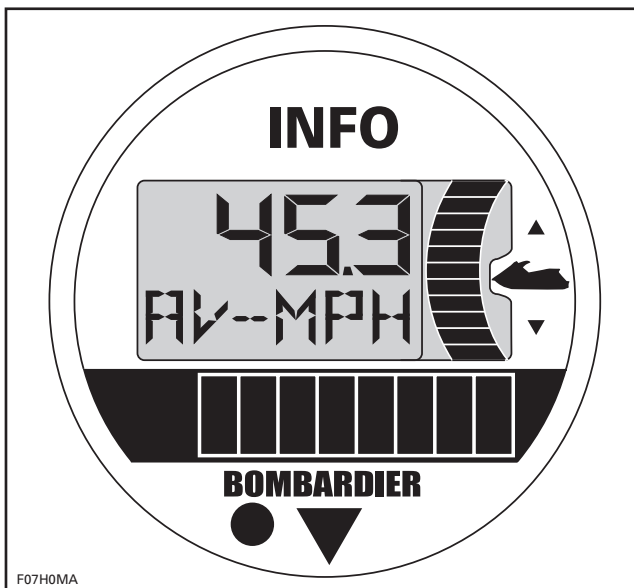
The PURPLE wire is the 12 Vdc power source of the speedometer.

The BLACK wire is the ground.

The PURPLE/YELLOW wire is the pulse signal from the speed sensor.

Info Center

GTX, GSX RFI and GTX RFI



TYPICAL

This is a LCD multifunction gauge. It features the following functions:

- fuel level
- low fuel level
- low oil level
- low voltage
- engine overheating
- hourmeter
- clock
- maintenance information
- chronometer
- tachometer
- speedometer
- peak speed
- average speed
- trip meter
- VTS (GSX RFI)
- compass (GTX and GTX RFI)
- air temperature (GTX and GTX RFI)
- water temperature.

The Info Center also features a red warning LED which blinks whenever one of the following circumstances occur: low fuel, low oil, low voltage and overheating.

For example, if the fuel level is low, the LED and the message "LOW FUEL" will blink.

As a self test, all LCD segments and the LED will turn on for 3 seconds each time the watercraft is started.

SCROLLING FUNCTIONS

Press the MODE button until the desired function is displayed on the Info Center.

RESET A FUNCTION

To reset a function such as the chronometer, peak speed, trip meter, etc., select the desired function using the MODE button then press and hold the SET button for 2 seconds.

Section 08 ELECTRICAL SYSTEM

Subsection 05 (INSTRUMENTS AND ACCESSORIES)



DISPLAY PRIORITIES

The clock (and compass for the GTX) is the basic mode of the Info Center.

The chronometer, tachometer and speedometer are the only other functions that may be chosen to replace the clock mode.

If another function is chosen, the clock mode will be displayed again after 4 seconds.

In the event of a warning message such as low fuel is displayed, the message will blink and override any other functions.

If more than one warning message is displayed, the messages will blink and reappear every 4 seconds.

LANGUAGE OPTION

While in the clock mode, press and hold the SET button for 2 seconds. Language option will be displayed.

Press the MODE button to scroll language (English, French and Spanish).

Press the SET button to confirm the selected language and return to the clock mode.

ENGLISH/METRIC OPTION

Press and hold both MODE and SET buttons for 2 seconds. The system will be automatically changed.

CHRONOMETER

Select the chronometer mode and press the SET button to start or stop the chronometer.

Press the SET button for 2 seconds to reset the chronometer.

CLOCK SETTING

While in the clock mode, press and hold both MODE and SET buttons for 2 seconds. The clock will blink to confirm the setting mode.

Press the MODE button to adjust the hours and the SET button to adjust the minutes.

Press again on both the MODE and SET buttons to exit the setting mode (or the gauge will automatically exit the setting mode after 10 seconds).

MAINTENANCE INFORMATION

When the watercraft is due for a maintenance inspection, the message "MAINT" will blink.

To clear the "MAINT" message, press the SET button for 2 seconds during the message blinking.

Verification

The PURPLE wire is the 12 Vdc power source of the Info Center.

The BLACK wire is the ground.

The RED/PURPLE wire is the 12 Vdc from the battery protected by a 5 A fuse on the MPEM.

The accuracy of some features of the Info Center can be checked with a potentiometer.

FUEL LEVEL

Disconnect the 4-circuit connector housing of the Info Center.

Using an appropriate terminal remover, remove the PINK wire from the tab housing.

Reconnect the connector housing.

Disconnect the 2-circuit connector housing which contains a PURPLE and BLACK wires.

Remove the BLACK wire from the receptacle housing.

Reconnect the connector housing.

Connect potentiometer test probes to the PINK and BLACK wires.

Adjust potentiometer to the resistance values as per following chart to test the accuracy of the gauge.

NOTE: The gauge must be activated to obtain a reading.

Section 08 ELECTRICAL SYSTEM
Subsection 05 (INSTRUMENTS AND ACCESSORIES)

RESISTANCE (Ω)	FUEL LEVEL LCD GRAPHIC	LOW FUEL LEVEL RED LIGHT
0 + 2.2	FULL	OFF
17.8 ± 2.2	7/8	OFF
27.8 ± 2.2	3/4	OFF
37.8 ± 2.2	5/8	OFF
47.8 ± 2.2	1/2	OFF
57.8 ± 2.2	3/8	OFF
67.8 ± 2.2	1/4	OFF
77.8 ± 2.2	1/8	ON
89.0 ± 2.2	EMPTY	ON

VTS

GSX RFI

Disconnect the 2-circuit connector housing of the Info Center.

Connect potentiometer test probes to the BROWN/WHITE and BROWN/BLACK wires.

Adjust potentiometer to the resistance values as per following chart to test the accuracy of the gauge.

NOTE: The gauge must be activated to obtain a reading.

RESISTANCE (Ω)	VTS LEVEL LCD GRAPHIC
167.3 ± 2.2	11/11 (UP)
153.0 ± 2.2	10/11
138.7 ± 2.2	9/11
124.4 ± 2.2	8/11
110.1 ± 2.2	7/11
95.8 ± 2.2	6/11
81.5 ± 2.2	5/11
67.2 ± 2.2	4/11
52.9 ± 2.2	3/11
38.6 ± 2.2	2/11
24.3 ± 2.2	1/11 (DOWN)

WATER TEMPERATURE

Disconnect the 2-circuit connector housing of the Info Center which contains a BLACK/ORANGE and TAN/ORANGE wires.

Connect potentiometer test probes to the BLACK/ORANGE and TAN/ORANGE wires.

Adjust potentiometer to the resistance values as per following chart to test the accuracy of the gauge.

NOTE: The gauge must be activated to obtain a reading.

RESISTANCE (Ω)	DISPLAY TEMPERATURE (°C)
25407.3	5 ± 2
19911.1	10 ± 2
15718.0	15 ± 2
12495.0	20 ± 2
10000.0	25 ± 2
8054.9	30 ± 2
6528.3	35 ± 2

RESISTANCE (Ω)	DISPLAY TEMPERATURE (°F)
22799.0	45 ± 4
17262.0	55 ± 4
13470.0	65 ± 4
10496.3	75 ± 4
8264.4	85 ± 4
6528.3	95 ± 4

AIR TEMPERATURE

Disconnect the 2-circuit connector housing of the Info Center which contains a TAN/WHITE and BLACK/WHITE wires.

Connect potentiometer test probes to the TAN/WHITE and BLACK/WHITE wires.

Adjust potentiometer to the resistance values as per following chart to test the accuracy of the gauge.

Section 08 ELECTRICAL SYSTEM

Subsection 05 (INSTRUMENTS AND ACCESSORIES)

NOTE: The gauge must be activated to obtain a reading.

RESISTANCE (Ω)	DISPLAY TEMPERATURE ($^{\circ}\text{C}$)
25590.1	5 ± 2
20005.8	10 ± 2
15761.7	15 ± 2
12510.2	20 ± 2
10000.0	25 ± 2
8047.8	30 ± 2
6518.7	35 ± 2

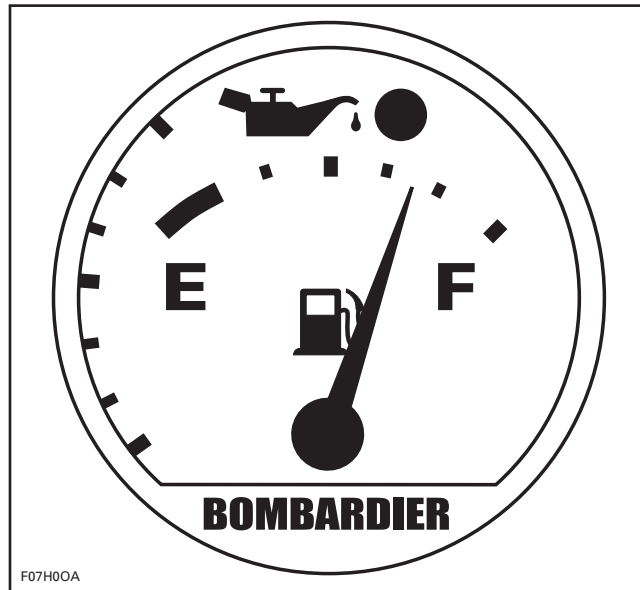
RESISTANCE (Ω)	DISPLAY TEMPERATURE ($^{\circ}\text{F}$)
22919.8	45 ± 4
17491.7	55 ± 4
13487.5	65 ± 4
10501.5	75 ± 4
8252.0	85 ± 4
6518.7	95 ± 4

Fuel/Oil Gauge/Low Oil Warning Light (56 mm)

GS, GTS, GTI and XP Models

The fuel gauge has a pointer which indicates fuel level in the tank.

The low oil warning light is part of the gauge. It will light when injection oil level is low.

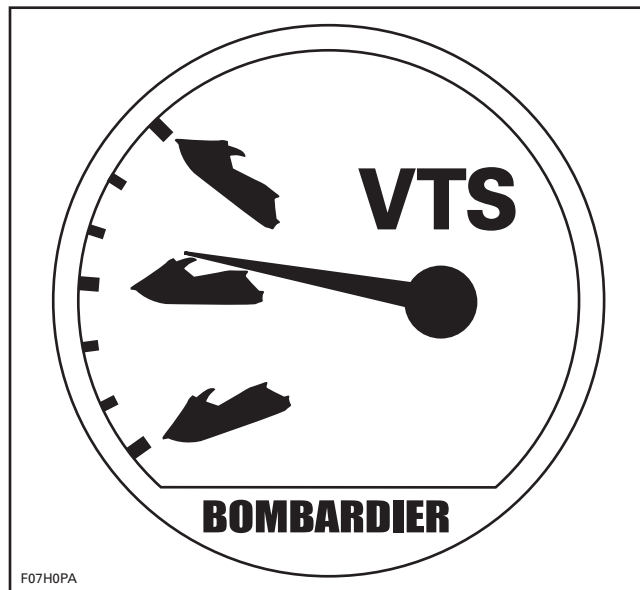


TYPICAL (56 MM)

Variable Trim Gauge

XP Model

The trim gauge shows the riding angle of the watercraft.



TYPICAL

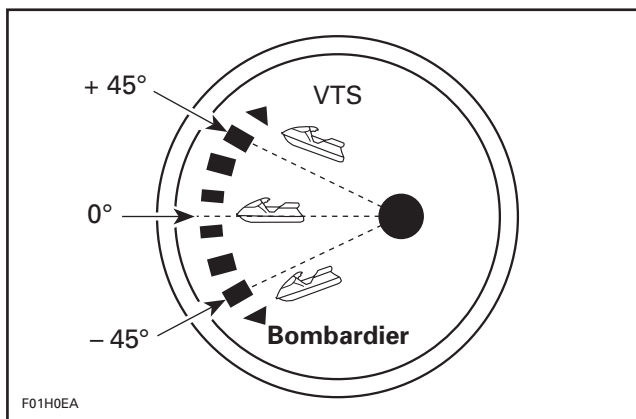
Section 08 ELECTRICAL SYSTEM
Subsection 05 (INSTRUMENTS AND ACCESSORIES)

Accuracy of gauge can be checked with a potentiometer.

- Disconnect 2-circuit connector housing of BROWN/BLACK and BROWN/WHITE wires of gauge.
- Connect potentiometer test probes to BROWN/BLACK and BROWN/WHITE wires of gauge.
- Adjust potentiometer to the resistance values as per following chart to test accuracy of gauge.

NOTE: Gauge must be activated to obtain a reading.

RESISTANCE (Ω)	GAUGE NEEDLE POSITION
24.3	- 45°
42.2	
60.1	
78.9	
95.8	0°
113.7	
131.6	
149.4	
167.3	+ 45°

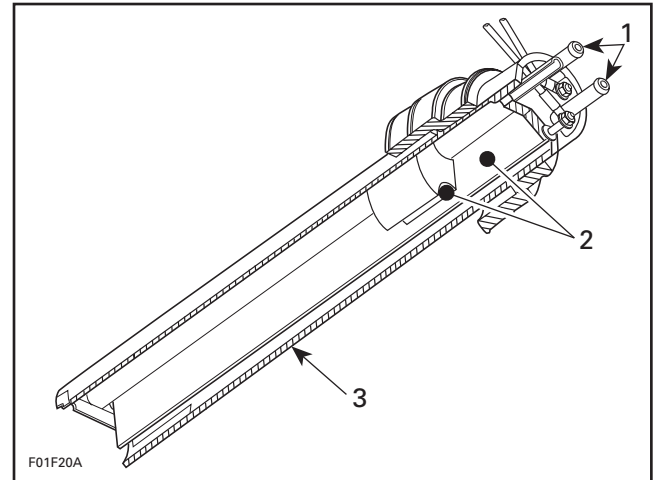


If gauge is not within the specifications, replace it.

Fuel Baffle Pick Up Sender

All Models Except GTX RFI and GSX RFI

The baffle pick-up has an integrated fuel sender. To verify fuel sender, a resistance test should be performed with a multimeter allowing the float to move up through a sequence.



1. Pick up tube
2. Fuel sender
3. Baffle pick-up

The resistance measured between PINK/BLACK and PINK wires must be in accordance with fuel level (measured from under the flange) as specified in the following charts.

FUEL LEVEL AND RESISTANCE (GTS)	
FUEL LEVEL (MM)	RESISTANCE (Ω)
From 257.9 \pm 5 and more	0 + 2.2
From 234.4 to 257.8 \pm 5	17.8 \pm 2.2
From 200.9 to 234.3 \pm 5	27.8 \pm 2.2
From 167.4 to 200.8 \pm 5	37.8 \pm 2.2
From 134 to 167.3 \pm 5	47.8 \pm 2.2
From 100.5 to 133.9 \pm 5	57.8 \pm 2.2
From 67 to 100.4 \pm 5	67.8 \pm 2.2
From 40.1 to 66.9 \pm 5	77.8 \pm 2.2
From 0 to 40 \pm 5	89.8 \pm 2.2

Section 08 ELECTRICAL SYSTEM

Subsection 05 (INSTRUMENTS AND ACCESSORIES)

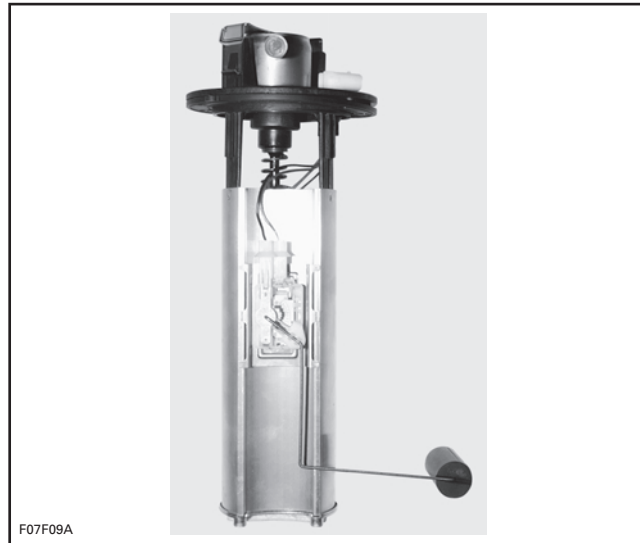
FUEL LEVEL AND RESISTANCE (GS, GTI AND GTX)	
FUEL LEVEL (MM)	RESISTANCE (Ω)
From 248.9 \pm 5 and more	0 + 2.2
From 234.4 to 248.8 \pm 5	17.8 \pm 2.2
From 200.9 to 234.3 \pm 5	27.8 \pm 2.2
From 167.4 to 200.8 \pm 5	37.8 \pm 2.2
From 134.0 to 167.3 \pm 5	47.8 \pm 2.2
From 100.5 to 133.9 \pm 5	57.8 \pm 2.2
From 67.0 to 100.4 \pm 5	67.8 \pm 2.2
From 40.1 to 66.9 \pm 5	77.8 \pm 2.2
From 0 to 40.0 \pm 5	89.8 \pm 2.2

FUEL LEVEL AND RESISTANCE (XP)	
FUEL LEVEL (MM)	RESISTANCE (Ω)
From 325 \pm 5 and more	0 + 2.2
From 294 to 325 \pm 5	17.8 \pm 2.2
From 263 to 294 \pm 5	27.8 \pm 2.2
From 225 to 263 \pm 5	37.8 \pm 2.2
From 190 to 225 \pm 5	47.8 \pm 2.2
From 149 to 190 \pm 5	57.8 \pm 2.2
From 93 to 149 \pm 5	67.8 \pm 2.2
From 41 to 93 \pm 5	77.8 \pm 2.2
From 0 to 41 \pm 5	89.8 \pm 2.2

GTX RFI and GSX RFI Models

The fuel pick up system is part of the fuel pump module mounted inside the fuel reservoir.

The fuel level gauge sender is also mounted on this module.

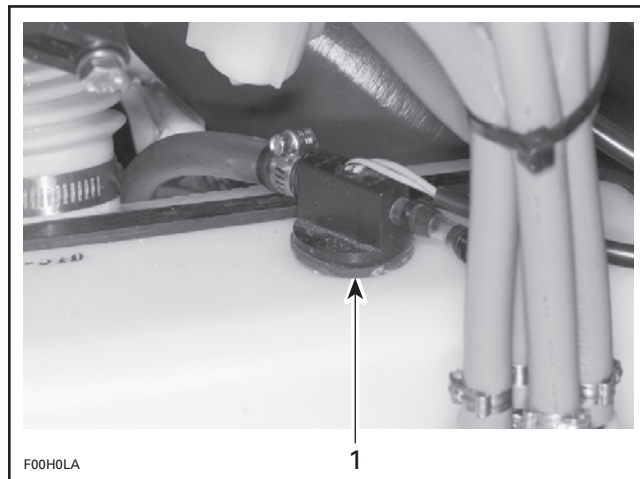


FUEL LEVEL GAUGE SENDER MOUNTED ON FUEL PUMP MODULE

Refer to FUEL INJECTION.

Oil Sensor

The sensor sends the signal to the low-oil level light in the fuel gauge or the LED in the Info Center.



1. Oil sensor

The bottom of the sensor has a small reservoir with two small holes underneath to let the oil enter inside and one at the top to let the air enter allowing the oil to flow out.

When there is enough oil inside the oil tank (and therefore in the sensor reservoir), the sensor detects the liquid and the light DOES NOT turn on.

When the oil level goes at critical LOW level inside the oil tank (and therefore in sensor reservoir), the sensor detects the absence of liquid and the light TURNS ON.

To check the oil sensor, unplug its connector and pull sensor out of oil tank.

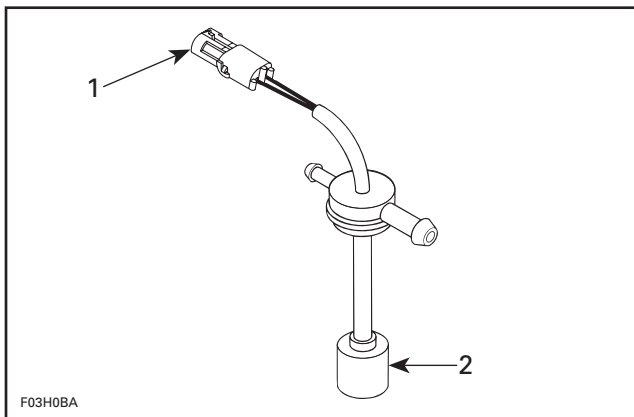
Using a multimeter, check the continuity between the BLUE and BLUE/BLACK terminals.

When sensor is out of oil tank and its reservoir is empty, resistance must be infinite (open circuit).

NOTE: Wait about 15-20 seconds before taking any reading to give the oil enough time to flow out or inside sensor reservoir.

Soak sensor in oil so that its reservoir fills up. Maximum resistance should be approximately 2 Ω (closed circuit).

TEST CONDITION	READING (Ω)
Sensor OUT of oil	∞ (open circuit)
Sensor soaked IN oil	2 Ω max. (closed circuit)



1. Measure resistance here
2. Sensor reservoir

To Reinstall Sensor:

- Remove rubber seal from sensor.
- Install seal in oil tank hole.
- Push sensor in seal.
- Plug connector.

NOTE: This sensor turns the LED to ON if the connector has been forgotten unconnected even when there is enough oil in tank.

VTS Switch

GSX RFI and XP Models

Always confirm first that the fuse is in good condition.

Disconnect BLACK wire, BLUE/WHITE wire and GREEN/WHITE wire of VTS switch.

Using a multimeter, connect test probes to switch BLACK and BLUE/WHITE wires; then, connect test probes to switch BLACK and GREEN/WHITE wires.

Measure resistance; in both test it should be high when button is released and must be close to zero when activated.

VTS Motor

GSX RFI and XP Models

Always confirm first that the fuse is in good condition.

The fuse is located on the MPEM module.

Motor condition can be checked with a multimeter. Install test probes on both BLUE/ORANGE and GREEN/ORANGE wires. Measure resistance, it should be close to 1.5 ohm.

If motor seems to jam and it has not reached the end of its stroke, the following test could be performed.

First remove motor, refer to VARIABLE TRIM SYSTEM. Then manually rotate worm to verify VTS system actuating mechanism for free operation.

Connect motor through a 15 A fuse directly to the battery.

Connect wires one way then reverse polarities to verify motor rotation in both ways.

If VTS actuating mechanism is correct and the motor turns freely in both ways, VTS module could be defective.

If VTS motor does not stop at the end of its stroke while installed, the motor could be defective.

VTS Control Module

GSX RFI and XP Models

It receives its current from the battery. It is protected by its own 7.5 A fuse, located on the MPEM module.

Section 08 ELECTRICAL SYSTEM

Subsection 05 (INSTRUMENTS AND ACCESSORIES)

RESISTANCE TEST

Disconnect BROWN/BLACK wire and BROWN/WHITE wire of VTS control module.

Connect test probes of a multimeter to BROWN/BLACK wire and BROWN/WHITE wire of VTS control module.



NOTE: To permit VTS actuation when engine is not running, remove safety lanyard from switch and depress start/stop button to activate MPEM timer.

Push on VTS switch down position until motor stops.

Read the resistance on the ohmmeter, it should indicate a resistance of 24 ohms \pm 1%.

Push on VTS switch up position until motor stops.

Read the resistance on the ohmmeter, it should indicate a resistance of 167 ohms \pm 1%.

RESISTANCE (Ω)	NOZZLE POSITION
167 \pm 1% 	UP 
24 \pm 1%	DOWN

NOTE: If the VTS control module passes this resistance test, it doesn't mean it is in perfect condition.

DIGITALLY ENCODED SECURITY SYSTEM

GENERAL

The Digitally Encoded Security System (DESS) features an anti-start protection against unauthorized use of the watercraft.

The following components are specially designed for this system: Multi-Purpose Electronic Module (MPEM), safety lanyard cap and safety lanyard switch.

The safety lanyard cap has a magnet and a ROM chip. The chip has a unique digital code.

The DESS circuitry in the watercraft MPEM is activated at the factory. Therefore, a safety lanyard must be programmed to start the engine.

NOTE: Actually, it is the memory of the MPEM which is programmed to recognize the digital code of the safety lanyard cap. This is achieved with the VCK (P/N 529 035 676) or with the MPEM programmer (P/N 529 034 500). Refer to *Guide to program* a safety lanyard.

The system is quite flexible. Up to eight safety lanyards may be programmed in the memory of the watercraft MPEM. They can also be erased.

NOTE: If desired, a safety lanyard can be used on other watercraft equipped with the DESS.

The memory of the MPEM is permanent. If the battery is disconnected, no information is lost.

The memory of the MPEM has also two self-diagnostic modes.

When ordering a new MPEM from the regular parts channel, the DESS circuitry will be activated.

Section 08 ELECTRICAL SYSTEM

Subsection 06 (DIGITALLY ENCODED SECURITY SYSTEM)

Basic Self-Diagnostic Mode

It is self-activated when the safety lanyard cap is being installed on the watercraft switch. It gives immediate monitoring. Some codes may occur only when pressing the start/stop button. Refer to the following chart.

SIGNAL	CAUSE	REMEDY
2 short beeps (while installing safety lanyard on watercraft switch)	<ul style="list-style-type: none">• Safety lanyard is recognized by the MPEM.• Good contact between safety lanyard cap and DESS post.	<ul style="list-style-type: none">• Ignition is authorized, engine can be started normally.
1 long beep (while installing safety lanyard on watercraft switch or when pressing start/stop button)	<ul style="list-style-type: none">• Bad connection between safety lanyard cap and switch.• Unprogrammed or defective safety lanyard.• Salt water or dirt in safety lanyard cap.• Improper operation of MPEM or defective wiring harness.	<ul style="list-style-type: none">• Remove and replace the safety lanyard on the switch until 2 short beeps are heard to indicate the system is ready to allow engine starting.• Use the safety lanyard that has been programmed for the watercraft. If it does not work, check safety lanyard condition with the programmer. Replace safety lanyard if reported defective. If it still does not work, enable advanced diagnostic mode to obtain more details about the failure.• Clean safety lanyard cap to remove dirt or salt water.• Enable advanced diagnostic mode to obtain more detail about the failure.
4 long beeps (while installing safety lanyard on DESS post)	<ul style="list-style-type: none">• The MPEM cannot communicate with the BOSCH ECU (787 RFI).	<ul style="list-style-type: none">• Check fuse on relay located in front electrical box or on the MPEM.• Check connectors between MPEM and ECU module.
	<ul style="list-style-type: none">• Low battery voltage.	<ul style="list-style-type: none">• Check battery connections and battery condition.• Recharge or replace battery.
8 short beeps	<ul style="list-style-type: none">• Defective MPEM (memory).	<ul style="list-style-type: none">• Replace MPEM.
Continuous beep	<ul style="list-style-type: none">• Engine overheating.	<ul style="list-style-type: none">• Refer to TROUBLESHOOTING CHART 03-01.

Advanced Self-Diagnostic Mode

It needs to be enabled manually. Proceed as follows:

1. Remove safety lanyard cap from watercraft switch.
2. Press 5 times on the watercraft start/stop button.

NOTE: 1 short beep and 1 long beep must be heard. They validate beginning of diagnostic mode.

3. Install safety lanyard on watercraft switch.
4. Press the watercraft start/stop button again.

NOTE: If everything is correct, engine will start. Otherwise, refer to the following chart.

SIGNAL	CAUSE	REMEDY
No beep	<ul style="list-style-type: none"> • Engine actually starts. 	<ul style="list-style-type: none"> • Everything is correct.
1 long and 1 short beeps	<ul style="list-style-type: none"> • No safety lanyard has ever been programmed in watercraft MPEM. 	<ul style="list-style-type: none"> • Use programmer and program a safety lanyard. This code can occur only when you receive a new MPEM from the factory and no key has ever been programmed.
2 short beeps	<ul style="list-style-type: none"> • MPEM can not read the digital code of the safety lanyard cap or the magnet is defective. • Mixed wires at safety lanyard switch connectors or bad connections. 	<ul style="list-style-type: none"> • Check safety lanyard cap condition with the MPEM programmer. Replace safety lanyard if reported defective. • Check switch wiring harness.
2 long beeps	<ul style="list-style-type: none"> • Wrong safety lanyard or bad connection of the DESS wires. 	<ul style="list-style-type: none"> • Use the safety lanyard that has been programmed for the watercraft. If the problem is not resolved, check safety lanyard cap condition with the MPEM programmer. Replace safety lanyard if reported defective.
3 short beeps	<ul style="list-style-type: none"> • Wiring harness of DESS switch is grounded or there is a short circuit. 	<ul style="list-style-type: none"> • Check wiring harness and safety lanyard switch.

If you need to listen again the coded beeps, remove safety lanyard and repeat the procedure to activate the diagnostic mode.

If there is more than one problem, the MPEM will send only one error code. When the problem is solved, the MPEM will send a second code and so on until all problems are resolved.

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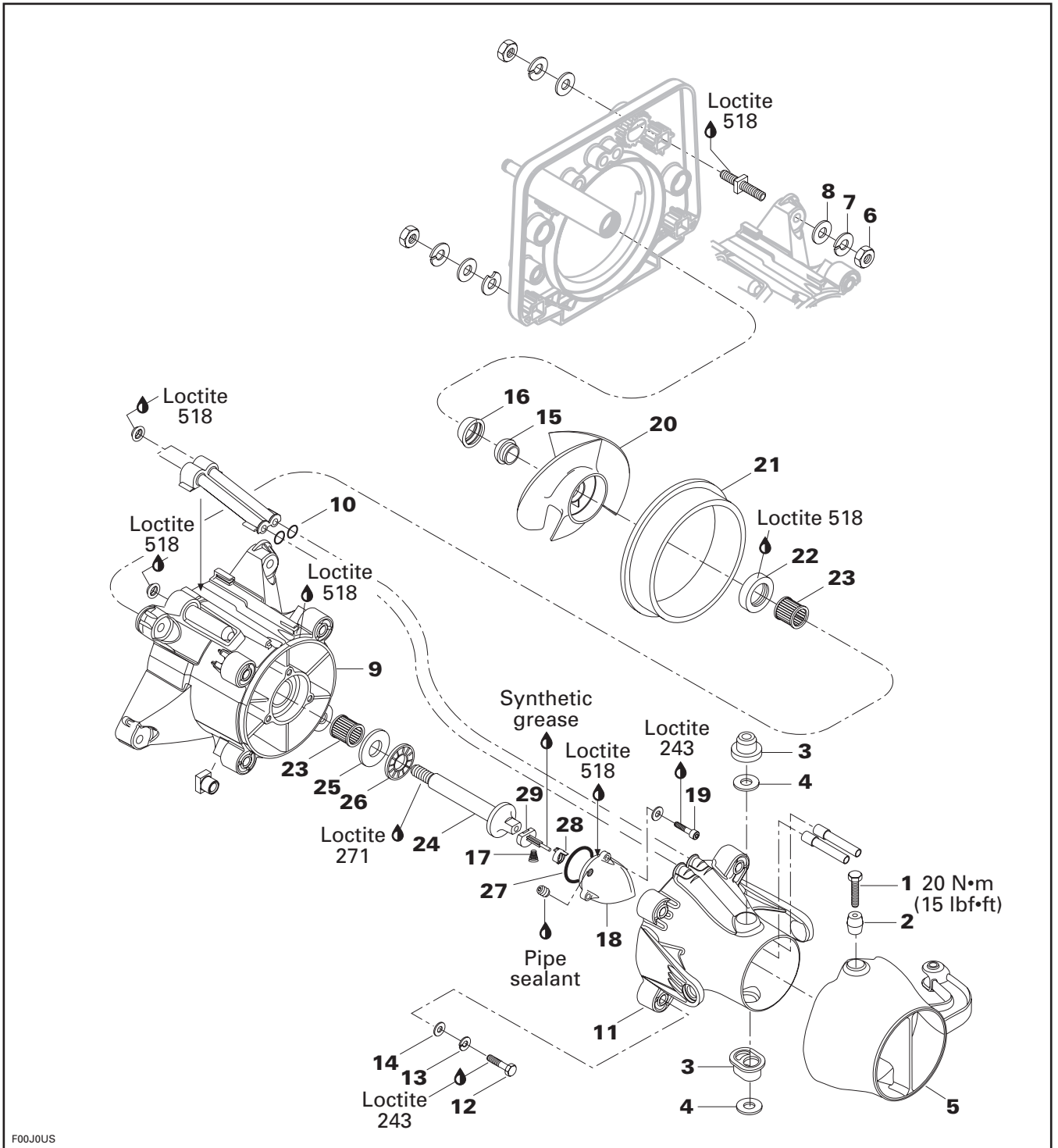
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JET PUMP



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Section 09 PROPULSION SYSTEM

Subsection 02 (JET PUMP)

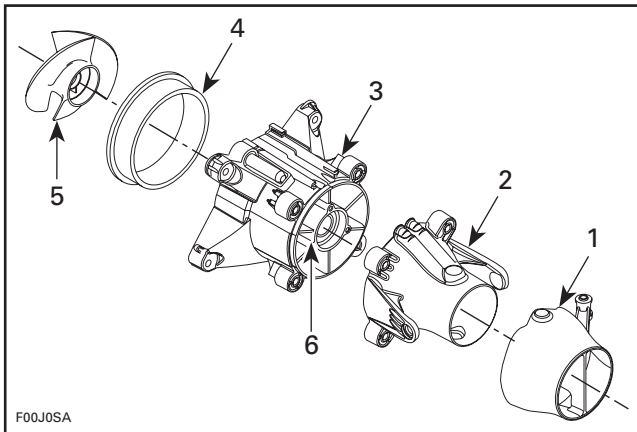
GENERAL

The jet pump housing is made of plastic. It is a one piece plastic unit, including the stator.

The jet pump housing and the stator are made of plastic on all models.

The venturi is made of plastic on all models except for the GTX and XP which have a venturi made of aluminum.

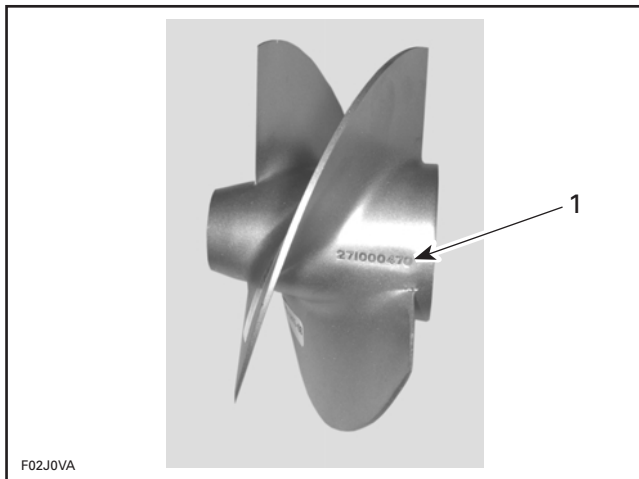
The nozzle is made of plastic on the GTS model only. On all other models, the nozzle is made of aluminum.



1. Nozzle
2. Venturi
3. Housing
4. Wear ring
5. Impeller
6. Stator

Impeller Identification

To identify the impellers refer to the following illustration and chart.



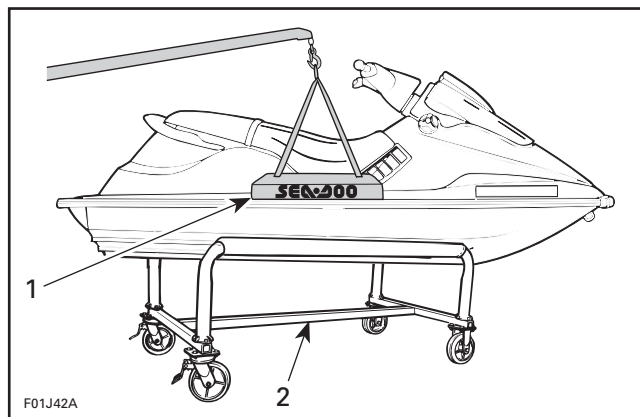
1. Stamped part number

WATERCRAFT MODEL	IMPELLER P/N	MATERIAL	PITCH
GS	204 160 072	Stainless steel	Progressive pitch 11° - 22°
GSX RFI	271 001 024	Stainless steel	Progressive pitch 12° - 25°
XP	271 000 920	Stainless steel	Progressive pitch 15° - 21°
GTS	271 000 826	Stainless steel	Progressive pitch 11° - 22°
GTI	204 160 072	Stainless steel	Progressive pitch 15° - 21°
GTX	271 000 920	Stainless steel	Progressive pitch 15° - 21°
GTX RFI	271 001 024	Stainless steel	Progressive pitch 12° - 25°

JET PUMP INSPECTION ON WATERCRAFT

To work on watercraft, securely install it on a stand. Thus, if access is needed to water inlet area, it will be easy to slide underneath watercraft.

A lift kit (P/N 295 100 044) can be used to install watercraft on a stand.

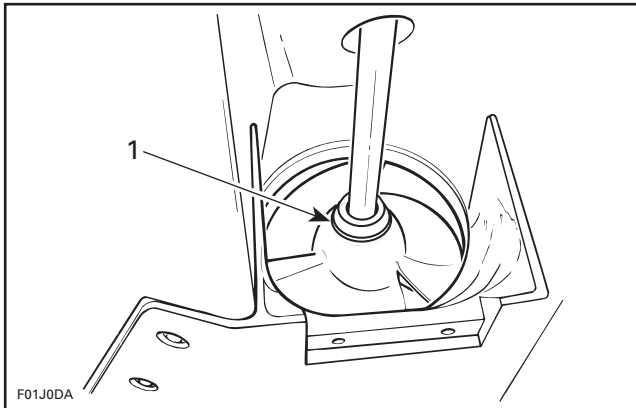


TYPICAL

1. Lift kit
2. Work stand

Impeller Condition

Condition of impeller no. 20, boot no. 15 and ring no. 16 can be quickly checked from underneath of the watercraft. Remove grate and look through water inlet opening.



TYPICAL

1. Inspect impeller and boot

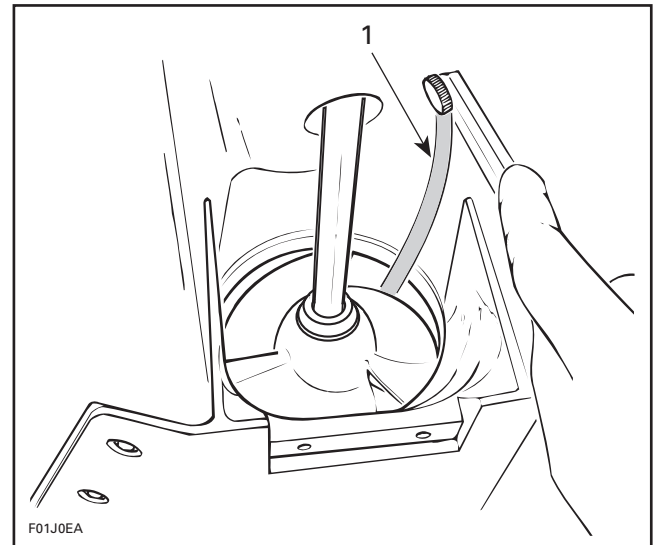
Impeller/Wear Ring Clearance

This clearance is critical for jet pump performance. Clearance can be checked from water inlet opening or from venturi side. However, the last method requires more work.

To check clearance from water inlet side, remove inlet grate.

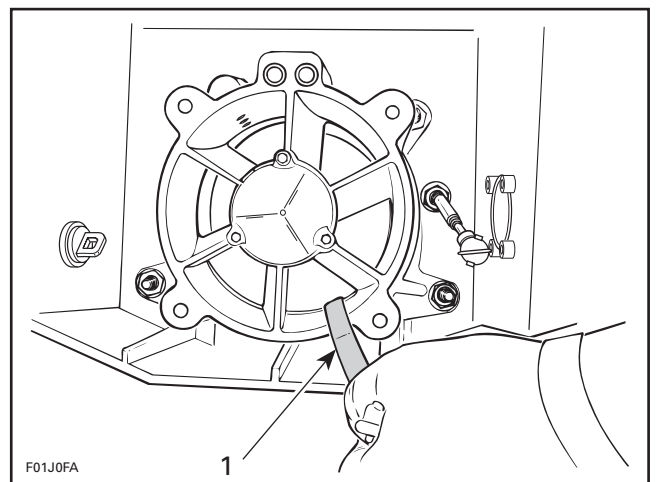
To check clearance from venturi side, remove venturi/nozzle assembly as described in **Oil Inspection** in this subsection.

Using a feeler gauge with 30 cm (12 in) blades, measure clearance between impeller blade tip and wear ring. Measure each blade at its center. Clearance should not exceed 1.0 mm (.040 in). If clearance is greater, disassemble jet pump and inspect impeller and wear ring. Renew worn parts.



TYPICAL — MEASURING FROM WATER INLET SIDE

1. Feeler gauge



TYPICAL — MEASURING FROM VENTURI SIDE

1. Feeler gauge

Oil Inspection

Detach ball joint of steering cable from nozzle.

GSX RFI and XP

Detach ball joint of VTS link rod.

GTS, GTI and GTX

Detach ball joint of reverse cable and springs from reverse gate (GTS model only).

Section 09 PROPULSION SYSTEM

Subsection 02 (JET PUMP)

All Models

Remove 4 screws retaining venturi to jet pump housing.

GTI and GTX

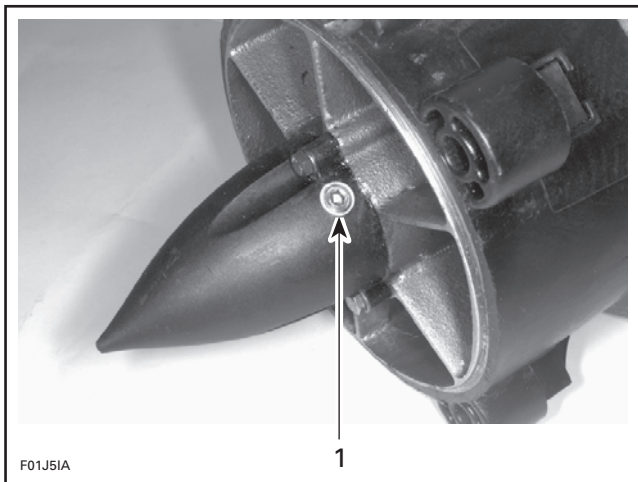
Remove reverse gate and support.

All Models

Pull nozzle and venturi from jet pump housing.

NOTE: On the GTS model, the venturi and reverse gate are removed as an assembly.

Remove plug from cover.



TYPICAL

1. Remove plug

Check oil level, it should be at bottom of hole threads.

If oil level is low, check impeller shaft housing for leaks. A pressure test must be performed. See PUMP PRESSURIZATION in this subsection.

To check oil condition, insert a wire through oil level hole then withdraw. A whitish oil indicates water contamination.

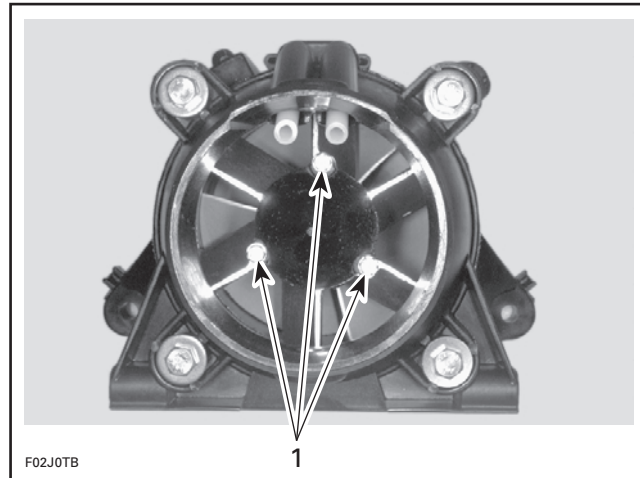
This may involve defective impeller shaft seal and/or O-ring of housing cover. Jet pump unit should be overhauled to replace seal.

If everything is correct, apply Loctite pipe sealant (P/N 293 800 018) on plug threads and reinstall it on cover. Properly reinstall removed parts.

Oil Replacement

Remove venturi as described in **Oil Inspection**.

Remove 3 screws retaining cover.



1. Screws

Using a fiber hammer, gently tap cover to release it from housing cover.

Thoroughly clean reservoir and inside of cover with a solvent. Check O-ring condition. Replace as necessary.

Apply a thin layer of Loctite 518 on mating surface of cover and reinstall it with its O-ring.

Apply Loctite 243 on threads and torque screws to 7 N•m (62 lbf•in) on the XP and GTX models and 4 N•m (35 lbf•in) on the other models.

Remove plug from cover.

Pour oil through hole until oil reaches the bottom of hole threads. Use SEA-DOO JET PUMP SYNTHETIC OIL (P/N 293 600 011) only. Oil will drain slowly into center area of housing, wait a few minutes and readjust oil level.

CAUTION: This is a synthetic oil. Do not mix with mineral based oil. Do not mix oil brands.

Apply Loctite pipe sealant (P/N 293 800 018) on plug threads and reinstall it on cover.

Properly reinstall removed parts.

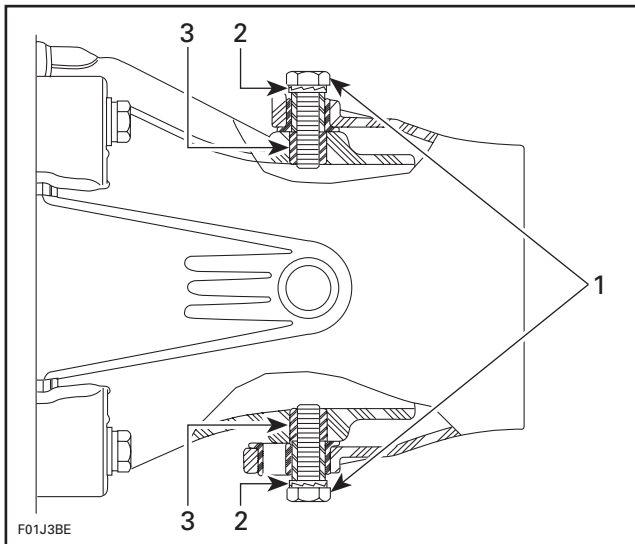
REMOVAL

Nozzle

Disconnect steering cable from jet pump nozzle no. 5.

GS, GTS, GTI and GTX

Remove 2 retaining screws no. 1, 2 sleeves no. 2, 2 washers no. 4.



TYPICAL

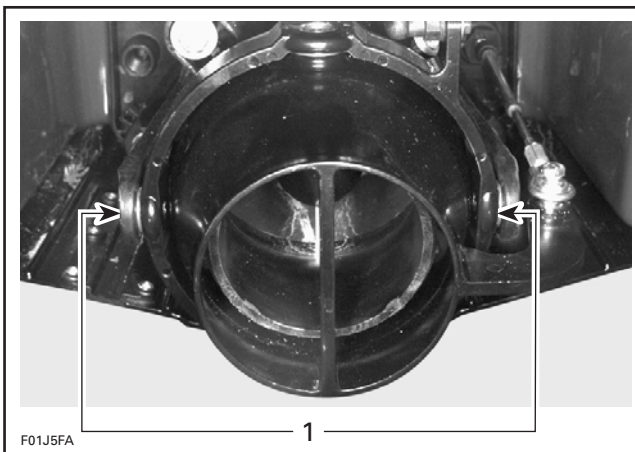
1. Screw
2. Washers
3. Sleeve

Remove nozzle.

GSX RFI and XP

Disconnect ball joint of VTS link rod.

Loosen 2 screws each side of trim ring.



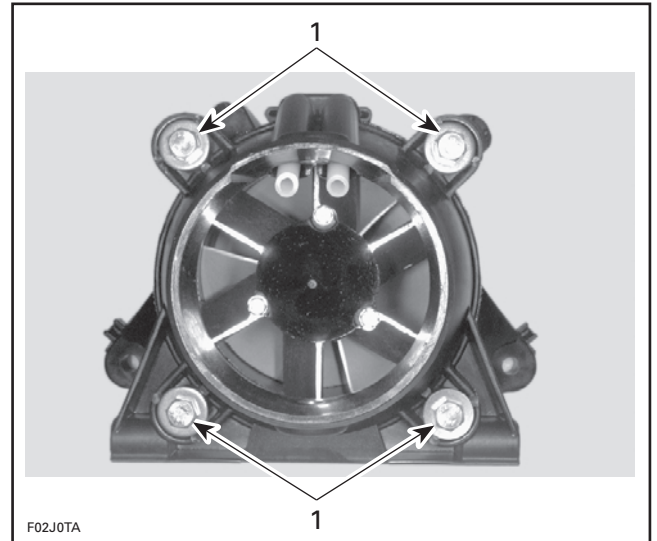
1. Remove screws

Remove nozzle.

Venturi

Disconnect steering cable from nozzle no. 5 prior removing venturi no. 11.

Remove 4 retaining screws and withdraw venturi.

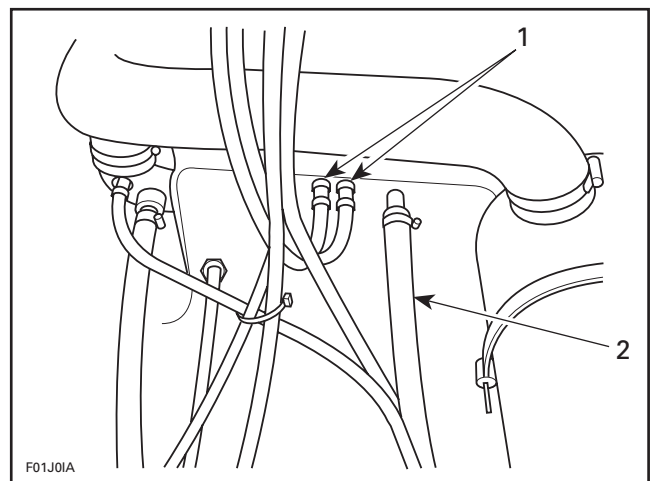


1. Remove screws

Jet Pump Housing

GTS Model

Disconnect engine water supply hose and both bailer pick up tubes in bilge.



TYPICAL

1. Bailer pick up tubes
2. Engine water supply hose

GSX RFI and XP

Detach ball joint of VTS link rod.

GTS, GTI and GTX

Detach ball joint of reverse cable and springs (GTS model) from reverse gate.

Section 09 PROPULSION SYSTEM

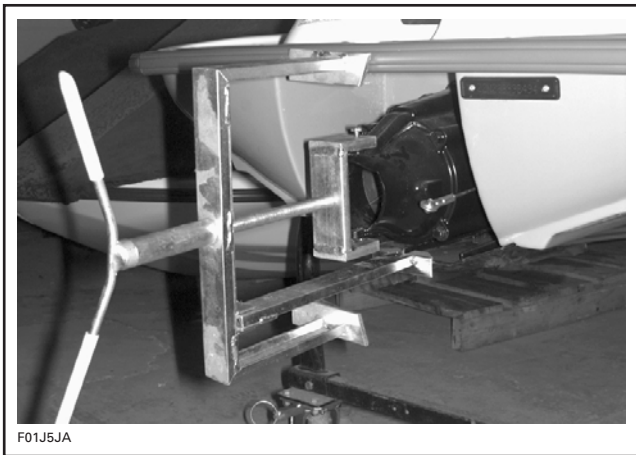
Subsection 02 (JET PUMP)

All Models Except GTS

Disconnect steering cable from jet pump nozzle.
Loosen 4 hexagonal nuts **no. 6** and remove flat washers and lock washers from jet pump housing.
Remove jet pump with a wiggle movement.

GTS Model

Disconnect steering cable from jet pump nozzle.
Remove nozzle.
Loosen 4 hexagonal nuts **no. 6** and remove flat washers and lock washers from jet pump housing.
Using screws previously removed from nozzle, install jet pump housing remover tool (P/N 295 000 113) on venturi.



TYPICAL

Rotate handle clockwise to remove jet pump.

All Models

CAUTION: When removing pump unit, a shim could have been installed between hull and pump housing. Be sure to reinstall it otherwise engine and jet pump alignment will be altered.

NOTE: After jet pump removal, if drive shaft remains in the PTO flywheel (except XP), simply pull it out. If drive shaft is seized in the PTO flywheel, refer to DRIVE SYSTEM.

DISASSEMBLY

NOTE: Whenever removing a part, visually check for damage such as: corrosion, crack, split, break, porosity, cavitation, deformation, distortion, heating discoloration, wear pattern, missing plating, missing or broken needles in needle bearing, water damage diagnosed by black-colored spots on metal parts, etc. Renew any damaged part. As a quick check, manually feel clearance and end play, where applicable, to detect excessive wear.

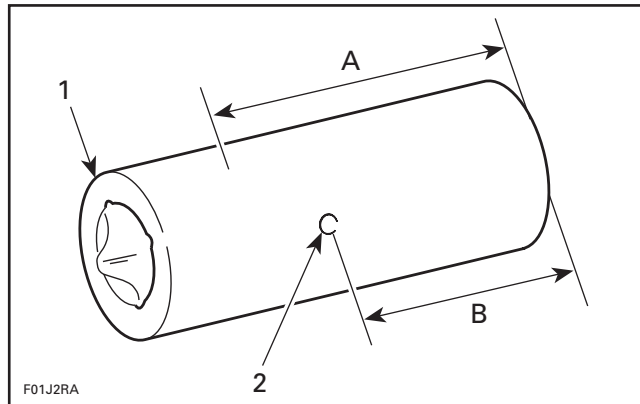
GTS Model

Pump Fitting

Pump fittings can be removed with deep socket or vise grip. Do not contact hose mounting area.

Fittings can be removed from pump housing with the following suggested tool:

- Use a 14 mm (9/16 in) deep socket.
- Drill deep socket with a 14 mm (9/16 in) drill bit, starting at hexagon head end as shown in following illustration.
- Drill a 2.40 mm (3/32 in) hole in center of deep socket as shown in following illustration.
- Install 2.40 mm (3/32 in) roll pin in the center hole.



1. Deep socket 14 mm (9/16 in)
2. Roll pin 2.40 mm (3/32 in)
- A. 42.50 mm (1-43/64 in)
- B. 36.80 mm (1-29/64 in)

All Models

Cover

With pump assembly in horizontal position, remove 3 retaining screws **no. 19**.

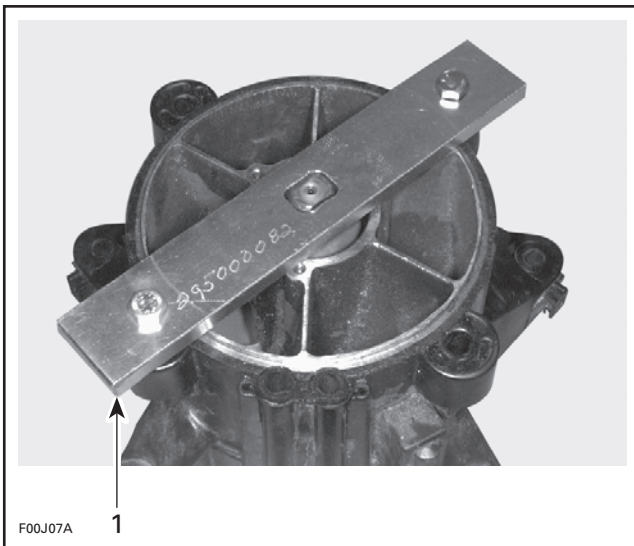
Place container under cover **no. 18** to catch oil.

Using a fiber hammer, gently tap cover to release it from jet pump housing.

Impeller

Insert impeller shaft holder (P/N 295 000 082) on impeller shaft flat end.

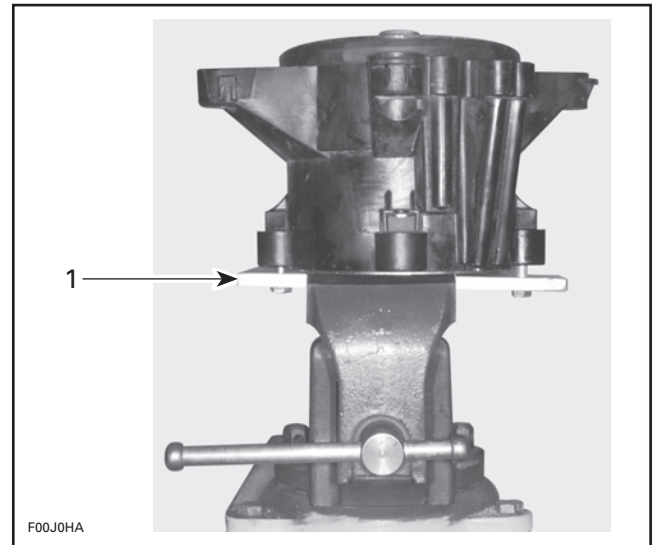
Using 2 screws previously removed from venturi, secure shaft holder to housing.



1. Shaft holder

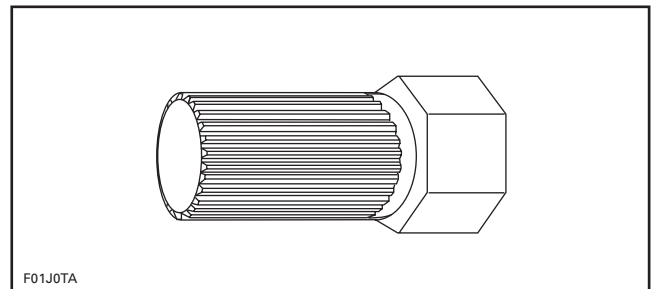
Heat impeller shaft end with a propane torch to approximately 150°C (300°F) to break the Loctite bond before to remove impeller. Do not heat impeller directly.

Install shaft holder in a vice.

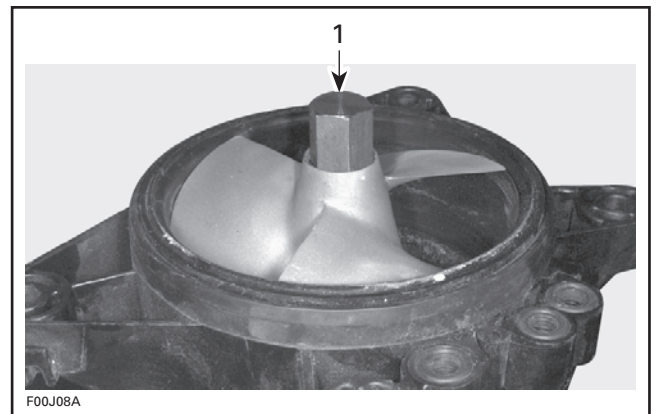


1. Shaft holder

Impeller is loosened using impeller remover tool (P/N 295 000 001).



Insert special tool in impeller splines.



1. Impeller remover tool

Section 09 PROPULSION SYSTEM

Subsection 02 (JET PUMP)

Rotate impeller remover tool counterclockwise and unscrew completely impeller.

CAUTION: Never use any impact wrench to loosen impeller.

To remove impeller, apply a rotating movement and pull at same time. Slide impeller out of housing. Remove tool from impeller.

Wear Ring

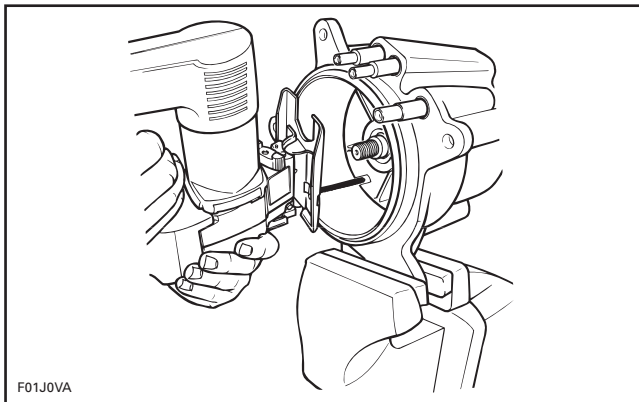
NOTE: On the models with the large pump (947 engine), remove the screws retaining wear ring in the jet pump housing.

Place jet pump housing in a vise with soft jaws. It is best to clamp housing using a lower ear.

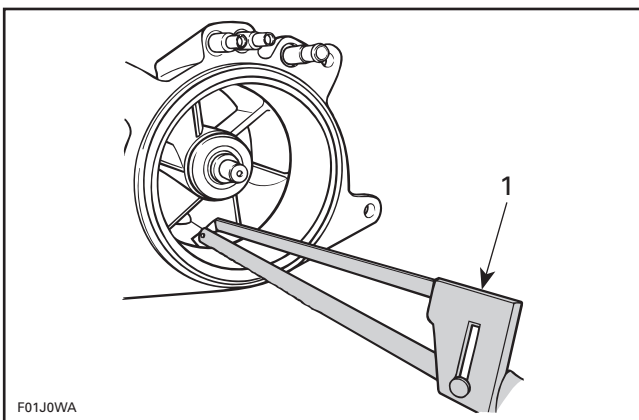
Cut wear ring at two places.

CAUTION: When cutting ring, be careful not to damage jet pump housing.

NOTE: Wear ring can be cut using a jigsaw, a small grinder or a low clearance hacksaw such as Snap-on HS3 or equivalent.



TYPICAL



TYPICAL

1. Snap-on HS3

After cutting ring, insert a screwdriver blade between jet pump housing and ring outside diameter.

Push ring so that it can collapse internally.

Pull ring out.

Impeller Shaft

Remove shaft holder tool.

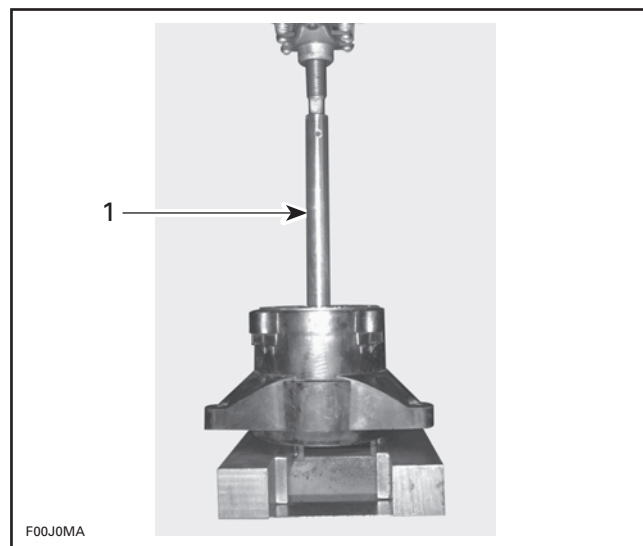
Remove impeller shaft no. 24 with thrust washer and thrust bearing.

Seal and Needle Bearing

Remove seal no. 22 and bearings no. 23 at the same time using bearing/seal remover tool (P/N 295 000 144).



Insert bearing remover then press tool using a arbor press until seal and bearings are out. However, care should be taken not to damage bearing journals.



1. Bearing/seal remover tool

NOTE: It is always recommended to renew both bearings, even if only one bearing needs to be replaced.

CLEANING

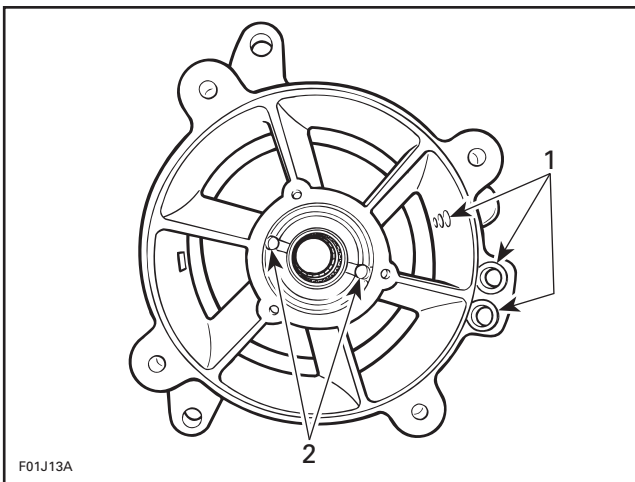
All Models

Sealant on the jet pump housing can be removed with a wire brush (disc) mounted on a drill or a scraper.

Properly clean all threads.

Remove all O-rings and clean parts in a solvent.

Carefully check water passages and oil passages. Blow low pressure compressed air through them and make sure they are clear.



TYPICAL

1. Water passages
2. Oil passages

Brush and clean impeller shaft threads, impeller and drive shaft splines with Loctite Safety solvent 755 (P/N 293 800 019) or equivalent. Free threads and splines from any residue.

CAUTION: Be careful not to damage impeller shaft diameter.

PARTS INSPECTION

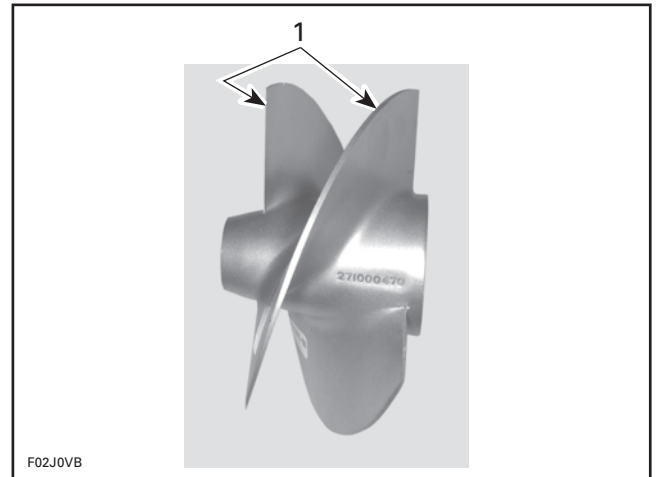
Impeller

Visually inspect impeller splines. Check for wear or deformation. Renew parts if damaged.

NOTE: Check also PTO flywheel and drive shaft condition. Refer to BOTTOM END and DRIVE SYSTEM.

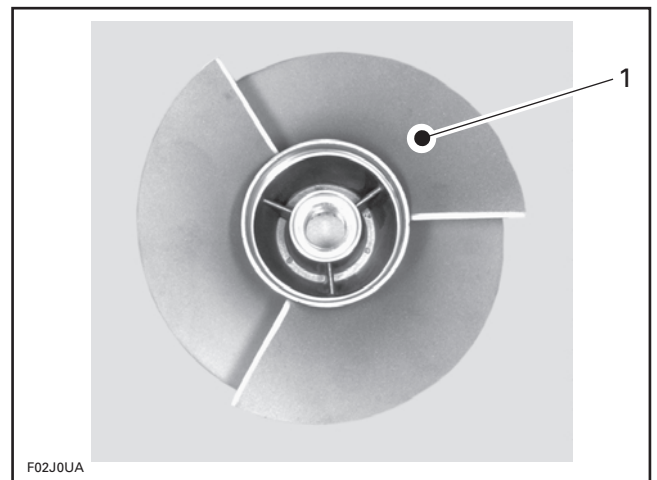
Examine impeller in wear ring for distortion.

Check if blade tips are blunted round, chipped or broken. Such impeller is unbalanced and will vibrate and damage wear ring, impeller shaft, shaft seal or bearings. Renew if damaged.



1. Replaced if blunted round or damaged

Check impeller for cavitation damage, deep scratches or any other damage.



1. Check for cavitation, deep scratches or other damage

Wear Ring

Check wear ring **no. 21** for deep scratches, irregular surface or any apparent damage.

If impeller/wear ring clearance is too large and impeller is in good shape, renew wear ring.

Section 09 PROPULSION SYSTEM

Subsection 02 (JET PUMP)

Needle Bearing and Impeller Shaft

WEAR

Inspect needle bearings **no. 23** and their contact surface. Check for scoring, pitting, chipping or other evidence of wear.

With your finger nail, feel contact surface of seal. If any irregular surface is found, renew impeller shaft **no. 24**.

Install bearings, then install impeller shaft and rotate it. Make sure it turns smoothly.

RADIAL PLAY

Radial play is critical for jet pump unit life span.

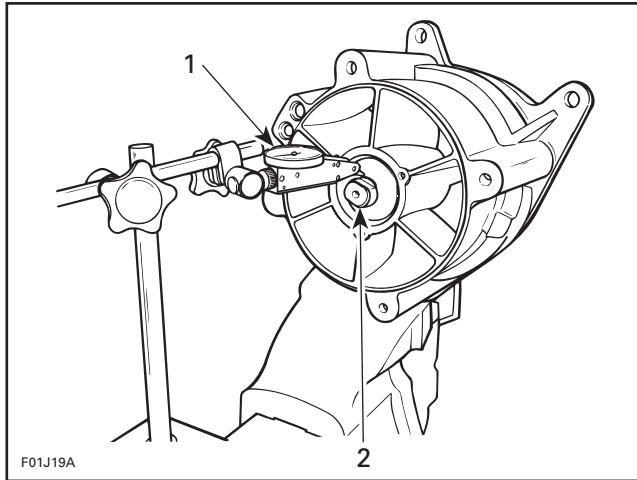
Radial play of impeller shaft is checked with shaft in housing, without impeller.

Retain housing in a soft jaw vise making sure not to damage housing lug.

Set a dial gauge and position its tip onto shaft end, close to end of threads.

Move shaft end up and down. Difference between highest and lowest dial gauge reading is radial play.

Maximum permissible radial play is 0.05 mm (.002 in).



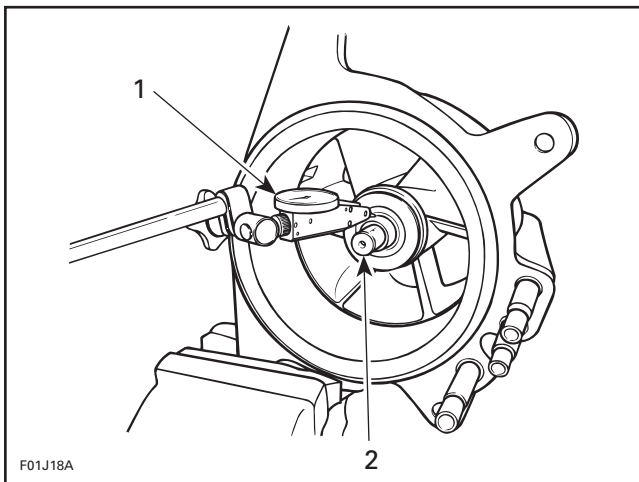
TYPICAL — MEASURING IMPELLER SHAFT RADIAL PLAY

1. Dial gauge
2. Measure close to flats at shaft end

Excessive play can come either from worn bearings or impeller shaft or damaged jet pump housing bearing surfaces.

