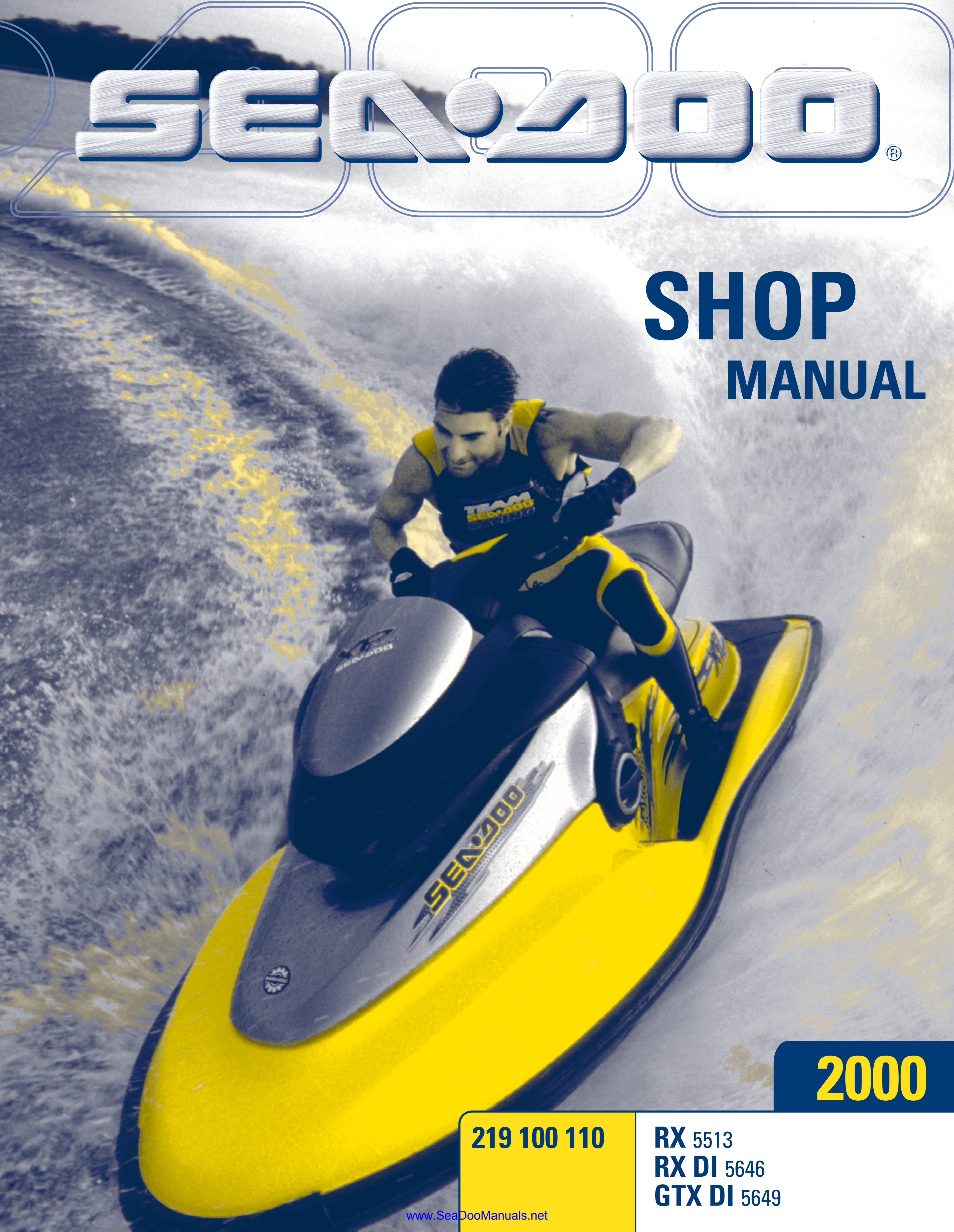

SEA•DOO®

SHOP MANUAL

2000

219 100 110

RX 5513
RX DI 5646
GTX DI 5649

2000 Shop Manual

VOLUME 2

RX

RX DI

GTX DI

BOMBARDIER
RECREATIONAL PRODUCTS

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Technical Publications
Bombardier Inc.
Valcourt (Quebec) Canada

Printed in Canada

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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.

INTRODUCTION

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

MODELS	MODEL NUMBER
RX	5513
RX International	5514
RX DI	5646
RX DI International	5656
GTX DI	5649
GTX DI International	5659

HULL IDENTIFICATION NUMBER (H.I.N.)

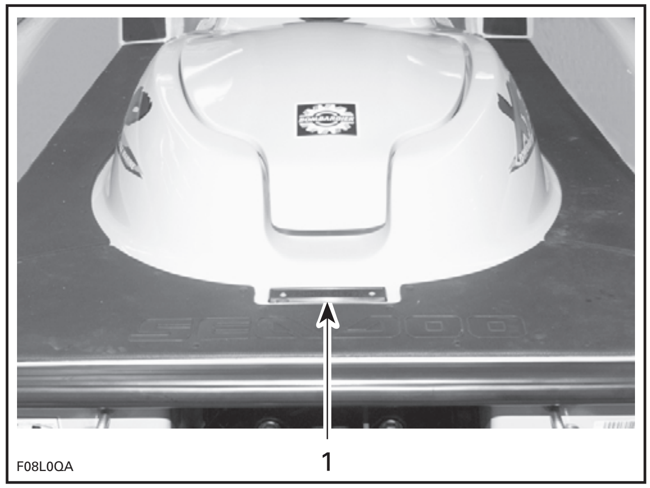
RX Models

It is located on footboard at the rear of watercraft.

RX/DI MODELS
1. *Hull Identification Number (H.I.N.)*

GTX Models

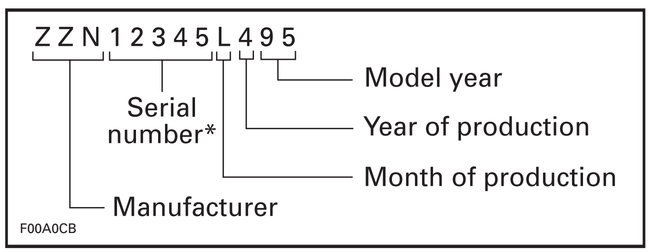
It is located on floorboard at the rear of the watercraft.



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

All Models

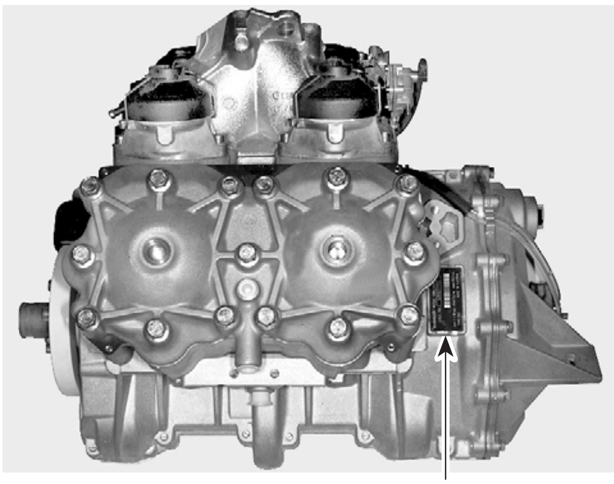
The Hull Identification Number is composed of 12 digits:



*A letter may also be used as a digit.

ENGINE IDENTIFICATION NUMBER (E.I.N.)

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



F06D15A

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 ENGINE MANAGEMENT (DI)

06 COOLING SYSTEM

07 FUEL SYSTEM

08 LUBRICATION SYSTEM

09 ELECTRICAL SYSTEM

10 PROPULSION SYSTEM

11 STEERING SYSTEM

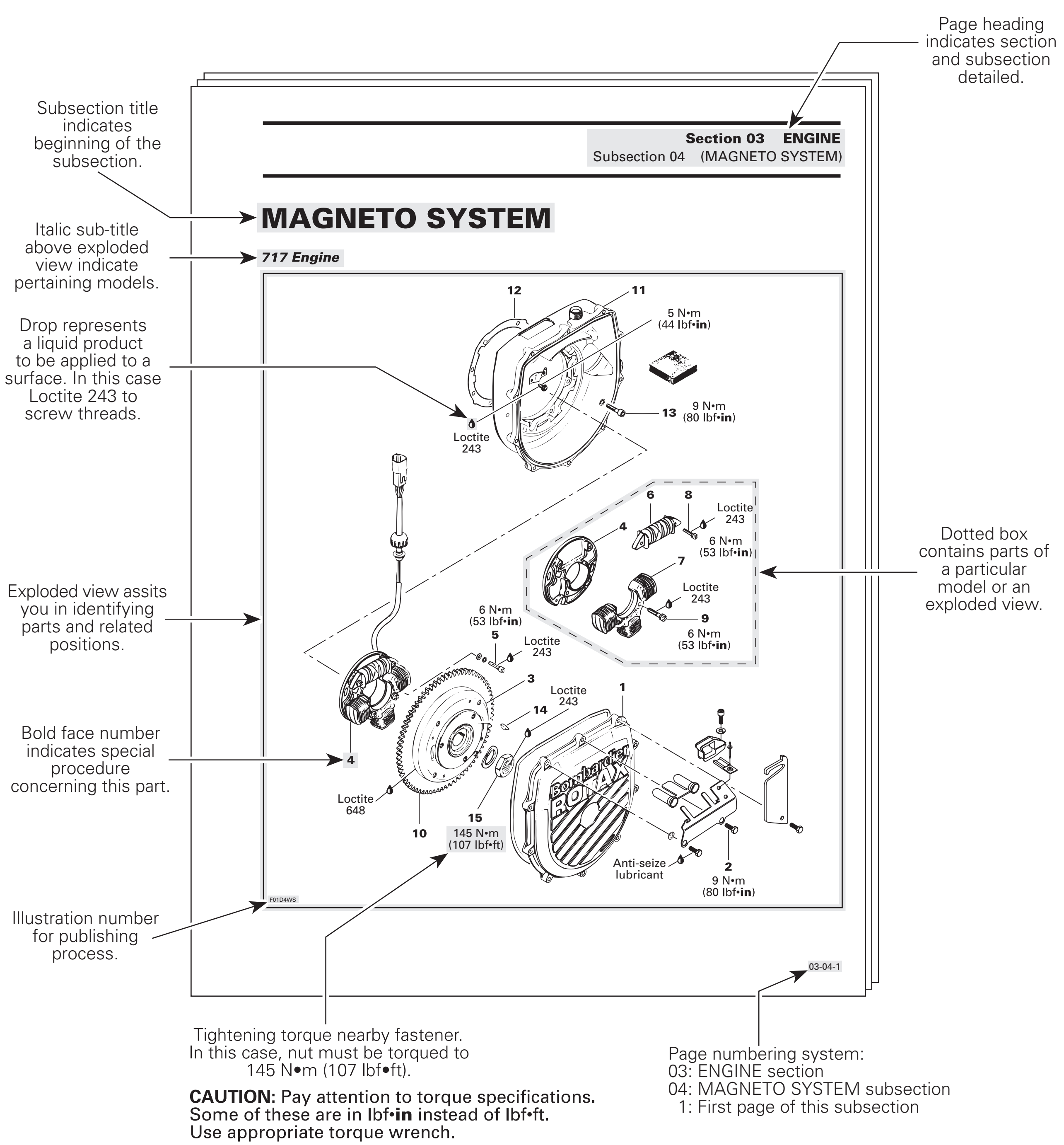
12 HULL/BODY

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.

TYPICAL PAGE



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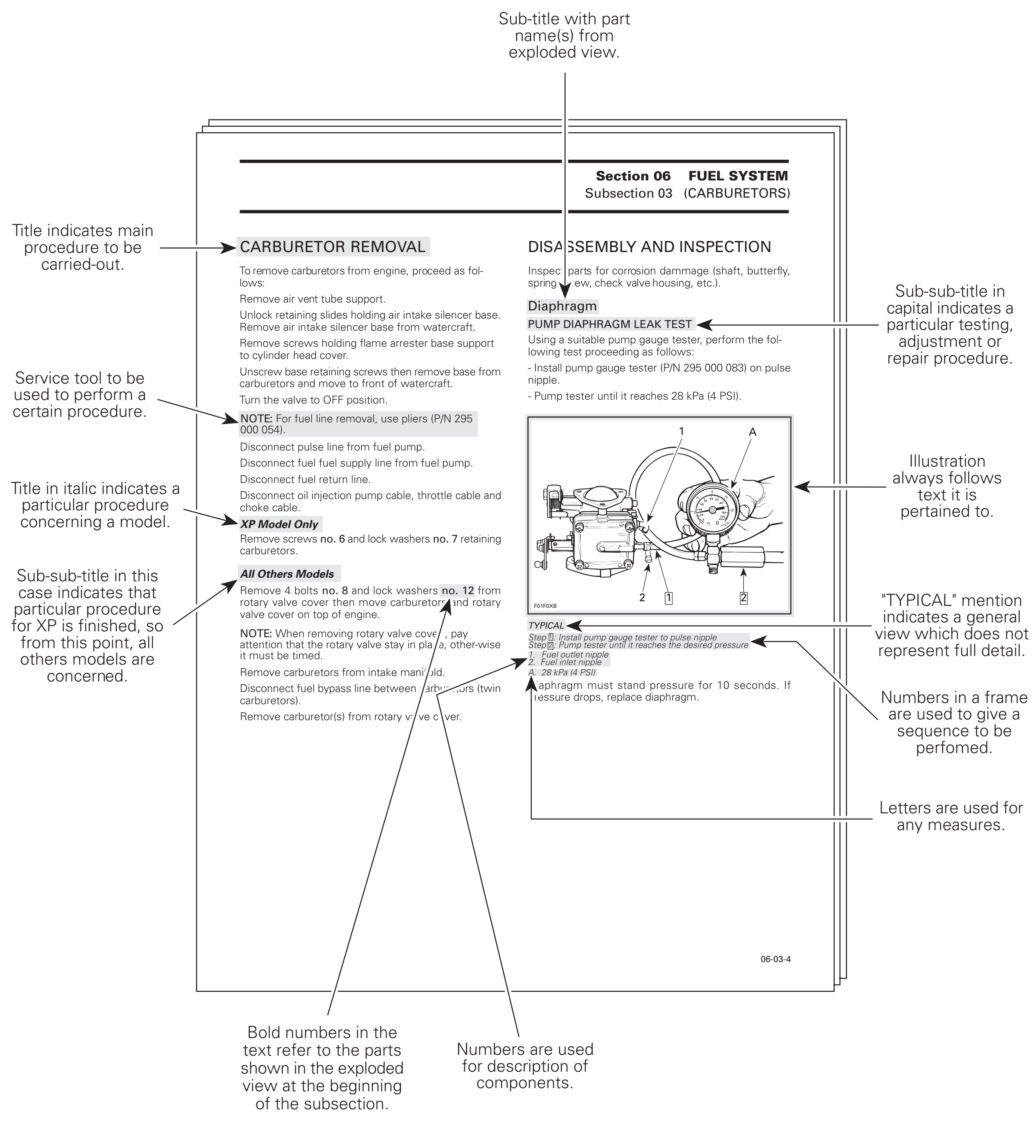
TYPICAL PAGE



F01A0BS

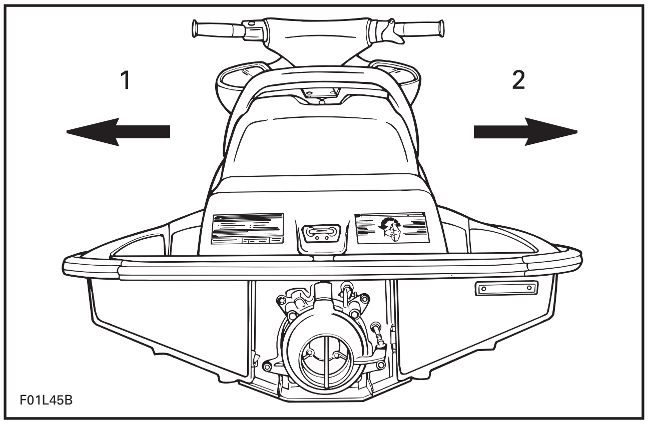
INTRODUCTION

LIST OF ABBREVIATIONS USED IN THIS MANUAL

	DESCRIPTION
AC	Alternate Current
APS	Air Pressure Sensor
ATS	Air Temperature Sensor
B.U.D.S.	Bombardier Utility and Diagnostic Software
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
EPA	Environmental Protection Agency (USA)
HP	Horse Power
LED	Light Emitting Diode
MAG	Magneto
MPEM	Multi-Purpose Electronic Module
MPH	Mile Per Hour
MPI	Multi Protocol Interface
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
VCK	Vehicle Communication Kit
VDC	Volt Direct Current
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.

ENGINE EMISSIONS INFORMATION

Manufacturer's Responsibility

Beginning with 1998 model year engines, manufacturers of marine engines must determine the exhaust emission levels for each engine horsepower family and certify these engines with the United States Environmental Protection Agency (EPA). A certification decal/emissions control information label, showing emission levels and engine specifications directly related to emissions, must be placed on each vehicle at the time of manufacture.

Dealer Responsibility

When performing service on all 1998 and later watercrafts that carry a certification, attention must be given to any adjustments that are made that affect emission levels.

Adjustments must be kept within published factory specifications.

Replacement or repair of any emission related component must be executed in a manner that maintains emission levels within the prescribed certification standards.

Dealers are not to modify the engine in any manner that would alter the horsepower or allow emission levels to exceed their predetermined factory specifications.

Exceptions include manufacturers prescribed changes, such as that for altitude adjustments.

Owner Responsibility

The owner/operator is required to have engine maintenance performed to maintain emission levels within prescribed certification standards.

The owner/operator is not to modify the engine in any manner that would alter the horsepower or allow emissions levels to exceed their predetermined factory specifications.

Single engine exceptions may be allowed with permission from the EPA for racing and testing.

EPA Emission Regulations

All new 1998 and later watercrafts manufactured by Bombardier are certified to the United States Environmental Protection Agency as conforming to the requirements of the regulations for the control of air pollution from new watercraft engines. This certification is contingent on certain adjustments being set to factory standards. For this reason, the factory procedure for servicing the product must be strictly followed and, whenever practicable, returned to the original intent of the design.

The responsibilities listed above are general and in no way a complete listing of the rules and regulations pertaining to the EPA laws on exhaust emissions for marine products. For more detailed information on this subject, you may contact the following locations:

VIA U.S. POSTAL SERVICE:

Office of Mobile Sources
Engine Programs and Compliance Division
Engine Compliance Programs Group (6403J)
401 M St. NW
Washington, DC 20460

VIA EXPRESS or COURIER MAIL:

Office of Mobile Sources
Engine Programs and Compliance Division
Engine Compliance Programs Group (6403J)
501 3rd St. NW
Washington, DC 20001

EPA INTERNET WEB SITE:
http:/www.epa.gov/omswww

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.

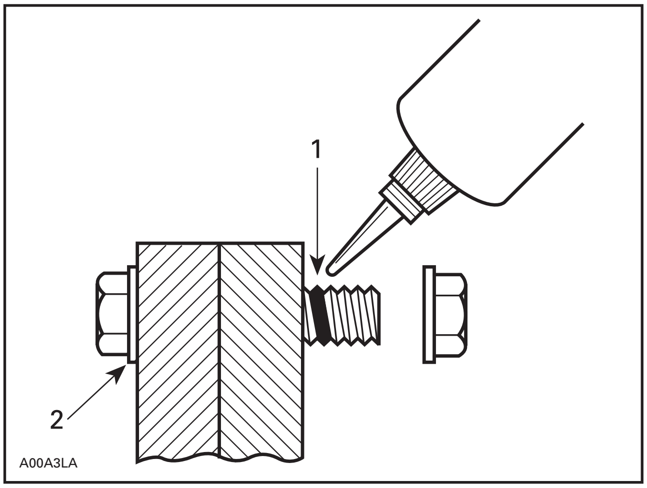
LOCTITE APPLICATION PROCEDURE

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

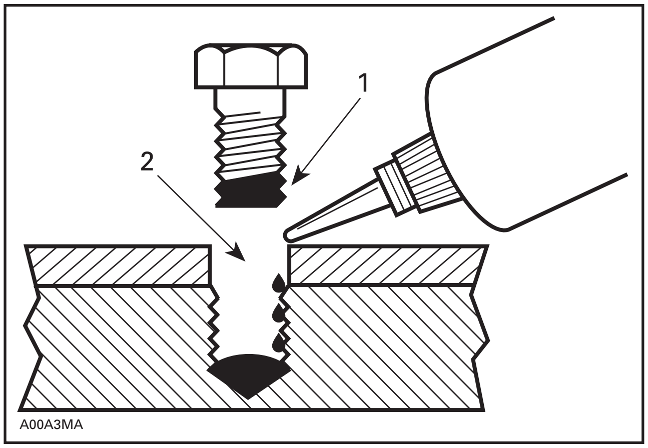
Uncovered Holes (bolts and nuts)



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.

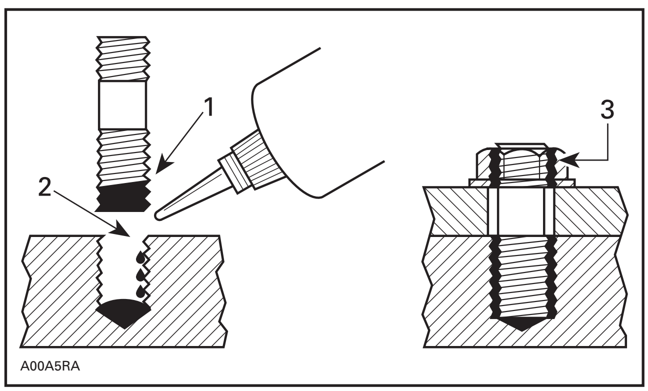
Blind Holes



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

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.

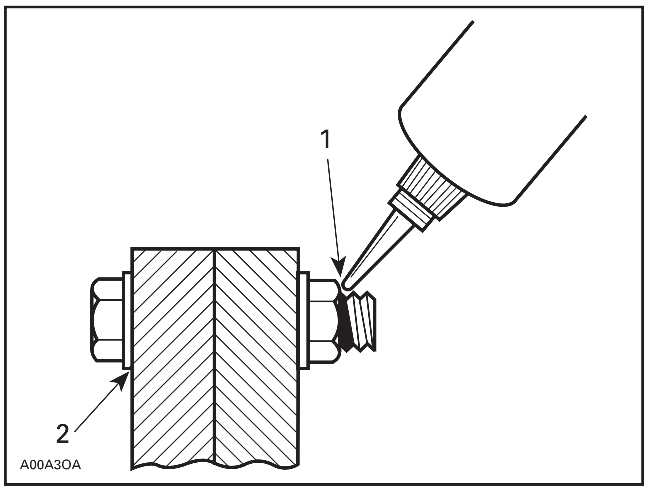
Stud in Blind Holes



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

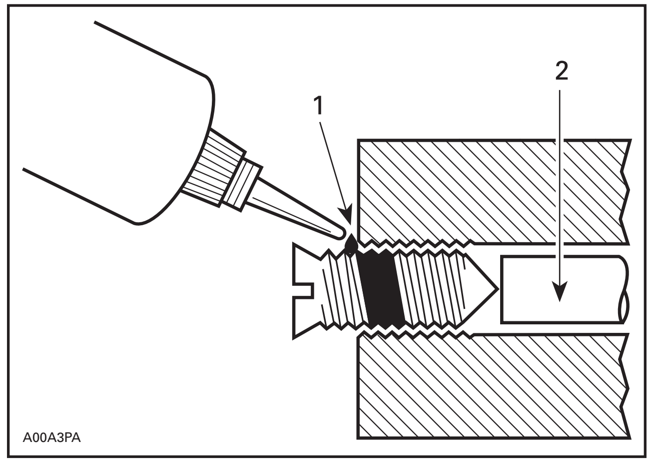


1. Apply here
2. Do not apply

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



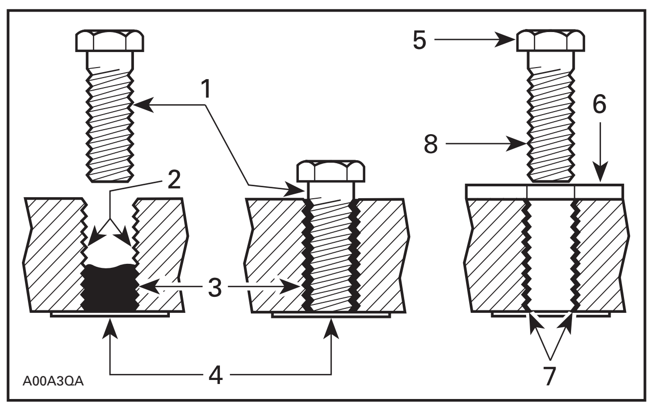
1. Apply here
2. Plunger

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.

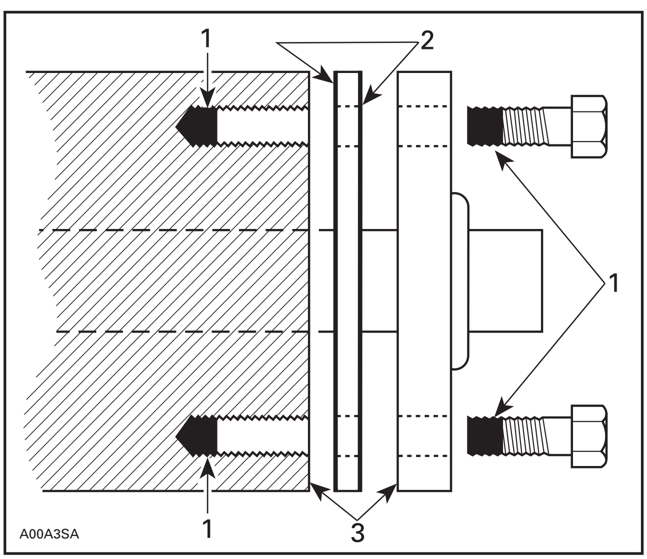
Option 2: Apply FORM-A-THREAD on the screw and insert in damaged hole.

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 293 800 038) 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 518 (P/N 293 800 038) on both sides of gasket, using a clean applicator.
5. Place gasket on mating surfaces and assemble immediately.

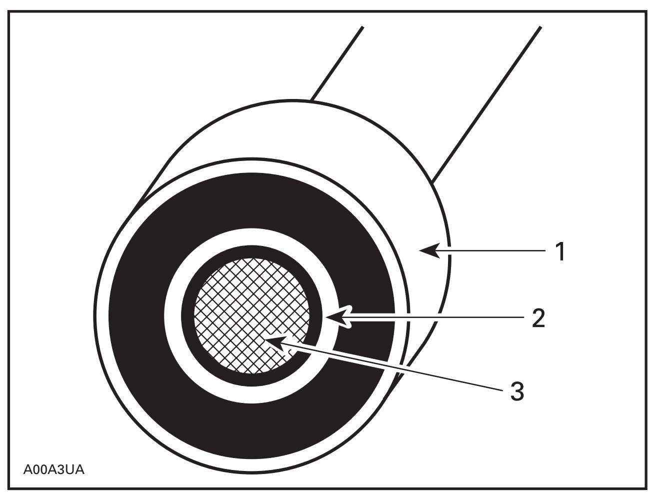
NOTE: If the cover is bolted to blind holes (above), apply proper strength Loctite in the hole and on threads. Tighten.

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

6. Tighten as usual.

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.

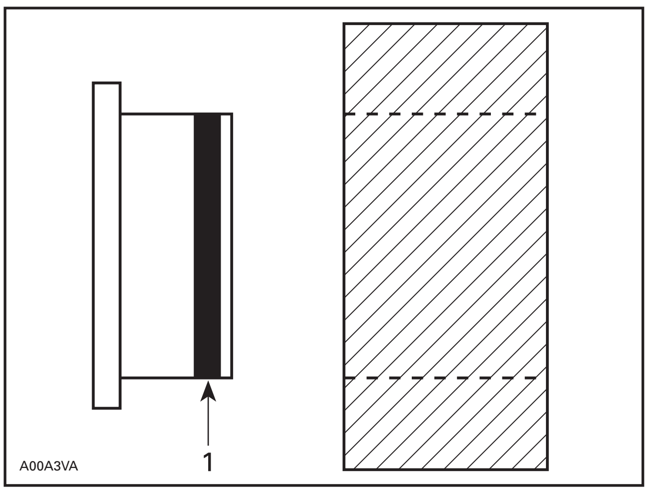
3. DO NOT use anti-seize Loctite or any similar product.
4. No curing period is required.

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
52		38
53		39
54		40
55		41
56		41
57		42
58		43
59		44
60		44
61		45
62		46
63		46
64		47
65		48
66		49
67		49
68		50
69		51
70		52
71		52
72		53
73		54
74		55
75		55
76		56
77		57
78		58
79		58
80	M12	59
81		60
82		60

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
142		105
143		105
144		106
145		107
146		108
147		108
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TIGHTENING TORQUES FOR 8.8 GRADE BOLTS AND NUTS

Technical Publications
Bombardier Inc.
Valcourt (Quebec), Canada

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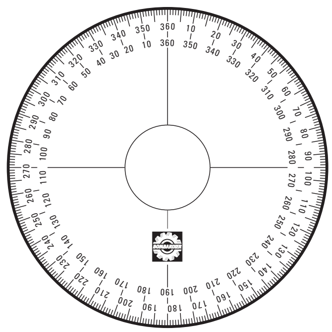
MANDATORY SERVICE TOOLS

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.

Air compressor ring compressor
P/N 529 035 713

NEW

APPLICATION
947 DI engine.

Carbon dam guide
P/N 529 035 715

NEW

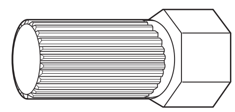
APPLICATION
947 DI engine.

Carbon dam compressor
P/N 529 035 716

NEW

APPLICATION
947 DI engine.

PTO flywheel remover/installer
P/N 295 000 001



F01J0T4

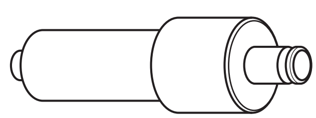
APPLICATION
717 engine.
NOTE: This tool is also used for the impeller.

Bearing pusher
P/N 420 876 501

F00B074

APPLICATION
717 and 787 engines.

Starter drive bearing pusher
P/N 290 876 502



F06B054

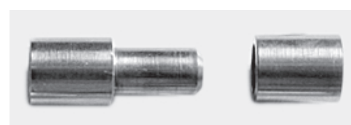
APPLICATION
947 engine.

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

F00B0T4

APPLICATION
All engines.

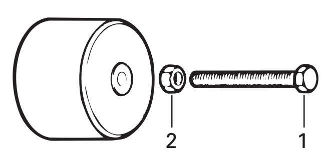
Sleeve set
A) P/N 529 035 542 (20 mm sleeve)
B) P/N 529 035 543 (21 mm sleeve)



F00B0U4

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

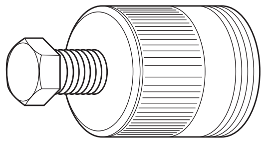
Puller ass'y
P/N 290 876 488
1) Screw P/N 290 240 860
2) Hexagonal nut P/N 290 242 210



F01B0I4

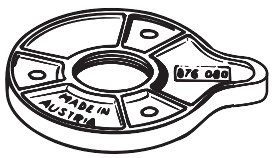
APPLICATION
717 and 787 engines.

Puller
P/N 529 035 547



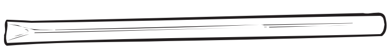
A00C1A4

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

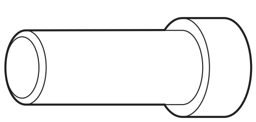
F00A094

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

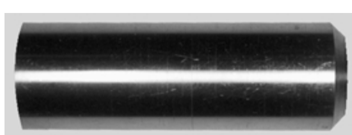
APPLICATION
All models.
A) 155.6 mm jet pump.
B) 139.5 mm jet pump.

Alignment shaft
P/N 295 000 141

F00B0G4

APPLICATION
All models.

Adapter
P/N 529 035 590



F00B124

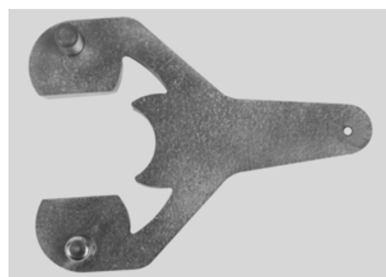
APPLICATION
XP model.

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

F12H0A4

APPLICATION
All models.

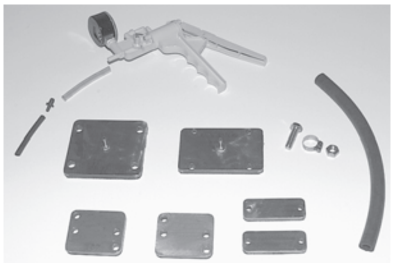
Flywheel extractor
P/N 295 000 156



F00B044

APPLICATION
XP model.

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



F01B2Q5

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

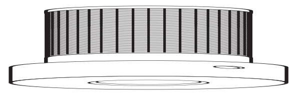
APPLICATION
787 RFI and 947 engines.
NOTE: This kit is supplementary to P/N 295 500 352.

Intake plug
P/N 529 035 708

NEW

APPLICATION
947 DI engine.

Handle
P/N 420 877 650



A00C3V4

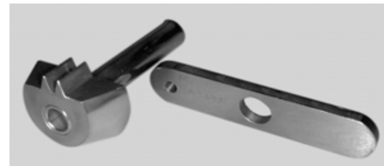
APPLICATION
Use with pushers (P/N 290 876 609 and 290 877 740).

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.

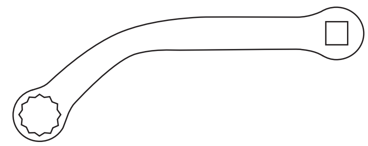
Ring gear blocking tool
P/N 295 000 155



F01B264

APPLICATION
787 engine.

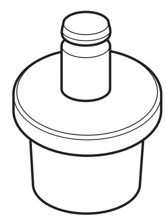
Polygonal wrench
P/N 529 035 505



F00B0Y4

APPLICATION
Exhaust system of the 947 engine.

Rotary valve shaft pusher
P/N 290 876 690

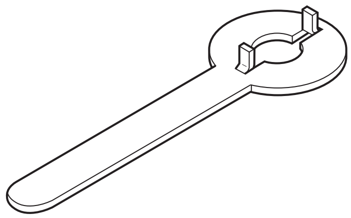


F01B2B4

APPLICATION
787 engine.

COOLING/FUEL/OIL SYSTEMS

Gear holder
P/N 420 277 905

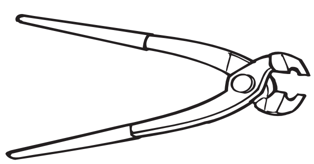


A00C164

APPLICATION
717 engine.

Pliers
P/N 295 000 070

Oetiker 1099

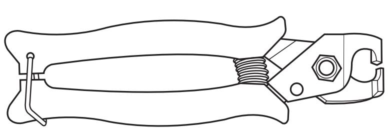


F01D174

APPLICATION
All models.

Pliers
P/N 295 000 054

Caillau



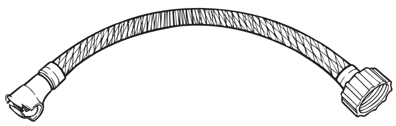
F01B1T4

APPLICATION
All models.

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

Coupler hose
P/N 295 500 258

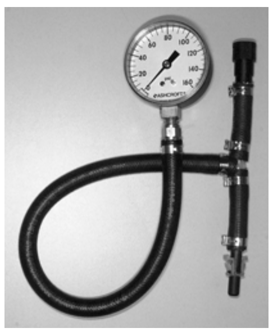
41 cm (16 in)



F01E0Z4

APPLICATION
GTS model.

Fuel pressure gauge
P/N 529 035 591

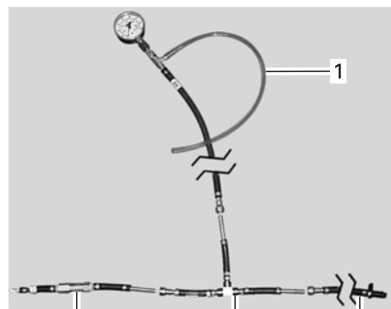


F02B0B4

APPLICATION
787 RFI engine.

1. Fuel pressure gauge
   P/N 529 035 709
2. Fuel pressure gauge T-fitting
   P/N 529 035 710
3. Fuel pressure gauge pressure relief valve
   P/N 529 035 711
4. Fuel pressure gauge air compressor adapter
   P/N 529 035 712

NEW

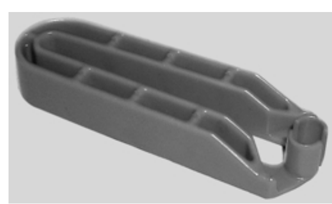


F12R014

APPLICATION
947 DI engine.

Fuel line disconnect tool
P/N 529 035 714

NEW

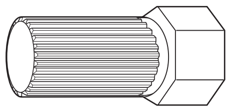


F12B0G4

APPLICATION
947 DI engine.

PROPULSION SYSTEM

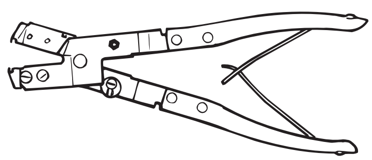
Impeller remover/installer
P/N 295 000 001



F01J0T4

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

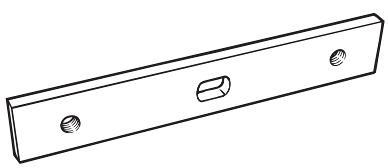
Pliers
P/N 295 000 069
Oetiker 1090



F01D184

APPLICATION
All models.

Impeller shaft holder
P/N 295 000 082



F01B0W4

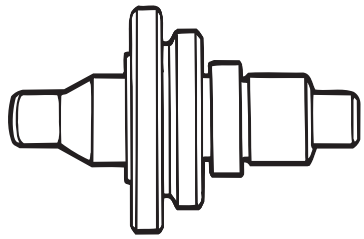
APPLICATION
All models.

Jet pump bearing remover
P/N 295 000 144

F01J114

APPLICATION
All models.

Bearing/seal installer
P/N 295 000 107



F01J4K4

APPLICATION
All models except GTX and XP.

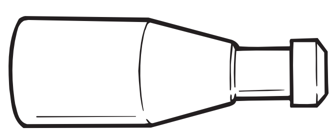
Inner seal installer
P/N 529 035 609

NEW

F08B014

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

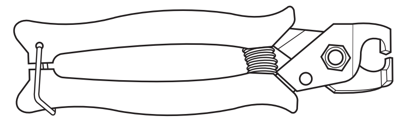
Impeller shaft guide
P/N 295 000 002



F01J1O4

APPLICATION
All models.

Pliers
P/N 295 000 054
Caillau



F01B1T4

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

VTS tool
P/N 295 000 133

F01B2P4

APPLICATION
GSX RFI and XP models.

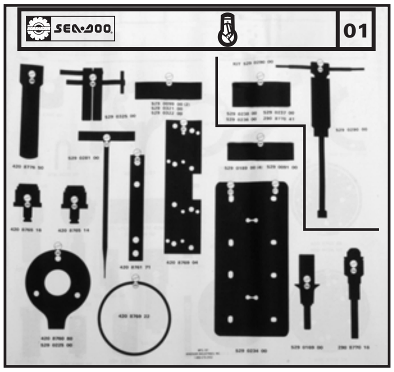
Drive shaft alignment tool
P/N 529 035 590

F08B024

APPLICATION
XP model.

WORKSHOP

Tool board
P/N 295 500 608



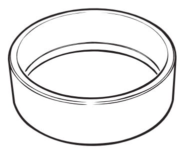
F00A0S4

APPLICATION
All models.

OPTIONAL SERVICE TOOLS

ENGINE

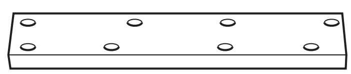
Coil centering tool
P/N 420 876 922



A01B1V4

APPLICATION
717 engine.

Cylinder aligning tool
P/N 420 876 904

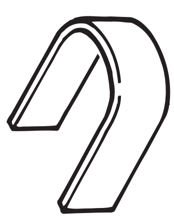


A00B084

APPLICATION
717 engine.

Distance gauge

A) P/N 529 034 800, 14 mm (.551 in)
B) P/N 529 034 900, 15.4 mm (.606 in)
C) P/N 529 035 100, 11.5 mm (.453 in)
D) P/N 529 035 000, 7.5 mm (.295 in)



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

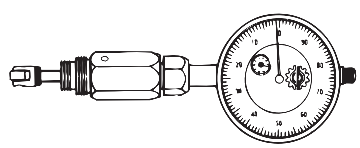
APPLICATION
All models.