Measuring shaft diameter will determine the defective parts.

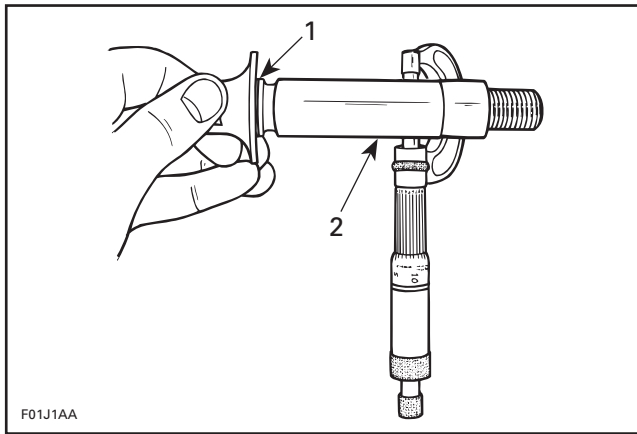
Using a micrometer, measure diameter on bearing contact surfaces. **Minimum** shaft diameter should be 22.24 mm (.876 in).



TYPICAL — MEASURING IMPELLER SHAFT RADIAL PLAY

1. Dial gauge
2. Measure close to threads at shaft end

To check both bearings, proceed the same way with other shaft end. Position gauge tip on diameter, close to flats on shaft.

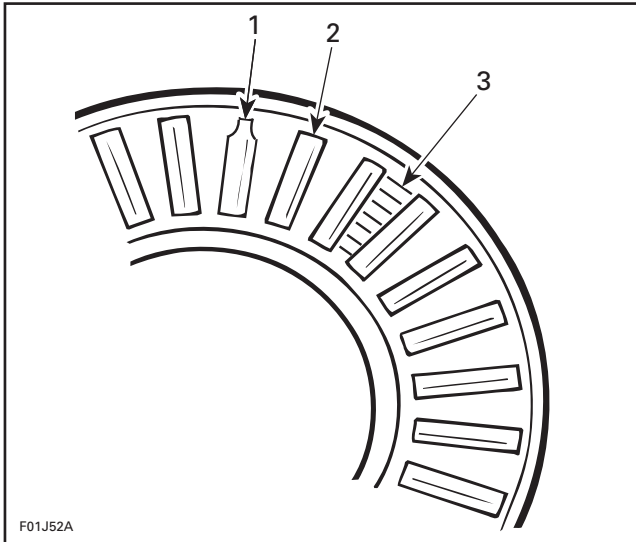


1. Inspect for wear at the bearing pilot
2. Radial bearing raceway

NOTE: If shaft is to be replaced, it is recommended to replace both bearings at the same time. In addition, it is suggested to replace thrust bearing and thrust washer.

Thrust Washer and Thrust Bearing

Visually inspect thrust washer **no. 25**, thrust bearing **no. 26** and their contact surface. Check for scoring, pitting, flaking, discoloration or other evidence of wear. For best inspection, use a 7X magnifying glass to check wear pattern.



TYPICAL

1. Worn roller (trunnion worn on end roller)
2. Good roller (cylindrical shape)
3. Look for scoring on retainer

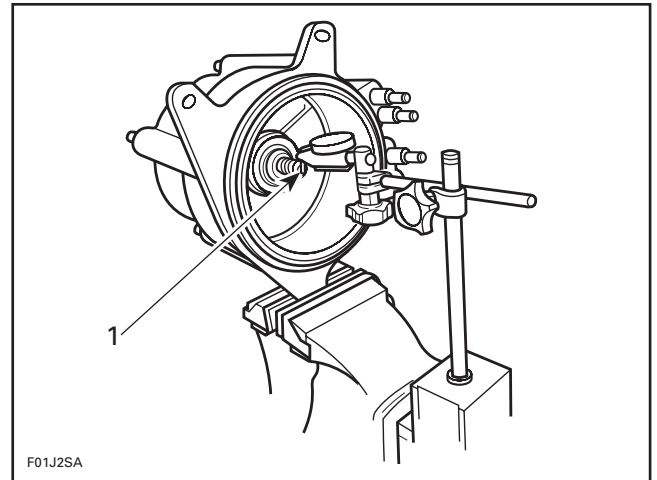
NOTE: When replacing either washer or bearing, it is recommended to renew both.

Cover and Impeller Shaft

END PLAY

End play of impeller shaft **no. 24** is checked with shaft in housing, without impeller and with cover **no. 18** installed.

Retain housing in a soft jaw vise making sure not to damage housing lug. Set a dial gauge and position its tip on the end of shaft. Move shaft end by pulling and pushing. Difference between highest and lowest dial gauge reading is end play. Maximum permissible end play (new) is 0.12 - 0.54 mm (.005 - .021 in). Make sure vise is secured and not adding to your measurement as you move impeller shaft.

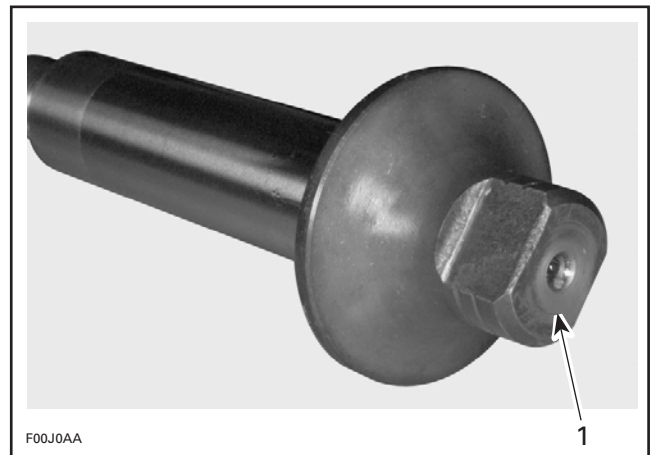


1. Tip on shaft end

Excessive play comes from a worn anti-rattle system located between cover and impeller shaft nose.

Remove the anti-rattle system and change it. See below for proper installation.

Inspect impeller shaft nose for wear.



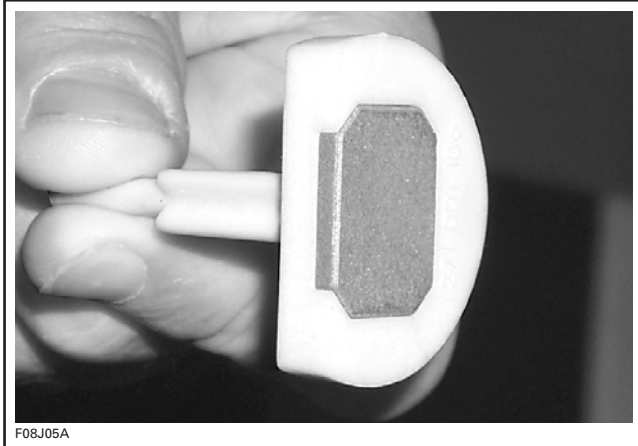
1. Impeller shaft nose

Section 09 PROPULSION SYSTEM

Subsection 02 (JET PUMP)

Anti-Rattle Pusher

Check for melted plastic around metal pad. If so, replace it.



Check for excessive wear of pad.

Seal

Carefully inspect seal lips. Make sure that lips are not worn, distorted, cracked or show signs of any other damage. Replace after 150 hours even if it seems good.

ASSEMBLY

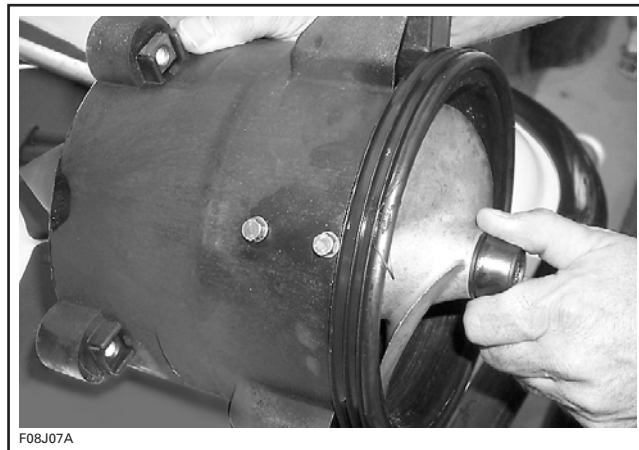
Wear Ring

GTX and XP

These models are equipped with large pumps. It is important that the screws retaining wear ring to housing are installed on this models.

On the old models, it is necessary to drill holes. Use a bit no. 20 and drill holes 9 mm (.35 in) deep maximum. See the next illustrations for proper holes location.

NOTE: Do not drill holes through the soft part of the wear ring.



CAUTION: Drilling holes someplace else can cause important damages to the housing.

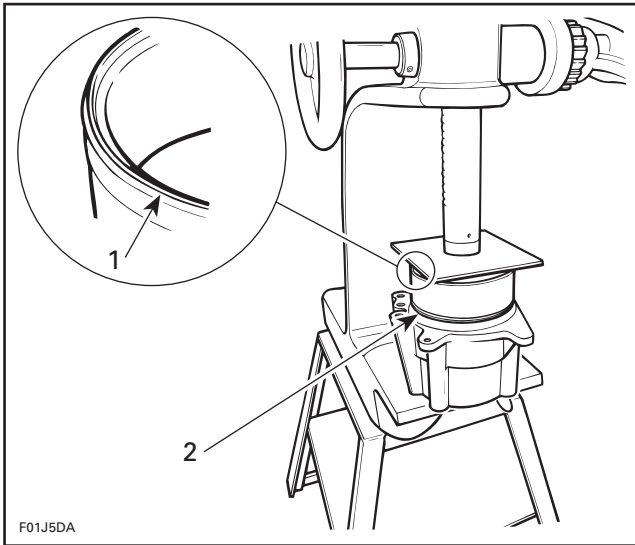
All Models Except GTX and XP

To install ring in housing, use a square steel plate of approximately 180 x 180 mm x 6 mm thick (7 x 7 in x 1/4 in) and a press.

Manually engage ring in housing making sure it is equally inserted all around. Press ring until it seats into bottom of housing.

Section 09 PROPULSION SYSTEM

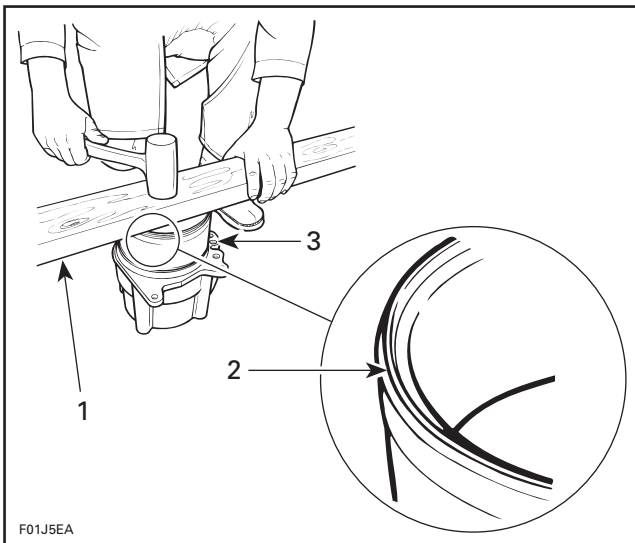
Subsection 02 (JET PUMP)



1. Seal lip
2. Press wear ring

If a press is not readily available, a piece of wood such as a 2 x 4 in x 12 in long, can be used.

Manually engage ring in housing making sure it is equally inserted all around. Place wood piece over ring. Using a hammer, strike on wood to push ring. Strike one side then rotate wood piece about 90° and strike again. Frequently rotate wood piece so that ring slides in evenly until it seats into bottom of housing.



1. Piece of wood
2. Seal lip facing upward
3. Wear ring

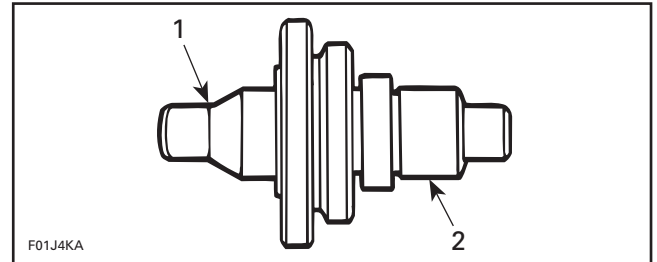
GTX and XP models

Manually engage ring in housing making sure it is equally inserted all around. Press ring until it seats into bottom of housing.

Install retaining screws.

Seal and Needle Bearing

Bearings no. 23 and seal no. 22 will be properly installed in housing using bearing/seal installer tool (P/N 295 000 107).



BEARING/SEAL INSTALLER TOOL

1. Seal side
2. Bearing side

155.6 mm Jet Pump Models

For **outlet end** of housing use inner bearing installer tool (P/N 529 035 609).



CAUTION: Failure to use this tool will cause major damage to the pump.

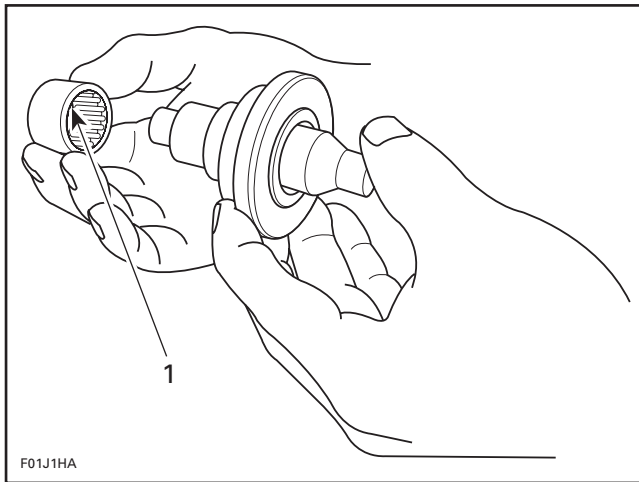
All Models

Stamped end of bearings (showing identification markings) must be located toward outside of housing.

Properly insert bearing on tool. Using an arbor press only, push tool until tool flange contacts housing. Proceed the same way for both bearings.

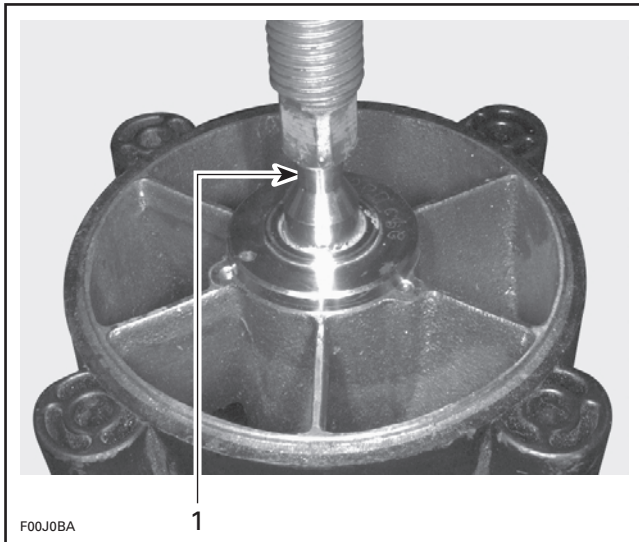
Section 09 PROPULSION SYSTEM

Subsection 02 (JET PUMP)



1. Stamped end this side

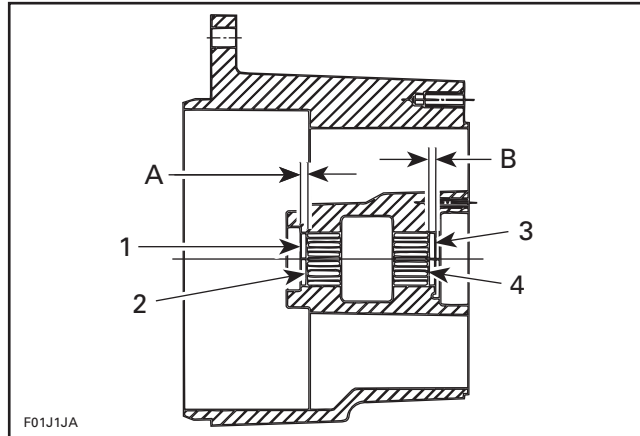
CAUTION: Never hammer the bearing into its housing.



1. Press on tool until it stops

CAUTION: This tool have been designed to properly position bearings and seal, thus providing space for lubrication purposes. The tool flanges allow this. If a different pusher type is being used, components must be properly positioned as follows.

Bearing on impeller side must be 1.5 to 2.5 mm (.060 - .100 in) inside reservoir measured from seal seat. Bearing on venturi side must be 2 to 4 mm (.080 - .157 in) inside reservoir measured from thrust washer seat. Refer to following illustration.

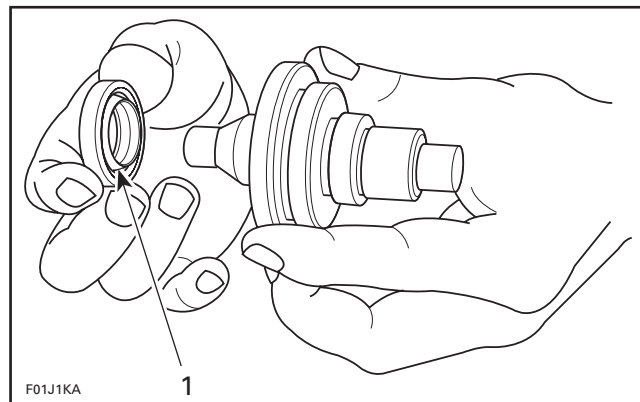


1. Seal seat
2. Stamped end of bearing
3. Thrust washer seat
4. Stamped end of bearing
- A. 1.5 - 2.5 mm (.060 - .100 in)
- B. 2 - 4 mm (.080 - .157 in)

Apply Loctite 518 (P/N 293 800 038) to seal housing, all around outer diameter and on seal seat.

Properly insert seal on tool.

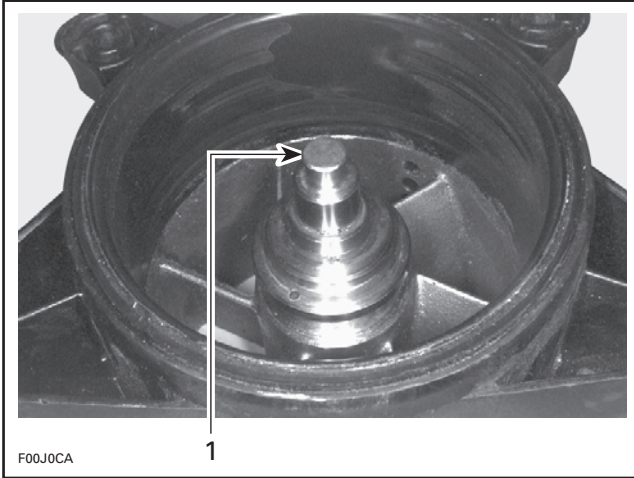
Install seal with the spring toward the **outside**.



1. Spring of seal this side

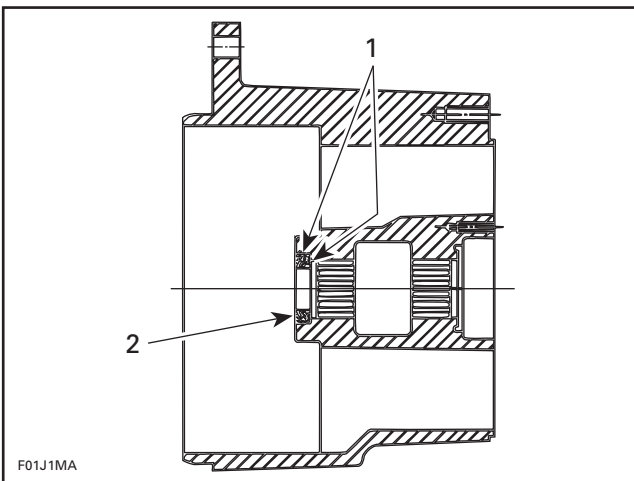
CAUTION: Prevent sealant from contacting any needles of bearing.

Push on tool end with a press until tool flange contacts housing.



1. Press on tool until it stops

Apply synthetic grease (P/N 293 550 010) between seal lips.

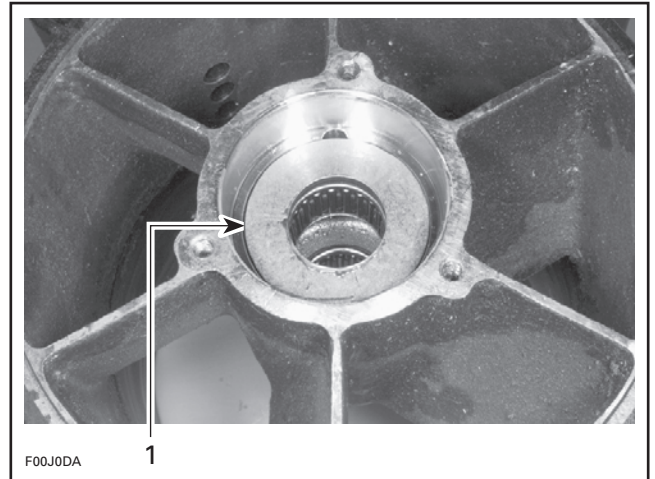


1. Loctite 518 all around and behind
2. Spring of seal lip this side

Thrust Washer

Position jet pump housing no. 9 with the stator vanes on top.

Insert thrust washer no. 25 in the stator seat.

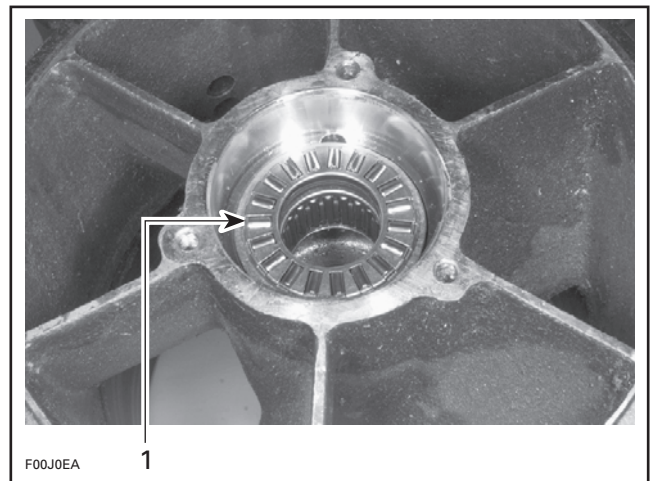


1. Thrust washer properly installed in stator seat

Thrust Bearing

Apply SEA-DOO JET PUMP SYNTHETIC OIL (P/N 293 600 011) on both sides of thrust bearing.

Position thrust bearing no. 26 on thrust washer no. 25.



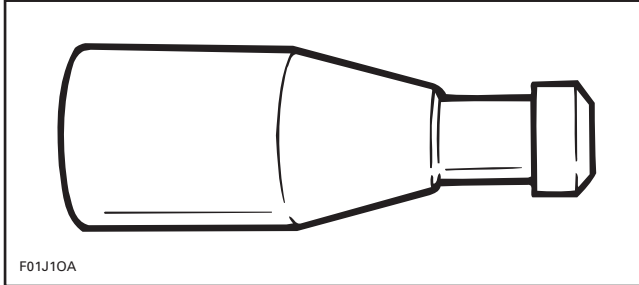
1. Thrust bearing on top of thrust washer

Section 09 PROPULSION SYSTEM

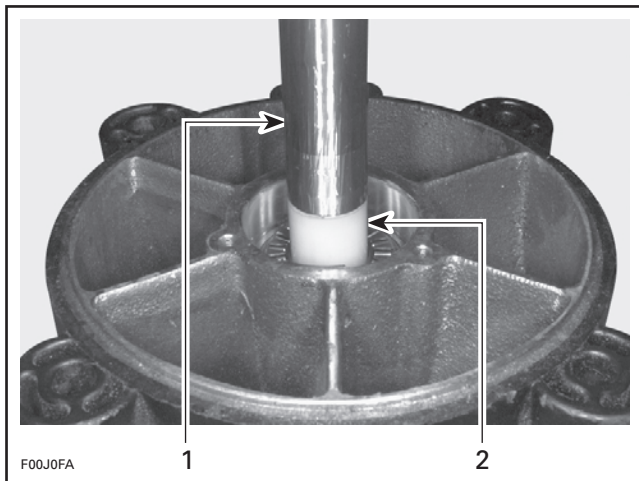
Subsection 02 (JET PUMP)

Impeller Shaft

To prevent seal lip damage when inserting impeller shaft, use impeller shaft guide (P/N 295 000 002).



Insert tool onto shaft end then carefully install shaft in jet pump housing.



1. Impeller shaft
2. Impeller shaft guide

NOTE: If jet pump housing rest against a table, raise it slightly to allow complete shaft insertion with the shaft guide.

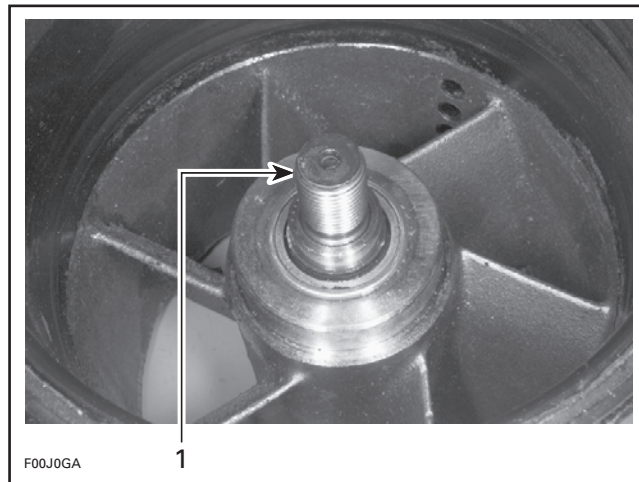
Remove shaft guide.

Impeller

Apply Loctite primer N (P/N 293 600 012) on threads of impeller shaft **no. 24**. Allow to dry for 2 minutes.

NOTE: Loctite primer is used to reduce Loctite 243 curing time and to activate stainless steel and aluminum surfaces for better bonding action. If applied, complete curing time is 6 hours, if primer is not used, allow 24 hours for curing time.

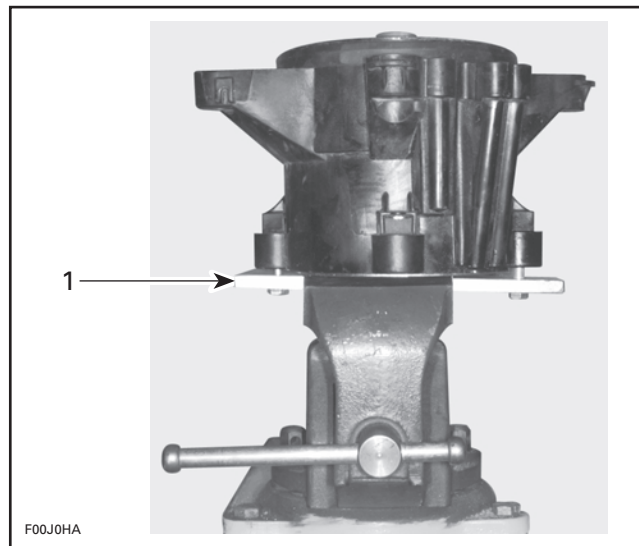
Apply Loctite 243 (blue) to shaft threads.



1. Apply Loctite 243 (blue) on threads

Using 2 screws previously removed from venturi, secure impeller shaft holder tool to housing.

Install shaft holder tool in a vice.

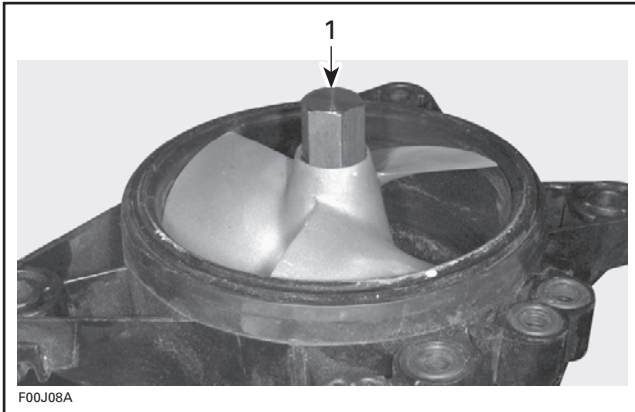


1. Impeller shaft holder secured in a vice

To ease impeller installation, apply BOMBARDIER LUBE lubricant on wear ring.

Insert impeller into wear ring. Manually rotate impeller and push so that it slides on impeller shaft threads. Carefully engage threads making sure they are well aligned.

Install impeller remover/installer tool into impeller splines and tighten.



1. Impeller remover/installer tool

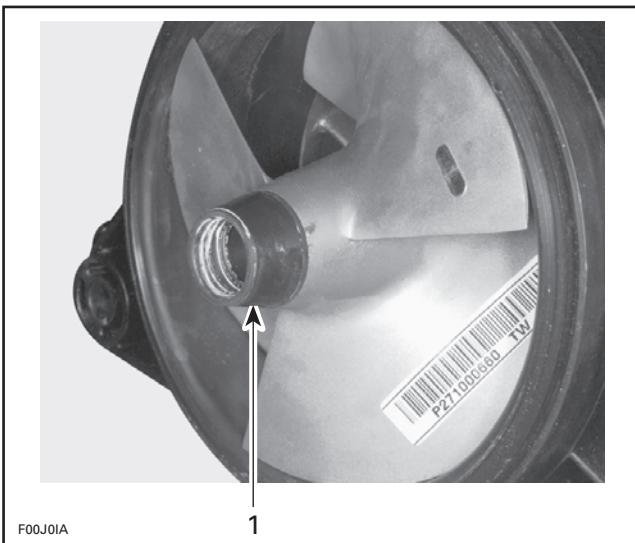
CAUTION: Make sure thrust washer and bearing are not wedged in shaft groove. To check, manually pull and push jet pump housing, some axial play must be felt.

Torque impeller to 110 N•m (81 lbf•ft) then remove tools.

CAUTION: Never use any impact wrench to tighten impeller.

Apply synthetic grease (P/N 293 550 010) on impeller splines.

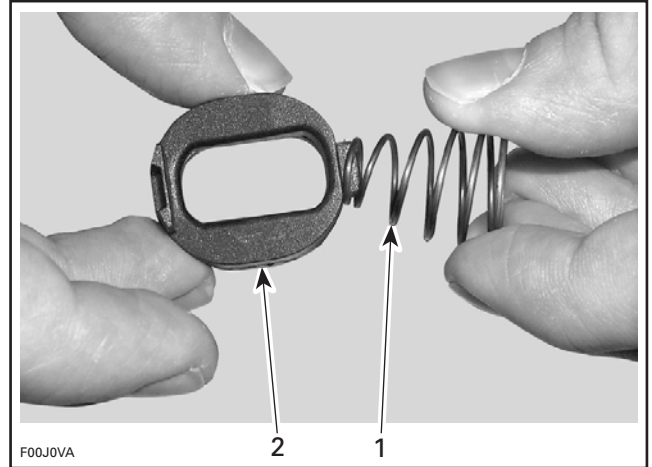
Insert a new boot no. 15 and ring no. 16 to impeller.



1. Boot and ring

Anti-rattle System

Install spring no. 17 on slider no. 28.



1. Spring
2. Slider

Insert slider and spring into cover.

NOTE: Align the longer slider tab with hole.

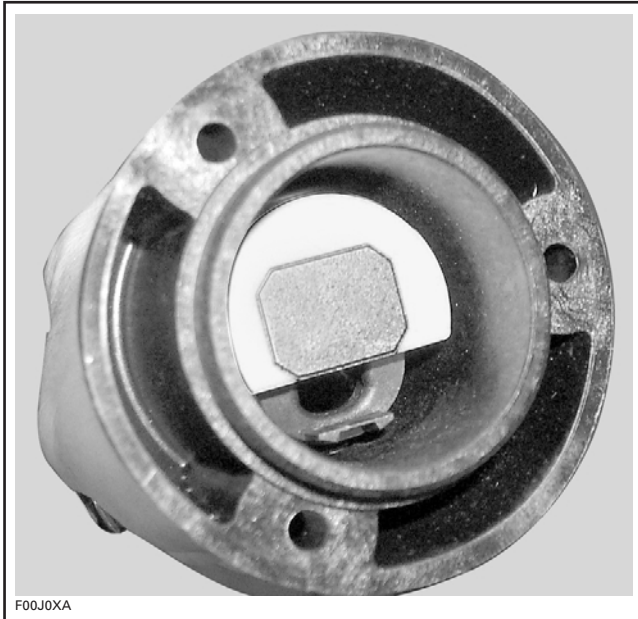


Apply synthetic grease in the center hole of the cover.

Section 09 PROPULSION SYSTEM

Subsection 02 (JET PUMP)

Install pusher no. 29 into cover. Place the flat side in front of slider tab.



Install O-ring no. 27 to cover. Apply Loctite 518 on O-ring.

Install cover to jet pump housing making sure to properly position filler plug on top side. Do not torque yet, keep a small gap.

Insert a pencil or any other plastic tool in the hole and push on the slider tab.

CAUTION: Do not use a metal tool to push the tab. It is possible to damage the inner threads.

Hold tab and torque screws.

Remove pencil or tool to release locking mechanism.

Check if the mechanism worked properly. Push tab with the pencil or tool; if there is a small play the installation is correct. If not, redo the procedure.

Verify if the impeller is rotating freely.

Add oil.

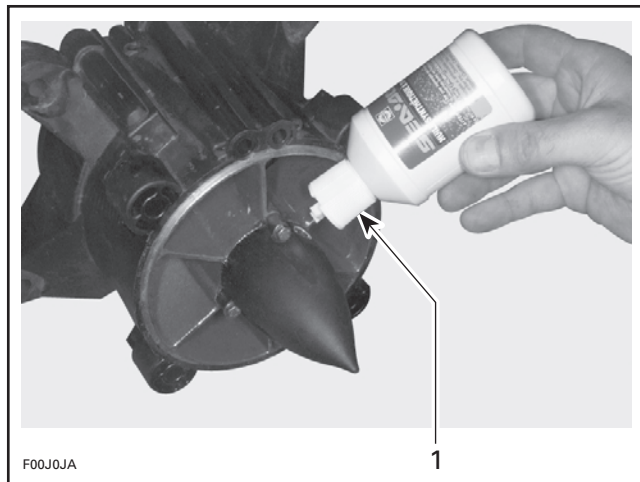
Oil Fill

NOTE: It is highly recommended to perform a leakage test prior adding the oil. See PUMP PRESSURIZATION in this subsection.

Place housing horizontally as in its operating position so that filler plug is located on top. Remove filler plug from cover. Pour SEA-DOO JET PUMP SYNTHETIC OIL (P/N 293 600 011) in reservoir until oil comes level with bottom of hole. Let oil drain into housing and after a few minutes add more oil until it is level with bottom of filler hole.

CAUTION: This is a synthetic oil. Do not mix with mineral based oil. Do not mix oil brands.

NOTE: When filling reservoir, oil must be poured into cover quite slowly to allow complete housing fill.

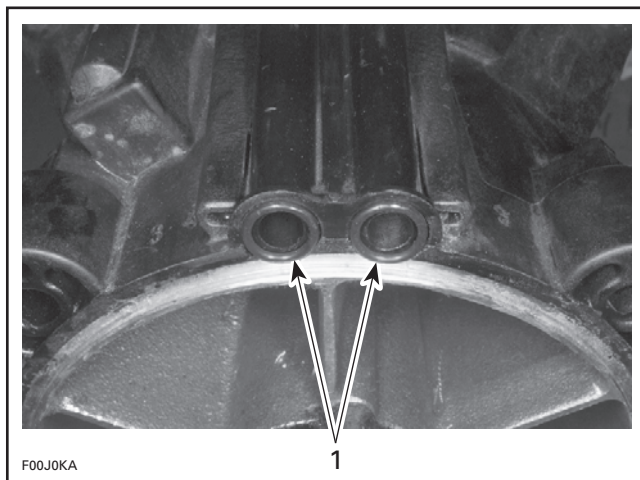


TYPICAL

1. Pour oil slowly until it is level with bottom of filler hole

Venturi

If needed, install new O-rings no. 10 around bailer passages.



1. O-rings

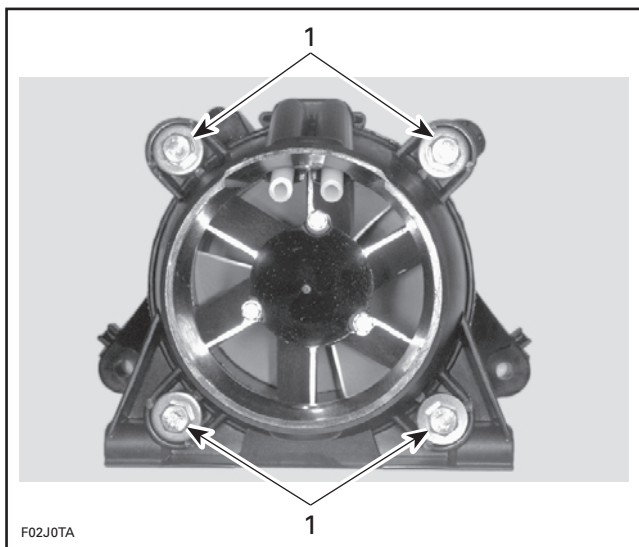
Apply Loctite 518 (Gasket Eliminator) on mating surface.

Position venturi **no. 11** with bailer passages on top.

Apply Loctite 243 (blue) on threads of screws **no. 12**.

NOTE: On the GTI and GTX models, install the reverse support with the venturi.

Install screws **no. 12**, lock washers **no. 13** and flat washers **no. 14** then torque to 21 N•m (16 lbf•ft).



1. Torque screws to 21 N•m (16 lbf•ft)

Fitting

GTS Model

Apply Loctite PST 592 on plastic fitting threads. Then thread fitting into pump housing until threads are bottomed.

O-Rings

GS, XP, GTI, and GTX

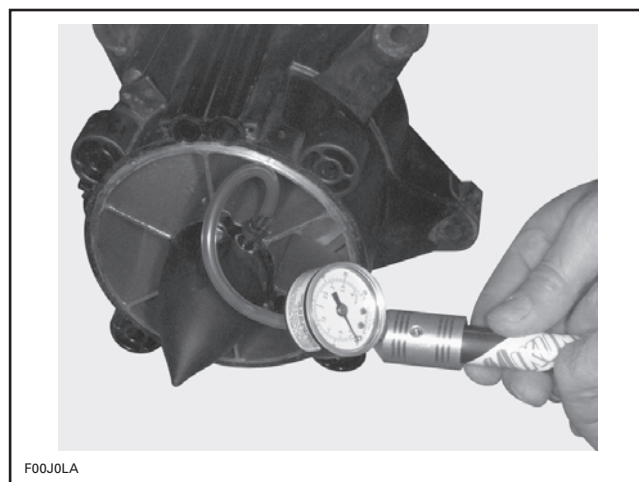
Install O-rings **no. 29** around bailer passages or make sure they are in place if they were not removed.

PUMP PRESSURIZATION

Whenever doing any type of repair on jet pump, a pressure test should be done to check for leakage.

Proceed as follows:

- Remove drain plug from cover.
- Apply Loctite PST 592 on threads of fitting tool (P/N 295 000 086) then secure on cover.
- Connect pump gauge tester (P/N 295 000 085) to fitting.
- Pressurize pump to a maximum of 70 kPa (10 PSI).



- Pump must maintain this pressure for at least 10 minutes.

CAUTION: Repair any leak, failure to correct a leak will lead to premature wear of pump components.

NOTE: If there is a pressure drop spray soapy water around cover. If there are no bubbles, impeller shaft, impeller shaft seal, or jet pump housing is leaking through porosity and has to be replaced. Jet pump unit has to be disassembled. If jet pump has been overhauled, the impeller shaft seal **no. 22** may be leaking; Add a small quantity of SEA-DOO JET PUMP SYNTHETIC OIL to wet the oil seal. Let soak and recheck.

- Disconnect pump gauge tester and remove fitting.
- Check oil level. Refill as necessary.
- Apply Loctite PST 592 to threads of filler plug then secure it in cover.

Section 09 PROPULSION SYSTEM

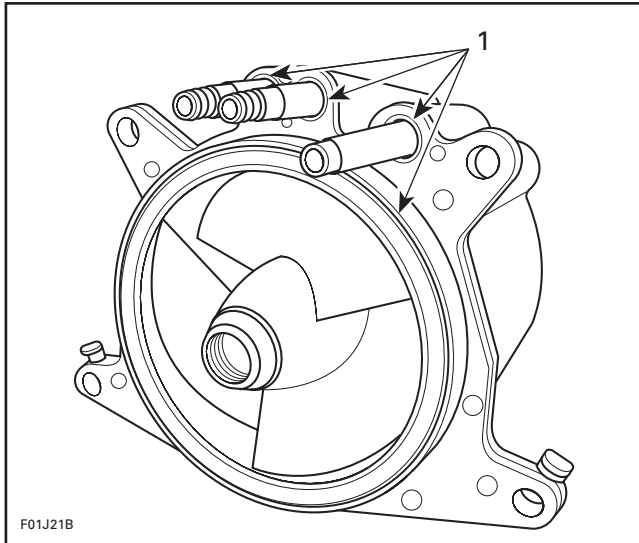
Subsection 02 (JET PUMP)

INSTALLATION

Jet Pump Housing

GTS Model

Apply Loctite Right Stuff around bailer and water supply fittings as well as around wear ring lip.



1. Apply Loctite Right Stuff where indicated

All Models

Generously apply synthetic grease on drive shaft splines.

Make sure rubber damper is on drive shaft end.

Install jet pump. If necessary, wiggle jet pump to engage drive shaft splines in impeller.

CAUTION: Some watercraft require a shim between hull and pump; if shim has been removed at pump removal, be sure to reinstall it, otherwise engine alignment will be altered.

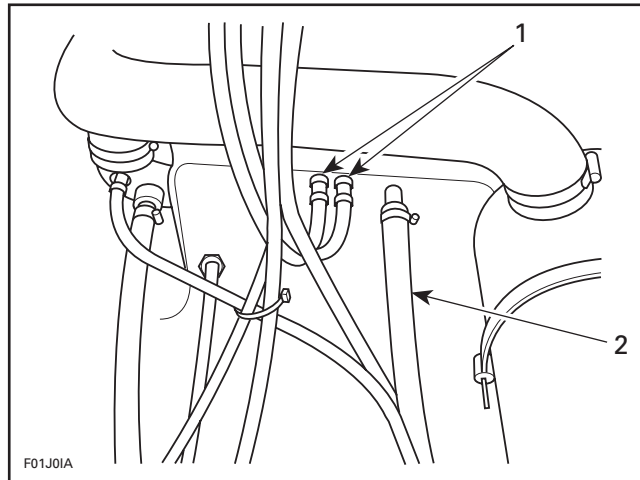
Apply Loctite 243 (blue) on stud threads of jet pump housing.

Install flat washers no. 8, lock washers no. 7 and nuts no. 6. Tighten nuts of jet pump housing in a criss-cross sequence and torque to 33 N•m (24 lbf•ft).

NOTE: Slightly lubricate wear ring with BOMBARDIER LUBE lubricant to minimize friction during initial start.

GTS Model

Secure water supply hose and both bailer tubes to jet pump housing using tie raps.



1. Bailer tubes
2. Water supply hose

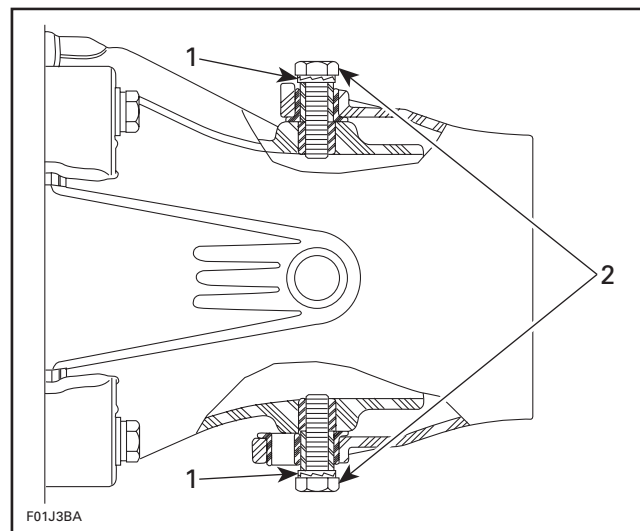
Nozzle

GS, GTS, GTI and GTX

Insert bushings no. 3 in nozzle no. 5, positioning their flanges from inside of nozzle.

Insert sleeves no. 2 in bushings no. 3.

Install nozzle no. 5 on venturi no. 11; position its steering arm on RH side. Apply Loctite 243 (blue) on screw threads (or use new screws with pre-applied threadlocker). Install screws no. 1 and washers no. 4 then torque to 20 N•m (15 lbf•ft).



TYPICAL

1. Washers
2. Torque screws to 20 N•m (15 lbf•ft)

WARNING

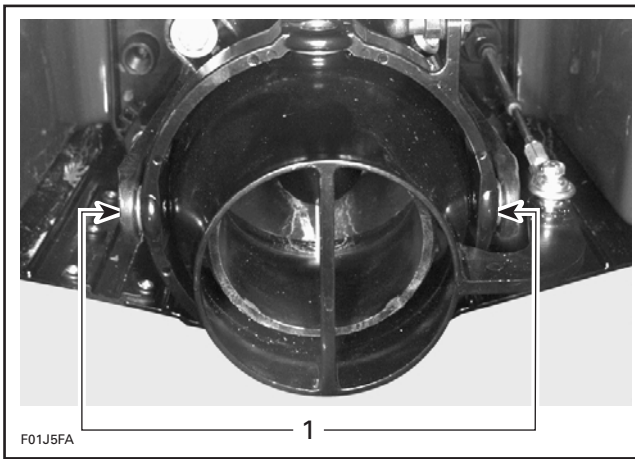
Screws must be torqued as specified.

XP Model

Install nozzle/trim ring assembly.

Torque screws to 14 N•m (10 lbf•ft).

NOTE: Trim ring has a tight fit; to install, insert both sides at the same time, taking care not to break plastic bushings. Carefully use a plastic tip hammer if necessary. Make sure steering arm of jet pump is on right side and trim arm is above venturi.



1. Torque screws to 14 N•m (10 lbf•ft)

Steering Cable

Refer to section, STEERING SYSTEM.

Trim System

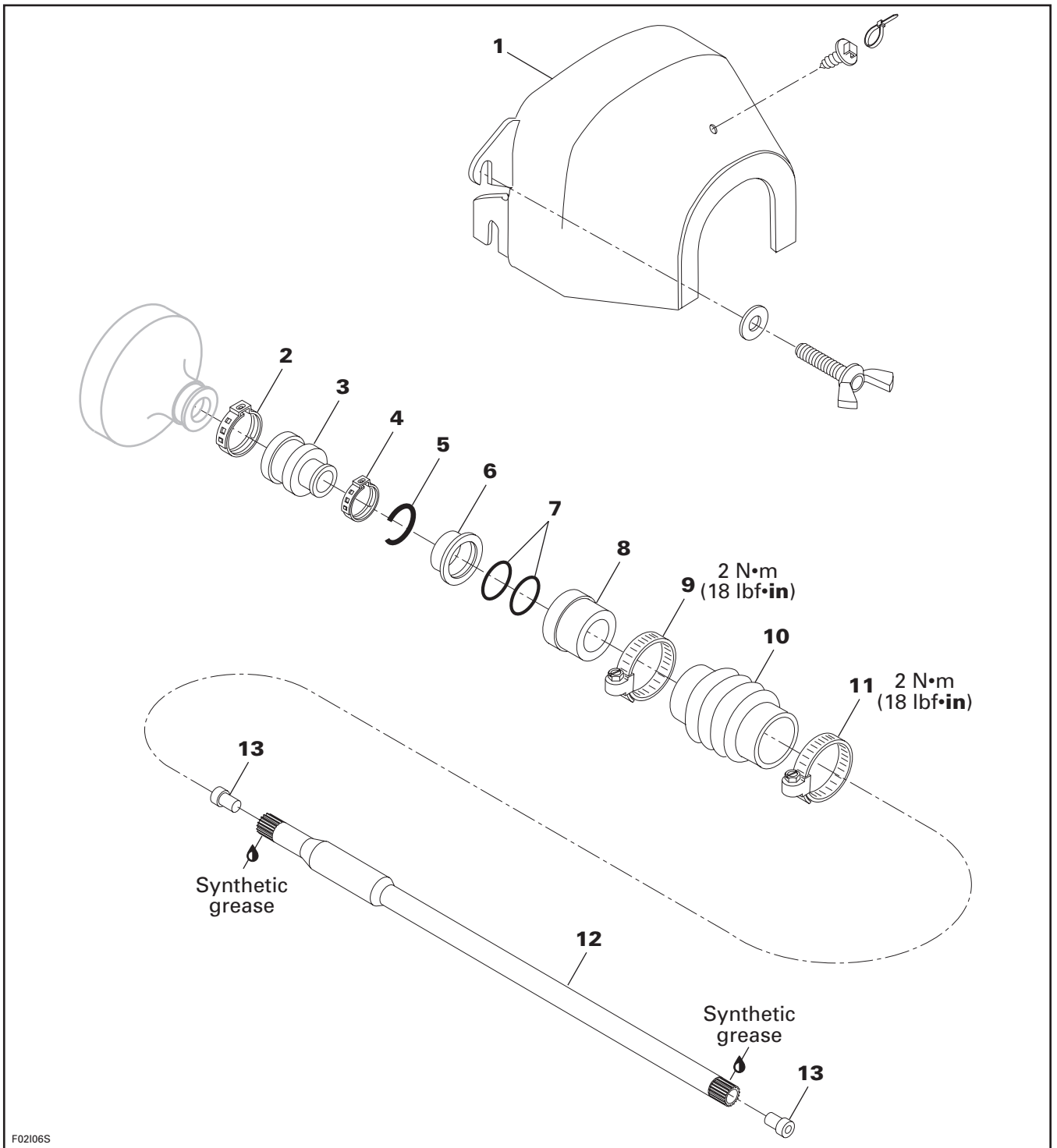
Refer to VARIABLE TRIM SYSTEM.

Reverse Cable

Refer to REVERSE SYSTEM.

DRIVE SYSTEM

GS, GTS and GTI Models

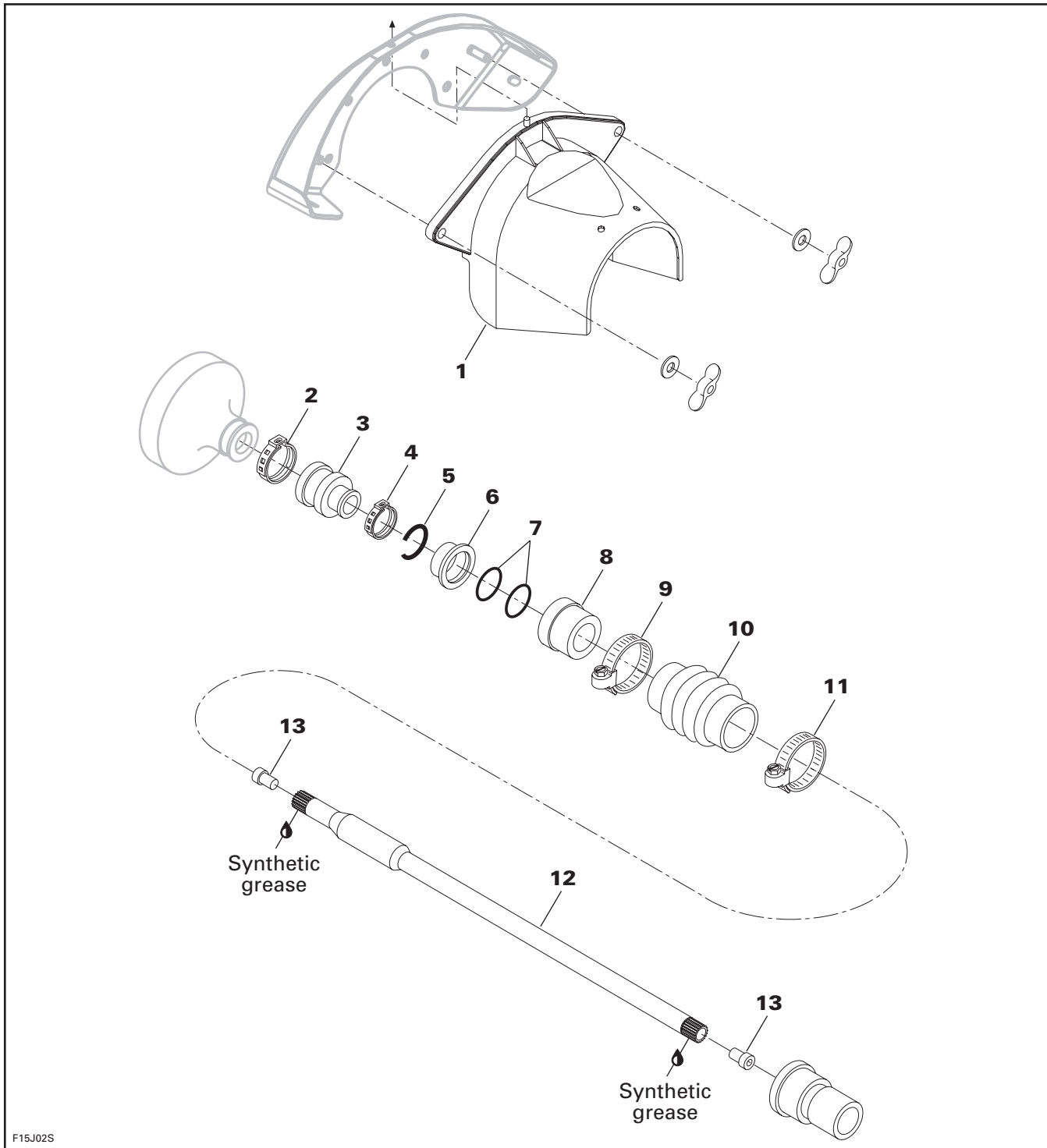


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Section 09 PROPULSION SYSTEM

Subsection 03 (DRIVE SYSTEM)

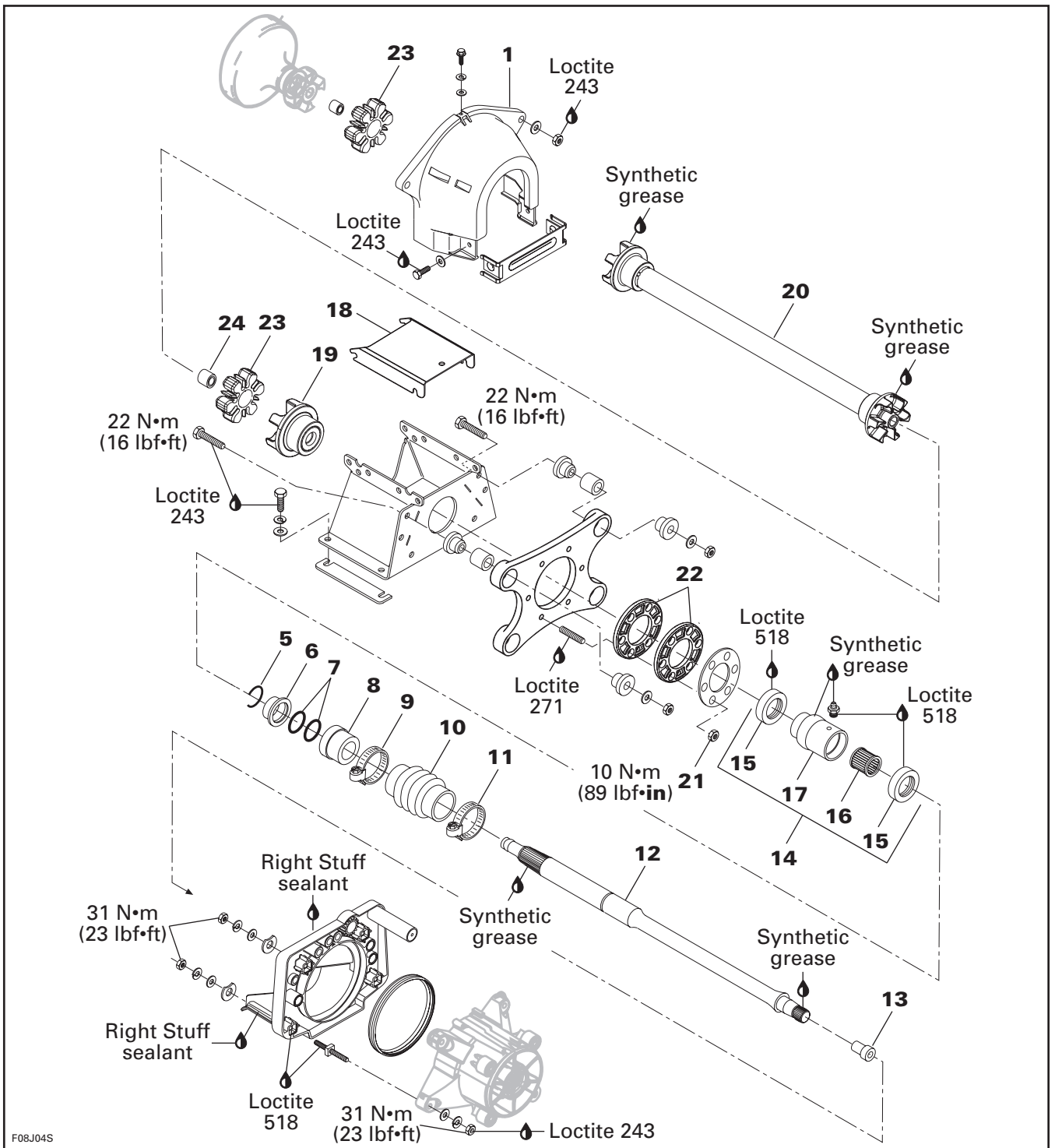
GTX, GSX RFI and GTX RFI Models



Section 09 PROPULSION SYSTEM

Subsection 03 (DRIVE SYSTEM)

XP Model



Section 09 PROPULSION SYSTEM

Subsection 03 (DRIVE SYSTEM)

GENERAL

Jet pump must be removed to replace any components of the drive system. Refer to JET PUMP for removal procedure.

REMOVAL

PTO Flywheel Guard

All Models Except XP

Remove seat(s).

Remove vent tube support or seat support (except GTS model).

Remove plastic wing nuts retaining PTO flywheel guard **no. 1** to engine support.

Detach PTO flywheel guard from engine and withdraw from bilge.

XP Model

Open engine compartment cover.

Remove storage basket.

Remove vent tubes from PTO flywheel guard.

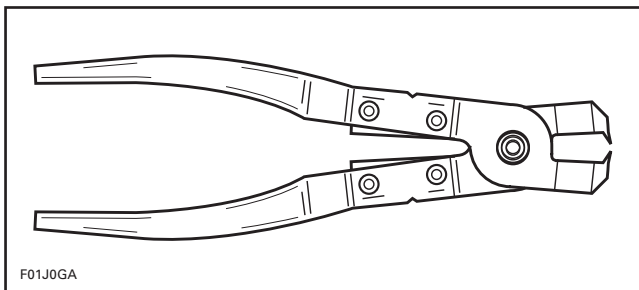
Remove PTO flywheel guard.

Large Clamp

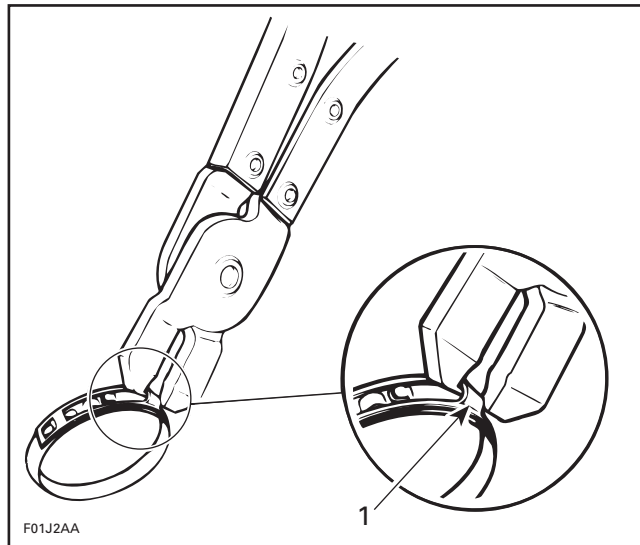
All Models Except XP Model

Unfasten large clamp of PTO flywheel boot **no. 3** as follows:

- Use pliers (P/N 295 000 069).



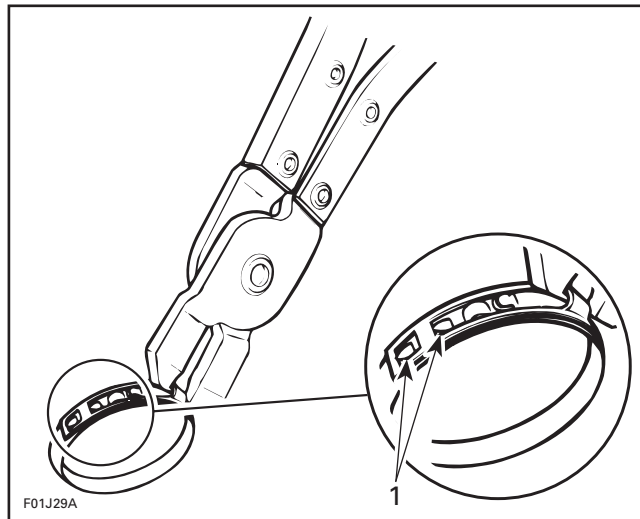
- Insert pointed tips of pliers in closing hooks.



TYPICAL

1. Closing hooks

- Squeeze pliers to draw hooks together and disengage windows from locking hooks.



TYPICAL

1. Locking hooks

Small Clamp

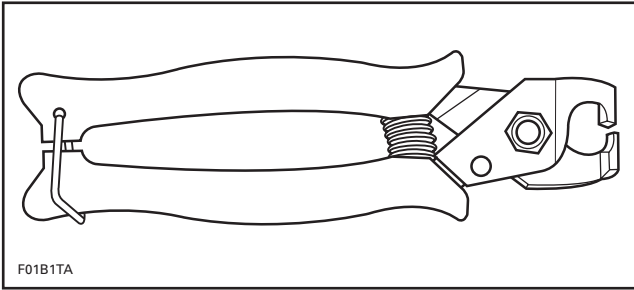
All Models Except XP Model

Unfasten small clamp of PTO flywheel boot as follows:

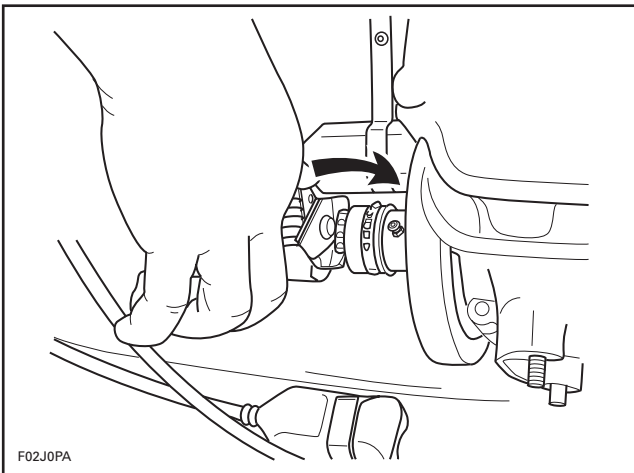
- Use pliers (P/N 295 000 054).

Section 09 PROPULSION SYSTEM

Subsection 03 (DRIVE SYSTEM)



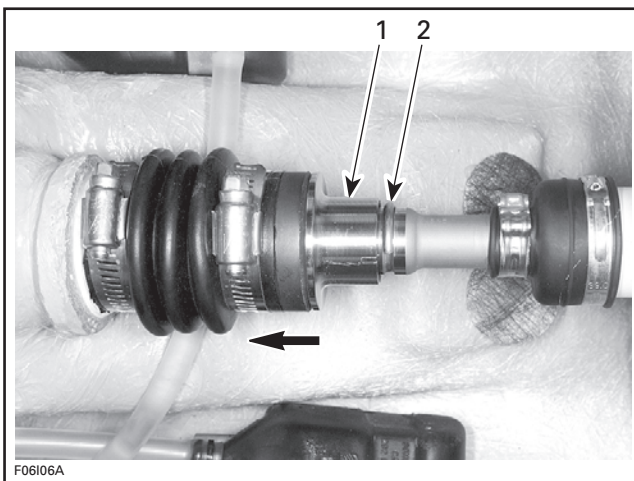
- To open clamp, place flat side of plier on clamp embossment, squeeze and twist plier.



Circlip and Floating Ring

NOTE: On XP model, open rear access cover to reach boot no. 10 and floating ring no. 6.

Hold floating ring no. 6 and compress boot no. 10; then, pull out circlip no. 5 from drive shaft groove.



TYPICAL

1. Push floating ring
2. Remove circlip

All Models Except the XP

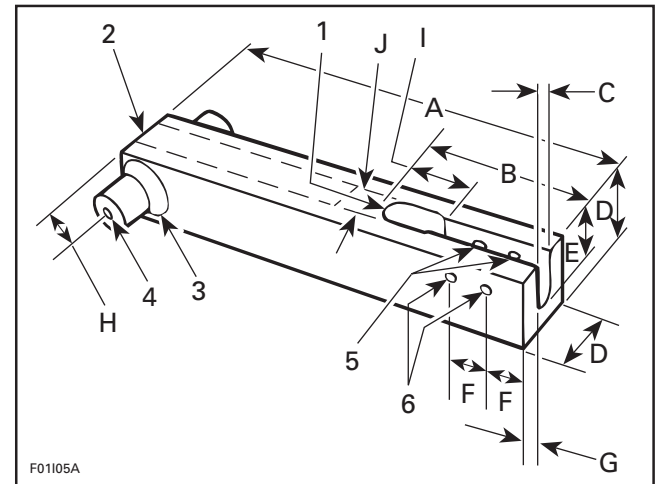
Drive Shaft

Simply pull out drive shaft.

NOTE: If the drive shaft is jammed into PTO fly-wheel, make the following tool and use it in conjunction with the jet pump housing remover (P/N 295 000 113) to withdraw drive shaft.

Raw Material:

- 1 aluminum alloy square of 51 mm (2 in) x 305 mm (12 in).
- 2 aluminum rods of 28.5 mm (1-1/8 in) dia. x 30 mm (1-3/16 in).

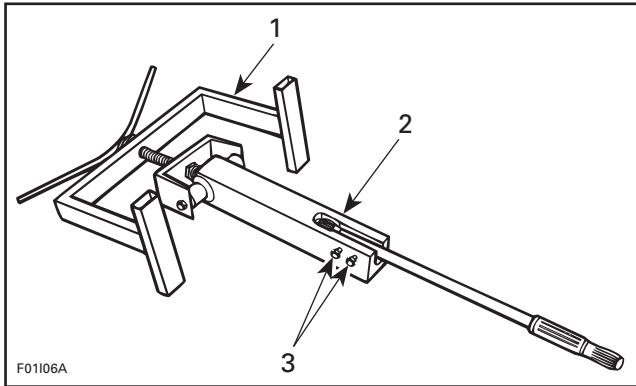


1. Use ball end mill for radius. This section of the slot should be 38 mm (1-15/32 in) deep
 2. Drill 25 mm (1 in) hole in center to remove material
 3. Weld all around
 4. Drill 9 mm (11/32 in) hole
 5. Drill through 9 mm (11/32 in)
 6. Drill and tap 6 mm (1/4 in) holes
- A. 305 mm (12 in)
 B. 105 mm (4-1/8 in)
 C. 16 mm (5/8 in)
 D. 51 mm (2 in)
 E. 36 mm (1-25/64 in)
 F. 22 mm (7/8 in)
 G. 17 mm (43/64)
 H. 19 mm (3/4 in)
 I. 35 mm (1-3/8 in)
 J. 20.3 mm ± .18 (.800 in ± .007)

Section 09 PROPULSION SYSTEM

Subsection 03 (DRIVE SYSTEM)

Mount on drive shaft puller the jet pump housing remover; then, install assembly on drive shaft using screws.



TYPICAL

1. Jet pump housing remover
2. Drive shaft puller
3. Screws

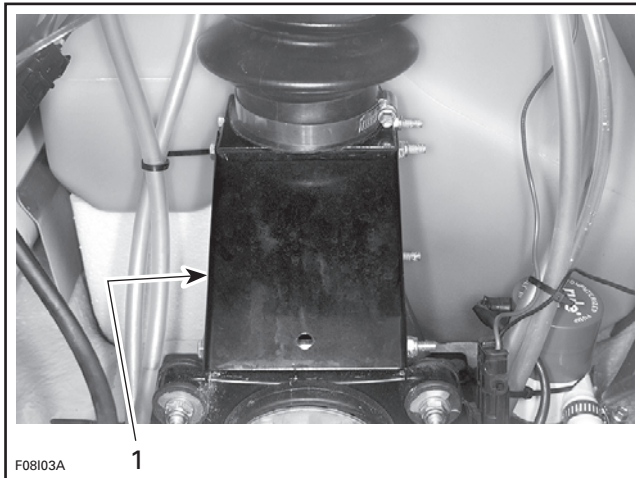
CAUTION: Be careful not to damage hull rear section or engine rubber mounts.

XP Model

Rear Drive Shaft

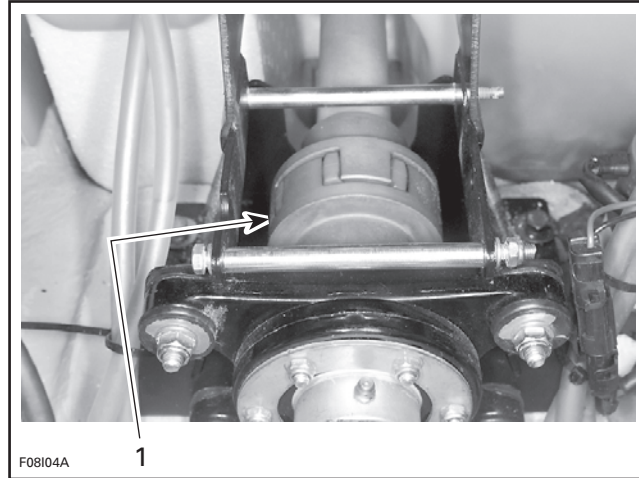
Remove rear access panel.

Remove protective plate no. 18.



1. Remove protective plate

Pull rear drive shaft until coupler no. 19 is disengage from splines.



1. Pull drive shaft to disengage coupler from splines

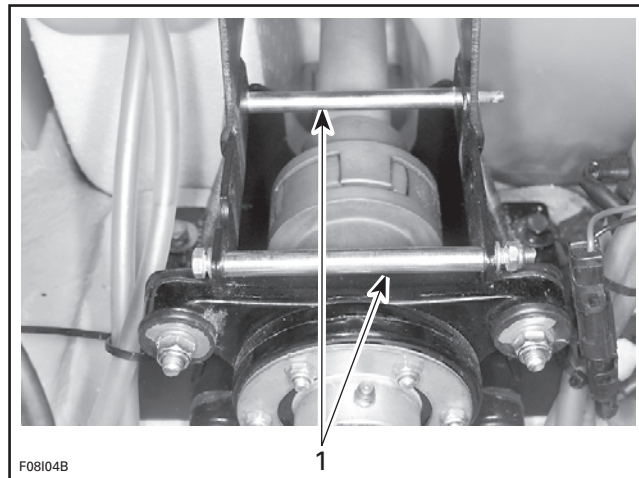
Remove rear drive shaft.

Remove coupler no. 19.

Front Drive Shaft

Remove PTO flywheel guard no. 1.

Remove bolts, lock nuts and sleeves from support.

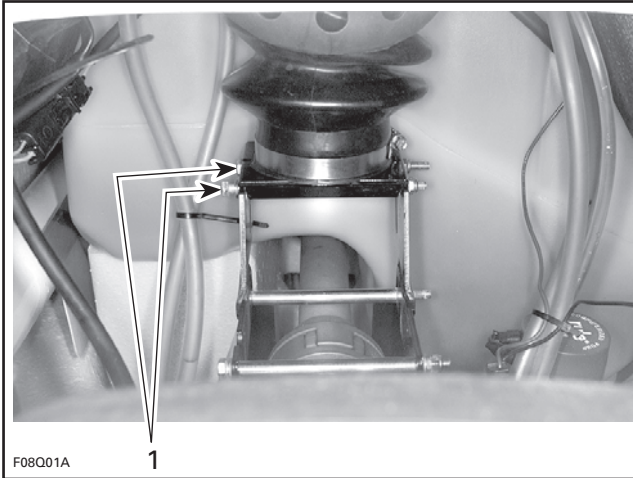


1. Remove bolts, lock nuts and sleeves

Section 09 PROPULSION SYSTEM

Subsection 03 (DRIVE SYSTEM)

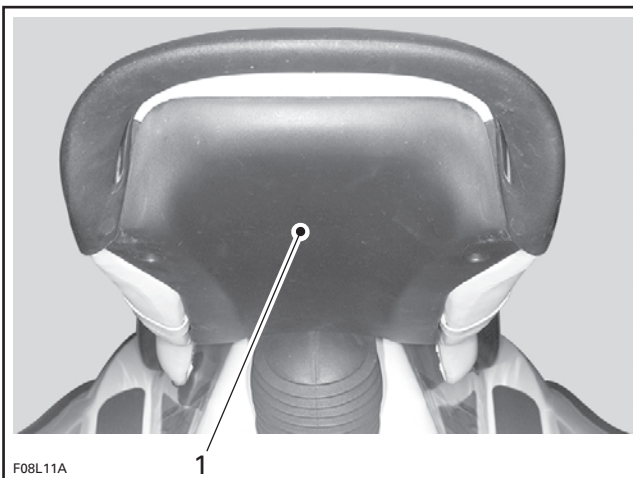
Loosen bolts and lock nuts retaining the lower support of the shock absorber.



TYPICAL

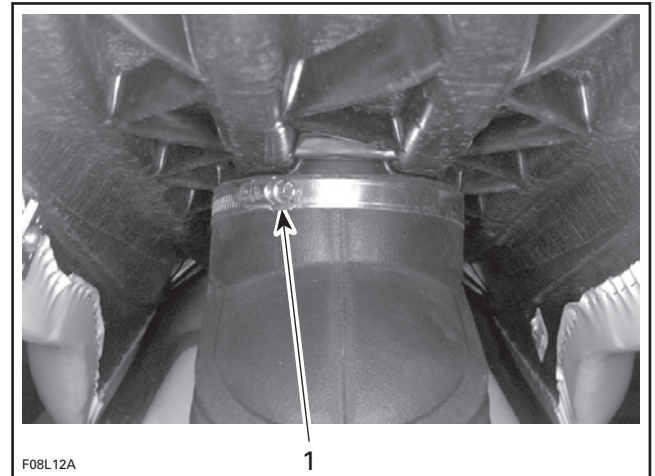
1. Remove bolts and lock nuts

Loosen 4 screws and remove bottom cover of seat.



1. Remove cover

Loosen gear clamp retaining the outer boot of the shock absorber.



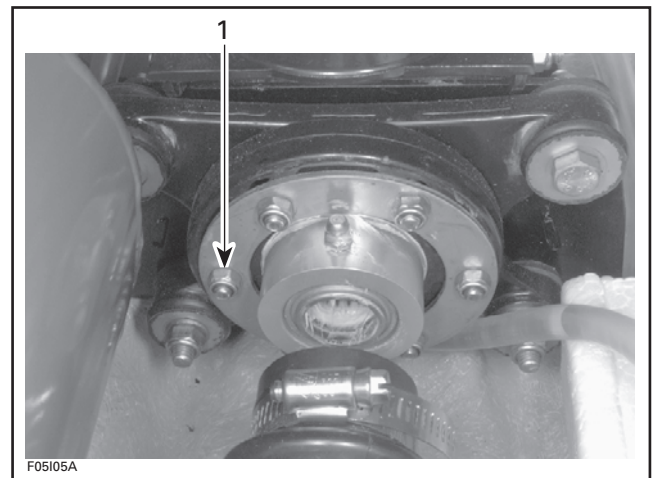
1. Loosen gear clamp

Tilt seat.

Remove front drive shaft.

Seal Carrier of Mid Bearing

To remove the seal carrier from support, loosen the 6 nuts no. 21.

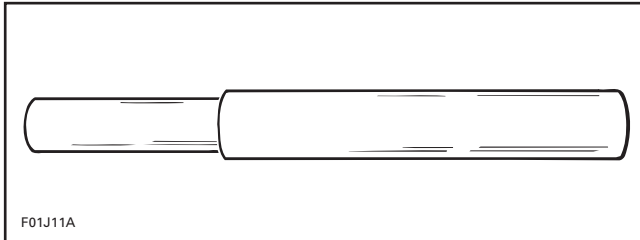


1. Nut (6)

Section 09 PROPULSION SYSTEM

Subsection 03 (DRIVE SYSTEM)

Bearing no. 16 and seals no. 15 can be easily removed using the bearing/seal remover tool (P/N 295 000 144).



NOTE: The same tool is used for bearing and seals removal of jet pump.

Properly support seal carrier housing no. 17 when removing seals and bearing.

All Models

Boot

Loosen gear clamp no. 11 holding boot, then carefully pull boot and carbon ring no. 8 from hull insert.

Carbon Ring

Loosen gear clamp no. 9 then pull carbon ring from boot no. 10.

INSPECTION

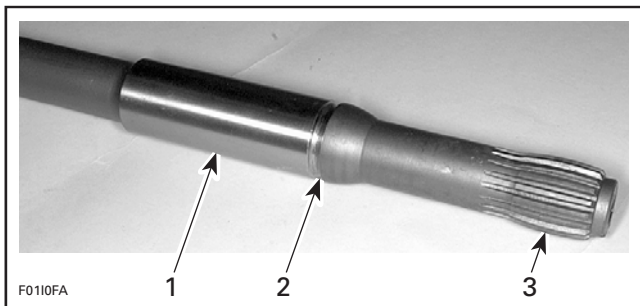
All Models

Drive Shaft

Inspect condition of drive shaft and PTO flywheel splines (except XP model).

Inspect condition of groove.

With your finger nail, feel machined surface of drive shaft. If any irregular surface is found, renew drive shaft.

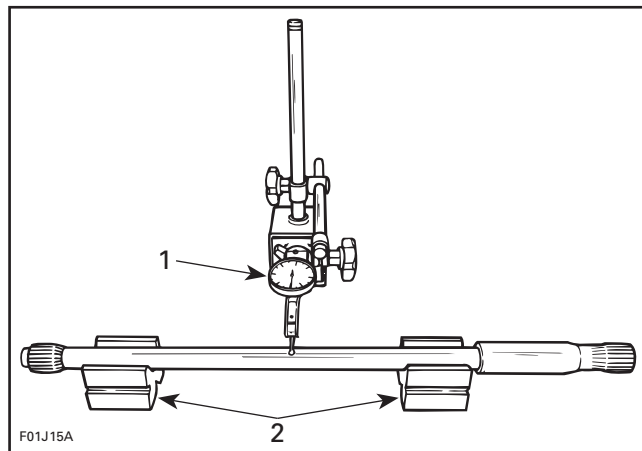


1. Surface condition
2. Groove condition
3. Splines condition

Excessive deflection could cause vibration and damage to drive shaft splines, impeller, flywheel or floating ring (seal carrier depending upon the model).

Place drive shaft on V-blocks and set-up a dial gauge in center of shaft. Slowly rotate shaft; difference between highest and lowest dial gauge reading is deflection. Refer to the following illustration.

Maximum permissible deflection is 0.5 mm (.020 in).



MEASURING DRIVE SHAFT DEFLECTION

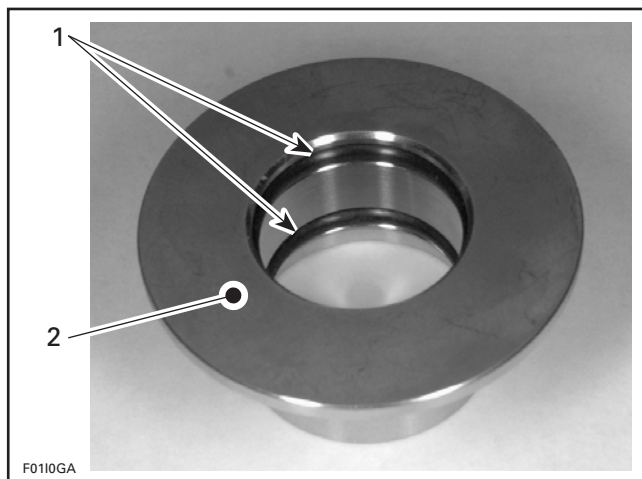
1. Dial gauge
2. V-blocks

Damper

Visually inspect shape of dampers no. 13 for deformation or other damage.

Floating Ring and O-Ring

Inspect condition of O-rings no. 7 and floating ring contact surface.



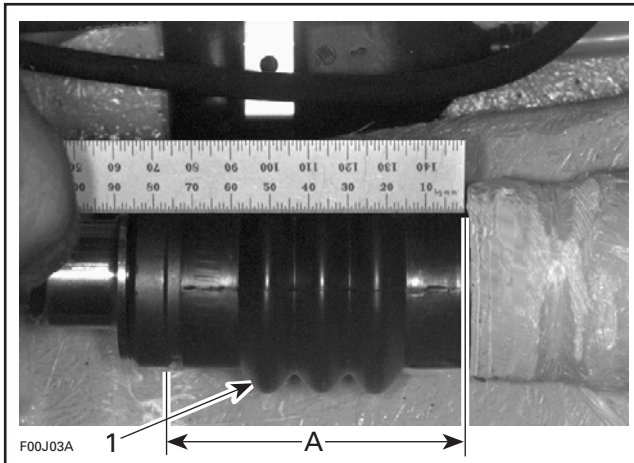
1. O-rings
2. Floating ring contact surface

Boot

To verify the preload of the boot **no. 10**, proceed as follows:

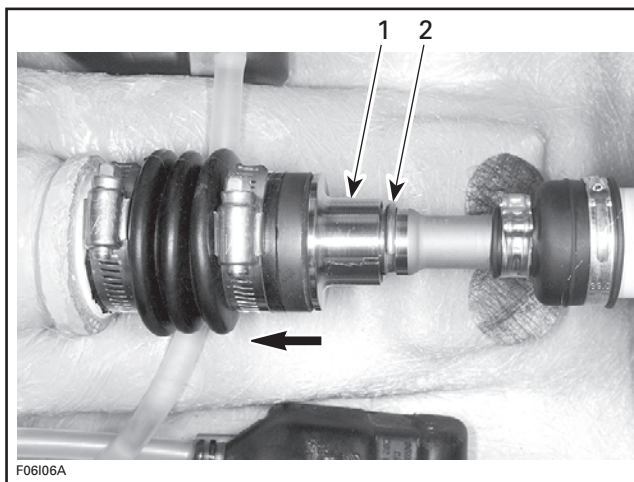
NOTE: To verify the boot preload and free length, jet pump and drive shaft must be installed.

Measure boot length when normally installed on drive shaft. Ensure circlip **no. 5** is properly installed into groove.



1. Boot
A. Measure here

Push floating ring to compress boot; then, remove circlip out of drive shaft groove.



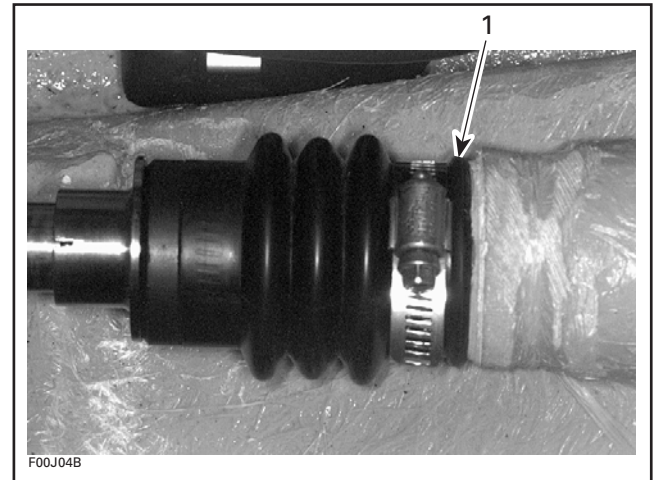
1. Push floating ring
2. Remove circlip

Slide floating ring far enough forward in order to release it from carbon ring.

Measure boot free length.

Subtract the installed length measurement from the free length measurement. A difference of 4 mm to 12 mm (5/32 in to 15/32 in) should be obtained.

If the length is less than 4 mm (5/32 in), install a spacer (P/N 293 250 017) between boot and thru hull fitting.



1. Spacer

NOTE: Drive shaft must be removed to install spacer.

XP Model

Seal Carrier of Mid Bearing

Inspect seal carrier needle bearing **no. 16**. Check parts for scoring, pitting, chipping or other evidence of wear.

Inspect seals **no. 15** for deterioration or excessive wear. Replace if necessary.

ASSEMBLY

XP Model

Seal Carrier of Mid Bearing

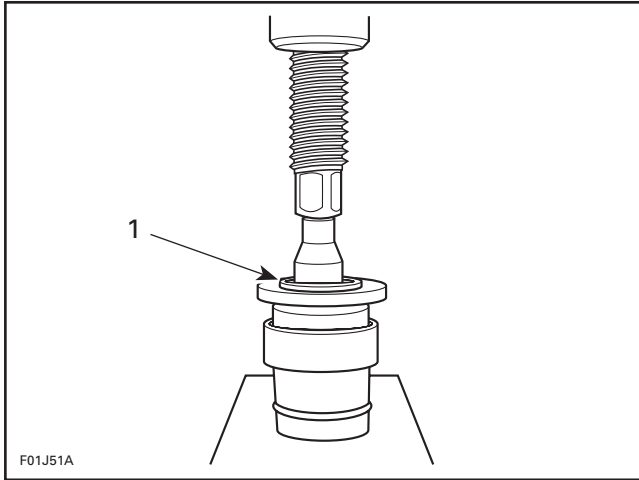
Properly support seal carrier housing **no. 17** when installing seals and bearing.

CAUTION: Ensure to install stamped end of bearing (showing identification markings) first on tool. Never hammer the bearing into its housing.

Section 09 PROPULSION SYSTEM

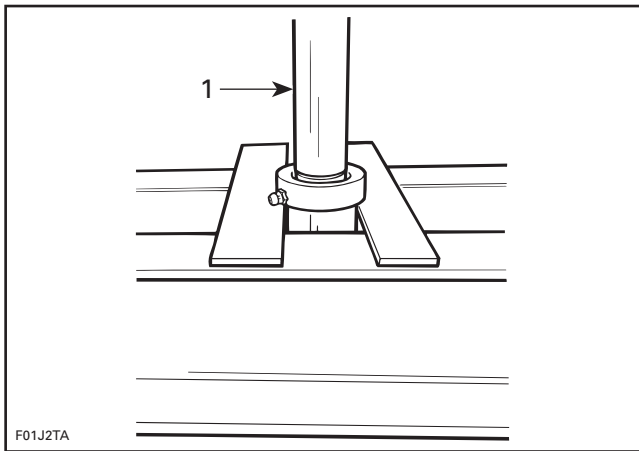
Subsection 03 (DRIVE SYSTEM)

Install bearing no. 16 with the bearing/seal installer tool (P/N 295 000 107).



1. Press bearing in its housing

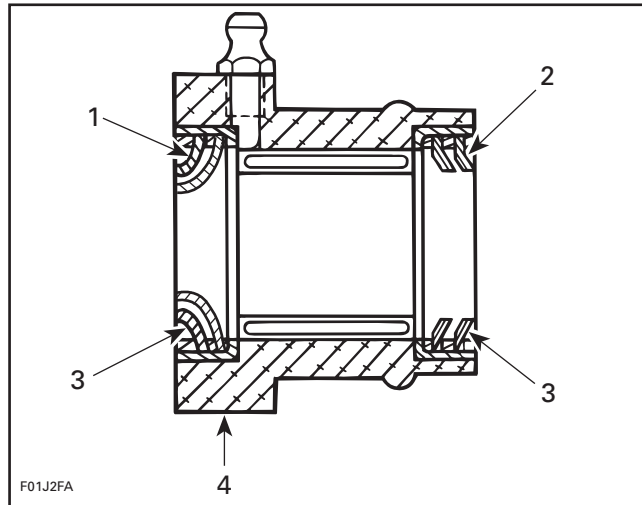
NOTE: Bearing can also be installed with the same driver used at disassembly. Center bearing in longitudinal axis of housing.



1. Push bearing centered in its housing

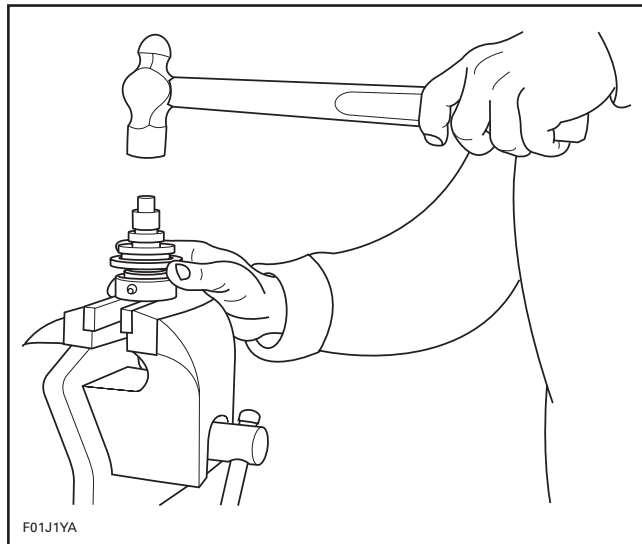
Install double-lip seal no. 15 with protector toward jet pump.

On both seals no. 15, raised edge of lip must be located outwards of seal carrier.



1. Double-lip seal toward engine
2. Double-lip seal with protector toward jet pump
3. Raised edge of lip outwards
4. Seal carrier

Apply Loctite 518 all around seals outside diameter. Seals no. 15 can be carefully installed in housing using bearing/seal installer tool (P/N 295 000 107). Push seals until tool comes in contact with housing.



TYPICAL

Pack seals and bearing with synthetic grease (P/N 293 550 010).

INSTALLATION

Installation is essentially the reverse of removal procedure. However, pay particular attention to the following.

XP Model

Seal Carrier of Mid Bearing

Properly index flanges **no. 22** together.

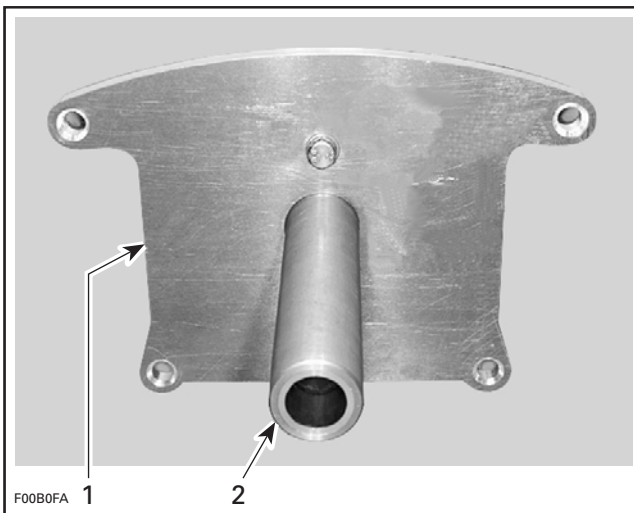
Install seal carrier and hand tighten nuts **no. 21**.

NOTE: Apply Loctite 243 (blue) on studs.

Align the seal carrier using the following tools:

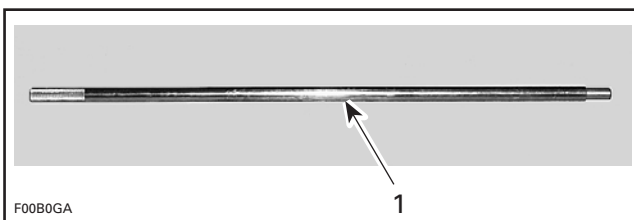
- support plate kit (P/N 529 035 506)

NOTE: Use plate (P/N 529 035 507) for the 155.6 mm (6-1/8 in) jet pump.



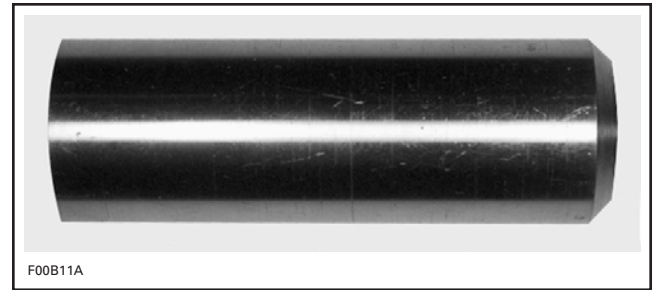
1. Plate (P/N 529 035 507)
2. Support (P/N 529 035 511)

- alignment shaft (P/N 529 035 590)



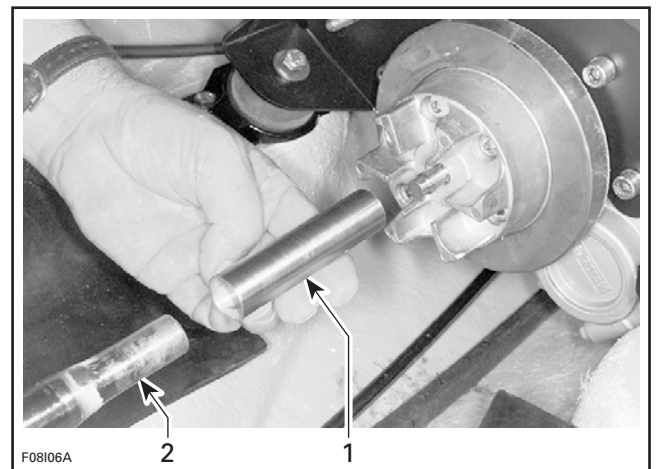
1. Alignment shaft

- PTO flywheel adapter.



Install support plate at rear of watercraft.

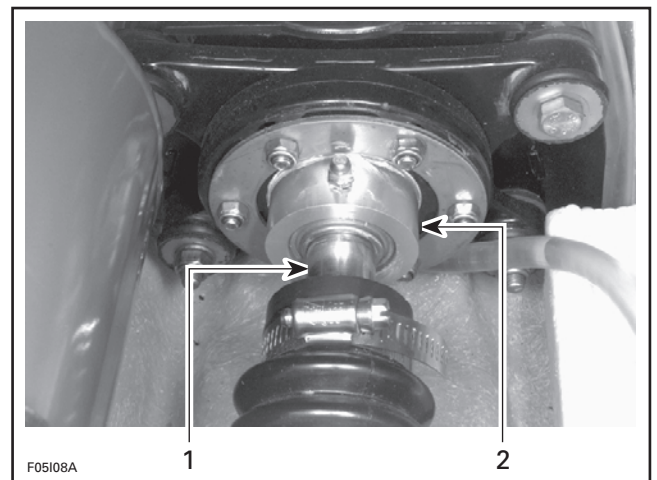
Install adapter on shaft.



1. Alignment shaft
2. Adaptor

Carefully slide shaft through support plate and seal carrier. Insert adapter end into PTO flywheel.

NOTE: Ensure the mid bearing is loosened.



TYPICAL

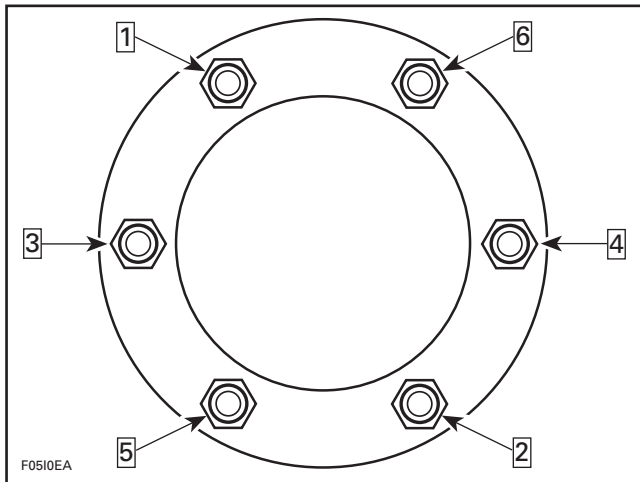
1. Alignment tool
2. Seal carrier

Section 09 PROPULSION SYSTEM

Subsection 03 (DRIVE SYSTEM)

Place grease fitting on the top and torque seal carrier nuts **no. 21** in a criss-cross sequence in 2 steps as per following illustration.

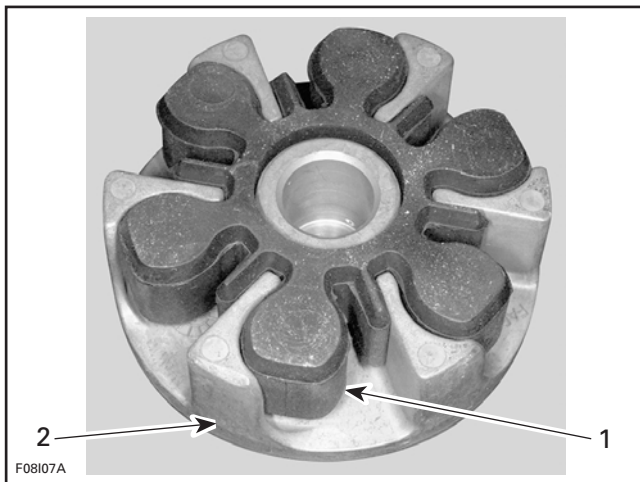
NOTE: It is very important to tighten nuts of seal carrier in a criss-cross sequence to maintain its alignment.



Step **1**: Torque to $3\text{ N}\cdot\text{m}$ ($26\text{ lbf}\cdot\text{in}$) as per sequence
Step **2**: Torque to $10\text{ N}\cdot\text{m}$ ($88\text{ lbf}\cdot\text{in}$) as per sequence

Front Drive Shaft Coupler and Damper

Make sure to install dampers into drive shaft coupler at both ends.



SAME COUPLER AND DAMPER AT BOTH ENDS

1. Damper
2. Drive shaft coupler

Front Drive Shaft

Install front drive shaft **no. 20**.

Rear Drive Shaft

Install damper **no. 13** to rear drive shaft **no. 12**.
Install drive shaft and jet pump at the same time.

Insert drive shaft through carbon ring **no. 8** and floating ring **no. 6**.

Insert drive shaft through seal carrier **no. 14** being careful not to damage seals.

CAUTION: When sliding the drive shaft through seal carrier, the double lip seal can be folded over. This would cause a seal carrier bearing failure.

Reinstall protective plate **no. 18**. Apply Loctite 243 (blue) on bolts and torque lock nuts to $10\text{ N}\cdot\text{m}$ ($88\text{ lbf}\cdot\text{in}$).

All Models Except the XP

Drive Shaft and Dampers

Install dampers **no. 13** on drive shaft **no. 12**.

NOTE: Make sure dampers were not left in PTO flywheel or impeller.

Install drive shaft and jet pump at the same time.
Insert drive shaft through carbon ring **no. 8** and floating ring **no. 6**.

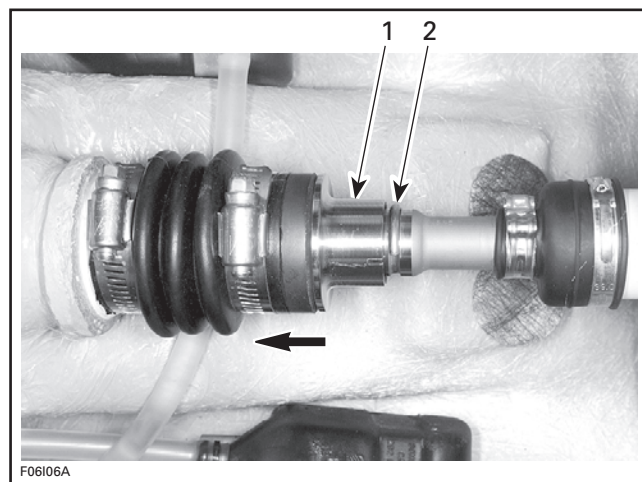
NOTE: Make sure to install floating ring before inserting the drive shaft in the PTO flywheel.

While holding jet pump, guide and engage drive shaft splines in PTO flywheel. Rotate shaft to properly index splines. Make sure boot is well positioned over shaft end.

All Models

Circlip

Push the floating ring to compress the boot. Insert the circlip **no. 5** in the drive shaft groove.



1. Push floating ring
2. Insert circlip in the groove

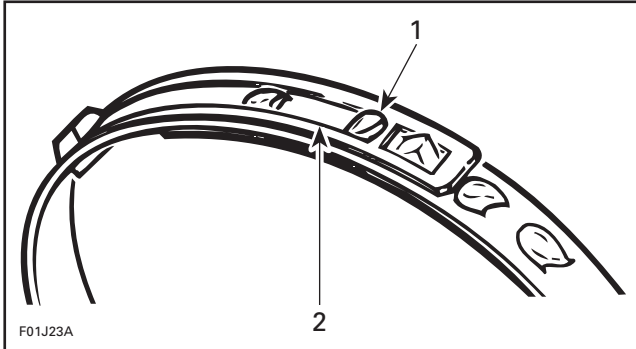
Slide the floating ring onto the circlip.

All Models Except the XP

Large Clamp

Secure large clamp no. 2 as follows:

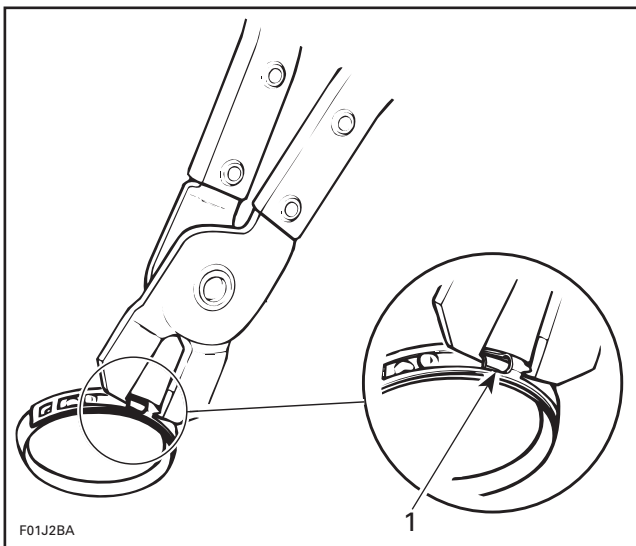
- Use pliers (P/N 295 000 069) as for removal.
- Manually engage holding hook in large window. This is a pre-clamping position only.



PRE-CLAMPING POSITION

1. Holding hook
2. Large window

- Insert pointed tips of pliers first in closing hooks.

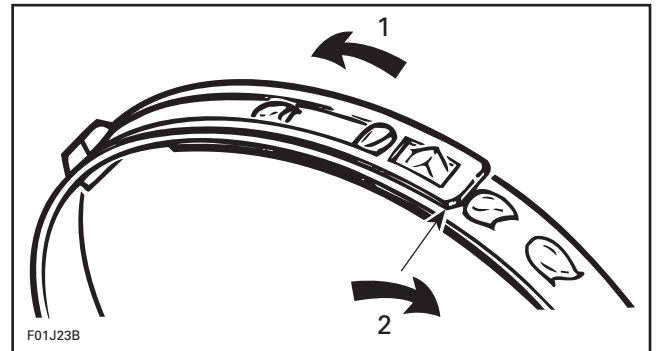


TYPICAL

1. Closing hooks

- Squeeze pliers. When both large and small windows are directly over the 2 locking hooks, press those windows down to engage hooks in windows.

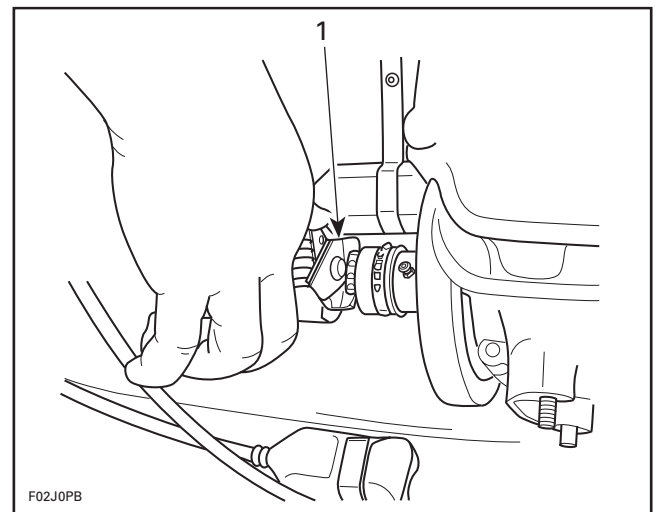
NOTE: At installation, clamp tail should be in opposite direction of engine rotation.



1. Engine rotation (counterclockwise)
2. Tail in opposite direction

Small Clamp

To secure small clamp no. 4, place notch side of plier on clamp embossment and squeeze plier.



1. Squeeze plier

Section 09 PROPULSION SYSTEM

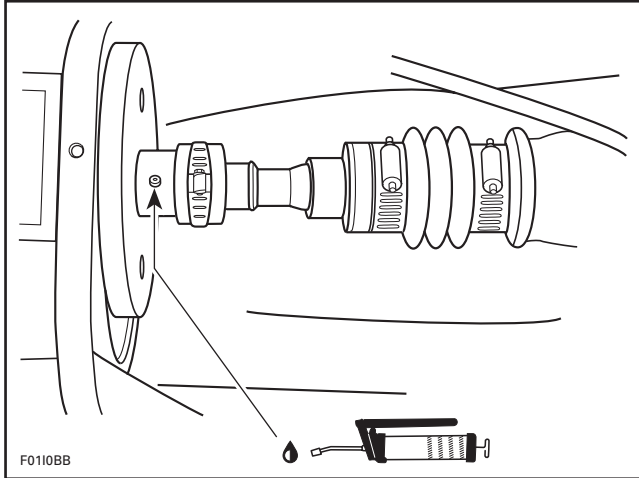
Subsection 03 (DRIVE SYSTEM)

LUBRICATION

PTO Flywheel

All Models Except the XP

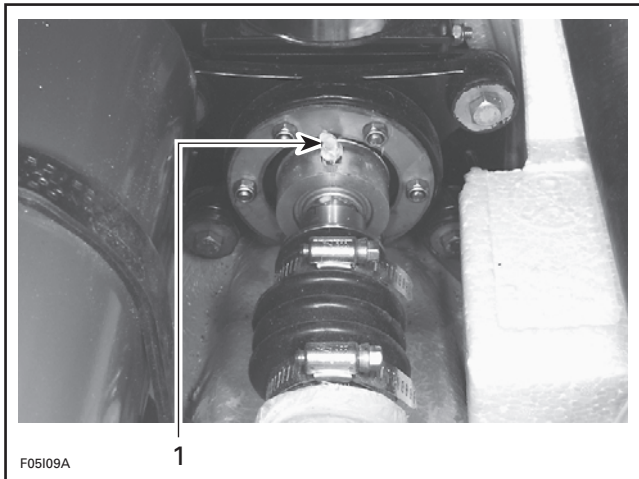
Using a grease gun, carefully lubricate PTO flywheel with synthetic grease (P/N 293 550 010), until boot is just beginning to expand. At this point, immediately stop greasing.



Seal Carrier of Mid Bearing

XP Model

Using a grease gun, lubricate seal carrier of mid bearing with synthetic grease (P/N 293 550 010).

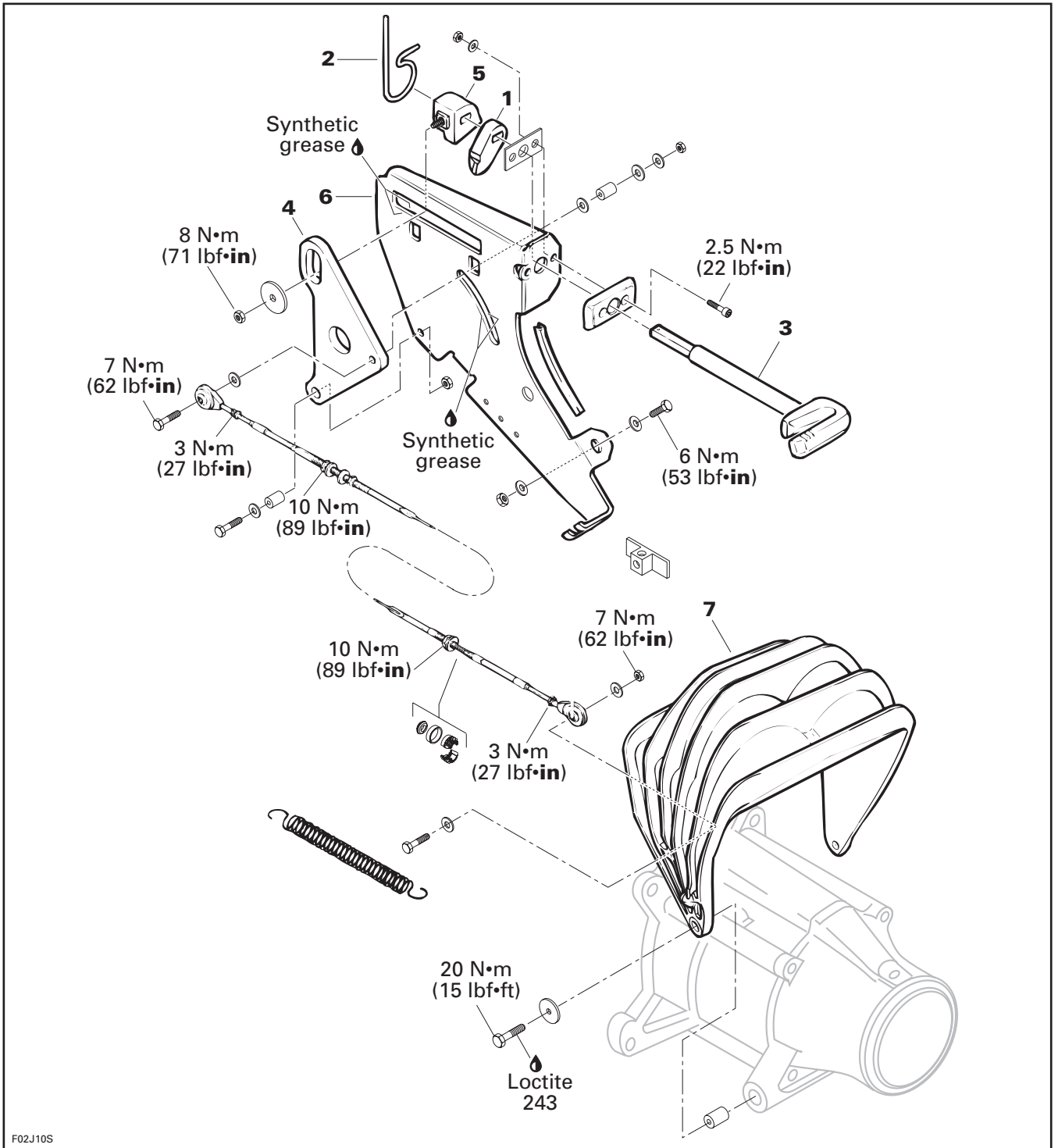


TYPICAL

1. Grease fitting

REVERSE SYSTEM

GTS Model



F02J10S

Section 09 PROPULSION SYSTEM

Subsection 04 (REVERSE SYSTEM)

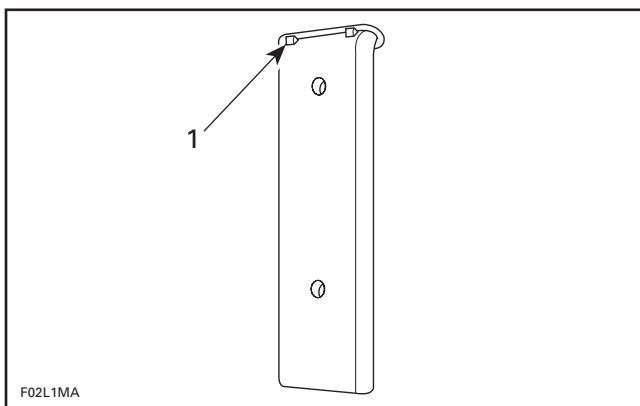
GENERAL

It is not necessary to remove reverse system from watercraft for servicing. However reverse system removal is necessary to replace reverse support.

DISASSEMBLY

Remove storage tray from watercraft.

Press on vent tube upper part to enable to withdraw tube from body.

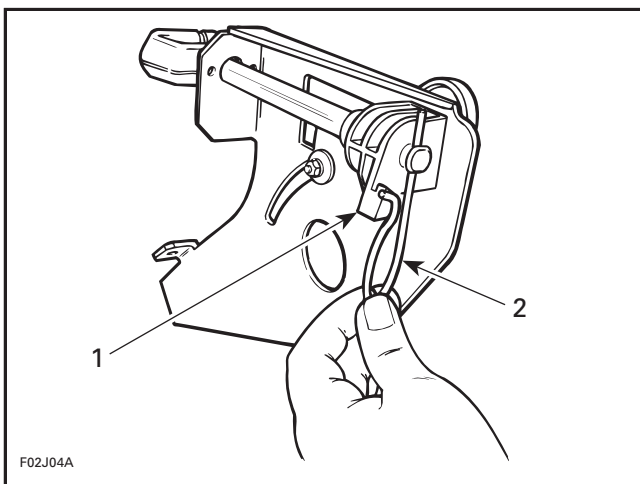


TYPICAL

1. Press on vent tube

Shift Lever

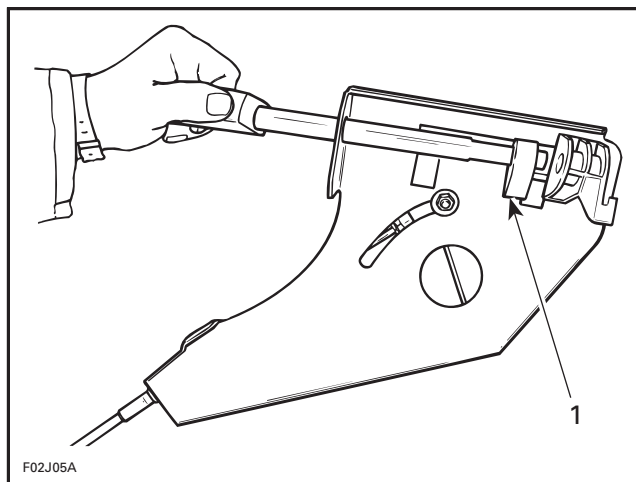
To remove shift lever **no. 3**, unhook spring **no. 2** from sliding block **no. 5** and pull spring from shift lever stem.



TYPICAL

1. Sliding block
2. Spring

Withdraw shift lever stem and locking lever **no. 1** from sliding block **no. 5**, then slide off locking lever from stem.



TYPICAL

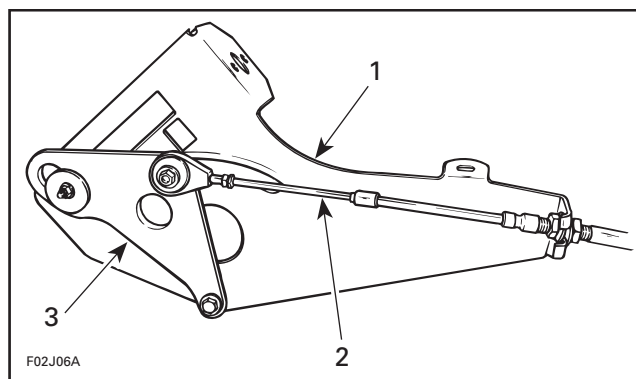
1. Locking lever

Triangular Lever and Sliding Block

Remove screw, lock nut, washers and bushing holding reverse cable to triangular lever **no. 4**.

Remove lock nut and washer holding sliding block **no. 5** to triangular lever and to support.

Remove screw, lock nut, washer and bushing holding triangular lever to reverse support.



TYPICAL

1. Reverse support
2. Reverse cable
3. Triangular lever

Reverse Support

In order to have access to screw holding lower part of reverse support **no. 6**, remove front seat by pulling on each side to release it from body.

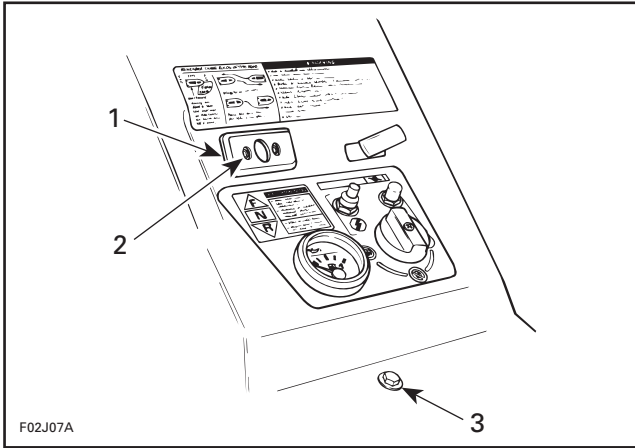
Remove screw, lock nut and washers holding lower part of support.

Remove reverse cable from support.

Section 09 PROPULSION SYSTEM

Subsection 04 (REVERSE SYSTEM)

Remove 2 Allen screws, lock nut and washer holding guide plate and support.

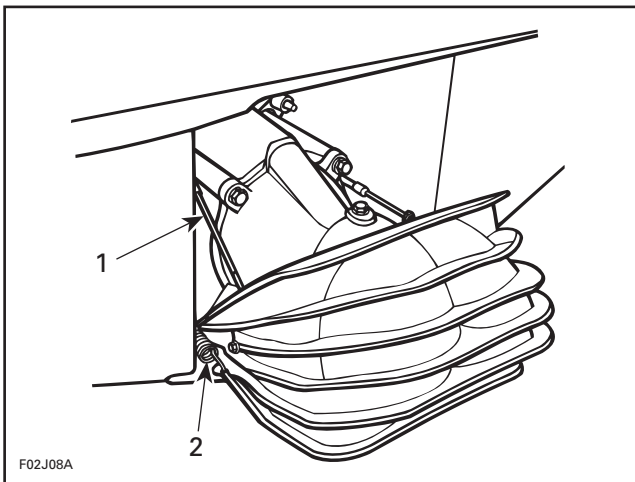


TYPICAL

1. Guide plate
2. Allen screw
3. Screw and washer

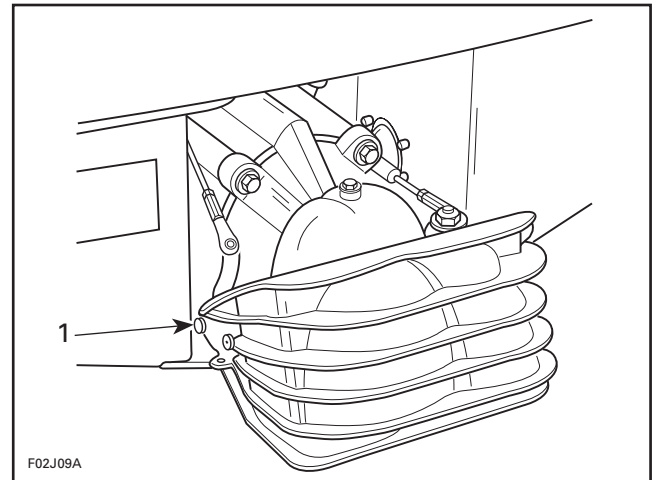
Reverse Gate

Unhook reverse gate springs and remove ball joint fasteners to release reverse cable from reverse gate no. 7.



1. Reverse cable
2. Reverse gate spring (each side)

Unscrew reverse gate retaining screws from venturi, then remove gate.



1. Screw (each side)

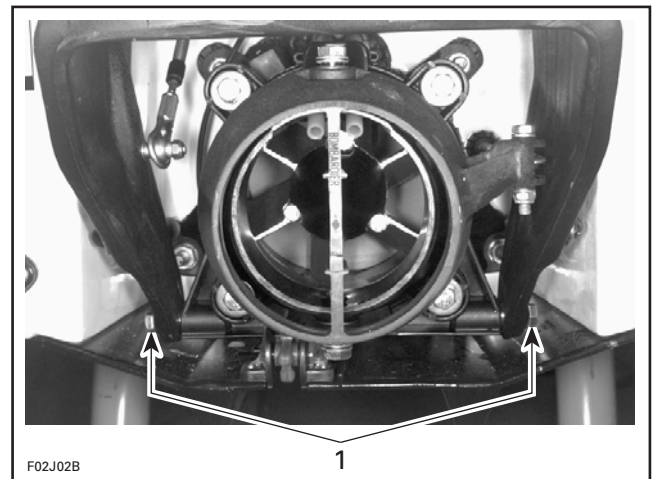
ASSEMBLY

Assembly is essentially the reverse of disassembly procedures. However pay particular attention to the following.

Reverse Gate

Install reverse gate no. 7 with sleeve and washer. Apply Loctite 243 (blue) on threads and torque to 20 N•m (15 lbf•ft).

CAUTION: Always hook reverse gate springs in order to ease reverse gate operation.



1. Screws, washers and sleeves

Section 09 PROPULSION SYSTEM

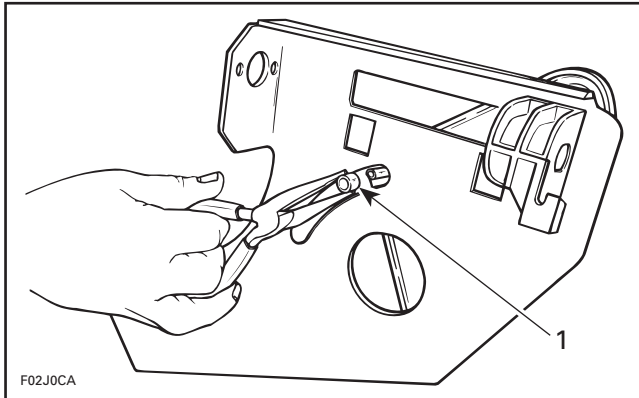
Subsection 04 (REVERSE SYSTEM)

Reverse Support

For installation of reverse support **no. 6**, torque screw to 8 N•m (71 lbf•in) and Allen screws to 2 N•m (18 lbf•in).

Triangular Lever and Sliding Block

Insert bushing in triangular lever **no. 4** and then install lever to reverse support.



TYPICAL

1. Bushing

Install reverse cable to triangular lever with bushing, plastic washer(s) and flat washers.

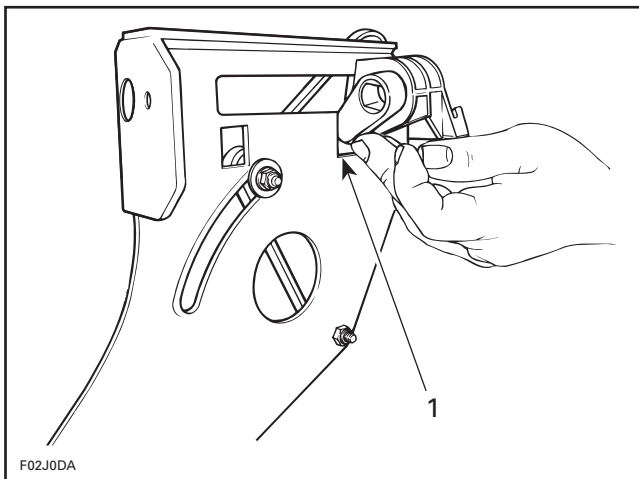
Torque cable screw to 7 N•m (62 lbf•in).

Torque triangular lever screw to 8 N•m (71 lbf•in).

Install sliding block **no. 5** to lever and torque nut to 8 N•m (71 lbf•in).

Locking Lever and Sliding Block

Insert locking lever end in support hole then align lever **no. 1** and sliding block holes.

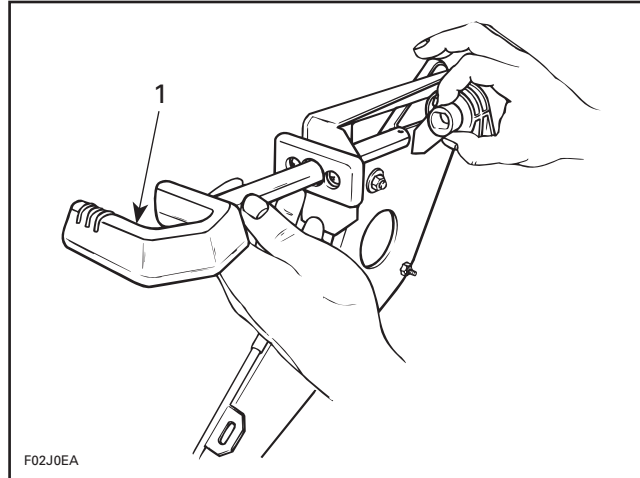


TYPICAL

1. Support hole

Shift Lever

NOTE: Always install shift lever **no. 3** with its open end facing left side of watercraft, then push shift lever stem through locking lever **no. 1** and sliding block **no. 5** holes.

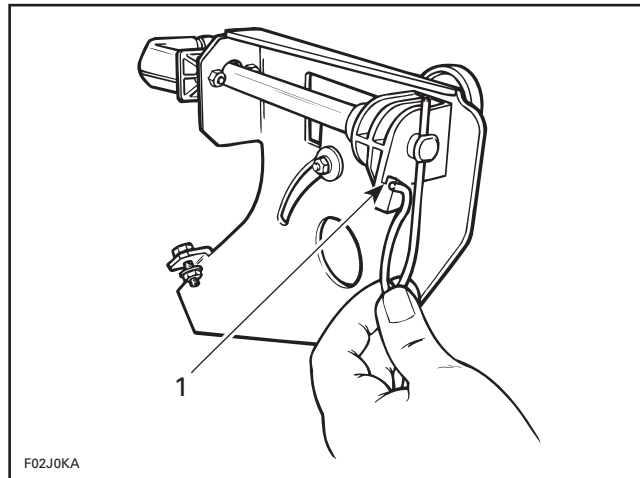


TYPICAL

1. Install shift lever as shown

Spring

Insert spring **no. 2** in lever stem hole and then install curved end in sliding block groove.

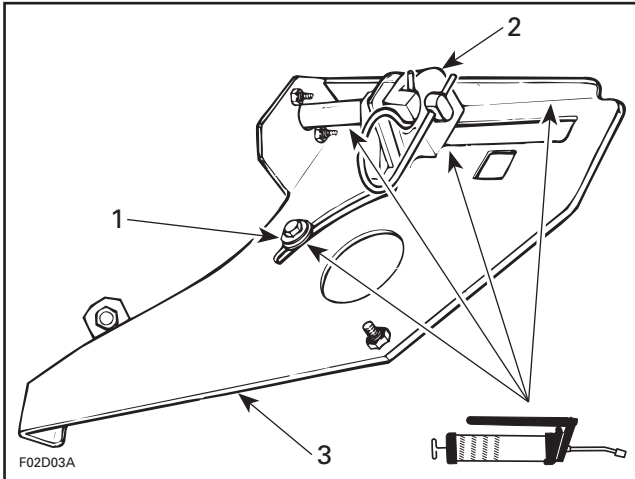


TYPICAL

1. Sliding block groove

Shift Lever Lubrication

Lubricate sliding block support sliding area and triangular lever with synthetic grease. Also, lubricate sliding washer and shift lever stem.



TYPICAL

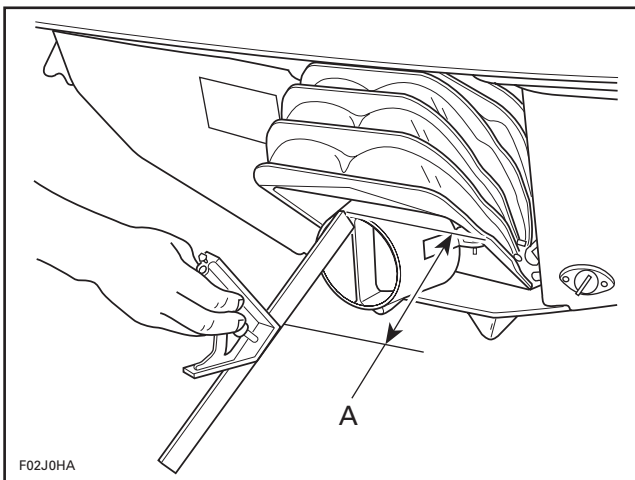
- 1. Sliding washer
- 2. Sliding block
- 3. Support plate

ADJUSTMENT

Reverse Gate

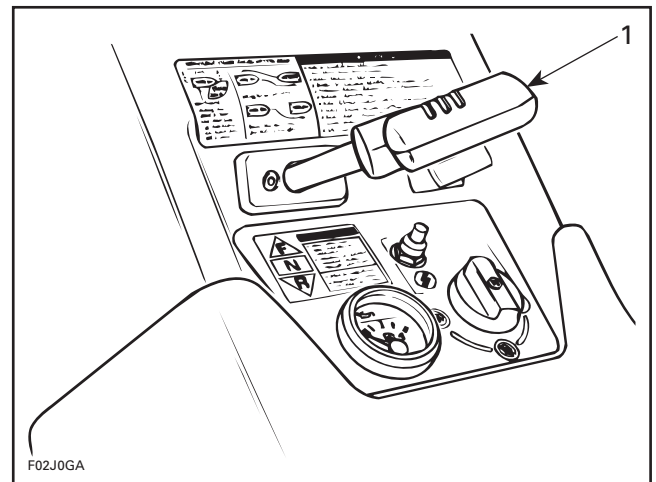
Position handlebar in a straight ahead position, nozzle should be parallel to rear of watercraft.

Using a square, set it to 129 ± 3 mm ($5\text{-}5/64 \pm 7/64$ in), then position square end at the top middle of nozzle.



A. 129 ± 3 mm ($5\text{-}5/64 \pm 7/64$ in)

Pull shift lever in REVERSE position.

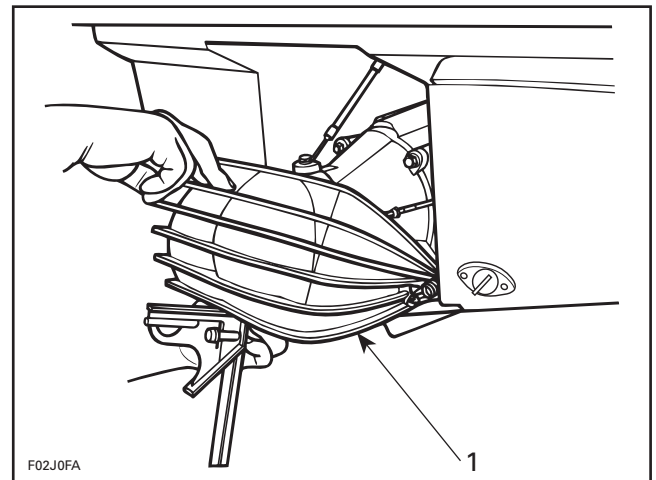


TYPICAL

- 1. Shift lever in REVERSE position

With the gate down to REVERSE position it should be at the specification.

NOTE: Push slightly on the gate in order to recover spring tension and to obtain proper position of the gate.



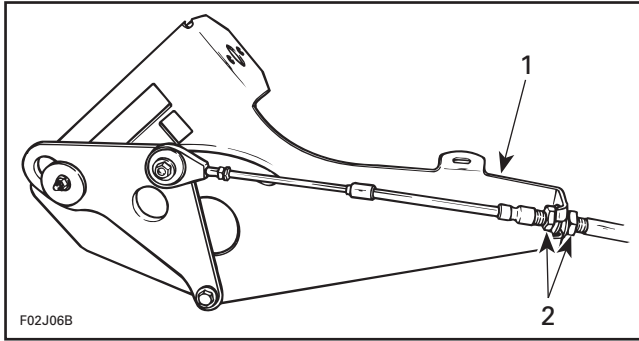
- 1. REVERSE position

Section 09 PROPULSION SYSTEM

Subsection 04 (REVERSE SYSTEM)

If reverse gate needs to be readjusted, it can be done at support with adjustment nuts. Turn cable nuts to obtain position.

NOTE: If reverse gate adjustment is not done adequately, performance and steering control will be reduced at reverse position.



TYPICAL

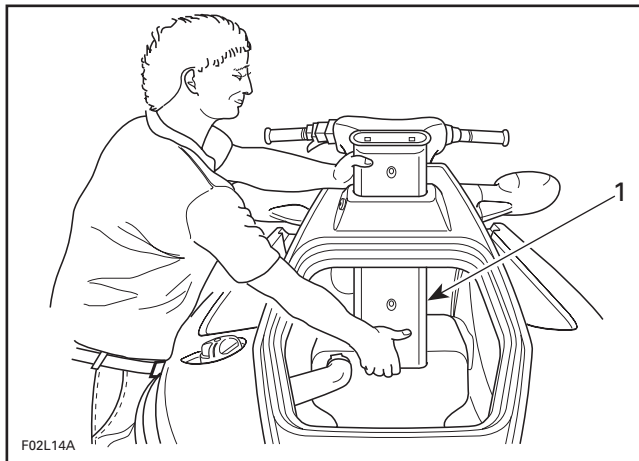
1. Support
2. Adjustment nuts

Tighten adjustment nuts and recheck gate position.

Reinstall vent tube.

⚠ WARNING

Vent tube must be in place to provide proper bilge ventilation.



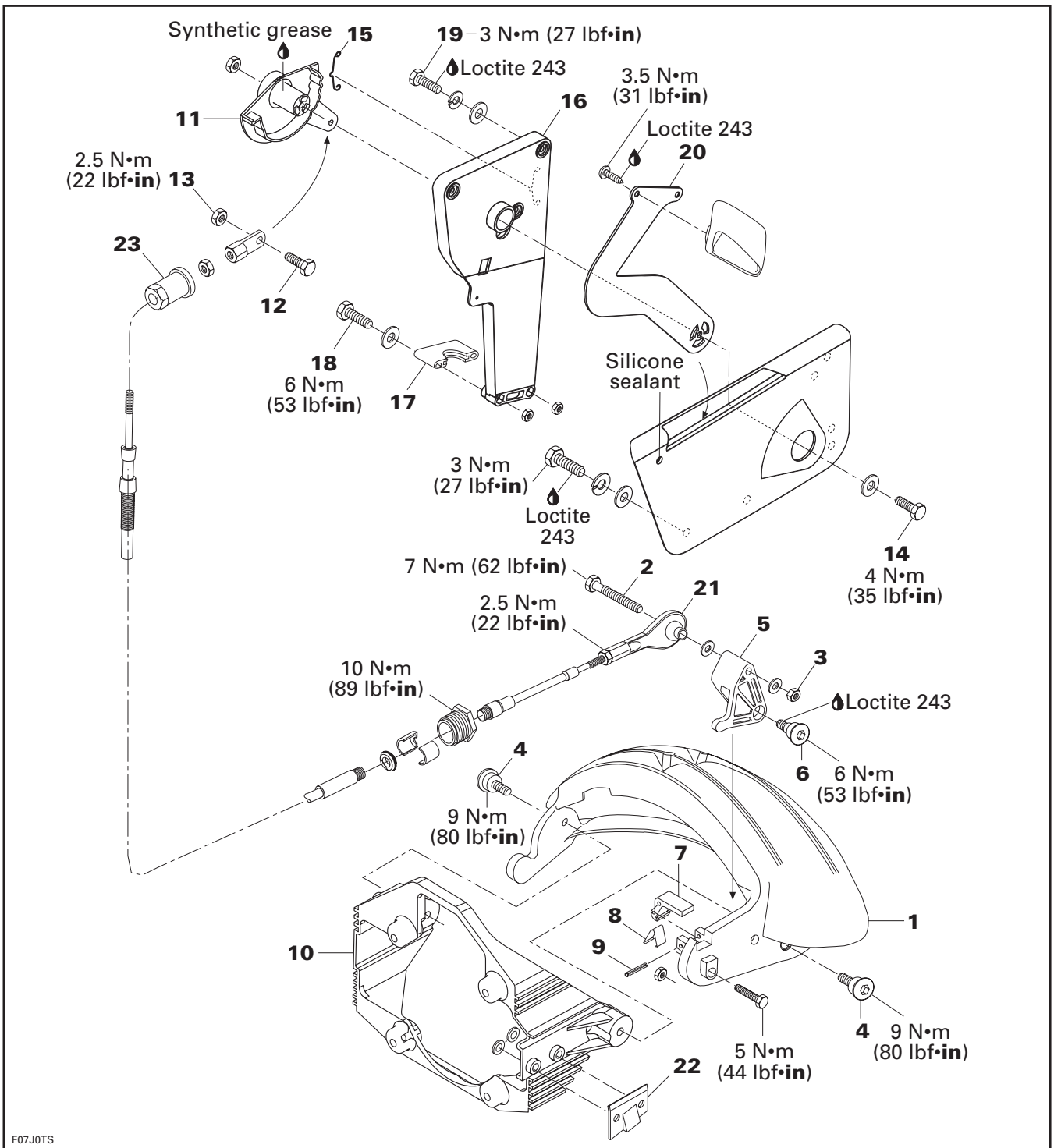
1. Install vent tube

Reinstall storage tray.

Section 09 PROPULSION SYSTEM

Subsection 04 (REVERSE SYSTEM)

GTI, GTX and GTX RFI Models



Section 09 PROPULSION SYSTEM

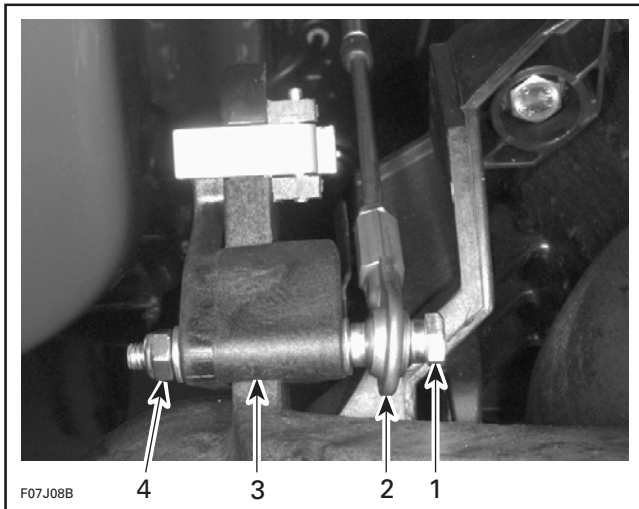
Subsection 04 (REVERSE SYSTEM)

DISASSEMBLY

Reverse Gate

Put shift lever in reverse position.

Disconnect reverse cable from reverse gate **no. 1**. Remove lock nut **no. 3** and bolt **no. 2** retaining cable end to cable lever **no. 5**.