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.

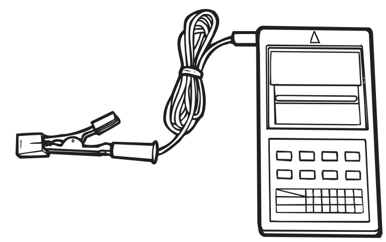
Dial indicator (TDC gauge)
P/N 295 000 143



A00B4E4

APPLICATION
All models.

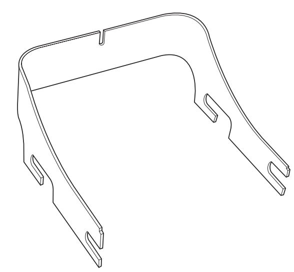
Digital/induction type tachometer
P/N 529 014 500



F01B1G4

APPLICATION
All models.

Timing mark pointer
P/N 295 000 130



F01B2O4

APPLICATION
717 engine.

Timing mark pointer
P/N 295 000 135

F01H544

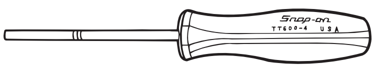
APPLICATION
787 and 947 engines.

Crimping tool
P/N 295 100 164

F00B0E4

APPLICATION
Contacts of AMP plug connectors.

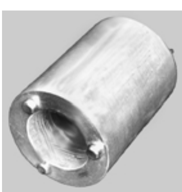
Terminal (Packard) remover
Not sold by Bombardier
Snap-on
TT 600-4



F01B1J4

APPLICATION
All models.

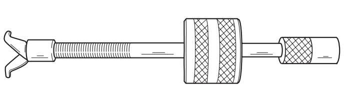
Safety lanyard switch tool
P/N 529 034 600



F01B244

APPLICATION
All models.

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



F01J0Z4

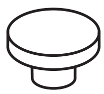
APPLICATION
717 and 787 engines.
NOTE: This tool is also used to pull out impeller shaft seal.

Protective mat
P/N 295 000 128

F02B0A4

APPLICATION
All models.

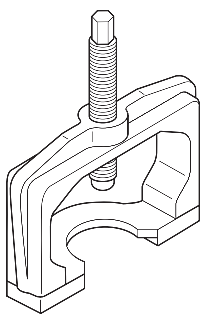
Crankshaft protector
P/N 420 876 552



F00B034

APPLICATION
For use with pullers.

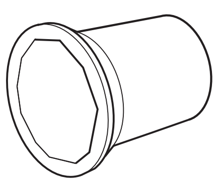
Gear/bearing puller
P/N 290 877 665



F04B034

APPLICATION
787 engine.

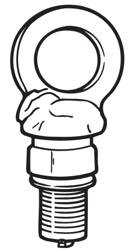
Exhaust outlet tool
P/N 295 000 132



F01B2A4

APPLICATION
All models.

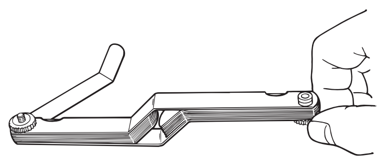
Engine lifting device
Not sold by Bombardier
Do it yourself
Refer to REMOVAL AND INSTALLATION section of engine.



F01D0A4

APPLICATION
717 engine.

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



F01B1K4

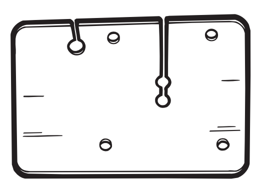
APPLICATION
717 and 787 engines.

Steering cable tool
P/N 295 000 145

F01B2P4

APPLICATION
All models except GTS.

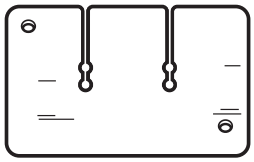
Rubber pad
P/N 295 000 101



F01B0J4

APPLICATION
717 and 787 engines.

Rubber pad
P/N 290 877 032



F06B064

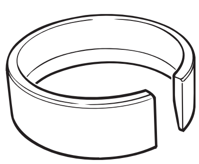
APPLICATION
947 engine.

MPEM programmer
P/N 529 035 718

A01B5B4

APPLICATION
All models.

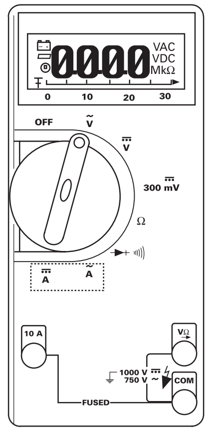
Piston ring compressor (2)
A) P/N 290 876 965 (88 mm)
B) P/N 290 876 979 (82 mm)



F01B1T4

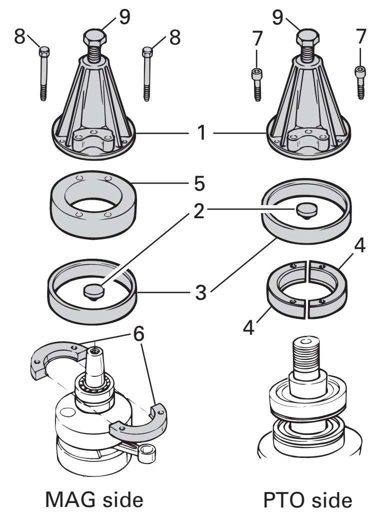
APPLICATION
A) 947 engine.
B) 717 and 787 engines.

Digital multimeter
P/N 529 022 000



F01B1O4

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)

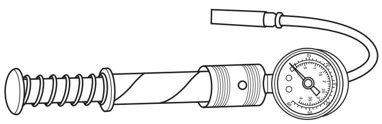
8) Screw M8 x 70
P/N 420 841 201 (2)

9) Puller bolt
P/N 420 940 755

APPLICATION
All engines.

COOLING/FUEL/OIL SYSTEMS

Pump gauge tester
P/N 295 000 114

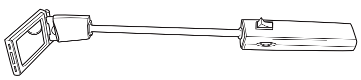


F01B0X4

APPLICATION
All models except RFI and DI models.

Lighted adjustable mirror
Not sold by Bombardier

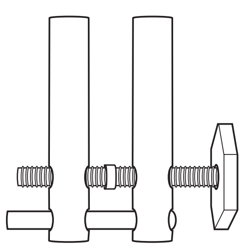
Snap-on
50101



F01B1I4

APPLICATION
All models.

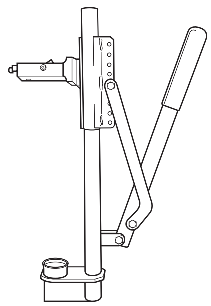
Hose pincher
P/N 529 032 500



F01B234

APPLICATION
All models.

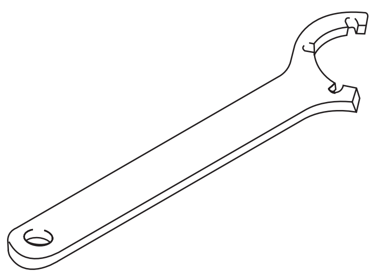
Spring compressor
P/N 529 035 504



A01B4O4

APPLICATION
XP model.

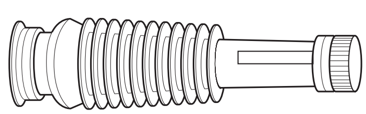
Suspension adjustment wrench
P/N 529 012 200



A25A014

APPLICATION
XP model.

Flexible spout (oil)
P/N 414 837 300



F04B044

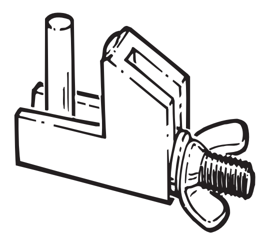
APPLICATION
All models.

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

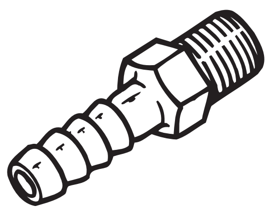


A01B2I4

APPLICATION
All models.

PROPULSION SYSTEM

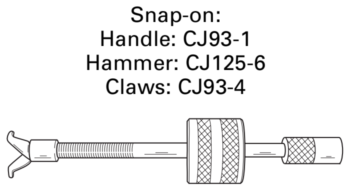
Fitting
P/N 295 000 086



F01B0Z4

APPLICATION
All models.

Slide hammer puller
Not sold by Bombardier

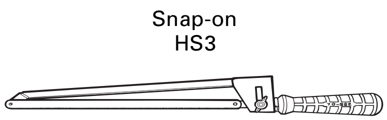


F01J0Z4

APPLICATION
All models.

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

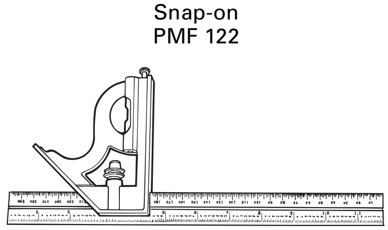
Hacksaw
Not sold by Bombardier



F01B1M4

APPLICATION
All models.

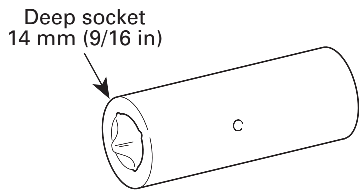
Machinist's square
Not sold by Bombardier



F02B064

APPLICATION
GTS model.

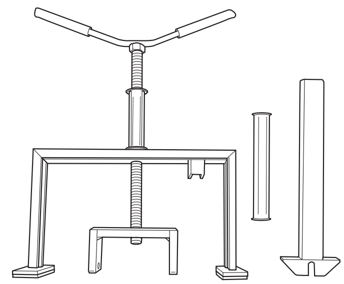
Fitting remover
Not sold by Bombardier
Do it yourself
Refer to JET PUMP section.



F01J2R4

APPLICATION
GTS model.

Impeller housing remover
P/N 295 000 113

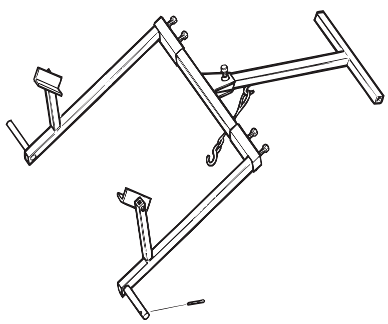


F01L2O4

APPLICATION
GTS model.

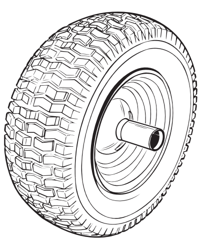
WATERCRAFT HANDLING

Dolly (with wheels)
P/N 295 000 126



F01B014

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



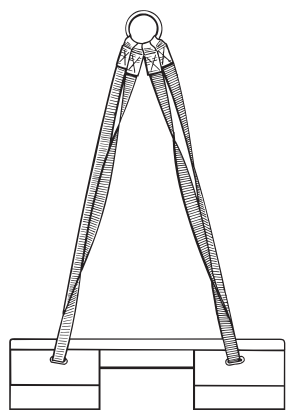
F01B074

APPLICATION
Dolly.

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

APPLICATION
All models.

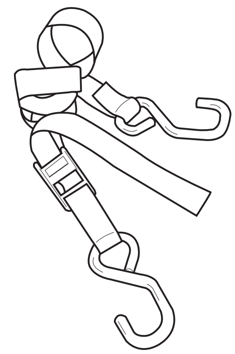
Lift kit
P/N 295 100 044



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)

F00A0O4

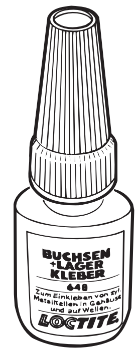
High strength threadlocker
P/N 293 800 005

Loctite 271 (red)
(10 mL)

A00B2U4

High temperature threadlocker
P/N 420 899 788

Loctite 648 (green)
(5 g)



A00B3D4

High temperature retaining compound
P/N 293 800 054

Loctite 642
(50 mL)

F00B024

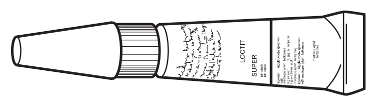
Retaining compound
P/N 413 703 100

Loctite RC/609 (green)
(10 mL)

A00B2S4

General purpose instant adhesive
P/N 293 800 021

Loctite 495



A00B2V4

Gasket eliminator
P/N 293 800 038

Loctite 518
(50 mL)

F01B124

Flange sealant
P/N 293 800 081

NEW

Loctite 5910
(300 mL)

Chisel gasket remover
P/N 413 708 500
(510 mL)

A00B574

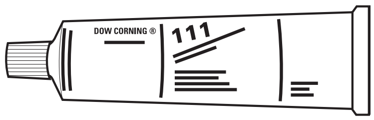
Thread sealant
P/N 293 800 050
Loctite 577
(250 mL)

F00B0W4

Solvent
P/N 293 800 019
Loctite Safety
Solvent 755
340 g (12 oz)

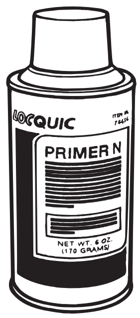
A00B3M4

Molykote 111
P/N 413 707 000



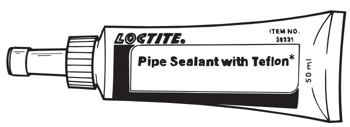
A00B3W4

Primer for gasket eliminator
P/N 293 800 041
Loctite 764



A00B3N4

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

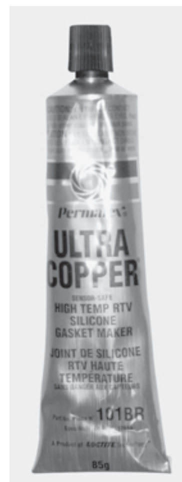
Hylomar sealant
P/N 293 800 001
PL-32
(100 g)

A00B3F4

Sealant
P/N 293 530 011
Sikaflex 221 (black)
(350 mL)

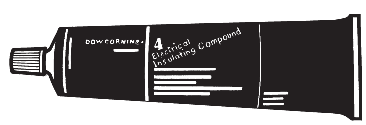
F01B1D4

Ultra Copper High temp sealant
P/N 413 710 300
(80 g)



A02B044

Dielectric grease
P/N 293 550 004
Dow Corning
(150 g)

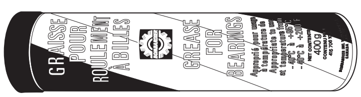


F01B164

Deoxit contact lubricant
P/N 293 550 015
(200 mL)

F00B0X4

Grease
P/N 293 550 005
(400 g)

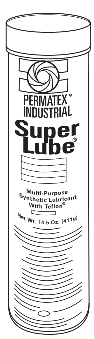


A00B2L4

Synthetic grease
P/N 293 550 010
(400 g)

F01B154

Super Lube grease
P/N 293 550 014



A00B474

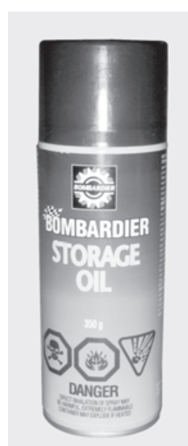
Anti-seize lubricant
P/N 293 800 023
Loctite 767
454 g (16 oz)

F01B174

BOMBARDIER LUBE
P/N 293 600 016
(12 x 14 oz)

F01B0S4

BOMBARDIER storage oil
P/N 413 711 600
(12 x 350 g)

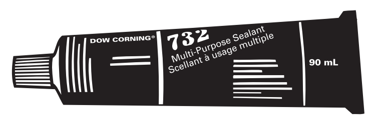


A02B054

Sea-Doo fuel stabilizer
P/N 413 408 600
236 mL (8 oz)

A00B3V4

732 Multi-purpose sealant
P/N 293 800 033
Dow Corning (90 mL)
(clear)



F01B1C4

BOMBARDIER injection oil
P/N 413 802 900
(12 x 1 L)

F01B184

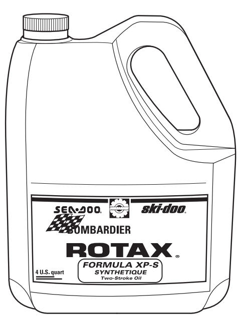
BOMBARDIER injection oil
P/N 413 803 000 (3 x 4 L)
P/N 413 803 200 (205 L)

F01B2H4

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

F01B2G4

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



F01B354

BOMBARDIER Formula XP-S DI
synthetic injection oil
P/N 293 600 032 (12 x 1 L)

NEW

BOMBARDIER Formula XP-S DI
synthetic injection oil
P/N 293 600 033 (3 x 4 L)
P/N 293 600 034 (205 L)

NEW

Sealant adhesive
P/N 293 800 033
Adchem 4511
(clear)

F01B1S4

The Right Stuff (sealant)
P/N 293 800 053
Permatex®
(198 g)

F00B0V4

Jet pump oil
P/N 293 600 011 (12 x 6 oz)
Sea-Doo
synthetic jet pump oil

F01B0P4

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

F01B2J4

TABLE OF CONTENTS

PERIODIC INSPECTION CHART

Maintenance, replacement, or repair of the emission control devices and systems may be performed by any marine SI (spark ignition) engine repair establishments or individual.

		FREQUENCY			
	DESCRIPTION	FIRST 10 HOURS	EVERY 25 HOURS OR 3 MONTHS	EVERY 50 HOURS OR 6 MONTHS	EVERY 100 HOURS OR 1 YEAR
GENERAL	Lubrication/corrosion protection	①		✔	
ENGINE	Support and rubber mount condition/tightness	✔		✔	
	Exhaust system fasteners ⑤	✔		✔	
	RAVE valve cleaning ⑤			✔	✔
	Counterbalance shaft oil level			✔	✔
	Spark plug inspection, cleaning and gap adjustment ⑤	④ ✔			
	Spark plug replacement ⑤			✔	
	TDC setting ⑤ (for **DI models**)	④ ✔			✔
	Air compressor, visual condition of hoses. Check for leaks ⑤ **CAUTION: Main hose between compressor and fuel rail may be hot.**			✔	
COOLING SYSTEM	Flushing		✔③		
	Hose condition and fasteners	✔		✔	
	Inspect/clean engine drain tubes		✔①		
	Water flow regulator valve inspection (**carburetor-equipped models**)				✔
FUEL SYSTEM	Carburetor adjustment including choke/throttle cable adjustments (**carburetor-equipped models**)				✔
	Throttle/choke cables (**carburetor-equipped models**), inspection/lubrication	①	✔		
	Fuel filter (**carburetor-equipped models**) and lines inspection	✔	✔		
	Fuel filter replacement				✔
	Visually check for oil leakage between head and injector (**DI models**) ⑤	✔		✔	
	Fuel injection system sensors (except throttle body), visual inspection (**DI models**) ⑤	✔			✔
	Throttle body cleaning and their sensors (**DI models**) ⑤ ⑥	✔		✔	
	Fuel vent line pressure relief valve inspection		✔		
	Fuel lines, connections (**DI models**), check-valve and **fuel system pressurization** ⑤	✔	✔		
	Visual inspection: carburetors/throttle bodies, sensors, fuel lines, fuel rail and fittings (**if so equipped**) ⑤	✔		✔	
	Air intake silencer fit/tightness	✔			✔
	Fuel tank straps visual inspection	✔			✔
LUBRICATION SYSTEM	Oil injection pump adjustment ⑤	✔			✔
	Oil filter and lines inspection	✔	✔		
	Oil filter replacement				✔
	Oil reservoir straps	✔			

	DESCRIPTION	FREQUENCY: FIRST 10 HOURS	EVERY 25 HOURS OR 3 MONTHS	EVERY 50 HOURS OR 6 MONTHS	EVERY 100 HOURS OR 1 YEAR
ELECTRICAL SYSTEM	Electrical connections condition and fastening (ignition system, electrical box(es), starting system, fuel injectors (**DI models**), etc.)	✔		✔	
	MPEM mounting brackets/fasteners			✔	
	Digitally Encoded Security System	✔			✔
	Monitoring beeper	✔		✔	
	Battery condition and straps	✔		✔	
STEERING SYSTEM	Inspection and cable adjustment	✔		✔	
PROPULSION SYSTEM	Drive shaft boot and spline condition (**if so equipped**)			✔ ②	
	PTO flywheel lubrication	✔	✔		
	Shifter system/cable adjustment	✔			✔
	VTS (Variable Trim System, **if so equipped**)	✔		✔	
	Jet pump reservoir oil level/oil condition	Replace	✔		Replace
	Jet pump cover pusher inspection				✔
	Jet pump seal				⑦
	Impeller condition and impeller/wear ring clearance			✔ ②	
	Water intake grate condition			✔ ②	
HULL AND BODY	Bailer pick-ups, check for obstructions	✔			✔
	Hull condition	✔			✔

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.
④ Except DI models.
⑤ Emission-related component.
⑥ In salt water use.
⑦ Replace at 150 hours.

FLUSHING AND LUBRICATION

GENERAL

Flushing

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

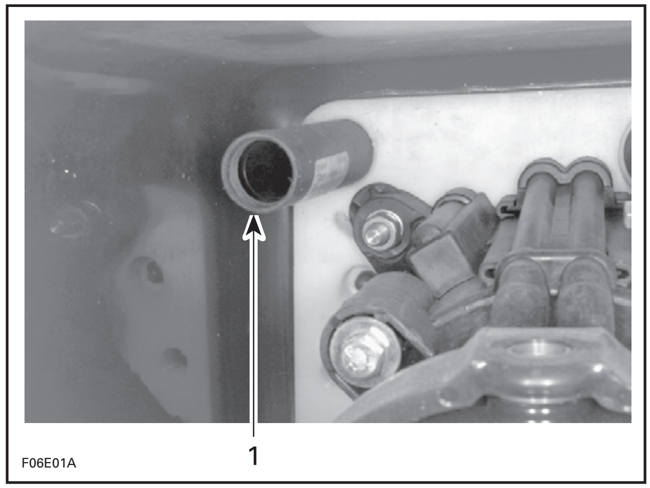
Perform this operation in a well ventilated area. Do not touch any electrical parts or jet pump area when engine is running.

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.

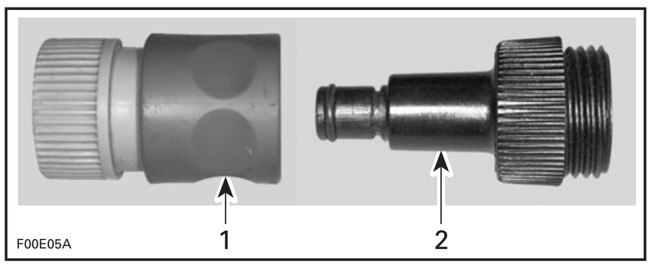
Install flushing adapter (P/N 295 500 473) to the water outlet located at the rear of the watercraft.



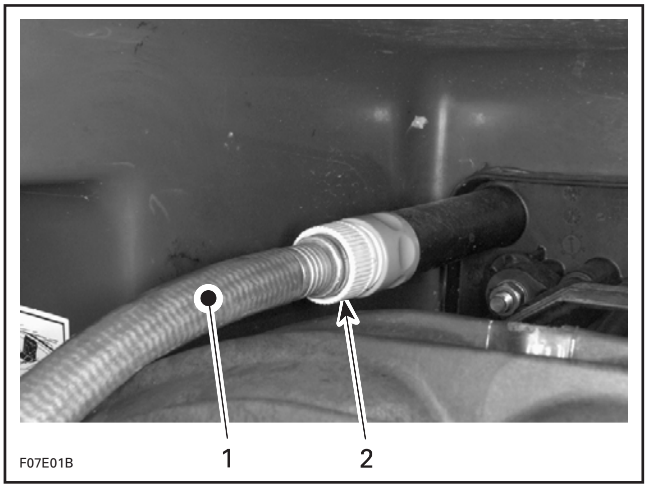
1. *Install flushing adaptor*

Connect a garden hose to the flushing adaptor.

NOTE: A quick connect adapter can be used to ease garden hose installation. The quick connect adapter may be supplied with **some models**. It has to be removed if you do not use a quick connect adapter on your garden hose. No hose pincher is required to flush the engine.



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



1. Garden hose installed
2. Quick connector adaptor

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.

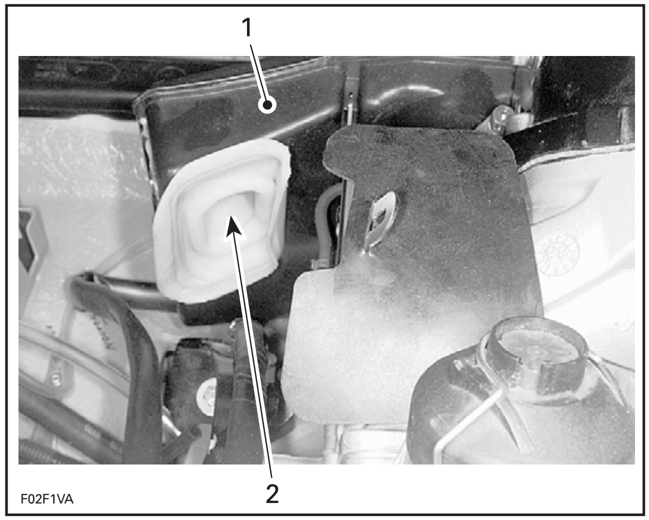
Run the engine about 3 minutes at a fast idle around 3500 RPM.

Ensure water flows out of drain lines (engine crankcase, engine cylinder and air compressor (**DI models**)) while flushing. Otherwise, clean the lines.

CAUTION: Never run engine longer than 5 minutes. Drive line seal has no cooling when watercraft is out of water.

Spray BOMBARDIER LUBE lubricant where shown keeping engine at fast idle for approximately one minute.

Carburetor-Equipped Models

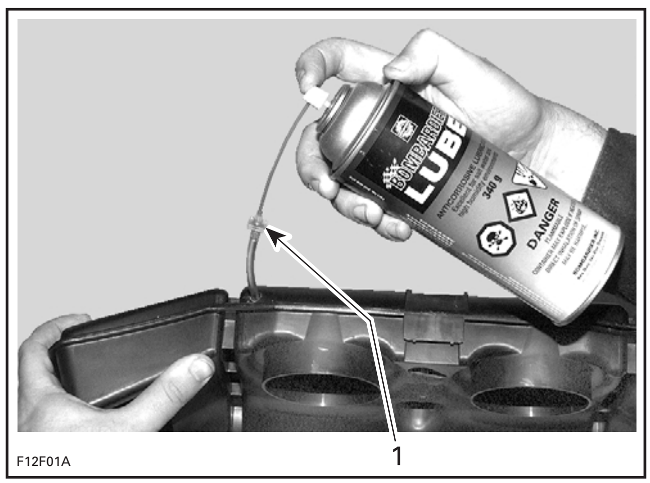


1. Air intake silencer
2. Spray BOMBARDIER LUBE here

DI Models

Spray, through hole of air intake silencer.

NOTE: An increase of engine RPM may be noticed while spraying the lubricant in the air intake silencer.



1. Partially pull tube out of air box to inject BOMBARDIER LUBE lubricant or equivalent. Push tube in when finished

Carburetor-Equipped Models

After fogging, 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.

All Models

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

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

Disconnect the garden hose.

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

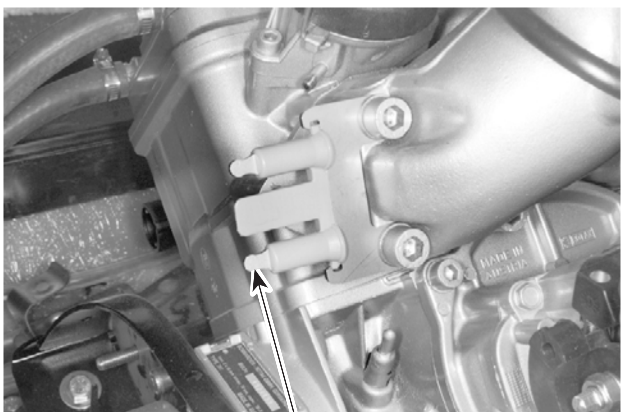
Final Steps

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.



F07H0AA

1. Grounding device

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

Connect safety lanyard cap to the switch.

Carburetor-Equipped Models

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.

DI Models

NOTE: Proceeding in this order, no fuel will be injected and no ignition will occur in the engine.

While engine is stopped, fully depress throttle lever and HOLD for cranking.

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

NOTE: A 1 second beep every second indicates the drowned mode is active.

All Models

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

⚠ WARNING

Always reconnect spark plug cables at the same spark plugs where they come from. The cable coming out the edge of the electrical box must be connected to the MAG side spark plug.

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.

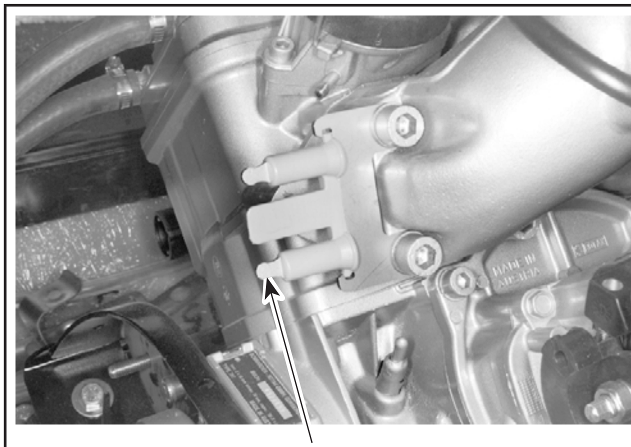
Turn fuel valve to OFF (**carburetor-equipped models**) position then drain fuel filter bowl. Refer to FUEL CIRCUIT.

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.



F07H0AA

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 yet.

Carburetor-Equipped Models

Fully depress the throttle lever then crank the engine to drain crankcase and ignition will be cut.

DI Models

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

While engine is stopped, fully depress throttle lever and HOLD for cranking.

Crank engine several times to drain crankcase.

⚠ WARNING

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

NOTE: A 1 second beep every second indicates the drowned mode is active.

If water does not completely go out, it may be necessary to remove the air intake silencer then to lean the vehicle so that water can flow out from throttle bodies.

All Models

NOTE: Depending on how much water is in engine, this procedure may need to be repeated.

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

Crank engine again.

Reinstall spark plugs and spark plug cables.

⚠ WARNING

Always reconnect spark plug cables at the same spark plugs where they come from. The cable coming out the edge of the electrical box must be connected to the MAG side spark plug.

Carburetor-Equipped Models

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.

DI Models

Start engine according to normal starting procedure.

All Models

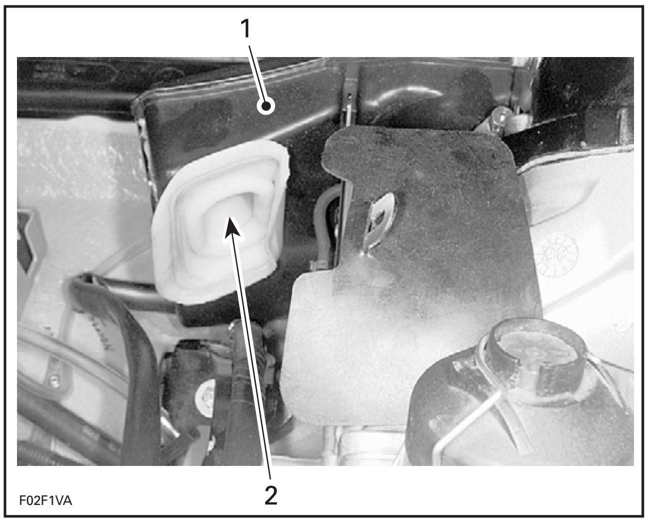
CAUTION: To avoid starting motor overheating, the cranking period should not exceed 5-10 seconds and a rest period of 30 seconds should be observed between cranking cycles.

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.

Carburetor-Equipped Models

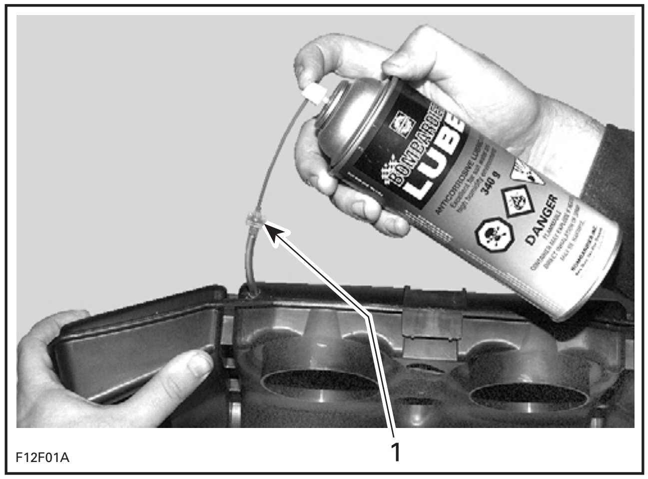


1. *Air intake silencer*
2. *Spray BOMBARDIER LUBE here*

DI Models

Spray through hole of air intake silencer.

NOTE: An increase of engine RPM may be noticed while spraying the lubricant in the air intake silencer.



1. *Partially pull tube out of air box to inject BOMBARDIER LUBE lubricant or equivalent. Push tube in when finished*

Run engine until it reaches its normal operating temperature.

CAUTION: Engine must be cooled using the flush kit.

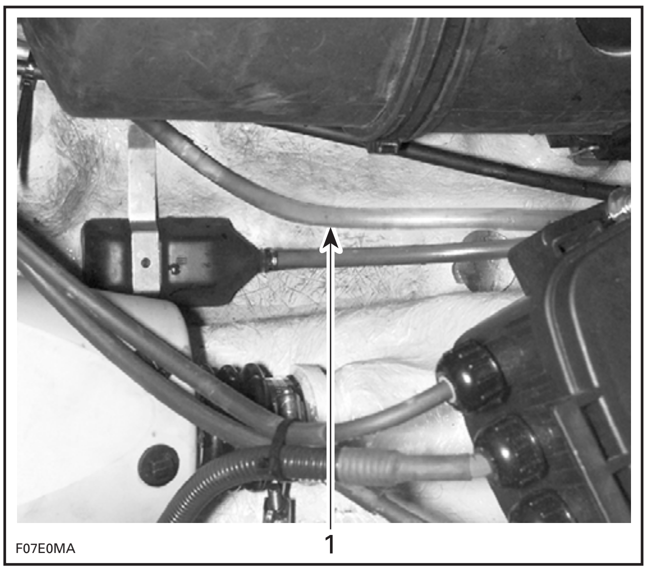
STORAGE

ENGINE DRAINING

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.

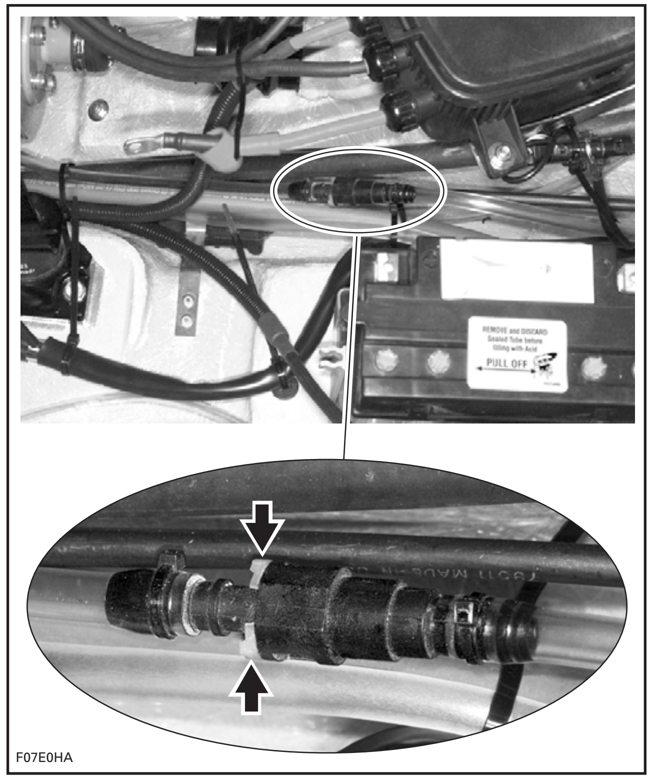
Carburetor-Equipped Models



1. *Engine drain hose*

DI Models

Disconnect the quick connect fitting. Press both tabs and pull fitting.



DISCONNECT THIS HOSE

Lower hose as necessary so that draining can take place.

Reconnect fitting when done.

Also ensure air compressor drain line is not obstructed. Clean as necessary.

All Models

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 gumming. Follow manufacturer's instructions for proper use.

Fill up fuel tank completely. Ensure there is no water inside fuel tank. If so, flush 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 carburetors, **if so equipped**, are protected against varnish deposits.

⚠ WARNING

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

Carburetor-Equipped Models

Always turn the fuel valve to OFF position when storing the watercraft.

COOLING SYSTEM FLUSHING AND ENGINE INTERNAL LUBRICATION

All Models

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.

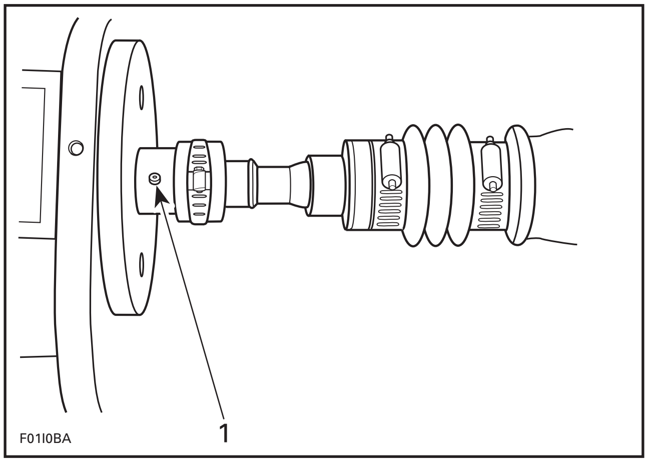
CAUTION: Use only SEA-DOO jet pump oil or equivalent synthetic gear oil, otherwise component service life could be reduced. Do not mix oil brands or types.

PTO Flywheel

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.

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. 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: Remaining water in cooling system will freeze. Either antifreeze must be added or water must be expelled with air compressed. This operation requires a good technical knowledge of the cooling system path. If antifreezing is not performed adequately engine/exhaust system may freeze and cause severe engine damage. 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 expel all water out of engine.

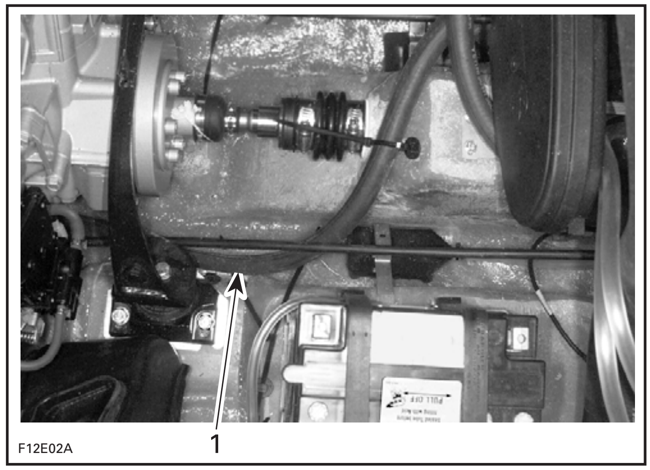
Water and Antifreeze Method

Hose Pinchers Installation

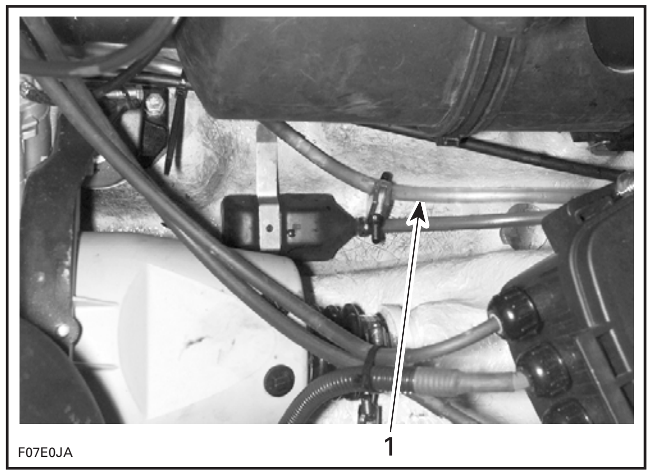
Some hoses have to be plugged to prevent draining, before filling cooling system jackets with the antifreeze.

Carburetor-Equipped Models

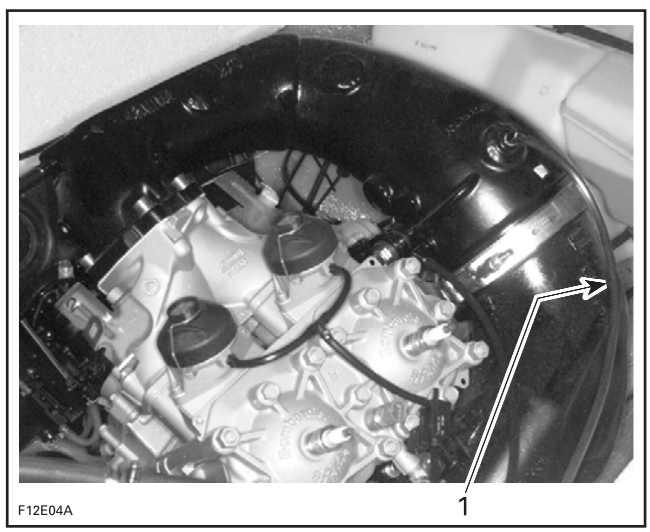
Install hose pinchers at the following location:



1. *Water outlet hose*

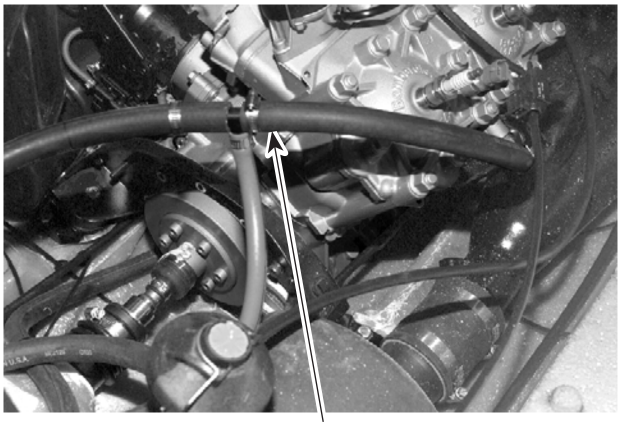


1. *Engine cylinder drain hose*



1. *Tuned pipe bleed hose*

Disconnect water INLET hose where shown.



F12E03A

1. *Disconnect hose this side of T-fitting*

Antifreeze

Insert a funnel into hose and pour antifreeze mix in engine until the colored solution appears at cooling system bleed outlet (LH side of hull).

F07E0LA

At this point, remove the hose pincher at tuned pipe bleed hose. If necessary, continue to pour antifreeze mix until the colored solution appears at the other cooling system bleed outlet (stern eyelet).

Remove the remaining hose pinchers in this order to allow proper flow of antifreeze.

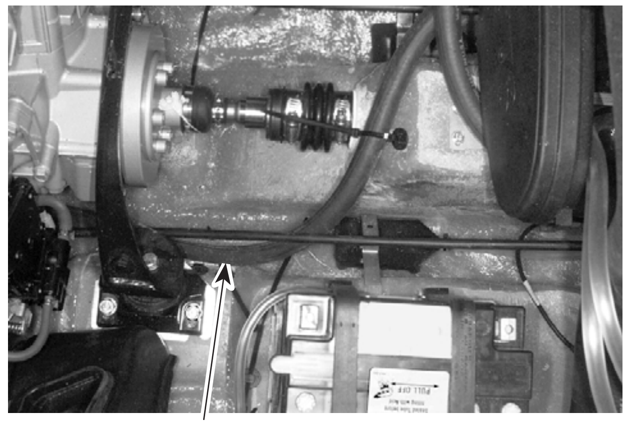
1. Engine cylinder drain hose.
2. Water outlet hose.

Pour approximately 200 mL (7 oz) of antifreeze in the water regulator valve supply hose to allow antifreeze flowing through the valve and into muffler to protect it.

Reconnect hose to T-fitting.

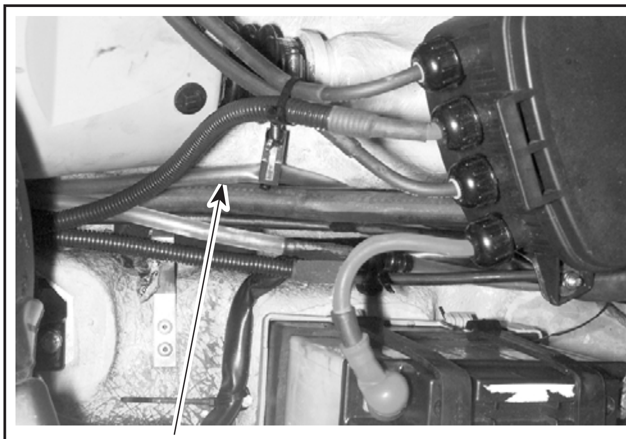
DI Models

Install hose pinchers at the following location:



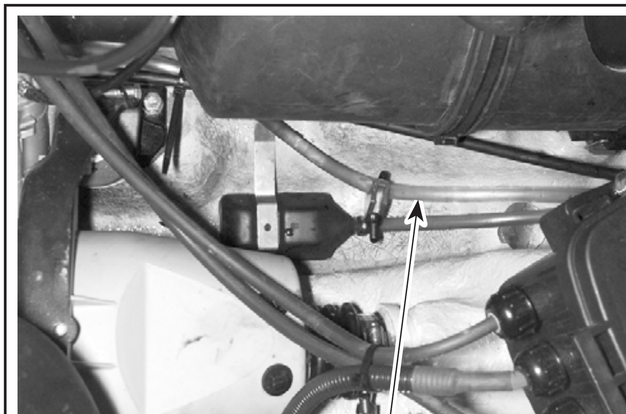
F12E02A

1. *Water outlet hose*



F07E0SA

1. *Crankcase cooling cover outlet hose*



F07E0JA

1. *Engine cylinder drain hose*

Disconnect water INLET hose at engine.

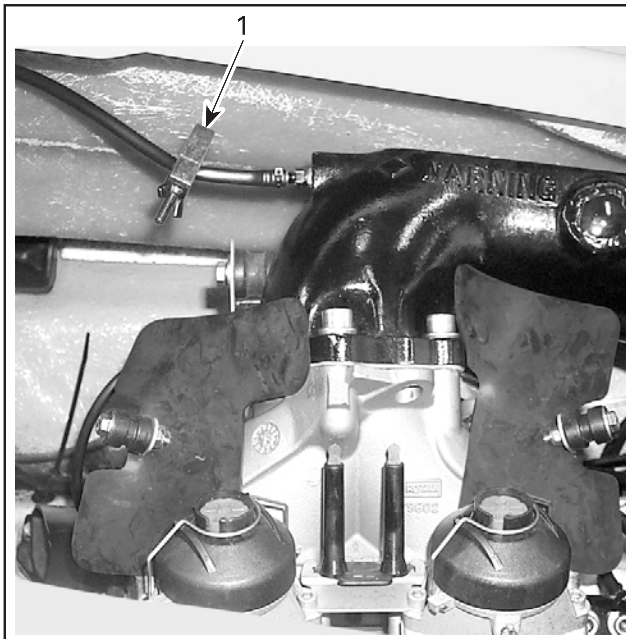
Temporarily install a short piece of hose to replace the one removed.

Antifreeze

Insert a funnel into the temporary hose and pour antifreeze mix in engine until the colored solution appears at cooling system bleed outlet.

F07E0LA

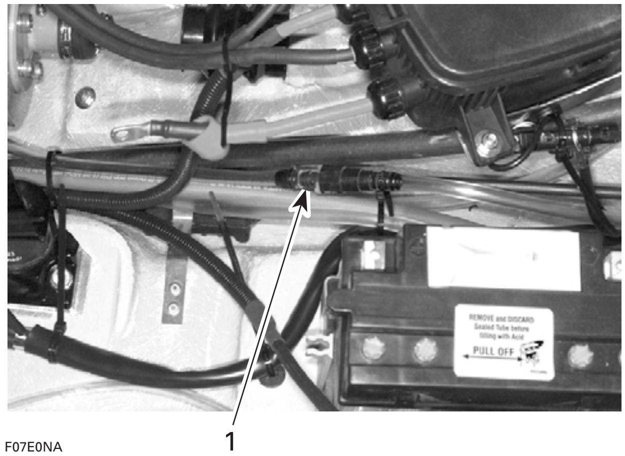
At this point, install a hose pincher on bleed outlet hose.



F07E0OA

1. *Bleed outlet hose*

Continue to pour until antifreeze flows in air compressor water outlet hose.



F07E0NA

1. *Air compressor water outlet hose*

Remove pinchers in this order to allow proper flow of antifreeze.

1. Bleed outlet hose.
2. Crankcase cooling cover outlet hose.
3. Engine cylinder drain hose.
4. Water outlet hose.

Pour approximately 200 mL (7 oz) of antifreeze in the water regulator valve supply hose to allow antifreeze flowing through the valve and into muffler to protect it.

Remove temporary hose and reconnect engine water outlet hose.

All Models

Most of the antifreeze will drain out when removing the hose pinchers. Use a container to recover it. DISPOSE 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 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 DI models, always check for fault codes recorded in the MPEM first using the VCK (vehicle communication kit (P/N 529 035 676). If a fault code is detected, service the fault code and recheck operating conditions. Refer to **Diagnostic Procedures** in ENGINE MANAGEMENT section.

ENGINE WILL NOT START

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Engine does not turn over	• DESS operation non functional	• If 2 short beeps are not heard when installing safety lanyard, refer to ELECTRICAL SYSTEM and ENGINE MANAGEMENT
	• Safety lanyard switch or harness damaged	• Replace
	• Burnt fuse on MPEM or in rear electrical box: battery, starting system, fuel pump (**DI models**)	• Check wiring then replace fuse
	• Starting system fuse keeps on burning	• Check wiring, solenoid and MPEM
	• Discharged battery	• Check/recharge
	• Defective Start/stop switch	• Check, refer to **Starting System** or ENGINE MANAGEMENT
	• Battery connections	• Check/clean/tighten
	• Water/fuel hydrolock	• Check, refer to section MAINTENANCE
	• Starter	• Check, refer to section ELECTRICAL SYSTEM
	• Seized engine	• Check/repair as needed
	• Seized engine	• Check, refer to section ENGINE
	• Hydraulically locked air compressor (**DI models**)	• Check/repair as needed
	• Seized jet pump	• Check, refer to section PROPULSION SYSTEM
	• Faulty sensor (**DI models**) or MPEM	• Check faulty codes in MPEM memory, refer to section ENGINE MANAGEMENT
Engine turns slowly	• Loose battery cable connections	• Check/clean/tighten
	• Discharged/weak battery	• Check/charge/replace
	• Restriction in jet pump	• Check/clean pump
	• Seizure in jet pump	• Inspect, refer to section PROPULSION SYSTEM
	• Partial engine hydrolock	• Check, refer to section MAINTENANCE
	• Partial engine seizure	• Check compression, refer to section ENGINE
	• Worn starter	• Check, refer to section ELECTRICAL SYSTEM

ENGINE WILL NOT START (cont'd)

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Engine turns over	• Faulty component in the fuel injection system (**DI models**)	• Check for fault codes with the VCK (vehicle communication kit). Refer to **Diagnostic Procedures** in ENGINE MANAGEMENT
	• Engine drowned mode is active	• Release throttle lever
	• Low battery voltage	• Recharge or replace battery
	• Low or no fuel pressure (**DI models**)	• Check fuel pump operation • Check fuel pump pressure output • Check air/fuel rail
	• Fuel injectors not working (**DI models**)	• Check fuel injector operation. Replace as necessary • Check output signal from MPEM
	• Low or no air pressure (**DI models**)	• Check air/fuel rail • Check air compressor system • Check RAVE valve system for leaks
	• Direct injector not working (**DI models**)	• Check direct injector operation • Check output signal from MPEM
	• No spark at the spark plug	• Check spark plugs condition and replace as necessary • Check ignition system and repair
	• Defective MPEM	• Replace MPEM
	• Defective crankshaft position sensor	• Check operation of CPS and replace if necessary
	• Fuel water-contaminated	• Check/siphon and refill
	• Dirty fuel filter	• Clean/replace
	• Water in engine	• Check, refer to section MAINTENANCE
	• Carburetion (**carburetor models**)	• Check, refer to section FUEL SYSTEM
	• Ignition	• Check, refer to section ELECTRICAL SYSTEM
	• Burnt fuel pump fuse (**DI models**)	• Check wiring harness and replace fuse
	• Flooded engine – Carburetor needle valve stuck open (**carburetor models**)	• Check, refer to section FUEL SYSTEM and COOLING SYSTEM on **DI models**
	• Internal engine damage	• Check, refer to sections ENGINE
	• Sheared flywheel key	• Check timing mark, refer to section ELECTRICAL SYSTEM
No spark at spark plugs	• Faulty rev limiter in MPEM (**carburetor models**)	• Replace MPEM
	• Faulty MPEM	• Replace MPEM

ENGINE HARD TO START

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
	• Water in fuel reservoir	• Flush reservoir and refill with fresh gas
	• Mechanical engine failure	• Check cylinder compression • Check for crankcase leaks • Check starting system
	• Spark plug faulty, fouled or worn out	• Check spark plug condition
	• Low fuel pressure (**DI models**)	• Check fuel pump operation. Refer to ENGINE MANAGEMENT • Check fuel pressure regulator. Refer to ENGINE MANAGEMENT
	• Low air pressure (**DI models**)	• Check air/fuel rail. Refer to ENGINE MANAGEMENT • Check air compressor system. Refer to ENGINE MANAGEMENT • Check RAVE valve for leaks
	• Water in fuel	• Flush fuel from tank and refill with fresh gas

ENGINE STARTS BUT RUNS ONLY AT IDLE SPEED

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
	• **DI models:** The DI system is in limp home mode.	• Refer to section ENGINE and check the fault codes in the MPEM

ENGINE MISFIRES, RUNS IRREGULARLY

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Weak spark	• Fouled, defective, worn spark plugs	• Check/verify heat range/gap/replace
	• Faulty MPEM	• Check, refer to section ELECTRICAL SYSTEM or ENGINE MANAGEMENT on **DI models**
	• Sheared flywheel key	• Check timing mark, refer to section ELECTRICAL SYSTEM
	• Too much oil supplied to engine	• Adjust oil injection pump
	• Bad ignition ground wiring	• Check wiring condition and proper grounding of ignition coil

ENGINE MISFIRES, RUNS IRREGULARLY (cont'd)

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Lean fuel mixture Dry spark plug (except when water fouled)	• Low fuel level	• Check/refill
	• Stale or water fouled fuel	• Check/siphon and refill
	• Fuel filter dirty or restricted	• Check/clean/replace
	• Carburetion dirty or out of adjustment (**carburetor models**)	• Check/clean/adjust, refer to section FUEL SYSTEM
	• Clogged direct injectors (**DI models**)	• Remove and clean direct injectors
	• Defective sensor or MPEM (**DI models**)	• Check faulty codes in MPEM memory, refer to section ENGINE MANAGEMENT
	• Leaking crankshaft seal(s) or intake (**carburetor models**)	• Pressure check engine, refer to section ENGINE
	• Restricted fuel valve (**carburetor models**)	• Check/replace
	• Loose carburetor (**carburetor models**)	• Tighten carburetors
Rich fuel mixture Fouled spark plug	• Partially closed choke (**carburetor models**)	• Check/adjust choke cable
	• Carburetor adjustment (**carburetor models**)	• Check/adjust, refer to section FUEL SYSTEM
	• Loose main jet (**carburetor models**)	• Check, refer to section FUEL SYSTEM
	• Improper air/fuel rail pressure (**DI models**)	• Check pressures, refer to ENGINE MANAGEMENT
	• Direct injector(s) (**DI models**)	• Remove and replace direct injector(s), refer to section ENGINE MANAGEMENT
	• Defective sensor or MPEM (**DI models**)	• Check faulty codes in MPEM memory, refer to section ENGINE MANAGEMENT
	• Damaged reed valve	• Check, refer to **Bottom End** in ENGINE SECTION
	• Leaking crankshaft seal(s) or intake (**DI models**)	• Pressure check engine, refer to section ENGINE
	• Leak in RAVE valve system (**DI models**)	• Check, refer to ENGINE MANAGEMENT
	• Oil injection pump adjustment	• Check/adjust, refer to section LUBRICATION SYSTEM
	• Worn needles and seals (**carburetor models**)	• Check, refer to section FUEL SYSTEM
	• Fuel pressure and/or air pressure fluctuating (**DI models**)	• Inspect fuel and air pressure regulators. Refer to ENGINE MANAGEMENT
Start but run poorly	– **DI models:** check spark plug condition, check fault codes in the MPEM memory, check fuel pressure, check RAVE valves operation.	• Check, refer to section ENGINE MANAGEMENT. If some work has been performed on the unit, make sure injector wire connectors were not mixed. Refer to the wiring diagram for wire colors and positions
Also fuel injection misinjecting	– **DI models:** Bent or missing tooth on encoder wheel.	• Check, refer to ENGINE MANAGEMENT under Component inspection and adjustment

ENGINE CONTINUALLY BACKFIRES

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Weak spark	• Fouled, defective spark plugs (**carburetor models**) • Malfunction of rev limiter in MPEM (**carburetor models**)	• Clean/replace • Clean/replace, refer to section ELECTRICAL SYSTEM
Spark plugs	• Spark plug leads or wiring reversed	• Check with wiring diagram
Ignition timing/TDC setting	• Incorrect setting • Sheared flywheel key	• Check/reset, refer to section ELECTRICAL SYSTEM • Check/replace, refer to sections ELECTRICAL SYSTEM and ENGINE
Carburetor (**if so equipped**)	• Carburetion too lean	• Check/adjust, refer to section FUEL SYSTEM
Engine	• Intake leak/crankshaft seal failure (**carburetor models**)	• Pressure check engine, refer to section ENGINE

ENGINE DETONATION OR PINGING

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Ignition	• Timing too far advanced • Spark plug heat range too high • Defective MPEM (**carburetor models**)	• Check/reset • Check/change to correct range • Check/replace, refer to section ELECTRICAL SYSTEM
Engine temperature	• Engine overheats • Fuel octane too low of poor quality	• Check, see engine overheats • Use good quality fuel

ENGINE LACKS ACCELERATION OR POWER

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
	• Weak spark	• Check/replace, refer to section ELECTRICAL SYSTEM
	• Carburetion, jetting too rich/lean (**carburetor models**)	• Check/adjust, refer to section FUEL SYSTEM
	• Throttle does not open fully (**carburetor models**)	• Check/readjust, refer to section FUEL SYSTEM
	• Low compression	• Check/repair, refer to section ENGINE
	• Exhaust system restriction	• Check/clean
	• Water in fuel or oil	• Check/siphon/replace
	• Debris in carburetor needle valve (**carburetor models**)	• Check/clean, refer to section FUEL SYSTEM
	• Impeller leading edge damaged	• Check/replace, refer to section PROPULSION SYSTEM
	• Twisted crankshaft	• Check, refer to section ENGINE
	• Clogged direct injectors (**DI models**)	• Remove and clean direct injectors
	• Low fuel pressure	• Check fuel line and fuel pump pressure
	• Incorrect throttle position sensor (TPS) adjustment (**DI models**)	• Check and adjust TPS, refer to section ENGINE MANAGEMENT
	• Overheated engine	• See ENGINE OVERHEATS in this chart
Engine revs lower than its maximum operational RPM	• RAVE valve does not open	• Check, refer to section ENGINE
Peak performance is delayed until higher RPM range is reached	• RAVE valve is stuck opened	• Check, refer to section ENGINE

ENGINE STOPS RUNNING

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Engine was running below 2000 RPM. No maintenance light.	• Electrical noise (**DI models**)	• Refer to section ENGINE MANAGEMENT
Engine stalls at idle	• Low air pressure (**DI models**)	• Check air delivery circuit for leaks • Check air compressor
Engine start but stops after approximately 2 sec.	• Engine running out of fuel (**DI models**) • Low air pressure (**DI models**)	• Check fuel delivery system for proper fuel pressure • Check air system (compressor, air/fuel rail etc.)

ENGINE CANNOT REACH MAXIMUM RPM

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
	• RAVE valve does not open	• Check, refer to section ENGINE and COOLING SYSTEM
	• Faulty water regulator valve	• Check, refer to COOLING SYSTEM
	• **DI models:** The DI system is in limp home mode. "MAINT" is displayed on Information Center	• Refer to section ENGINE and COOLING SYSTEM and check the fault codes in the MPEM
	• Low fuel pressure (**DI models**)	• Check fuel pump pressure output
	• Jet pump related problem	• Check propulsion components. Refer to JET PUMP
	• Exhaust system blockage	• Check and repair

ENGINE RUNS TOO FAST (VEHICLE CANNOT REACH ITS TOP SPEED)

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Engine RPM too high	• Faulty rev limiter in MPEM (**carburetor models**)	• Check, refer to section ELECTRICAL SYSTEM
	• Improper impeller pitch (too low)	• Check/replace, refer to section PROPULSION SYSTEM
Jet pump cavitation	• Damaged leading or trailing edge of impeller	• Check/replace **NOTE:** Leading edge damage contributes to poor performance from start. Trailing edge damage contributes to poor top performance and stator vanes erosion.
	• Sealing of ride plate, jet pump support or jet pump	• Check/reseal, refer to section PROPULSION SYSTEM or HULL/BODY

ENGINE OVERHEATS

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
Monitoring beeper sounds continuously	• Restricted jet pump water intake	• Check/clean
	• Cooling system restriction	• Check/flush, refer to section MAINTENANCE
	• Grounded temperature sensor or sensor wire (**carburetor models**)	• Check/repair/replace

ABNORMAL NOISE FROM PROPULSION SYSTEM

OTHER OBSERVATION	POSSIBLE CAUSE	REMEDY
	• Weeds/debris caught in intake grate or impeller	• Check/clean
	• Low oil level in jet pump	• Check/troubleshoot source of leak/refill supply, refer to section PROPULSION SYSTEM
	• Worn anti-rattle system	• Check/replace pusher in cover, refer to section PROPULSION SYSTEM
	• Damaged or bent drive shaft	• Check/replace, refer to section PROPULSION SYSTEM
	• Broken engine mounts	• Check/replace, refer to section ENGINE

NOTE: Prior to replacing a MPEM, refer to the MPEM section or **MPEM replacement** in the ENGINE MANAGEMENT section and read carefully the tests to do before replacing a MPEM that could otherwise be good.

TABLE OF CONTENTS

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.

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.

Two areas of the engine will be tested in sequence as per the diagnostic flow chart (see the end of this subsection).

1. Engine Cooling System.
2. Bottom End and Top End.

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.

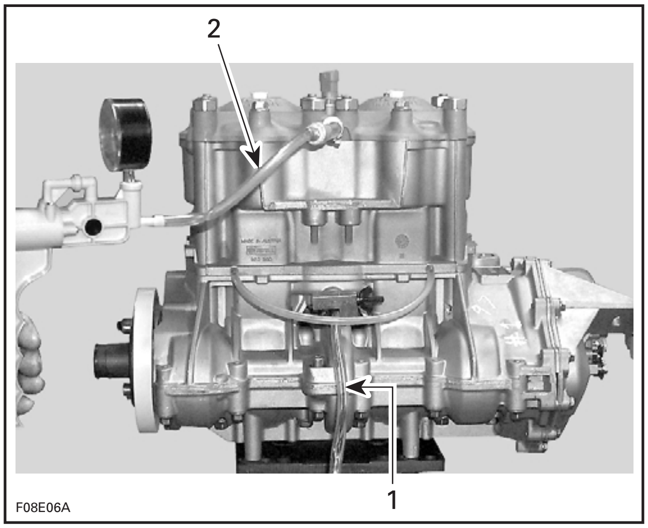
Install the appropriate exhaust manifold plate from the Supplementary Engine Leak Test Kit (P/N 295 500 780). Tighten plate using fasteners provided in the kit.

NOTE: Do not torque plate excessively.

Install a hose pincher on engine drain hose.

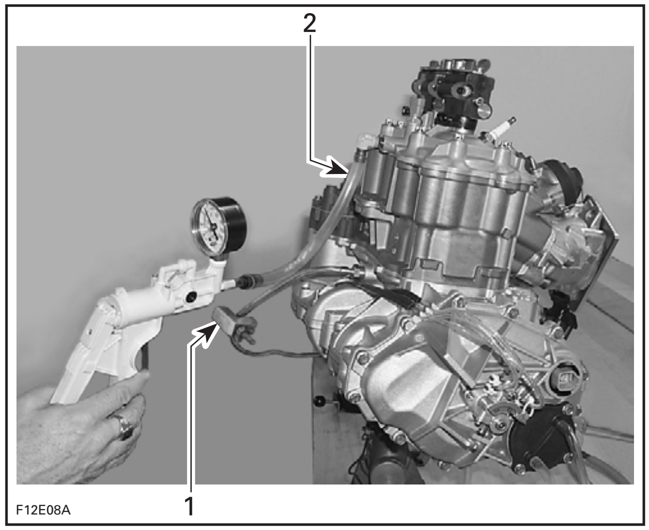
Use hoses provided in the kit and install them on the engine.

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



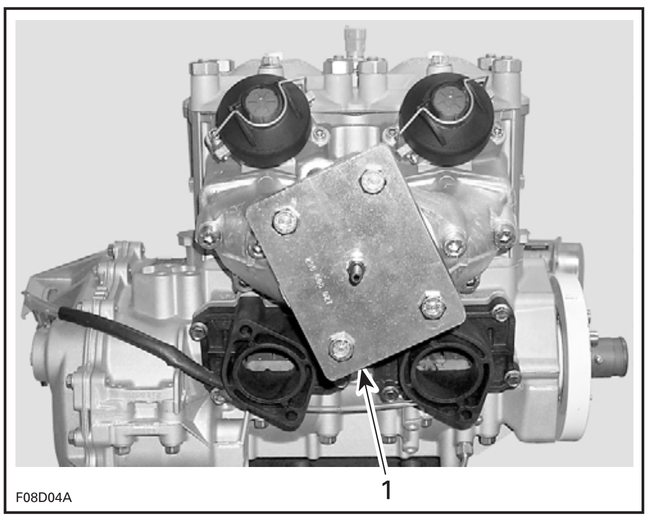
947 CARBURETOR-EQUIPPED ENGINE — REAR VIEW

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



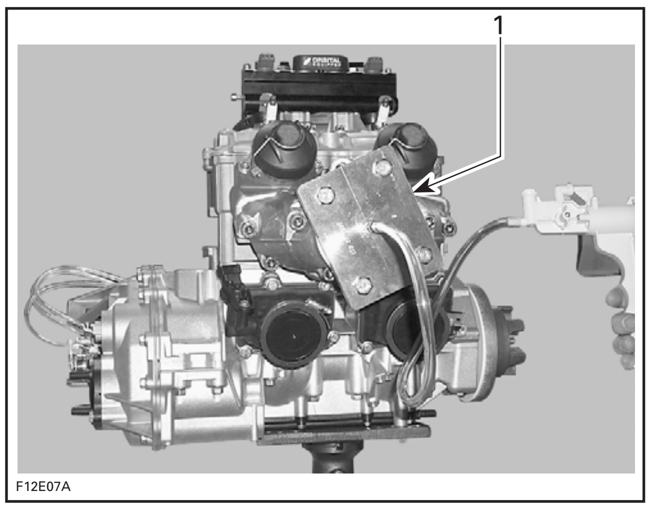
947 DI ENGINE — SIDE VIEW

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



947 CARBURETOR-EQUIPPED ENGINE — FRONT VIEW

1. Exhaust manifold plate



947 DI ENGINE — FRONT VIEW

1. Exhaust manifold plate

NOTE: Water is not required for testing. On the DI models, it is not necessary to pressurize the bottom crankcase cover nor the magneto cover. There is no possible water leak path toward the internal components of the engine.

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 and temperature sensors. 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

NOTE: Use the intake and exhaust plates included in the Supplementary Engine Leak Test Kit (P/N 295 500 780).

Carburetor-Equipped Models

Remove the carburators and gaskets. Make sure the surface of the intake manifold are clean.

Install the intake plates with fasteners from the kit and tighten adequately.

NOTE: Use the intake and exhaust plates included in the Supplementary Engine Leak Test Kit (P/N 295 500 780).

DI Models

Remove throttle bodies on DI models.

Install intake manifold plugs (P/N 529 035 708).

All Models

Remove the RAVE valves and gaskets.

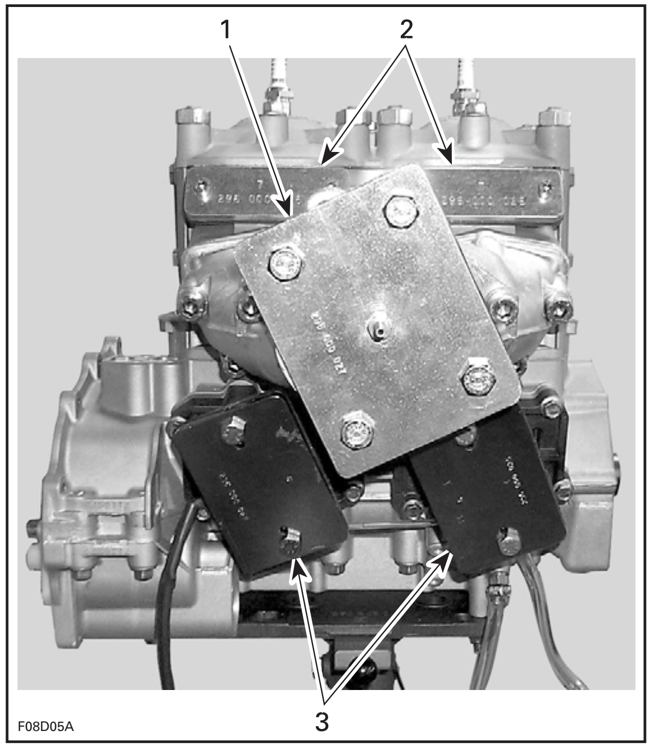
Install the RAVE valve plate with fasteners from the kit and tighten adequately.

NOTE: The boot (carburetor-equipped engines) and O-ring can be checked for leakage with the valve in place. Simply remove the cover to expose the parts.

Make sure the spark plugs (and the air/fuel rail on DI engines) are installed and tightened.

Block pulse hose (carburetor-equipped engines) using a hose pincher.

Install pump to the exhaust plate fitting.



947 CARBURETOR-EQUIPPED ENGINE SHOWN

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
– direct injector sealing (DI engines)
– cylinder head gasket
– cylinder base gasket
– crankcase halves
– intake flanges
– engine plugs
– exhaust manifold.

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

Check for leak through cournterbalancing shaft seal toward air compressor (**DI engines**). Air bubbles in lowest fitting (oil return line) underneath compressor indicates a seal leakage.

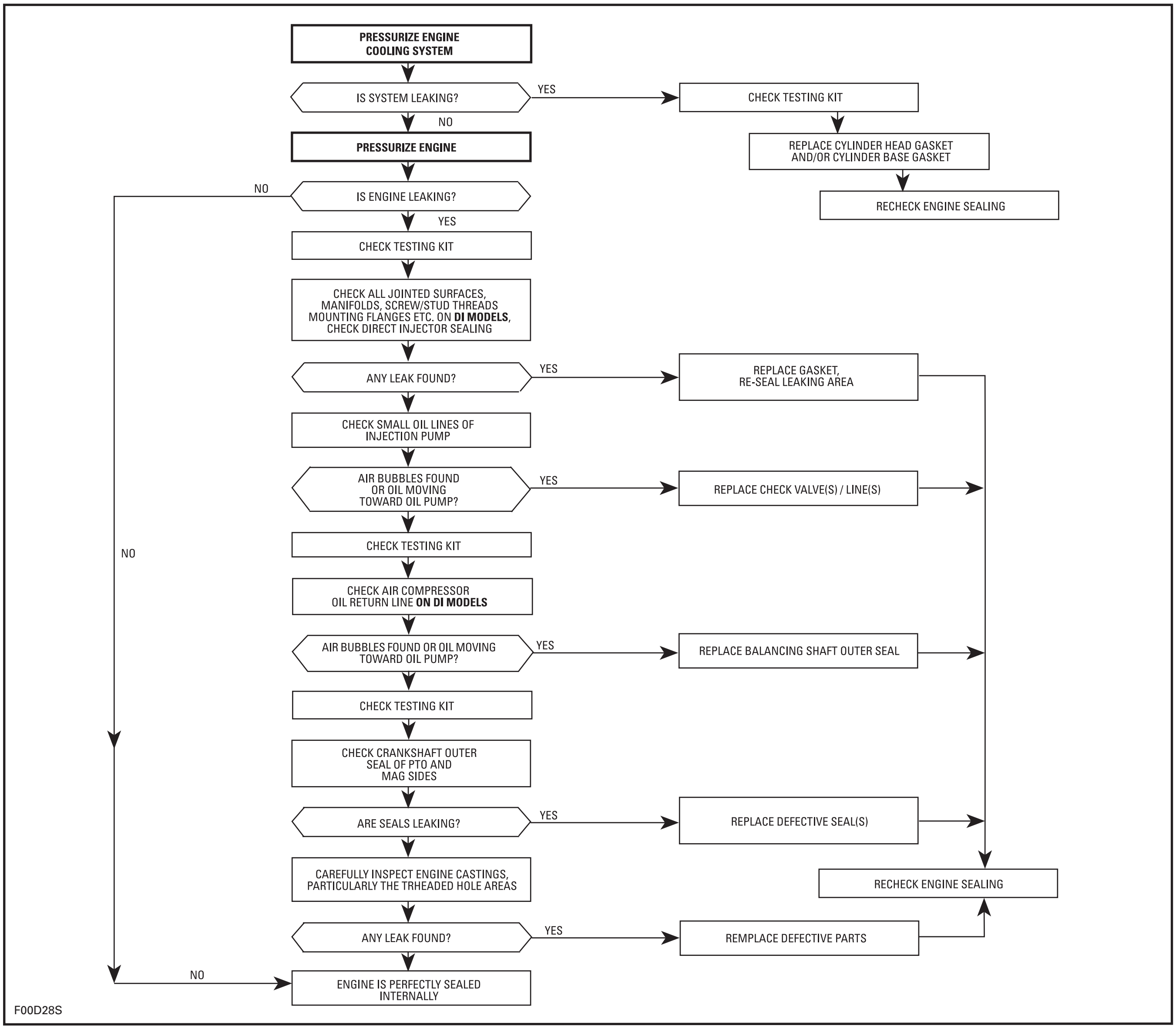
If there is still some leakage, remove the PTO flywheel to verify outer seal.

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

If none of the above components is leaking, it could indicates 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.

ENGINE LEAKAGE DIAGNOSTIC FLOW CHART

947 Engine



REMOVAL AND INSTALLATION

GENERAL

On DI 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

DI Models

– Use the VCK (Vehicle Communication Kit) (P/N 529 035 676) and release the fuel pressure in the fuel system. Refer to ENGINE MANAGEMENT section.

All Models

In order to remove engine from watercraft proceed as follows.

Disconnect battery cables from battery.

⚠ WARNING

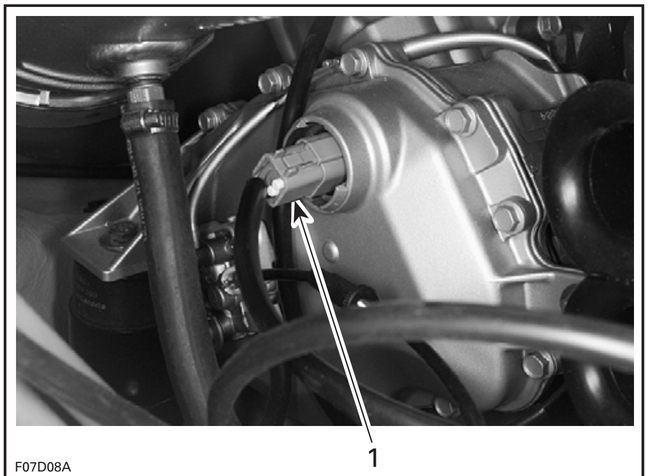
Always disconnect battery cables exactly in the specified order, BLACK negative cable first then the RED positive battery cable last.

Electrical Connections

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

Disconnect temperature sensor wire and spark plug cables.

Disconnect magneto wiring harness.



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1. *Unplug connector*

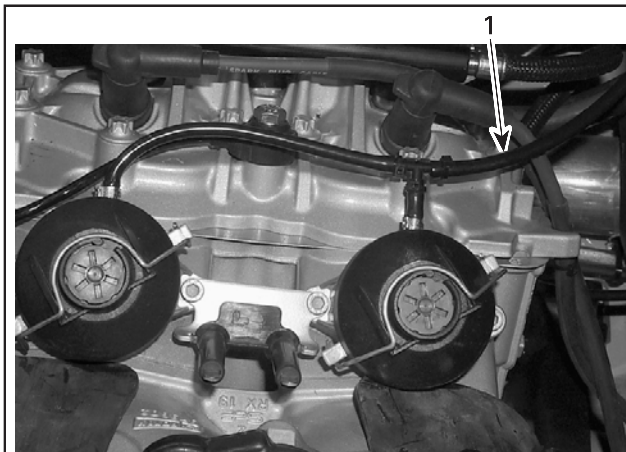
DI Models

Disconnect throttle position sensors (TPS), manifold air pressure sensor (MAPS) and manifold air temperature sensor (MATS).

Disconnect connectors from fuel injectors and direct injectors.

Disconnect connector from knock sensor.

Disconnect RAVE valve hose where shown. Inspect hose. If it has hardened, replace hose.



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1. *Disconnect hose here*

Refer to ENGINE MANAGEMENT for location of sensors and connectors.

Unplug air compressor lines (inlets and outlets): cooling, oil and air.

All Models

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.

Disconnect air compressor 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/Throttle Body

Carburetor-Equipped Models

Turn fuel valve to OFF.

Disconnect fuel supply and fuel return hoses.

To remove carburetors, refer to CARBURETOR for proper procedure.

DI Models

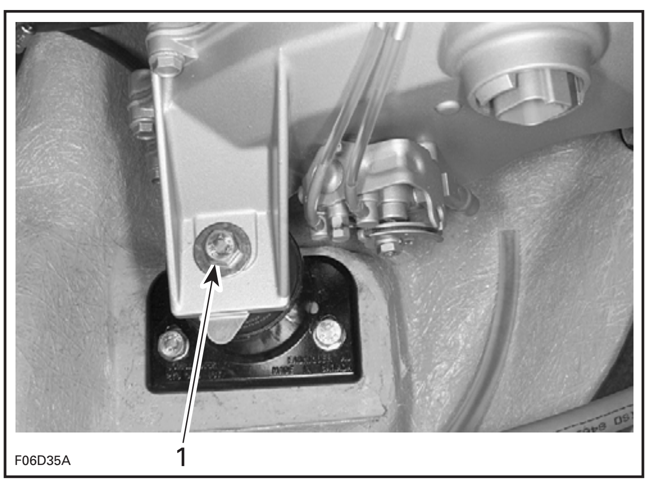
Remove air/fuel rail. Refer to ENGINE MANAGEMENT.

All Models

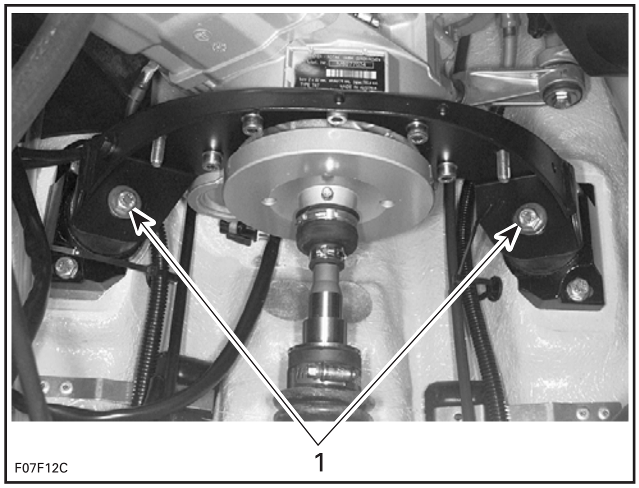
Engine Support

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.



FRONT SUPPORT
1. Remove screw



REAR SUPPORT
1. Remove screws

Lifting Engine

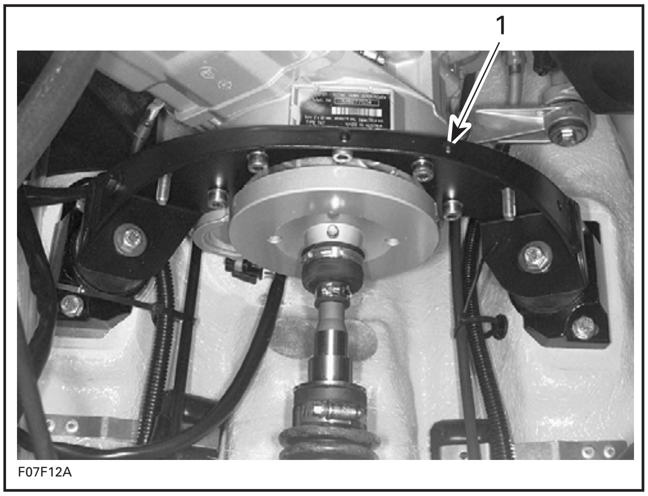
Engine can be easily lifted by inserting a hook into exhaust manifold eyelet.