1. Bolt
2. Cable end
3. Cable lever
4. Lock nut

Unscrew and remove 2 Allen screws **no. 4** retaining reverse gate to support **no. 10** and remove reverse gate.

Cable Lever

Remove Allen screw **no. 6** and detach cable lever from reverse gate.

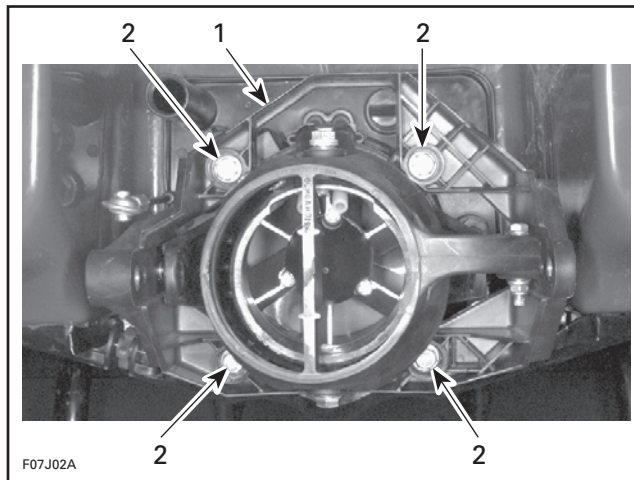
Pawl Lock and Spring

To remove pawl lock **no. 7** and spring **no. 8** remove roll pin **no. 9**.

Reverse Gate Support

Unscrew 4 bolts which retain reverse gate support **no. 10** to venturi.

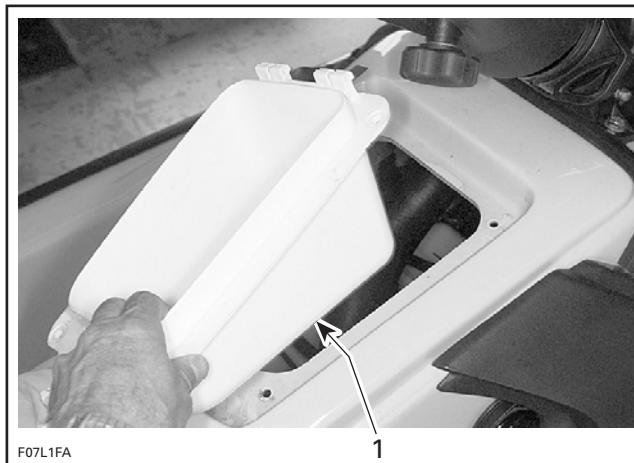
Remove reverse gate support from venturi.



1. Reverse gate support
2. Remove bolts

Interior Lever

Remove glove box to have access to the shifting lever mechanism.

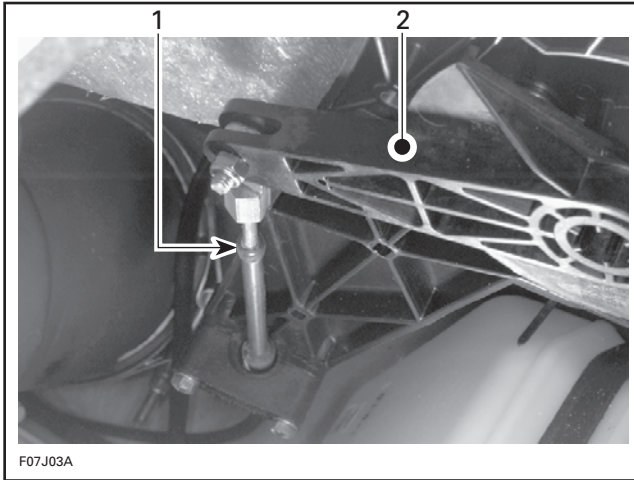


1. Remove glove box

Section 09 PROPULSION SYSTEM

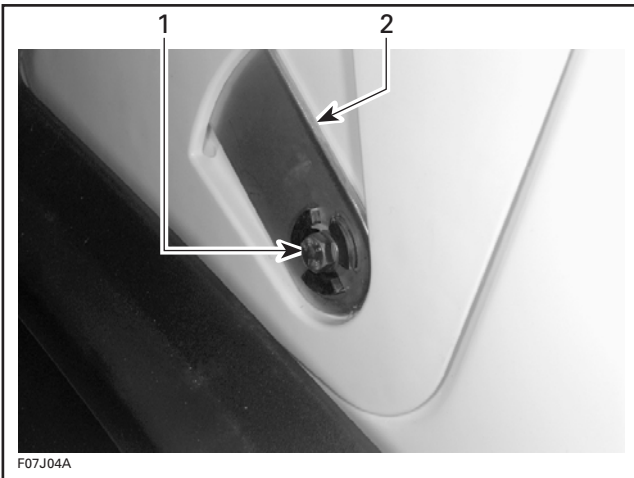
Subsection 04 (REVERSE SYSTEM)

Remove bolt no. 12 and lock nut no. 13 retaining reverse cable end to interior lever no. 11.



1. Reverse cable
2. Interior lever

From outside of body, unscrew bolt no. 14 retaining the interior lever.



1. Bolt
2. Shift lever

Remove the interior lever no. 11 and spring no. 15.

Reverse Cable Support

Unscrew bolts no. 18 and remove retaining block no. 17. Detach adjustment nut no. 23 from reverse cable support no. 16.

Remove 3 bolts no. 19 retaining reverse cable support no. 16 to body.

Remove reverse cable support.

INSPECTION

Visually inspect parts for wear or cracks. Replace parts as required.

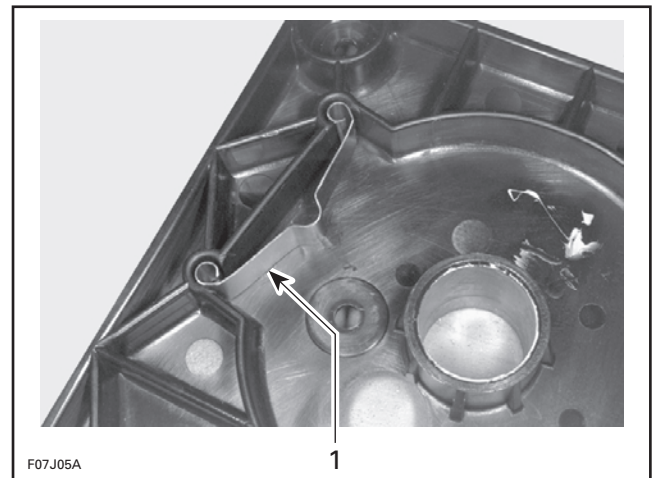
ASSEMBLY

Assembly is essentially the reverse of disassembly procedures. However, pay particular attention to the following.

CAUTION: Apply all specified torques and service products as per main illustration.

Spring

Make sure to properly install spring no. 15 into interior lever no. 11 as per following illustration.



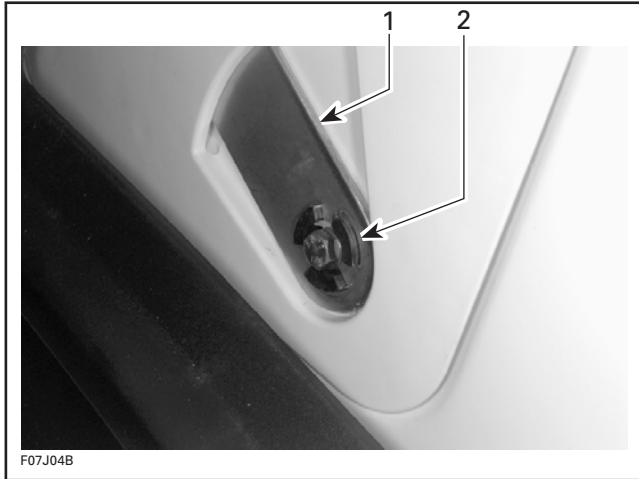
1. Spring

Section 09 PROPULSION SYSTEM

Subsection 04 (REVERSE SYSTEM)

Interior Lever and Shift Lever

Install the interior lever no. 11 in a rotating movement. Engage properly the interior lever tabs in the shift lever slots.

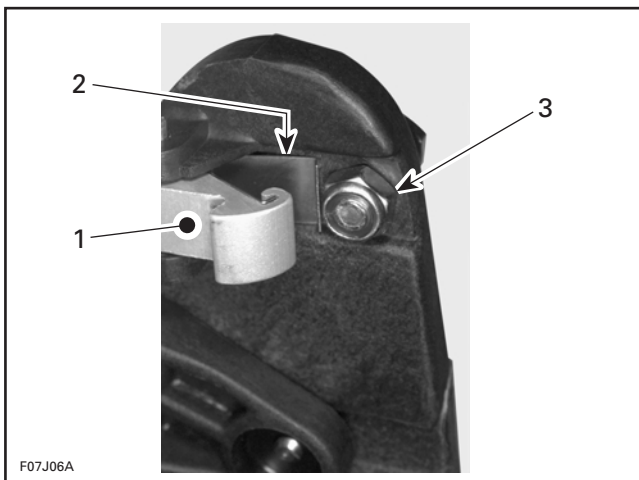


1. Shift lever
2. Interior lever tabs

Make sure the shift lever action is smooth and precise. Forward, neutral and reverse positions should be easy to select with a detent position between each.

Spring and Pawl Lock

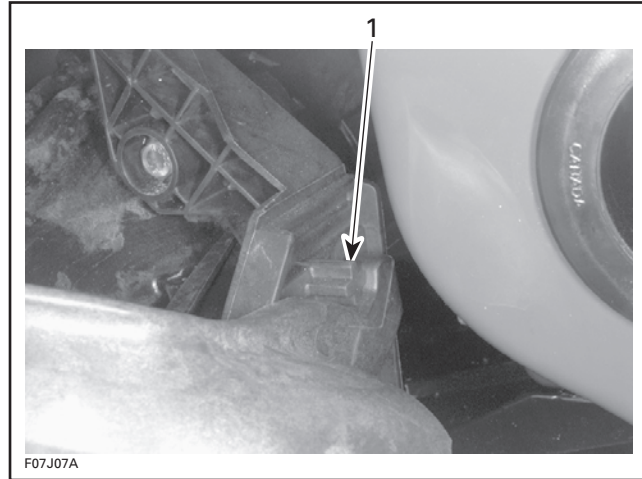
Make sure spring no. 8 is properly installed. One end of the spring is hooked in the pawl lock no. 7 and the other end is retained by the stopper lock nut.



1. Pawl lock
2. Spring
3. Stopper lock nut

Reverse Gate

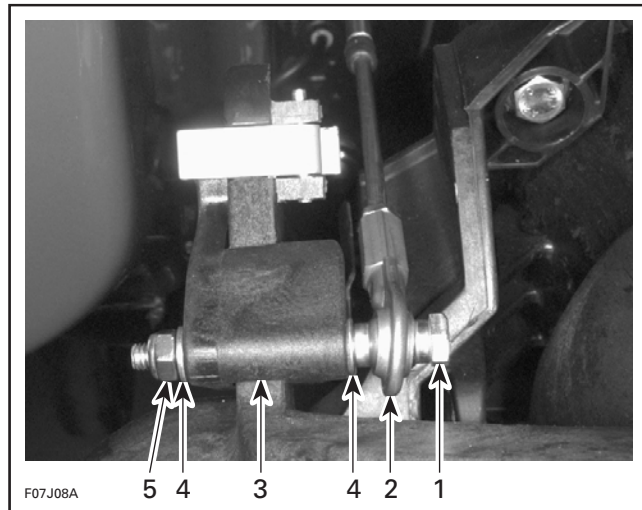
When installing the reverse gate, pay attention to position its lever behind the reverse gate support stopper.



1. Stopper

Reverse Cable

Install reverse cable to cable lever as per following illustration.



1. Bolt
2. Ball joint
3. Cable lever
4. Flat washer
5. Lock nut

CAUTION: Ensure cable ball joint is parallel to cable lever ($90^\circ \pm 5^\circ$) to minimize tension on cable. Adjust as required.

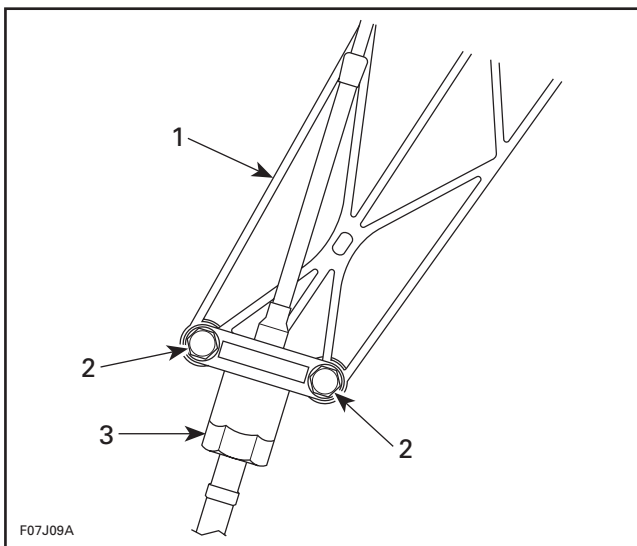
ADJUSTMENT

Put shift lever in forward position.

Pull shift lever approximately 50 mm (2 in) and push it back slowly in forward position.

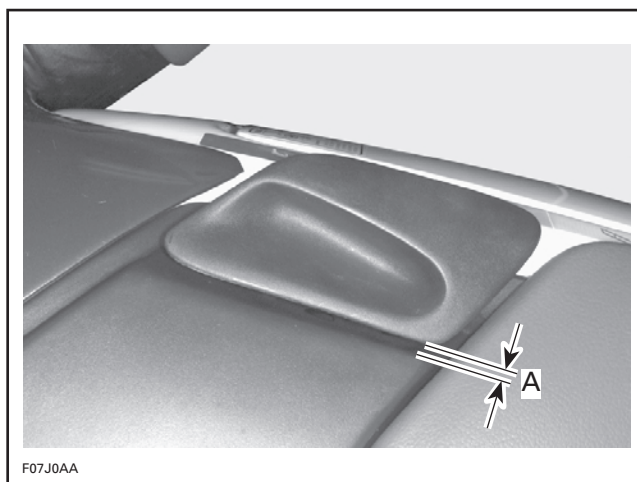
The pawl lock **no. 7** should be engaged in the anchor **no. 22**.

If not, adjust reverse cable. Loosen 2 bolts **no. 18** at reverse cable support **no. 16**. Turn adjustment nut **no. 23** as required.



1. Reverse cable support
2. Loosen bolts
3. Adjustment nut

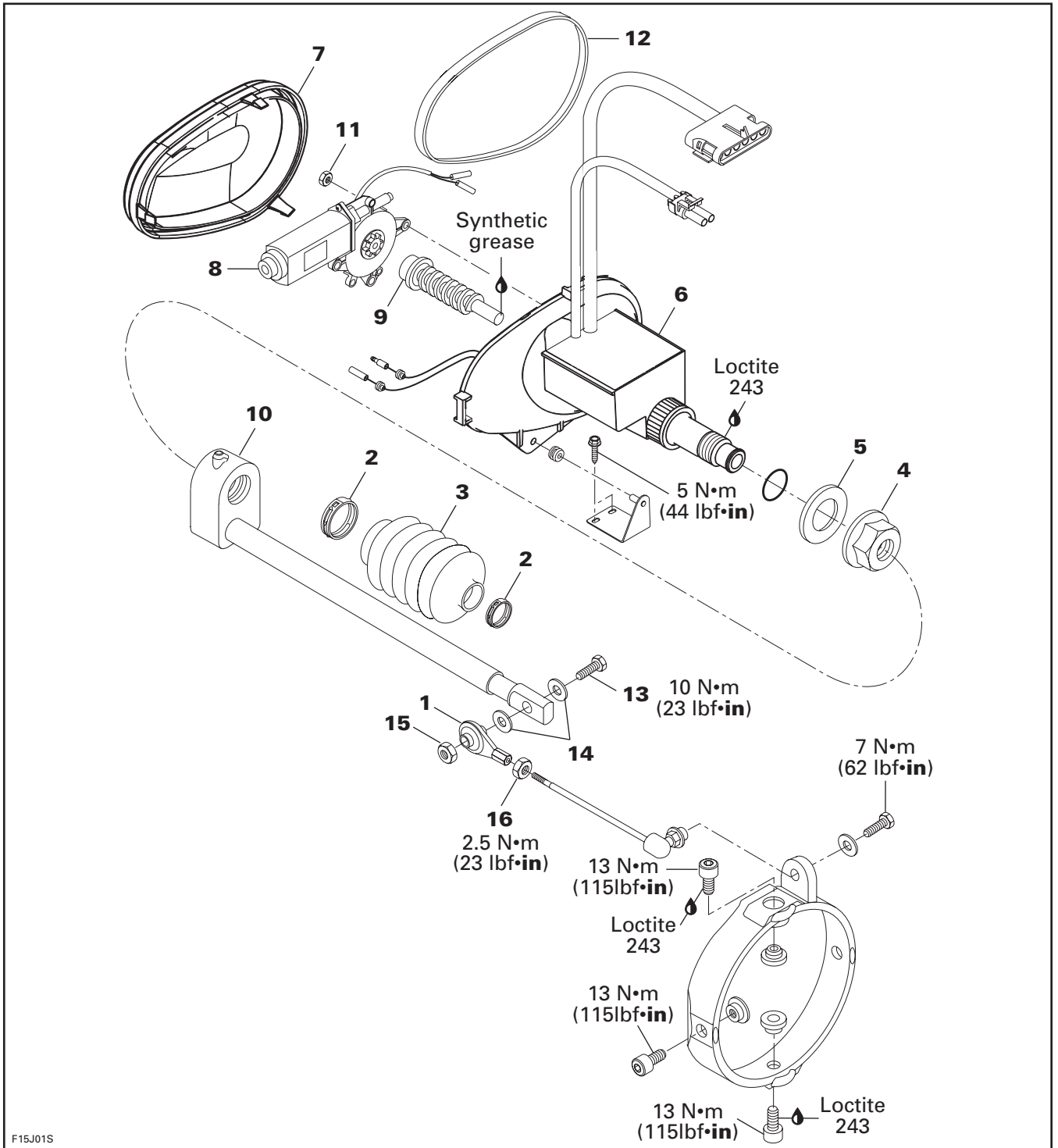
When adjustment is completed, there should be gap of 2 to 3 mm (5/64 to 7/64 in) between handle and left cover.



- A. 2 to 3 mm (5/64 to 7/64 in)

VARIABLE TRIM SYSTEM

GSX RFI and XP Models



Section 09 PROPULSION SYSTEM

Subsection 05 (VARIABLE TRIM SYSTEM)

GENERAL

To test VTS control module, motor or switch, refer to INSTRUMENTS AND ACCESSORIES.

To have access to VTS module, remove seat (except XP).

NOTE: On XP model, open rear access cover.

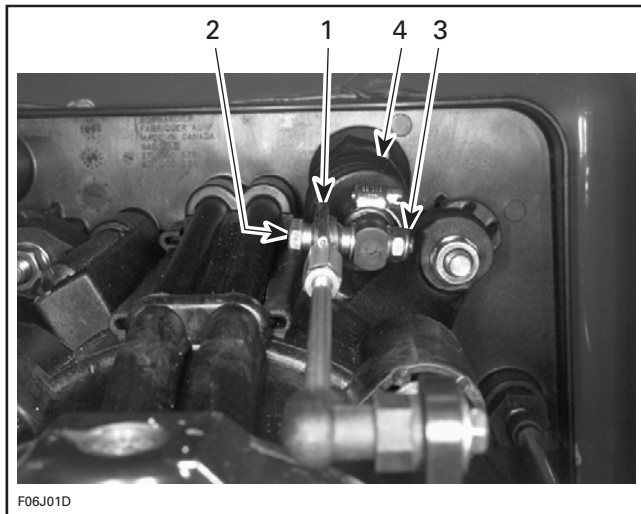
Remove screws retaining electrical box and move it aside (on GSX RFI only).

REMOVAL

Remove nut **no. 15** and bolt **no. 13** retaining ball joint **no. 1** to sliding shaft.

Remove clamps **no. 2**.

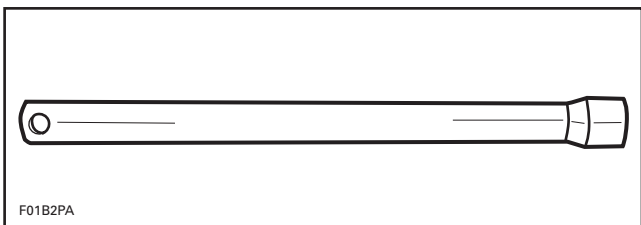
Remove boot **no. 3**.



TYPICAL

1. Ball joint
2. Bolt
3. Lock nut
4. Rubber boot

To loosen nut **no. 4**, use VTS socket tool (P/N 295 000 133).



Remove sealing washer **no. 5**.

All Models

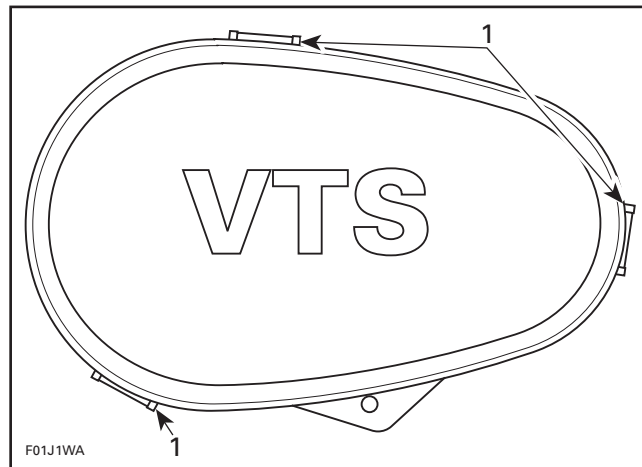
Disconnect wiring harnesses.

Pull out VTS assembly **no. 6** from bilge.

DISASSEMBLY

Cover

Remove VTS cover **no. 7** by pressing on tabs.

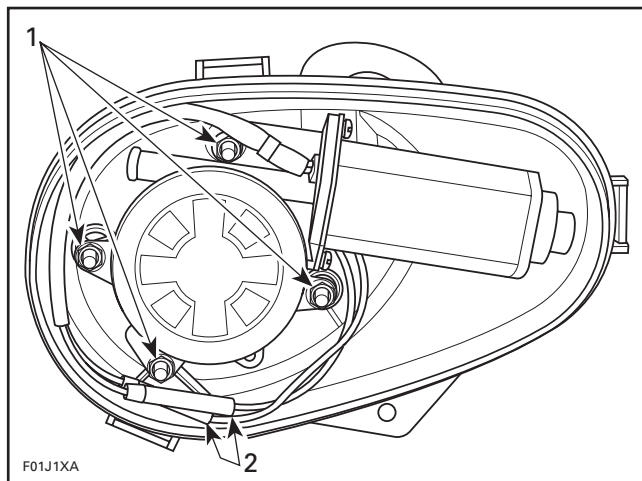


1. Press tabs to remove cover

Motor

Disconnect wires from motor.

Remove retaining nuts **no. 11**.



1. Remove nuts
2. Disconnect wires

Pull on motor to remove it.

Worm and Sliding Shaft

Simply pull on worm **no. 9** and sliding shaft **no. 10** in order to remove them.

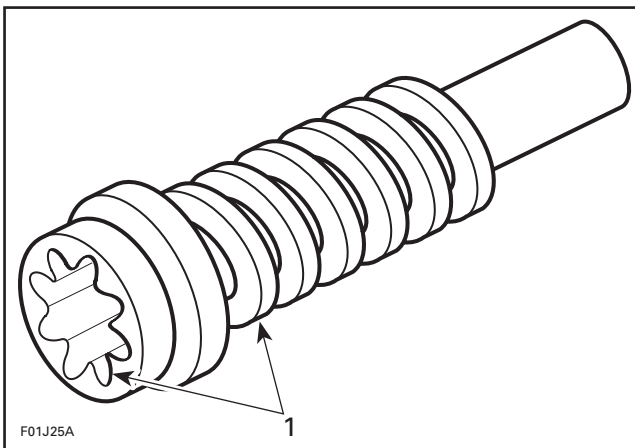
INSPECTION

Boot

Make sure boot **no. 3** is in good condition. If it is cracked or teared, replace boot.

Worm

Inspect threads and splines of worm **no. 9** for wear. If worm replacement is necessary, renew also sliding shaft.



1. Inspect threads and splines

ASSEMBLY

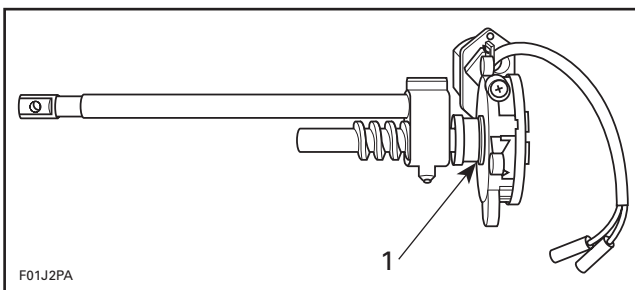
Assembly is essentially the reverse of disassembly procedures. However pay particular attention to the following.

Motor, Worm and Sliding Shaft

Apply synthetic grease to worm.

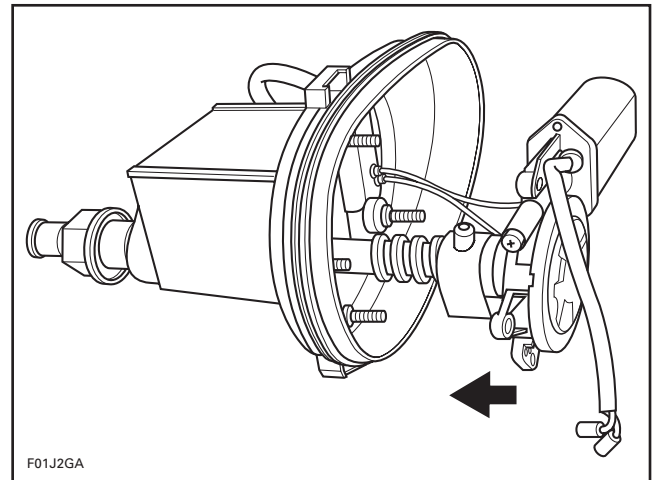
Screw worm **no. 9** to sliding shaft **no. 10**.

Mesh worm splines to gear of motor.



1. Mesh worm spline to gear of motor

Install motor, worm and sliding shaft in VTS housing.



Apply Loctite 243 (blue) to nuts **no. 11** and tighten to 7 N•m (62 lbf•in).

Connect wires of motor.

CAUTION: Make sure wire color codes match.

Install cover **no. 7**.

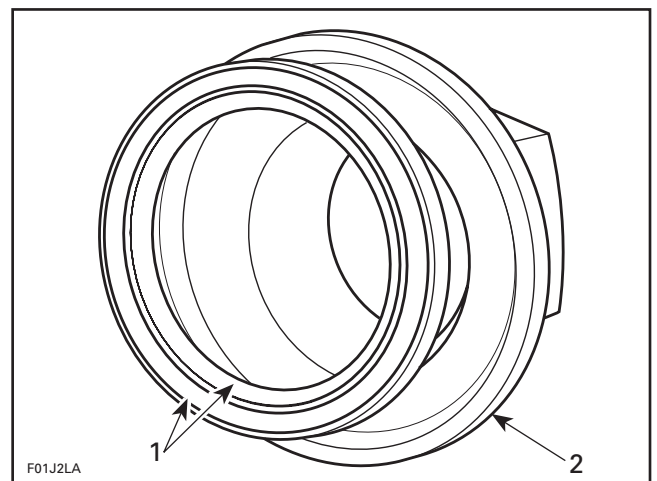
NOTE: Make sure seal **no. 12** is in place.

INSTALLATION

Installation is essentially the reverse of removal procedures. However pay particular attention to the following.

Nut and Sealing Washer

Place sealing washer **no. 5** on nut **no. 4**. Make sure seal lips are facing toward hull.



1. Seal lips facing hull
2. Nut

Section 09 PROPULSION SYSTEM

Subsection 05 (VARIABLE TRIM SYSTEM)

Apply Loctite Primer N (P/N 293 800 041) to threads of VTS housing and Loctite 243 (blue) to nut **no. 4**. Install nut with sealing washer and torque to 6 N•m (53 lbf•in) using the VTS socket tool.

Boot and Clamps

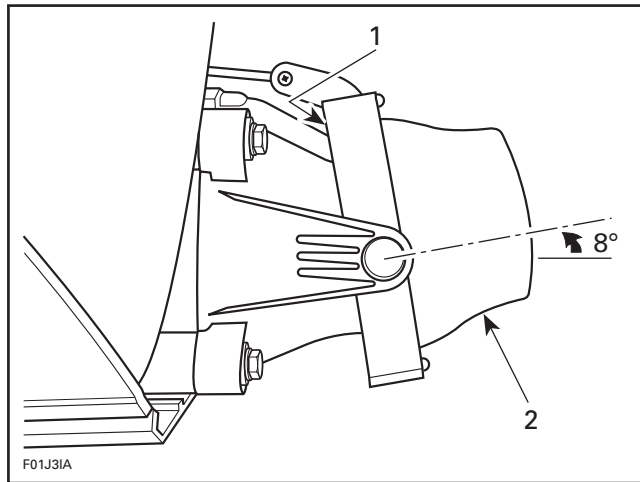
install rubber boot **no. 3** over sliding shaft and secure with clamps.

Ball Joint

GSX RFI and XP

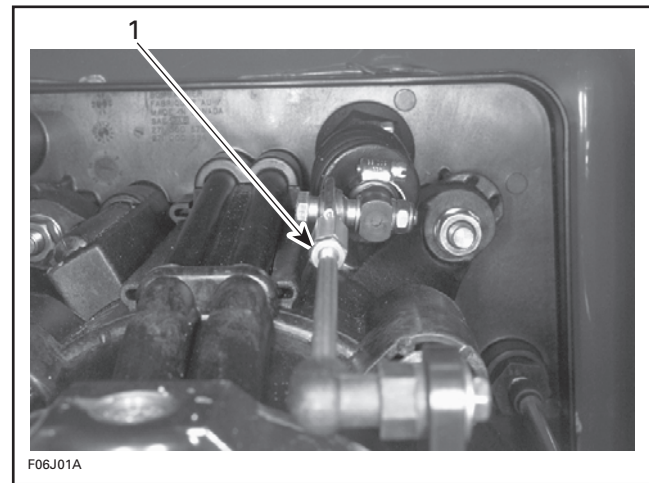
Install ball joint on LEFT side of sliding shaft **no. 10** using bolt **no. 13**, washers **no. 14** and nut **no. 15**. Torque nut to 10 N•m (88 lbf•in).

NOTE: Activate timer to be able to position VTS.



1. No interference
2. Nozzle up

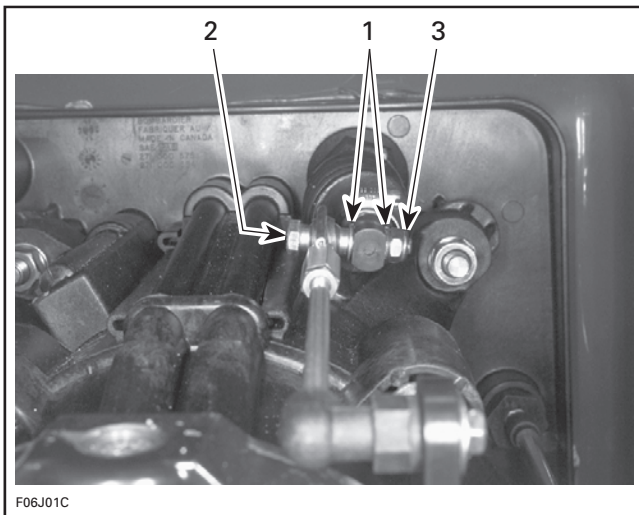
If an adjustment is necessary, loosen jam nut **no. 16** of link rod ball joint **no. 1**. Turn adjustment nut of ball joint to obtain the desired gap between trim ring and venturi.



TYPICAL

1. Turn adjustment nut of ball joint

Tighten jam nut of ball joint to 2.5 N•m (23 lbf•in) when adjustment is completed.



TYPICAL

1. Washers
2. Bolt
3. Lock nut

ADJUSTMENT

Push on VTS button up position until motor stops. When the nozzle is up (8°), nozzle edge must not interfere with venturi (there should be a gap of 1 mm (.039 in)).

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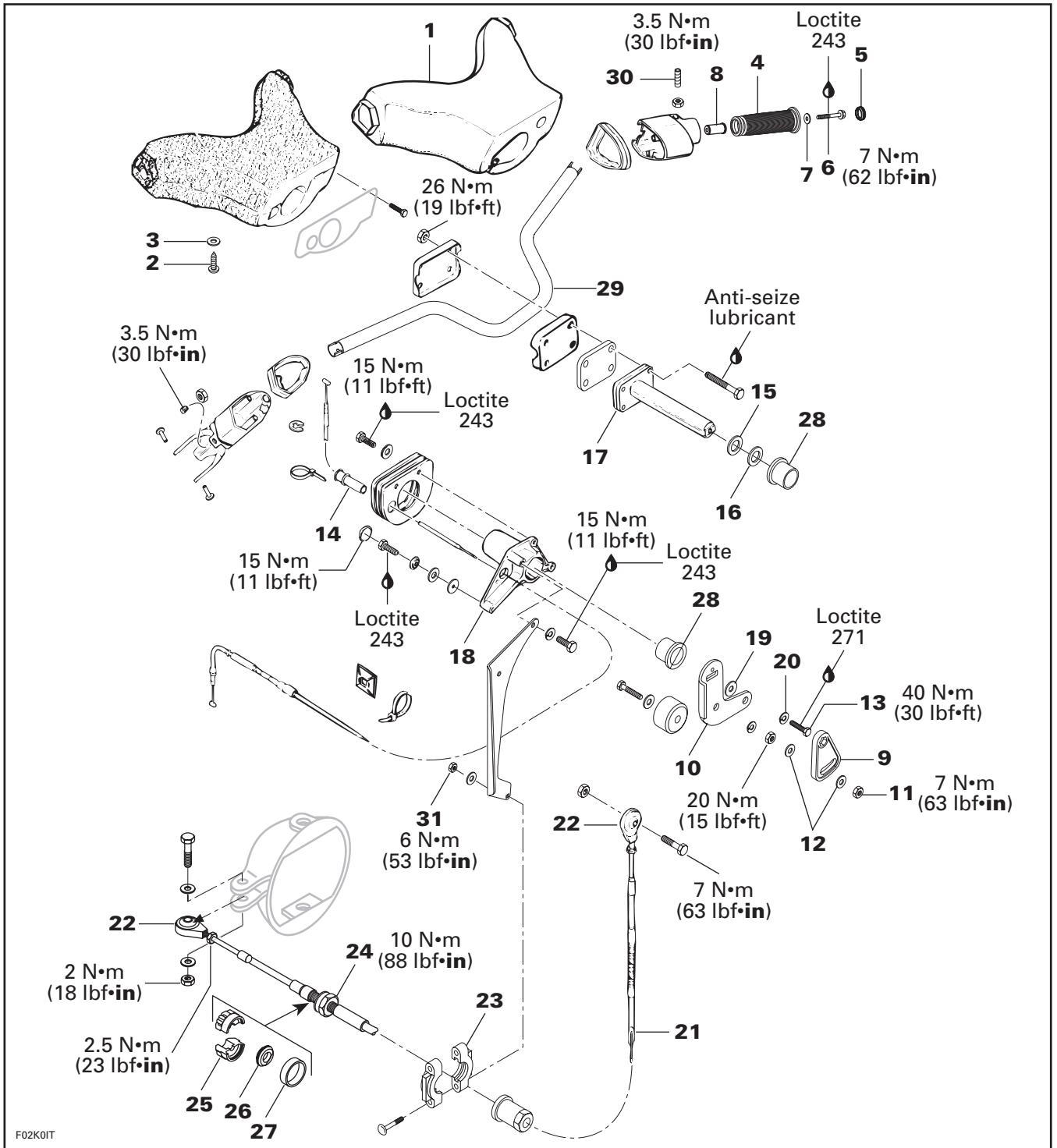
STEERING SYSTEM	10-02-1
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DISASSEMBLY.....	10-02-6
ASSEMBLY.....	10-02-9
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DISASSEMBLY.....	10-03-2
ASSEMBLY.....	10-03-6

ALIGNMENT	10-04-1
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STEERING SYSTEM

GTS Model



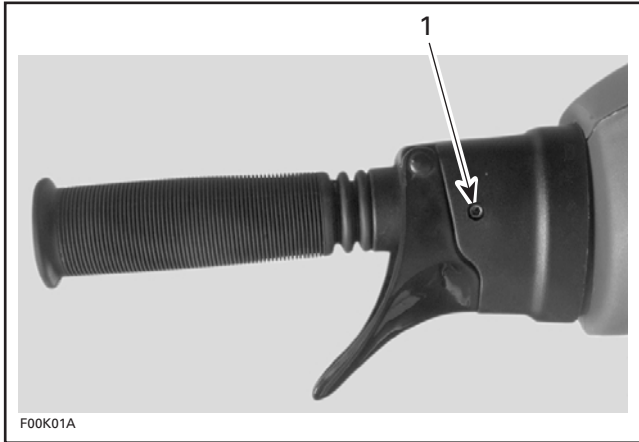
Section 10 STEERING SYSTEM

Subsection 02 (STEERING SYSTEM)

REMOVAL AND INSTALLATION

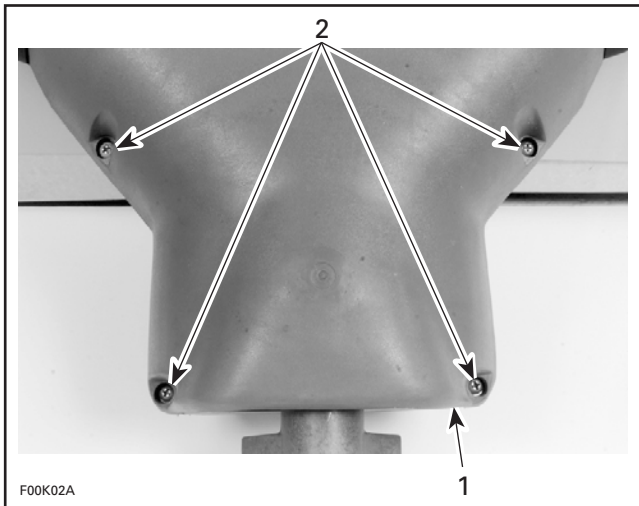
Steering Cover

To replace the cover, loosen set screws **no. 30** of handlebar housing.



1. Set screw

Remove and reinstall 4 screws **no. 2** and washers **no. 3**.



1. Cover
2. Screws

Remove steering cover and top foam from handlebar.

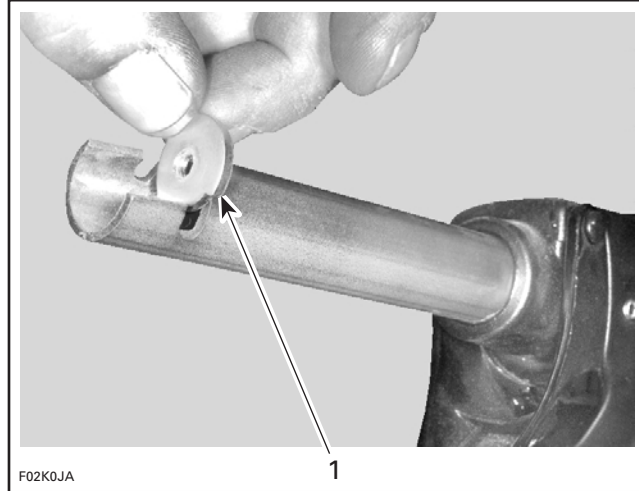
Handle Grip and Grip Insert

To remove handle grip **no. 4**, just pull out cap **no. 5** from grip end and remove screw **no. 6** and washer **no. 7**.

Pull out grip and remove grip insert from handlebar.

NOTE: Verify grip insert for damage.

When installing the grip insert in the handlebar **no. 29**, ensure that it is properly inserted in the slot at the end of the handlebar tubing.



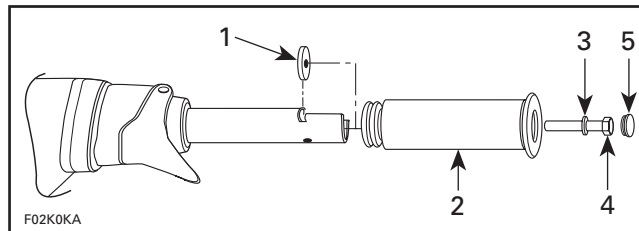
1. Grip insert

Install grip **no. 4** on handlebar **no. 29** matching it to the hex form on the grip insert.

Install flat washer **no. 7** and screw **no. 6**.

Torque screw to 7 N•m (62 lbf•in).

Install cap **no. 5**.



1. Grip insert
2. Grip
3. Flat washer
4. Screw. Torque to 7 N•m (62 lbf•in)
5. Cap

CAUTION: Ensure to install flat washer otherwise screw will damage grip end.

Steering Stem and Handlebar

Disconnect wiring harnesses leading out of dashboard hole.

Disconnect throttle cable at carburetor.

Remove throttle cable from tie-block and clip.

Unscrew nut **no. 11** retaining locking plate **no. 9**; then remove locking plate and washers **no. 12**.

Unscrew screw **no. 13** of steering stem arm **no. 10**.

Pull out handlebar and steering stem.

Section 10 STEERING SYSTEM

Subsection 02 (STEERING SYSTEM)

NOTE: It is not necessary to disconnect steering cable to remove handlebar and steering stem.

Inspect bushings **no. 28** for wear, cracks, scoring, etc. Replace as necessary.

Installation is essentially the reverse of removal procedures. However, pay particular attention to the following.

Insert throttle cable through dashboard hole and slide grommet **no. 14** on cable.

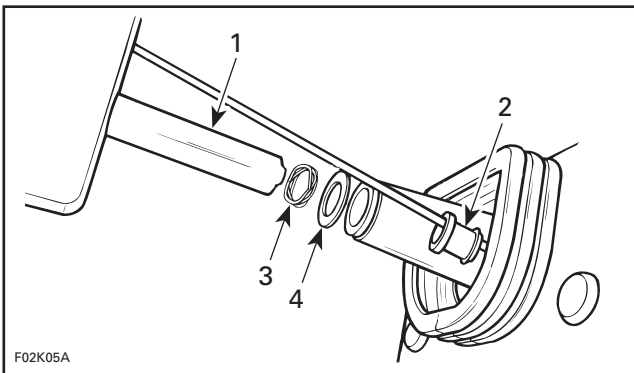
Insert grommet **no. 14** in dashboard hole and pull it from inside bilge.

NOTE: To ease installation, apply water on grommet.

Insert wires of monitoring beeper and start/stop button.

Insert spring washer **no. 15** and the shim **no. 16** onto steering stem **no. 17**.

Insert steering stem into support **no. 18**.



1. Steering stem
2. Grommet
3. Spring washer
4. Shim

Properly position steering stem arm **no. 10** on steering stem. Make sure to insert stem tenon into arm mortise.

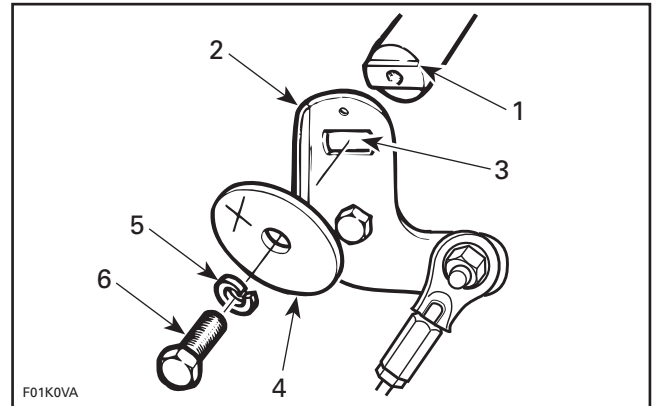
Apply Loctite 271 (red) on threads of screw **no. 13**.

Install large flat washer **no. 19**, lock washer **no. 20** and screw **no. 13**. Torque screw to 40 N•m (30 lbf•ft).

⚠ WARNING

The recommended torque and Loctite must be applied on screw. Steering arm mortise must seat properly on steering stem tenon.

CAUTION: Always install large flat washer with the X stamped side facing the lock washer.



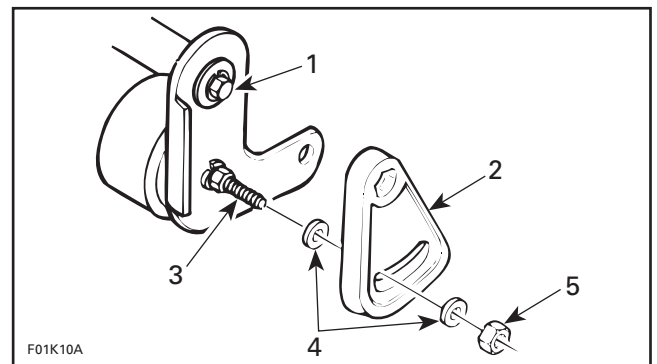
TYPICAL

1. Steering stem tenon
2. Steering stem arm
3. Mortise
4. Large flat washer with X
5. Lock washer
6. Screw, apply Loctite 271 and torque to 40 N•m (30 lbf•ft)

Position 8 mm flat washer **no. 12** on steering stopper screw then install locking plate **no. 9** over steering stem head screw.

NOTE: Ensure locking plate slot is inserted in steering stopper screw.

Install a second 8 mm flat washer **no. 12** and secure locking plate using jam nut **no. 11**. Torque nut to 7 N•m (62 lbf•in).

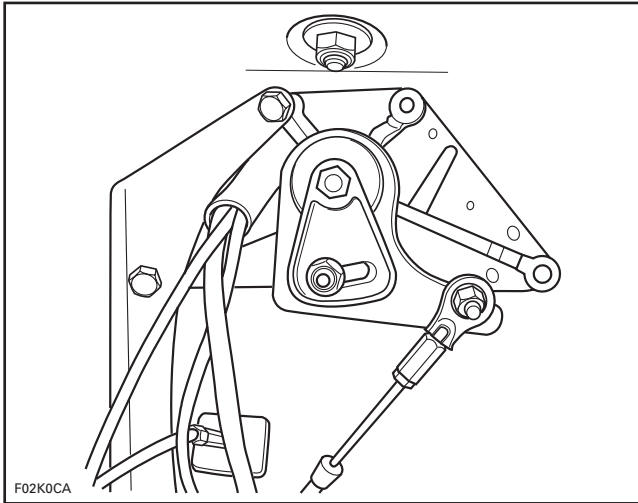


STEERING CABLE NOT SHOWN FOR MORE CLARITY

1. Steering stem head screw
2. Locking plate
3. Steering stopper screw
4. 8 mm flat washers
5. Torque nut to 7 N•m (62 lbf•in)

Section 10 STEERING SYSTEM

Subsection 02 (STEERING SYSTEM)



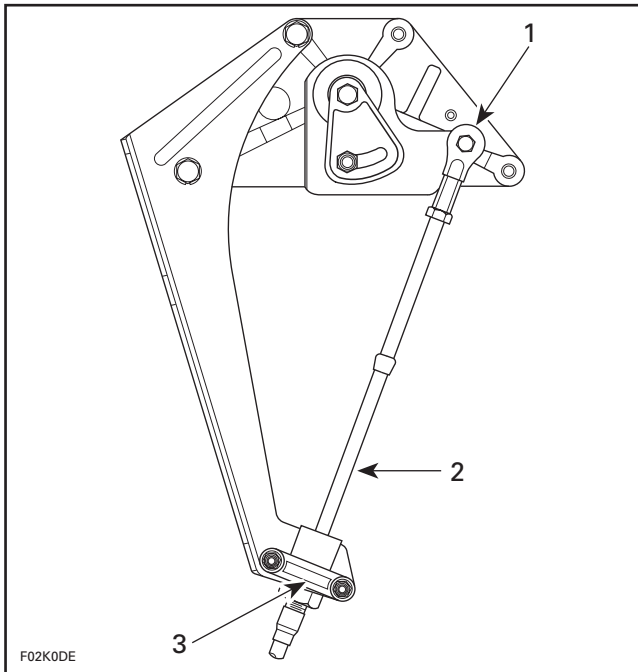
TYPICAL

Steering Cable

To replace steering cable no. 21, proceed as follows:

Disconnect front ball joint no. 22 of steering cable at steering stem arm no. 19.

Loosen nuts no. 31 and open retaining block no. 23.



TYPICAL

1. Ball joint
2. Steering cable
3. Retaining block

Disconnect rear ball joint no. 22 of steering cable at jet pump nozzle; then, remove ball joint.

From bilge, unscrew nut no. 24 retaining steering cable to hull.

Remove half rings no. 25, rubber washer no. 26 and retaining ring no. 27.

NOTE: Move shift lever in reverse position to lower reverse gate. It will ease parts removal.

Remove steering cable from tie-block and clips.

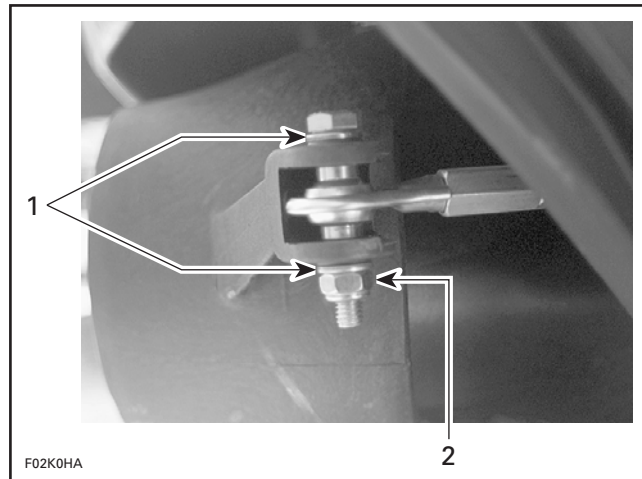
Pull out steering cable.

Assembly is essentially the reverse of disassembly procedures. However pay particular attention to the following.

Inspect and reuse ball joints no. 22 only if they are in good condition.

Secure rear ball joint to nozzle.

CAUTION: Ensure the ball joint is parallel ($\pm 5^\circ$) to the nozzle arm.



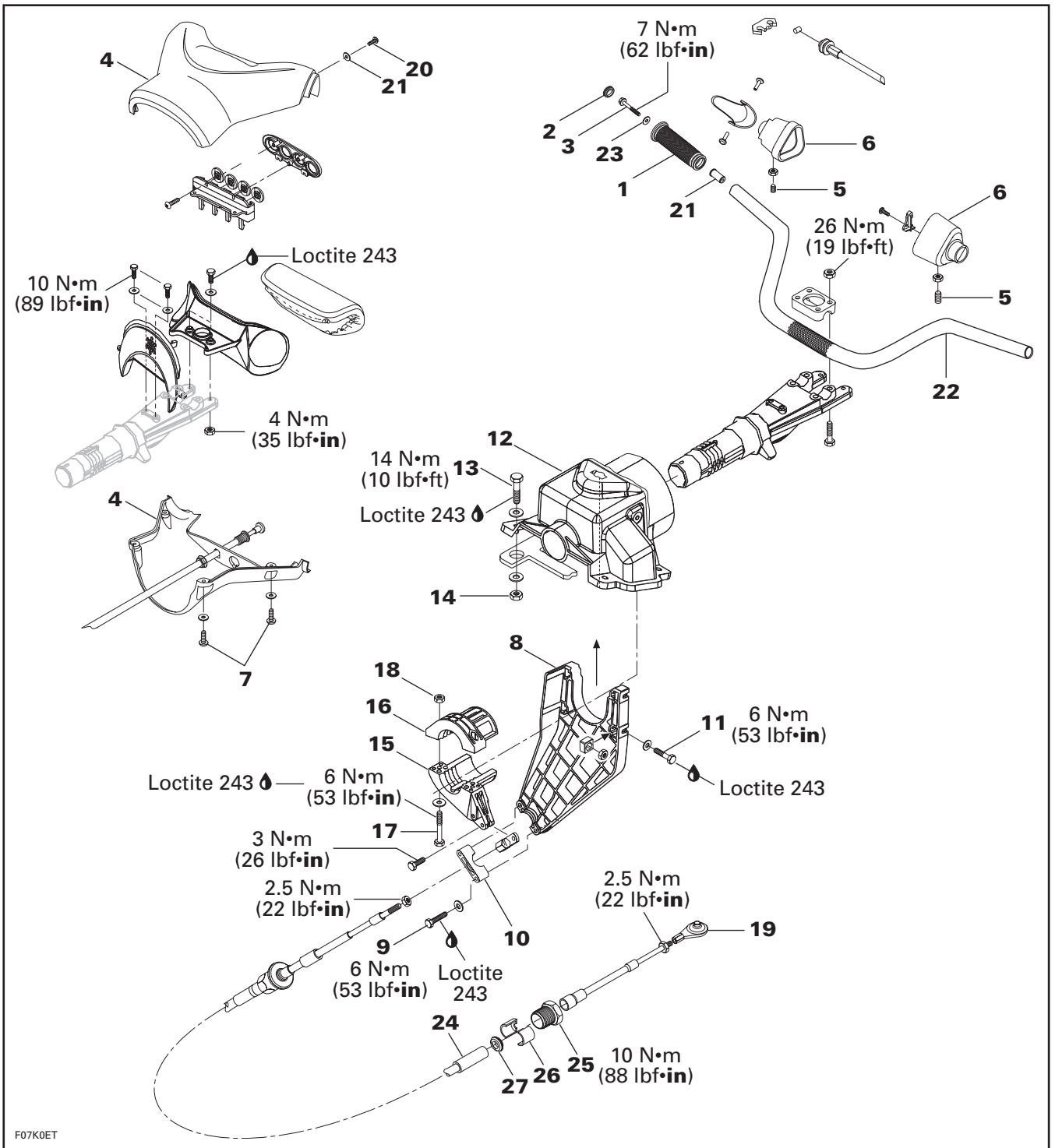
1. One washer each side of arm
2. Torque nut to 2 N•m (18 lbf•in)

STEERING ALIGNMENT

For steering alignment procedure, refer to ALIGNMENT.

Section 10 STEERING SYSTEM
Subsection 02 (STEERING SYSTEM)

GS, GSX RFI, GTI and GTX Models



Section 10 STEERING SYSTEM

Subsection 02 (STEERING SYSTEM)

DISASSEMBLY

Handle Grip and Grip Insert

To remove handle grip no. 1, pull out cap no. 2 and remove screw no. 3.

Pull out grip and remove grip insert from handlebar no. 22.

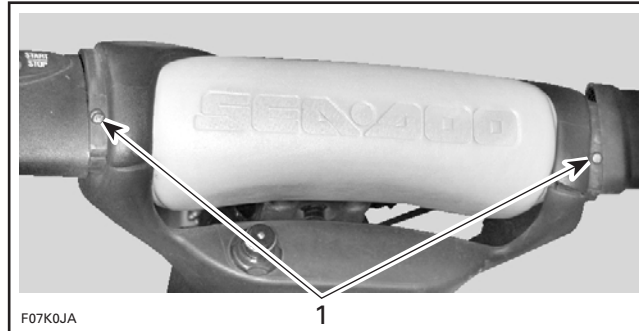
NOTE: Verify grip insert for damage.

Steering Cover

Remove grips no. 1.

Loosen set screws no. 5 of handlebar housings no. 6.

Remove 2 screws no. 20 and flat washers no. 21 each side of cover.

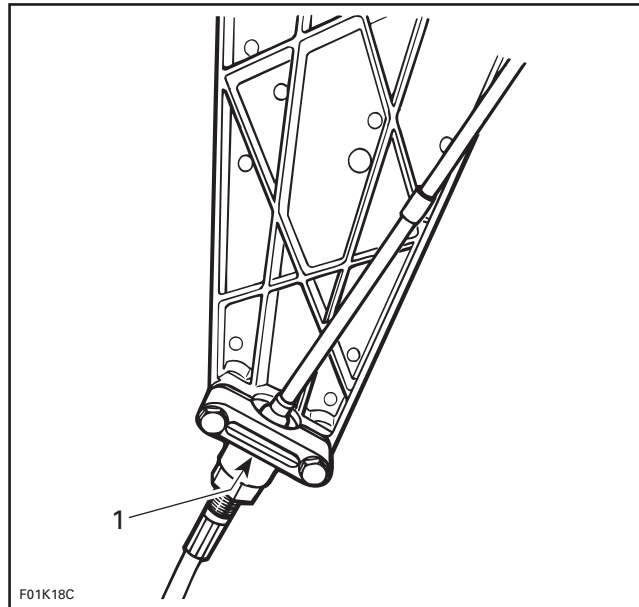


1. Remove screws

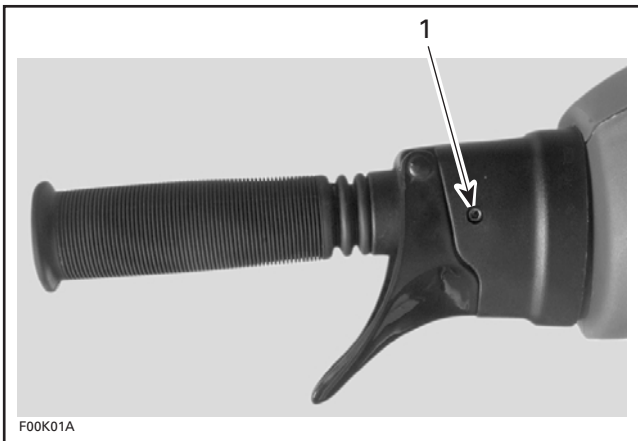
Remove cover.

Cable Support

Loosen bolts no. 9 and remove retaining block no. 10.

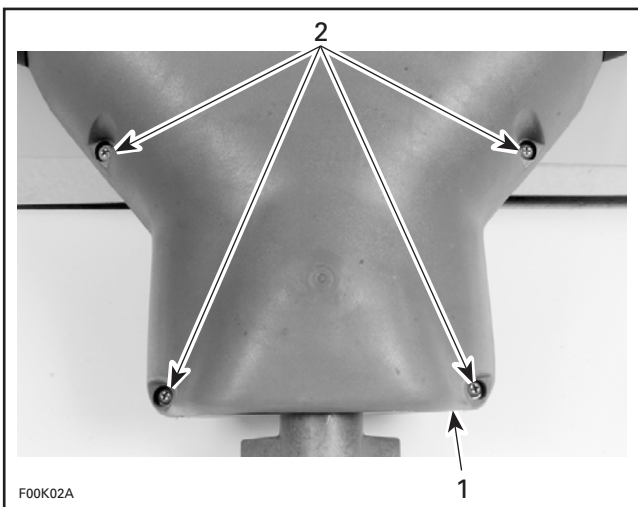


1. Retaining block



1. Set screw

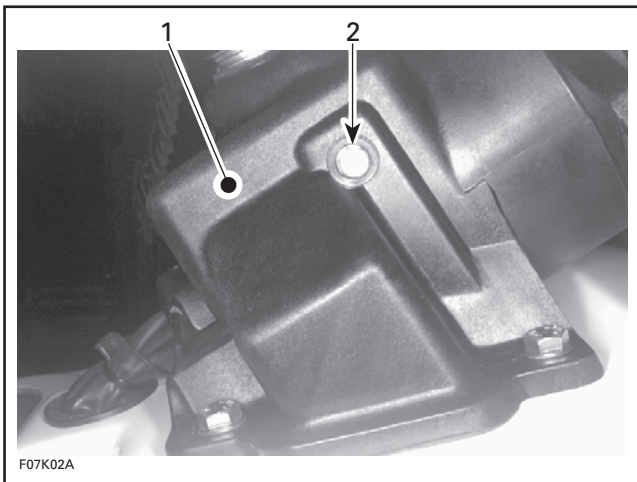
Remove 4 screws no. 7.



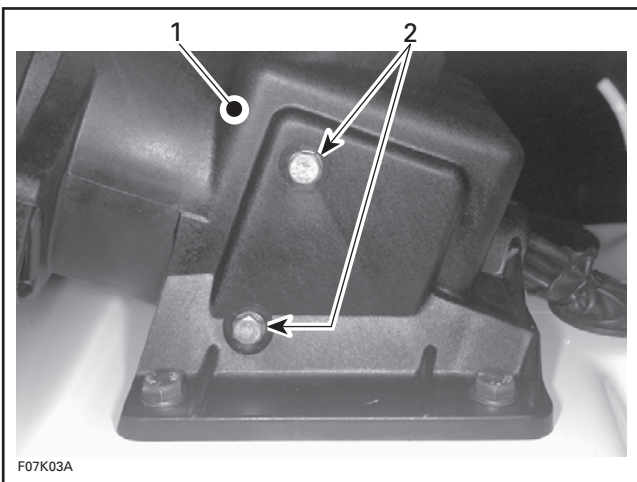
TYPICAL

1. Cover
2. Screws

Loosen bolts no. 11 each side of steering support no. 12.



- 1. Steering support
- 2. Bolt



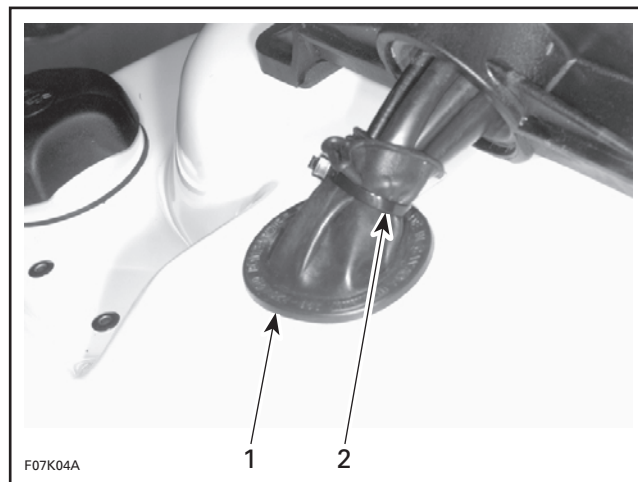
- 1. Steering support
- 2. Bolts

Remove cable support no. 8.

Steering Support

GTI and GTX Models

Cut locking tie securing wiring harness boot.

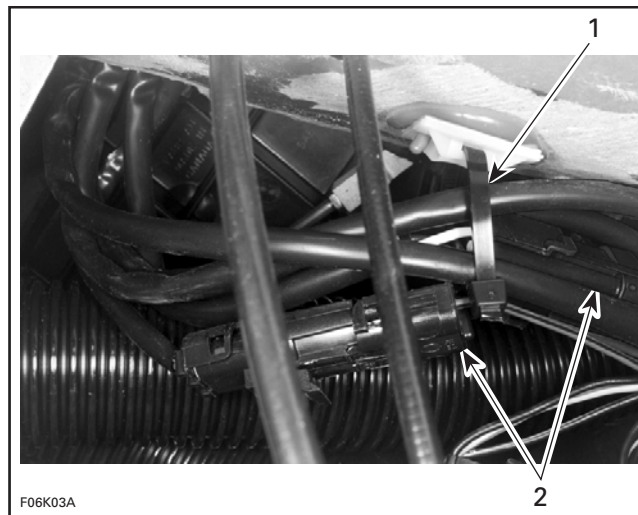


- 1. Boot
- 2. Locking tie

All Models

Disconnect the throttle and choke cables from carburetor levers.

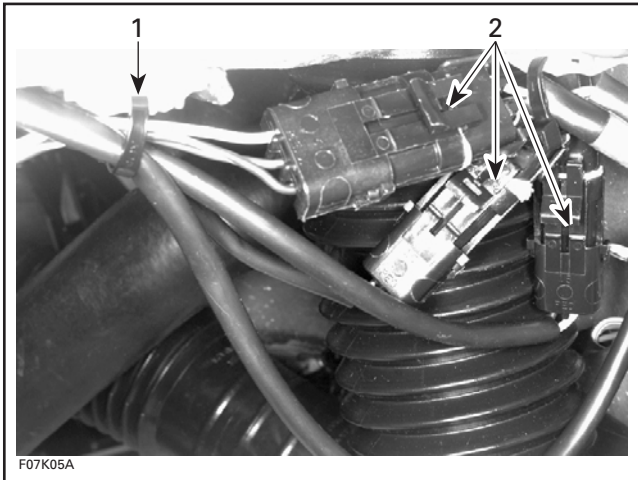
Disconnect the wiring harnesses leading out of steering stem and cut locking tie.



- GS AND GSX**
- 1. Locking tie
- 2. Connectors

Section 10 STEERING SYSTEM

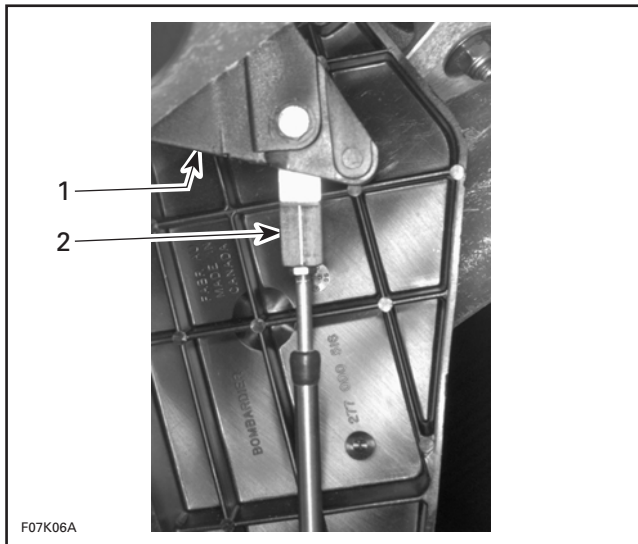
Subsection 02 (STEERING SYSTEM)



GTI AND GTX

1. Tie rap
2. Connectors

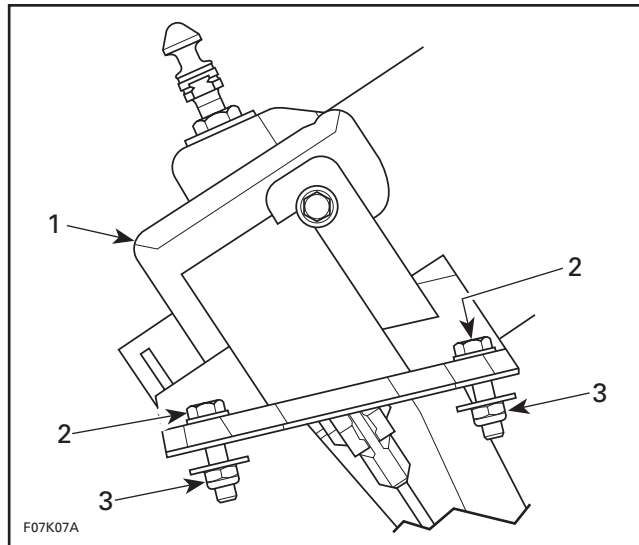
Disconnect the steering cable from the steering stem arm no. 15.



1. Steering stem arm
2. Steering cable

Loosen bolts no. 11 retaining cable support no. 8 to steering support no. 12.

Loosen bolts no. 13 and lock nuts no. 14.

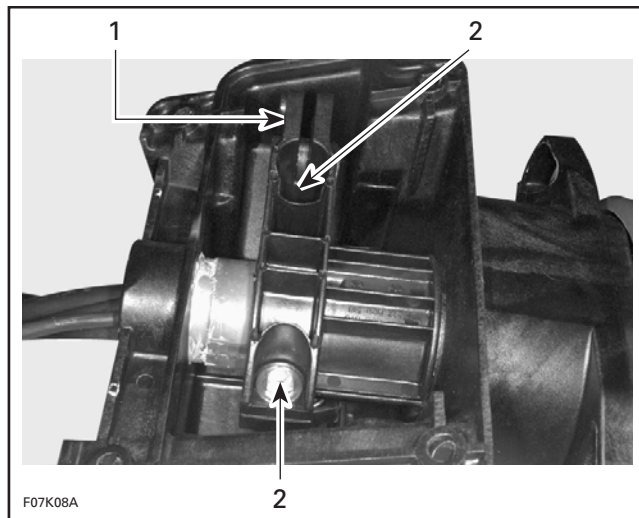


1. Steering support
2. Bolt
3. Lock nut

Remove steering support no. 12 with handlebar, wiring harnesses and cables.

Steering Stem Arm and Support

Loosen bolts no. 17 retaining steering stem arm no. 15 to support no. 16.



1. Steering stem arm
2. Bolts

Remove steering stem arm and support.

Steering Cable

Disconnect steering cable no. 24 from steering stem arm no. 15.

Remove retaining block no. 10.

Disconnect ball joint no. 19 from jet pump nozzle.

Remove ball joint no. 19 and jam nut from cable.

Loosen nut no. 25, then remove half rings no. 26 and O-ring no. 27.

NOTE: To loosen nut, use steering cable tool (P/N 295 000 145).

Remove steering cable from watercraft.

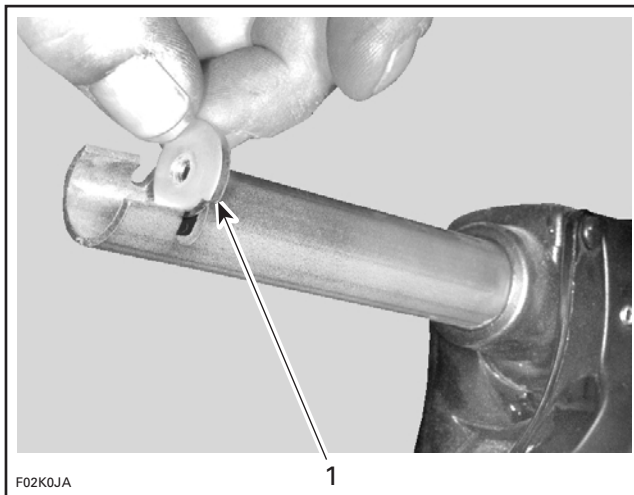
ASSEMBLY

Assembly is essentially the reverse of disassembly procedures. However, pay particular attention to the following.