TYPICAL

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.

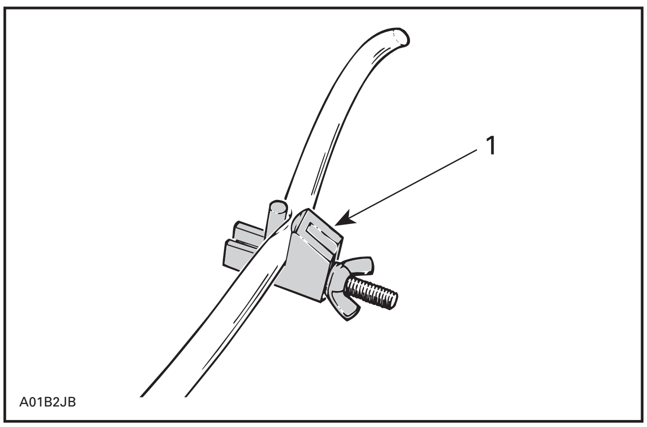


TYPICAL
1. *Rear support*

Removal of Remaining Components

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

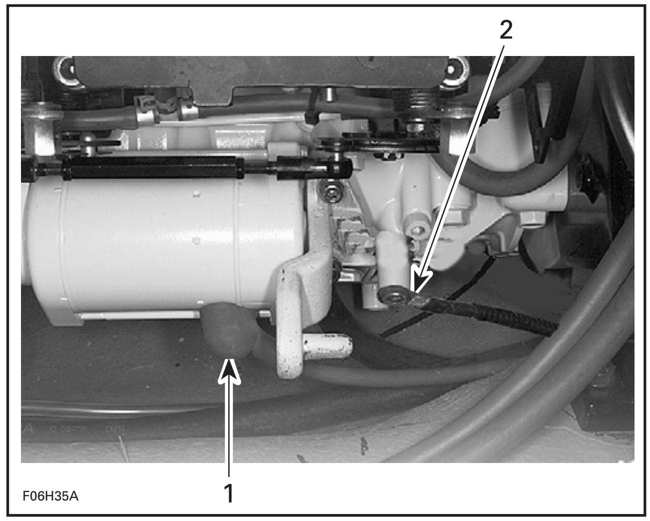
Install a hose pincher to oil supply hoses of oil injection pump then, disconnect hose.



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

Disconnect RED positive cable from starter post.

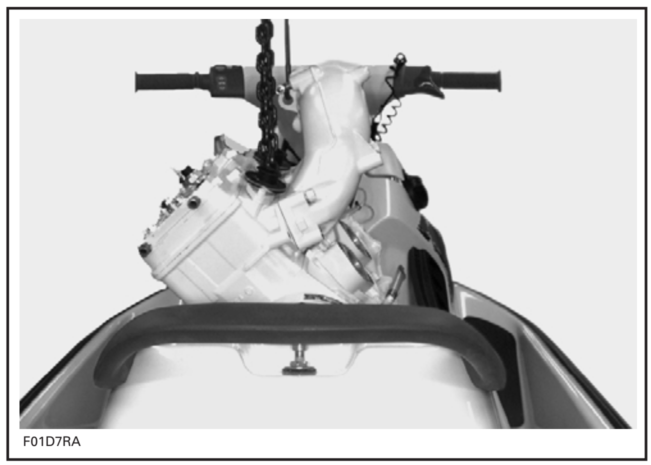
Disconnect BLACK negative cable from engine crankcase.



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.

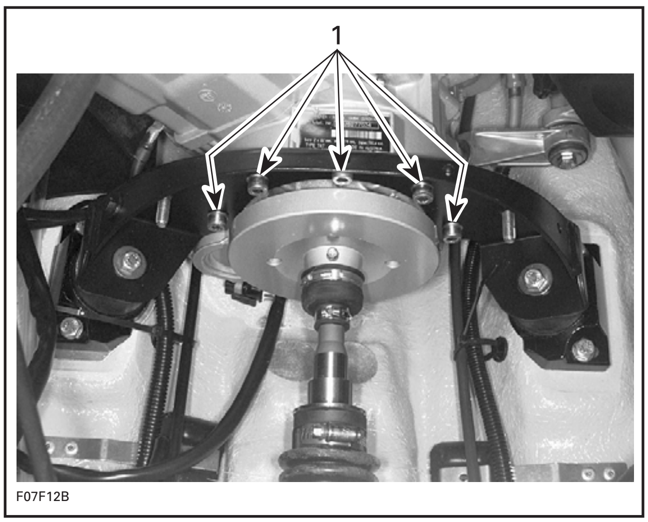
Rubber Mount, Shim and Screw

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

Apply Loctite 243 (blue) to rear engine support screws and torque to 25 N•m (18 lbf•ft).



TYPICAL
1. Torque engine support screws to 25 N•m (18 lbf•ft)

Positive Starter Cable

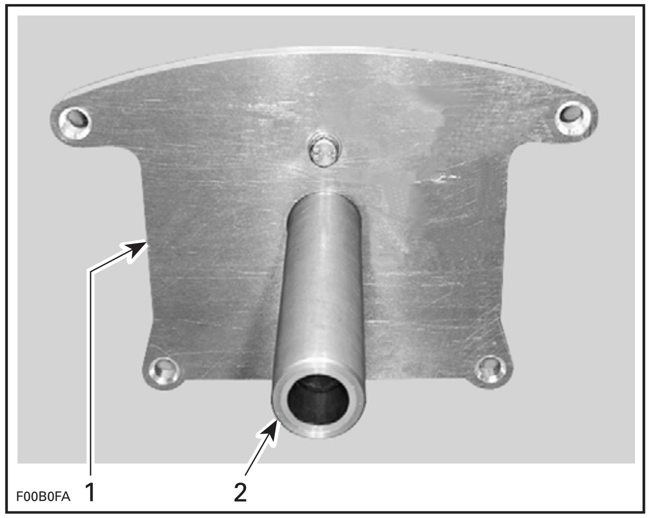
Torque nut of positive starter cable to 6 N•m (53 lbf•**in**). Apply dielectric grease on nut.

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.

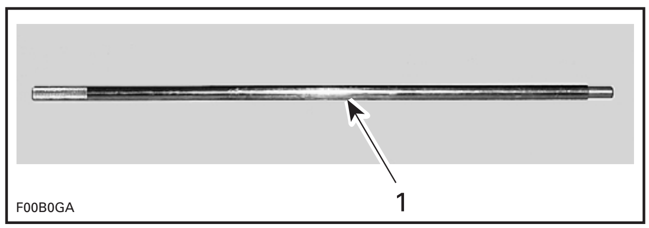
Support plate kit (P/N 529 035 506).

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



1. Plate
2. Support

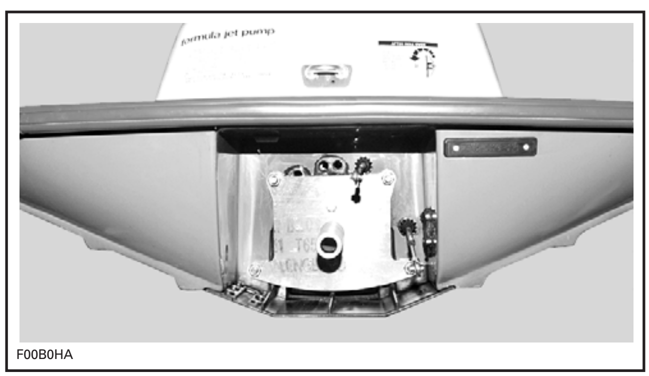
Alignment shaft (P/N 295 000 141).



1. Alignment shaft

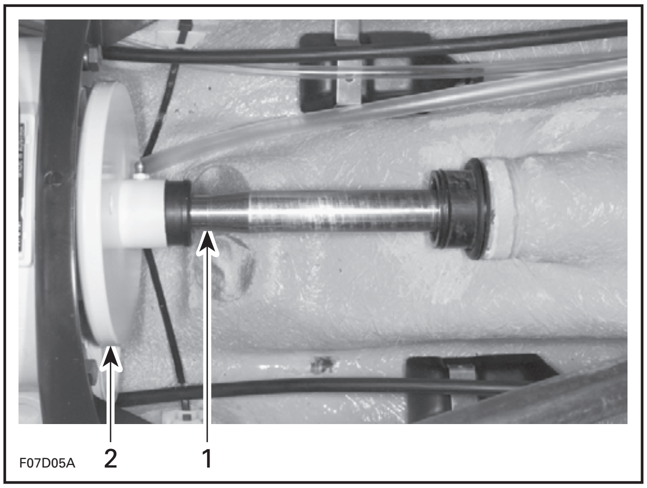
To verify alignment proceed as follows:

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



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

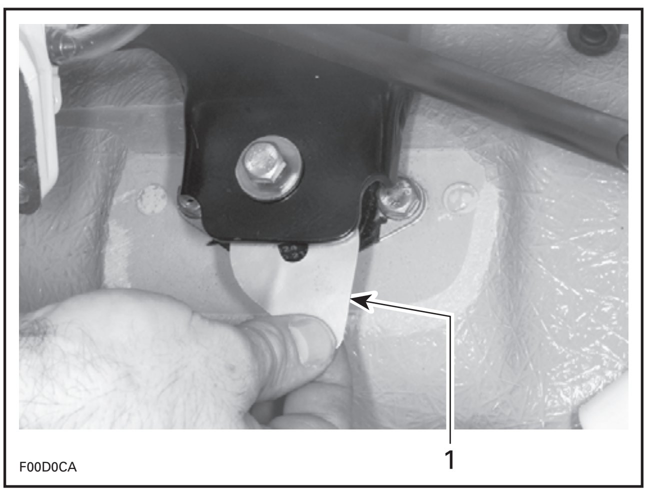
NOTE: Ensure the protective hose and carbon ring (or seal carrier) is removed to check engine alignment. If the alignment is correct, the shaft will slide easily without any deflection in PTO flywheel.



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.



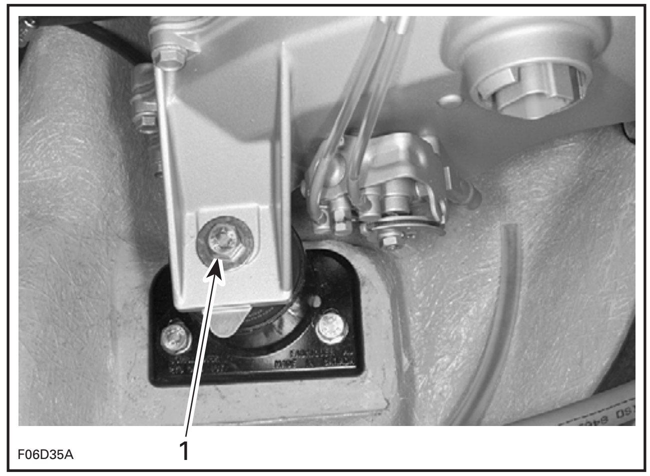
TYPICAL
1. *Shim*

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

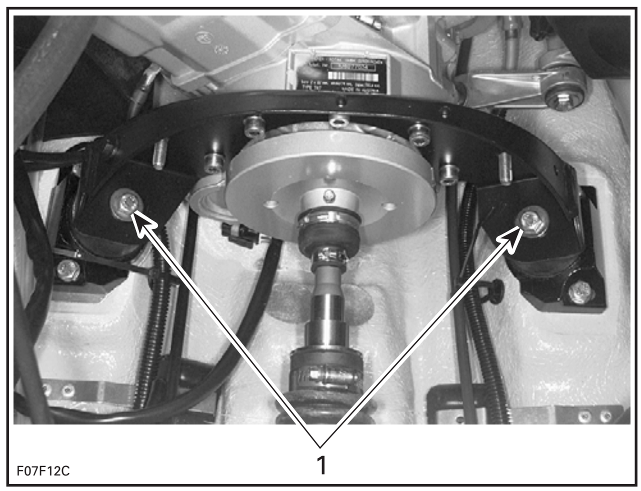
Engine Support Screws

Apply Loctite 243 (blue) on screw threads.

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



FRONT ENGINE SUPPORT
1. *Torque to 25 N•m (18 lbf•ft)*



REAR ENGINE SUPPORT
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 and adjust throttle cable as specified in ENGINE MANAGEMENT.

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.

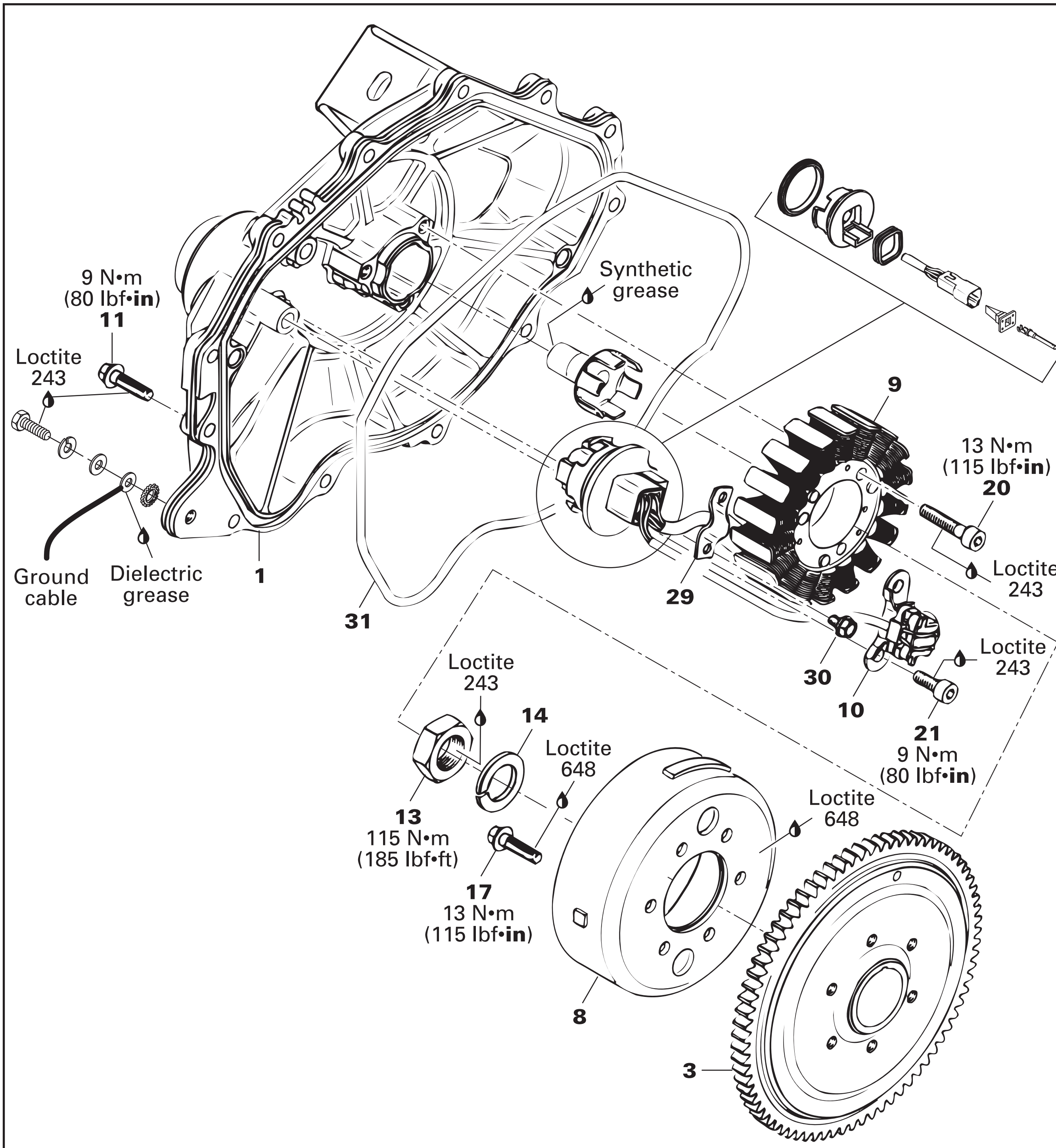
Verify all electrical connections.

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

947 Carburetor-Equipped Engine



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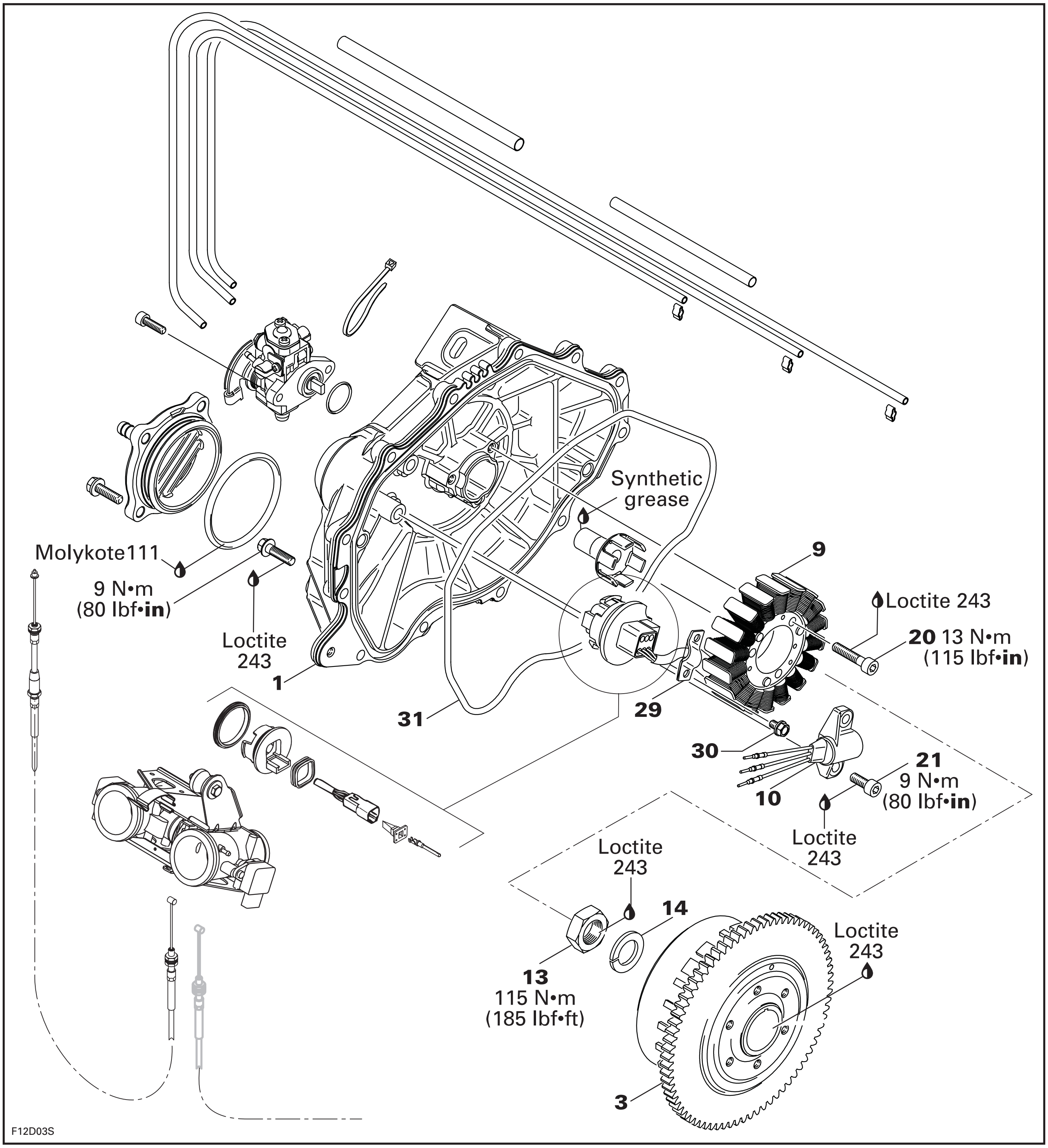
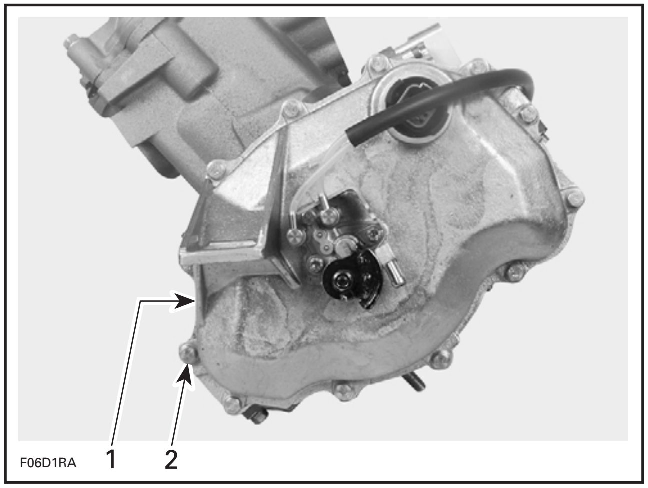
947 DI Engine



DISASSEMBLY

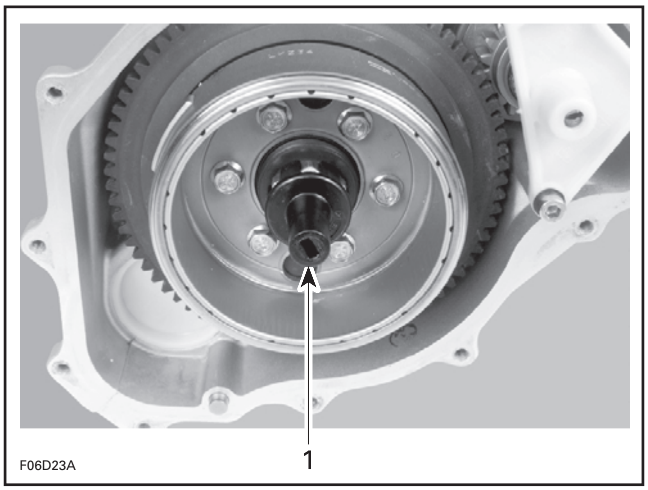
Cover

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



TYPICAL
1. Cover
2. Screw

Remove oil pump shaft from flywheel nut.

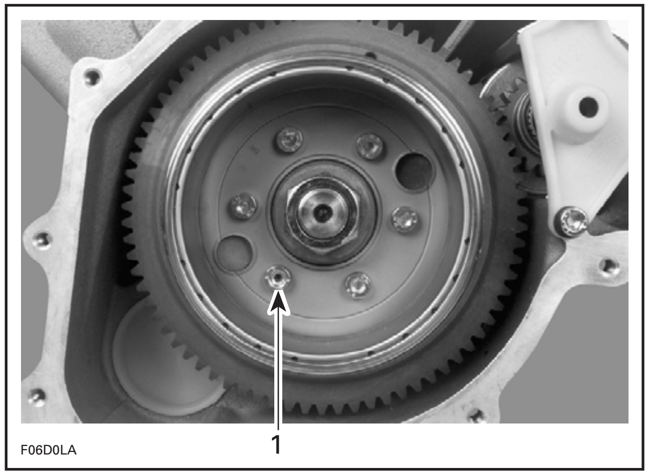


TYPICAL
1. Remove oil pump shaft

Rotor and Flywheel

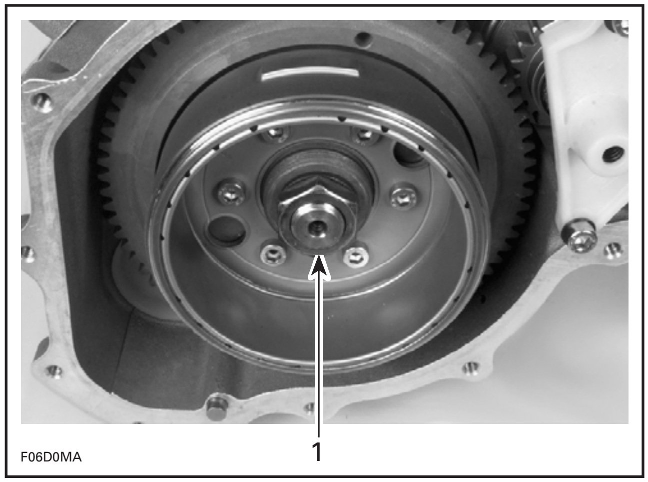
To remove the rotor **no. 8** or the flywheel **no. 3**, the crankshaft must be locked. For procedure, refer to BOTTOM END.

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



TYPICAL
1. Screw

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



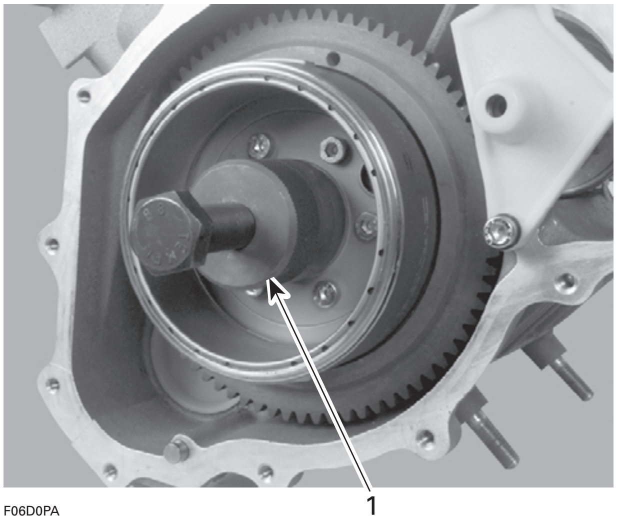
TYPICAL
1. Nut

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.

CAUTION: Ensure to completely screw the puller until it bottoms. Otherwise, not enough threads would be engaged and damage may occur.



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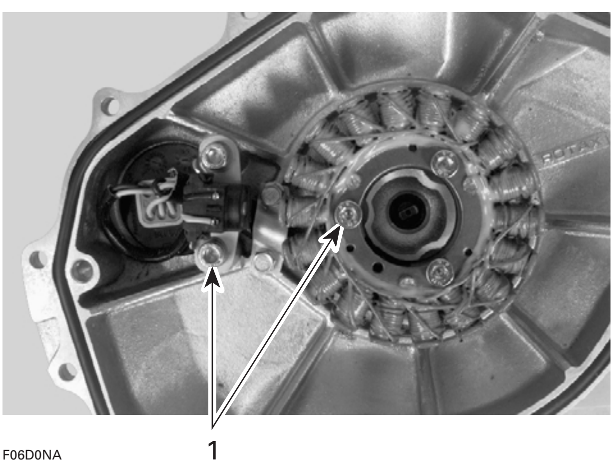
TYPICAL
1. *Puller*

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

CAUTION: Be careful after flywheel removal not to bend the encoder wheel teeth. Also pay attention when putting away. If you suspect a bent tooth, refer to ENGINE MANAGEMENT for inspection procedure.

Stator and Trigger Coil/CPS (Crankshaft Position Sensor)

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



F06D0NA

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 using acetone. Apply the acetone on a rag first then clean the crankshaft.

ASSEMBLY

Stator and Trigger Coil/CPS (Crankshaft Position Sensor)

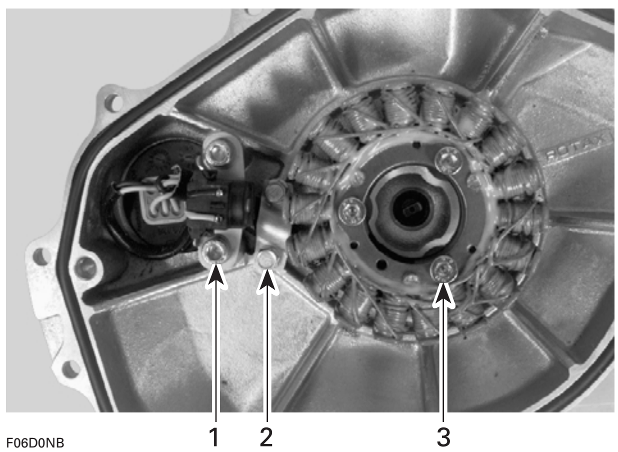
Install the stator **no. 9** and trigger coil/CPS **no. 10** in engine magneto cover. Torque screws to 9 N•m (80 lbf•**in**).

Reinstall wiring harness bracket **no. 29** using taptite screws **no. 30**.

Torque trigger coil/CPS 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/CPS is not adjustable.



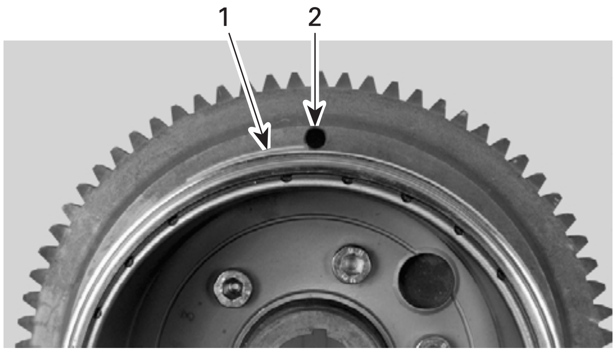
F06D0NB

TYPICAL
1. *Torque to 9 N•m (80 lbf•**in**)*
2. *Taptite screws*
3. *Torque to 13 N•m (115 lbf•**in**)*

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.



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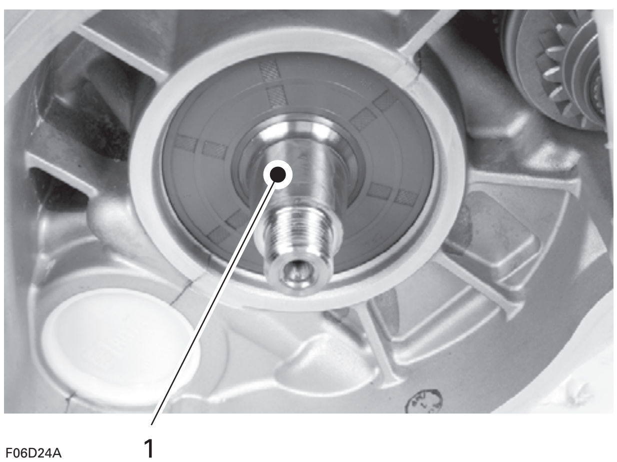
1. *Protrusion*
2. *Hole*

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.



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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).

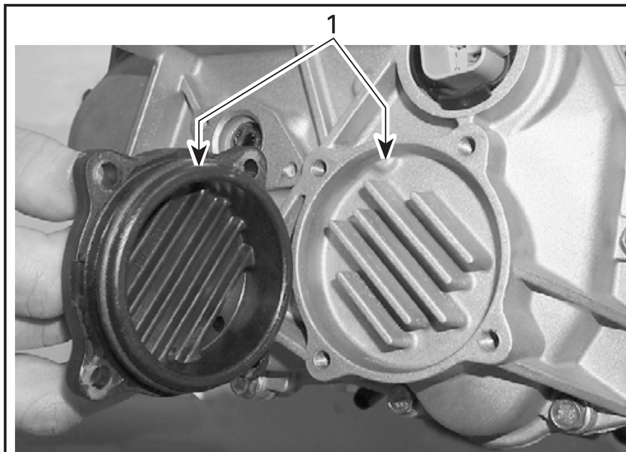
Cover

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**).

DI Models

If heat exchanger cover has been removed, ensure to align its notch with the emboss in casing.

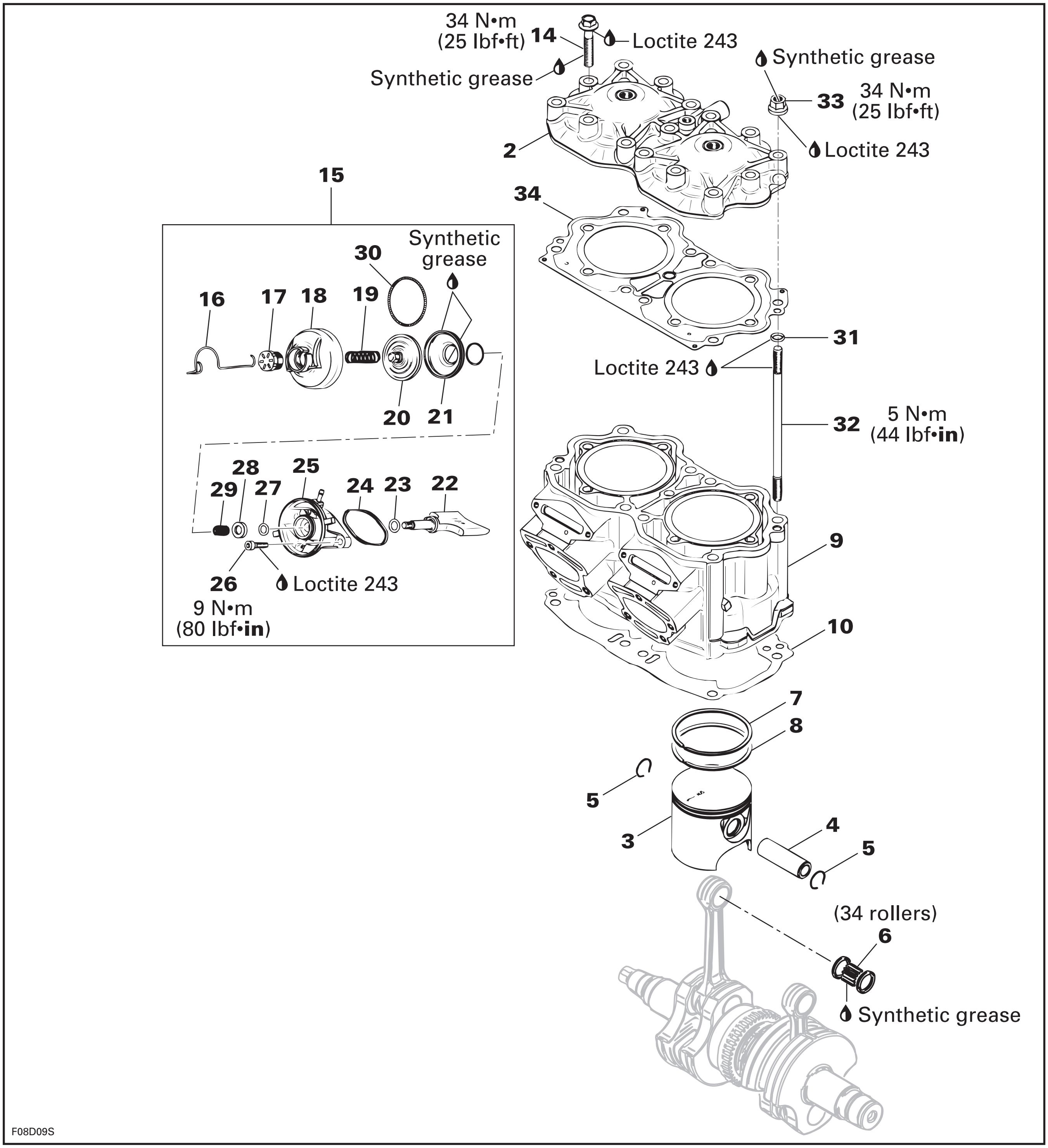


F12R0EA

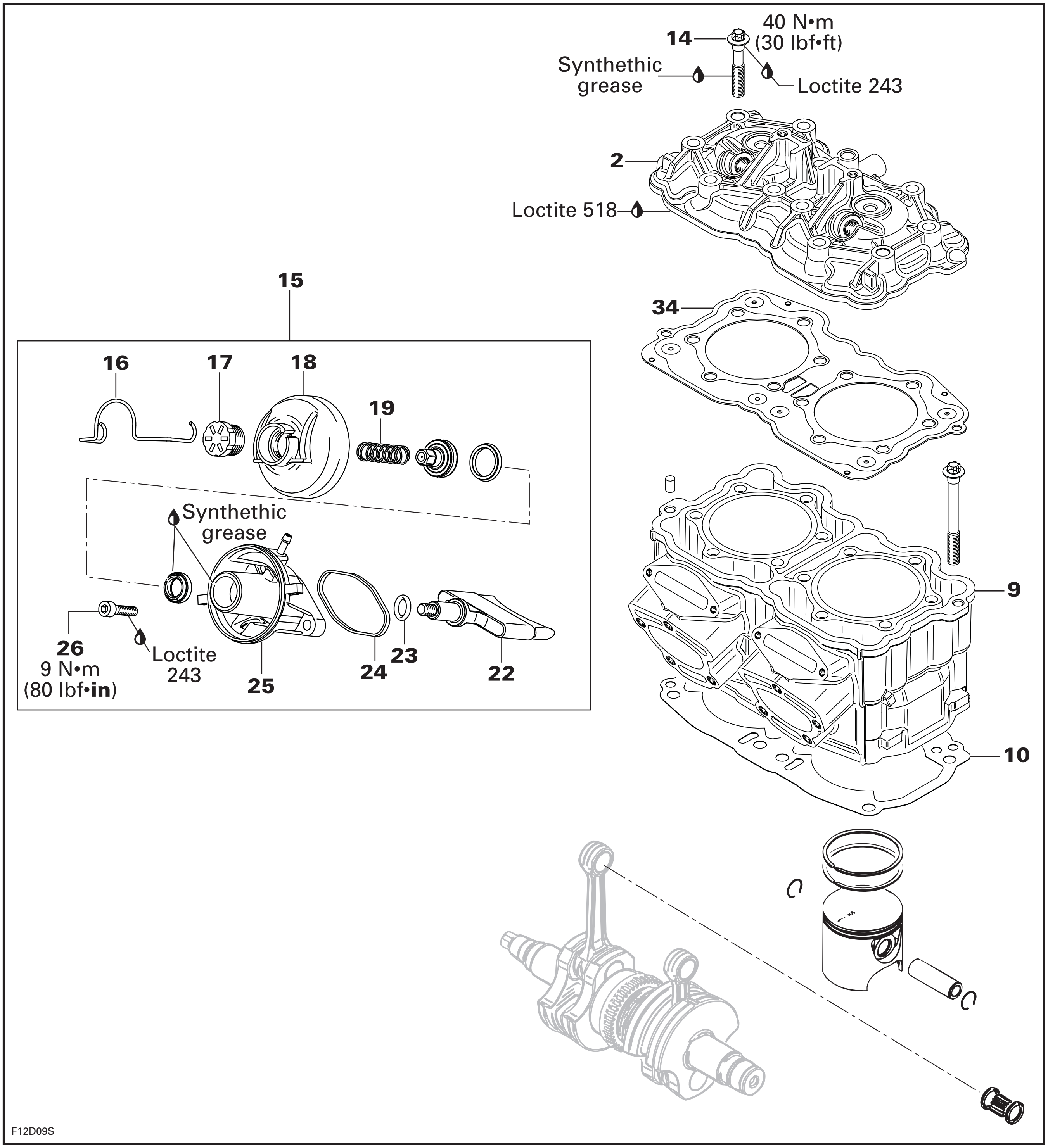
1. *Align notch with the emboss*

TOP END

947 Carburetor-Equipped Engines



947 DI Engines



GENERAL

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

The 947 engine uses reed valves in the crankcase.

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

CAUTION: No engine components can be interchanged between engines.

RAVE System (Rotax Adjustable Variable Exhaust)

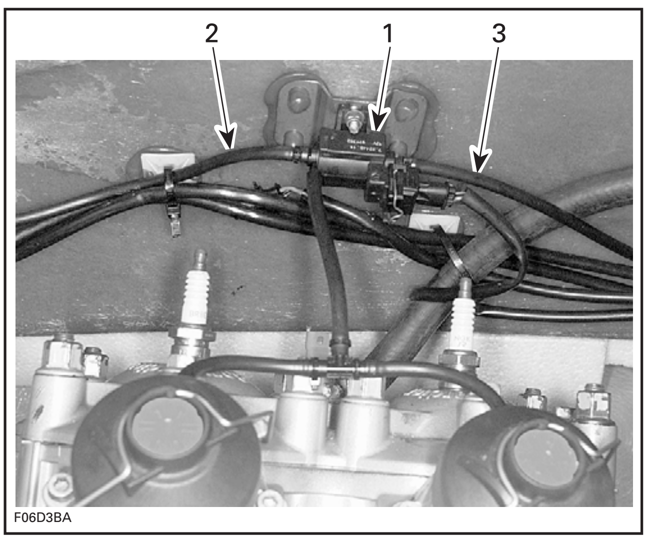
BASIC OPERATION

The RAVE system changes the exhaust port height. The exhaust port height is controlled by the MPEM according to the engine RPM.

Carburetor-Equipped Engines

On top of the RAVE valves, there is a red plastic adjustment knob. Turning the adjustment in or out changes the preload on the return spring. On this engine, the spring preload does not have a significant effect on the valve operation.

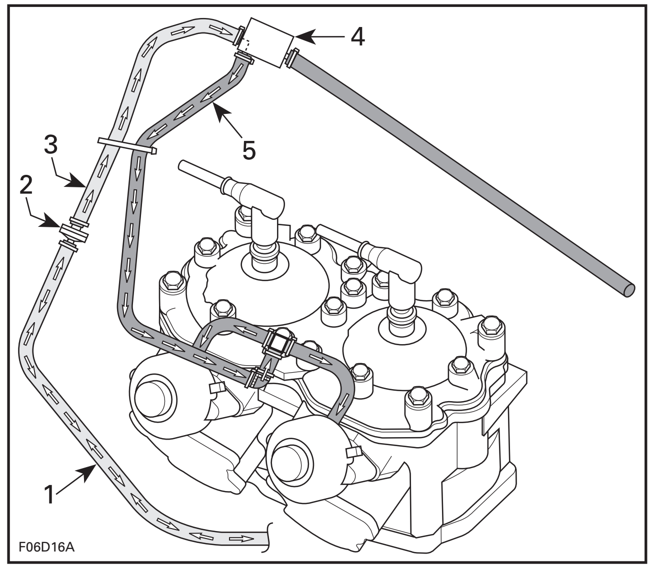
To open the RAVE valves, the MPEM activates a solenoid which directs the positive pressure from engine crankcase to the valves.



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

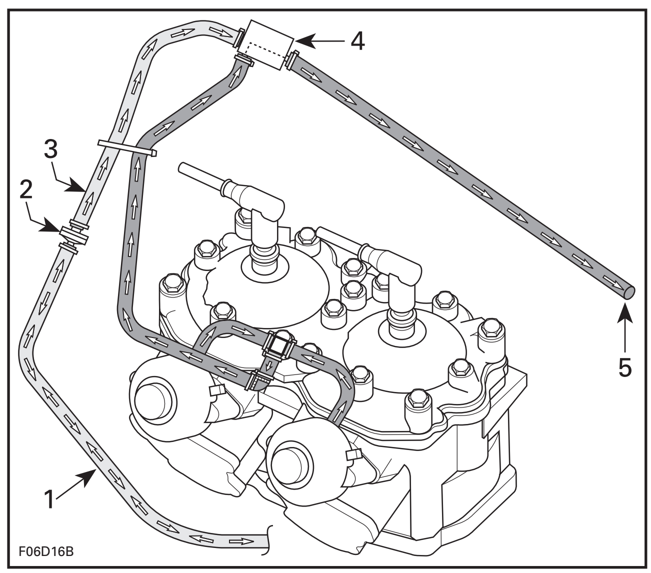
NOTE: A check valve on the pressure line eliminates the negative pressure from the crankcase.

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



RAVE VALVE OPENED

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

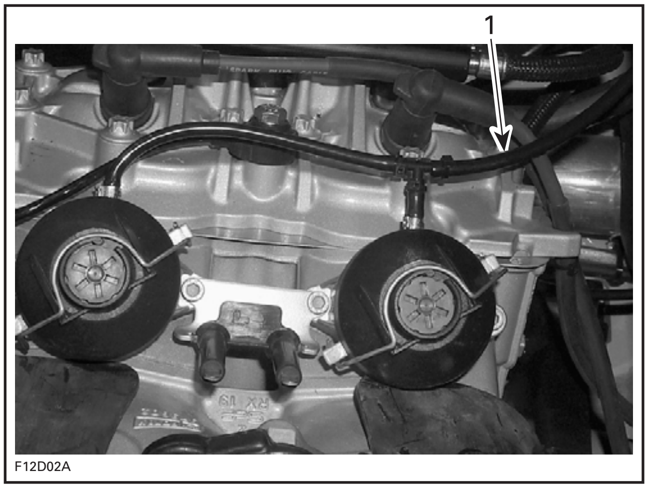


RAVE VALVE CLOSED

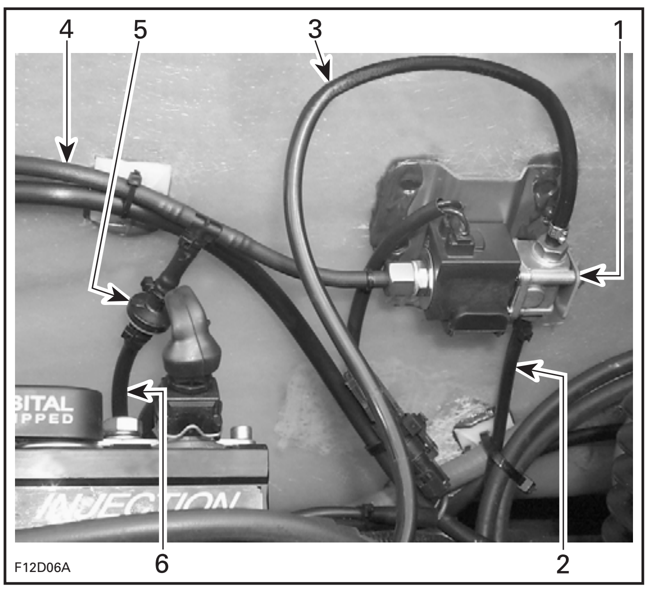
1. Pulse from crankcase
2. Check valve
3. Positive pressure blocked by the solenoid
4. Solenoid deactivated
5. RAVE valves are opened to atmosphere

947 DI Engines

To open the RAVE valves, the MPEM activates a solenoid which directs the pressure from air compressor to the valves.



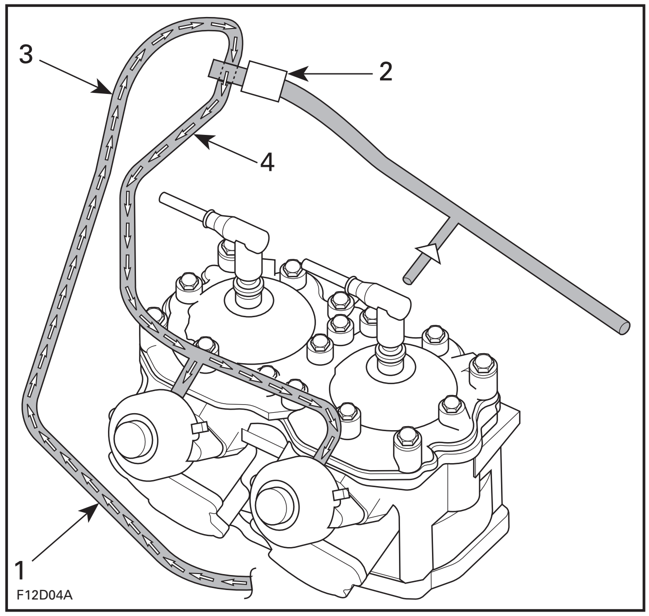
1. Pressure from solenoid



1. Solenoid
2. Pressure from air compressor
3. Pressure to RAVE valves
4. Vent to air intake silencer
5. Check valve
6. Vent from couterbalancing shaft oil cavity

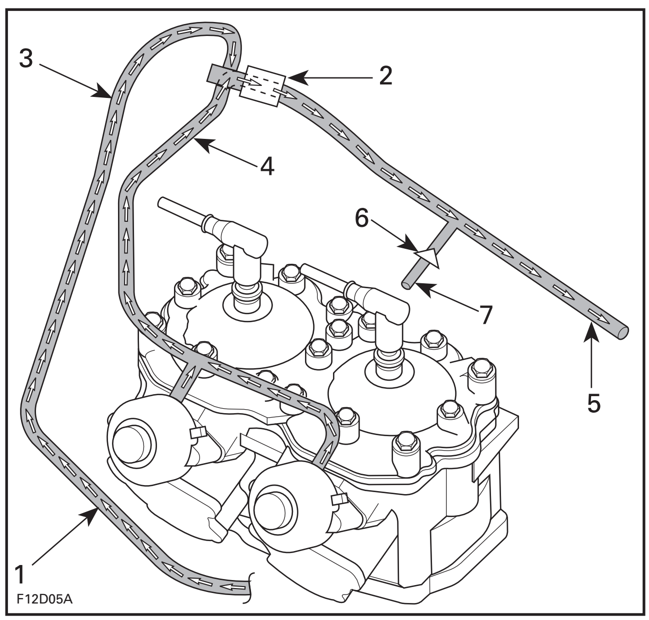
To close the RAVE valves, the MPEM deactivates the solenoid which blocks the air compressor pressure. The RAVE valves are opened to the atmosphere.

The vent on couterbalancing shaft oil cavity is necessary to prevent pressure buildup in the cavity by the air compressor piston movement. The check valve prevents the eventual possibility of any liquid that would otherwise flow toward the oil cavity and be trapped there.



RAVE VALVE OPENED

1. Pressure from air compressor
2. Solenoid activated
3. Pressure to solenoid
4. Pressure to RAVE valves



RAVE VALVE CLOSED

1. Pressure from air compressor
2. Solenoid deactivated
3. Pressure to solenoid
4. Pressure to RAVE valves blocked by the solenoid
5. Vent to air intake silencer
6. Couterbalancing shaft oil cavity vent
7. Check valve

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 vehicle usage. 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

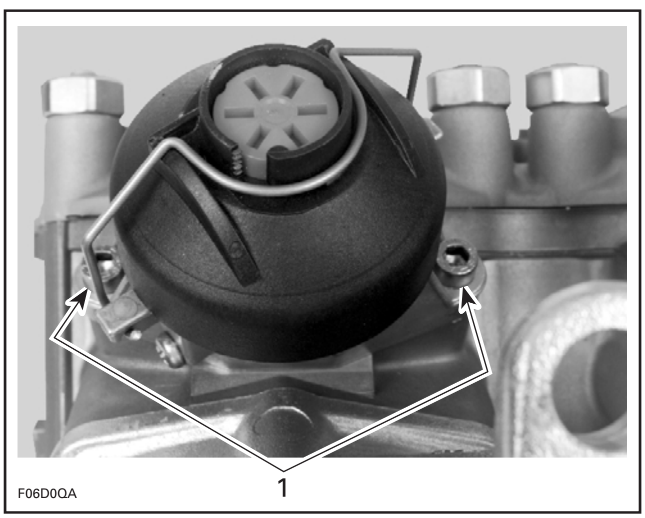
In its stock configuration the RAVE valve guillotine has a minimum of 0.5 mm (.020 in) clearance to the cylinder bore measured at the center line of the cylinder. This is the minimum production clearance.

There is only a first oversize piston available for the 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

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



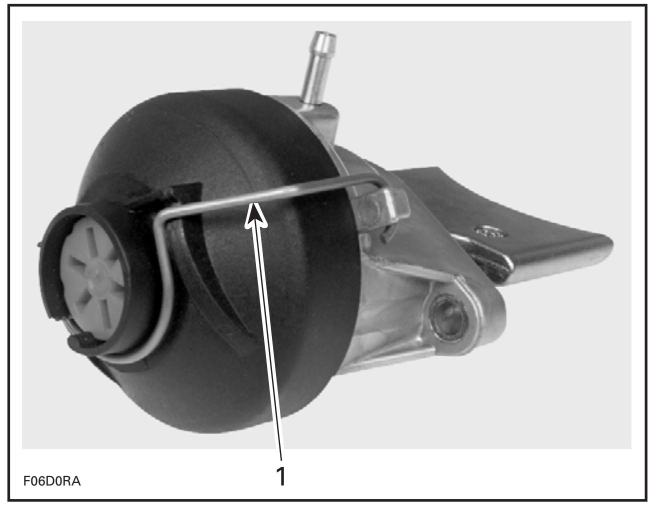
1. *Remove screws*

Remove RAVE valve **no. 15**.

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

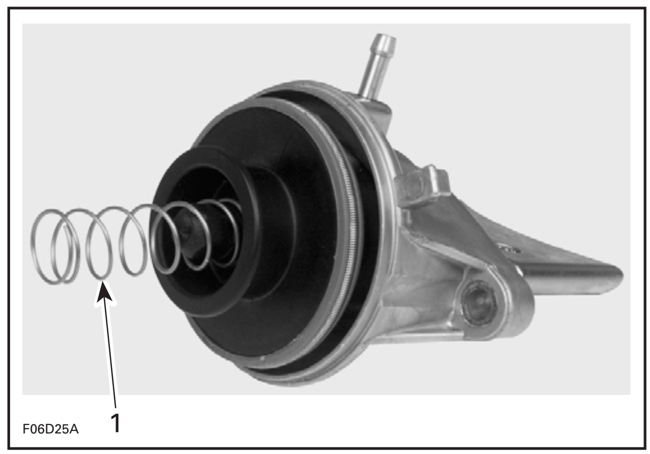
⚠ WARNING

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



1. *Spring*

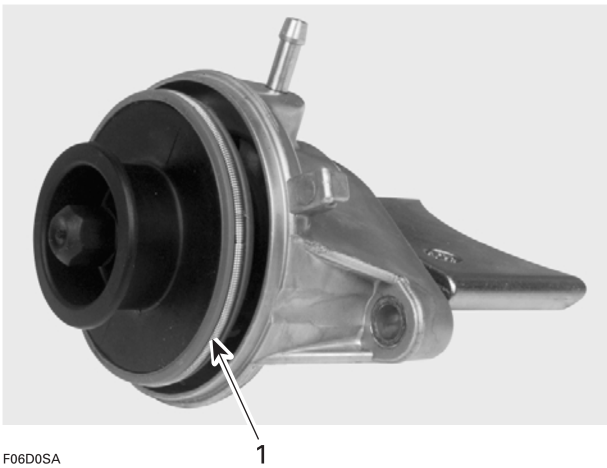
Remove the compression spring **no. 19**.



1. *Remove spring*

NOTE: The following procedures relates the steps for the **carburetor-equipped engines**. The **DI engine** is very similar except it does not have a large boot.

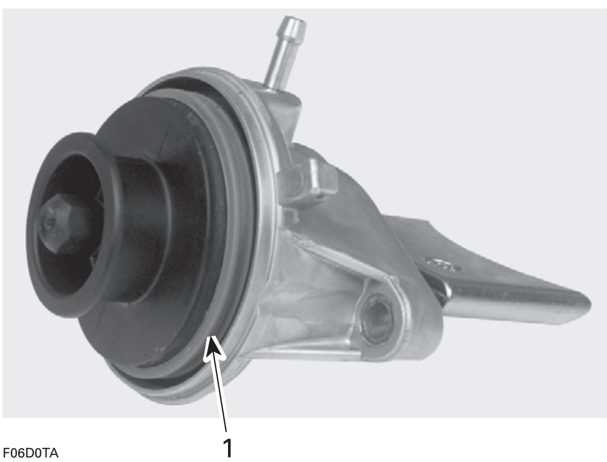
Remove spring **no. 30** retaining bellows **no. 21** to valve piston **no. 20**.



F06D0SA

1. *Spring*

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

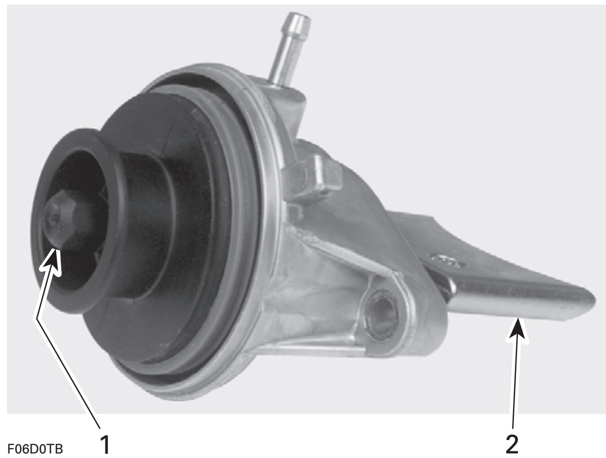


F06D0TA

1. *Bellows removed from piston*

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

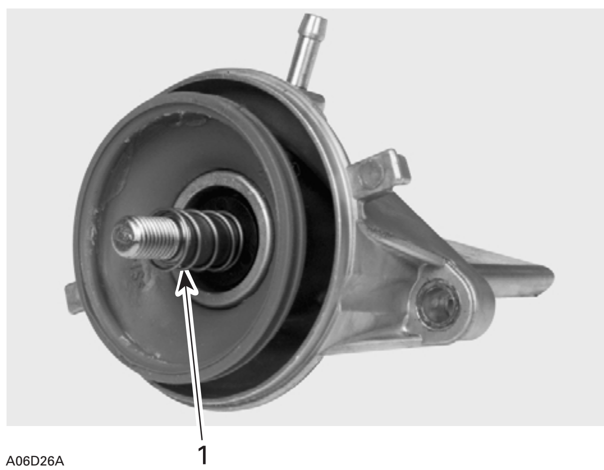
NOTE: Hold the sliding valve to prevent it from turning.



F06D0TB

1. *Unscrew piston*
2. *Hold sliding valve*

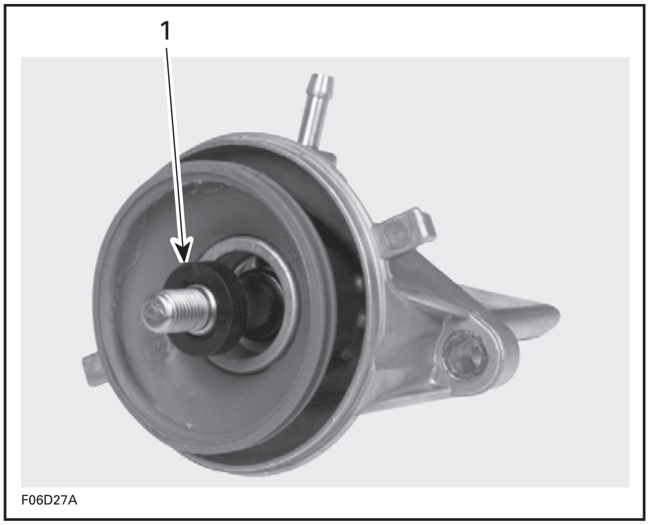
Remove compression spring **no. 29**.



A06D26A

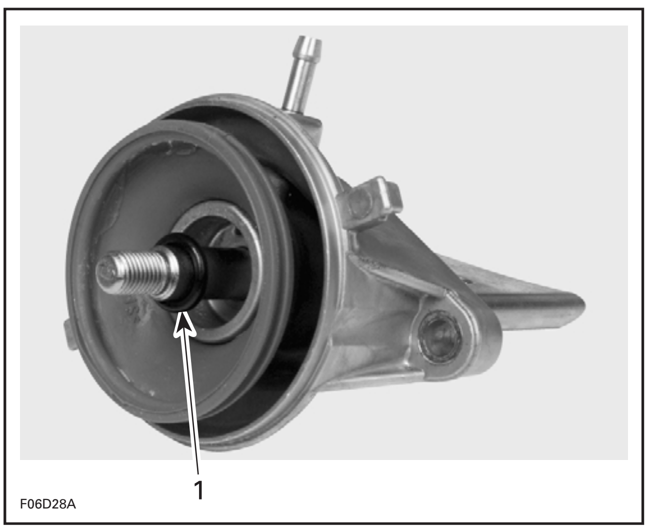
1. *Remove spring*

Remove supporting ring **no. 28**.



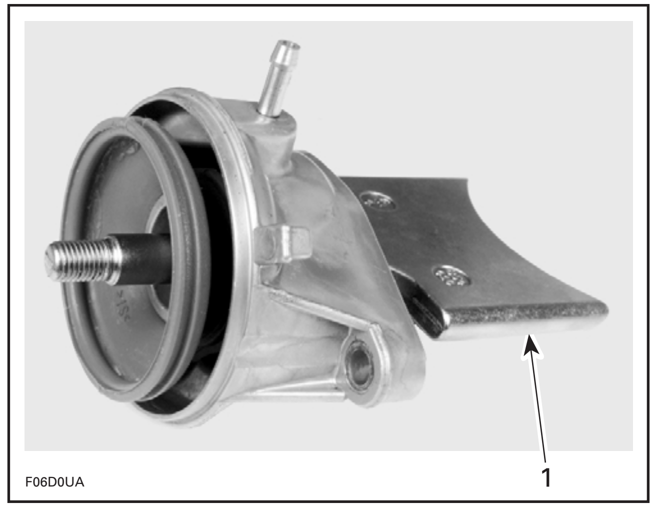
1. Remove supporting ring

Remove O-ring **no. 23**.



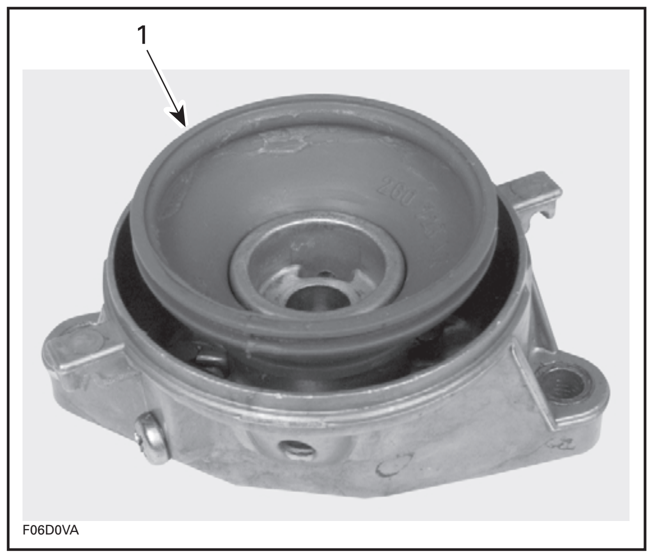
1. Remove O-ring

Remove sliding valve **no. 22**.



1. Remove sliding valve

Remove bellows **no. 21**.



1. Remove bellows

Cylinder Head Cover and Cylinder Head

Disconnect temperature sensor wire and spark plug cables.

Connect spark plug cables on grounding device.

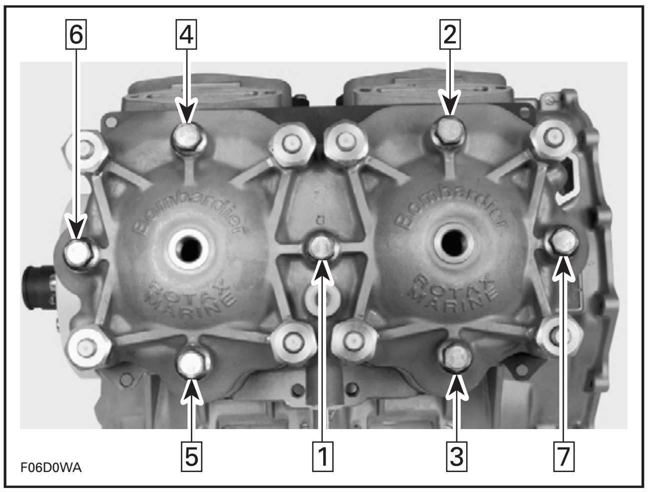
Disconnect hose of RAVE valves.

On DI engines, remove air/fuel rail. Refer to ENGINE MANAGEMENT.

947 Carburetor-Equipped Engines

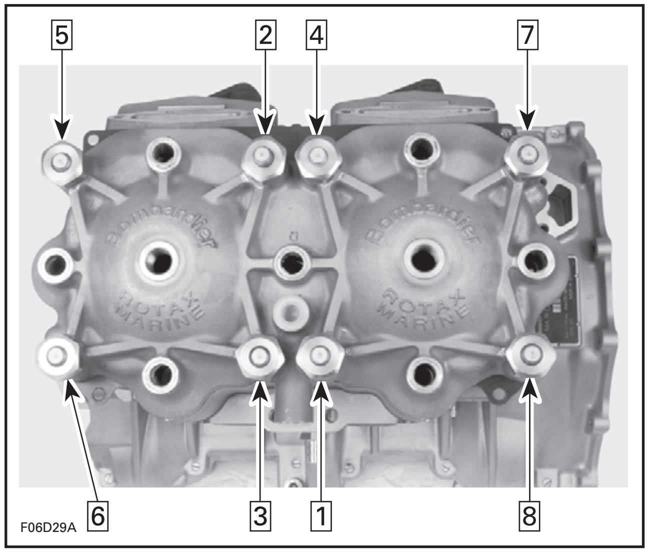
NOTE: Due to the cylinder mounting studs, it is recommended to remove the engine from the hull to service the top end. However, one might unfasten the engine support to allow leaning the engine so that cylinder can be pulled out.

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



UNTORQUING SEQUENCE FOR THE CYLINDER HEAD BOLTS

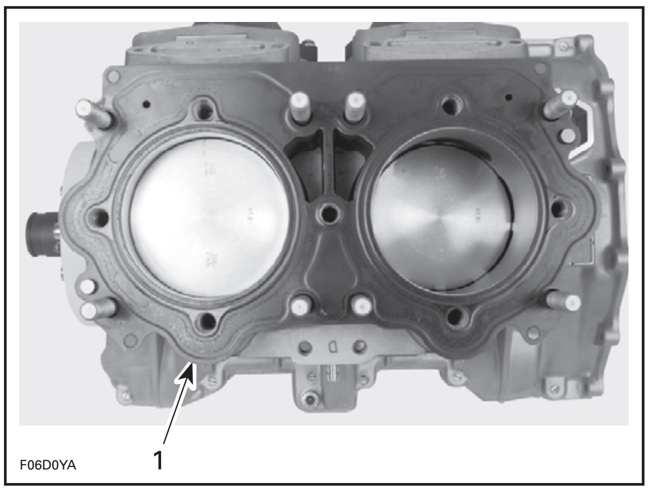
Loosen nuts **no. 33** following the sequence shown in the next photo.



UNTORQUING SEQUENCE FOR THE NUTS

Remove cylinder head **no. 2**.

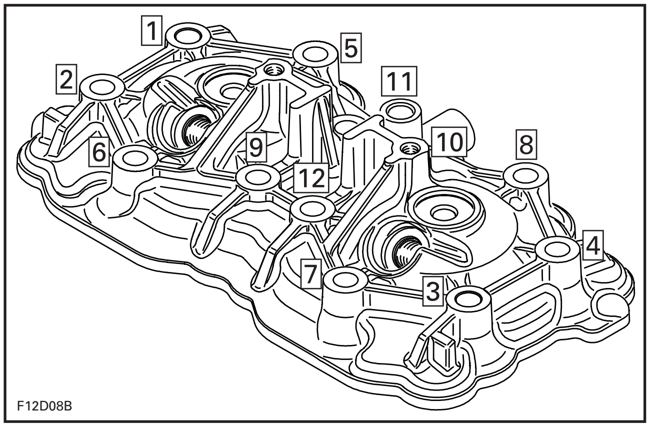
Remove cylinder head gasket **no. 34**.



1. *Remove gasket*

947 DI Engines

Use Snap-On Torx socket E12 and unscrew cylinder head screws **no. 14** following the sequence shown in the next illustration.



Remove cylinder head **no. 2** and gasket **no. 34**.

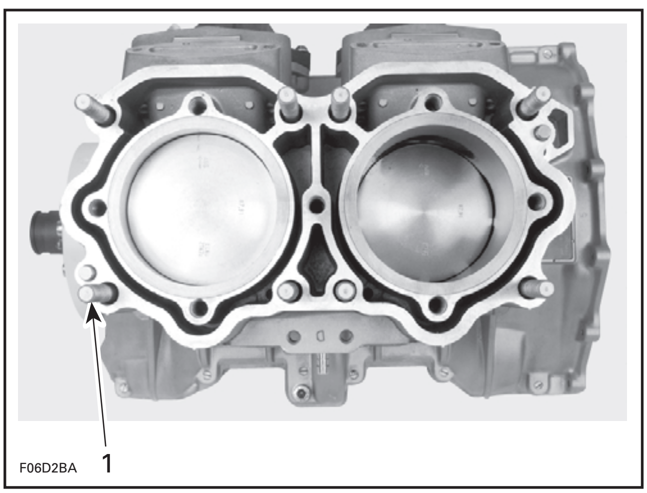
Cylinder

NOTE: When removing cylinder, be careful that connecting rods do not hit crankcase edge.

947 Carburetor-Equipped Engines

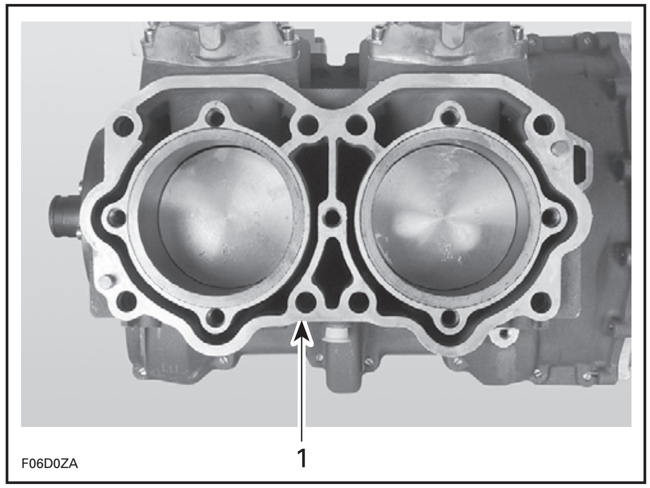
Remove studs **no. 32**. Take two head cover nuts. Screw nuts onto stud. Lock both nuts together and unscrew the stud. Repeat this operation for the other studs.

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**.

947 DI Engines

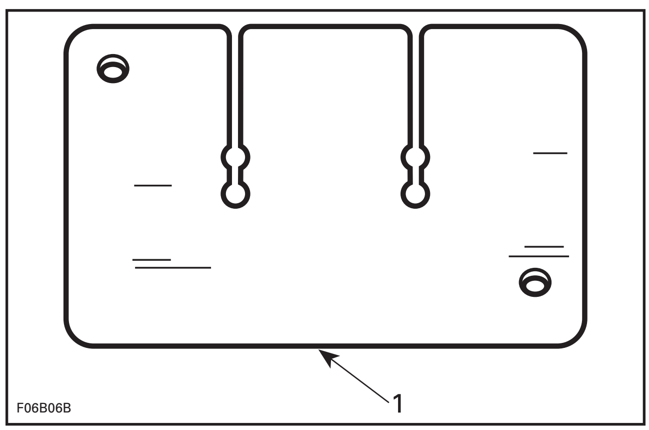
Remove cylinders screws then cylinders **no. 9**.

All Engines

Piston

NOTE: All engines feature cageless piston pin bearings.

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

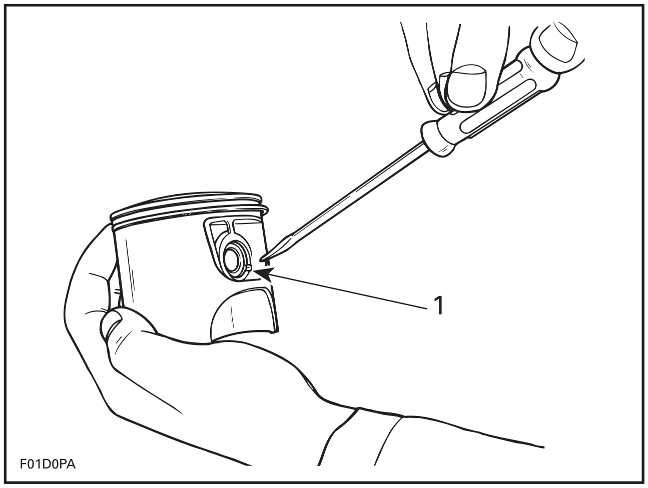


1. *Rubber pad (P/N 290 877 032)*

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

⚠ WARNING

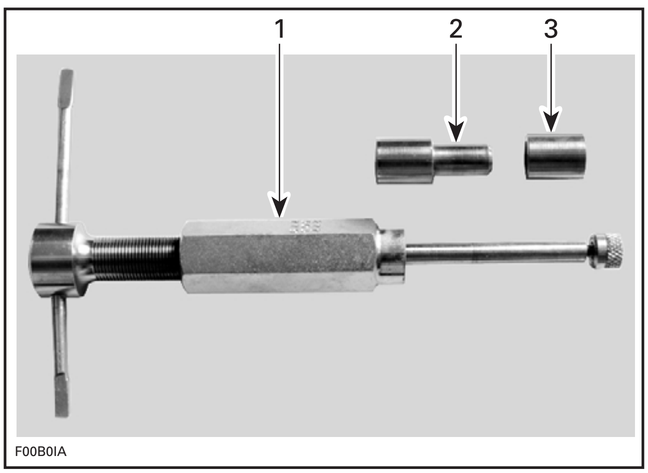
Always wear safety glasses when removing piston circlips.



TYPICAL
1. Piston notch

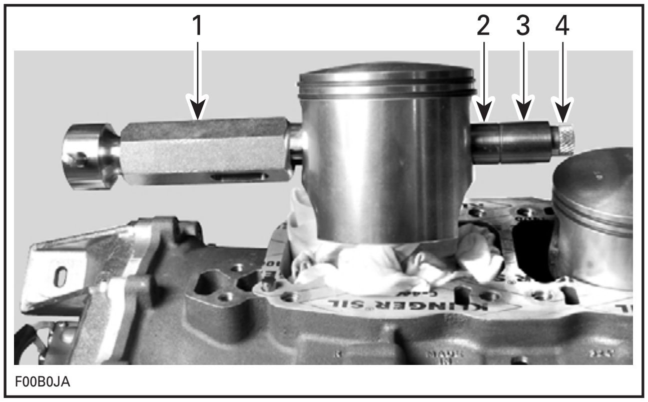
To extract piston pin **no. 4**, use piston pin puller (P/N 529 035 503) with the appropriate set of sleeves.

ENGINE	SLEEVE SET
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.
– Screw in extracting nut with the movable extracting ring towards spindle.

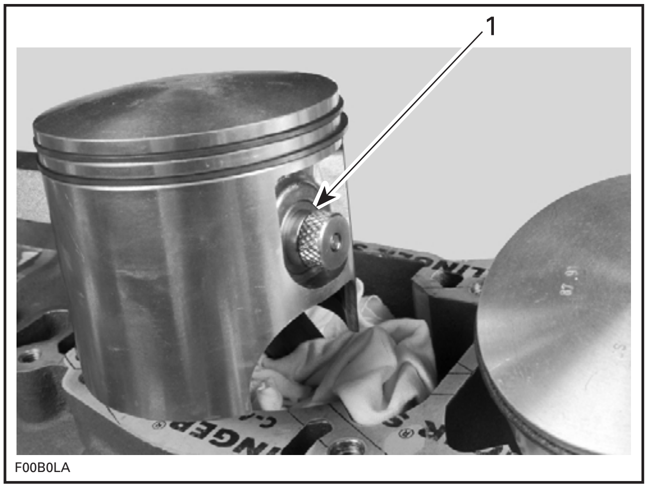


1. Puller
2. Sleeve
3. Shoulder sleeve
4. Extracting nut

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

1. Tool cutout toward bottom of piston

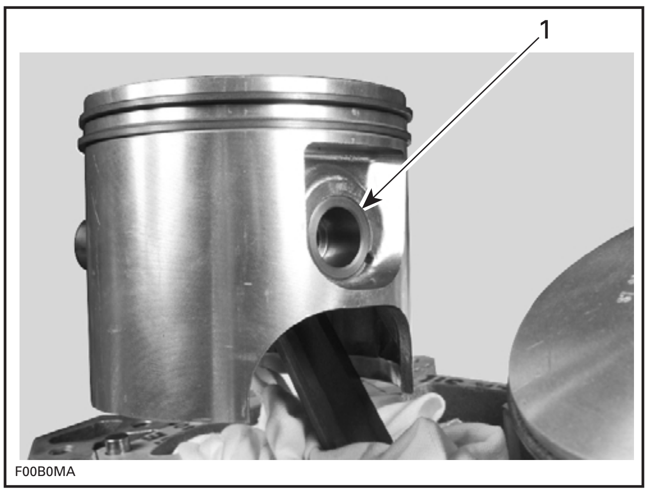
– Firmly hold puller and rotate handle to pull piston pin **no. 4**.
– Rotate spindle until the shoulder sleeve is flushed with the piston recess.



1. Shoulder sleeve flush with piston recess

– Loosen the extracting nut and remove puller.

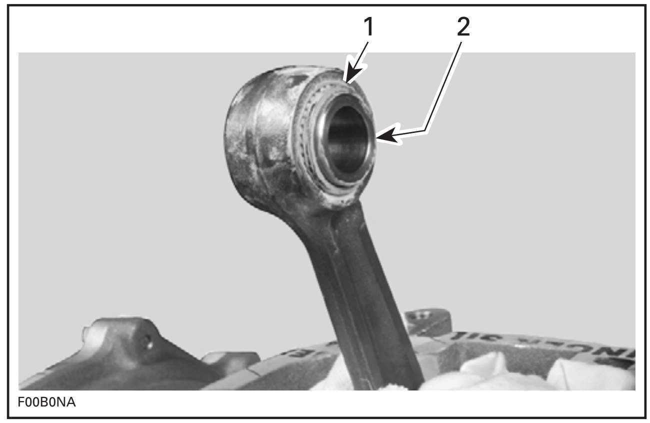
– Remove the shoulder sleeve from piston.



1. Remove shoulder sleeve

– Carefully remove the piston **no. 3**.

– 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, 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.

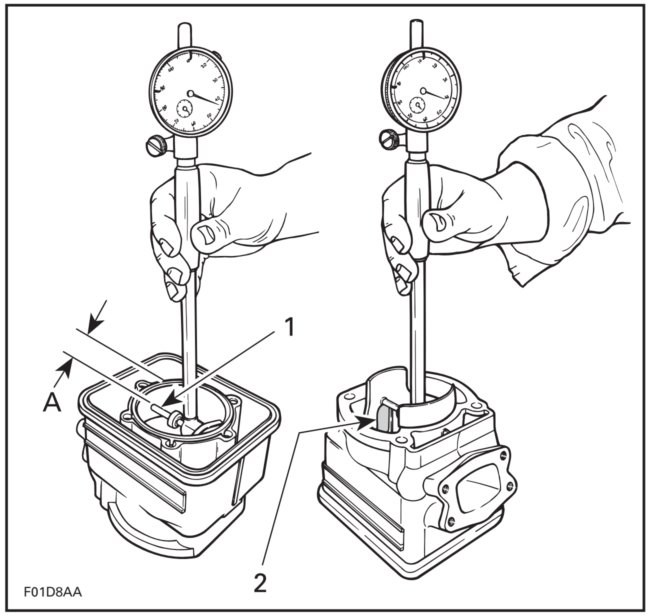
ENGINE MEASUREMENT	TOLERANCES		
	NEW PARTS (min.)	NEW PARTS (max.)	WEAR LIMIT
Cylinder taper	N.A.	0.05 mm (.002 in)	0.1 mm (.004 in)
Cylinder out of round	N.A.	0.008 mm (.0003 in)	0.08 mm (.003 in)
Piston/cylinder wall clearance for 947 carburetor-equipped engine	0.09 mm (.0035 in)	N.A.	0.20 mm (.008 in)
Piston/cylinder wall clearance for 947 DI engine	0.12 mm (.0047 in)	N.A.	0.20 mm (.008 in)
Ring/piston groove clearance for 947 carburetor-equipped engine	0.048 mm (.002 in)	0.075 mm (.003 in)	0.20 mm (.008 in)
Ring/piston groove clearance for 947 DI engine	0.044 mm (.002 in)	0.089 mm (.003 in)	0.20 mm (.008 in)
Ring end gap for 947 carburetor-equipped engine	0.45 mm (.018 in)	0.60 mm (.024 in)	1.0 mm (.039 in)
Ring end gap for 947 DI engine	0.55 mm (.022 in)	0.7 mm (.028 in)	1.1 mm (.043 in)

N.A.: Not Applicable

NOTE: Replacement cylinder sleeves are available if necessary. Also, oversize pistons of 0.25 mm (.010 in) are available.

Cylinder Taper

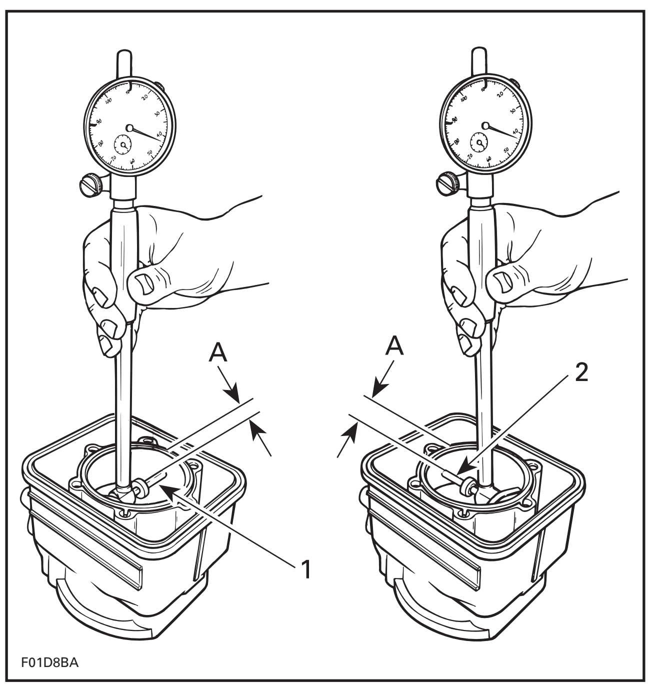
Using a cylinder bore gauge, measure cylinder diameter at 16 mm (5/8 in) from top of cylinder just below auxiliary transfer port, facing exhaust port. If the difference between readings exceed specification, cylinder should be rebored and honed or replaced.