CAUTION: Apply all specified torques and service products as per main illustration at the beginning of this subsection.

Handle Grip and Grip Insert

When installing the grip insert no. 21 in the handlebar no. 22, ensure that it is properly inserted in the slot at the end of the handlebar tubing.



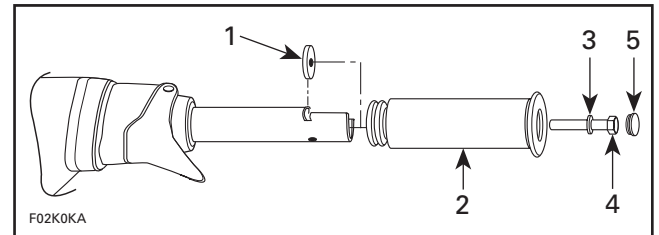
1. Grip insert

Install grip no. 1 on handlebar no. 22 matching it to the hex form on the grip insert.

Install flat washer no. 23 and screw no. 3.

Torque screw to 7 N•m (62 lbf•in).

Install cap no. 2.



1. Grip insert
2. Grip
3. Flat washer
4. Screw. Torque to 7 N•m (62 lbf•in)
5. Cap

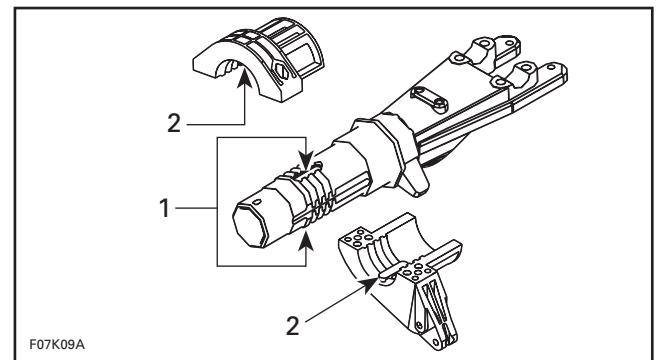
CAUTION: Ensure to install flat washer otherwise screw will damage grip end.

Steering Stem Arm and Support

Position steering stem arm no. 15 and support no. 16 onto steering stem.

WARNING

Make sure the integrated flat keys of the steering stem arm and support are properly seated in steering stem keyways. Steering stem arm must be locked in place before torquing the bolts.



1. Keyways
2. Integrated flat key

Replace lock nuts no. 18 by new ones.

Torque bolts no. 17 of steering stem arm to 6 N•m (53 lbf•in).

Section 10 STEERING SYSTEM

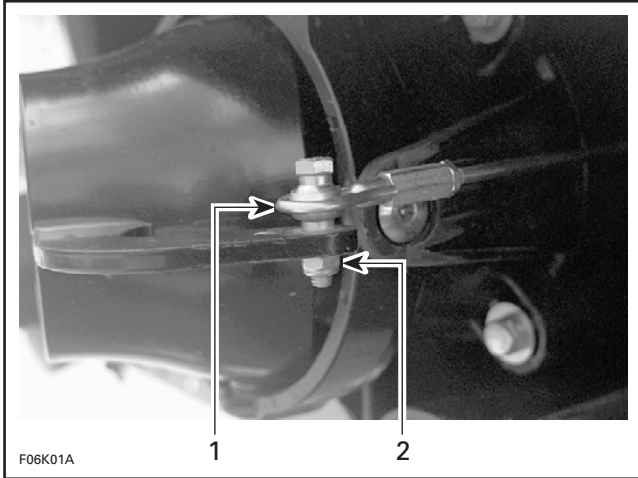
Subsection 02 (STEERING SYSTEM)

Ball Joint

Secure the steering cable ball joint no. 19 to the nozzle as per following illustrations.

CAUTION: Ensure the ball joint is parallel ($\pm 5^\circ$) to the nozzle arm.

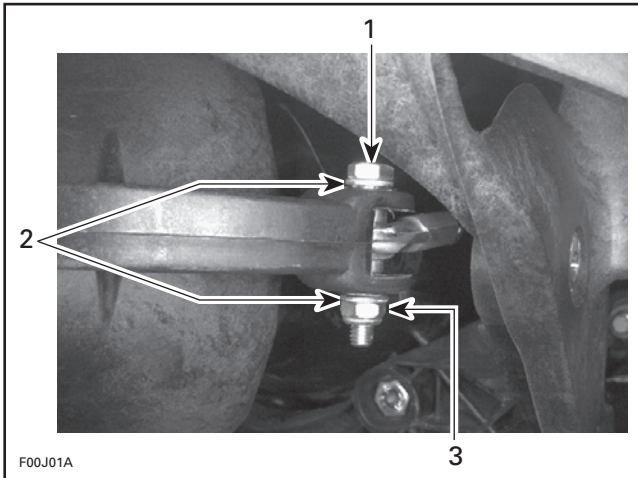
GTX Model



TYPICAL

1. Ball joint on top of steering arm
2. Torque nut to 7 N•m (62 lbf•in)

GS and GTI Models



TYPICAL

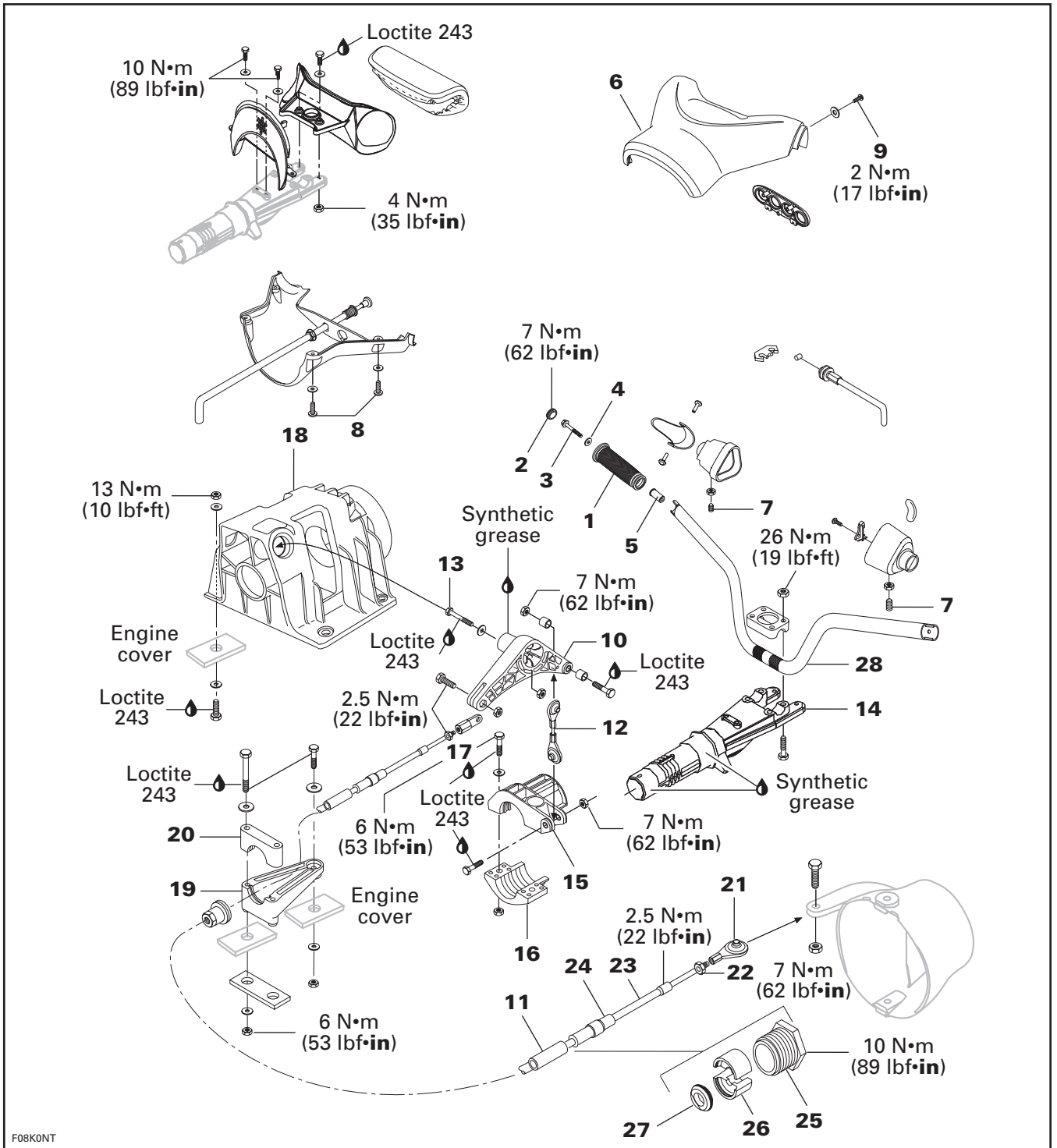
1. Bolt
2. Flat washers
3. Lock nut. Torque to 2 N•m (18 lbf•in)

STEERING ALIGNMENT

For steering alignment procedure, refer to ALIGNMENT.

Section 10 STEERING SYSTEM
Subsection 02 (STEERING SYSTEM)

XP Model



Section 10 STEERING SYSTEM

Subsection 02 (STEERING SYSTEM)

DISASSEMBLY

Handle Grip and Grip Insert

To remove handle grip **no. 1**, pull out cap **no. 2** from grip end and remove screw **no. 3** and washer **no. 4**.

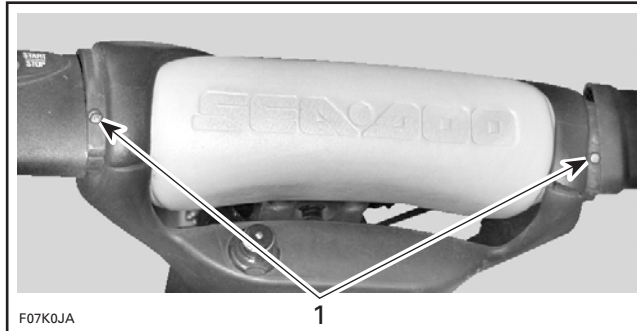
Pull out grip and remove grip insert from handlebar.

NOTE: Verify grip insert **no. 5** for damage.

Steering Cover

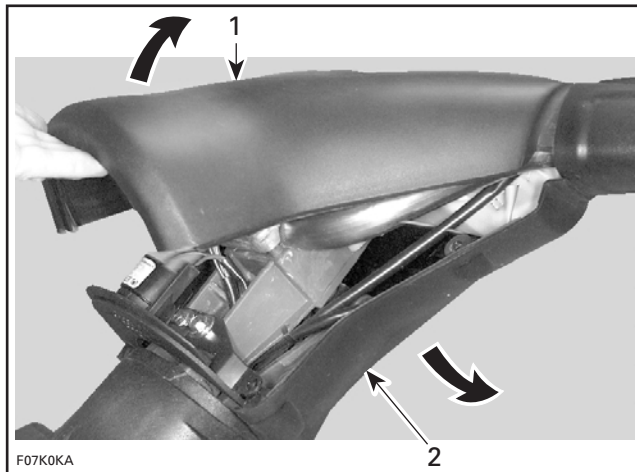
To remove the steering cover **no. 6**, loosen set screws **no. 7** of handlebar housing.

Remove 2 screws **no. 9** and flat washers each side of cover.

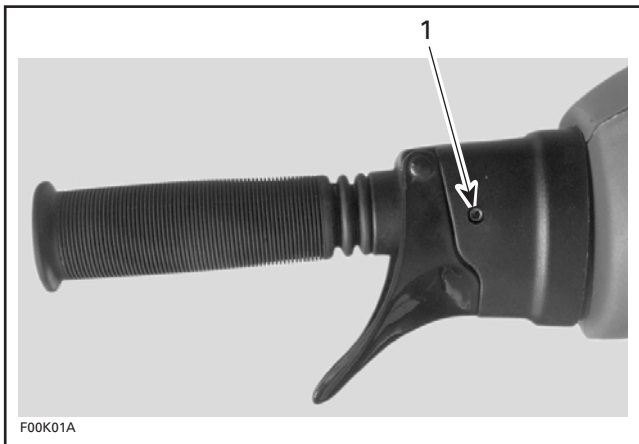


1. Remove screws

Detach upper and lower section of cover from steering.

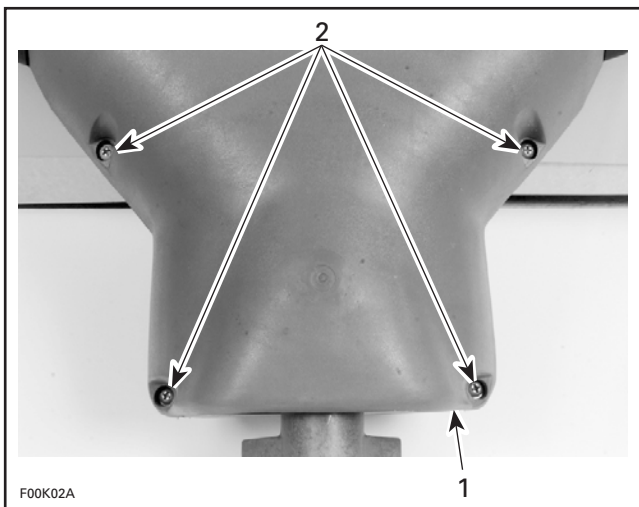


1. Upper section
2. Lower section



1. Set screws

Remove 4 screws **no. 8** and washers **no. 9**.



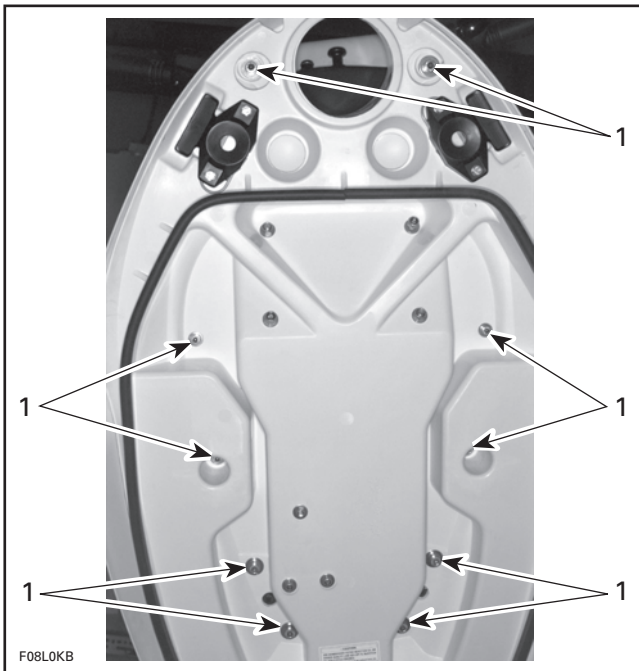
TYPICAL

1. Cover
2. Screws

Lever

Open engine compartment cover.

Remove the top section of the engine cover by loosening the 10 Allen screws located inside the cover.

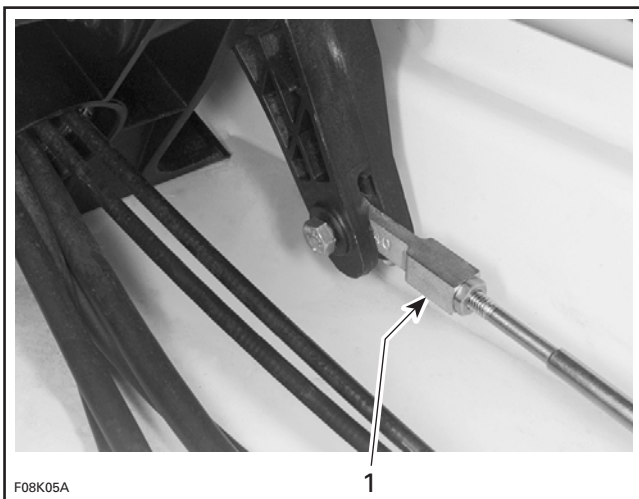


1. Loosen Allen screws

Lift the top section of the engine cover and disconnect wiring harnesses.

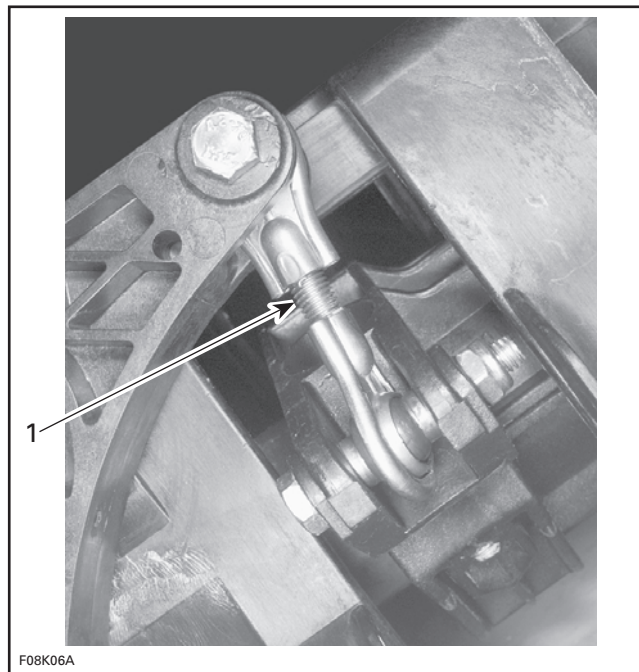
Remove the top section of the engine compartment cover.

Disconnect steering cable no. 11 from lever no. 10.



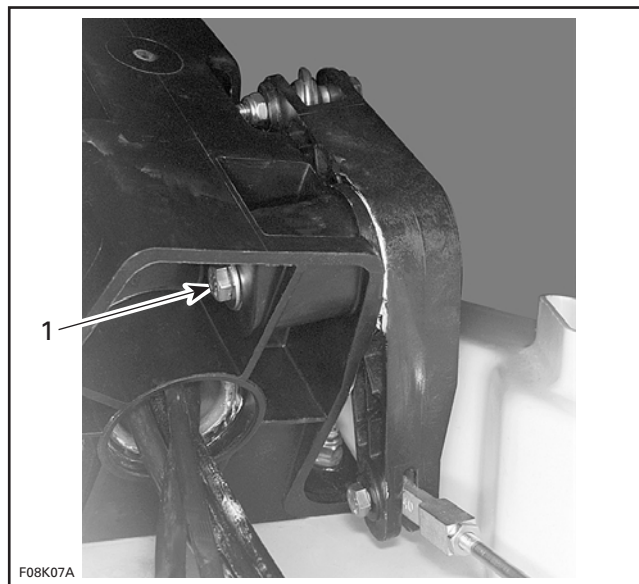
1. Disconnect steering cable

Remove link rod no. 12.



1. Remove link rod

Remove bolt no. 13 and washer retaining lever no. 10 to steering support no. 18.



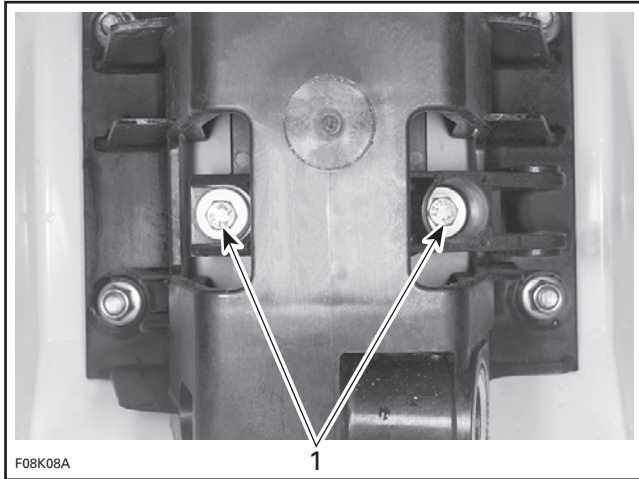
1. Remove bolt and washer

Section 10 STEERING SYSTEM

Subsection 02 (STEERING SYSTEM)

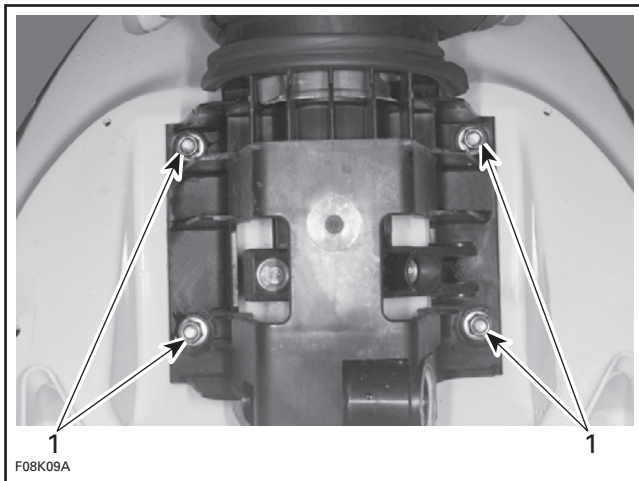
Steering Stem Arm and Support

Loosen bolts no. 17 retaining steering stem arm no. 15 and support no. 16.



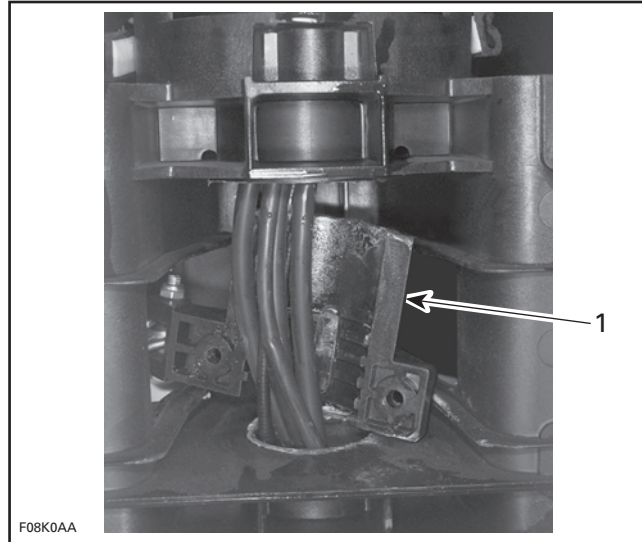
1. Loosen bolts

Loosen nuts and bolts retaining steering support no. 18.



1. Loosen nuts and bolts

Lift steering support no. 18 and slightly pullback steering stem no. 14 in order to remove the support no. 16 and steering stem arm no. 15.



1. Remove support and steering stem arm

Steering Stem

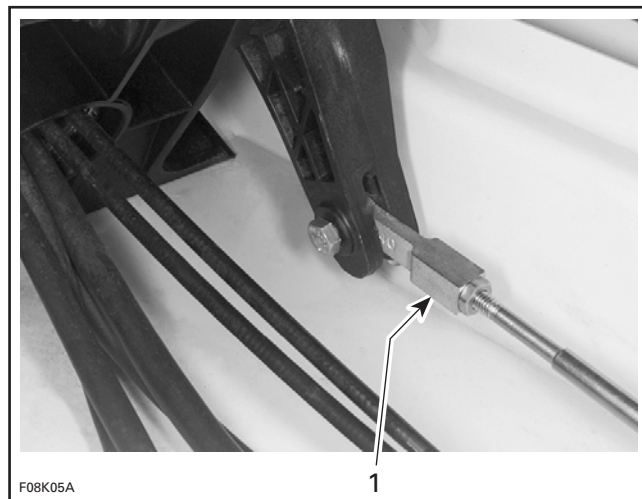
Disconnect wiring harnesses, choke and throttle cables from engine.

Remove steering stem no. 14.

Steering Cable

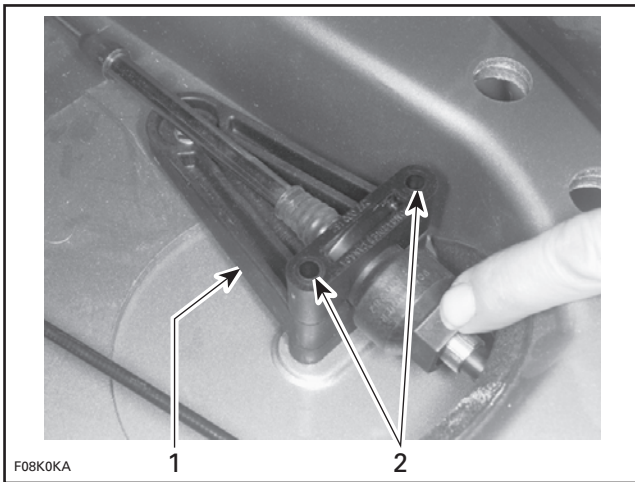
Remove glove box.

Disconnect steering cable no. 11 at lever no. 10.



1. Disconnect steering cable

Remove retaining block no. 20.



1. Cable Support
2. Remove M6 bolts

Disconnect ball joint no. 21 of steering cable from jet pump nozzle.

Remove ball joint no. 21, jam nut no. 22 and boots no. 23 and no. 24.

Loosen nut no. 25 and remove half rings no. 26 and O-ring no. 27.

NOTE: To loosen nut, use steering cable tool (P/N 295 000 145).

Remove steering cable from watercraft.

ASSEMBLY

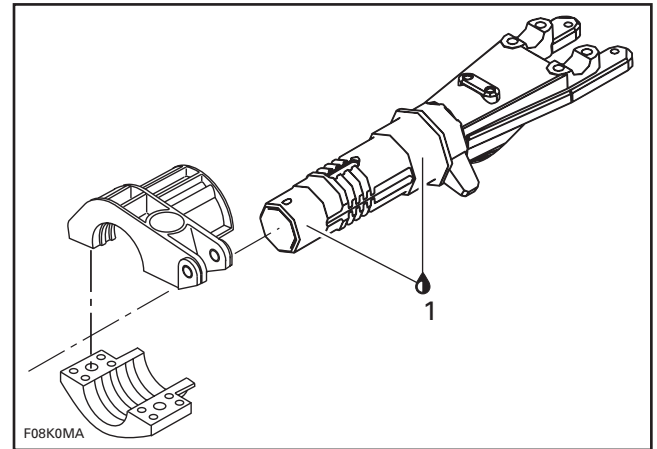
Assembly is essentially the reverse of disassembly procedure. However, pay particular attention to the following.

Lever

Prior installing lever no. 10, apply synthetic grease to pivot.

Steering Stem

Apply synthetic grease to front and rear thrust bearing surface.



1. Apply synthetic grease

Steering Stem Arm and Support

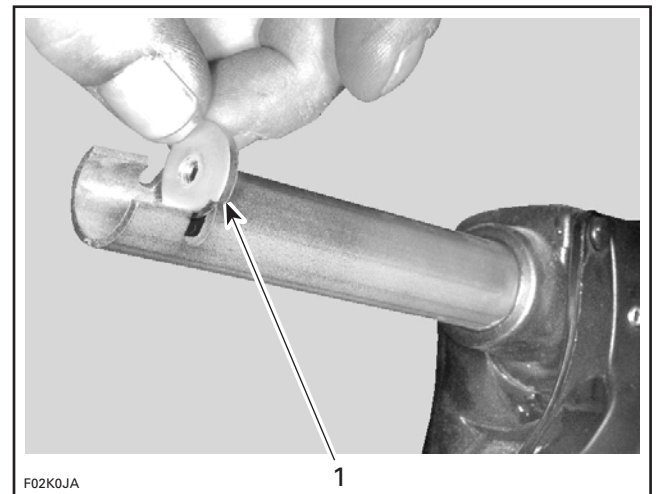
Position steering stem arm no. 15 and support no. 16 onto steering stem no. 14.

⚠ WARNING

Make sure integrated flat keys of steering stem arm and support are properly seated in steering stem keyways.

Handle Grip and Grip Insert

When installing the grip insert no. 5 in the handlebar no. 28, ensure that it is properly inserted in the slot at the end of the handlebar tubing.



1. Grip insert

Section 10 STEERING SYSTEM

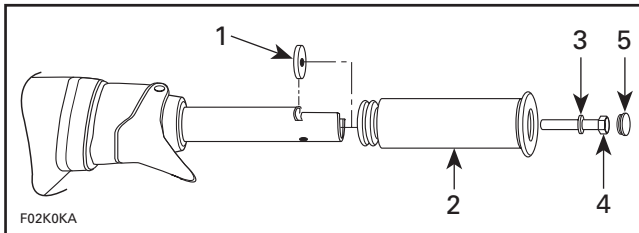
Subsection 02 (STEERING SYSTEM)

Install flat washer no. 4 and screw no. 3.

Torque screw to 7 N•m (62 lbf•in).

WARNING

Correct torque must be strictly followed.



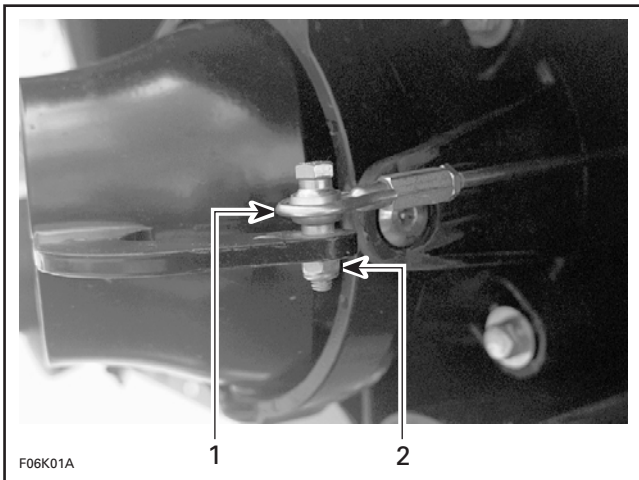
1. Grip insert
2. Grip
3. Flat washer
4. Torque screw to 7 N•m (62 lbf•in)
5. Cap

CAUTION: Ensure to install flat washer otherwise screw will damage grip end.

Ball Joint

Secure the steering cable ball joint no. 21 to the nozzle as per following illustration.

CAUTION: Ensure the ball joint is parallel ($\pm 5^\circ$) to the nozzle arm.



TYPICAL

1. Ball joint on top of steering arm
2. Torque nut to 7 N•m (62 lbf•in)

STEERING ALIGNMENT

For steering alignment procedure, refer to ALIGNMENT.

Section 10 STEERING SYSTEM

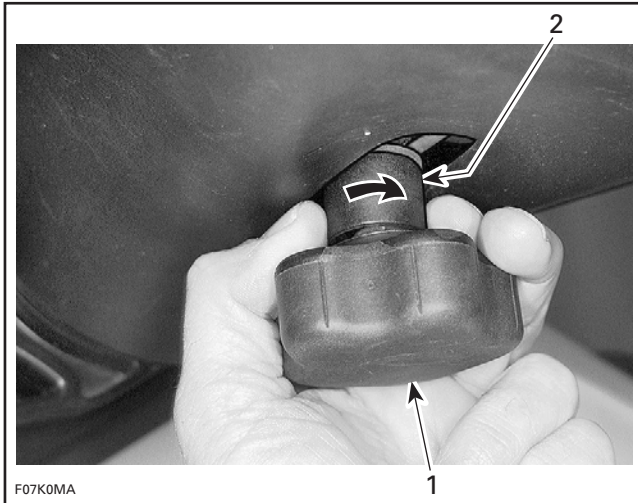
Subsection 03 (ADJUSTABLE STEERING)

DISASSEMBLY

Adjustment Handle

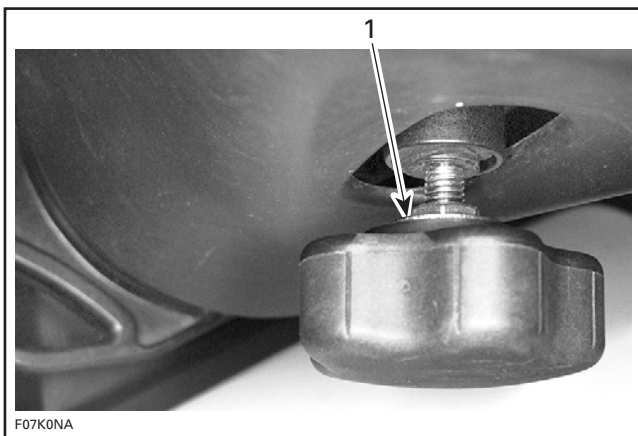
Set handle bar to its lowest position by turning adjustment handle **no. 26** counterclockwise.

While holding adjustment handle **no. 26**, turn support bushing **no. 28** clockwise.



1. Adjustment handle
2. Support bushing

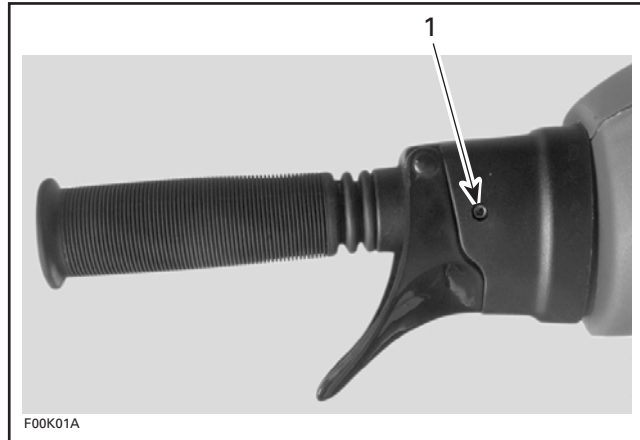
Hold jam nut **no. 27** and unscrew adjustment handle **no. 26** from adjuster screw **no. 29**.



1. Loosen jam nut

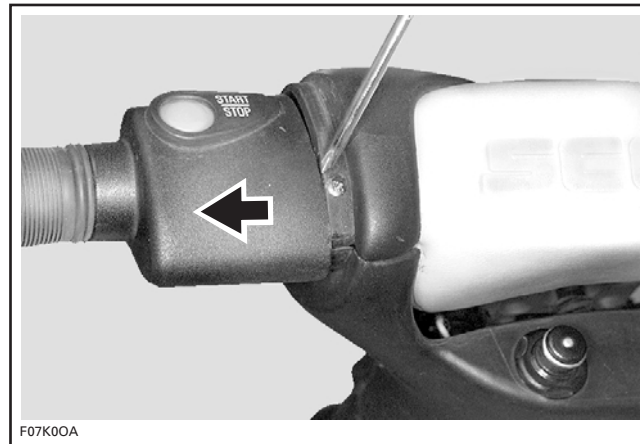
Steering Cover

Loosen set screws **no. 5** of handlebar housings **no. 6**.

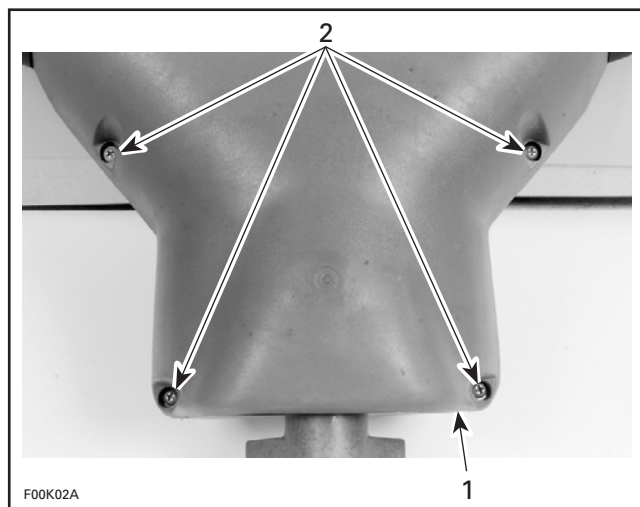


1. Set screw

Pull handle bar housings to disengage from steering cover.



Remove 4 screws **no. 7**.



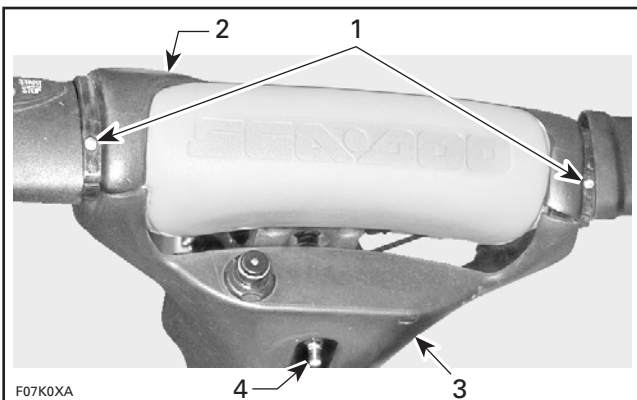
TYPICAL

1. Cover
2. Screws

Section 10 STEERING SYSTEM

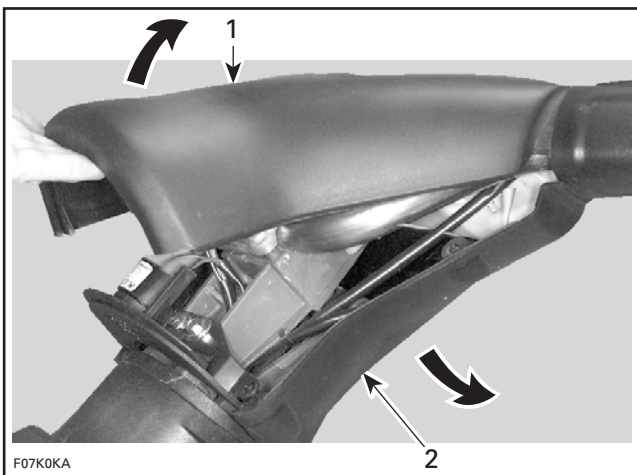
Subsection 03 (ADJUSTABLE STEERING)

Remove 2 screws no. 20 each side of cover.



1. Remove screws
2. Upper cover
3. Lower cover
4. Adjuster screws

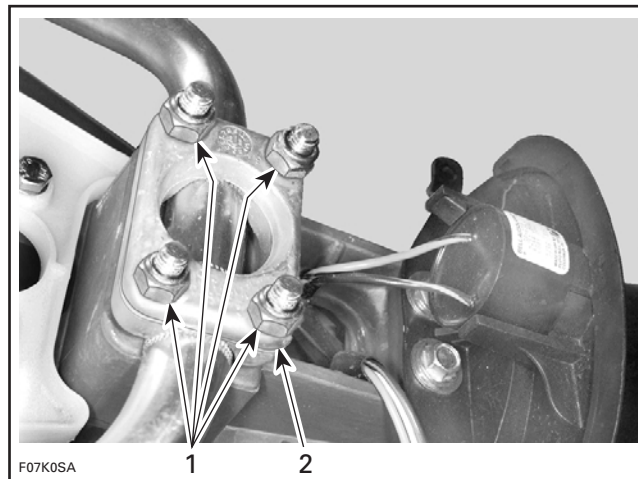
Remove both upper and lower steering covers.



1. Upper cover
2. Lower cover

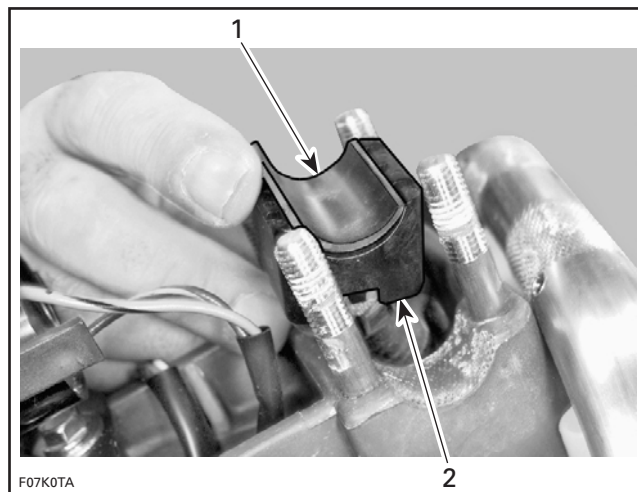
Handle Bar

Remove 4 elastic stop nuts M8 retaining steering clamp no. 31.



1. Remove nuts
2. Steering clamp

Detach steering clamp no. 31 and remove handle bar no. 22. Withdraw rubber pad no. 32 and stopper no. 33.



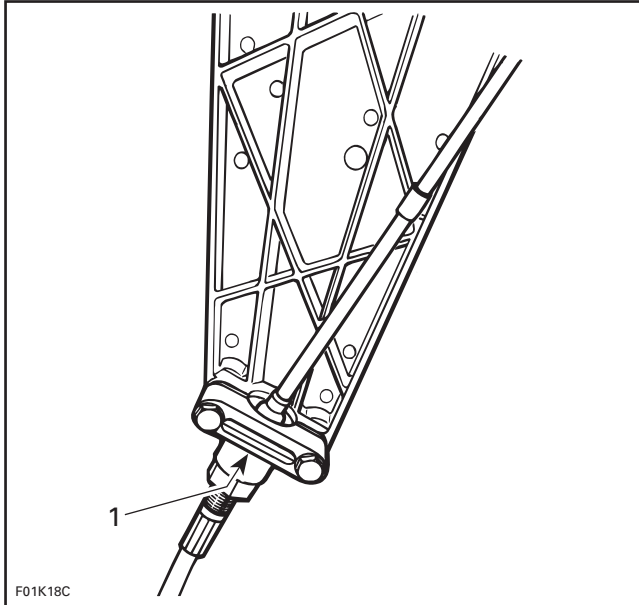
1. Rubber pad
2. Stopper

Section 10 STEERING SYSTEM

Subsection 03 (ADJUSTABLE STEERING)

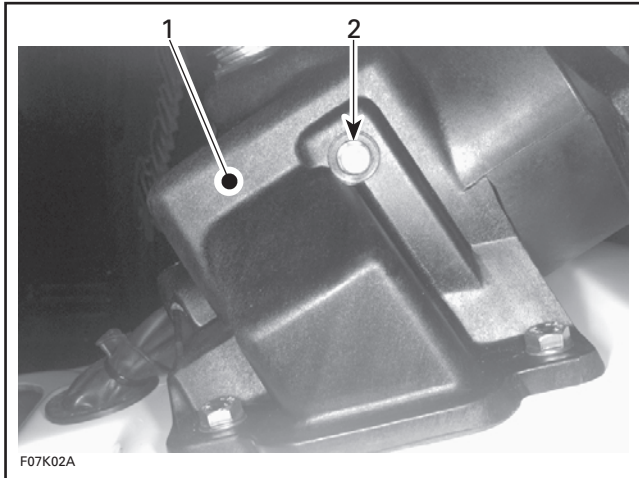
Cable Support

Loosen bolts no. 9 and remove retaining block no. 10 holding cable adjusting nut to cable support no. 8.



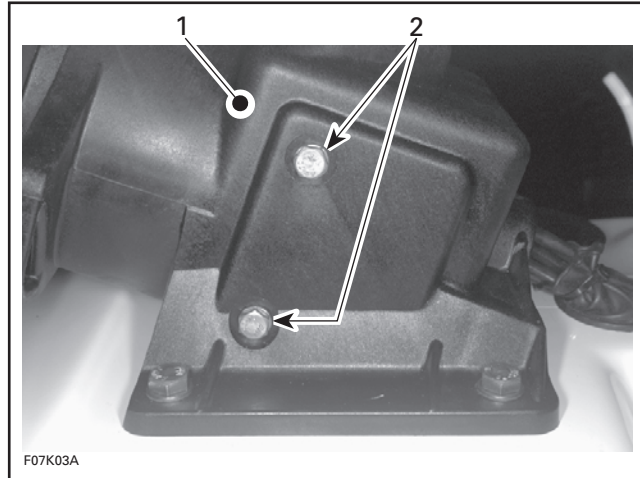
1. Retaining block

Remove bolts no. 11 each side of steering support no. 12.



LEFT SIDE

1. Steering support
2. Bolt



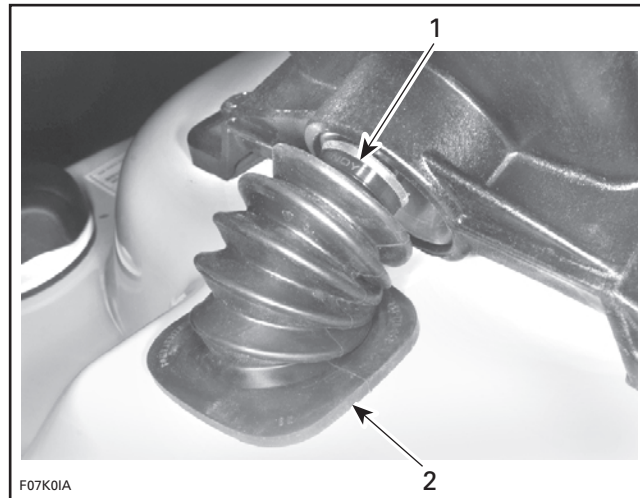
RIGHT SIDE

1. Steering support
2. Bolts

From inside bilge, pull down cable support no. 8 to detach it from steering support no.12.

Steering Support

Cut locking tie securing wiring harness boot.



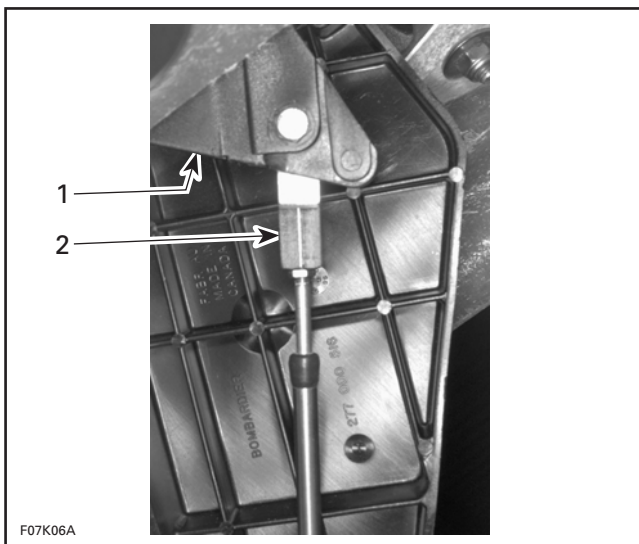
1. Locking tie
2. Boot

Section 10 STEERING SYSTEM

Subsection 03 (ADJUSTABLE STEERING)

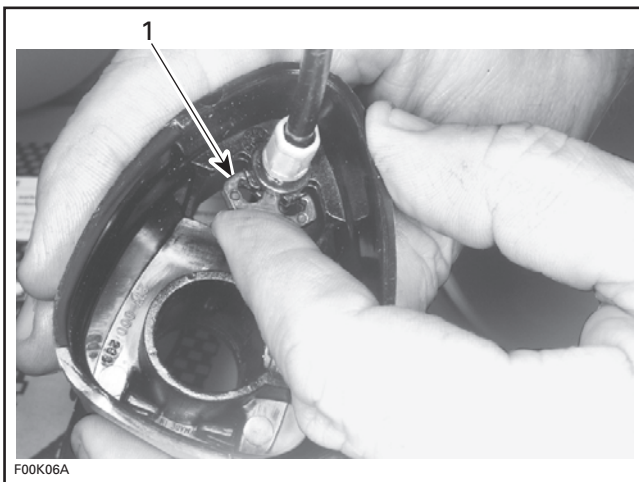
Disconnect the wiring harnesses leading out of steering stem and cut locking tie.

Disconnect the steering cable from the steering stem arm **no. 15**.



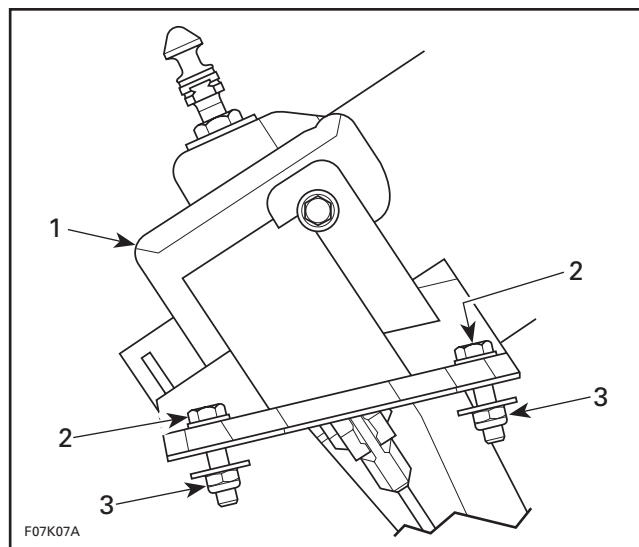
1. Steering stem arm
2. Steering cable

Detach throttle cable from throttle handle.



1. Locking Tab

From inside bilge, remove lock nuts **no. 14**.

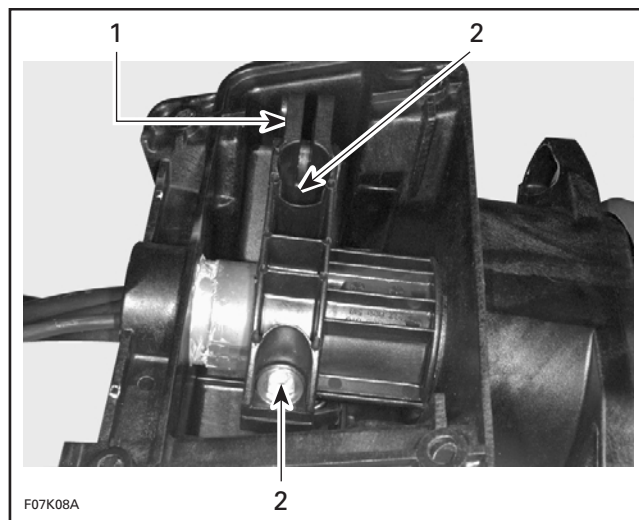


1. Steering support
2. Bolt
3. Lock nut

Remove bolts **no. 13** and steering support **no. 12** with handlebar and wiring harnesses.

Steering Stem Arm and Support

Loosen bolts **no. 17** retaining steering stem arm **no. 15** to support **no. 16**.



1. Steering stem arm
2. Bolt

Remove steering stem arm and support.
Remove steering stem.

Section 10 STEERING SYSTEM

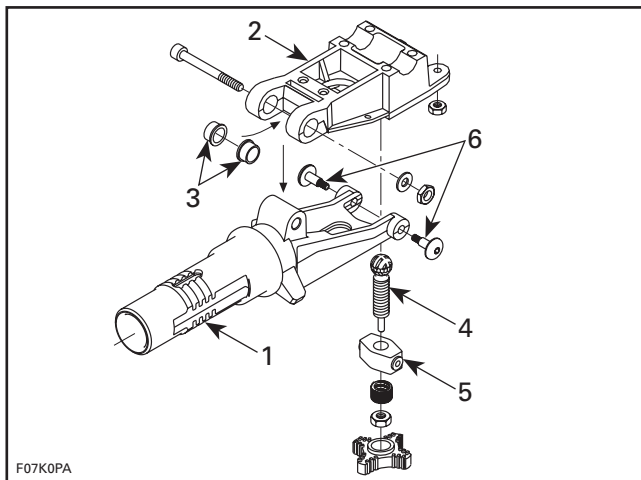
Subsection 03 (ADJUSTABLE STEERING)

Steering Stem and Steering Support

Unscrew nut and remove pivot bolt no. 25 retaining steering support no. 24 to steering stem no. 19.

Remove adjuster screw from block and detach steering support from steering stem.

Unscrew threaded pivots to remove threaded block from steering stem no. 19.



1. Steering stem
2. Steering support
3. Support bushing
4. Adjuster screw
5. Threaded block
6. Threaded pivots

ASSEMBLY

Assembly is essentially the reverse of disassembly procedures. However, pay particular attention to the following.

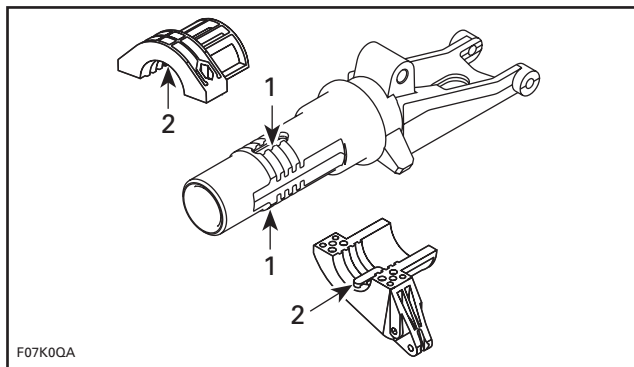
CAUTION: Apply all specified torques and service products as per main illustration at the beginning of this subsection.

Steering Stem Arm and Support

Position steering stem arm no. 15 and support no. 16 onto steering stem.

WARNING

Make sure the integrated flat keys of the steering stem arm and support are properly seated in steering stem keyways. Steering stem arm must be locked in place before torquing the bolts.



1. Keyways
2. Integrated flat key

Replace lock nuts no. 18 by new ones.

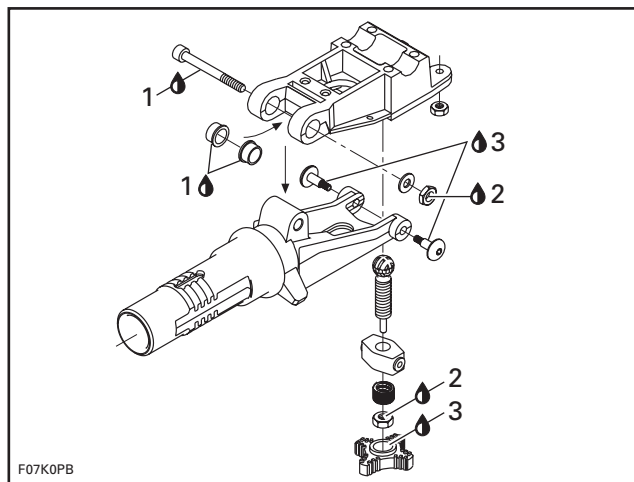
Torque bolts no. 17 of steering stem arm to 6 N•m (53 lbf•in).

Steering Stem and Steering Support

Install support bushings no. 30 on steering support.

Apply Loctite 767 antiseized lubricant (P/N 413 701 000) on pivot bolt no. 25.

CAUTION: Make sure antiseize lubricant does not come in contact with threads of bolt.

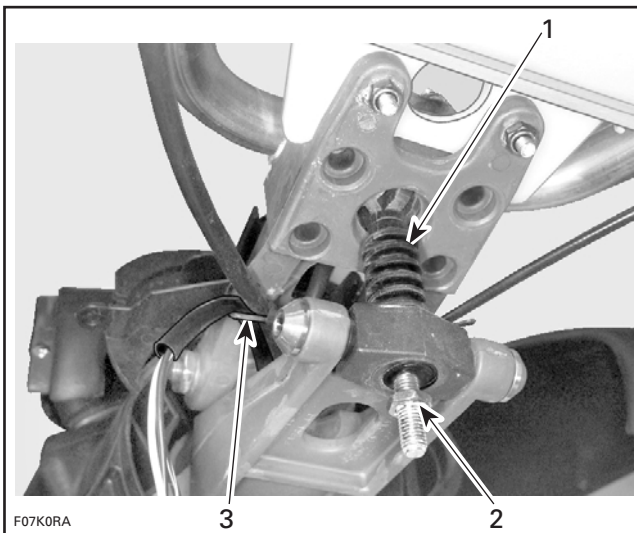


1. Antiseize lubricant
2. Loctite 271
3. Loctite 243

Section 10 STEERING SYSTEM

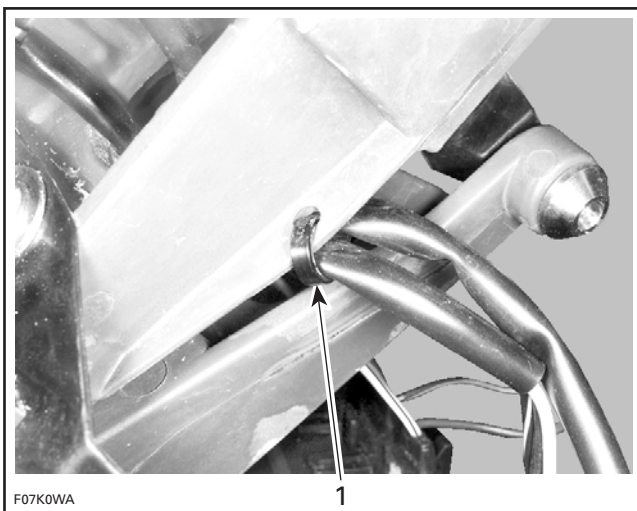
Subsection 03 (ADJUSTABLE STEERING)

Install steering support no. 24 to steering stem no. 19 and secure with pivot bolt no. 25. Install nut and torque to 26 N•m (19 lbf•ft).



1. Adjuster screw
2. Apply Loctite 243
3. Locking tie

Ensure wire harness is properly secured to steering support with a locking tie.

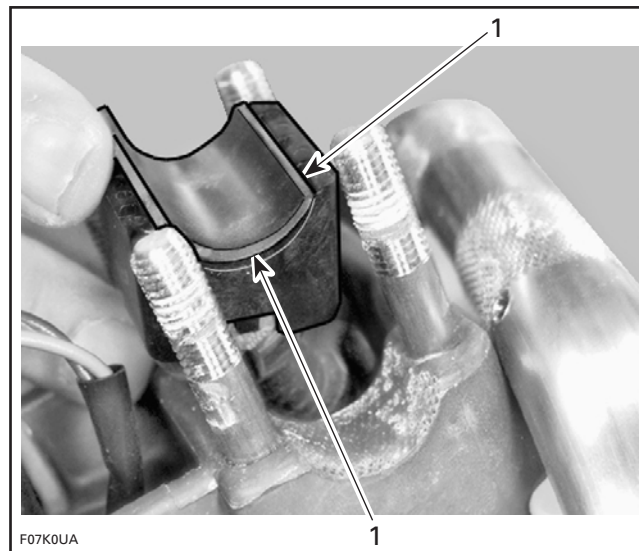


1. Locking tie holding harness to steering support

Handle Bar

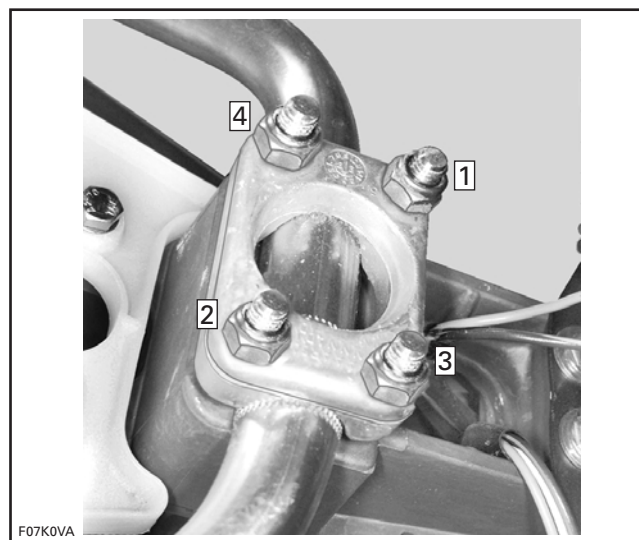
Before installing handle bar, position stopper no. 33 and rubber pad no. 32.

CAUTION: Rubber pad must not exceed stopper.



1. Pad must not exceed stopper

Position handle bar no. 22. Install steering clamp no. 31 and secure with new elastic stop nuts M8. Torque nuts to 26 N•m (19 lbf•ft) as per the following sequence.



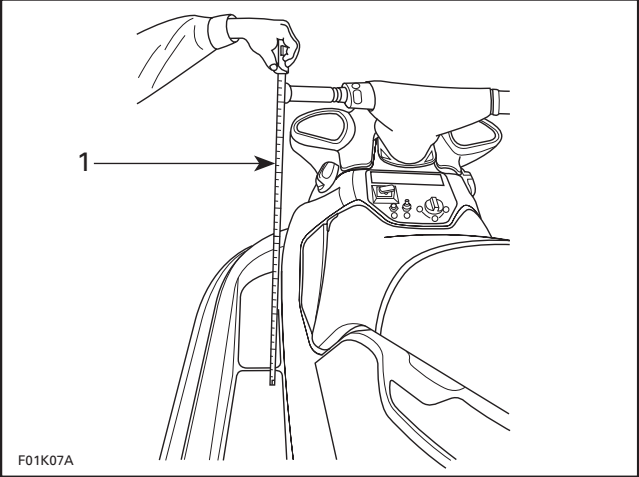
TORQUE SEQUENCE

STEERING ALIGNMENT

For steering alignment procedure, refer to ALIGNMENT.

ALIGNMENT

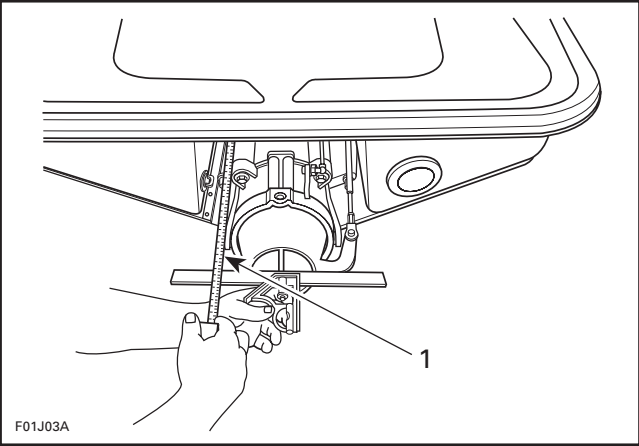
Position handlebar in straight ahead position by measuring each side the distance from handlebar grip end to floorboard.



TYPICAL

1. Measuring handlebar grip end/floorboard distance

Check jet pump nozzle position by placing a straight edge on nozzle outer end. Measure the distance on each side of the straight edge. It must be equalled.



TYPICAL

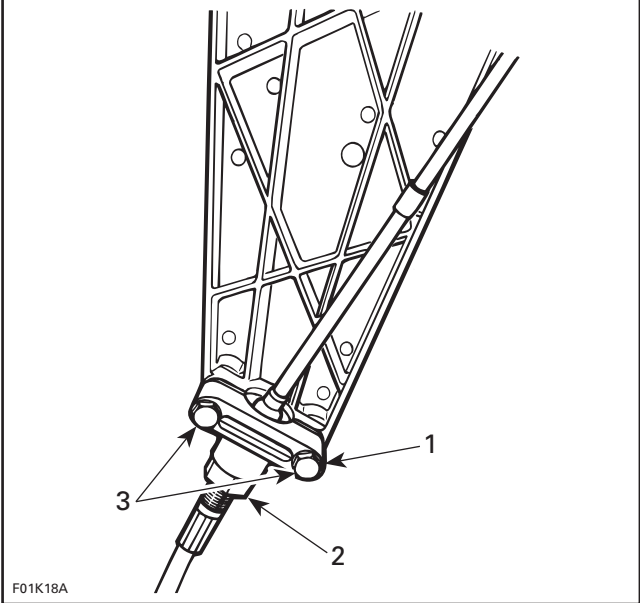
1. Measure the distance on each side of the straight edge

If necessary, steering alignment adjustment should be performed at steering cable support.

All Models Except the XP

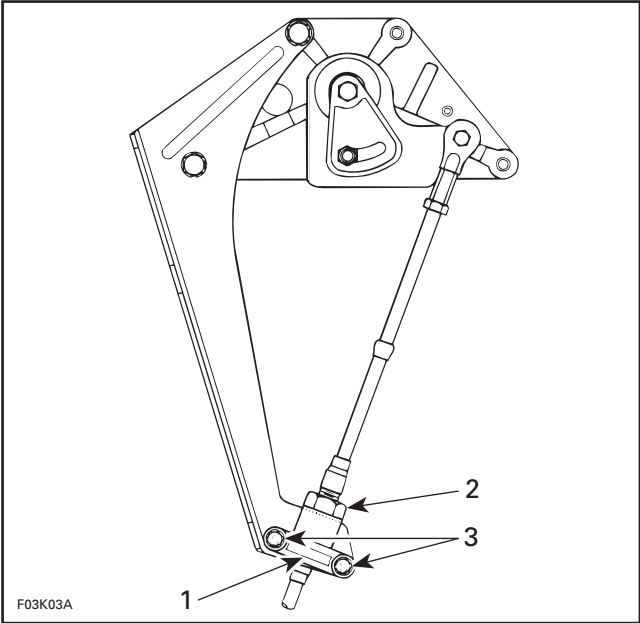
Open storage compartment cover and remove basket.

Loosen 2 bolts retaining block at cable support.
Turn adjustment nut as required.



ALL MODELS EXCEPT GTS AND XP

- 1. Retaining block
- 2. Adjustment nut
- 3. Loosen bolts



GTS MODEL

- 1. Retaining block
- 2. Adjustment nut
- 3. Loosen bolts

Section 10 STEERING SYSTEM

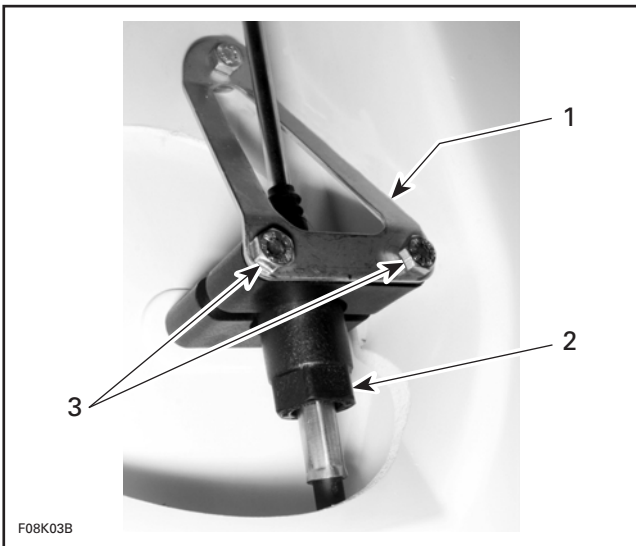
Subsection 04 (ALIGNMENT)

XP Model

To have access to the cable adjustment nut, open upper storage compartment cover and remove storage basket.



1. Remove storage basket



TYPICAL — XP MODEL

1. Support
2. Adjustment nut
3. Loosen bolts

After adjustment, torque retaining block bolts to 6 N•m (53 lbf•in).

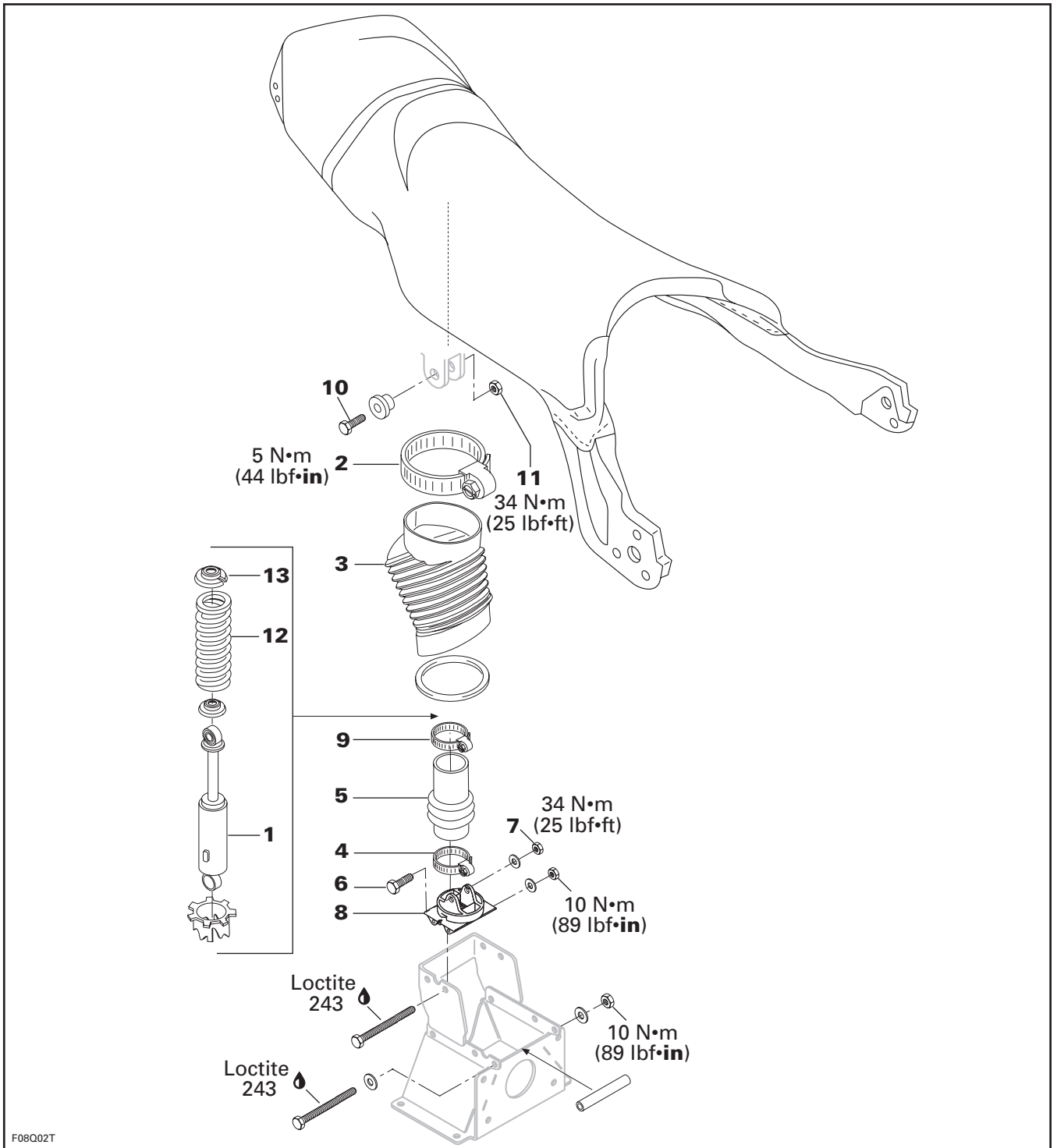
CAUTION: Verify when the handlebar is turned completely to the left or right side, that there is no interference with venturi.