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

Cylinder Out of Round

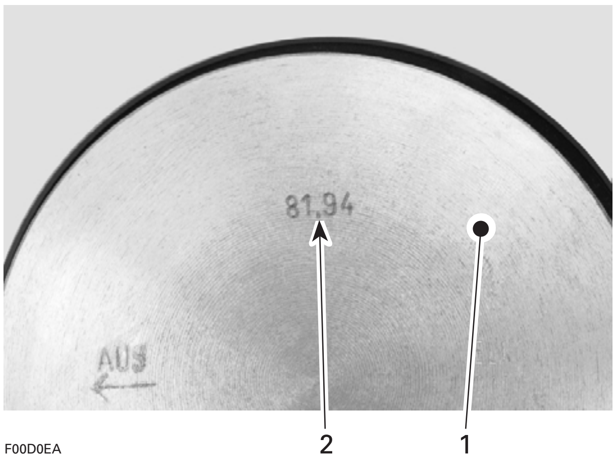
Using a cylinder bore gauge, measure cylinder diameter at 16 mm (5/8 in) from top of cylinder. Measure diameter in piston pin axis direction then perpendicularly (90°) to it. If the difference between readings exceed specification, cylinder should be rebored and honed or replaced.



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

Piston/Cylinder Wall Clearance

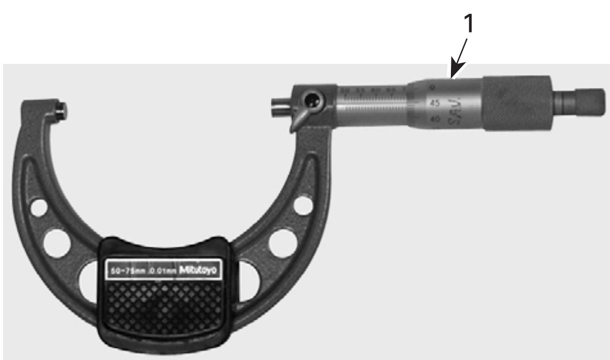
To determine the piston dimension, take the measurement on the piston dome.



F00D0EA

1. *Piston dome*
2. *Piston measurement*

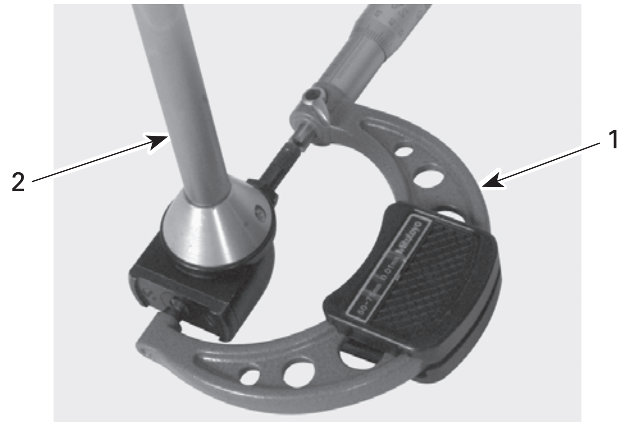
Adjust and lock a micrometer to the specified value on the piston dome.



F00B08A

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.



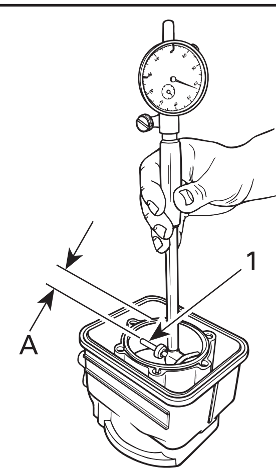
F00B09A

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

F00B0AA

1. *Indicator set to zero*

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



F01D0KA

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

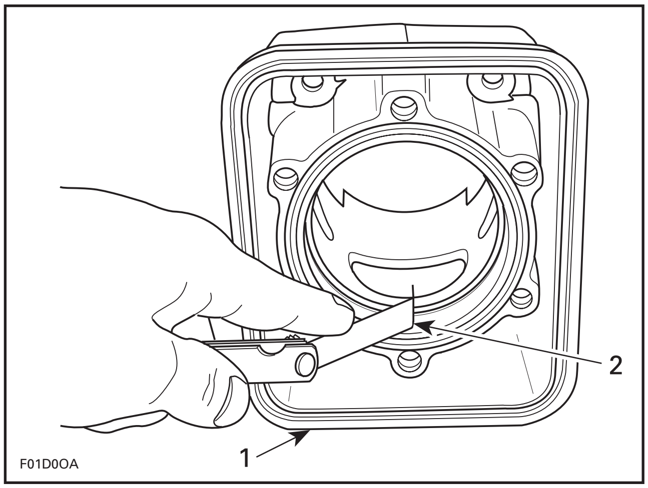
Due to the semi-trapez rings, it is not possible to accurately measure ring/piston groove clearance.

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.



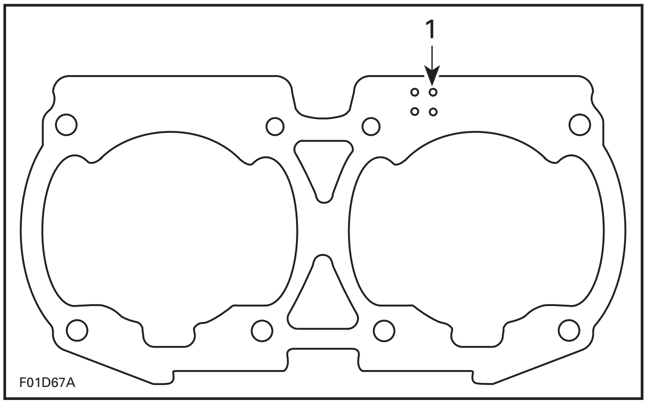
1. Top of cylinder
2. Ring end gap

Cylinder Base Gasket

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 crank repair has involved replacement of connecting rods, refer to the COMBUSTION CHAMBER VOLUME MEASUREMENT to properly determine the required gasket thickness.

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

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

947 Carburetor-Equipped Engines

Check RAVE valve bellows **no. 21** for cracks.

All Engines

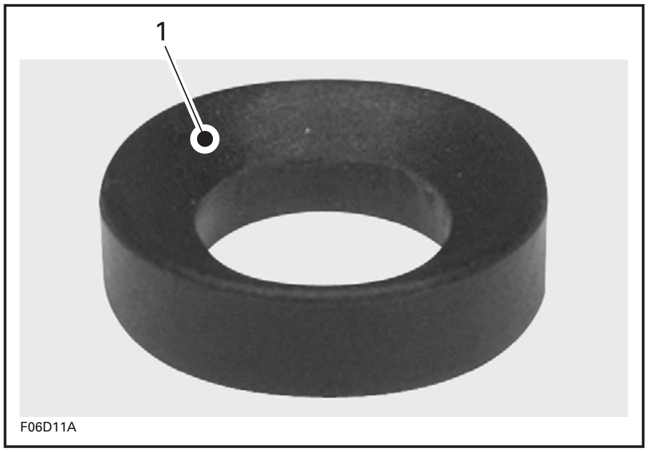
ASSEMBLY

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

RAVE Valve

Carburetor-Equipped Engines

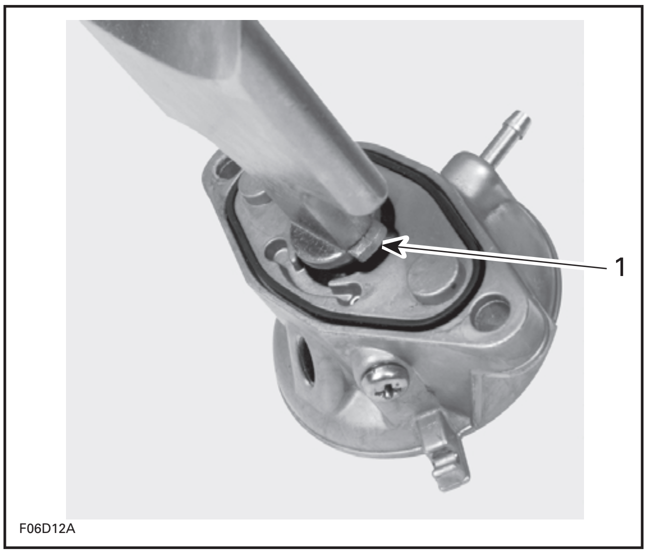
Install the supporting ring **no. 28** with the bevel side facing the O-ring **no. 27**.



1. *Bevel facing the O-ring*

All Engines

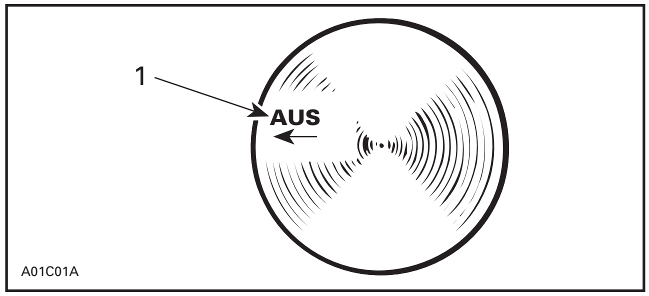
There is only one way to insert the sliding valve **no. 22** in valve housing **no. 25**.



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: The exhaust ports are located on the same side as the intake.

Carefully cover crankcase opening as for disassembly.

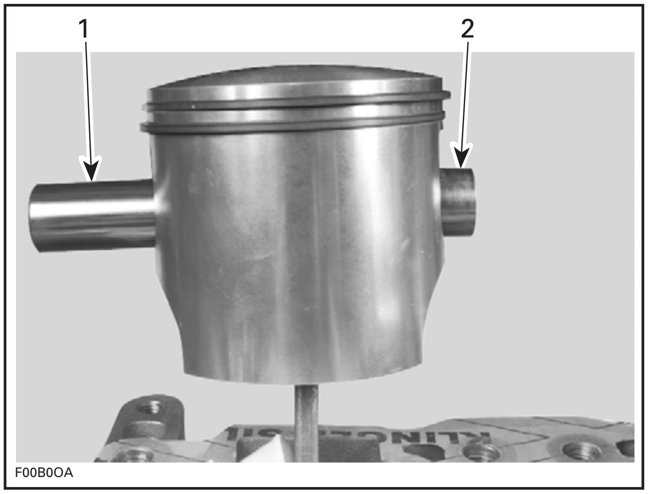
Piston Pin and Roller Bearing

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.

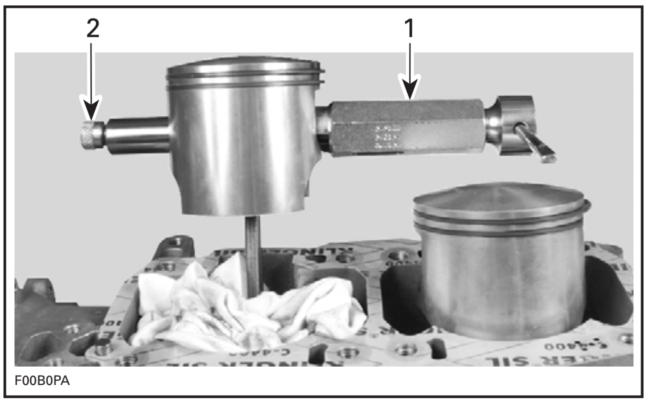
NOTE: Make sure thrust washers are present each side of needles.

– 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.

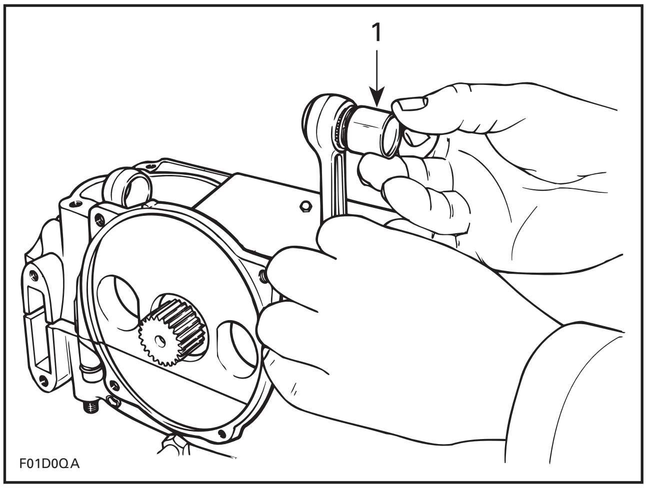
Plastic Mounting Device Method

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:

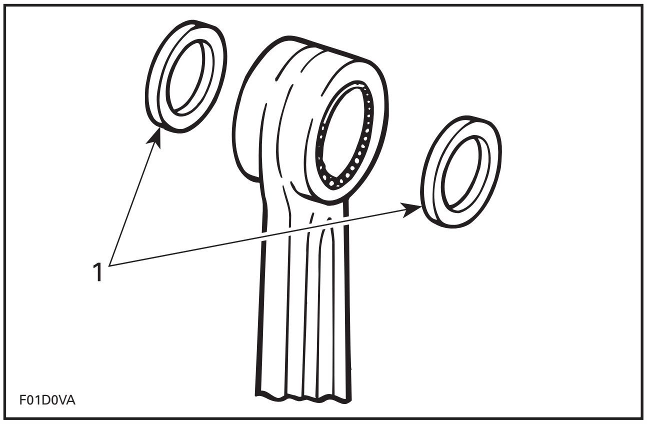
– Align replacement roller bearing with connecting rod bore.

– Carefully push inner plastic sleeve into connecting rod bore; outer plastic ring will release rollers.



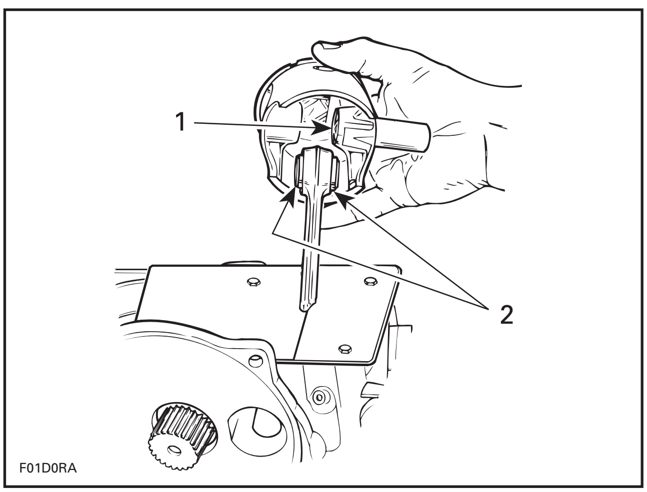
1. *Outer ring removal after inner sleeve insertion into bore*

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



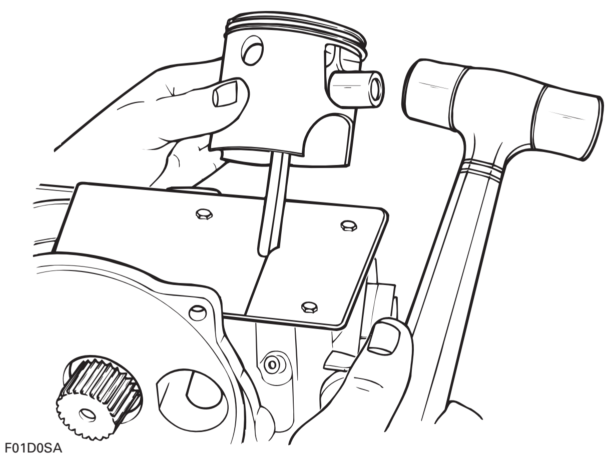
1. *Thrust washer each side*

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



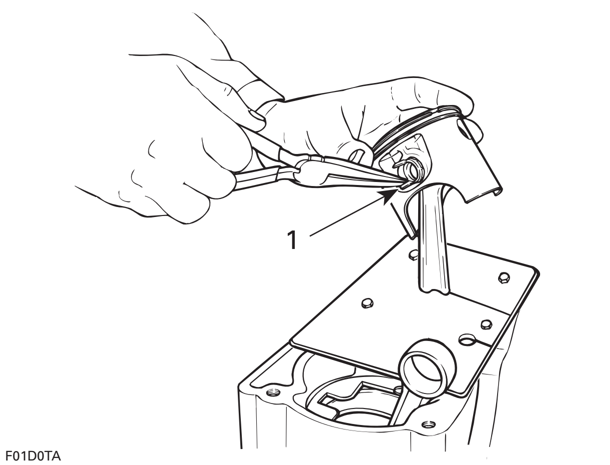
1. *Piston pin flush here*
2. *Thrust washers*

– 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.



F01D0SA

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



F01D0TA

1. *Pulling inner sleeve half*

Circlip

Always use new circlips.

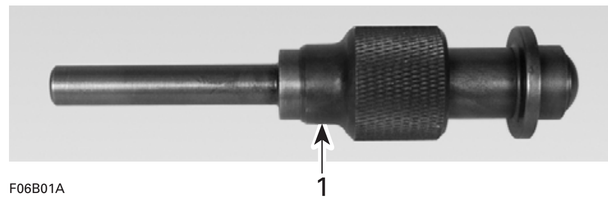
CAUTION: Always use new circlips. At installation, take care not to deform them. Circlips must not move freely after installation.

⚠ WARNING

Always wear safety glasses when installing piston circlips.

To easily insert circlip into piston, use circlip installer.

ENGINE	TOOL P/N
947	290 877 517



F06B01A

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.

F00B0QA

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.

F00B0RA

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

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 Block

947 Carburetor-Equipped Engines

Install studs **no. 32**. Apply Loctite 243 to threads and torque studs to 15 N•m (11 lbf•ft). Refer to exploded view to see what end to insert in crankcase.

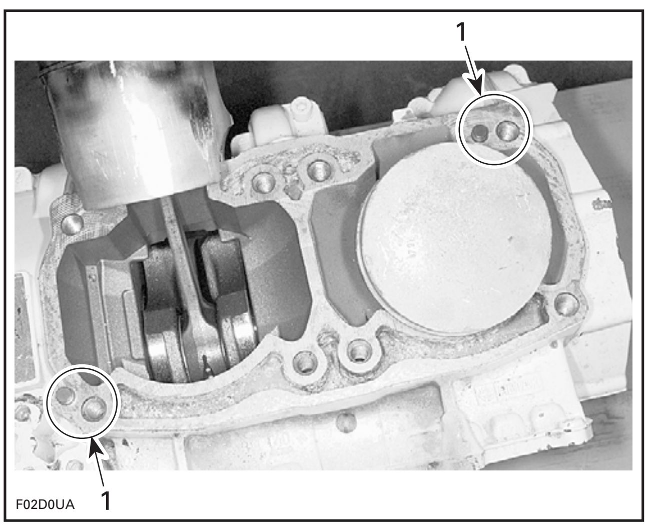
Remove O-rings from studs.

All Engines

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

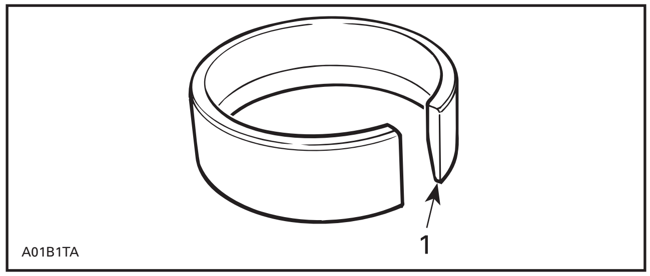
The cylinder block is positioned with locating dowels.

Line up dowels with corresponding holes in cylinder block.



1. *Dowels*

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.

947 DI Engines

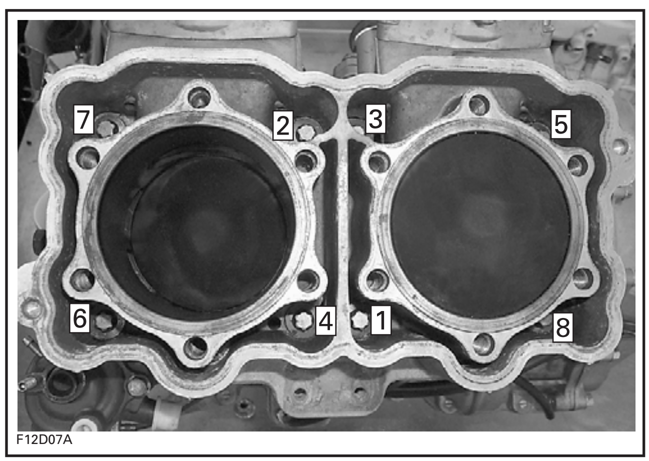
Cylinder Screw

Apply Loctite 518 on cylinder head contact surface.

Apply synthetic grease below the screw head.

Apply also Loctite 243 (blue) on screw threads.

Install and torque screws to 40 N•m (30 lbf•ft) in the indicated order. Refer to the following illustration.



947 Carburetor-Equipped Engines

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.

All Engines

Cylinder Head

Install cylinder head gasket.

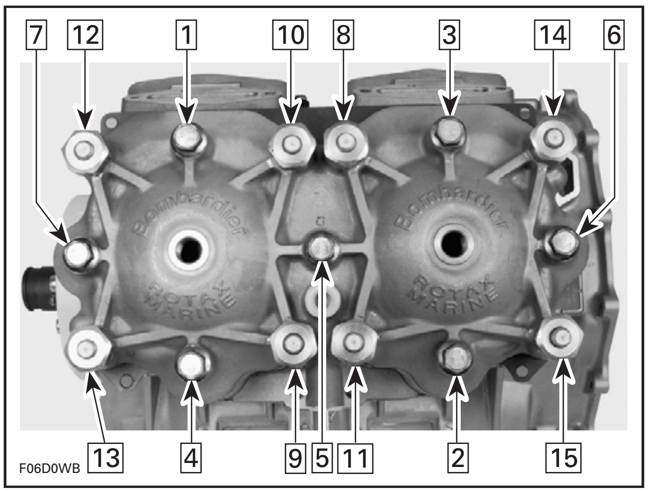
947 Carburetor-Equipped Engines

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).



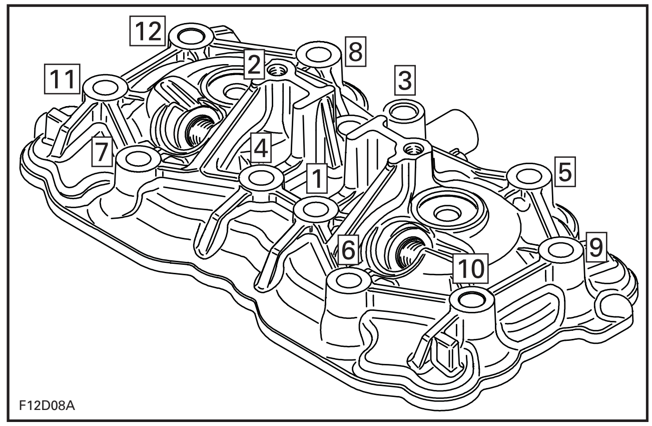
TORQUING SEQUENCE

947 DI Engines

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 to 20 N•m (15 lbf•ft) as per following sequence in the next picture. Repeat the torquing sequence by retightening to 40 N•m (30 lbf•ft).

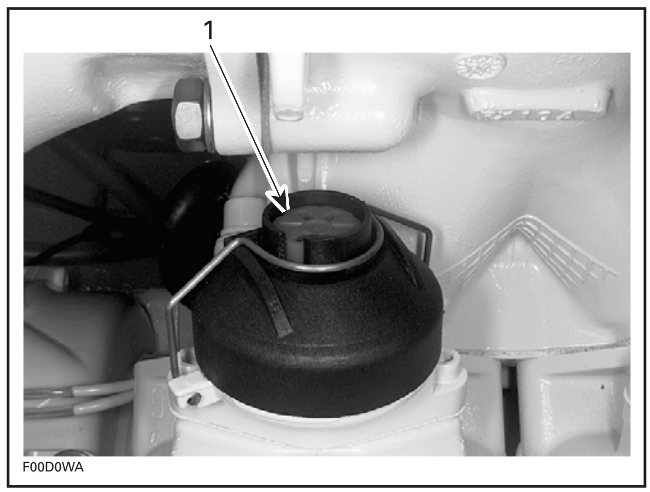


ADJUSTMENT

RAVE Valve

947 Carburetor-Equipped Engines

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



1. *Knob fully tightened*

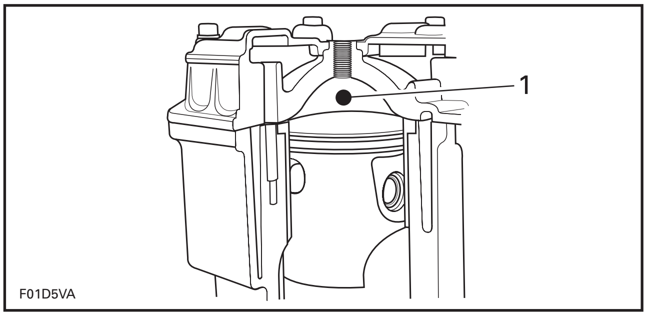
This will ensure the correct preload on the return spring **no. 19** in order to open and close the RAVE valve at the proper RPM.

Combustion Chamber Volume Measurement

All Engines

NOTE: This procedure is required to determine gasket thickness if you do not know the gasket thickness that was 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.

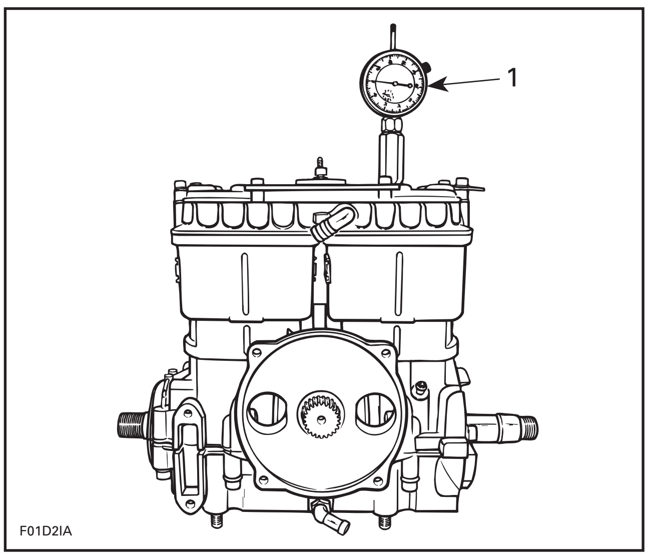


TYPICAL
1. Combustion chamber

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

947 Carburetor-Equipped Engines

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



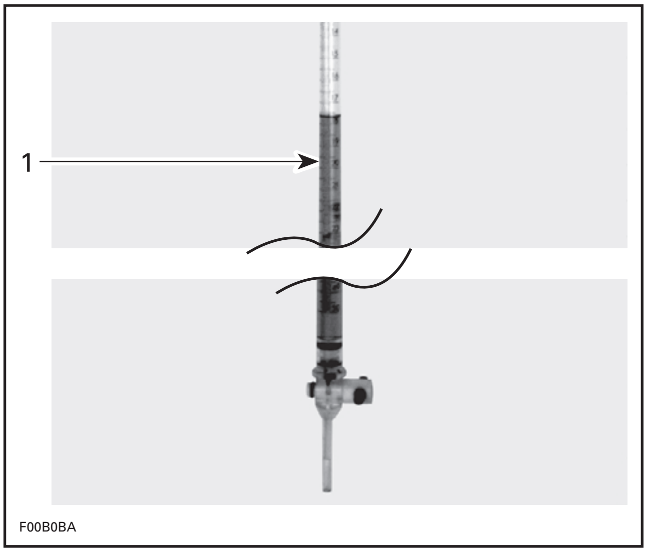
1. Bring piston to TDC

947 DI Engines

1. Remove both direct injectors and bring one piston to Top Dead Center using a TDC gauge. Keep spark plugs in their holes.

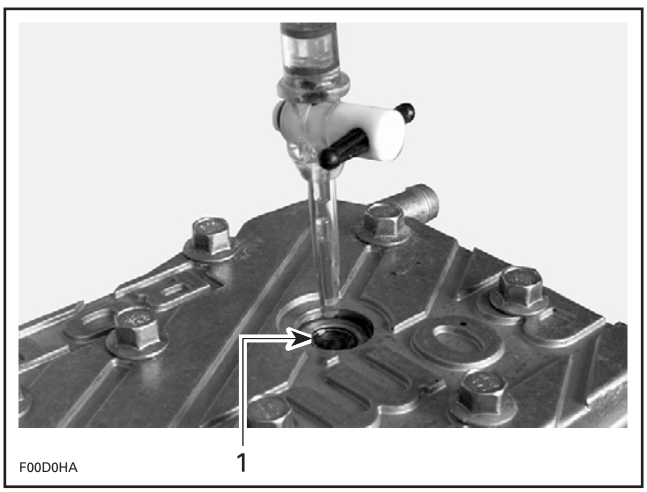
All 947 Engines

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 on carburetor-equipped engines and through direct injector hole on DI engines until liquid touches the top hole.



TYPICAL
1. Top of 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.

A higher volume dictates a thinner gasket.

A lower volume dictates a thicker gasket.

947 Carburetor-Equipped Engines

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.

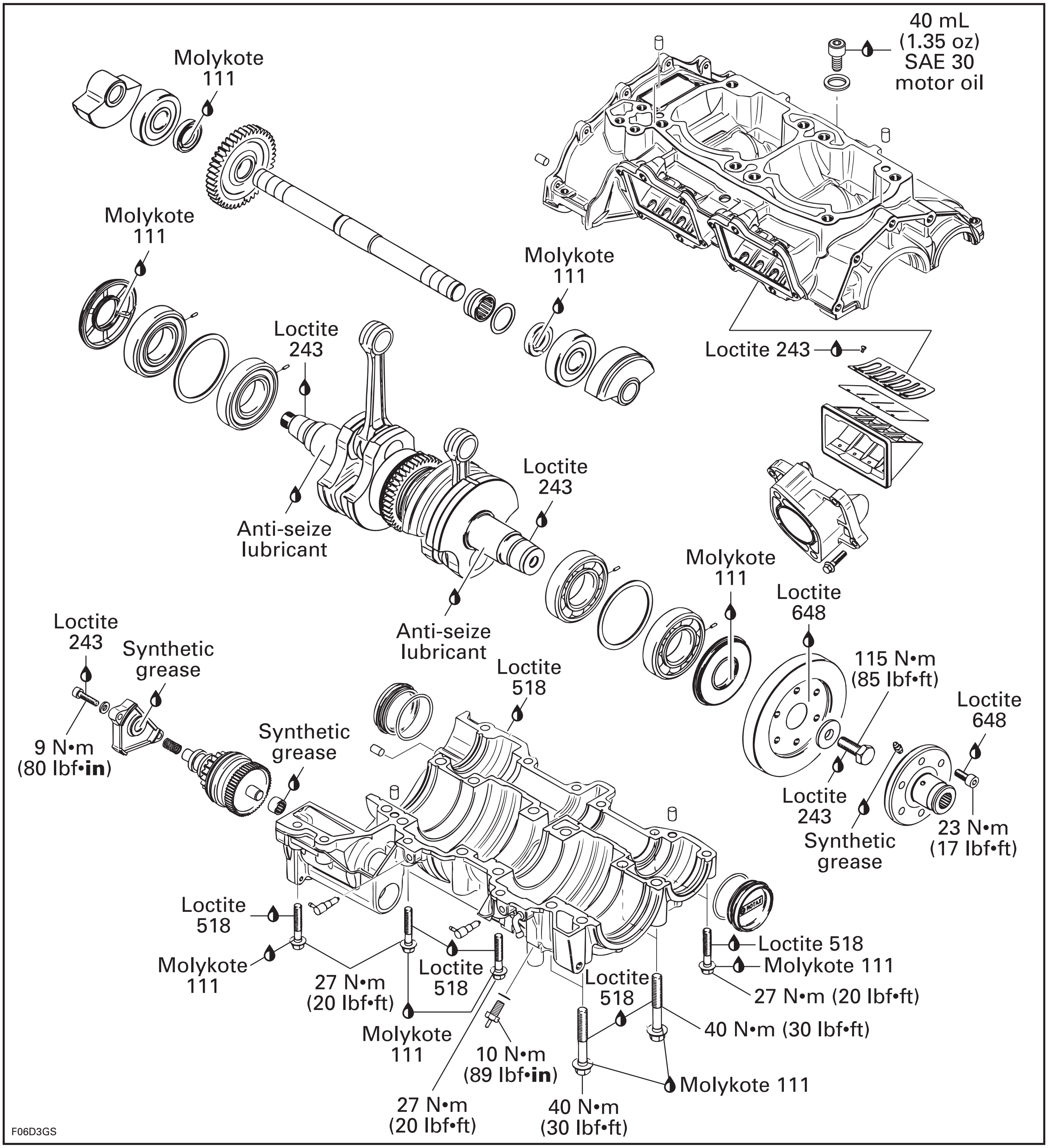
All 947 Engines

ENGINE	COMBUSTION CHAMBER VOLUME
947 carburetor-equipped engine	43.3 - 47.3 cc
947 DI engine	48 cc

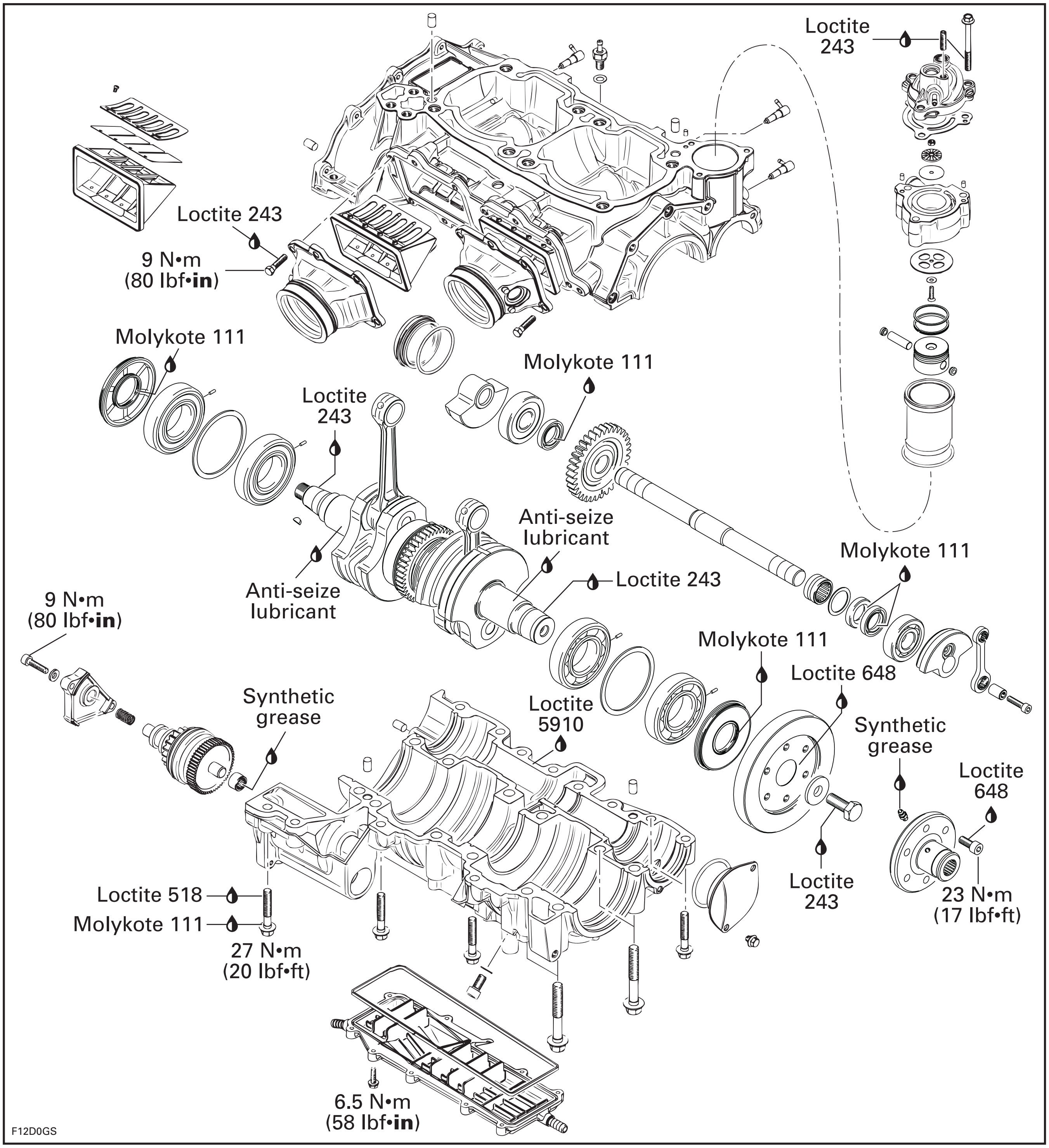
7. Repeat the procedure for the other cylinder.

BOTTOM END

947 Carburetor-Equipped Engines



947 DI Engines

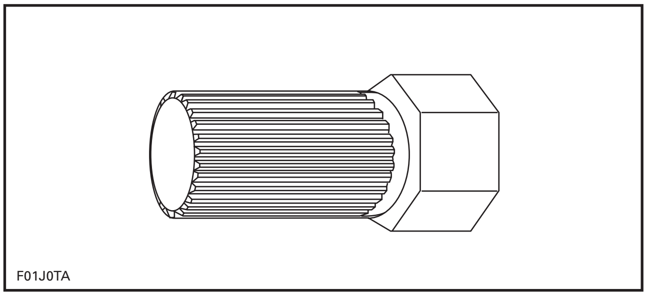


DISASSEMBLY

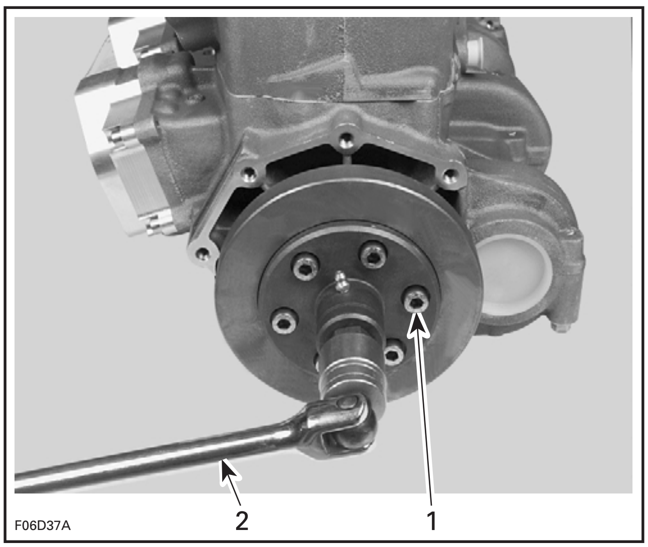
Engine has to be removed from watercraft and top end has to be disassembled to open bottom end. Refer to REMOVAL AND INSTALLATION and TOP END.

PTO Flywheel

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

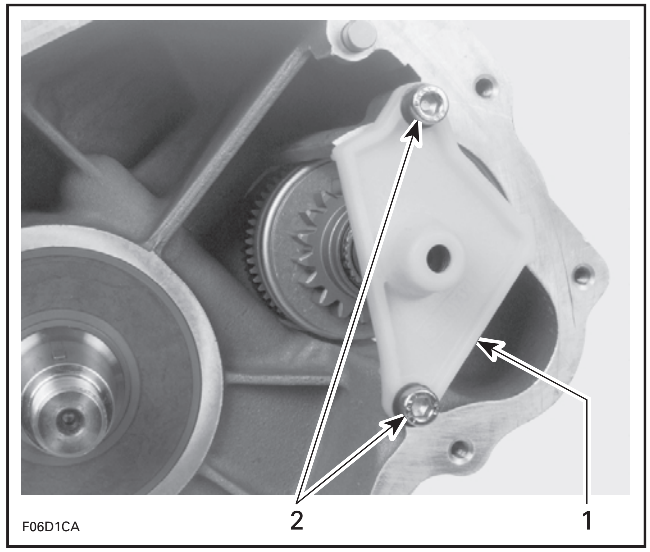


1. *Loosen Allen screws*
2. *Breaker bar locking crankshaft*

Remove the coupler **no. 20**.

Starter Drive Assembly

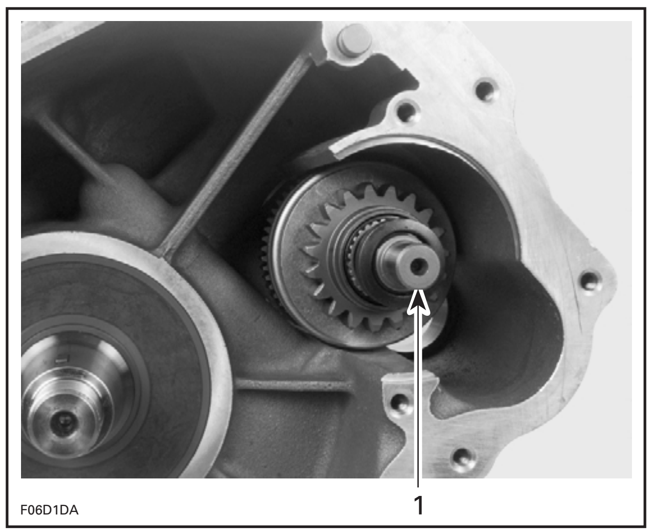
Loosen 2 Allen screws **no. 24** retaining starter drive cover **no. 25**.



1. *Cover*
2. *Allen screw*

Remove starter drive cover **no. 25** and spring **no. 9**.

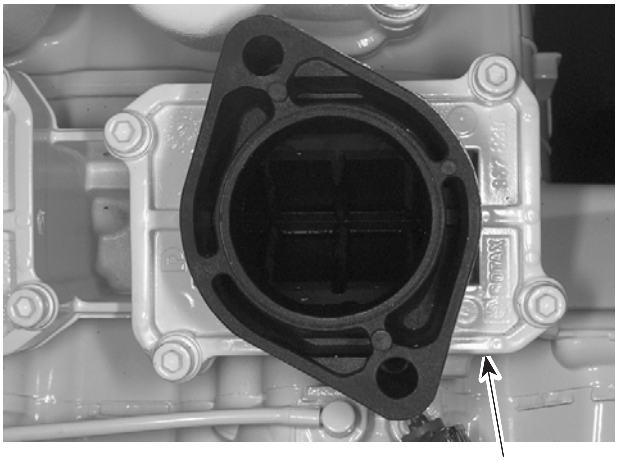
Remove starter drive assembly **no. 27**.



1. *Starter drive assembly*

Reed Valve

Remove both carburetor flanges.



F06D0JA

1. *Carburetor flange*

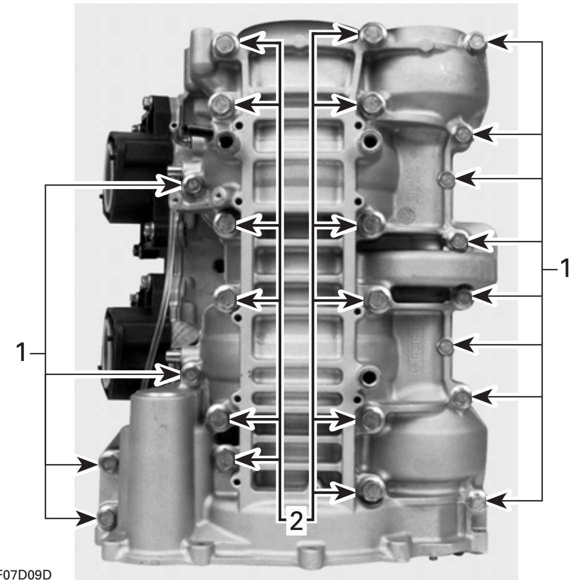
Remove reed valves **no. 28** from crankcase.

Crankcase

Before opening the bottom end, remove the following parts:

– magneto flywheel, refer to MAGNETO SYSTEM
– starter
– starter drive assembly
– reed valves
– air compressor cover (**947 DI engines**).

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

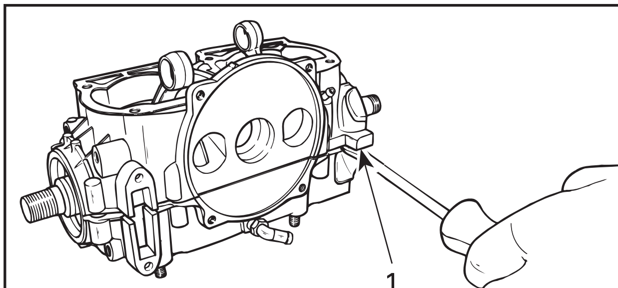


F07D09D

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

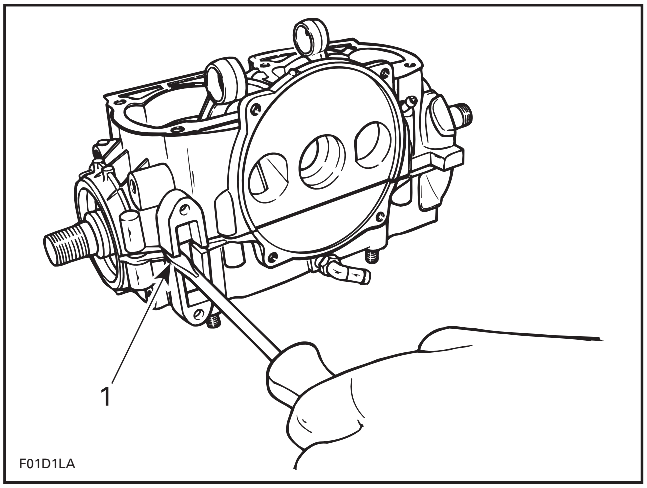
Put engine back on a support. Insert a pry bar between crankcase lugs to separate halves.

CAUTION: **Be careful to precision machined surfaces.**



F01D1KA

TYPICAL
1. *Separate halves by prying at provided lugs*



TYPICAL
1. *Separate halves by prying at provided lugs*

Remove crankshaft and counterbalance shaft.

947 DI Engines

Open air compressor and disconnect the piston as described in ENGINE MANAGEMENT.

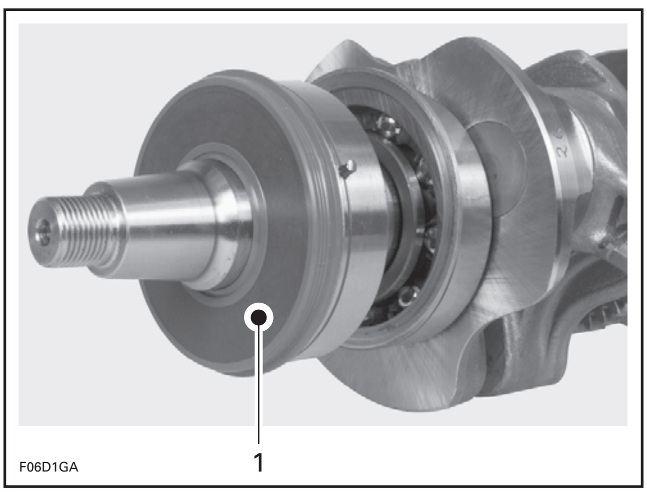
All Engines

Crankshaft Bearing and Seal

If a crankshaft end seal **no. 5** has to be replaced, bottom end must be opened.

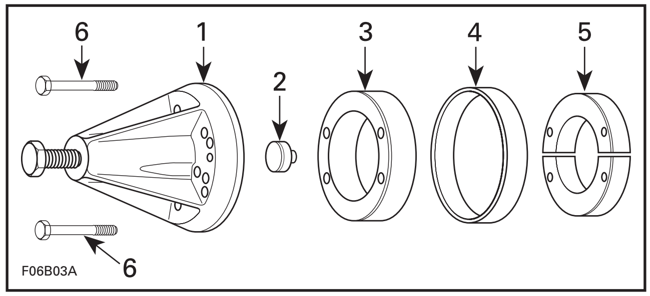
NOTE: Do not needlessly remove crankshaft bearings.

Remove end seal(s).

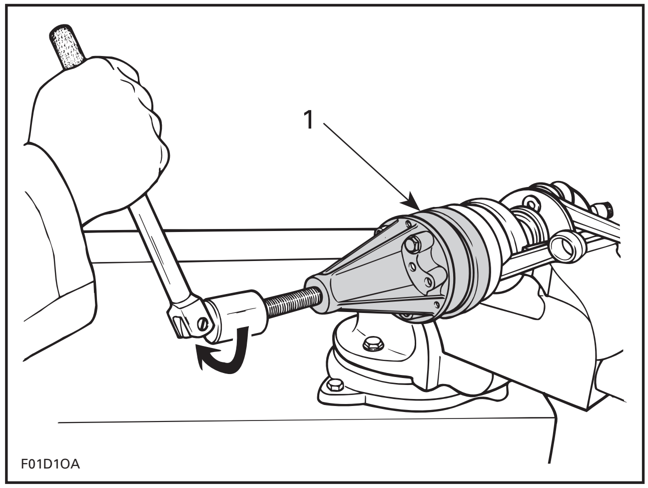


TYPICAL
1. *End seal*

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

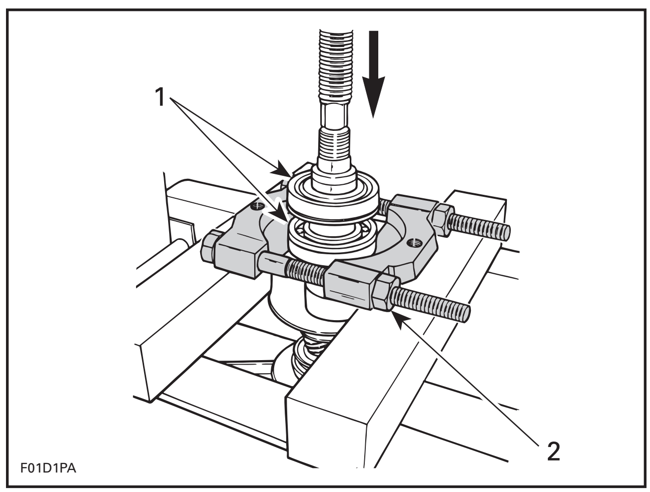


1. *Puller (P/N 420 877 635)*
2. *Protective cap (P/N 290 877 414)*
3. *Distance ring (P/N 420 876 569)*
4. *Ring (P/N 420 977 480)*
5. *Ring halves (P/N 420 876 330)*
6. *Screw (P/N 420 940 755)*



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.

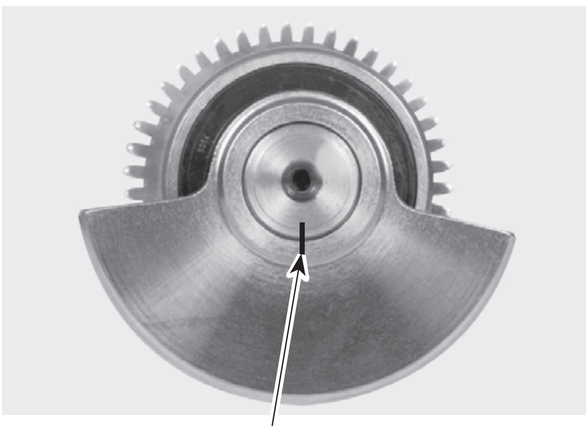


1. *Press bearings out*
2. *Bearing extractor*

Counterbalance Shaft

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 chisel gasket remover (P/N 413 708 500).

DI Models

Crankcase mating surfaces are best cleaned using a combination of the chisel gasket remover (P/N 413 708 500) and a brass brush. Brush a first pass in one direction then make the final brushing perpendicularly (90°) to the first pass cross (hatch).

Finish the cleaning with acetone.

CAUTION: Ensure to clean compressor lubrication nipple.

All Models

CAUTION: Be careful not to spray cleaner on the painted surface of the engine.

CAUTION: Never use a sharp object to scrape away old sealant as score marks incurred are detrimental to crankcase sealing.

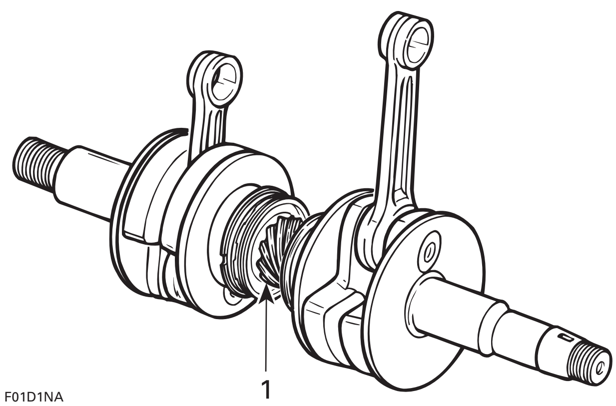
INSPECTION

Assembled Engine

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

Crankshaft Alignment at Center Main Journal

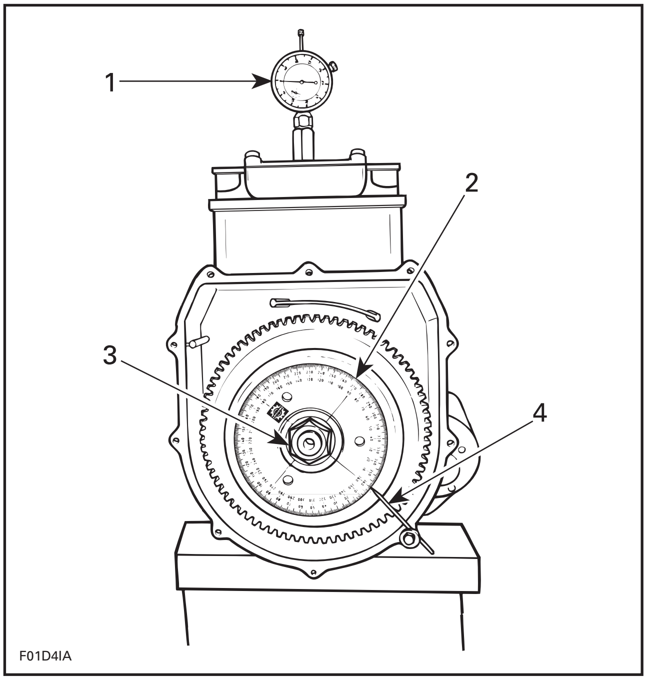
Since it is an assembled crankshaft it can become misaligned or deflected. Crankshaft can be twisted on center main journal, changing timing of one cylinder in relation with the other.



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. 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**.

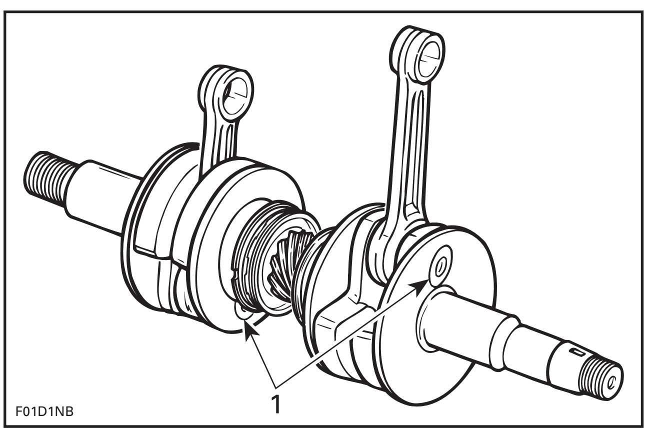
– Bring **PTO** piston at Top Dead Center.

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

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

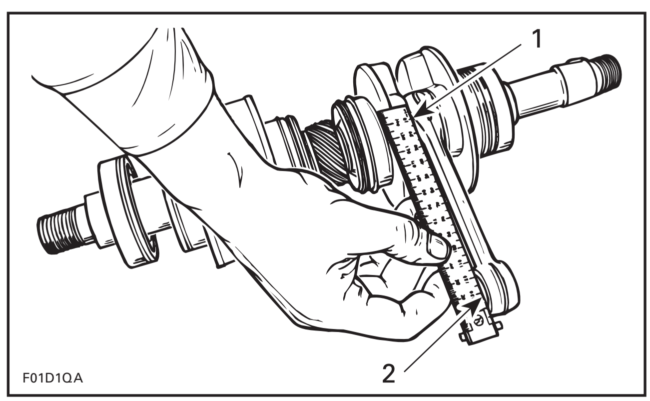
Inspect crankshaft bearings **no. 4**. Check for corrosion, scoring, pitting, chipping or other evidence of wear. Make sure plastic cage is not melted. Rotate and make sure they turn smoothly.

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*

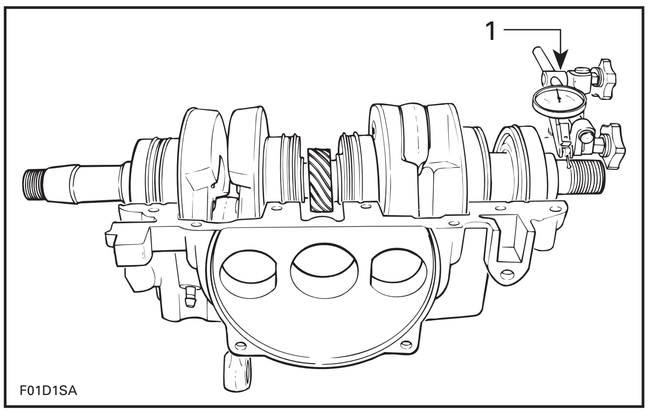
Crankshaft Deflection

All Models

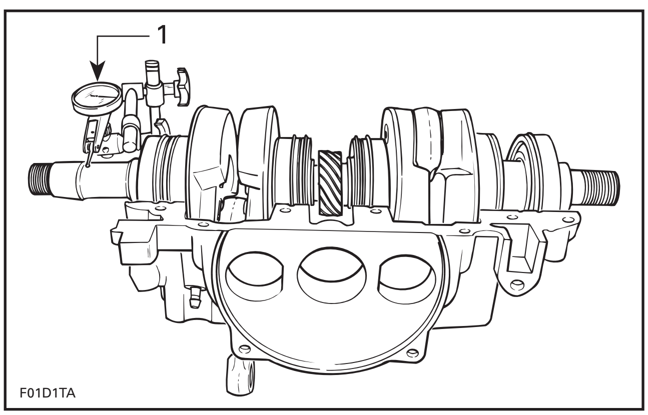
MEASUREMENT	MAG SIDE	PTO SIDE
Crankshaft deflection (max.)	0.050 mm (.002 in)	0.030 mm (.001 in)

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.

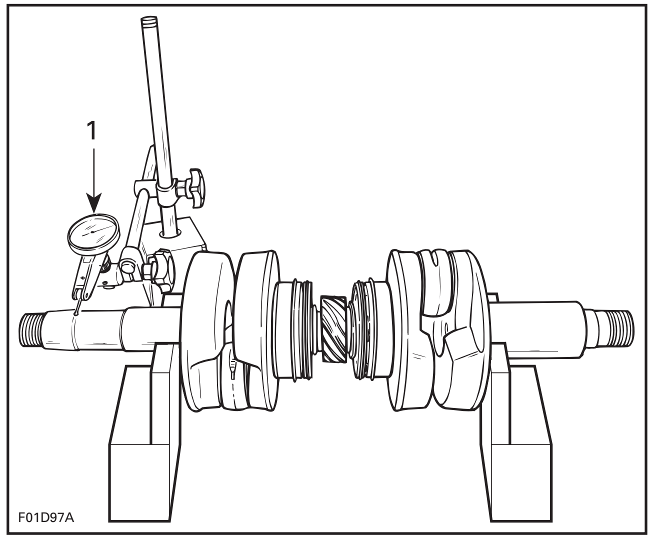


TYPICAL
1. *Measuring PTO side deflection in crankcase*

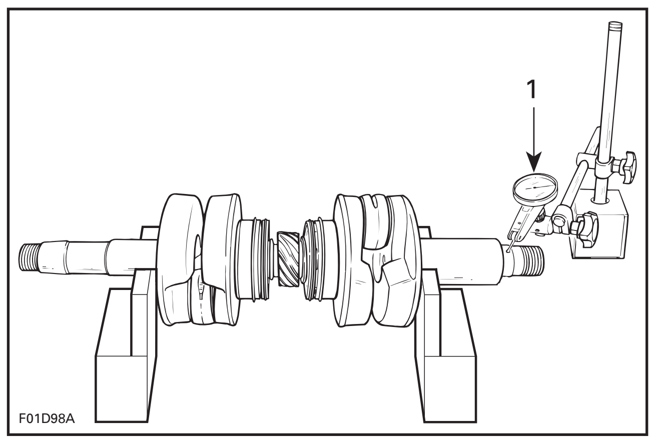


TYPICAL
1. *Measuring MAG side deflection in crankcase*

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



1. *Measuring MAG side deflection on V-shaped blocks*



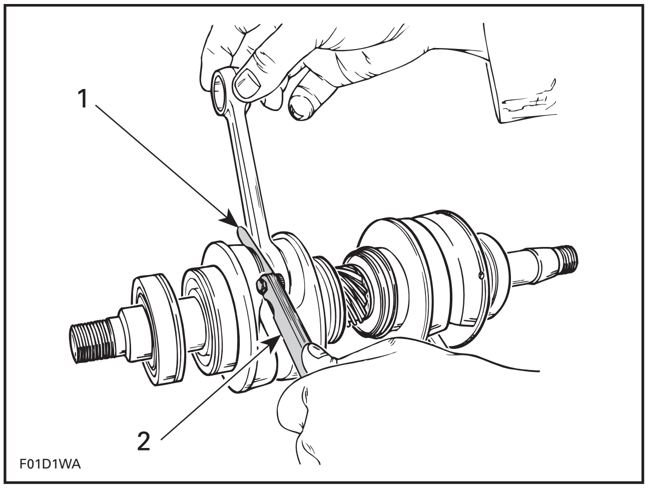
1. *Measuring PTO side deflection on V-shaped blocks*

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.)	NEW PARTS (max.)	WEAR LIMIT
947 engine	0.390 mm (.015 in)	0.737 mm (.029 in)	1.2 mm (.047 in)

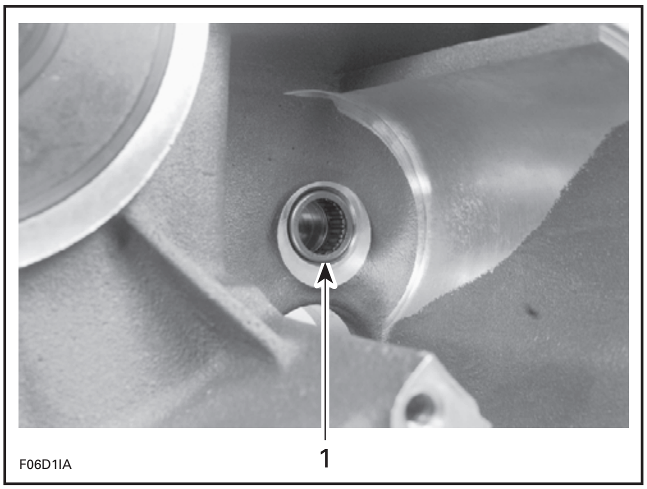
Using a feeler gauge, measure distance between thrust washer and crankshaft counterweight.



1. *Measuring big end axial play*
2. *Feeler gauge*

Starter Drive Bearing

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

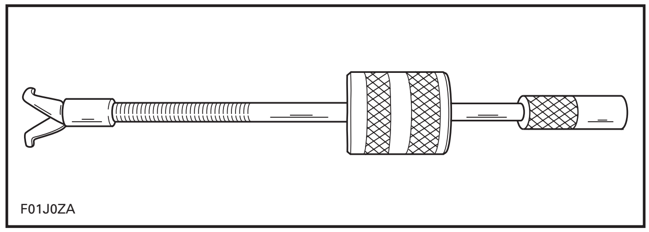


1. *Bearing of starter drive assembly*

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.



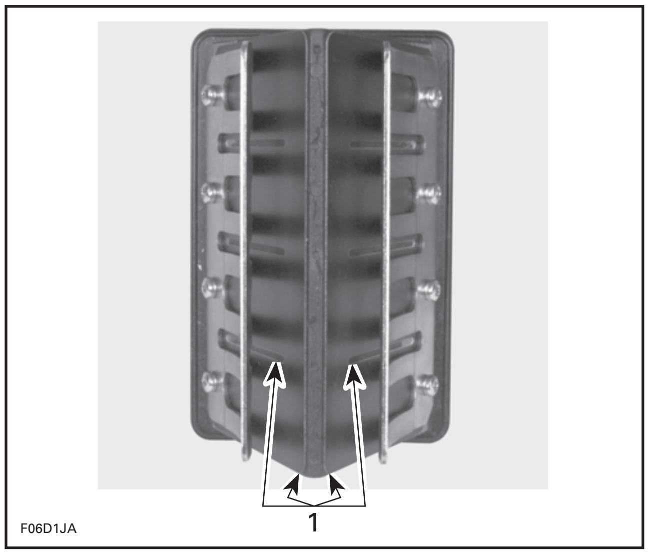
Close puller claws so that they can be inserted in end bearing. Holding claws, turn puller shaft clockwise so that claws open and become firmly tight against bearing.

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

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.

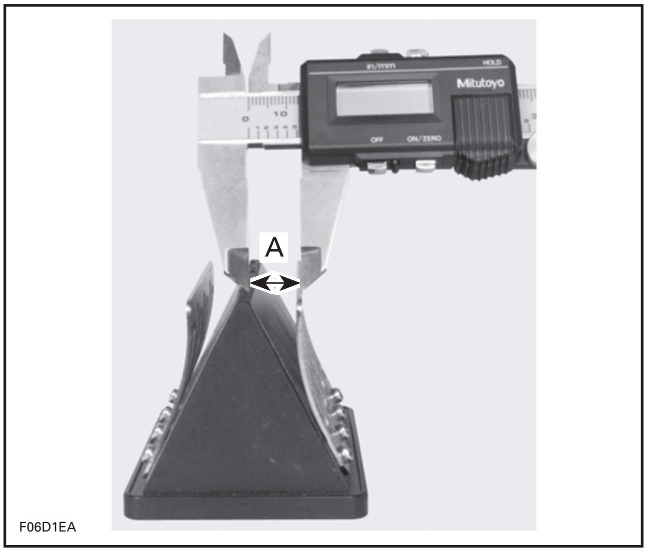


1. *No play*

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 ± 0.25 mm (.512 ± .010 in)

NOTE: Distance should be the same on both sides.

Bent stopper as required to obtain the proper distance.

Air Compressor

Refer to ENGINE MANAGEMENT for components inspection. However, if you find aluminum dust or debris in this area, they may have flowed toward the injection oil reservoir. In this case, the oil reservoir and lines must be flushed and the filter replaced.

CAUTION: Failure to properly clean the oil system will result in serious engine damage.

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 reassembling the engine.

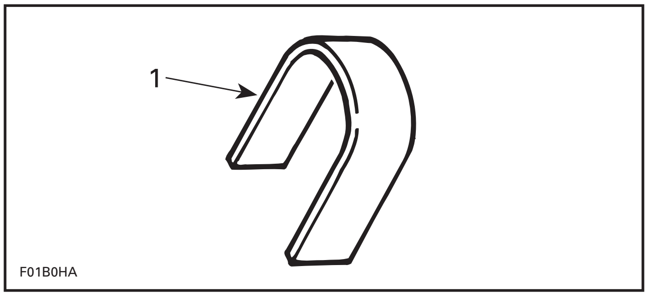
Crankshaft and Bearing

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

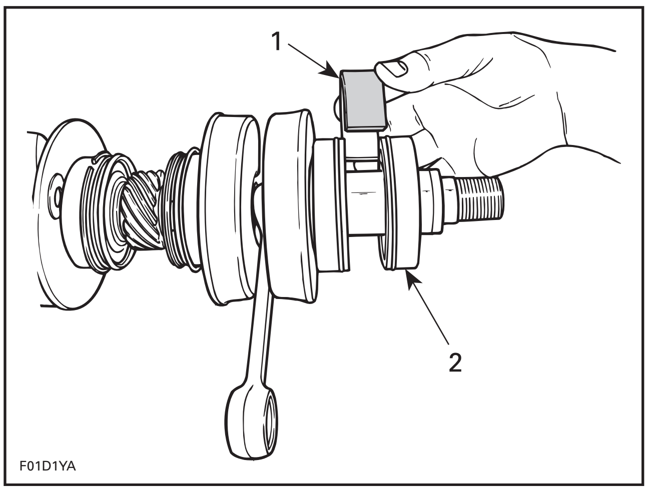
Prior to installation, place bearings **no. 4** into a container filled with oil, previously heated to 75°C (167°F). This will expand bearing and ease installation.

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
947	P/N 529 035 100 (MAG) P/N 529 035 000 (PTO) 7.5 mm (.295 in)



1. Distance gauge



TYPICAL
1. Distance gauge
2. Outer bearing

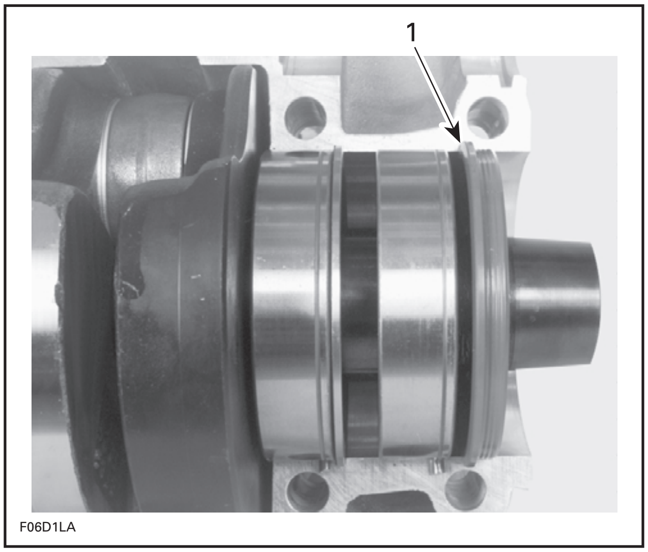
Distance Ring

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

Crankshaft Seal

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

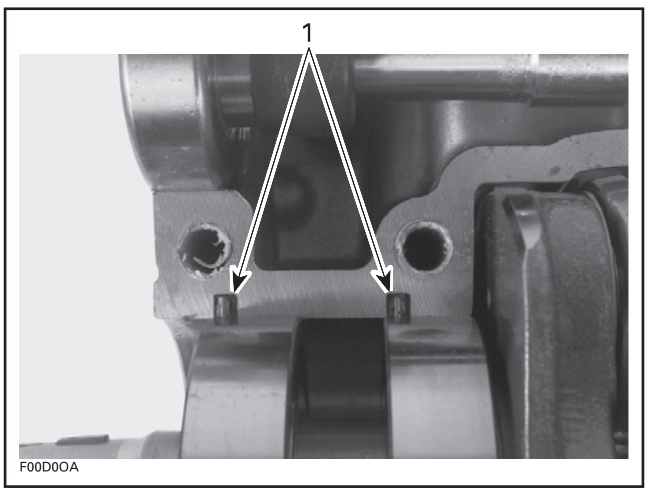
Seals are positioned with the outer lip in the crankcase recess.



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*

Counterbalance Shaft

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.

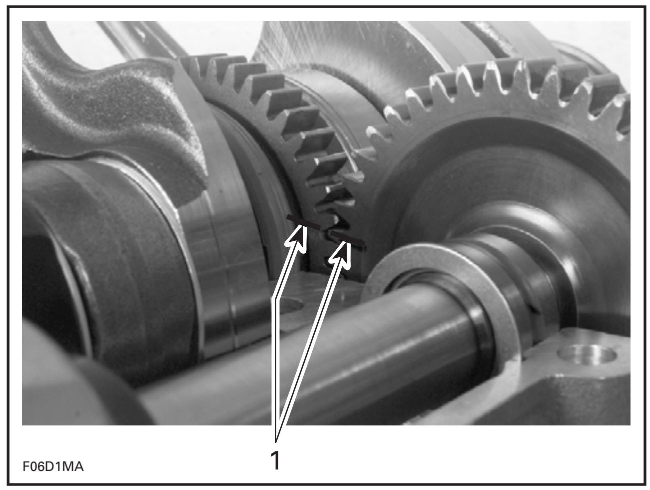
Reinstall counterweights **no. 16** using a press and take care to align index marks previously traced.

Crankshaft and Counterbalance Shaft

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.

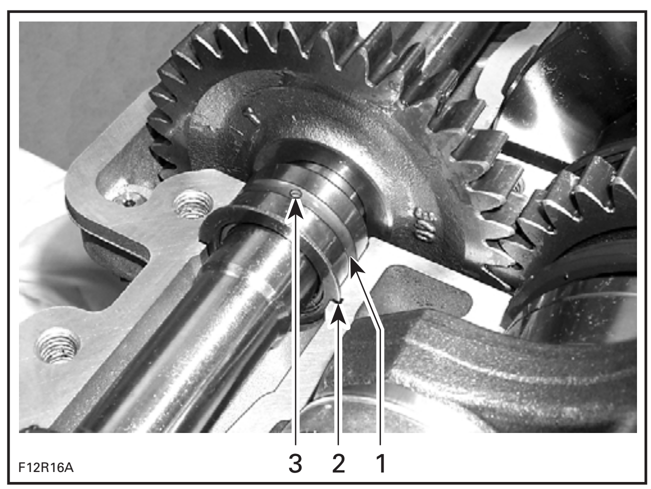
CAUTION: Marks on the crankshaft and counterbalance shaft must be aligned, otherwise engine will vibrate and premature wear will occur.



1. *Marks must be aligned*

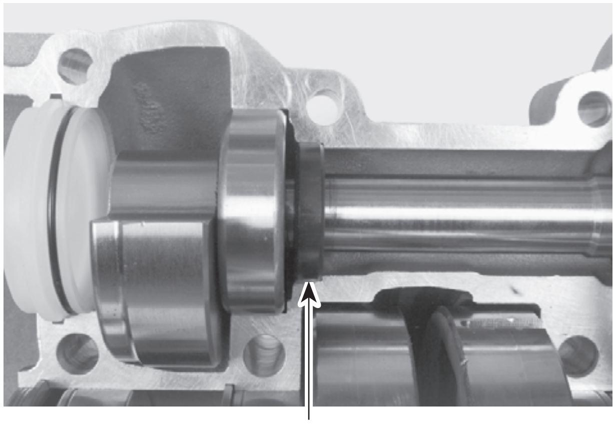
Turn by hand the crankshaft and counterbalance shaft. Make sure they do not interfere with the crankcase.

Properly position bearing **no. 31** and washer **no. 32**. Ensure to position lubrication hole on top (**if so equipped**).



1. *Bearing*
2. *Washer in crankcase groove*
3. *Lubrication hole on top **(if so equipped)***

Place seals **no. 17** in their respective positions.



F06D1OA

1. *Seal in place*

947 DI Engines

Air Compressor

Refer to ENGINE MANAGEMENT for procedures.

Crankcase

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

947 Carburetor-Equipped Engines

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.

947 DI Engine

Add 40 mL (1.35 oz) of Sea-Doo synthetic jet pump oil (P/N 293 600 011) or standard gear oil in the counterbalance shaft gear cavity.

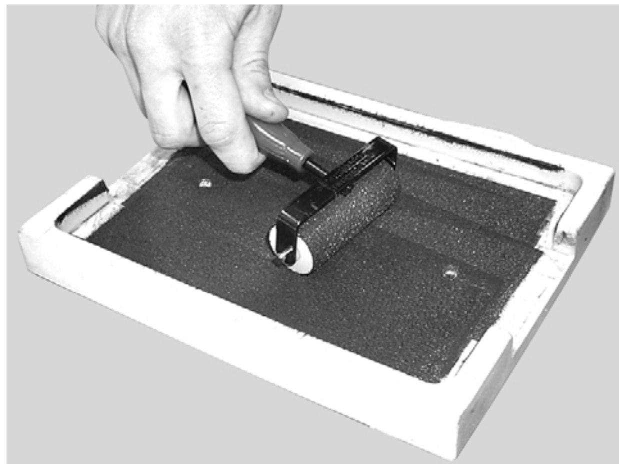
CAUTION: Using different type of oil may reduce engine component life.

IMPORTANT: When beginning the application of the crankcase sealant, the assembly and the first torquing should be done within 10 minutes. It is suggested to have all you need on hand to save time.

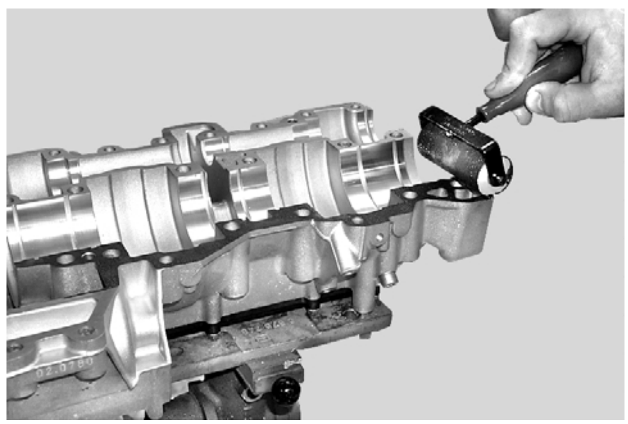
NOTE: It is recommended to apply this specific sealant as described here to get an uniform application without lumps.

Use the silicone-based Loctite 5910 (P/N 293 800 081) on mating surfaces.

Use a plexyglass plate and apply some sealant on it. Use a soft rubber roller (50 - 75 mm (2 - 3 in)) (available in arts products suppliers for printmaking) and roll the sealant to get a thin uniform coat on the plate (spread as necessary). When ready, apply the sealant on crankcase mating surfaces.



F12R17A



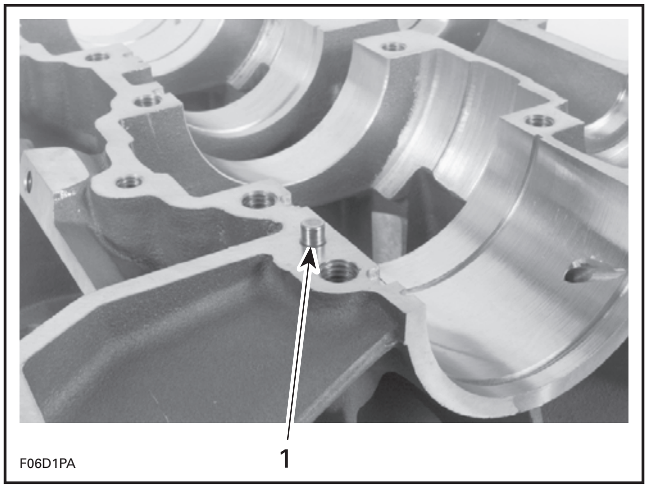
F12R18A

Do not apply in excess as it will spread out inside crankcase.

CAUTION: If sealant spread out inside air compressor area, it clould plug the compressor lubrication nipple and serious compressor damage may occur. NEVER use the Loctite 515 or 518 to seal this crankcase.

NOTE: Do not use Loctite Primer N with this sealant. The sealant curing time is similar to the Loctite 518 without using the Primer N.

Make sure all locating dowels are in place.



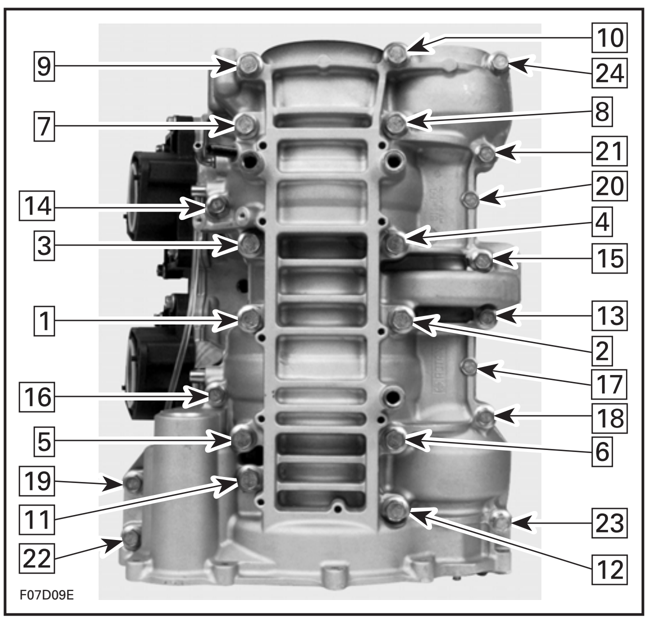
1. *Dowel*

All Engines

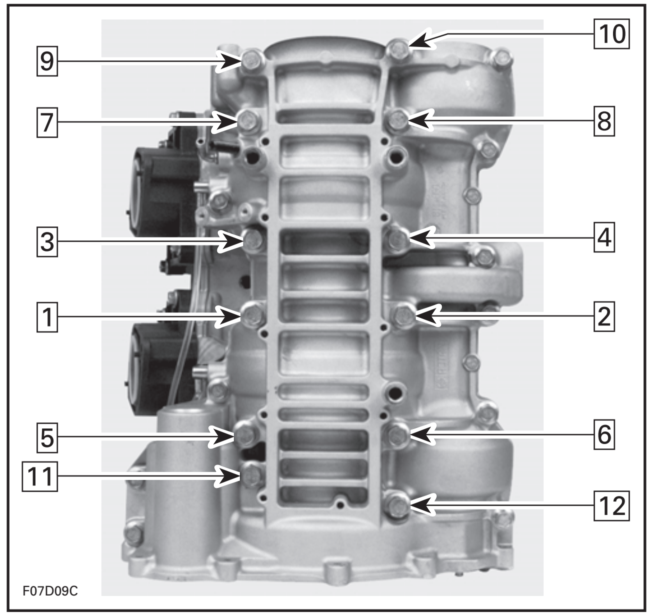
Crankcase Screws

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).