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DIRECT ACTION SUSPENSION

XP Model



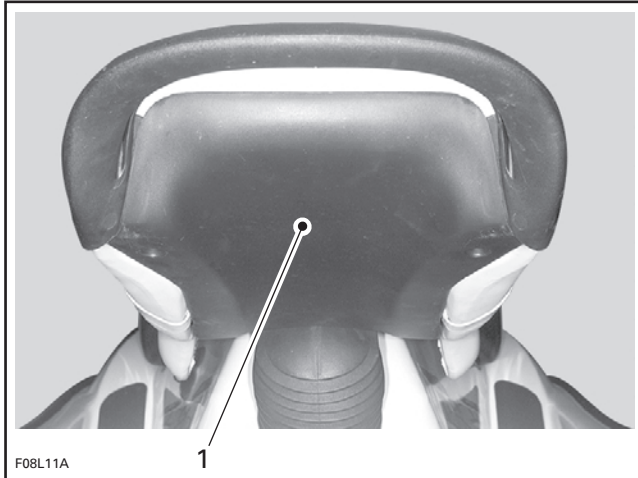
Section 11 SUSPENSION

Subsection 02 (DIRECT ACTION SUSPENSION)

REMOVAL

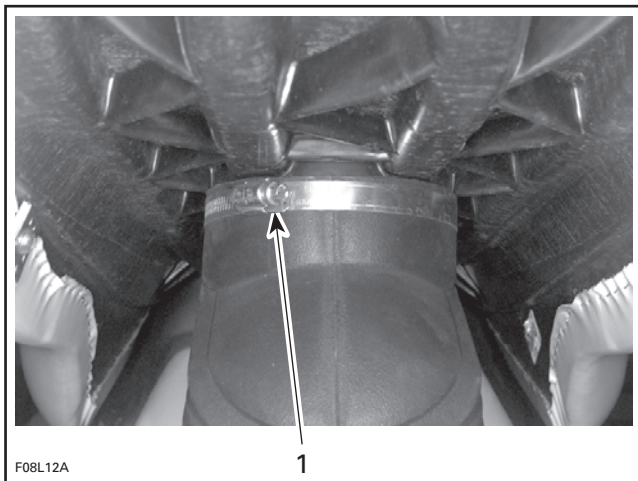
Shock Absorber

Loosen 4 screws and remove bottom cover of seat.



1. Remove cover

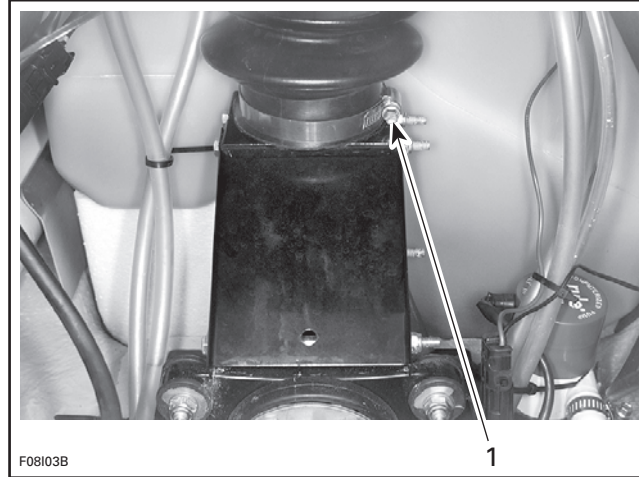
Loosen gear clamp no. 2 of outer boot no. 3, then pull outer boot downward.



1. Loosen gear clamp

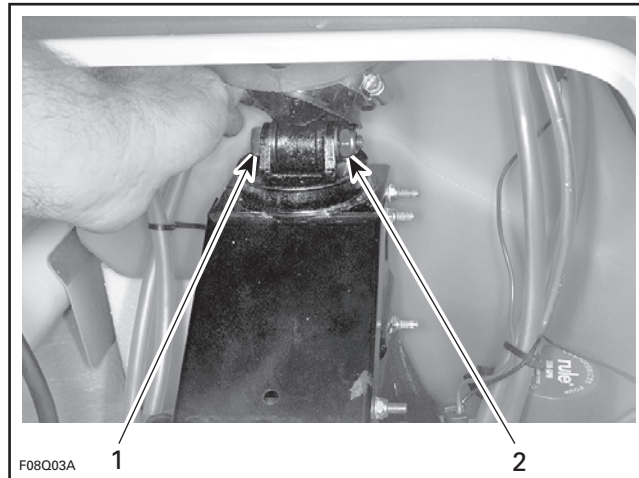
Remove rear access panel from body.

Loosen lower gear clamp no. 4, then push inner boot no. 5 upward.



1. Loosen gear clamp

Remove bolt no. 6 and lock nut no. 7 from shock absorber lower support no. 8.



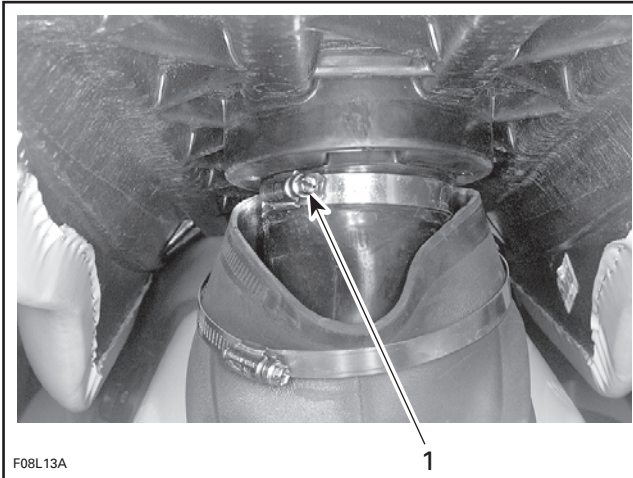
1. Bolt
2. Lock nut

Section 11 SUSPENSION

Subsection 02 (DIRECT ACTION SUSPENSION)

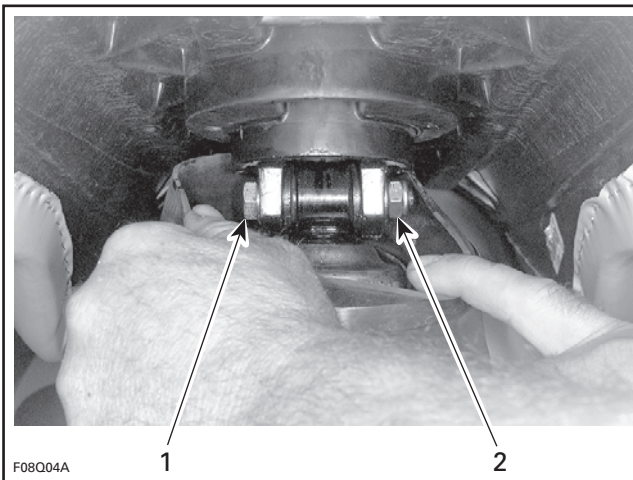
Tilt seat upward.

Loosen upper gear clamp **no. 9** of inner boot **no. 5**.



1. Loosen gear clamp

Remove bolt **no. 10** and lock nut **no. 11** from shock absorber upper support.



1. Bolt
2. Lock nut

Remove shock absorber/coil spring assembly.

Outer Boot

Pull outer boot to remove it from body.

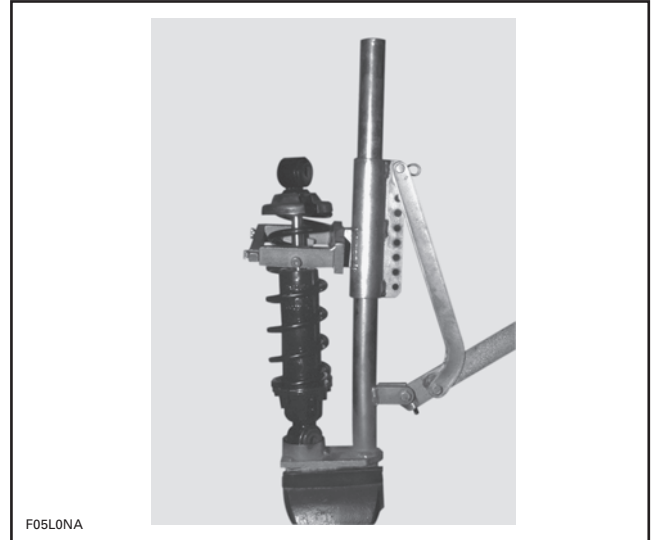
Coil Spring

Install spring compressor tool (P/N 529 027 100) in a vise.

WARNING

Do not attempt to dismantle a spring without using the proper tool.

Install shock absorber/coil spring assembly in spring compressor tool.



Compress spring and remove cup **no. 13**.

Unload tool and remove spring from shock absorber.

INSPECTION

Boot

Inspect condition of boots. If there is any tear, renew boot(s).

Shock Absorber

Inspect shock absorber for wear. Extend and compress the piston several times over its entire stroke; it should move smoothly and with uniform resistance.

Pay attention to the following conditions that will denote a defective shock absorber:

- A skip or a hang back when reversing stroke at mid travel.
- Seizing or binding condition except at extreme end of either stroke.
- Oil leakage.
- A gurgling noise, after completing one full compression and extension stroke.

Renew if any defects are present.

ASSEMBLY

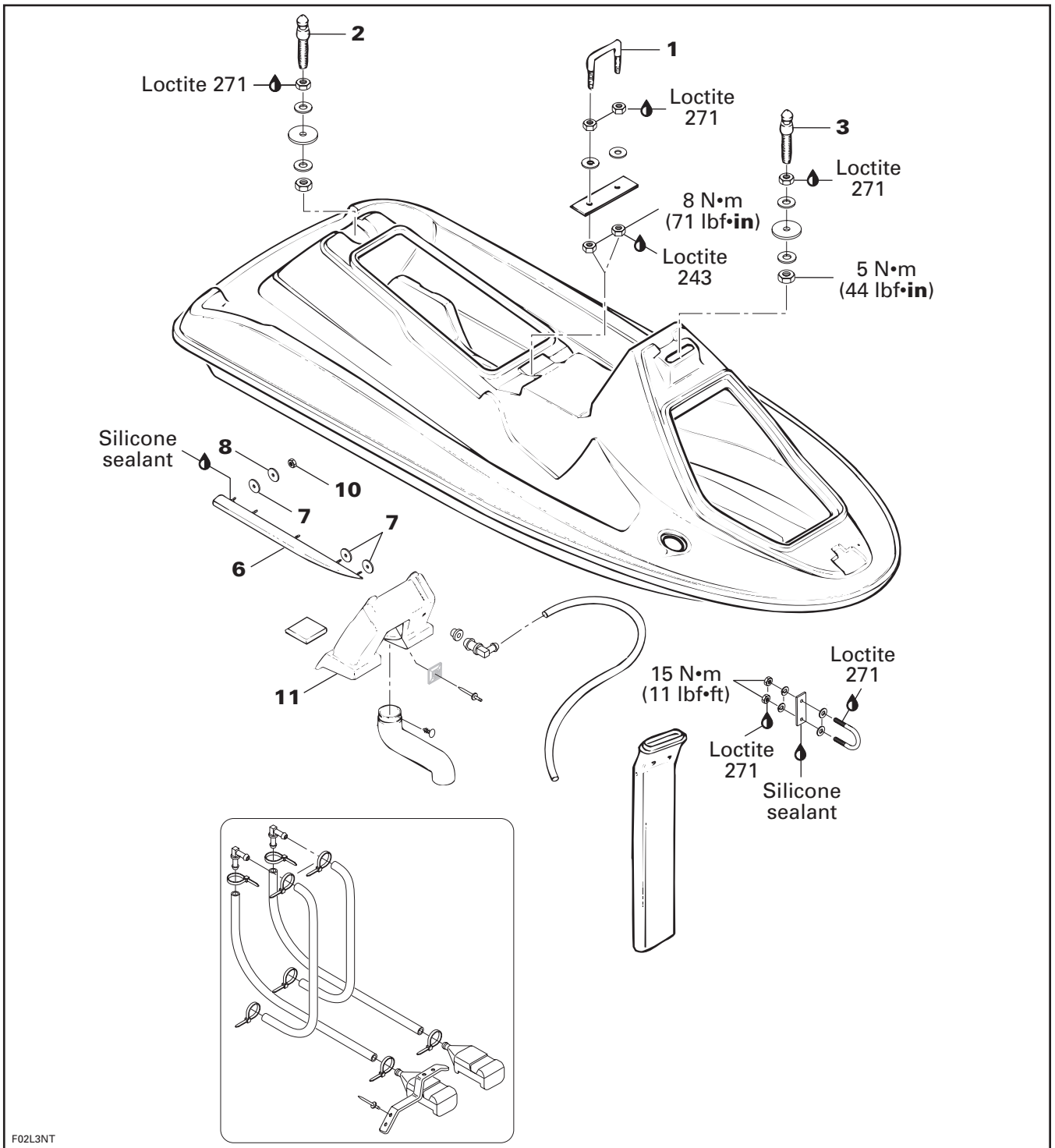
Assembly is essentially the reverse of disassembly procedure. Refer to the main illustration at the beginning of this subsection for torque specifications and service products to be used.

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ADJUSTMENT AND REPAIR

GTS Model (bow)

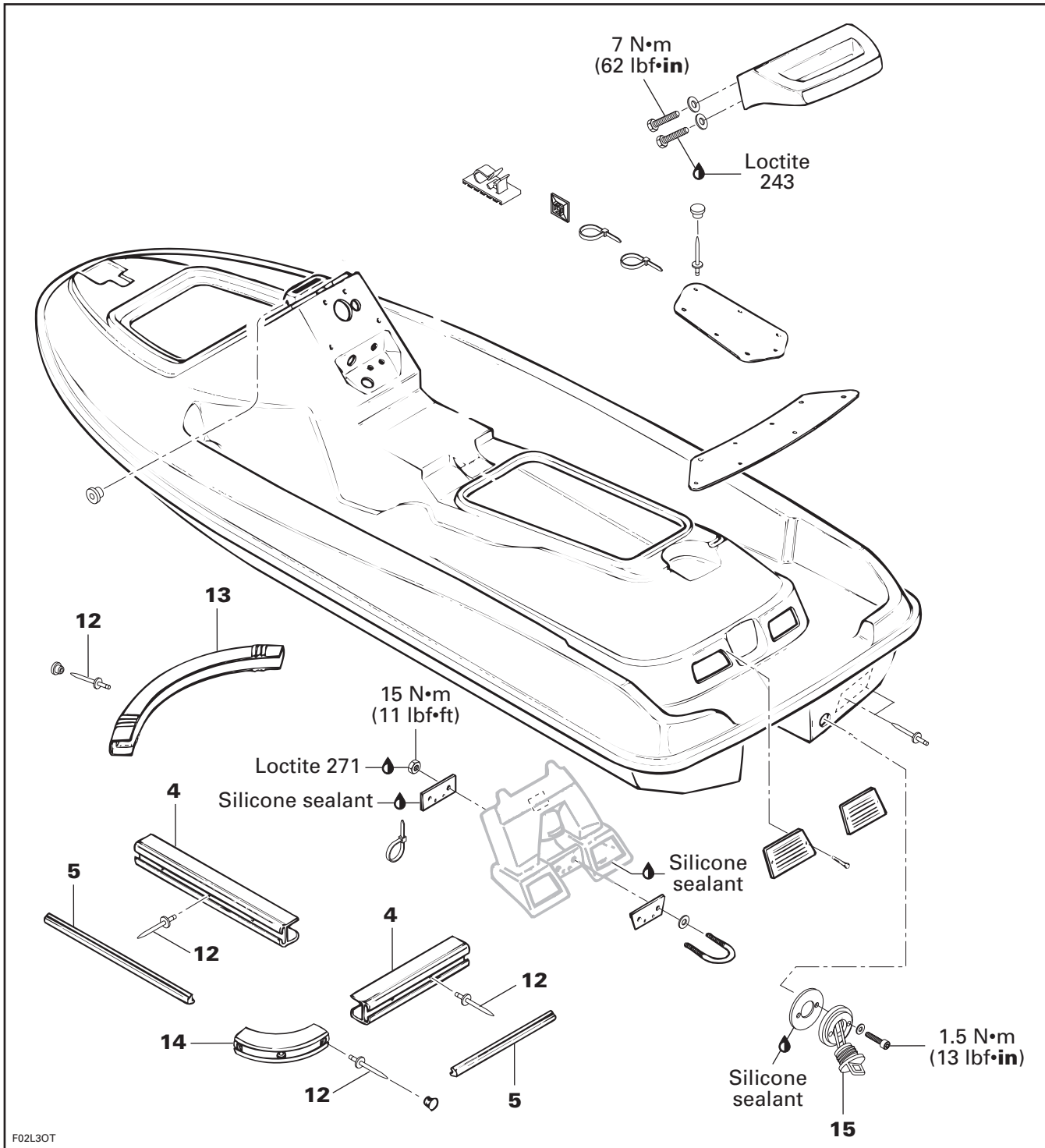


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Section 12 HULL/BODY

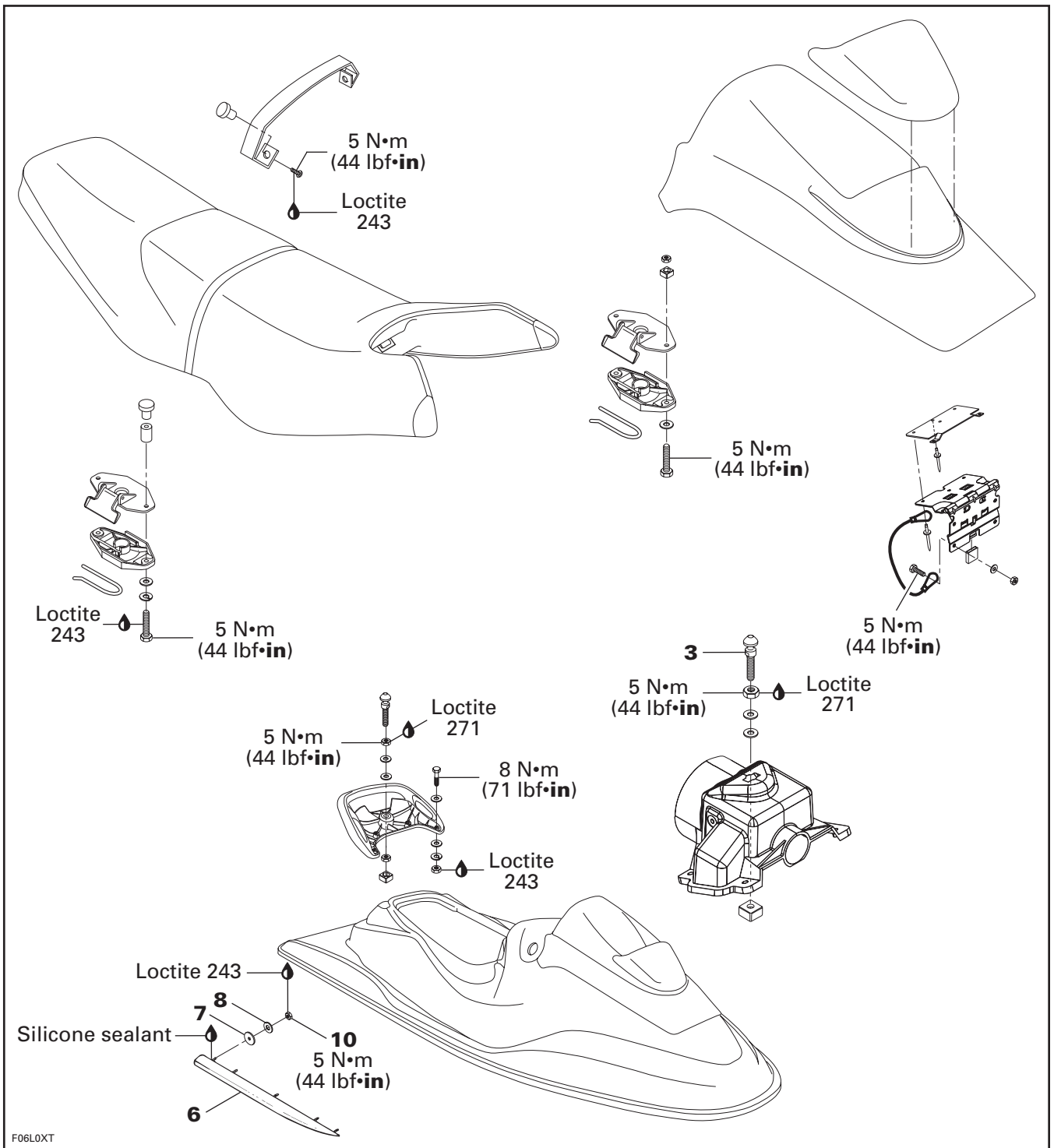
Subsection 02 (ADJUSTMENT AND REPAIR)

GTS Model (stern)



Section 12 HULL/BODY
Subsection 02 (ADJUSTMENT AND REPAIR)

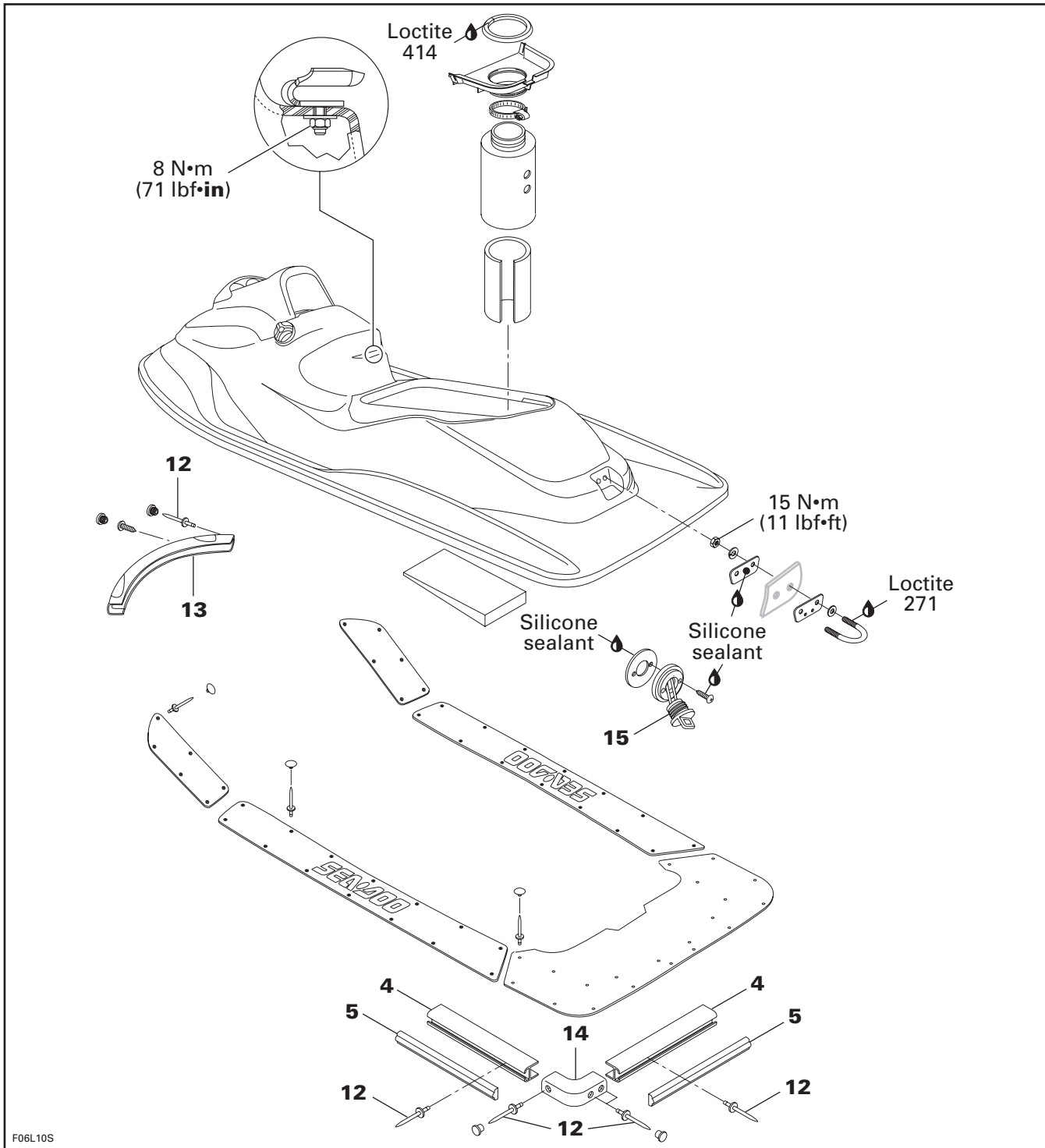
GS and GSX RFI Models (bow)



Section 12 HULL/BODY

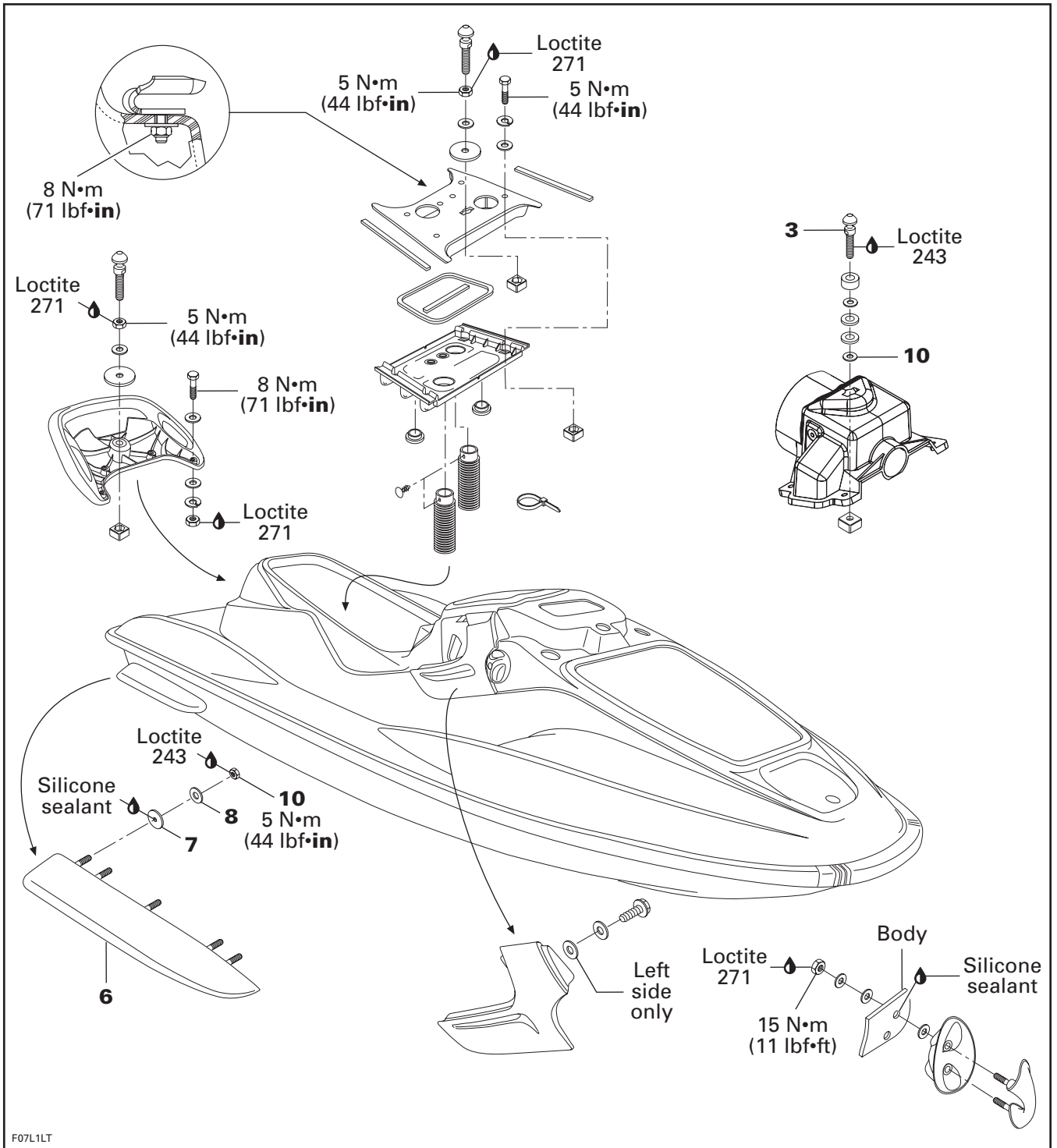
Subsection 02 (ADJUSTMENT AND REPAIR)

GS and GSX RFI Models (stern)



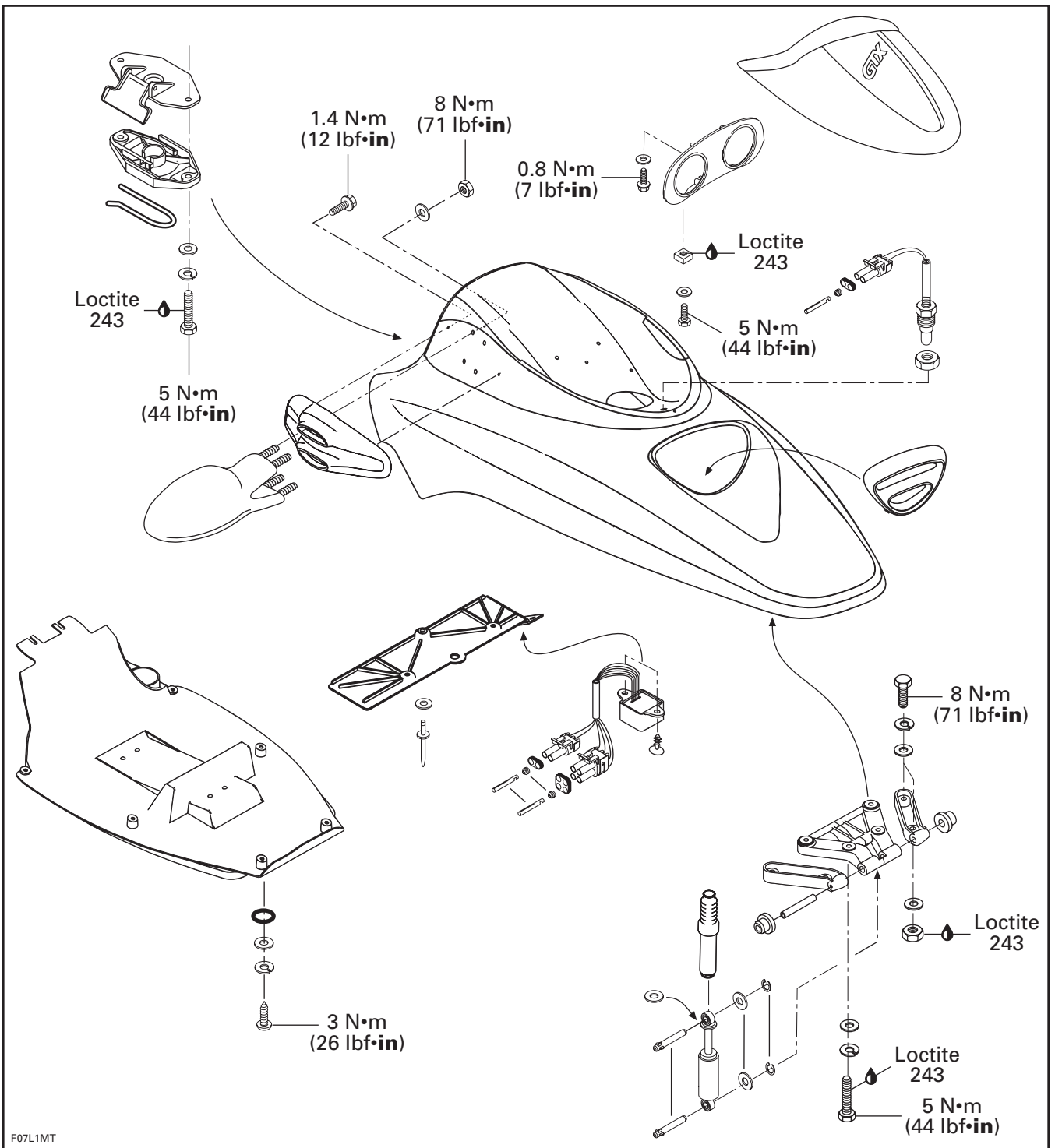
Section 12 HULL/BODY
Subsection 02 (ADJUSTMENT AND REPAIR)

GTI, GTX RFI and GTX Models (bow)



Section 12 HULL/BODY
Subsection 02 (ADJUSTMENT AND REPAIR)

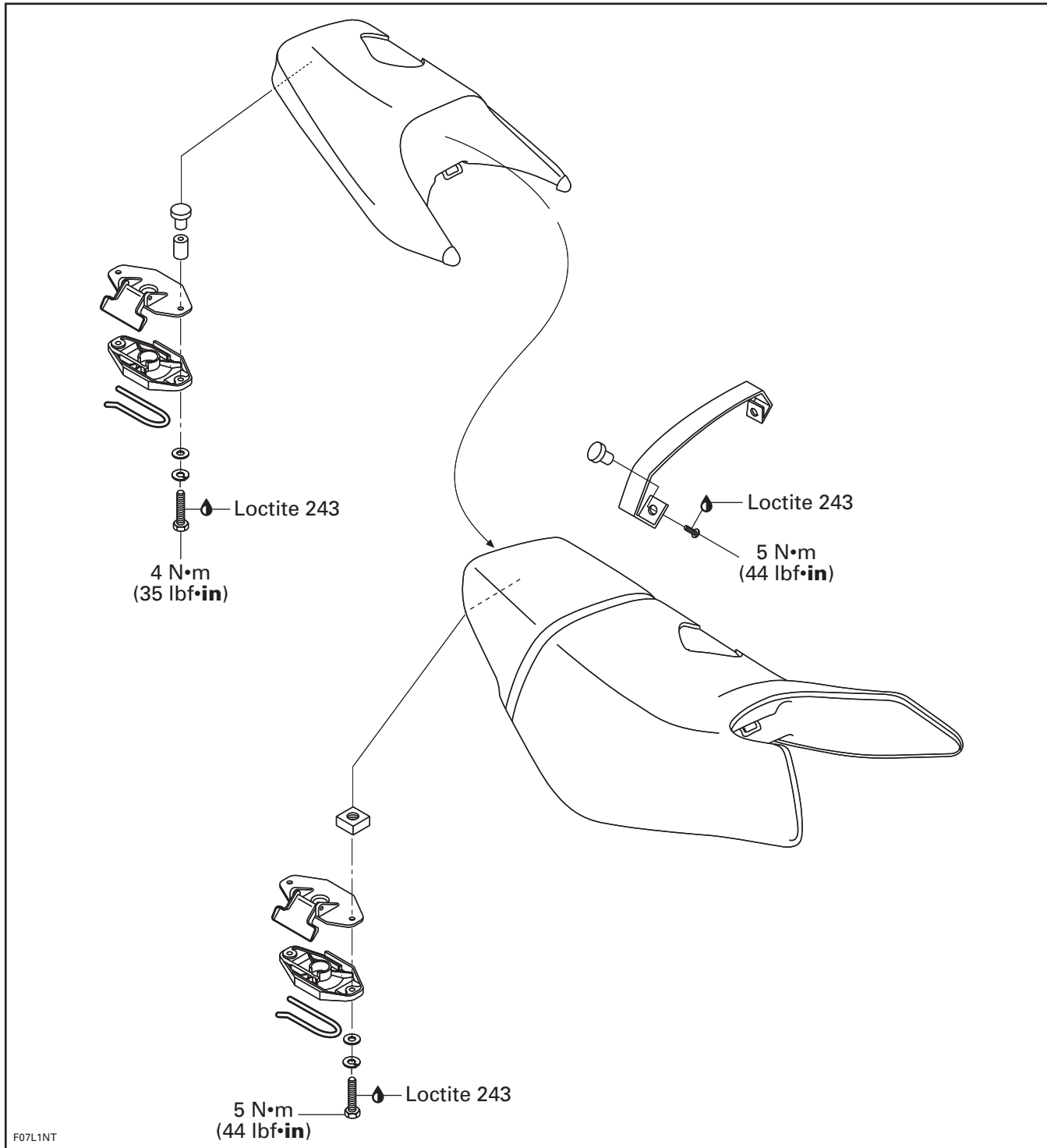
GTI, GTX RFI and GTX Models (cover)



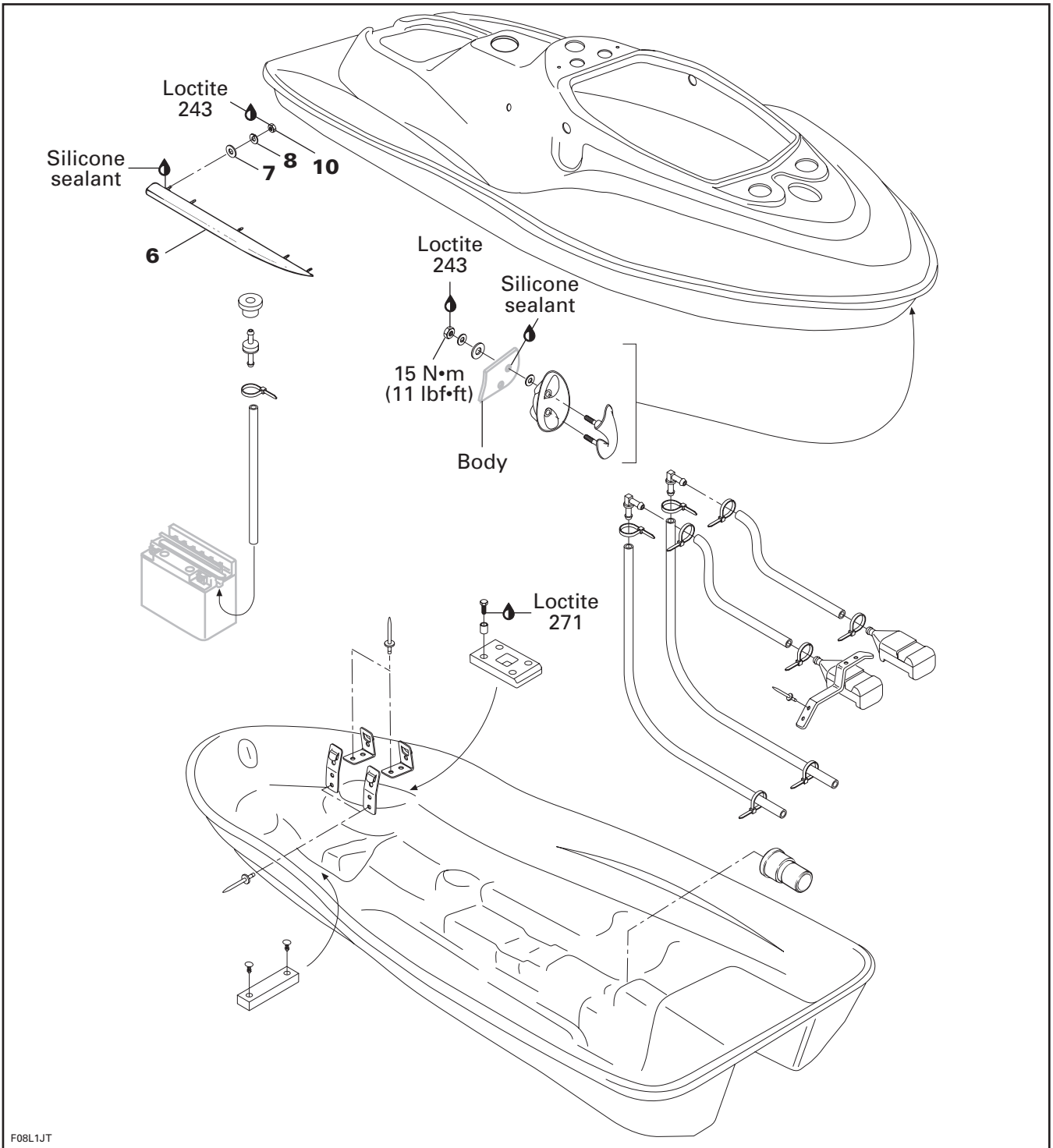
Section 12 HULL/BODY

Subsection 02 (ADJUSTMENT AND REPAIR)

GTI, GTX RFI and GTX Models (seat)

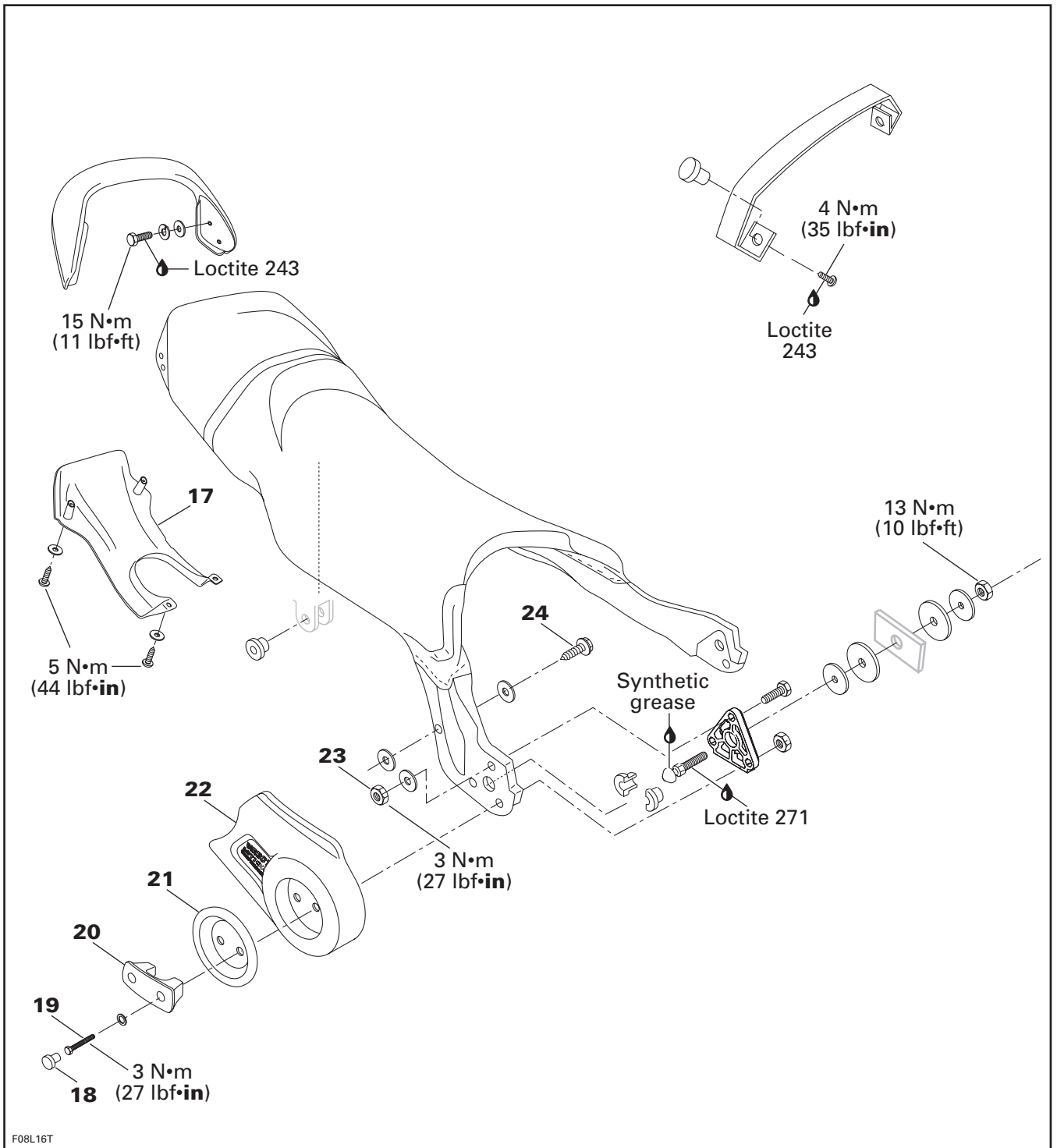


XP Model (bow)



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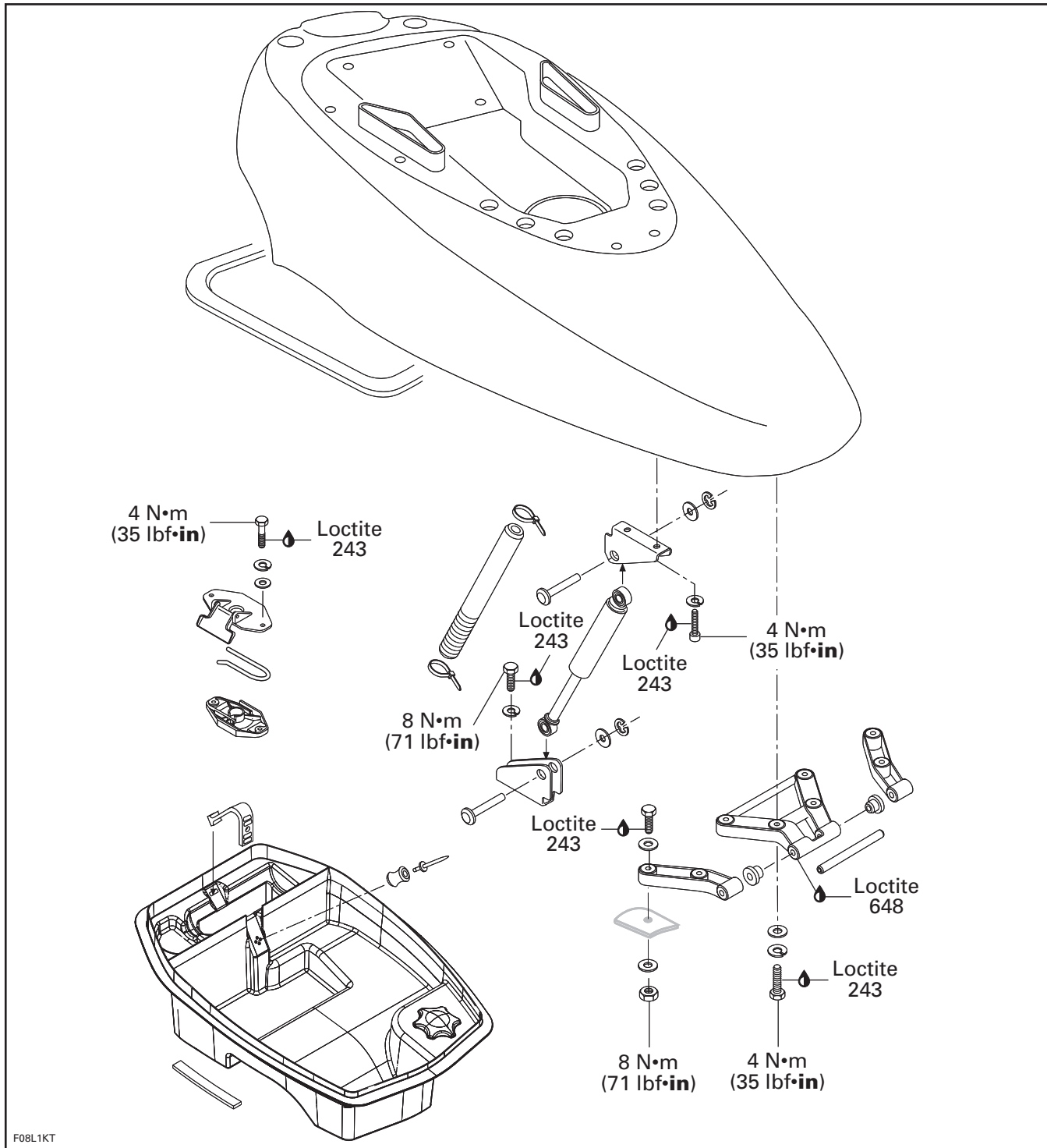
XP Model (seat)



Section 12 HULL/BODY

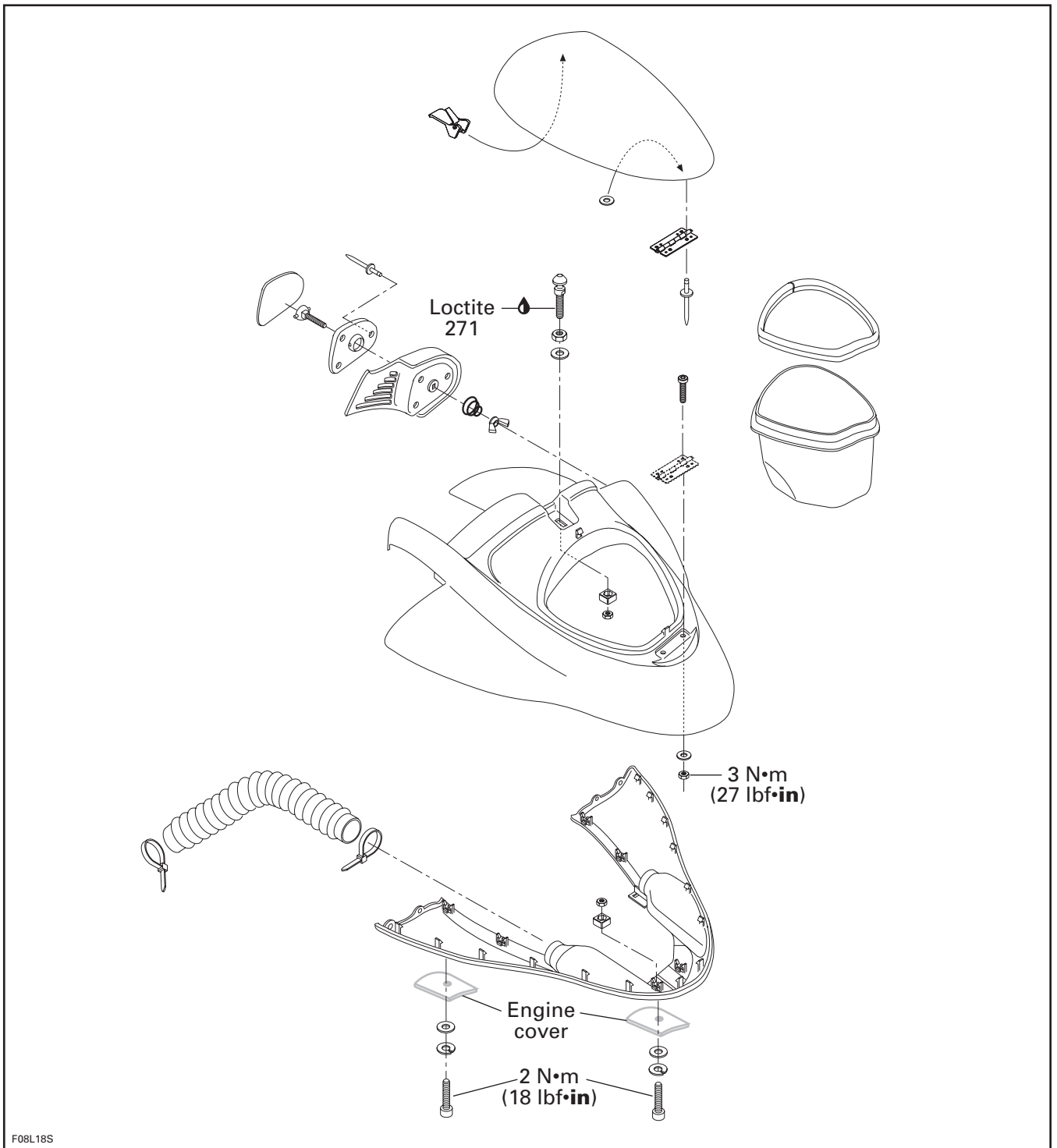
Subsection 02 (ADJUSTMENT AND REPAIR)

XP Model (suspension)



F08L1KT

XP Model (front cover)

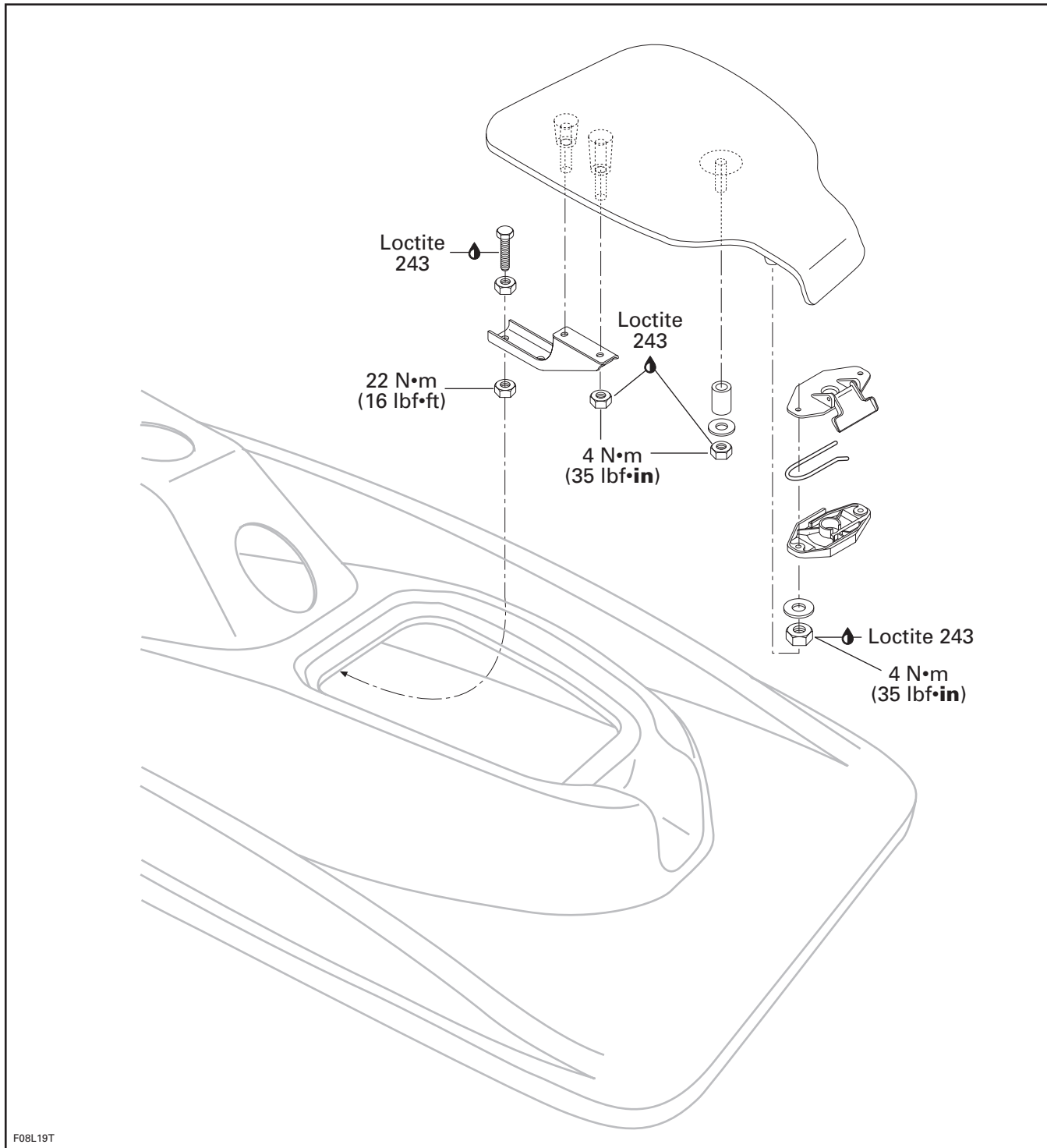


F08L18S

Section 12 HULL/BODY

Subsection 02 (ADJUSTMENT AND REPAIR)

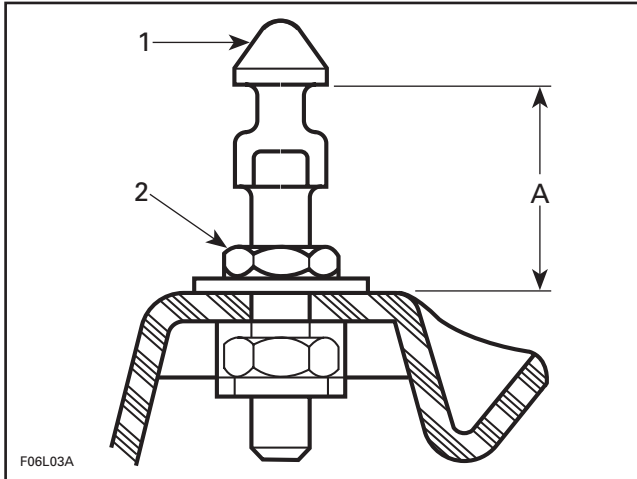
XP Model (rear cover)



F08L19T

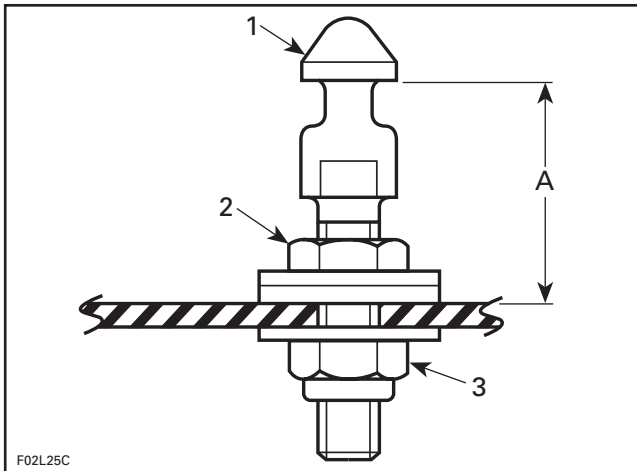
SEAT ADJUSTMENT

Seat Retainer



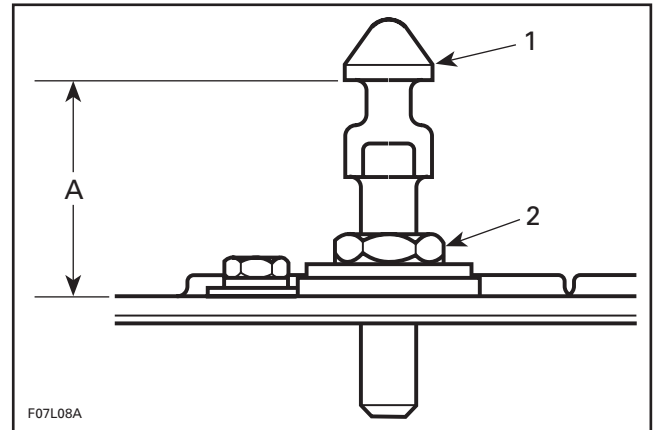
GS AND GSX RFI MODELS

1. Lock pin
2. Adjustment nut (apply Loctite 271)
- A. $33.5 \pm 1 \text{ mm}$ ($1\text{-}5/16 \pm 3/64 \text{ in}$)



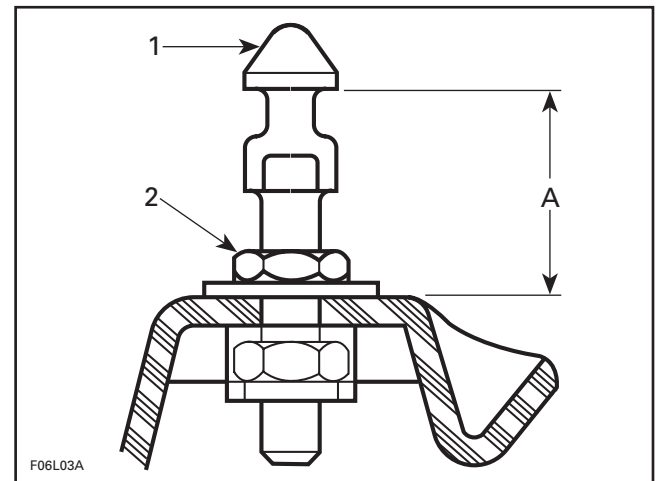
GTS MODEL

1. Lock pin
2. Adjustment nut (Loctite 271)
3. Lock nut. Torque to $5 \text{ N}\cdot\text{m}$ ($44 \text{ lbf}\cdot\text{in}$)
- A. $38 \pm 1 \text{ mm}$ ($1\text{-}1/2 \pm 3/64 \text{ in}$)



GTI, GTX RFI AND GTX MODELS — FRONT SEAT

1. Lock pin
2. Adjustment nut (Loctite 271)
- A. $39 \pm 1 \text{ mm}$ ($1\text{-}35/64 \pm 3/64 \text{ in}$)



GTI, GTX RFI AND GTX MODELS — REAR SEAT

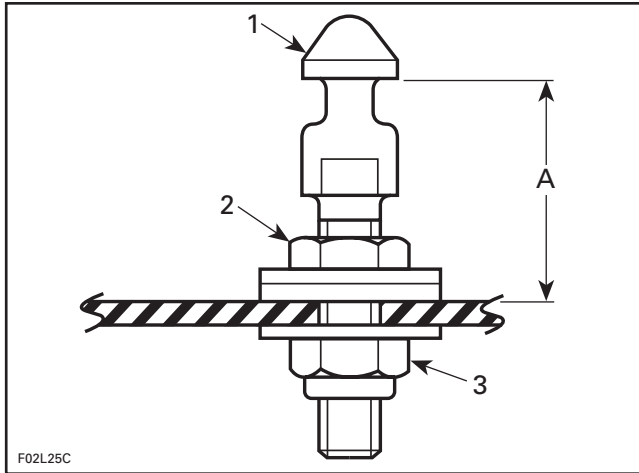
1. Lock pin
2. Adjustment nut (apply Loctite 271)
- A. $33.5 \pm 1 \text{ mm}$ ($1\text{-}5/16 \pm 3/64 \text{ in}$)

Section 12 HULL/BODY

Subsection 02 (ADJUSTMENT AND REPAIR)

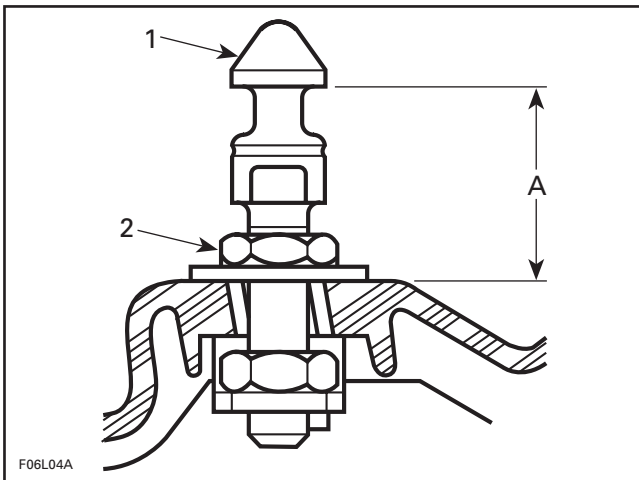
STORAGE COMPARTMENT COVER ADJUSTMENT

Adjust lock pin no. 3 as per following specifications:



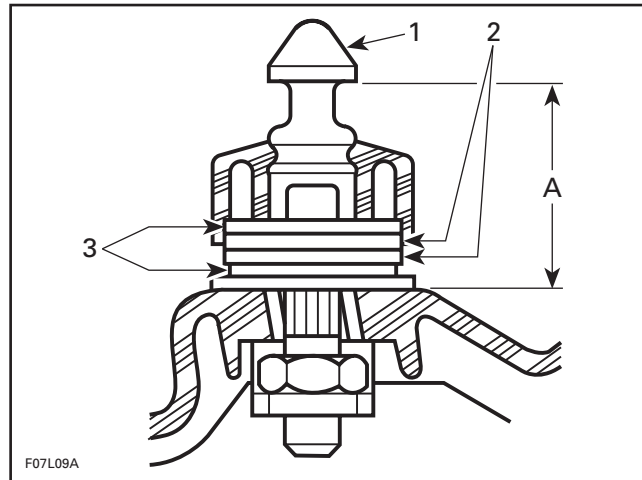
GTS MODEL

1. Lock pin
 2. Adjustment nut (Loctite 271)
 3. Lock nut. Torque to 5 N•m (44 lbf•in)
- A. 37 ± 1 mm (1-29/64 \pm 3/64 in)



GTI, GTX RFI AND GTX MODELS

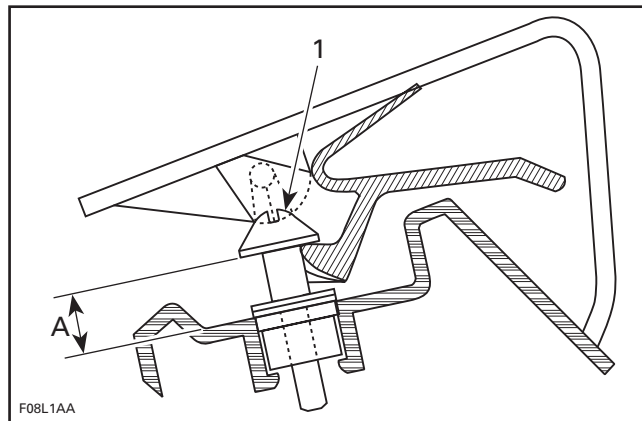
1. Lock pin (apply Loctite 271)
 2. Adjustment nut
- A. 34 ± 1 mm (1-11/32 \pm 3/64 in)



GTI, GTX RFI AND GTX MODELS

1. Lock pin (apply Loctite 243)
 2. Rubber washer
 3. Flat washers
- A. 39.2 ± 1 mm (1-35/64 \pm 3/64 in)

NOTE: The GTI, GTX RFI and GTX have a floating type lock pin. It is normal to have a front and aft play of the lock pin. To adjust, tighten lock pin until any vertical play is eliminated. Make sure a front and aft play remains when pressing by hands.



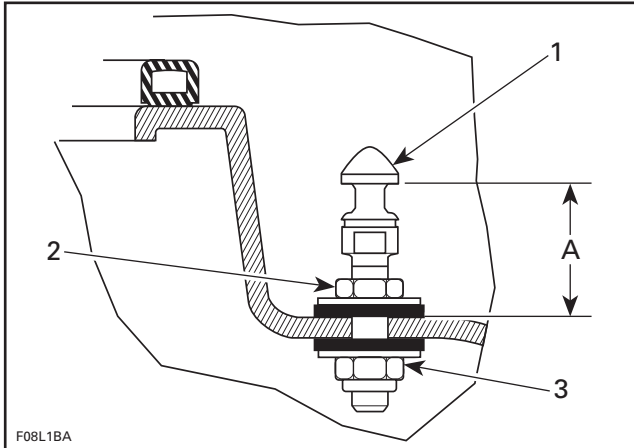
XP MODEL

1. Lock pin
- A. 13.4 mm (17/32 in)

ACCESS PANEL ADJUSTMENT

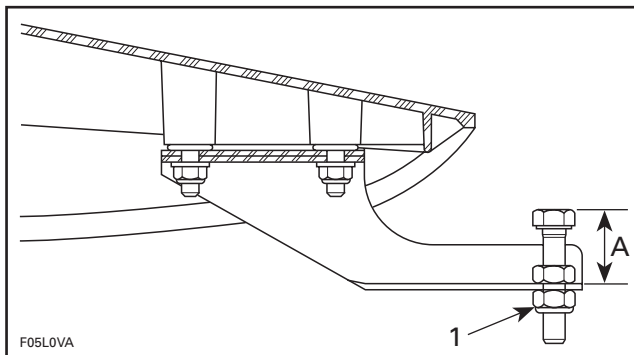
XP Model

Adjust lock pin **no. 3** of access panel as per following specifications:



1. Lock pin
 2. Adjustment nut (Loctite 271)
 3. Lock nut. Torque to 5 N•m (44 lbf•in)
- A. 39 ± 1 mm (1-17/32 \pm 3/64 in)

Adjust bolts **no. 16** of access panel arms as per following specifications:



1. Lock nut. Torque to 22 N•m (16 lbf•ft)
- A. 33 ± 1 mm (1-19/64 \pm 3/64 in)

INLET GRATE

Removal and Installation

Loosen screws and remove inlet grate.

NOTE: An impact screwdriver should be used to loosen tight screws.

When reinstalling inlet grate, apply Loctite 271 on threads and torque screws to 11 N•m (8 lbf•ft).

RIDING PLATE

Removal

All Models Except some GTX

Remove inlet grate.

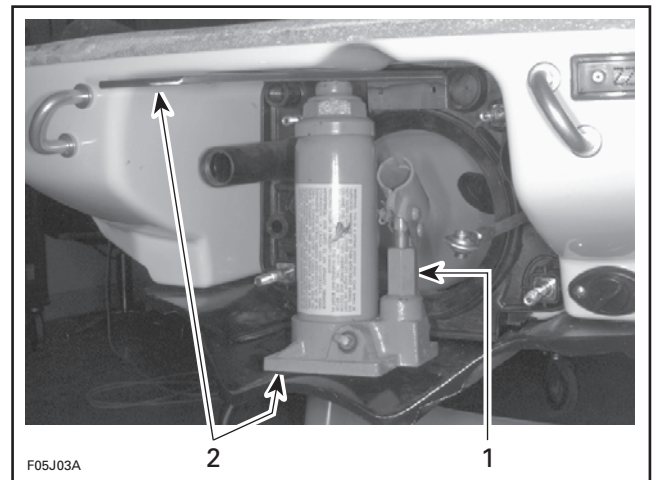
Remove jet pump. Refer to JET PUMP.

Remove the speed sensor from the riding plate (if applicable).

Loosen riding plate screws.

NOTE: An impact screwdriver should be used to loosen tight screws.

Using a low height hydraulic bottle jack and 2 steel plates, pry out riding plate.



TYPICAL

1. Hydraulic bottle jack
2. Steel plates

GTX Model (with serial number included between ZZN54056B000 and ZZN54929B000)

Remove:

- RH muffler
- LH upper resonator
- silicone, nuts, washers and screws.

Section 12 HULL/BODY

Subsection 02 (ADJUSTMENT AND REPAIR)



Cleaning

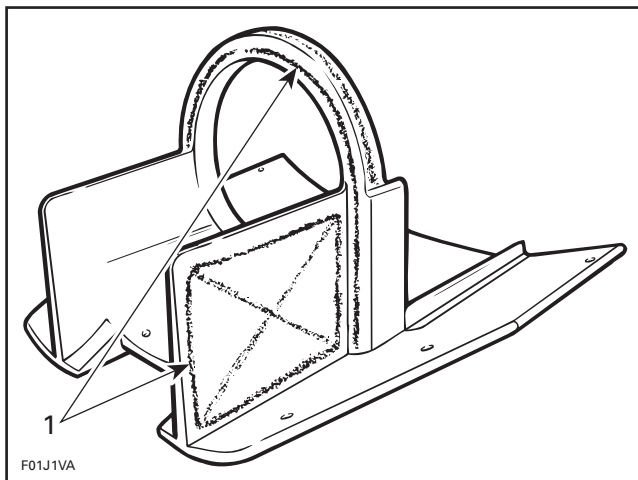
Scrape off all excess of sealant from riding plate and hull.

Clean hull surface with acetone based solvent to eliminate grease, dust and any residue of sealant.

Installation

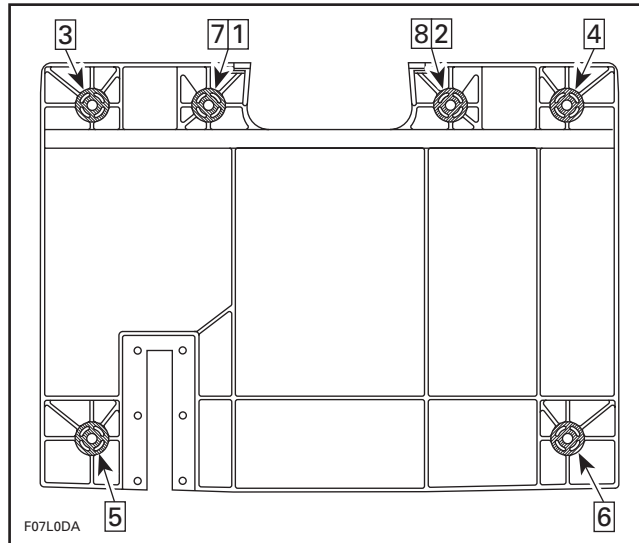
All Models Except some GTX

Apply Loctite The Right Stuff Gasket as indicated by the shaded areas in the next illustrations. Follow also the torquing sequence (if applicable) as shown in the same illustrations.

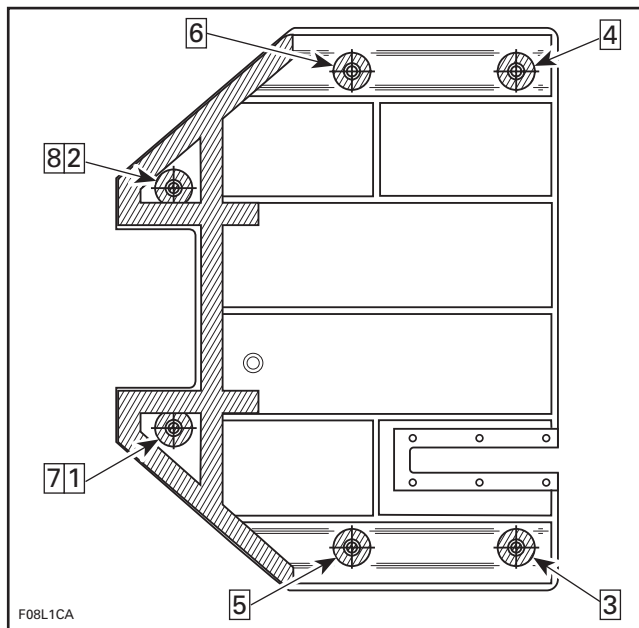


GTS MODEL

1. Apply Loctite The Right Stuff Gasket as indicated by the shaded area



GS, GTI, GTX, GSX RFI AND GTX RFI MODELS



XP MODEL

GTX Model (with serial number included between ZZN54056B000 and ZZN54929B000)

Apply Loctite The Right Stuff Gasket as indicated by the shaded areas in the previous illustrations. Install washers, nuts and silicone inside hull. Use a same torquing sequence.

JET PUMP SUPPORT

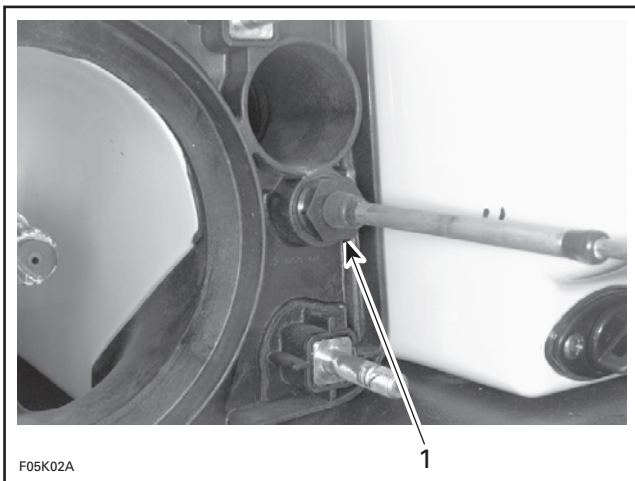
All Models Except GTS

Removal

Remove jet pump. Refer to JET PUMP.

Remove inlet grate and riding plate.

Remove ball joint, boot, nut, half rings and O-rings from steering cable.



TYPICAL

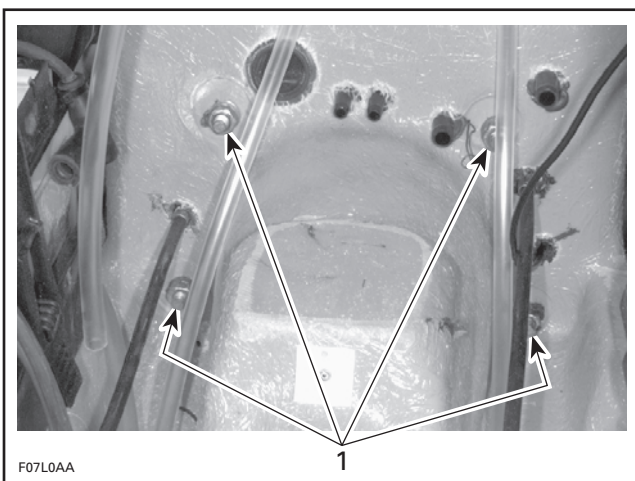
1. Unscrew nut

Remove ball joint, boot, nut, half rings and O-rings from reverse cable (GTI, GTX RFI and GTX models).

Remove boot and nut from VTS sliding shaft (XP model).

Disconnect water supply hose, water return hose and bailer hoses.

Remove nuts, lock washers and flat washers retaining jet pump support.



TYPICAL

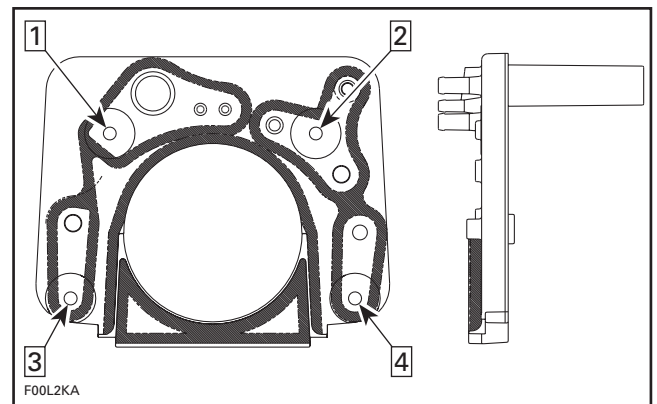
1. Remove nuts

Using a heat gun, heat jet pump support until it is possible to pull it.

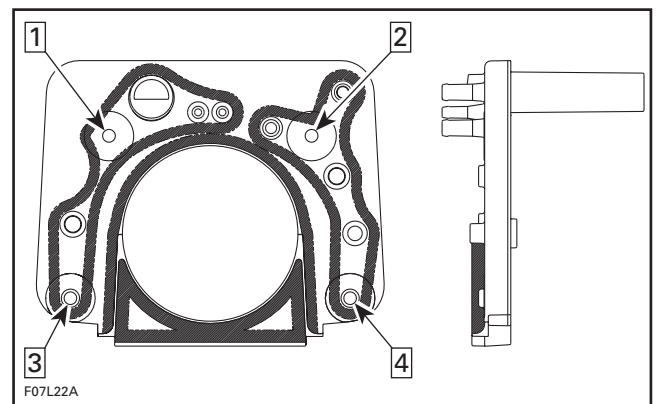
NOTE: Shims may have been installed between support and body. Do not remove these shims, otherwise jet pump alignment will be altered.

Installation

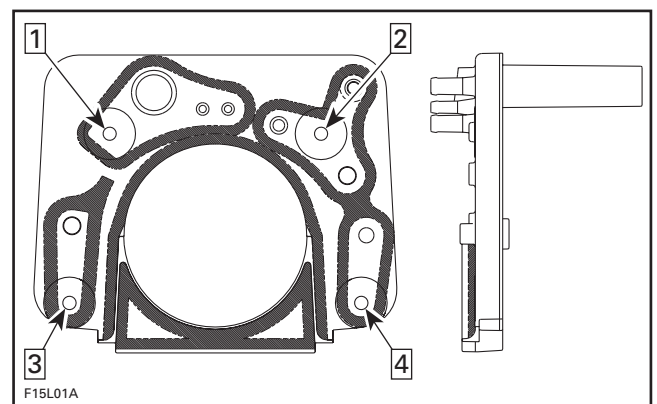
Apply Loctite The Right Stuff Gasket as indicated by the shaded areas in the next illustrations. Follow also the torquing sequence as shown in the same illustrations.



GS MODEL



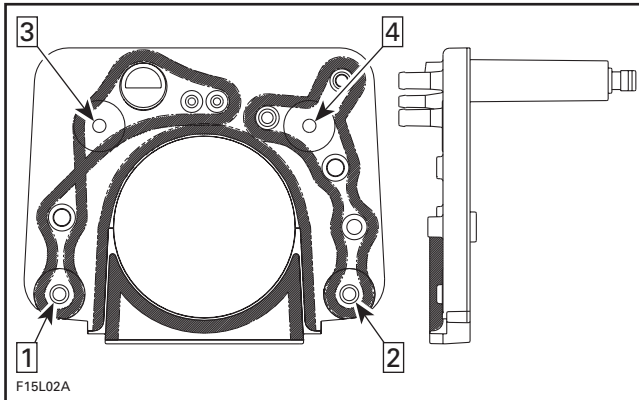
GTI MODEL



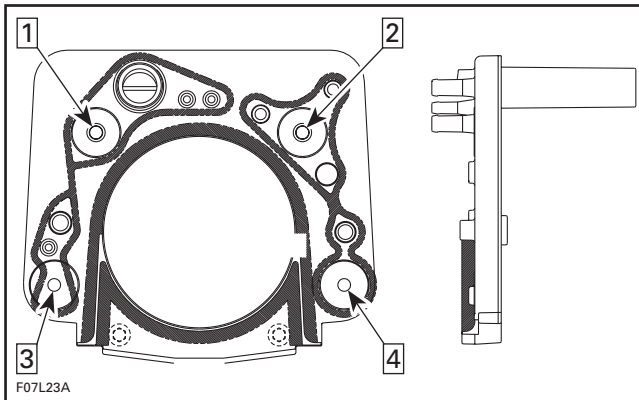
GSX RFI MODEL

Section 12 HULL/BODY

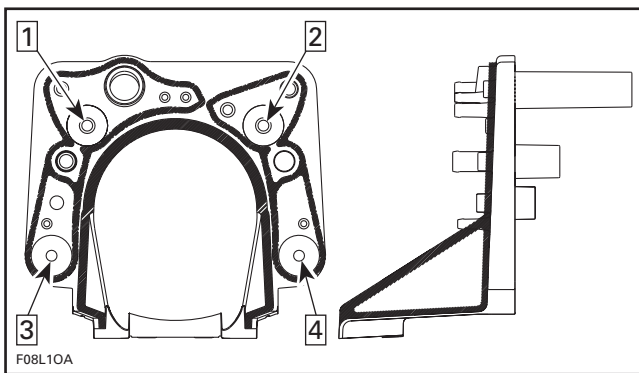
Subsection 02 (ADJUSTMENT AND REPAIR)



GTX RFI MODEL



GTX MODEL



XP MODEL

DEFLECTOR

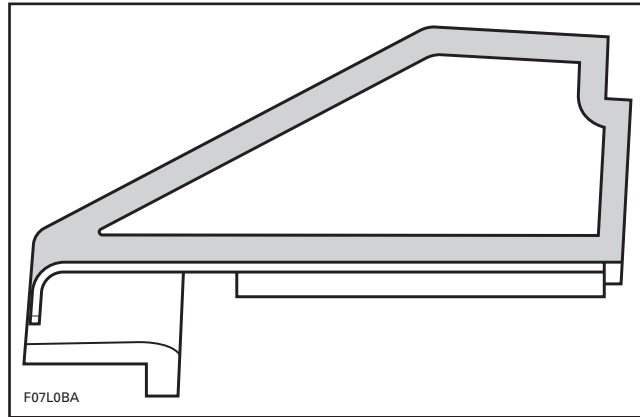
GS, GTI and GTX Models

Removal

Using a heat gun, heat deflector and pry it using a piece of wood.

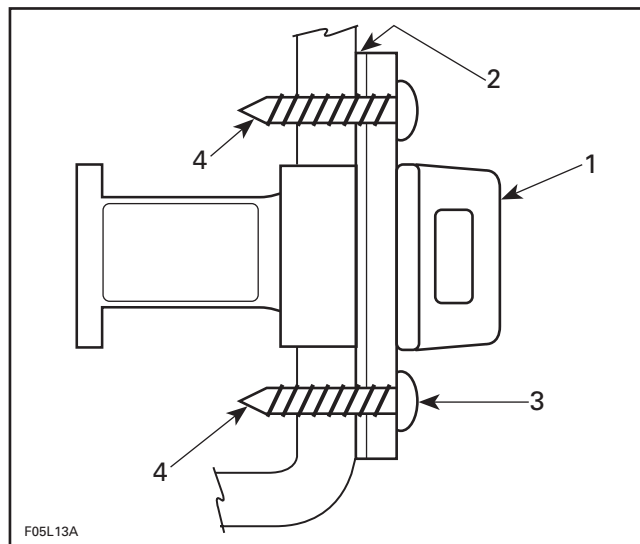
Installation

Apply Loctite The Right Stuff Gasket as indicated by the shaded area in the following illustration.



DRAIN PLUG INSTALLATION

Refer to the following illustration to install drain plug no. 15.

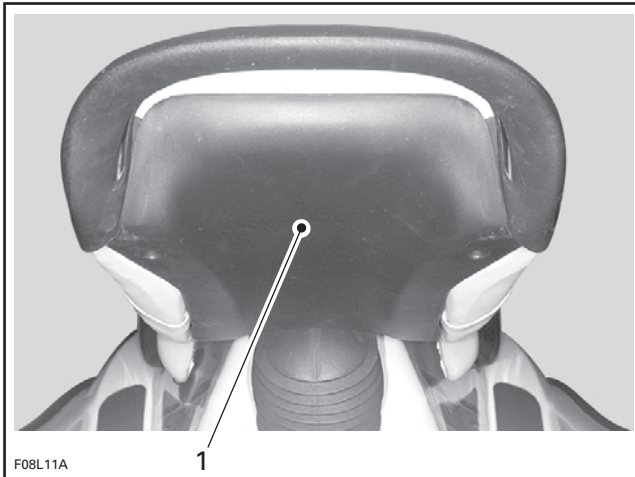


1. Drain plug
2. Gasket and 732 sealant
3. Torque screws to 1.5 N•m (13 lbf•in)
4. From inside bilge, apply 732 sealant on screws

SEAT REMOVAL

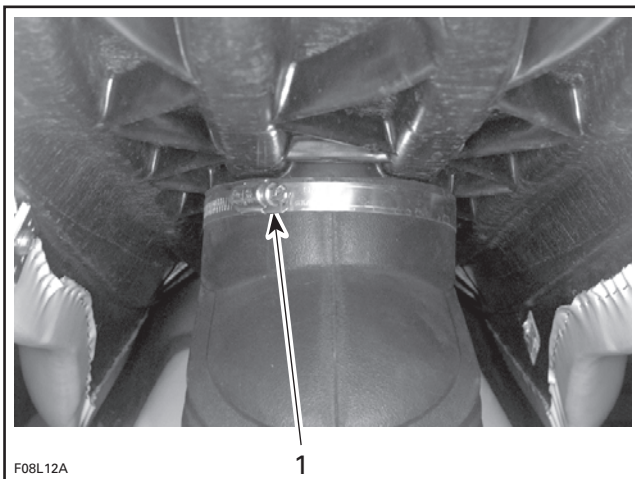
XP Model

Loosen 4 screws and remove bottom cover no. 17 of seat.



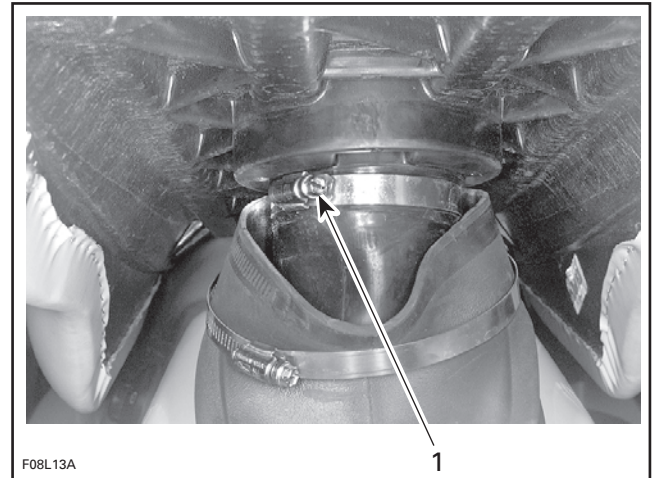
1. Remove cover

Loosen gear clamp of outer boot; then, pull outer boot downward.



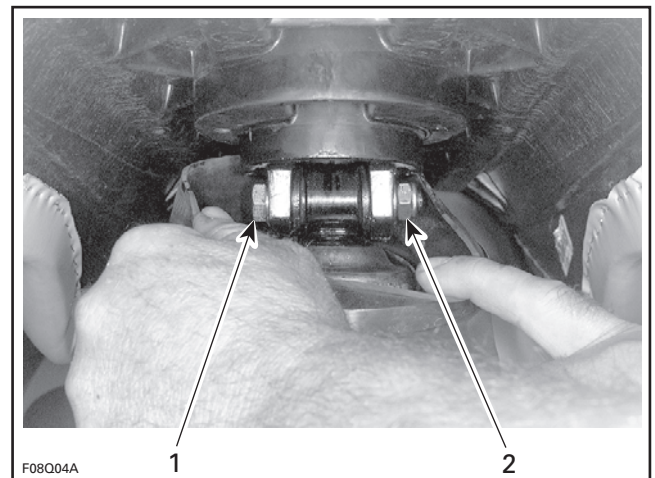
1. Loosen gear clamp

Loosen gear clamp of inner boot; then, pull boot downward.



1. Gear clamp

Remove bolt and lock nut from shock absorber upper support.

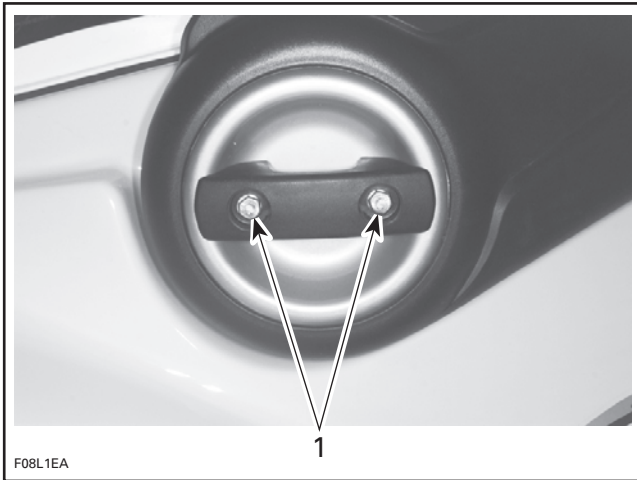


1. Bolt
2. Lock nut

Remove protective caps no. 18 and loosen screws no. 19 to remove eyelet no. 20 on each side of seat.

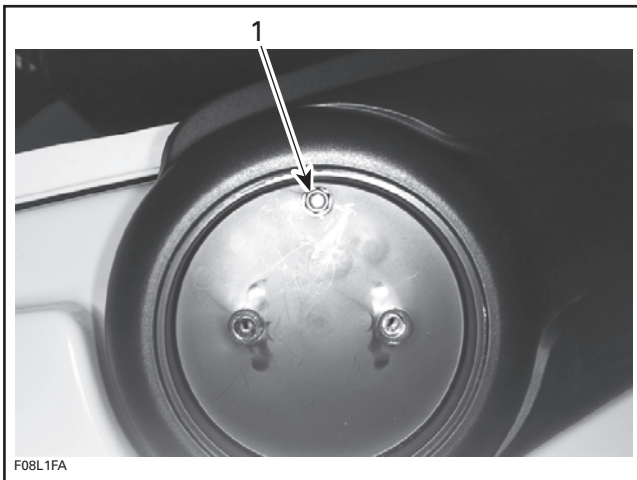
Section 12 HULL/BODY

Subsection 02 (ADJUSTMENT AND REPAIR)



1. Loosen screws of eyelet

Remove cup no. 21 on each side of seat.
Loosen nut no. 23 on each side of seat.



1. Loosen nut

Tilt seat.

Loosen screws no. 24 on each side of seat retaining the side covers.

Lower seat.

Remove side covers.

Pull seat frame out of pivots.

Remove seat.

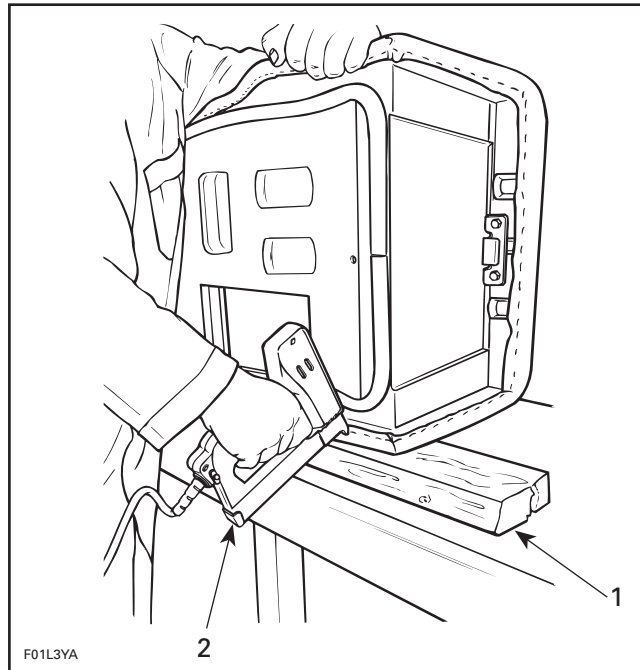
Seat installation is essentially the reverse of removal procedure. Refer to the main illustration of seat at the beginning of this subsection for proper torque specifications and service products to be used.

SEAT COVER REPLACEMENT

Install staples with an electric tacker such as Arrow tacker no. ETN-50 or with a manual tacker such as Arrow tacker no. T-50.

NOTE: For an easier installation, it's highly recommended to use an electric tacker.

Ensure that the seat rest firmly against a hard surface such as a piece of wood. This is done to get the staples completely pushed in place.



TYPICAL

1. Piece of wood
2. ETN-50 (electric) or T-50 (manual)

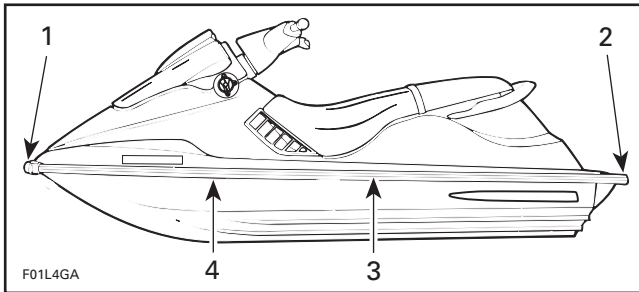
After cover installation cut all around the excess of material.

BUMPER REPLACEMENT

1. Remove trim no. 5 from side bumper rail no. 4.
2. Drill pop rivets no. 12 to remove side bumper rail no. 4.
3. Mark hole positions on body straight and bow sections.

Section 12 HULL/BODY

Subsection 02 (ADJUSTMENT AND REPAIR)



TYPICAL

1. Front bumper
2. Corner bumper
3. Straight section
4. Bow section

4. Slide bumper rail no. 4 under front bumper no. 13.
5. Using a 4.80 mm (3/16 in) drill bit, drill first hole through bumper rail no. 4 at front of bow section. Use locating mark as a guide. Then install a rivet no. 12.

CAUTION: When drilling, be careful not to damage bumper rail and/or hull.

6. Position bumper rail no. 4 properly onto body and cut excess length if necessary.
7. Slide bumper rail no. 4 in corner bumper no. 14.
8. Using hole positions previously marked on body, drill holes in bumper rail no. 4 and install rivets no. 12.
9. Install trim no. 5 using soapy water.
10. Repeat procedure for the other side.

SPONSON REPLACEMENT

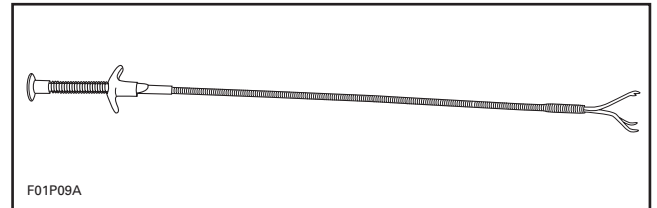
- Remove seat (access cover for the XP).
- Remove air vent tube support (GS and GSX RFI).
- Remove seat support (GTI, GTX RFI and GTX).
- Remove muffler.
- Remove battery.
- From inside bilge, remove lock nuts no. 10 using a 10 mm deep socket with an extension.
- Remove sponsons no. 6. Clean any residues of sealant adhesive on hull.
- Install gaskets no. 7 on new sponsons no. 6.
- Apply silicone sealant (P/N 293 800 033) around sponson studs.

Apply Loctite 243 (blue) on sponson studs.

Install sponsons no. 6 on hull.

From inside bilge, first insert flat washers no. 8 over sponson studs. Secure with lock nuts no. 10. Tighten to 5 N•m (44 lbf•in).

NOTE: To ease flat washer and lock washer installation, use a flexible 4-claw Snap-on pick-up tool.



Reinstall removed parts.

Clean hull and sponsons of any sealant adhesive surplus.

WARNING

Recommended torques and use of Loctite must be strictly followed.

BAFFLE SEALING

GTS Model

Apply silicone sealant (P/N 293 800 033) on rear baffle section to be sealed.

ENGINE COMPARTMENT COVER REMOVAL

XP Model

Disconnect throttle and choke cables at carburetor linkage.

Disconnect wiring harnesses of start/stop button, monitoring beeper, safety lanyard switch and gauges.

Loosen bolts and nuts of hinge from watercraft body.

Disconnect the gas assist cylinder.

Remove engine compartment cover.

Engine cover installation is essentially the reverse of removal procedure. Refer to the main illustration of engine cover at the beginning of this subsection for proper torque specifications and service products to be used.

Section 12 HULL/BODY

Subsection 02 (ADJUSTMENT AND REPAIR)

DECALS REPLACEMENT

Removal

Using a heat gun warm up one end of decal for a few seconds until decal can roll off when rubbing with your finger.

Pull decal slowly and when necessary apply more heat to ease removal on the area that has to be peeled off.

If decal tears while pulling off, it has to be heated for a few seconds longer. If decal tends to stretch while pulling off, stop heating and wait a few seconds to let it cool, then peel it off.

Installation

There are 2 types of decals used on watercraft. One has a protective film on back side and the other has a protective film on both sides. They are used on 3 types of materials; plastic, gelcoat and metal.

DECALS HAVING A PROTECTIVE FILM ON BACK SIDE ONLY

These decals usually contain written information (ex.: warning) and are used on gelcoat or metal.

Clean surface with a good solvent such as ACRYLIC-CLEAN DX 330 from PPG or equivalent (refer to manufacturer instructions).

Using a pencil and the decal as a template, mark the area where decal will be located.

Remove half of the decal back protective film and align decal with marks. Start sticking it from center and remove the other half of the film to stick it completely. Carefully squeegee decal beginning at center and working outward using, firm, short, overlapping strokes.

DECALS HAVING A PROTECTIVE FILM ON BOTH SIDES

These decals usually contain graphics and are used on gelcoat or plastic.

INSTALLATION ON GELCOAT

Clean surface with a good solvent such as ACRYLIC-CLEAN DX 330 from PPG or equivalent (refer to manufacturer instructions).

For best result apply an activator (P/N 293 530 036) to prepare the surface using a clean cloth. After a few seconds, when the activator evaporates, the surface is ready.

Using a pencil and the decal as a template mark the area where decal will be located.

For better adhesion a dry application is recommended, however, to ease decal installation a mild solution of soapy water can be sprayed over surface where decal will be installed.

Remove back protective film from decal and align decal with marks. When well aligned squeegee decal beginning at center and working outward using firm, short, overlapping strokes.

Remove front protective film once decal has adhered to hull.

INSTALLATION ON PLASTIC (storage cover)

Clean surface with isopropyl alcohol.

Using a pencil and the decal as a template, mark the area where decal will be located.

Apply an activator (P/N 293 530 036) to prepare the surface using a clean cloth. After a few seconds, when the activator evaporates, the surface is ready.

CAUTION: Do not use soapy water to locate decal on plastic parts.

Remove back protective film from decal and carefully align decal with marks. When well aligned squeegee decal beginning at center and working outward using firm, short, overlapping strokes.

Remove front protective film once decal has adhered.

HULL AND BODY REPAIR

General

Gelcoat is the smooth and durable cosmetic finish which coats the fiberglass hull and body of a Sea-Doo watercraft. It also provides a protective barrier against water and sun. It consists of a mixture of resin, pigment (coloring), fillers, monomers and catalyst which is sprayed into the mold.

The body and hull of the Sea-Doo are constructed of chopped fiberglass, saturated with resin. It is sprayed on the layer of gelcoat along with pieces of fiberglass mat, cloth and woven rowing which are added at required areas. This type of construction is very accommodating for high quality repairs. With patience, the proper techniques and materials, a damaged area can be restored to an original finish.

NOTE: Fiberglass repair kit is available through automotive or marine suppliers. Gelcoat repair kits are available through regular channel.

⚠ WARNING

Protect skin, wear gloves when in contact with resin, hardeners and gelcoat. A barrier skin cream may also be used. Do not expose area to open flame or lit cigarette. Some of the materials are flammable. Protect eyes, wear safety glasses when grinding, sanding or spraying. Use a dust mask when sanding or grinding. When spraying wear a respirator or paint mask. Always read warning labels on products.

Air Bubbles

Possible cause:

- Air pocket trapped between layers of laminate and gelcoat.

PREPARATION OF SURFACE

Remove all of the damaged gelcoat surrounding the air bubble with a putty knife or preferably a carbide grinding tip. Make sure all loose and weak areas are completely removed. Sand a small area of the gelcoat surface with 220-grit sandpaper. If needed, sand the cavity itself. These areas must have a rough surface to allow the gelcoat putty to bond properly.

FILLING THE CAVITY

The prepared surface must be cleaned with acetone on a cloth. Use the Bombardier gelcoat repair kit (P/N 295 500 100). Follow the mixing instructions in the kit when preparing the gelcoat putty.

Carefully mix the required amount while making sure there are no air bubbles in the mixture. With a putty knife, fill the repair area and cover with plastic film. Curing time may depend on temperature, amount of putty and percentage of catalyst. After 2 hours, press lightly on the surface with fingers to test the hardness. When the area becomes hard, remove the plastic film.

SANDING

Begin block sanding the patch with 320-grit sandpaper until you come close to the original surface. Remove dust with a water soaked cloth and continue sanding with a 400-grit wet paper. Finish wet sanding with a 600-grit to remove deeper scratches. If needed you can wet sand with finer grit paper such as 1000-grit.

BUFFING AND WAXING

Buff the surface using a heavy duty polisher with a buffing pad. Make sure the pad is free of dirt or you may damage the gelcoat. Carefully begin buffing with a white medium compound. Finish off using a fine compound. While buffing, pay close attention to avoid overheating the surface.

Blisters

Possible causes:

- Insert catalyst.
- Improper catalyst/gelcoat ratio.

A blister is a visible bump on the watercraft surface that may not necessarily come right through the gelcoat layer. In the case of only a few blisters, follow the same repair procedure as for air bubbles. If they are numerous and in close concentration, spray liquid gelcoat to achieve proper repair. This procedure is covered in **Minor Gelcoat Fractures**.

Minor Gelcoat Fractures

Possible causes:

- Flexing of fiberglass laminate.
- Gelcoat thickness.
- Direct result of impact.

In case of fractures which have not penetrated past the gelcoat layer, the repair concerns the gelcoat only. If flex cracking or impact are evident, then additional reinforcement may be necessary. This subject will be covered in **Compound Fractures**.

Section 12 HULL/BODY

Subsection 02 (ADJUSTMENT AND REPAIR)

PREPARING THE SURFACES

Small Fractures

Open the cracks up with a sharp triangular can opener or preferably a carbide tipped die grinder. The V groove will provide a good bonding area for the gelcoat. With 220-grit sandpaper, sand the sides of the notched out areas.

Numerous Fractures

Using a grinder with a 24-grit disk, remove the gelcoat. Sand the area edge with 220-grit sandpaper.

FILLING THE REPAIR AREA

Small Fractures

Refer to the same procedure as in the **Air Bubbles**.

Numerous Fractures Over Large Surface:

Prepare the area for spray application of liquid gelcoat. Wipe down the surface with acetone. Mask the area off to protect the watercraft from overspray.

Mix the needed quantity of gelcoat and catalyst according to suppliers recommendations. The gelcoat can be thinned with acetone up to 10%. If it needs more consistency you can add cabosil.

Make sure that the air supply is free of oil, dirt and water.

Test spray the gelcoat mixture on paper to verify its consistency and pattern. You may have to apply 5 or 6 coats to cover the area properly. Overlap each coat further than the last, leaving at least 30 seconds between passes. Avoid trying to coat the surface with only a few heavy coats, this will not allow the gelcoat to dry properly.

Apply a coat of polyvinyl alcohol to seal off the air and protect the gelcoat surface from dust. PVA speeds up the curing process because gelcoat will not cure properly when exposed to air.

SANDING

Wash the polyvinyl alcohol off with water. Depending on the size of the area repaired, you can either block sand as per previous procedure or you may use an air sander. Sand the surface down with progressively finer grits of sandpaper until the desired finish is achieved.

BUFFING AND WAXING

Buff the surface using a heavy duty polisher with a buffing pad. Make sure the pad is free of dirt or you may damage the gelcoat. Carefully begin buffing with a white medium compound. Finish off using a fine compound. While buffing, pay close attention to avoid overheating the surface.

Compound Fractures

Possible causes:

- Thickness of fiberglass laminate.
- Direct result of impact.

Compound fractures are those that have gone past the gelcoated surface and in through the layers of fiberglass laminate. Two types of repairs have to be performed. The first is to restore the structural integrity of the damaged area. Fracture types can vary from a simple crack to a large hole. Usually, fiberglass reinforcement becomes necessary, especially if the fracture can be attributed to weakness. The final part of the repair is the gelcoating, which cannot be done until the interior and exterior laminate surfaces have been repaired.

Outside

Remove the damaged gelcoat and fiberglass with a 24-grit disk using a power sander. Grind outward at least 2 inches from the fracture to allow the patch to bond to strong material. Cut enough pieces of fiberglass mat necessary to build up the area. The pieces should be cut so they overlap each other by at least a half inch. For a smoother finish, the last layer should be fiberglass cloth. If the fracture is small enough all you may have to do is fill the area with an epoxy filler.

Inside

For the interior repair, you can grind more. This will allow for more fiberglass material which will strengthen the area. If the fracture opening is too large after surface preparation, you may need a backing support to cover the opening. Cut alternating pieces of fiberglass mat and cloth in overlapping sizes.

PATCHING THE REPAIR AREA

Outside

The outside should be done first. Wipe clean the area with acetone on a cloth, then mask off area. For a small crack use an epoxy filler in the same way you would use Bombardier's gelcoat repair putty. When laying up a larger area you will use mat, cloth and fiberglass resin and hardener. Use a clean container to mix the resin, mix only what you will need. Follow the recommended catalyst ratio.

Using a clean paintbrush, brush the mixed resin on the surface. Place the smallest piece of mat over the fracture and then wet out the mat. Follow with the remaining pieces of mat and final layer of cloth. While wetting the pieces make sure you work the air bubbles out and saturate all the pieces evenly. Try to work quickly, you may only have 15 or 20 minutes. You may clean the brush with acetone.

Wait until the repair has hardened before moving on to the interior repair. If the size of the opening is too large for the pieces to maintain the proper shape, you will have to use a backing support. It is a shaped piece of cardboard that fits flush to the interior surface and has a plastic layer on the repair side. It is held in place by tape or a support.

Inside

Wipe down the area with acetone on a cloth. Apply the same procedure as for outside repair when laminating the alternating pieces of fiberglass material. If a backing support was used, remove it before starting the repair. After the area has hardened, remove sharp edges of material from surface. If required paint the surface.

SANDING

Outside

This surface will have to be prepared for application of gelcoat. The size of the area will determine the gelcoating procedure to be used. Refer to the repair procedure for minor gelcoat fractures.

BUFFING AND WAXING

Refer to the buffing and waxing for **Minor Gelcoat Fractures**.

TOOLS AND MATERIALS LIST

Tools

- safety glasses
- air mask
- white cloths
- sanding block
- putty knife
- plastic film
- stirring stick
- cover sheets (for Sea-Doo)
- scissors
- buffing pad
- heavy-duty polisher
- power sander
- paint brush
- plastic container (mixing)
- spray gun
- plastic squeegee

Materials

- fiberglass mat
- fiberglass cloth
- polyester resin
- cardboard
- masking tape
- sandpaper (100-grit, 220-grit, 320-grit, 400-grit, 600-grit, 1000-grit)
- 24-grit sanding disks
- Bombardier gelcoat putty
- Bombardier liquid gelcoat
- acetone
- cabosil
- epoxy filler
- medium compound (white)
- fine compound (white)
- wax

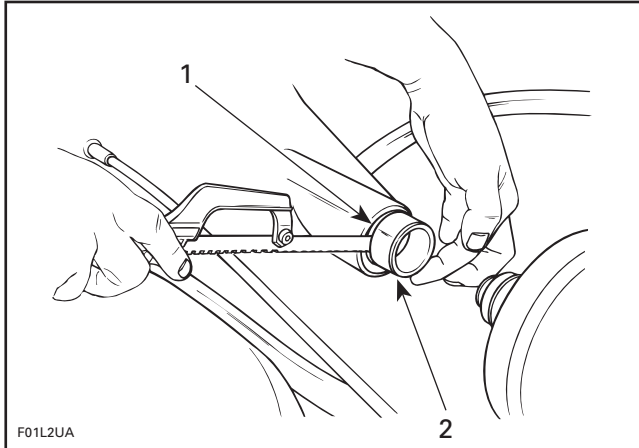
Section 12 HULL/BODY

Subsection 02 (ADJUSTMENT AND REPAIR)

THRU-HULL FITTING INSTALLATION

For hull insert repair proceed as follows:

Cut plastic hull insert flush with hull using a saw.

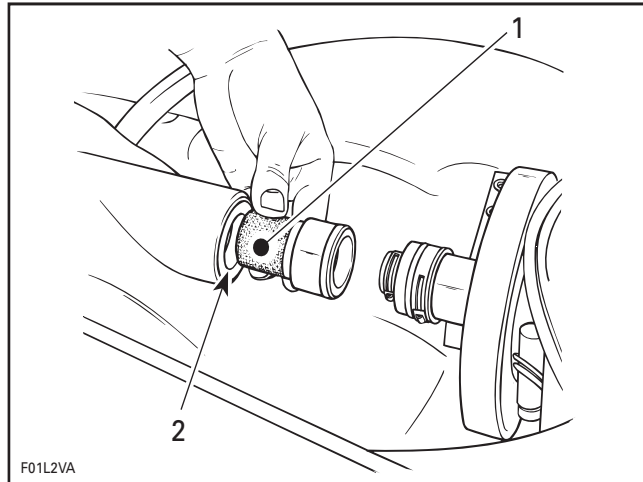


1. Hull
2. Plastic hull insert

Mix epoxy glue (3M-05900), follow manufacturer instructions.

Apply epoxy glue on aluminum insert (P/N 292 000 075) knurled surface and on plastic insert inner bore.

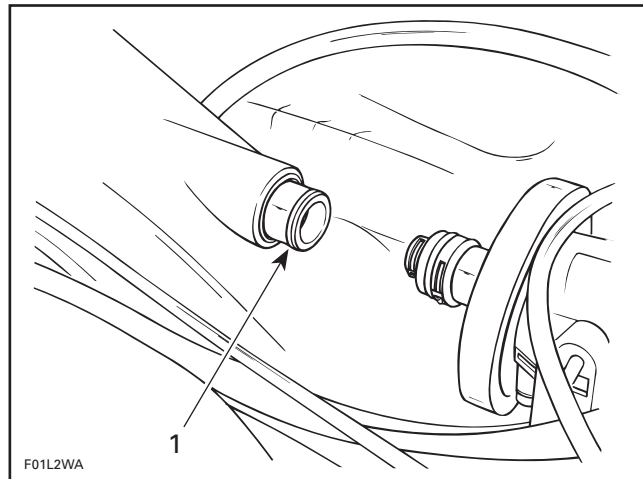
CAUTION: If you notice any clearance between plastic insert and aluminum insert, fill gap with epoxy glue to obtain good adhesion of aluminum insert.



1. Knurled surface
2. Inner bore

Install aluminum insert into plastic hull insert.

NOTE: Align aluminum insert as much as possible with PTO flywheel.



1. Aluminum insert

NOTE: The epoxy glue curing time is 30 minutes.

GS MODEL

ENGINE		GS (5644/5827)
Engine type		BOMBARDIER-ROTAX 717
Induction type		Rotary valve
Exhaust system	Type	Water cooled, water injected
	Water injection fitting (head)	3.5 mm (.139 in)
	Water injection fitting (cone)	3.5 mm (.139 in)
Starting system		Electric start
Lubrication	Fuel/oil mixture	VROI (Variable Rate Oil Injection)
	Oil injection pump	Gear driven
	Oil injection type	BOMBARDIER-ROTAX
Number of cylinders		2
Bore	Standard	82 mm (3.228 in)
	First oversize	82.25 mm (3.238 in)
	Second oversize	82.50 mm (3.248 in)
Stroke		68 mm (2.677 in)
Displacement		718.2 cm ³ (43.81 in ³)
Corrected compression ratio		6.2: 1
Cylinder head volume		42.4 ± 0.4 cc
Cylinder head warpage (maximum)		0.05 mm (.002 in)
Piston ring type and quantity		1 semi-trapez — 1 rectangular
Ring end gap	New	0.25 - 0.40 mm (.010 - .016 in)
	Wear limit	1.00 mm (.039 in)
Ring/piston groove clearance	New	0.025 - 0.070 mm (.001 - .003 in)
	Wear limit	0.2 mm (.008 in)
Piston/cylinder wall clearance	New (minimum)	0.10 mm (.0039 in)
	Wear limit	0.20 mm (.008 in)
Cylinder taper	New	0.05 mm (.002 in)
	Wear limit	0.10 mm (.004 in)
Cylinder out of round	New	0.008 mm (.0003)
	Wear limit	0.08 mm (.003 in)
Connecting rod big end axial play	New	0.311 - 0.677 mm (.012 - .027 in)
	Wear limit	1.2 mm (.047 in)
Crankshaft deflection		MAG: 0.050 mm (.002 in); PTO: 0.030 mm (.001 in)
Rotary valve timing	Opening	147° ± 5 BTDC
	Closing	65.5° ± 5 ATDC
Rotary valve duration		159°
Rotary valve/cover clearance		0.25 - 0.35 mm (.010 - .014 in)
Connecting rod/ crankshaft pin radial clearance	New	0.020 - 0.033 mm (.0008 - .0013 in)
	Wear limit	0.050 mm (.002 in)
Connecting rod/piston pin radial clearance	New	0.003 - 0.012 mm (.00012 - .00047 in)
	Wear limit	0.015 mm (.00059 in)
ADDITIONAL INFORMATION:		

Section 13 TECHNICAL DATA

Subsection 01 (GS MODEL)

ELECTRICAL		GS (5644/5827)
Magneto generator output		160 W @ 6000 RPM
Ignition system type		Digital CDI
Spark plug	Make and type	NGK BR8ES
	Gap	0.5 - 0.6 mm (.020 - .024 in)
Ignition timing (BTDC)	mm (in)	2.59 ± 0.38 (.102 ± .015)
	Degrees	20° ± 1.5 ①
Generating coil (low speed)		40 - 76 Ω
Battery charging coil		0.05 - 0.6 Ω
Trigger coil		Not applicable
Ignition coil	Primary	0.33 - 0.62 Ω
	Secondary	9 - 15 kΩ
Engine rev limiter setting		7000 ± 50 RPM
Battery		12 V, 19 A•h (Yuasa/Exide)
Fuses	MPEM	5 A
	Electrical system	2 x 15 A
	VTS system	Not applicable
	Bilge pump	Not applicable
ADDITIONAL INFORMATION: ① Engine cold @ 6000 RPM.		

CARBURETION		GS (5644/5827)
Carburetor	Type	Mikuni BN-40i diaphragm, fuel accelerator pump
	Quantity	1
Main jet		167.5
Pilot jet		75
Spring		130 g
Adjustment	Low-speed screw	1 turn ± 1/4
	High-speed screw	0
	Idle speed (in water)	1500 RPM
	Idle speed (out of water)	3000 RPM
Fuel	Type	Regular unleaded gasoline
	Minimum octane no.	87
Fuel return line orifice		0.8 mm (.031 in)
ADDITIONAL INFORMATION:		

COOLING		GS (5644/5827)
Type		Open circuit — Direct flow from jet propulsion unit
Thermostat		None
Monitoring beeper setting		86 - 94°C (187 - 201°F)
ADDITIONAL INFORMATION:		

Section 13 TECHNICAL DATA

Subsection 01 (GS MODEL)

PROPULSION		GS (5644/5827)
Propulsion system		BOMBARDIER Formula Pump
Jet pump type		Axial flow single stage
Impeller rotation (seen from rear)		Counterclockwise
Transmission		Direct drive
Coupling type		Crown splines
Oil type		SEA-DOO JET PUMP SYNTHETIC POLYOLESTER OIL 75W90 GL5
Steering nozzle pivoting angle		20°
Minimum required water level		90 cm (35 in)
Drive shaft deflection (maximum)		0.5 mm (.020 in)
Impeller outside diameter		139.5 mm (5.490 in)
Impeller/wear ring clearance	New	0.0 - 0.4 mm (.000 - .016 in)
	Wear limit	1.0 mm (.040 in)
Impeller shaft end play (new)		0
Impeller shaft radial play		0.05 mm (.002 in)
Impeller pitch/material		Progressive pitch/stainless steel
ADDITIONAL INFORMATION: Do not mix different brands or oil types.		

DIMENSIONS		GS (5644/5827)
Number of passenger (driver incl.)		2
Overall length		270 cm (106 in)
Overall width		116 cm (45.7 in)
Overall height		99 cm (39 in)
Dry weight		219 kg (483 lb)
Load limit (passenger and 10 kg (22 lb) luggage)		159 kg (351 lb)
ADDITIONAL INFORMATION:		

CAPACITIES		GS (5644/5827)
Fuel tank (including reserve)		56.5 L (15 U.S. gal)
Fuel tank reserve		11.4 L (3 U.S. gal)
Oil injection reservoir		6 L (1.6 U.S. gal)
Jet pump impeller shaft reservoir	Capacity	95 mL (3.21 U.S. oz)
	Oil level height	Up to plug
ADDITIONAL INFORMATION:		

Section 13 TECHNICAL DATA

Subsection 01 (GS MODEL)

MATERIALS	GS (5644/5827)
Hull	Composite
Inlet grate	Aluminum
Impeller housing/stator/venturi/nozzle	Plastic/plastic/plastic/aluminum
Air intake silencer	Thermoplastic
Flame arrester	Multi-layer wire screen
Steering padding	Thermoplastic
Fuel tank	Polyethylene
Oil injection reservoir	Polyethylene
Seat	Polyurethane foam
ADDITIONAL INFORMATION:	

STANDARD EQUIPMENT	GS (5644/5827)
Safety lanyard	Standard
Digitally Encoded Security System	Standard
Fuel tank reserve	Standard
Monitoring beeper	Standard
Fuel/oil gauge (analog)	Standard
Mirrors	Optional
Storage compartment	Standard
Rear grab handle	Standard
Tool kit	Standard
ADDITIONAL INFORMATION:	

PERFORMANCE	GS (5644/5827)	
Estimated pump power	26.3 kW (35.3 HP)	
Maximum fuel consumption at wide open throttle	33.5 L/h (8.8 U.S. gal/h)	
Cruising time at full throttle	Fuel tank without reserve	1 hour 21 minutes
	Fuel tank reserve	21 minutes
ADDITIONAL INFORMATION:		

Section 13 TECHNICAL DATA

Subsection 01 (GS MODEL)

TIGHTENING TORQUES		GS (5644/5827)			
ENGINE	Exhaust manifold screw		24 N•m (17 lbf•ft)	(4)	
	Magneto flywheel nut		145 N•m (107 lbf•ft)	(1)	
	Flywheel (PTO side)		110 N•m (81 lbf•ft)	(5)	
	Crankcase screws	M8		24 N•m (17 lbf•ft)	(3) (4)
		M10		40 N•m (30 lbf•ft)	(3) (4)
	Crankcase/engine support nuts		35 N•m (26 lbf•ft)	(1)	
	Engine mount/hull		25 N•m (18 lbf•ft)	(1)	
	Cylinder head screws		24 N•m (17 lbf•ft)	(1) (4)	
	Crankcase/cylinder screws		24 N•m (17 lbf•ft)	(1) (4)	
	Tuned pipe flange screws/nut		25 N•m (18 lbf•ft)	(1)	
	Tuned pipe fixation screws		25 N•m (18 lbf•ft)	(1)	
	Flame arrester screws		10 N•m (89 lbf•in)	(1)	
	Magneto housing cover screws		9 N•m (80 lbf•in)	(5)	
	Starter mounting screws		22 N•m (16 lbf•ft)	(1)	
	Spark plugs		24 N•m (17 lbf•ft)	(5)	
JET PUMP	Impeller		110 N•m (81 lbf•ft)	(1)	
	Pump/hull nuts		31 N•m (23 lbf•ft)	(1)	
	Venturi/pump housing screws		21 N•m (16 lbf•ft)	(1)	
	Pump housing cover screws		4 N•m (35 lbf•in)	(1)	
	Inlet grate screws		8 N•m (71 lbf•in)	(1)	
	Riding plate screws		22 N•m (16 lbf•ft)	(1)	
STEERING	Cable retaining block bolts		6 N•m (53 lbf•in)		
	Steering cable/stem arm bolt		3 N•m (26 lbf•in)		
	Steering stem arm bolts		6 N•m (53 lbf•in)		
	Handlebar clamp bolts		26 N•m (19 lbf•ft)		
	Steering cable ball joint (nozzle)		2 N•m (18 lbf•in)		
	Steering support bolts		15 N•m (11 lbf•ft)	(1)	
	Handlebar grip screw		7 N•m (62 lbf•in)		
<p>ADDITIONAL INFORMATION: Apply where indicated; (1) Loctite 243 (blue) (2) Loctite 271 (red) (3) Loctite 518 (4) Synthetic grease (5) Anti-seize lubricant</p>					
WARNING					
Correct torques and use of Loctite must be strictly followed.					

XP MODEL

ENGINE		XP (5651/5655)
Engine type		BOMBARDIER-ROTAX 947
Induction type		Reed valve
Exhaust system	Type	Water cooled, water injected with regulator
	Water injection fitting (head)	3.5 mm (.139 in)
	Water injection fitting (cone)	Not applicable
	Water injection fitting (muffler)	3.5 mm (.139 in)
Exhaust valve		Rotax Adjustable Variable Exhaust (RAVE)
Starting system		Electric start
Lubrication	Fuel/oil mixture	VROI (Variable Rate Oil Injection)
	Oil injection pump	Direct driven
	Oil injection type	BOMBARDIER Formula XP-S (synthetic)
Number of cylinders		2
Bore	Standard	88 mm (3.465 in)
	First oversize	88.25 mm (3.474 in)
	Second oversize	Not applicable
Stroke		78.20 mm (3.079 in)
Displacement		951.2 cm ³ (58 in ³)
Corrected compression ratio		6.1: 1
Cylinder head volume		51.8 ± 0.6 cc
Cylinder head warpage (maximum)		0.10 mm (.0039 in) total
Piston ring type and quantity		2 semi-trapez
Ring end gap	New	0.45 - 0.60 mm (.018 - .024 in)
	Wear limit	1.00 mm (.039 in)
Ring piston groove	New	0.048 - 0.075 mm (.002 - .003 in)
	Wear limit	0.2 mm (.008 in)
Piston/cylinder wall clearance	New (minimum)	0.09 mm (.0035 in)
	Wear limit	0.20 mm (.008 in)
Cylinder taper (maximum)		0.10 mm (.004 in)
Cylinder out of round (maximum)		0.08 mm (.003 in)
Connecting rod big end axial play	New	0.390 - 0.737 mm (.015 - .029 in)
	Wear limit	1.2 mm (.047 in)
Crankshaft deflection		MAG: 0.050 mm (.002 in); PTO: 0.030 mm (.001 in)
Rotary valve timing	Opening	Not applicable
	Closing	Not applicable
Rotary valve duration		Not applicable
Rotary valve/cover clearance		Not applicable
Connecting rod/crankshaft pin radial clearance	New	0.017 - 0.034 mm (.0006 - .0013 in)
	Wear limit	0.050 mm (.002 in)
Connecting rod/piston pin radial clearance	New	0.003 - 0.012 mm (.00012 - .00047 in)
	Wear limit	0.015 mm (.00059 in)
ADDITIONAL INFORMATION:		

Section 13 TECHNICAL DATA

Subsection 02 (XP MODEL)

ELECTRICAL		XP (5651/5655)
Magneto generator output		180 W @ 6000 RPM
Ignition system type		Digital DC-CDI
Spark plug	Make and type	NGK BR8ES
	Gap	0.5 - 0.6 mm (.020 - .024 in)
Ignition timing (BTDC)	mm (in)	2.99 (.118)
	Degrees	20° ± 1 @ 3500 RPM
Battery charging coil		0.1 - 1 Ω
Trigger coil		190 - 300 Ω
Ignition coil	Primary	0.33 - 0.62 Ω
	Secondary	8.4 - 15.6 k Ω
Engine rev limiter setting		7200 ± 50 RPM
Battery		12 V, 19 A•h (Yuasa/Exide)
Fuses	MPEM	5 A
	Electrical system	2 x 15 A
	VTS system	7.5 A
	Bilge pump	3 A
ADDITIONAL INFORMATION:		

CARBURETION		XP (5651/5655)
Carburetor	Type	Mikuni BN-46i (diaphragm), fuel accelerator pump
	Quantity	2
Main jet		MAG and PTO: 162.5
Pilot jet		75
Spring		95 g
Adjustment	Low-speed screw	1-1/2 turn ± 1/4
	High-speed screw	0
	Idle speed (in water)	1400 ± 100 RPM
	Idle speed (out of water)	3000 RPM
Fuel	Type	Regular unleaded gasoline
	Minimum octane no.	87
Fuel return line orifice		MAG and PTO: 0.8 mm (.031 in)
ADDITIONAL INFORMATION:		

COOLING		XP (5651/5655)
Type		Open circuit — Direct flow from jet propulsion unit
Thermostat		None
Monitoring beeper setting		86 - 94°C (187 - 201°F)
ADDITIONAL INFORMATION:		

Section 13 TECHNICAL DATA

Subsection 02 (XP MODEL)

PROPULSION		XP (5651/5655)
Propulsion system		BOMBARDIER Formula Pump
Jet pump type		Axial flow single stage
Impeller rotation (seen from rear)		Counterclockwise
Transmission		Direct drive
Coupling type		Split FR and RR
Oil type		SEA-DOO JET PUMP SYNTHETIC POLYOLESTER OIL 75W90 GL5
Steering nozzle pivoting angle		20°
Minimum required water level		90 cm (35 in)
Drive shaft deflection (maximum)		0.5 mm (.020 in)
Impeller outside diameter		155.6 mm (6.126 in)
Impeller/wear ring clearance	New	0.0 - 0.4 mm (.000 - .016 in)
	Wear limit	1.00 mm (.040 in)
Impeller shaft end play (new)		0
Impeller shaft radial play		0.05 mm (.002 in)
Impeller pitch/material		Progressive pitch/stainless steel
ADDITIONAL INFORMATION: Do not mix different brands or oil types.		

DIMENSIONS		XP (5651/5655)
Number of passenger (driver incl.)		2
Overall length		272 cm (107 in)
Overall width		112 cm (44 in)
Overall height		104 cm (40.9 in)
Dry weight		255 kg (562 lb)
Load limit (passenger and 10 kg (22 lb) luggage)		159 kg (351 lb)
ADDITIONAL INFORMATION:		

CAPACITIES		XP (5651/5655)
Fuel tank (including reserve)		54 L (14 U.S. gal)
Fuel tank reserve		10 L (2.6 U.S. gal)
Oil injection reservoir		4 L (1.1 U.S. gal)
Jet pump impeller shaft reservoir	Capacity	115 mL (3.88 U.S. oz)
	Oil level height	Up to plug
ADDITIONAL INFORMATION:		

Section 13 TECHNICAL DATA

Subsection 02 (XP MODEL)

MATERIALS	XP (5651/5655)
Hull	Composite
Inlet grate	Aluminum
Impeller housing/stator/venturi/nozzle	Plastic/plastic/aluminum/aluminum
Air intake silencer	Thermoplastic
Flame arrester	Tubular wire screen
Steering padding	Elastomer thermoplastic with polystyrene foam
Fuel tank	Polyethylene
Oil injection reservoir	Polyethylene
Seat	Polyurethane foam
ADDITIONAL INFORMATION:	

STANDARD EQUIPMENT	XP (5651/5655)
Safety lanyard	Standard
Digitally Encoded Security System	Standard
Fuel tank reserve	Standard
Monitoring beeper	Standard
Speedometer	Standard
Fuel/oil gauge (analog)	Standard
Tachometer	Standard
Variable trim system (VTS)	Standard
Storage compartment	Standard
Rear grab handle	Standard
Tool kit	Standard
ADDITIONAL INFORMATION:	

PERFORMANCE	XP (5651/5655)	
Estimated pump output	53.1 kW (71.1 HP)	
Maximum fuel consumption at wide open throttle	55 L/h (14.5 U.S. gal/h)	
Cruising time at full throttle	Fuel tank without reserve	48 minutes
	Fuel tank reserve	11 minutes
ADDITIONAL INFORMATION:		

Section 13 TECHNICAL DATA

Subsection 02 (XP MODEL)

TIGHTENING TORQUES		XP (5651/5655)			
ENGINE	Exhaust manifold screw		40 N•m (30 lbf•ft)	(4)	
	Magneto flywheel nut		115 N•m (85 lbf•ft)	(1)	
	Flywheel (PTO side)		115 N•m (85 lbf•ft)	(1)	
	Crankcase screws	M8		27 N•m (20 lbf•ft)	(3) (4)
		M10		40 N•m (30 lbf•ft)	(3) (4)
	Crankcase/engine support nuts		25 N•m (18 lbf•ft)	(1)	
	Engine mount/hull		25 N•m (18 lbf•ft)	(1)	
	Cylinder head screws		34 N•m (25 lbf•ft)	(1) (4)	
	Cylinder head nuts		34 N•m (25 lbf•ft)	(1)	
	Tuned pipe flange screws/nut		40 N•m (30 lbf•ft)	(1)	
	Tuned pipe fixation screws		25 N•m (18 lbf•ft)	(1)	
	Magneto cover screws		9 N•m (80 lbf•in)	(5)	
	Starter mounting screws		10 N•m (89 lbf•in)	(1)	
	Spark plugs		24 N•m (17 lbf•ft)	(5)	
JET PUMP	Impeller		110 N•m (81 lbf•ft)	(1)	
	Pump/hull nuts		31 N•m (23 lbf•ft)	(1)	
	Venturi/pump housing screws		21 N•m (16 lbf•ft)	(1)	
	VTS ring screws		13 N•m (10 lbf•ft)	(1)	
	Pump housing cover screws		4 N•m (35 lbf•in)	(1)	
	Inlet grate screws		8 N•m (71 lbf•in)	(1)	
	Riding plate screws		10 N•m (89 lbf•in)	(1)	
STEERING	Cable retaining block bolts		6 N•m (53 lbf•in)		
	Steering cable/lever		3 N•m (26 lbf•in)		
	Steering stem arm bolts		6 N•m (53 lbf•in)		
	Handlebar clamp bolts		26 N•m (19 lbf•ft)		
	Steering cable ball joint bolt (nozzle)		7 N•m (62 lbf•in)		
	Steering support bolts		15 N•m (11 lbf•ft)		
	Lever pivot bolt		6 N•m (53 lbf•in)		
	Handlebar grip screw		7 N•m (62 lbf•in)		
ADDITIONAL INFORMATION: Apply where indicated; (1) Loctite 243 (blue) (2) Loctite 271 (red) (3) Loctite 518 (4) Synthetic grease (5) Anti-seize lubricant					
WARNING					
Correct torques and use of Loctite must be strictly followed.					

GTS MODEL

ENGINE		GTS (5639)
Engine type		BOMBARDIER-ROTAX 717
Induction type		Rotary valve
Exhaust system	Type	Water cooled, water injected
	Water injection fitting (head)	3.5 mm (.139 in)
	Water injection fitting (cone)	3.5 mm (.139 in)
Starting system		Electric start
Lubrication	Fuel/oil mixture	VROI (Variable Rate Oil Injection)
	Oil injection pump	Gear driven
	Oil injection type	BOMBARDIER-ROTAX (mineral)
Number of cylinders		2
Bore	Standard	82 mm (3.228 in)
	First oversize	82.25 mm (3.238 in)
	Second oversize	82.50 mm (3.248 in)
Stroke		68 mm (2.677 in)
Displacement		718.2 cm ³ (43.81 in ³)
Corrected compression ratio		6.2: 1
Cylinder head volume		42.4 ± 0.4 cc
Cylinder head warpage (maximum)		0.05 mm (.002 in)
Piston ring type and quantity		1 semi-trapez — 1 rectangular
Ring end gap	New	0.25 - 0.40 mm (.010 - .016 in)
	Wear limit	1.00 mm (.039 in)
Ring/piston groove clearance	New	0.025 - 0.070 mm (.001 - .003 in)
	Wear limit	0.2 mm (.008 in)
Piston/cylinder wall clearance	New (minimum)	0.10 mm (.0039 in)
	Wear limit	0.20 mm (.008 in)
Cylinder taper (maximum)		0.10 mm (.004 in)
Cylinder out of round (maximum)		0.080 mm (.003 in)
Connecting rod big end axial play	New	0.311 - 0.677 mm (.012 - .027 in)
	Wear limit	1.2 mm (.047 in)
Crankshaft deflection		MAG: 0.050 mm (.002 in); PTO: 0.030 mm (.001 in)
Rotary valve timing	Opening	147° ± 5 BTDC
	Closing	65.5° ± 5 ATDC
Rotary valve duration		159°
Rotary valve/cover clearance		0.25 - 0.35 mm (.010 - .014 in)
Connecting rod/crankshaft pin radial clearance	New	0.020 - 0.033 mm (.0008 - .0013 in)
	Wear limit	0.050 mm (.002 in)
Connecting rod/piston pin radial clearance	New	0.003 - 0.012 mm (.00012 - .00047 in)
	Wear limit	0.015 mm (.00059 in)
ADDITIONAL INFORMATION:		

Section 13 TECHNICAL DATA

Subsection 03 (GTS MODEL)

ELECTRICAL		GTS (5639)
Magneto generator output		160 W @ 6000 RPM
Ignition system type		Digital CDI
Spark plug	Make and type	NGK BR8ES
	Gap	0.5 - 0.6 mm (.020 - .024 in)
Ignition timing (BTDC)	mm (in)	2.59 (.102)
	Degrees	20° ± 1.5 ①
Generating coil		40 - 76 W
Battery charging coil		0.05 - 0.6 W
Ignition coil	Primary	0.34 - 0.62 W
	Secondary	9 - 15 kW
Engine rev limiter setting		7000 ± 50 RPM
Battery		12 V, 19 A•h (Yuasa/Exide)
Fuse	MPEM	5 A
	Electrical system	15 A
ADDITIONAL INFORMATION: Engine cold @ 6000 RPM.		

CARBURETION		GTS (5639)
Carburetor	Type	Mikuni BN-40i diaphragm, fuel accelerator pump
	Quantity	1
Main jet		167.5
Pilot jet		75
Spring		130 g
Adjustment	Low-speed screw	1 turn ± 1/4
	High-speed screw	0
	Idle speed (in water)	1500 RPM ± 100
	Idle speed (out of water)	3000 RPM
Fuel	Type	Regular unleaded gasoline
	Minimum octane no.	87
Fuel return line orifice		0.8 mm (.031 in)
ADDITIONAL INFORMATION:		

COOLING		GTS (5639)
Type		Open circuit — Direct flow from jet propulsion unit
Thermostat		None
Monitoring beeper setting		86 - 94°C (187 - 201°F)
ADDITIONAL INFORMATION:		

Section 13 TECHNICAL DATA
Subsection 03 (GTS MODEL)

PROPULSION		GTS (5639)
Propulsion system		BOMBARDIER Formula Pump
Jet pump type		Axial flow single stage
Impeller rotation (seen from rear)		Counterclockwise
Transmission		Direct drive
Coupling type		Crown splines
Oil type		SEA-DOO JET PUMP SYNTHETIC POLYOLESTER OIL 75W90 GL5
Steering nozzle pivoting angle		26°
Minimum required water level		90 cm (35 in)
Drive shaft deflection (maximum)		0.5 mm (.020 in)
Impeller outside diameter		139.5 mm (5.490 in)
Impeller/wear ring clearance	New	0.0 - 0.4 mm (.000 - .016 in)
	Wear limit	1.00 mm(.040 in)
Impeller shaft end play (new)		0.12 - 0.54 mm (.005 - .021 in)
Impeller shaft radial play		0.05 mm (.002 in)
Impeller pitch/material		Progressive pitch/stainless steel
ADDITIONAL INFORMATION: Do not mix different brands or oil types.		

DIMENSIONS		GTS (5639)
Number of passenger (driver included)		3
Overall length		302 cm (119.0 in)
Overall width		119 cm (46.9 in)
Overall height		95 cm (37.4 in)
Dry weight		222 kg (489 lb)
Load limit (passenger and 10 kg (22 lb) luggage)		225 kg (496 lb)
ADDITIONAL INFORMATION:		

CAPACITIES		GTS (5639)
Fuel tank (including reserve)		47 L (12 U.S. gal)
Fuel tank reserve		11.4 L (3 U.S. gal)
Oil injection reservoir		4.5 L (1.2 U.S. gal)
Jet pump impeller shaft reservoir	Capacity	80 mL (2.7 U.S. oz)
	Oil level height	Up to plug
ADDITIONAL INFORMATION:		

Section 13 TECHNICAL DATA

Subsection 03 (GTS MODEL)

MATERIALS	GTS (5639)
Hull	Composite
Inlet grate	Plastic
Impeller housing/stator/venturi/nozzle	Plastic/plastic/plastic/plastic
Air intake silencer	Thermoplastic
Flame arrester	Multi-layer wire screen
Steering padding	Elastomer thermoplastic with polystyrene foam
Fuel tank	Polyethylene
Oil injection reservoir	Polyethylene
Seat	Polyurethane foam
ADDITIONAL INFORMATION:	

STANDARD EQUIPMENT	GTS (5639)
Safety lanyard	Standard
Digitally Encoded Security System	Standard
Fuel tank reserve	Standard
Monitoring beeper	Standard
Fuel gauge/low oil warning light	Standard
Tachometer	Not applicable
Speedometer	Not applicable
Variable trim system (VTS)	Not applicable
Storage compartment	Standard
Rear grab handle	Standard
Tool kit	Standard
ADDITIONAL INFORMATION:	

PERFORMANCE	GTS (5639)	
Estimated pump power	24.5 kW (32 HP)	
Maximum fuel consumption at wide open throttle	33.5 L/h (8.8 U.S. gal/h)	
Cruising time at full throttle	Fuel tank without reserve	1 hour
	Fuel tank reserve	20 minutes
ADDITIONAL INFORMATION:		

Section 13 TECHNICAL DATA

Subsection 03 (GTS MODEL)

TIGHTENING TORQUES		GTS (5639)			
ENGINE	Exhaust manifold screws	24 N•m	(17 lbf•ft)	(4)	
	Magneto flywheel nut	145 N•m	(107 lbf•ft)	(1)	
	Flywheel (PTO side)	110 N•m	(81 lbf•ft)	(5)	
	Crankcase screws	M8	24 N•m	(17 lbf•ft)	(3) (4)
		M10	40 N•m	(30 lbf•ft)	(3) (4)
	Crankcase/engine support nuts	35 N•m	(26 lbf•ft)	(1)	
	Engine mount/hull	25 N•m	(18 lbf•ft)	(1)	
	Cylinder head screws	24 N•m	(17 lbf•ft)	(1) (4)	
	Crankcase/cylinder screws	24 N•m	(17 lbf•ft)	(1) (4)	
	Tuned pipe flange screws/nut	25 N•m	(18 lbf•ft)	(1)	
	Tuned pipe fixation screws	25 N•m	(18 lbf•ft)	(1)	
	Flame arrester screws	10 N•m	(89 lbf•in)	(1)	
	Magneto housing cover screws	9 N•m	(80 lbf•in)	(5)	
	Starter mounting screws	22 N•m	(16 lbf•ft)	(1)	
Spark plugs	24 N•m	(17 lbf•ft)	(5)		
JET PUMP	Impeller	110 N•m	(81 lbf•ft)	(1)	
	Pump/hull nuts	31 N•m	(23 lbf•ft)	(1)	
	Venturi/pump housing screws	21 N•m	(16 lbf•ft)	(1)	
	Nozzle/venturi screws	20 N•m	(15 lbf•ft)	(1)	
	Pump housing cover screws	4 N•m	(35 lbf•in)	(1)	
	Inlet grate screws	8 N•m	(71 lbf•in)	(1)	
	Riding plate screws	10 N•m	(89 lbf•in)	(1)	
STEERING	Steering cable jam nuts	10 N•m	(89 lbf•in)		
	Steering support/collar screws	15 N•m	(11 lbf•ft)	(1)	
	Steering stem screw	40 N•m	(30 lbf•ft)	(2)	
	Handlebar nuts	26 N•m	(19 lbf•ft)		
	Reverse gate screws	20 N•m	(15 lbf•ft)	(1)	
	Steering cable ball joint (nozzle)	2 N•m	(18 lbf•in)		
	Reverse cable ball joint nut	7 N•m	(62 lbf•in)		
Handlebar grip screw	7 N•m	(62 lbf•in)			
<p>ADDITIONAL INFORMATION: Apply where indicated; (1) Loctite 243 (blue) (2) Loctite 271 (red) (3) Loctite 518 (4) Synthetic grease (5) Anti-seize lubricant</p>					
<div style="background-color: black; color: white; padding: 5px; display: inline-block;"> WARNING </div>					
<div style="border: 1px solid black; padding: 5px; display: inline-block;"> <p>Correct torques and use of Loctite must be strictly followed.</p> </div>					

Section 13 TECHNICAL DATA
Subsection 04 (GTI AND GTX MODELS)

GTI AND GTX MODELS

ENGINE		GTI (5647/5657)	GTX (5653/5669)
Engine type		BOMBARDIER-ROTAX 717	BOMBARDIER-ROTAX 947
Induction type		Rotary valve	Reed valve
Exhaust system	Type	Water cooled, water injected	Water cooled, water injected with regulator
	Water injection fitting (head)	3.5 mm (.139 in)	
	Water injection fitting (cone)	3.5 mm (.139 in)	Not applicable
	Water injection fitting (muffler)	Not applicable	3.5 mm (.139 in)
Exhaust valve		Not applicable	RAVE
Starting system		Electric start	
Lubrication	Fuel/oil mixture	VROI (Variable Rate Oil Injection)	
	Oil injection pump	Gear driven	Direct driven
	Oil injection type	BOMBARDIER-ROTAX	BOMBARDIER Formula XP-S (synthetic)
Number of cylinders		2	
Bore	Standard	82 mm (3.228 in)	88 mm (3.465 in)
	First oversize	82.25 mm (3.238 in)	88.25 mm (3.474 in)
	Second oversize	82.50 mm (3.248 in)	Not applicable
Stroke		68 mm (2.677 in)	78.20 mm (3.079 in)
Displacement		718.2 cm ³ (43.81 in ³)	951.2 cm ³ (58 in ³)
Corrected compression ratio		6.2: 1	6.1: 1
Cylinder head volume		42.4 ± 0.4 cc	51.8 ± 0.6 cc
Cylinder head warpage (maximum)		0.05 mm (.002 in)	0.10 mm (.004 in) total
Piston ring type and quantity		1 semi-trapez 1 rectangular	2 semi-trapez
Ring end gap	New	0.25 - 0.40 mm (.010 - .016 in)	0.45 - 0.60 mm (.018 - .024 in)
	Wear limit	1.00 mm (.039 in)	
Ring/piston groove clearance	New	0.025 - 0.070 mm (.001 - .003 in)	0.048 - 0.075 mm (.002 - .003 in)
	Wear limit	0.2 mm (.008 in)	
Piston/cylinder wall clearance	New (minimum)	0.10 mm (.0039 in)	0.09 mm (.0035 in)
	Wear limit	0.20 mm (.008 in)	
Cylinder taper (maximum)		0.10 mm (.004 in)	
Cylinder out of round (maximum)		0.08 mm (.003 in)	
Connecting rod big end axial play	New	0.311 - 0.677 mm (.012 - .027 in)	0.390 - 0.737 mm (.015 - .029 in)
	Wear limit	1.2 mm (.047 in)	
Crankshaft deflection		MAG: 0.050 mm (.002 in); PTO: 0.030 mm (.001 in)	
Rotary valve timing	Opening	147° ± 5 BTDC	Not applicable
	Closing	65.5° ± 5 ATDC	Not applicable
Rotary valve duration		159°	Not applicable
Rotary valve/cover clearance		0.25 - 0.35 mm (.010 - .014 in)	Not applicable
Connecting rod/crankshaft pin radial clearance	New	0.020 - 0.033 mm (.0008 - .0013 in)	0.017 - 0.034 mm (.0006 - .0013 in)
	Wear limit	0.050 mm (.002 in)	
Connecting rod/piston pin radial clearance	New	0.003 - 0.012 mm (.00012 - .00047 in)	
	Wear limit	0.015 mm (.00059 in)	
ADDITIONAL INFORMATION:			

Section 13 TECHNICAL DATA

Subsection 04 (GTI AND GTX MODELS)

ELECTRICAL		GTI (5647/5657)	GTX (5653/5669)
Magneto generator output		160 W @ 6000 RPM	180 W @ 6000 RPM
Ignition system type		Digital CDI	Digital DC-CDI
Spark plug	Make and type	NGK BR8ES	
	Gap	0.5 - 0.6 mm (.020 - .024 in)	
Ignition timing (BTDC)	mm (in)	2.59 (.102)	2.99 (.118)
	Degrees	20° ± 1.5 ①	20° ± 1 @ 3500 RPM
Generating coil		40 - 76 Ω	Not applicable
Battery charging coil		0.05 - 0.6 Ω	0.1 - 1 Ω
Trigger coil		Not applicable	190 - 300 Ω
Ignition coil	Primary	0.34 - 0.62 Ω	0.33 - 0.62 Ω
	Secondary	9 - 15 kΩ	8.4 - 15.6 kΩ
Engine rev limiter setting		7100 (± 50) RPM	7200 (± 50) RPM
Battery		12 V, 19 A•h (Yuasa/Exide)	
Fuses	MPEM	5 A	
	Electrical system	2 x 15 A	
	VTS system	Not applicable	
ADDITIONAL INFORMATION: ① Engine cold @ 6000 RPM.			

CARBURETION		GTI (5647/5657)	GTX (5653/5669)
Carburetor	Type	Mikuni BN-40i diaphragm, fuel accelerator pump	Mikuni BN-46i diaphragm, fuel accelerator pump
	Quantity	1	2
Main jet		167.5	MAG and PTO: 162.5
Pilot jet		75	
Spring		115 g	95 g
Adjustment	Low-speed screw	1 turn ± 1/4	1-1/2 turn ± 1/4
	High-speed screw	0	
	Idle speed (in water)	1500 ± 100 RPM	1400 ± 100 RPM
	Idle speed (out of water)	3000 RPM	
Fuel	Type	Regular unleaded gasoline	
	Minimum octane no.	87	
Fuel return line orifice		0.8 mm (.031 in)	MAG and PTO: 0.8 mm (.031 in)
ADDITIONAL INFORMATION:			

COOLING		GTI (5647/5657)	GTX (5653/5669)
Type		Open circuit — Direct flow from jet propulsion unit	
Thermostat		None	
Monitoring beeper setting		86 - 94°C (187 - 201°F)	
ADDITIONAL INFORMATION:			

Section 13 TECHNICAL DATA
Subsection 04 (GTI AND GTX MODELS)

PROPULSION		GTI (5647/5657)	GTX (5653/5669)
Propulsion system		BOMBARDIER Formula Pump	
Jet pump type		Axial flow single stage	
Impeller rotation (seen from rear)		Counterclockwise	
Transmission		Direct drive	
Coupling type		Crown splines	
Oil type		SEA-DOO JET PUMP SYNTHETIC POLYOLESTER OIL 75W90 GL5	
Steering nozzle pivoting angle		20°	
Minimum required water level		90 cm (35 in)	
Drive shaft deflection (maximum)		0.5 mm (.020 in)	
Impeller outside diameter		139.5 mm (5.490 in)	155.6 mm (6.126 in)
Impeller/wear ring clearance	New	0.0 - 0.4 mm (.000 - .016 in)	
	Wear limit	1.0 mm (.040 in)	
Impeller shaft end play (new)		0	
Impeller shaft side play		0.05 mm (.002 in)	
Impeller pitch/material		Progressive pitch/stainless steel	
ADDITIONAL INFORMATION: Do not mix different brands or oil types.			

DIMENSIONS		GTI (5647/5657)	GTX (5653/5669)
Number of passenger (driver incl.)		3	
Overall length		315 cm (124 in)	
Overall width		122 cm (48 in)	
Overall height		104 cm (41 in)	
Dry weight		275 kg (606 lb)	301 kg (664 lb)
Load limit (passenger and 10 kg (22 lb) luggage)		243 kg (536 lb)	
ADDITIONAL INFORMATION:			

CAPACITIES		GTI (5647/5657)	GTX (5653/5669)
Fuel tank (including reserve)		56.5 L (15 U.S. gal)	
Fuel tank reserve		11.4 L (3.0 U.S. gal)	
Oil injection reservoir		6 L (1.6 U.S. gal)	
Jet pump impeller shaft reservoir	Capacity	95 mL (3.2 U.S. oz)	115 mL (3.88 U.S. oz)
	Oil level height	Up to plug	
ADDITIONAL INFORMATION:			

Section 13 TECHNICAL DATA

Subsection 04 (GTI AND GTX MODELS)

MATERIALS	GTI (5647/5657)	GTX (5653/5669)
Hull	Composite	
Inlet grate	Aluminum	
Impeller housing/stator/venturi/nozzle	Plastic/plastic/plastic/ aluminum	Plastic/plastic/aluminum/ aluminum
Air intake silencer	Thermoplastic	
Flame arrester	Multi-layer wire screen	Tubular wire screen
Steering padding	Thermoplastic	
Fuel tank	Polyethylene	
Oil injection reservoir	Polyethylene	
Seat	Polyurethane foam	
ADDITIONAL INFORMATION:		

STANDARD EQUIPMENT	GTI (5647/5657)	GTX (5653/5669)
Safety lanyard	Standard	
Digitally Encoded Security System	Standard	
Fuel tank reserve	Standard	
Monitoring beeper	Standard	
Speedometer	Standard	
Fuel/oil gauge (analog)	Standard	Not applicable
Tachometer	Not applicable	Not applicable
Info Center	Not applicable	Standard
Storage compartment	Standard	
Glove box	Standard	
Rear grab handle	Standard	
Tool kit	Standard	
ADDITIONAL INFORMATION: Info Center standard functions: Fuel level/low fuel level/low oil level/low voltage/ high temperature/tachometer/speedometer/average speed/peak speed/trip meter/hour meter/clock/compass/ exterior temperature/lake temperature/chronometer/maintenance information.		

PERFORMANCE	GTI (5647/5657)	GTX (5653/5669)
Estimated pump power	25.2 kW (33.8 HP)	51 kW (68.4 HP)
Maximum fuel consumption at wide open throttle	33.5 L/h (8.8 U.S. gal/h)	55 L/h (14.5 U.S. gal/h)
Cruising time at full throttle	Fuel tank without reserve	49 minutes
	Fuel tank reserve	13 minutes
ADDITIONAL INFORMATION:		

Section 13 TECHNICAL DATA
Subsection 04 (GTI AND GTX MODELS)

TIGHTENING TORQUES		GTI (5647/5657)	GTX (5653/5669)	
ENGINE	Exhaust manifold screw	24 N•m (17 lbf•ft) (4)	40 N•m (30 lbf•ft) (4)	
	Magneto flywheel nut	145 N•m (107 lbf•ft) (1)	115 N•m (85 lbf•ft) (1)	
	Flywheel (PTO side)	110 N•m (81 lbf•ft) (5)	115 N•m (85 lbf•ft) (1)	
	Crankcase screws	M8	24 N•m (17 lbf•ft) (3) (4)	27 N•m (20 lbf•ft) (3) (4)
		M10	40 N•m (30 lbf•ft) (3) (4)	
	Crankcase/engine support nuts	35 N•m (26 lbf•ft) (1)	25 N•m (18 lbf•ft) (1)	
	Engine mount/hull	25 N•m (18 lbf•ft) (1)		
	Cylinder head screws	24 N•m (17 lbf•ft) (1) (4)	34 N•m (25 lbf•ft) (1) (4)	
	Cylinder head nuts	Not applicable	34 N•m (25 lbf•ft) (1)	
	Crankcase/cylinder screws	24 N•m (17 lbf•ft) (1) (4)	Not applicable	
	Tuned pipe flange screws/nut	25 N•m (18 lbf•ft) (1)	40 N•m (30 lbf•ft) (1)	
	Tuned pipe fixation screws	25 N•m (18 lbf•ft) (1)		
	Flame arrester screws	10 N•m (89 lbf•in) (1)	Not applicable	
	Magneto housing cover screws	9 N•m (80 lbf•in) (5)		
	Starter mounting screws	22 N•m (16 lbf•ft) (1)	10 N•m (89 lbf•in) (1)	
	Spark plugs	24 N•m (17 lbf•ft) (5)		
JET PUMP	Impeller	110 N•m (81 lbf•ft) (1)		
	Pump/hull nuts	31 N•m (23 lbf•ft) (1)		
	Venturi/pump housing screws	21 N•m (16 lbf•ft) (1)		
	Pump housing cover screws	4 N•m (35 lbf•in) (1)		
	Inlet grate screws	8 N•m (71 lbf•in) (1)		
	Riding plate screws	22 N•m (16 lbf•ft) (1)		
STEERING	Cable retaining block bolts	6 N•m (53 lbf•in)		
	Steering cable/stem arm bolt	3 N•m (26 lbf•in)		
	Steering stem arm bolts	6 N•m (53 lbf•in)		
	Handlebar clamp bolts	26 N•m (19 lbf•ft)		
	Steering cable ball joint (nozzle)	2 N•m (18 lbf•in)	7 N•m (62 lbf•in)	
	Steering support bolts	15 N•m (11 lbf•ft) (1)		
	Handlebar grip screw	7 N•m (62 lbf•in)		

ADDITIONAL INFORMATION: Apply where indicated; (1) Loctite 243 (blue)
(2) Loctite 271 (red)
(3) Loctite 518
(4) Synthetic grease
(5) Anti-seize lubricant

 WARNING

Correct torques and use of Loctite must be strictly followed.

GTX RFI AND GSX RFI MODELS

ENGINE		GTX RFI (5515/5516/5648/5658)	GSX RFI (5645/5654)
Engine type		BOMBARDIER-ROTAX 787	
Induction type		Rotary valve	
Exhaust system	Type	Water cooled, water injected with regulator	
	Water injection fitting (head)	3.5 mm (.139 in)	
	Water injection fitting (cone)	Not applicable	
	Water injection fitting (muffler)	3.5 mm (.139 in)	
Exhaust valve		Rotax Adjustable Variable Exhaust (RAVE)	
Starting system		Electric start	
Lubrication	Fuel/oil mixture	VROI (Variable Rate Oil Injection)	
	Oil injection pump	Direct driven	
	Oil injection type	BOMBARDIER Formula XP-S (synthetic)	
Number of cylinders		2	
Bore	Standard	82 mm (3.228 in)	
	First oversize	82.25 mm (3.238 in)	
	Second oversize	Not applicable	
Stroke		74 mm (2.91 in)	
Displacement		781.6 cm ³ (47.7 in ³)	
Corrected compression ratio		6.0: 1	
Cylinder head volume		47.7 ± 0.4 cc	
Cylinder head warpage (maximum)		0.05 mm (.002 in)	
Piston ring type and quantity		1 semi-trapez — 1 rectangular	
Ring end gap	New	0.40 - 0.55 mm (.016 - .022 in)	
	Wear limit	1.00 mm (.039 in)	
Ring/piston groove	New	0.025 - 0.070 mm (.001 - .003 in)	
	Wear limit	0.24 mm (.009 in)	
Piston/cylinder wall clearance	New (minimum)	0.13 mm (.005 in)	
	Wear limit	0.22 mm (.009 in)	
Cylinder taper (maximum)		0.10 mm (.004 in)	
Cylinder out of round (maximum)		0.08 mm (.003 in)	
Connecting rod big end axial play	New	0.230 - 0.617 mm (.009 - .024 in)	
	Wear limit	1.2 mm (.047 in)	
Crankshaft deflection		MAG: 0.050 mm (.002 in); PTO: 0.030 mm (.001 in)	
Rotary valve timing	Opening	147° ± 5° BTDC	
	Closing	63.5° ± 5° ATDC	
Rotary valve duration		159°	
Rotary valve/cover clearance		0.25 - 0.35 mm (.010 - .014 in)	
Connecting rod/crankshaft pin radial clearance	New	0.023 - 0.034 mm (.0009 - .0013 in)	
	Wear limit	0.050 mm (.002 in)	
Connecting rod/piston pin radial clearance	New	0.003 - 0.012 mm (.00012 - .00047 in)	
	Wear limit	0.015 mm (.00059 in)	
ADDITIONAL INFORMATION:			

Section 13 TECHNICAL DATA

Subsection 05 (GTX RFI AND GSX RFI MODELS)

ELECTRICAL SYSTEM		GTX RFI (5515/5516/5648/5658)	GSX RFI (5645/5654)
Magneto generator output		270 W @ 6000 RPM	
Ignition system type		Digital, inductive type	
Spark plug	Make and type	NGK BR8ES	
	Gap	0.5 - 0.6 mm (.020 - .024 in)	
Ignition timing (BTDC)	mm (in)	1.02 (.040)	
	Degrees	12° @ 6000 RPM	
Battery charging coil		0.1 Ω - 1 Ω	
Ignition coil	Primary	0.3 Ω \pm 0.6 Ω	
	Secondary	Not applicable	
Engine rev limiter setting		7200 \pm 50 RPM	
Battery		12 V, 19 A•h (Yuasa/Exide)	
Fuses	MPEM	5 A	
	Electrical system	1 x 15 A, 2 x 20 A	
	VTS	Not applicable	7.5 A
	Info center	1 A	
	Fuel pump	10 A	
ADDITIONAL INFORMATION:			

FUEL SYSTEM		GTX RFI (5515/5516/5648/5658)	GSX RFI (5645/5654)
Fuel injection type		Rotax Fuel Injection, semi-direct, single throttle body (56 mm)	
Idle speed (in water)		1500 \pm 100 RPM	
Throttle Position Sensor (TPS)		1.6 k Ω - 2.4 k Ω (terminals 1-2) 710 Ω - 1380 Ω (terminals 2-3)	
Crankshaft Position Sensor (CPS)		774 Ω - 946 Ω	
Air Temperature Sensor (ATS)		2.280 k Ω - 2.74 k Ω	
Water Temperature Sensor (WTS)		2.280 k Ω - 2.74 k Ω	
Air Pressure Sensor (APS)		3.4 k Ω and 8.2 k Ω (terminals 9-2) 2.4 k Ω and 8.2 k Ω (terminals 1-2)	
RAVE solenoid		30 Ω	
Fuel injector		2.3 Ω - 2.5 Ω	
Fuel	Type	Regular unleaded gasoline	
	Minimum octane no.	87	
ADDITIONAL INFORMATION:			

COOLING		GTX RFI (5515/5516/5648/5658)	GSX RFI (5645/5654)
Type		Open circuit — Direct flow from jet propulsion unit	
Thermostat		None	
Monitoring beeper setting		86 - 94°C (187 - 201°F)	
ADDITIONAL INFORMATION:			

Section 13 TECHNICAL DATA
Subsection 05 (GTX RFI AND GSX RFI MODELS)

PROPULSION		GTX RFI (5515/5516/5648/5658)	GSX RFI (5645/5654)
Propulsion system		BOMBARDIER Formula Pump	
Jet pump type		Axial flow single stage	
Impeller rotation (seen from rear)		Counterclockwise	
Transmission		Direct drive	
Coupling type		Crown splines	
Oil type		SEA-DOO JET PUMP SYNTHETIC POLYOLESTER OIL 75W90 GL5	
Steering nozzle pivoting angle		20°	
Minimum required water level		90 cm (35 in)	
Drive shaft deflection (maximum)		0.5 mm (.020 in)	
Impeller outside diameter		139.5 mm (5.490 in)	
Impeller/wear ring clearance	New	0.0 - 0.4 mm (.000 - .016 in)	
	Wear limit	1.00 mm (.040 in)	
Impeller shaft end play (new)		0	
Impeller shaft radial play		0.05 mm (.002 in)	
Impeller pitch/material		Progressive pitch/stainless steel	
ADDITIONAL INFORMATION: Do not mix different brands or oil types.			

DIMENSIONS		GTX RFI (5515/5516/5648/5658)	GSX RFI (5645/5654)
Number of passenger (driver incl.)		3	2
Overall length		315 cm (124 in)	270cm (106.3 in)
Overall width		122 cm (48 in)	116 cm (45.7 in)
Overall height		107 cm (42 in)	99 cm (39 in)
Dry weight		292 kg (643.7 lb)	234 kg (518.9 lb)
Load limit (passenger and 10 kg (22 lb) luggage)		243 kg (535.7 lb)	159kg (351 lb)
ADDITIONAL INFORMATION:			

CAPACITIES		GTX RFI (5515/5516/5648/5658)	GSX RFI (5645/5654)
Fuel tank		56.5 L (15 U.S. gal)	
Oil injection reservoir		6 L (1.6 U.S. gal)	
Jet pump impeller shaft reservoir	Capacity	95 mL (3.21 U.S. oz)	
	Oil level height	Up to plug	
ADDITIONAL INFORMATION:			

Section 13 TECHNICAL DATA

Subsection 05 (GTX RFI AND GSX RFI MODELS)

MATERIALS	GTX RFI (5515/5516/5648/5658)	GSX RFI (5645/5654)
Hull	Composite	
Inlet grate	Aluminum	
Impeller housing/stator/venturi/nozzle	Plastic/plastic/plastic/aluminum	
Air intake silencer	Thermoplastic	
Flame arrester	Multi-layer wire screen	
Steering padding	Thermoplastic	
Fuel tank	Polyethylene	
Oil injection reservoir	Polyethylene	
Seat	Polyurethane foam	
ADDITIONAL INFORMATION:		

STANDARD EQUIPMENT	GTX RFI (5515/5516/5648/5658)	GSX RFI (5645/5654)
Safety lanyard	Standard	
Digitally Encoded Security System	Standard	
Fuel tank reserve	Standard	
Monitoring beeper	Standard	
Speedometer	Standard	Not applicable
Tachometer	Not applicable	
Info Center	Standard	
Adjustable handlebar	Standard	Not applicable
Storage compartment	Standard	
Glove box	Standard	
Rear grab handle	Standard	
Boarding ladder	Standard	Not applicable
Tool kit	Standard	
ADDITIONAL INFORMATION:		

PERFORMANCE	GTX RFI (5515/5516/5648/5658)	GSX RFI (5645/5654)
Estimated pump output	30.6 kW (41 HP)	33.5 kW (44.9 HP)
Maximum fuel consumption at wide open throttle	41.5 L/h (11 U.S. gal/h)	
Cruising time at full throttle	1 hour 20 minutes	
ADDITIONAL INFORMATION:		

Section 13 TECHNICAL DATA
Subsection 05 (GTX RFI AND GSX RFI MODELS)

TIGHTENING TORQUES		GTX RFI (5515/5516/5648/5658)	GSX RFI (5645/5654)	
ENGINE	Exhaust manifold screw	40 N•m	(30 lbf•ft) (3) (4)	
	Magneto flywheel nut	105 N•m	(77 lbf•ft) (1)	
	Flywheel (PTO side)	110 N•m	(81 lbf•ft) (5)	
	Crankcase screws	M8	24 N•m	(17 lbf•ft) (3) (4)
		M10	40 N•m	(30 lbf•ft) (3) (4)
	Crankcase/engine support nuts	35 N•m	(26 lbf•ft) (1)	
	Engine mount/hull	25 N•m	(18 lbf•ft) (1)	
	Cylinder head screws	24 N•m	(17 lbf•ft) (1) (4)	
	Crankcase/cylinder screws	40 N•m	(30 lbf•ft) (3) (4)	
	Tuned pipe flange screws/nut	40 N•m	(30 lbf•ft) (1)	
	Tuned pipe fixation screws	25 N•m	(18 lbf•ft) (1)	
	Flame arrester screws	10 N•m	(89 lbf•in) (1)	
	Magneto housing cover screws	9 N•m	(80 lbf•in) (5)	
	Starter mounting screws	22 N•m	(16 lbf•ft) (1)	
Spark plugs	24 N•m	(17 lbf•ft) (5)		
JET PUMP	Impeller	110 N•m	(81 lbf•ft) (1)	
	Pump/hull nuts	31 N•m	(23 lbf•ft) (1)	
	Venturi/pump housing screws	21 N•m	(16 lbf•ft) (1)	
	Pump housing cover screws	4 N•m	(35 lbf•in) (1)	
	Inlet grate screws	8 N•m	(71 lbf•in) (1)	
	Riding plate screws	22 N•m	(16 lbf•ft) (1)	
STEERING	Cable retaining block bolts	6 N•m	(53 lbf•in)	
	Steering cable/stem arm bolt	3 N•m	(26 lbf•in)	
	Steering stem arm bolts	6 N•m	(53 lbf•in)	
	Handlebar clamp bolts	26 N•m	(19 lbf•ft)	
	Steering cable ball joint bolt (nozzle)	7 N•m	(62 lbf•in)	
	Steering support bolts	15 N•m	(11 lbf•ft) (1)	
	Handlebar grip screw	7 N•m	(62 lbf•in)	
ADDITIONAL INFORMATION: Apply where indicated; (1) Loctite 243 (blue) (2) Loctite 271 (red) (3) Loctite 518 (4) Synthetic grease (5) Anti-seize lubricant				
⚠ WARNING				
Correct torques and use of Loctite must be strictly followed.				

WIRING DIAGRAMS

WIRE COLOR CODES

First color of a wire is the main color. Second color is the tracer.

Example: YELLOW/BLACK (YL-BK) is a YELLOW wire with a BLACK tracer.

COLOR CODE	
WH — WHITE	BK — BLACK
RE — RED	YL — YELLOW
PU — PURPLE	TA — TAN
GR — GREEN	BW — BROWN
GY — GREY	BL — BLUE
PK — PINK	OR — ORANGE

WIRE DIGIT CODES

All Models Except GTS

First number indicates in which connector the wire is plugged in.

Second number indicates the position of the wire in the connector.

The letter at the end of the number (if applicable) indicates a common circuit in the MPEM printed circuit with another wire bearing the same letter.

Example: 2-18 (g)

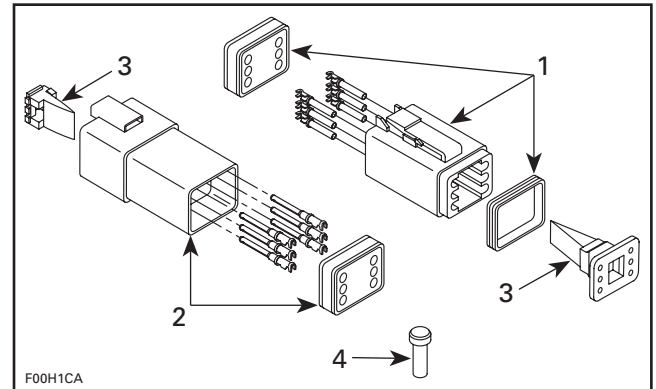
The first number indicates that the wire is positioned in the connector **no. 2** of the MPEM.

The second number indicates that the wire is positioned in the terminal **no. 18**.

The letter (g) indicates a common circuit with another wire(s) bearing the same letter (g) in the circuit.

DEUTSCH CONNECTORS

Deutsch connectors are used to connect wiring harness to magneto and to electrical box (some models).

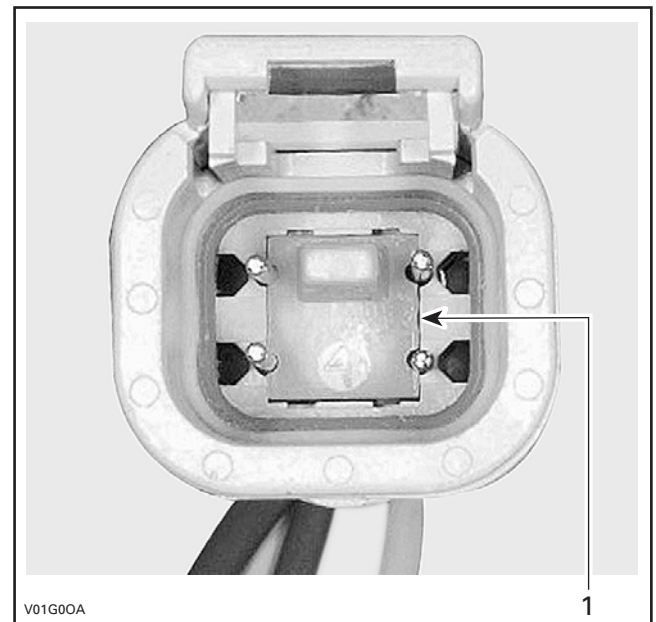


1. Male housing
2. Female housing
3. Secondary lock
4. Sealing cap

CAUTION: Do not apply dielectric grease on contacts inside plug connector.

To remove wire contacts from housing, proceed as follows:

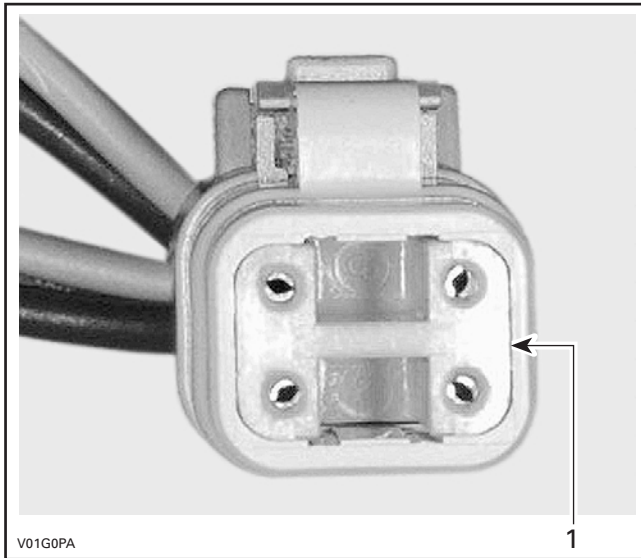
- Using a long nose pliers, pull out the lock.



- FEMALE HOUSING**
1. Female lock

Section 14 WIRING DIAGRAMS

Subsection 01 (WIRING DIAGRAMS)

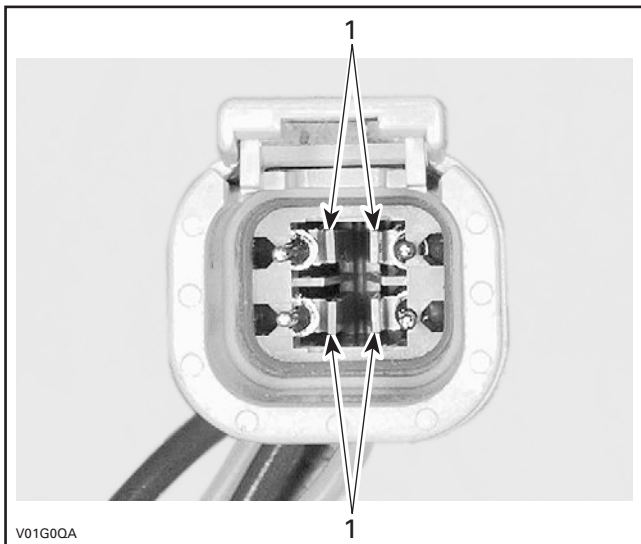


MALE HOUSING

1. Male lock

NOTE: Before extraction, push wire forward to relieve pressure on retaining tab.

- Insert a 4.8 mm (0.189 in) wide screwdriver blade inside the front of the contact cavity.
- Pry back the retaining tab while gently pulling wire back until contact is removed.



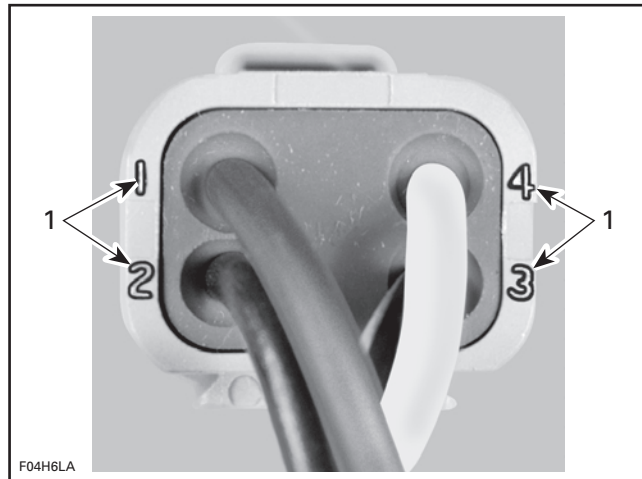
FEMALE CONNECTOR HOUSING

1. Retaining tab

To install:

- For insertion of signal contact, make sure the lock is removed.
- Insert contact into appropriate circuit cavity and push as far as it will go.

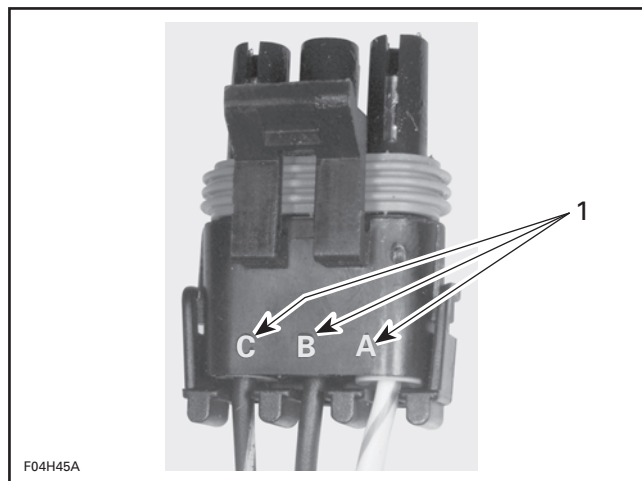
- Pull back on the contact wire to be sure the retention fingers are holding the contact.
- After all required contacts have been inserted, the lock must be installed.



1. Wire identification numbers

PACKARD CONNECTOR

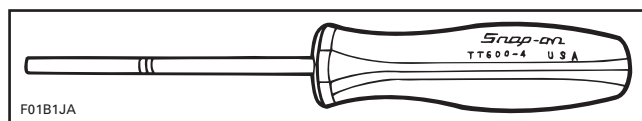
Packard connectors are used to connect electrical harnesses and gauges.



VIEW OF A 3-POSITION PACKARD CONNECTOR

1. Identification letters

To remove terminal from Packard connector housing, use Snap-on TT600-4 tool.



⚠ WARNING

Ensure all terminals are properly crimped on wires and connector housings are properly fastened.

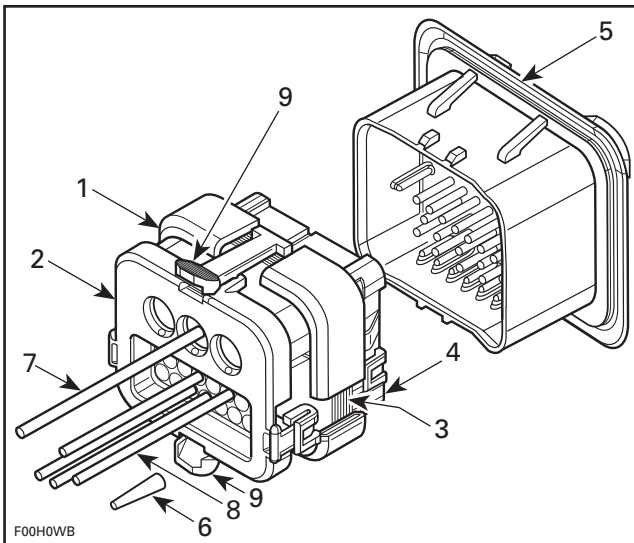
AMP PLUG CONNECTOR

All Models Except GTS

These connectors are found on the MPEM.

When servicing electrical system, special care must be taken when working with AMP Plug Connectors in order to prevent any malfunction of the system.

Description

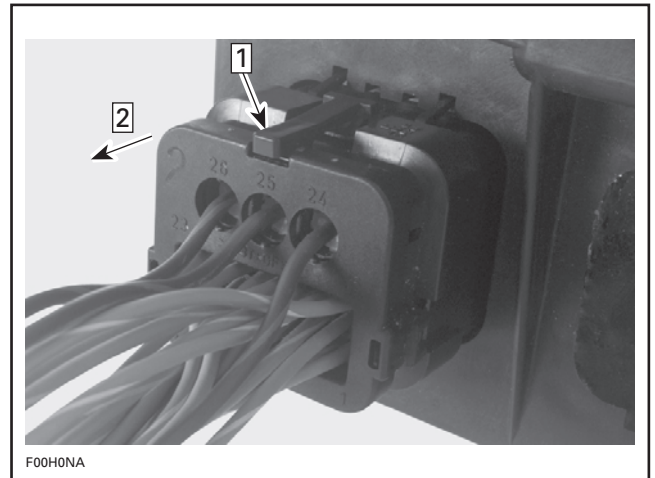


AMP PLUG CONNECTOR

1. Plug assembly
2. Cover assembly
3. Mating seal
4. Wedge lock
5. Header assembly
6. Seal plug
7. Power wire
8. Signal wire
9. Locking tab

Removal

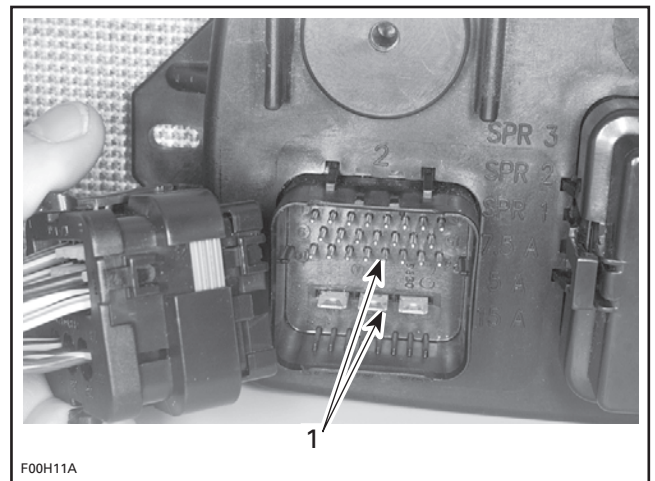
To remove the plug connector from the header assembly, press both tabs and pull plug.



- Step 1: Press tabs (both sides)
 Step 2: Pull plug

Installation

Apply a thin coat of DEOXIT contact lubricant (P/N 293 550 015) to the pins of the header on the MPEM only.



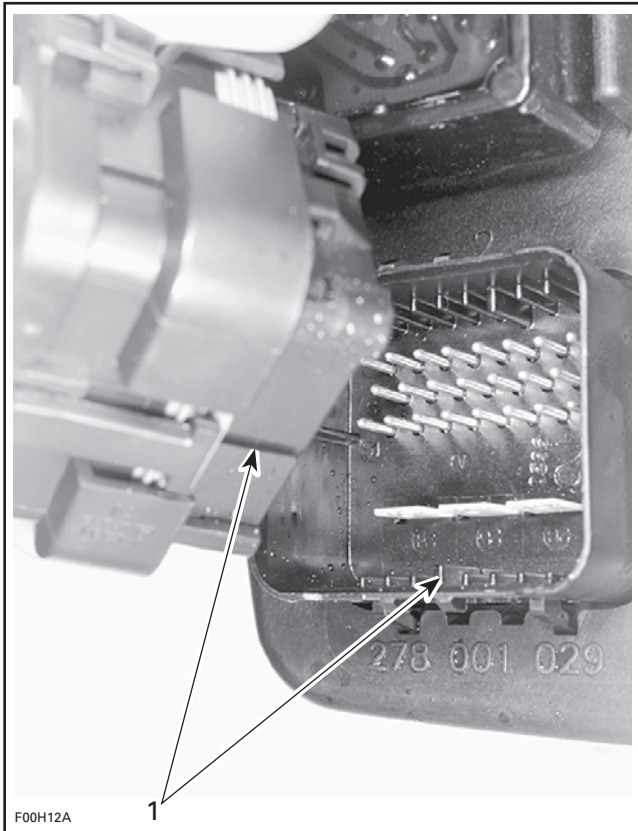
1. Apply a thin coat of DEOXIT contact lubricant

CAUTION: Do not apply lubricant excessively. Care must be taken so that the lubricant will not come in contact with the mating seal; the seal may lose its sealing capacities. Do not apply lubricant on contacts inside plug connector.

Each plug assembly is mechanically keyed to mate only with identical mechanical keyed header on the MPEM.

Section 14 WIRING DIAGRAMS

Subsection 01 (WIRING DIAGRAMS)



1. Mechanically keyed

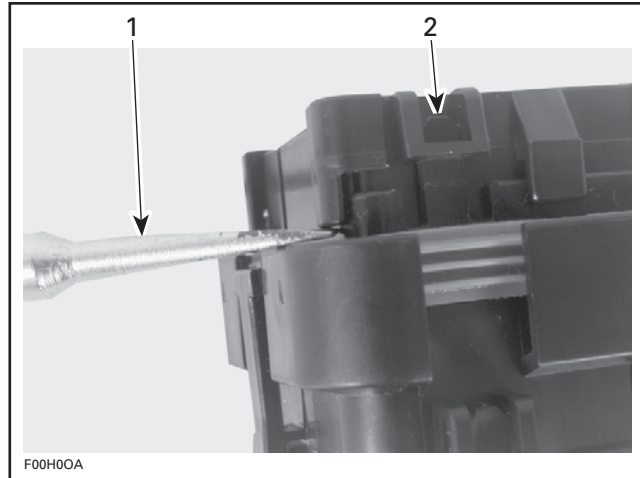
Contact Removal

SIGNAL WIRE

Insert a screwdriver blade between the connector and the wedge lock tab.

Release the locking tab and at the same time, pry open the wedge lock to open position.

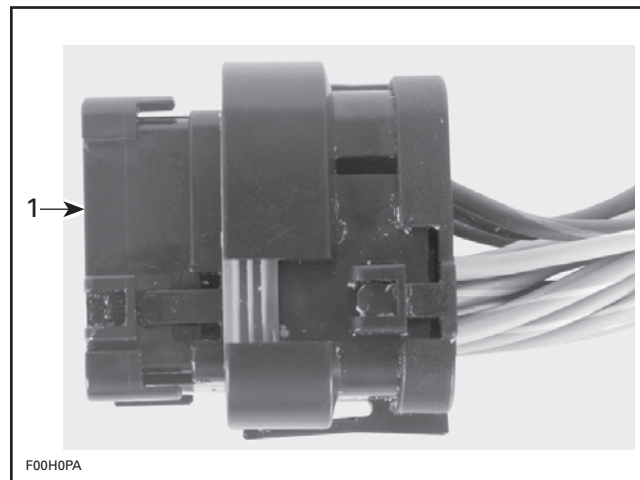
CAUTION: The wedge lock should never be removed from the connector for insertion or removal of the signal wire contacts.



1. Screwdriver between wedge lock and connector
2. Locking tab

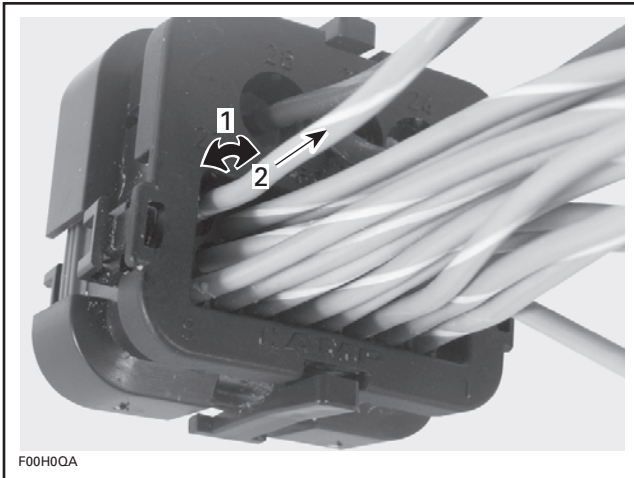
Repeat the same steps for the other locking tab retaining the wedge lock.

The wedge lock is now in the open position.



1. Wedge lock opened

While rotating the wire back and forth over a half turn (1/4 turn in each direction), gently pull the wire until the contact is removed.



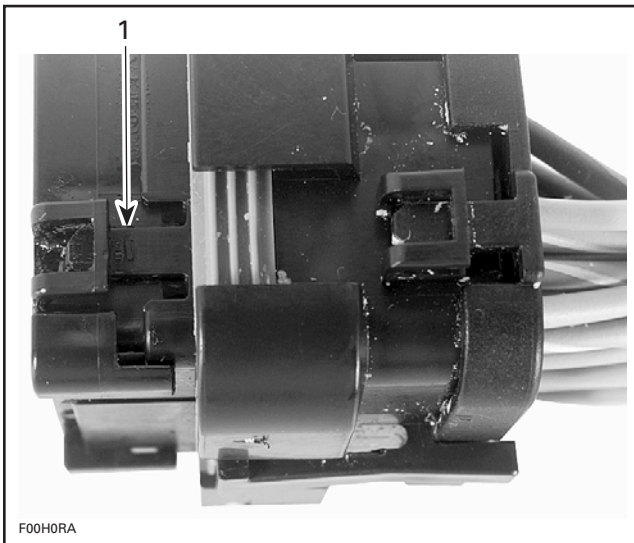
1. Rotate wire back and forth
2. Pull wire

POWER WIRE CONTACT

NOTE: The wedge lock must be removed to extract power contact.

Open the wedge lock.

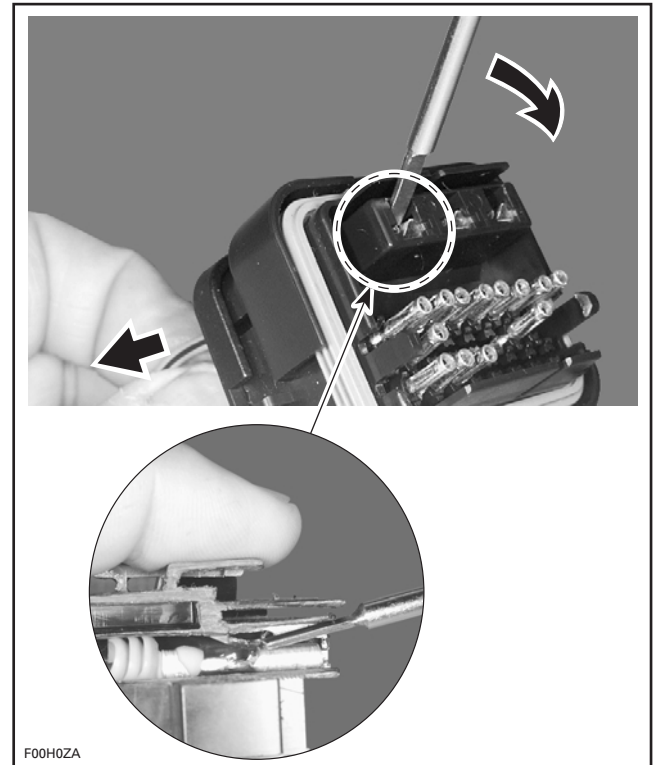
Pull both locking tabs and remove wedge lock from plug assembly.



1. Pull locking tab (both sides)

Before extraction, push wire forward to relieve pressure on retaining tab.

Insert a 4.8 mm (.189 in) wide screwdriver blade inside the front of the contact cavity.



Pry back the retaining tab while gently pulling wire back until contact is removed.

Contact Crimping

The size of the wires must be 20 to 16 AWG with a wire insulation diameter having a minimum dimension of 1.7 mm (.067 in) and a maximum dimension of 2.78 mm (.106 in).

The wire strip length shall be 5.1 mm (13/64 in).

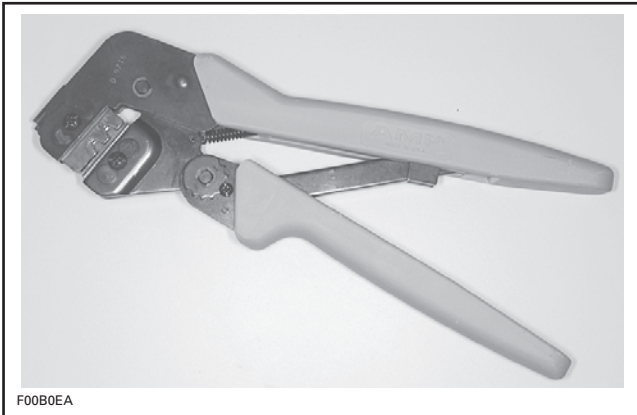
NOTE: When stripping wires, ensure conductor is not nicked, scrapped or cut. Wire stripping tool jaws may leave marks on the surface of the wire insulation. If these marks occur at the location of the wire seal, leakage may result. Insulation surface within 25 mm (1 in) from the tip of the contact must be smooth.

All contacts in AMP plug connectors must be crimped using the crimping tool (P/N 295 100 164).

CAUTION: If contacts are not crimped using the proper crimping tool, the wire seal may be damaged.

Section 14 WIRING DIAGRAMS

Subsection 01 (WIRING DIAGRAMS)



F00B0EA

CRIMPING TOOL (P/N 295 100 164)

All circuits are sealed by a diaphragm in the rubber wire seal. When installing wire contacts in plug connector, the diaphragm is pierced as the contact passes through it.

If the diaphragm is pierced and the cavity is not used, install a seal plug, **large end first**, into circuit cavity as far as it will go.

NOTE: It is suggested that all unused circuit cavities be sealed with a seal plug, even if they are not pierced.

CAUTION: Do not pierce the diaphragm with a sharp point for electrical troubleshooting. The resulting pinholes in the insulation will allow moisture to penetrate the system and possibly result in system failure.

Contact Installation

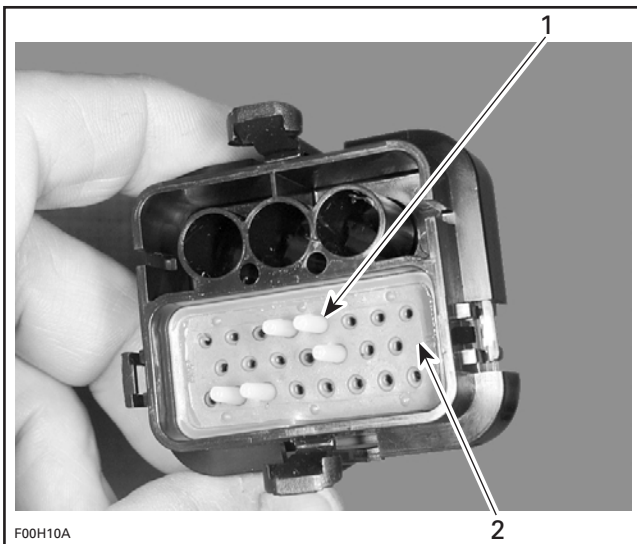
For insertion of signal contact, make sure the wedge lock is in the open position.

NOTE: For insertion of power contact, the wedge lock may or may not be on the open position.

Insert contact into appropriate circuit cavity and push as far as it will go.

Pull back on the contact wire to be sure the retention fingers in the housing are holding the contact properly.

After all required contacts have been inserted, the wedge lock must be closed to its **locked** position.



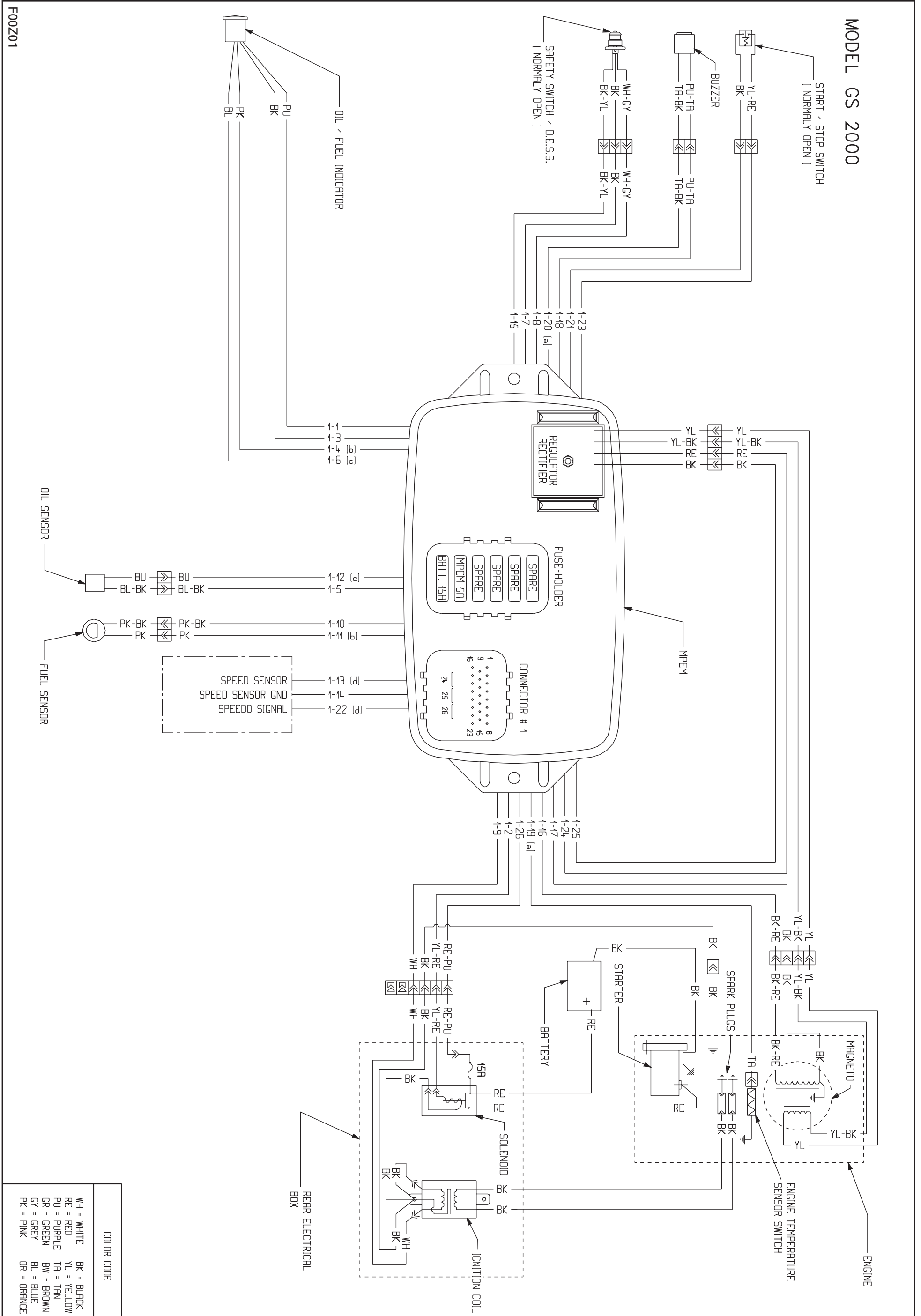
F00H10A

1. Seal plug
2. Wire seal

GS MODEL

5644/5827

MODEL GS 2000



COLOR CODE	
WH = WHITE	BK = BLACK
RE = RED	YL = YELLOW
PU = PURPLE	TR = TAN
GR = GREEN	BW = BROWN
GY = GREY	BL = BLUE
PK = PINK	OR = ORANGE

F00Z01

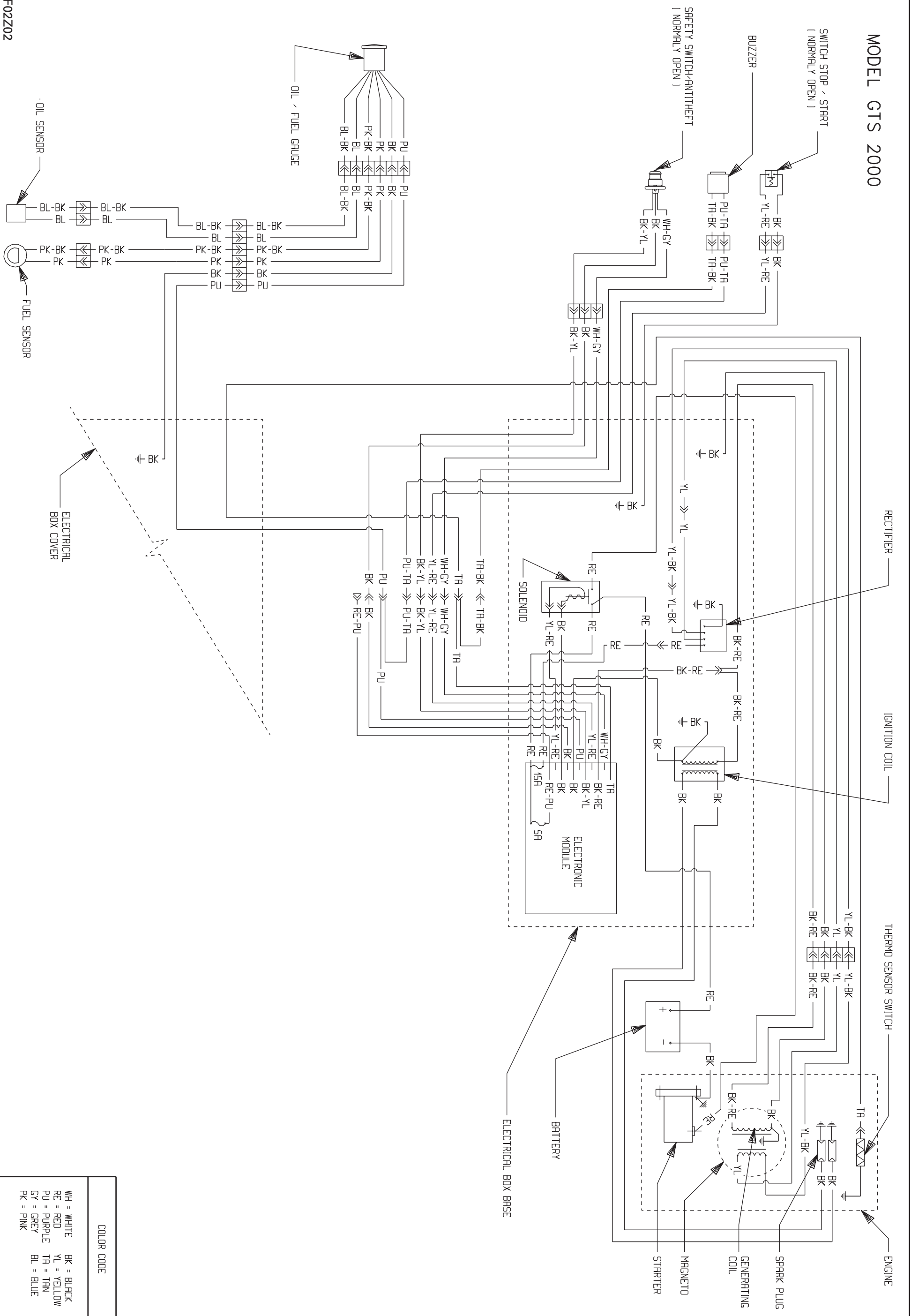
XP MODEL

5651 / 5655

GTS MODEL

5639

MODEL GTS 2000



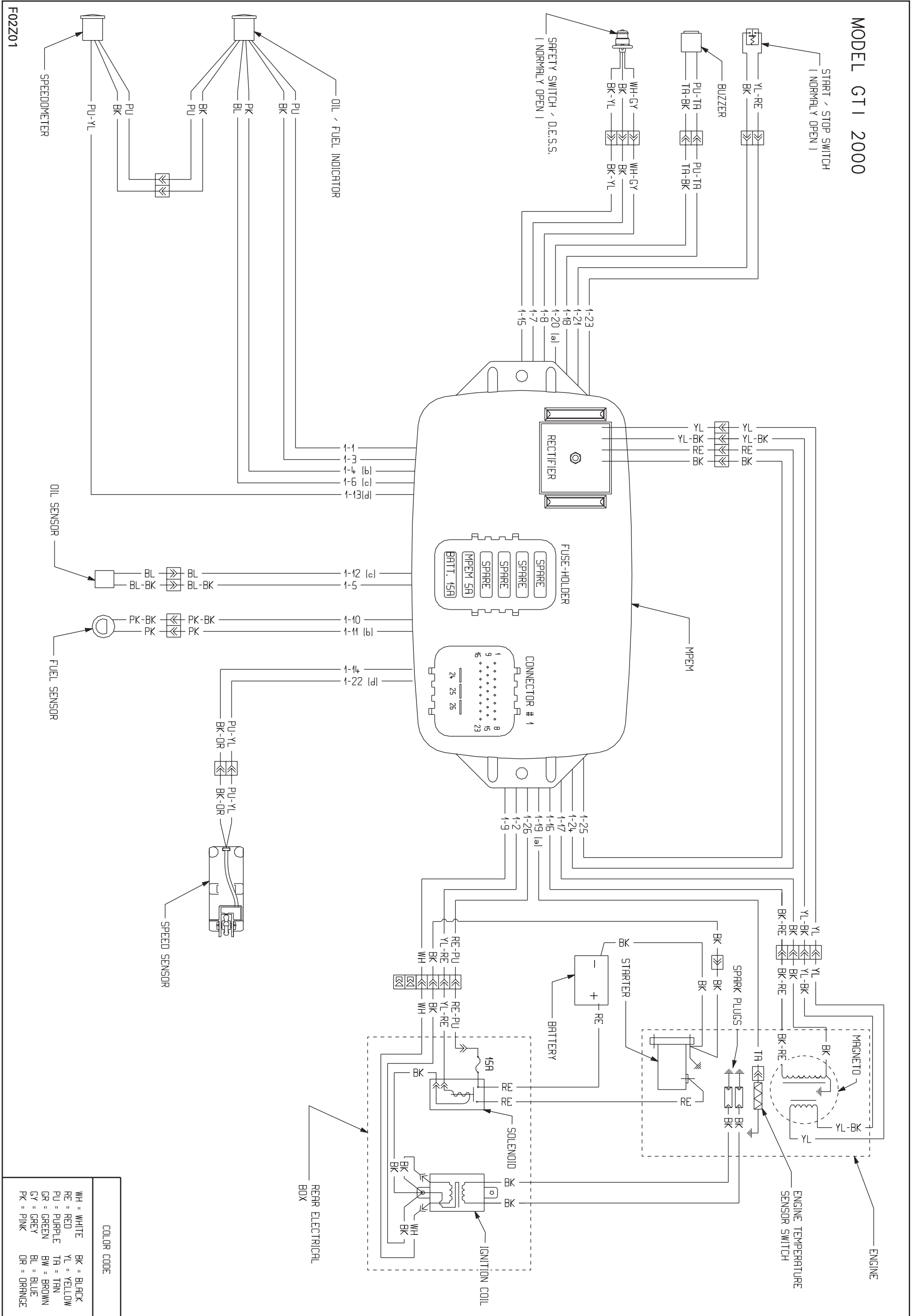
F02Z02

COLOR CODE	
WH = WHITE	BK = BLACK
RE = RED	YL = YELLOW
PU = PURPLE	TR = TAN
CY = GREY	BL = BLUE
PK = PINK	

GTI MODEL

5647 / 5657

MODEL GTI 2000



F02Z01

COLOR CODE	
WH = WHITE	BK = BLACK
RE = RED	YL = YELLOW
PU = PURPLE	TR = TAN
GR = GREEN	BW = BROWN
GY = GREY	BL = BLUE
PK = PINK	OR = ORANGE

SMR2000-034_14_00A.FM

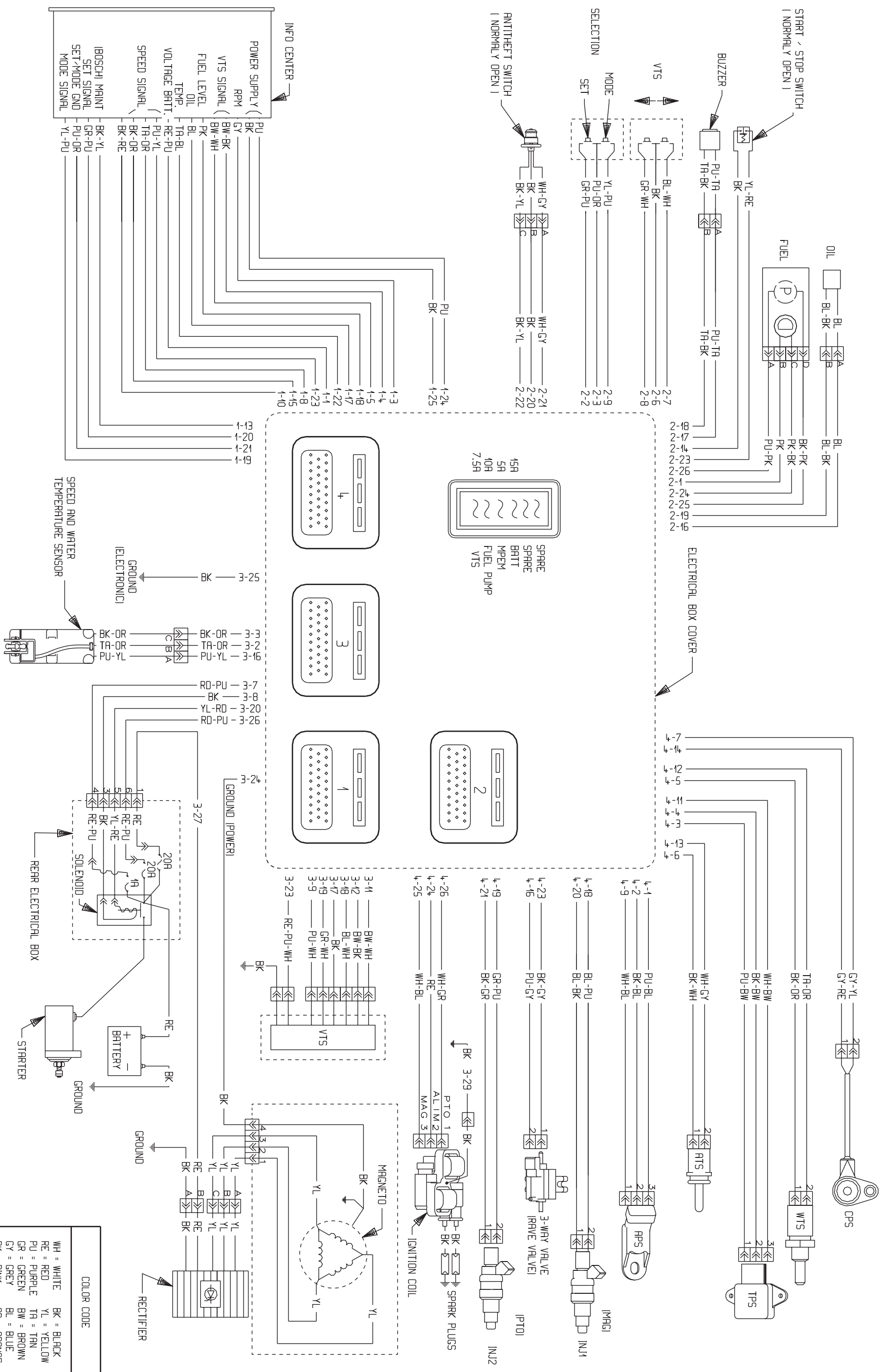
GTX MODEL

5653/5669

GSX RFI MODEL

5645/5654

MODEL GSX-RF1-2000



F15Z01

COLOR CODE	
WH = WHITE	BK = BLACK
RE = RED	YL = YELLOW
PU = PURPLE	TR = TAN
GR = GREEN	BW = BROWN
GY = GREY	BL = BLUE
PK = PINK	OR = ORANGE

GTX RFI MODEL 5515/5516/5648/5658

SEAN



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