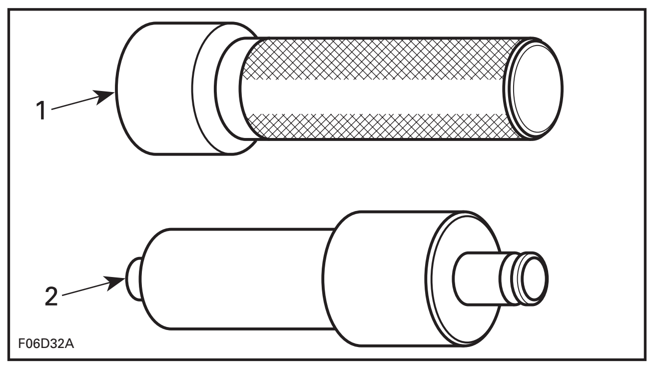


As a final step, torque only the M10 x 73.5 bolts to 40 N•m (30 lbf•ft) as per following sequence.



Starter Drive Bearing

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

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).

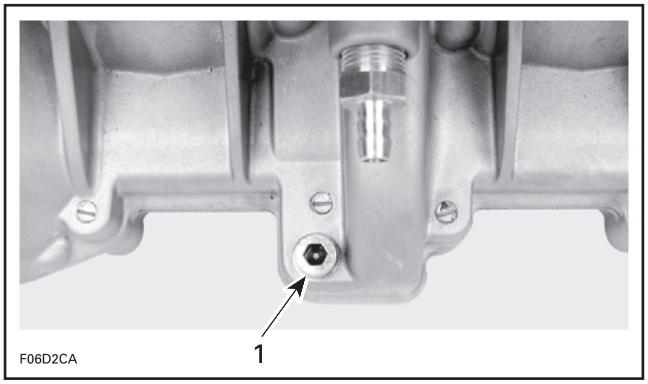
Apply Loctite 648 on mating surface of PTO flywheel and coupler.

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

Final Assembly

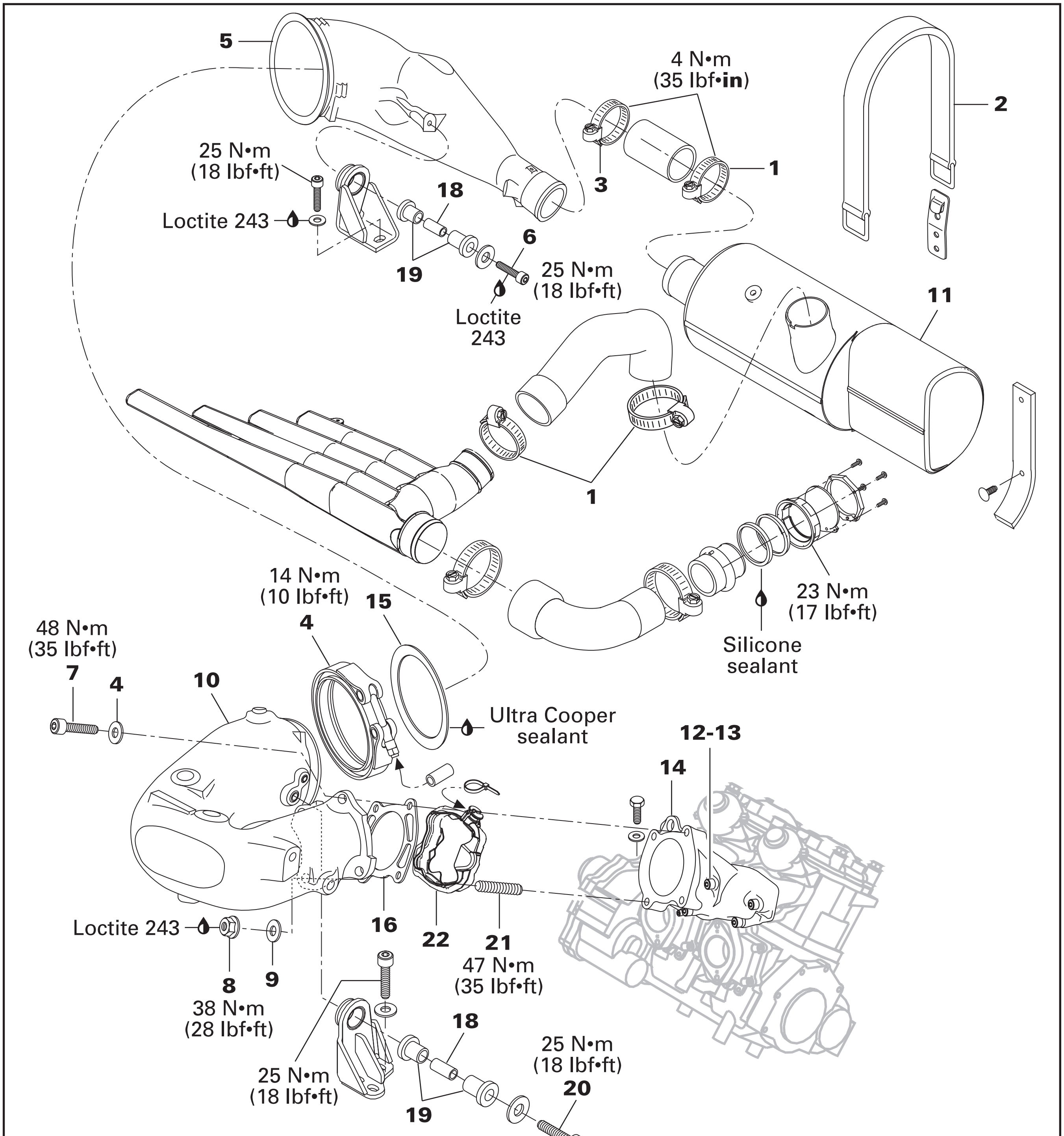
947 Carburetor-Equipped Engines

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

EXHAUST SYSTEM



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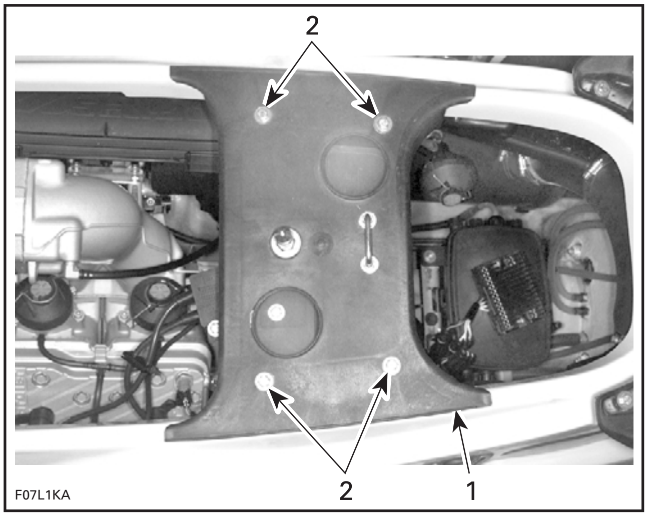
REMOVAL

RX Models

Remove seat.

GTX DI Models

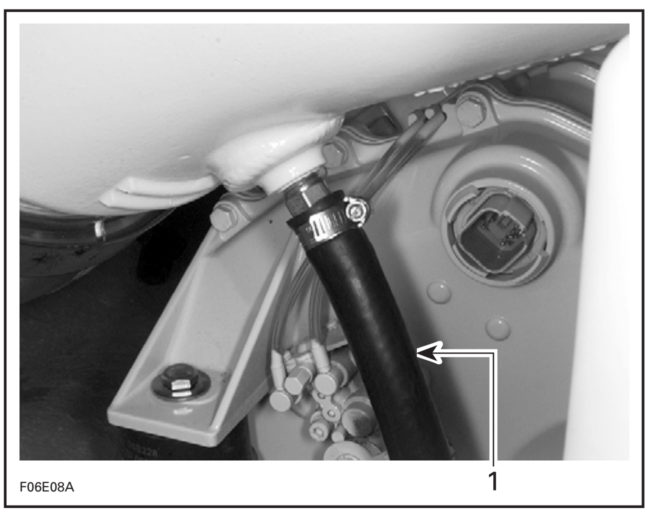
Remove seat support.



1. *Seat support*
2. *Remove screws*

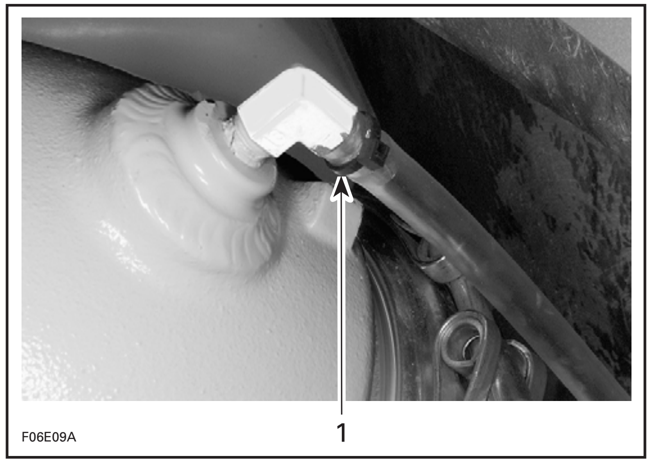
Tuned Pipe

Disconnect water return hose at tuned pipe head **no. 10**.



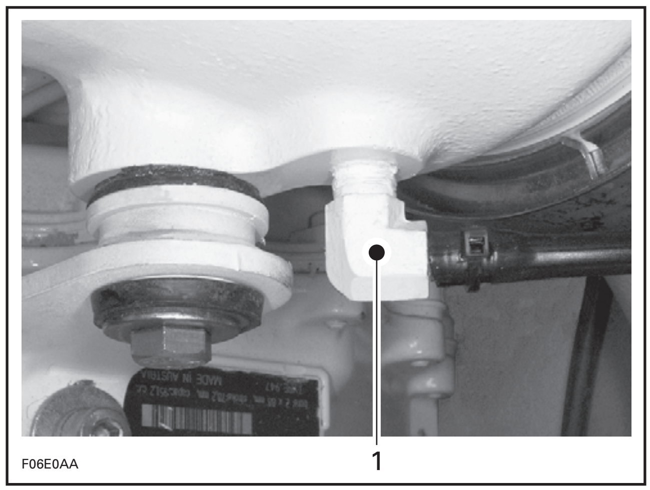
1. *Water return hose*

Disconnect small hose from water outlet fitting at the tuned pipe head **no. 10**.



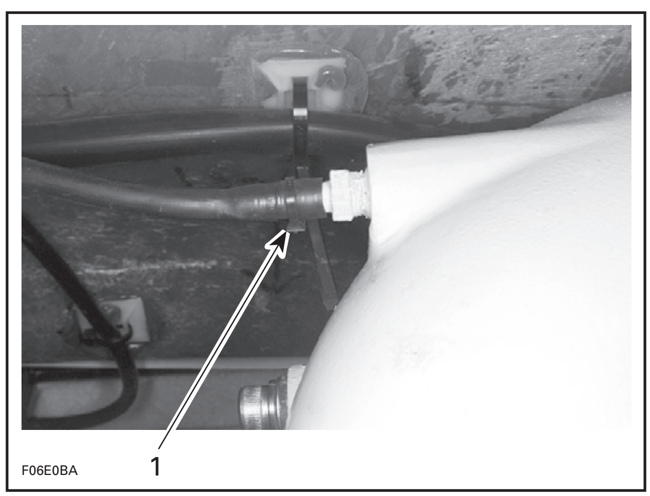
1. *Disconnect hose from outlet fitting*

Disconnect the water injection hose at tuned pipe head **no. 10**.



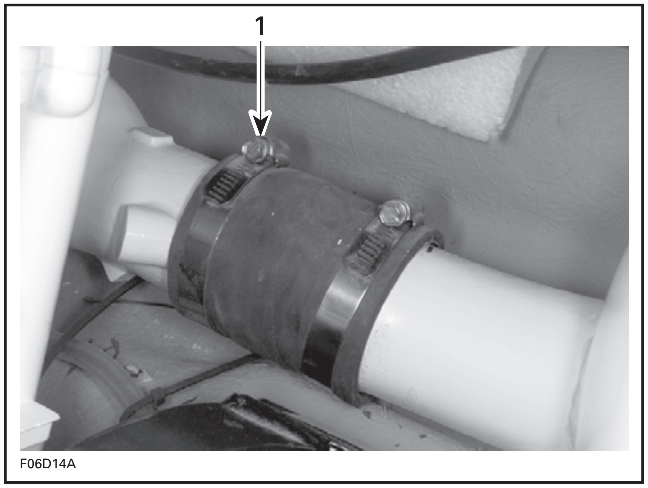
1. *Water injection hose*

Disconnect the water bleed hose.



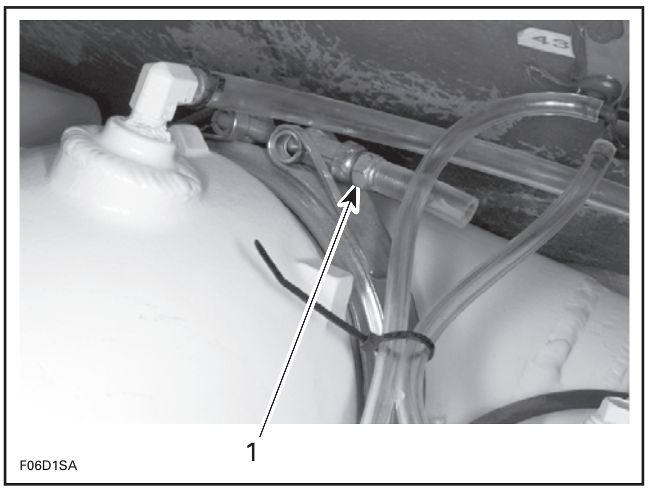
1. *Water bleed hose*

Loosen clamp **no. 1** retaining exhaust hose **no. 3** to tuned pipe cone **no. 5**.



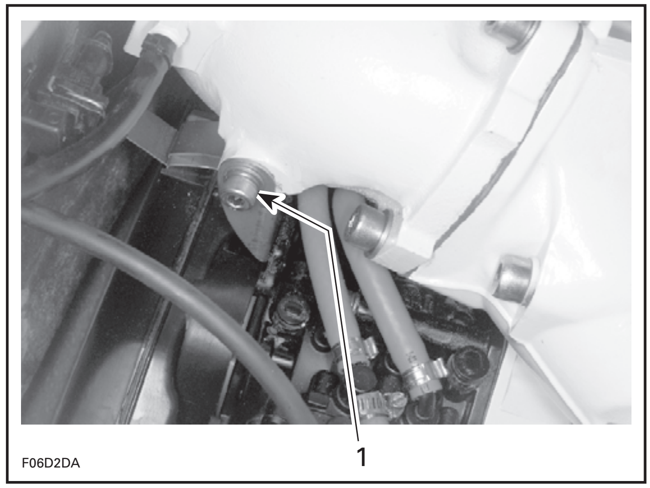
1. *Loosen clamp*

Loosen and remove clamp **no. 4** retaining tuned pipe head **no. 10** to tuned pipe cone **no. 5**.



1. *Loosen and remove clamp*

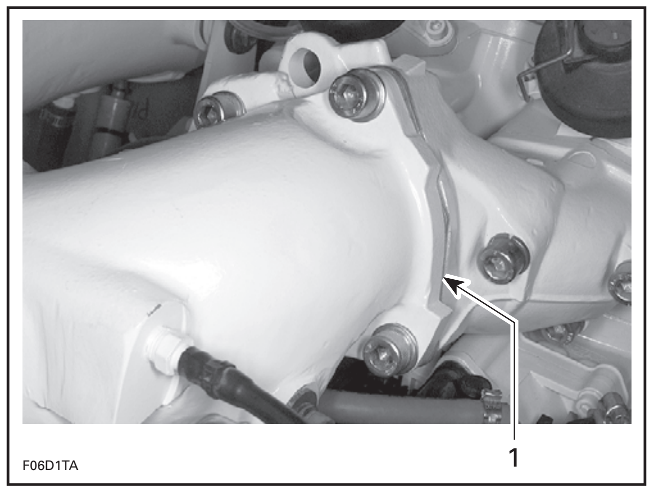
Loosen Allen screw retaining carburetor/throttle body bracket to tuned pipe head.



1. *Loosen Allen screw*

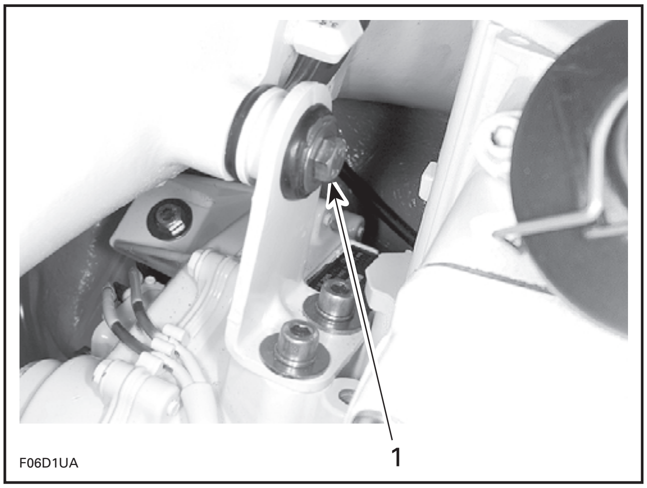
Loosen Allen screws **no. 7** and nut **no. 8** at tuned pipe flange.

NOTE: To loosen nut, use polygonal wrench (P/N 529 035 505).



1. *Tuned pipe flange*

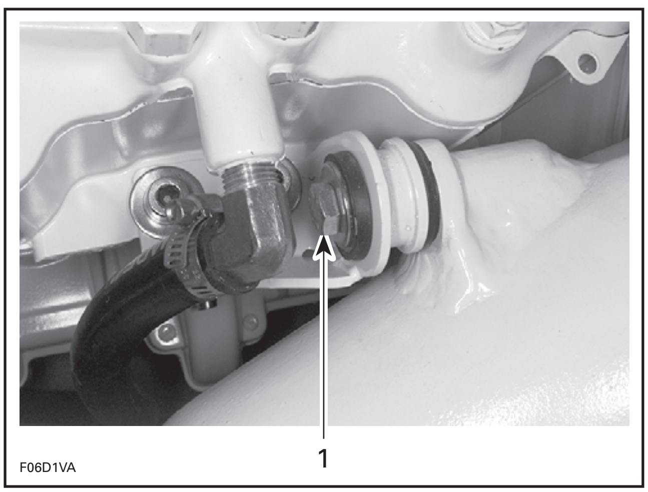
Loosen bolt **no. 20** of tuned pipe head above the engine magneto.



1. *Remove bolt*

Remove tuned pipe head **no. 10**.

Loosen bolt **no. 6** of tuned pipe cone beside the engine water supply 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 screw tap 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

RX Models

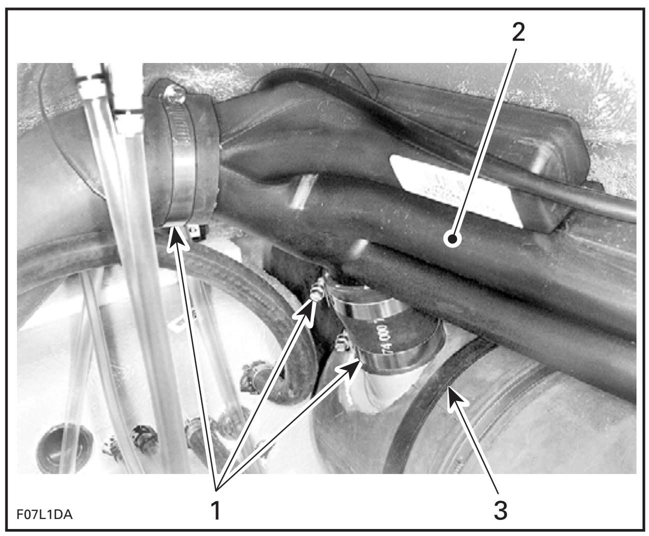
Remove vent tube support.

RX DI Models

Upper Type Resonators

Detach resonator from body.

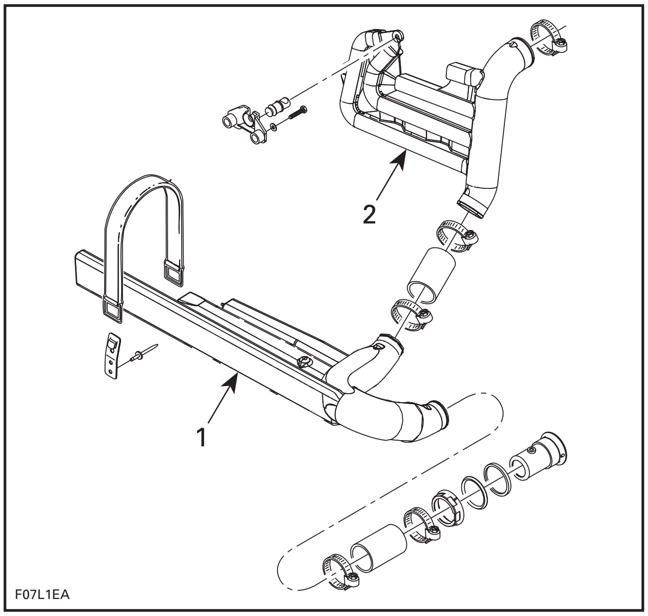
Loosen clamps and disconnect hoses. Withdraw resonator from watercraft.



TYPICAL
1. *Loosen hose clamps*
2. *Upper type resonator*
3. *Muffler holding strap*

Footwell Type Resonators

NOTE: Some models are equipped with both types of resonators.



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.

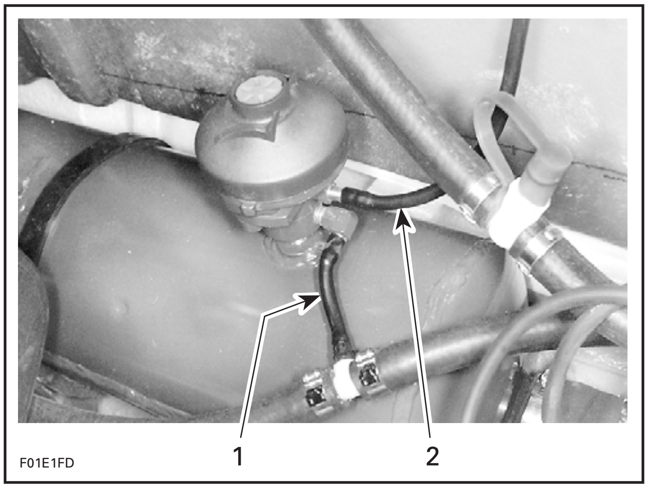
Pull resonator out of bilge.

Muffler

On DI models, disconnect the EGT (exhaust gas temperature) sensor.

Disconnect hoses from muffler **no. 11**.

Disconnect hoses of the water flow regulator valve.



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 RX models, remove the VTS motor. Refer to VARIABLE TRIM SYSTEM.

All Models

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.

NOTE: Prior to verifying leaks, plug all holes and pressurize tuned pipe while immerging it in water.

CAUTION: Always ensure water passages are not blocked partially or completely while welding tuned pipe.

INSTALLATION

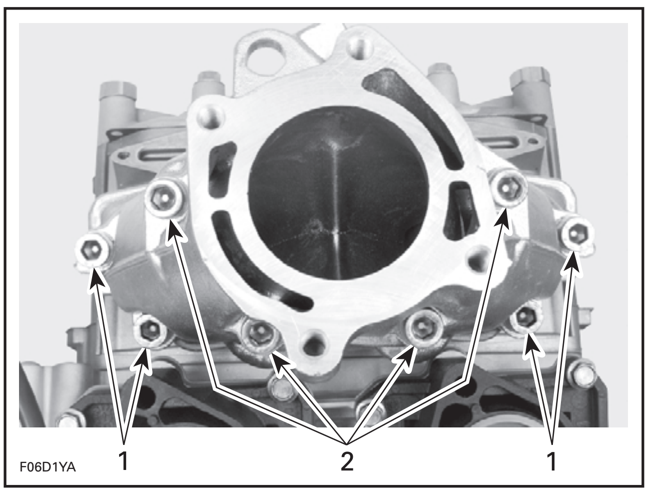
Installation is essentially the reverse of removal procedures. However, pay particular attention to the following.

Exhaust Manifold

Make sure gasket(s) **no. 17** are properly positioned prior to finalizing manifold installation.

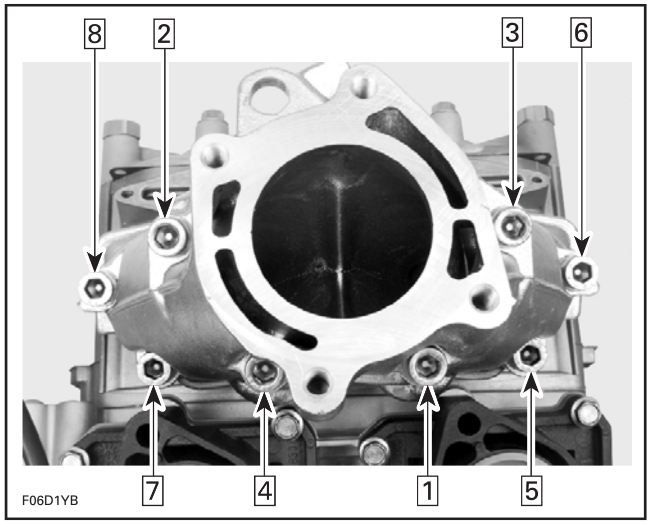
Apply Molykote 111 on threads of Allen screws **no. 12**.

Install and hand tighten Allen screws **no. 12** as per following picture.



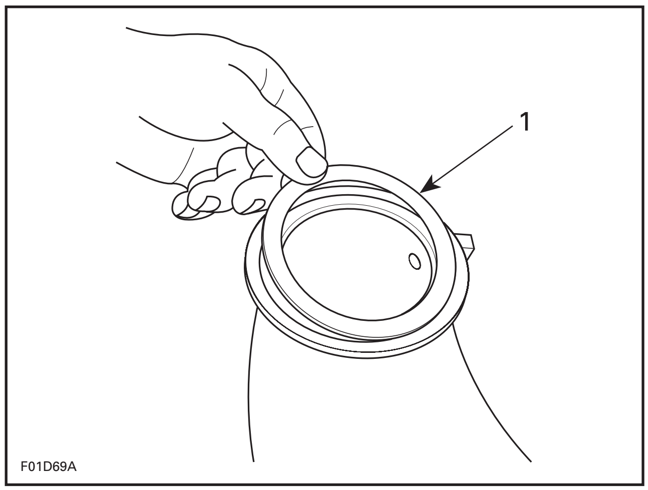
1. M10 x 60 Allen screws
2. M10 x 110 Allen screws

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

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.

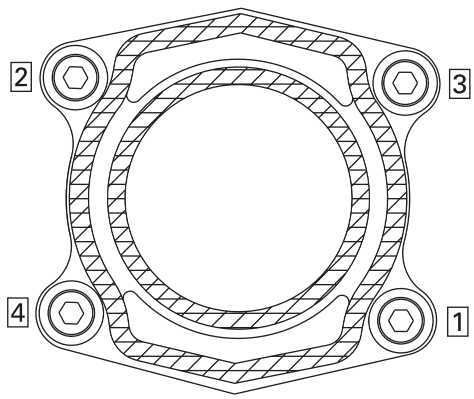
Install the new bushing **no. 18**.

CAUTION: Torque the tuned pipe in accordance with the following sequence, otherwise serious engine damage will occur.

Torquing sequence:

Torque all screws by hand. Do not torque yet.

Torque the 3 screws **no. 7** to 6 N•m (53 lbf•**in**) and the nut **no. 8** to 3 N•m (27 lbf•**in**), using the polygonal key (P/N 529 035 505), as per the following illustration.



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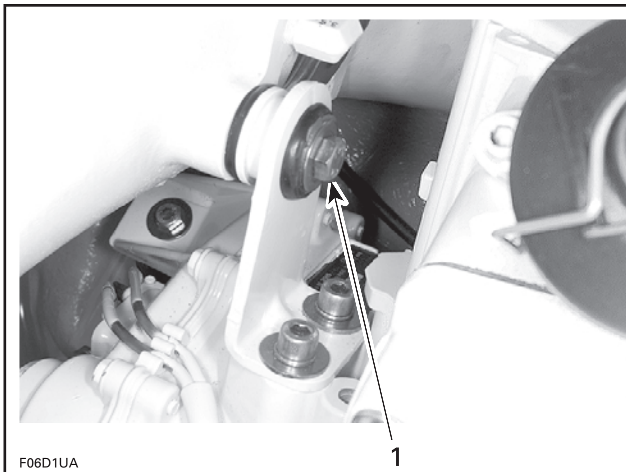
NOTE: Apply Loctite 243 on the stud threads.

Retorque the 3 screws **no. 7** to 48 N•m (35 lbf•ft) and the nut **no. 8** to 38 N•m (28 lbf•ft). Use the same order as the previous step.

Torque bolt of tuned pipe head above the engine magneto to 40 N•m (29 lbf•ft).



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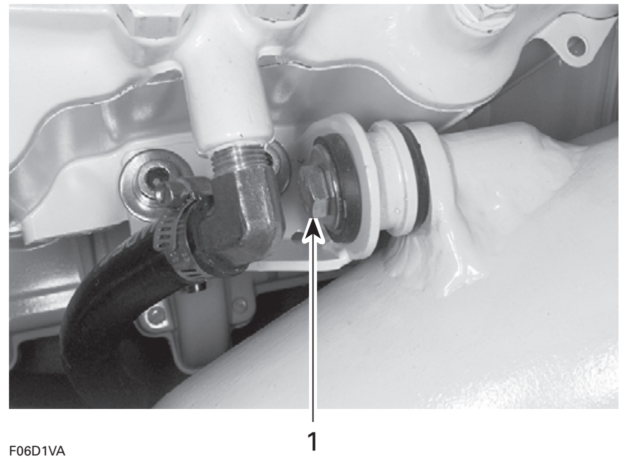
1. *Torque bolt to 40 N•m (29 lbf•ft)*

Torque bolt of tuned pipe cone beside the engine water return hose to 40 N•m (29 lbf•ft).

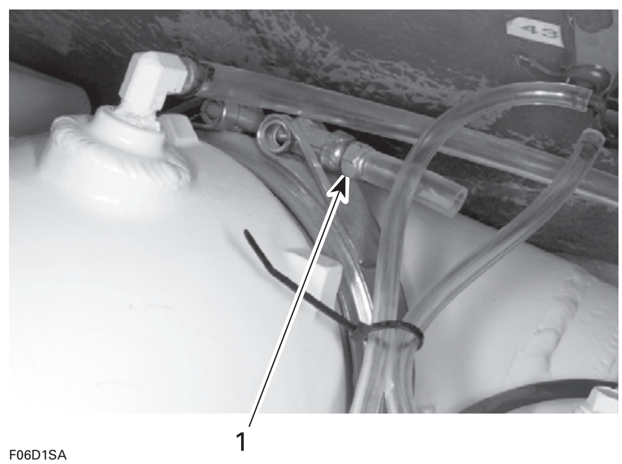


F06D1VA

1. *Torque bolt to 40 N•m (29 lbf•ft)*

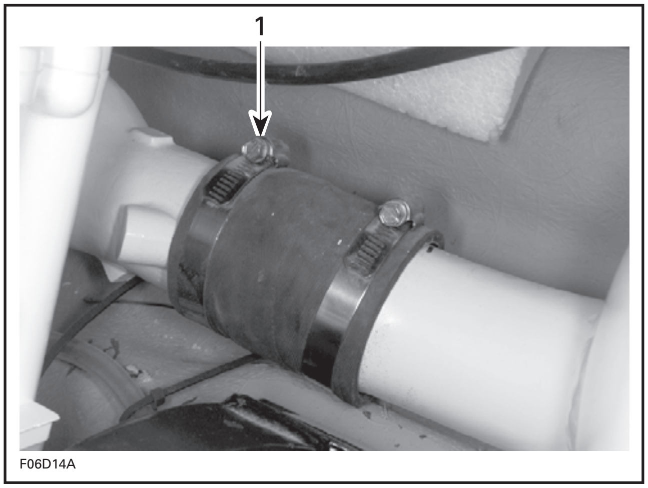
Install the recovery envelope **no. 22** and secure with a tie rap.

Torque clamp of tuned pipe head to 14 N•m (10 lbf•ft).



F06D1SA

1. *Torque clamp to 14 N•m (10 lbf•ft)*



1. *Torque clamp to 4 N•m (35 lbf•**in**)*

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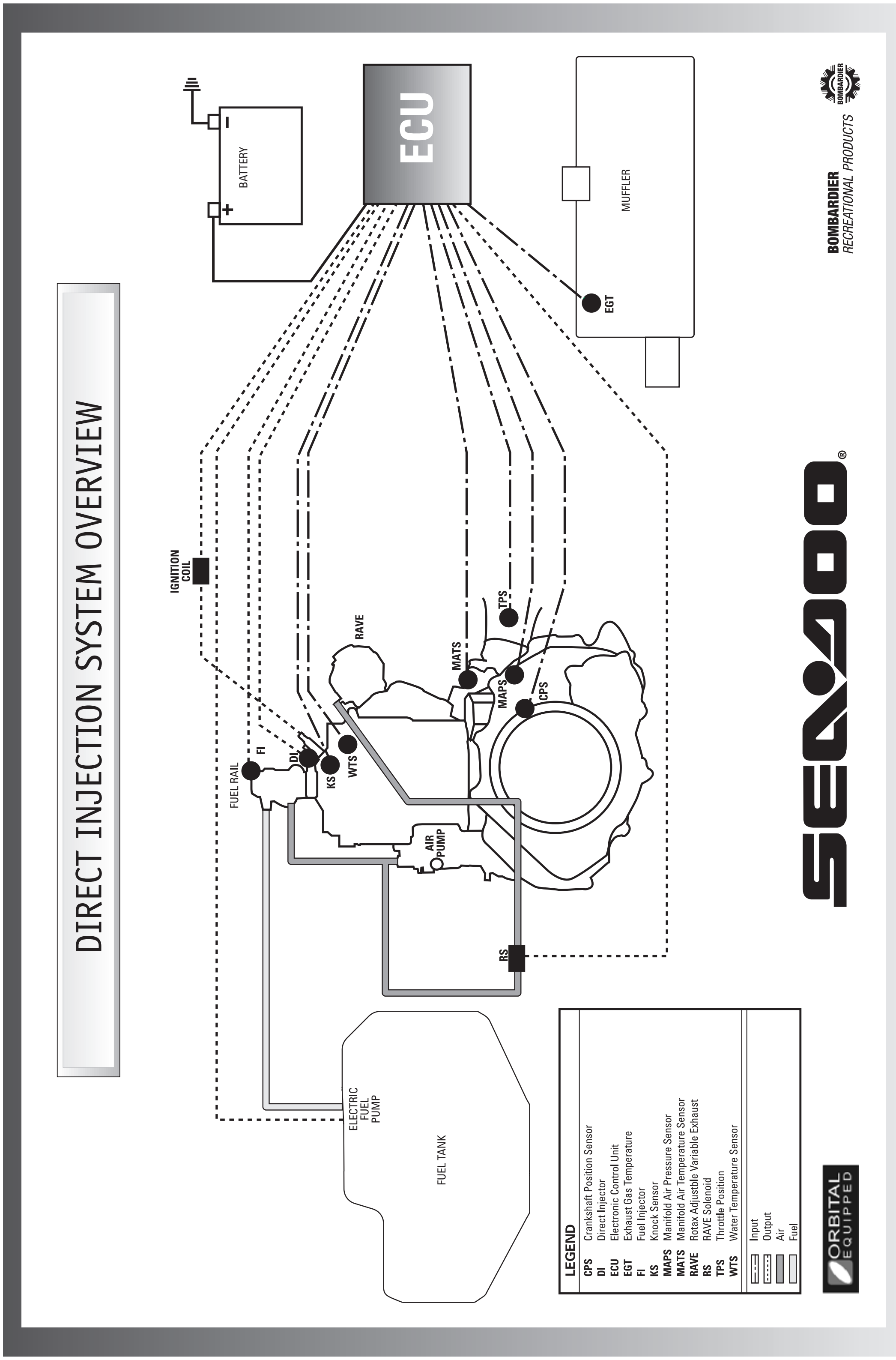
OVERVIEW



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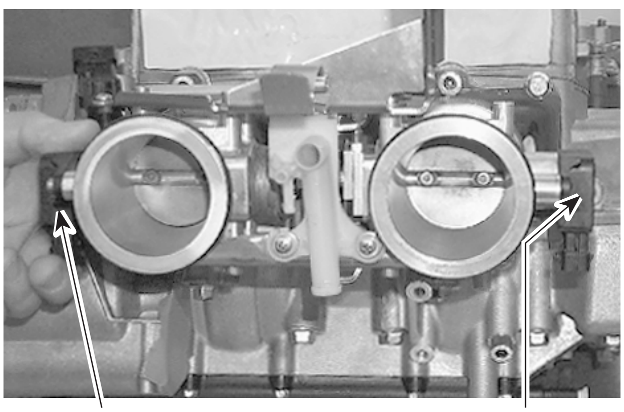
OPERATING PRINCIPLE

The Orbital Combustion Process (OCP) provides a stratified combustion process resulting from the direct injection of a finely atomized fuel spray (less than 10 microns). This is achieved by using a pneumatically assisted direct injection system, a unique combustion chamber geometry and a precise control of the combustion process by the MPEM (Multi-Purpose Electronic Module).

AIR INDUCTION

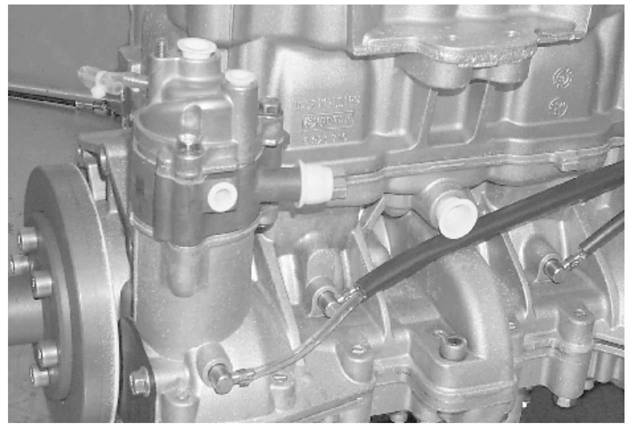
Air for combustion is drawn directly at the base of the engine through two 46 mm throttle bodies. The air flow is controlled by two throttle plates. The air continues through the reed valves into the crankcase.



TWIN 46 mm THROTTLE BODIES
1. *Throttle position sensor (TPS)*

AIR COMPRESSOR SYSTEM

The air compressor supplies the compressed air required for fuel atomization in the air injector. It is integrated with the engine and mechanically driven by the counterbalance shaft. It also supplies the air pressure required to operate the RAVE valves.



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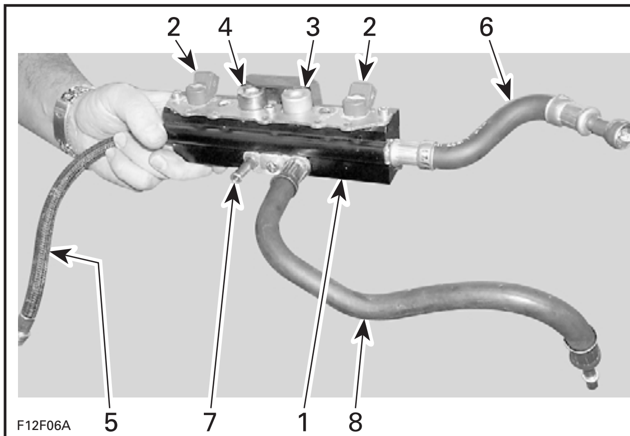
FUEL DELIVERY SYSTEM

BASIC OPERATION

When the piston reaches the correct position, the MPEM opens the fuel injector and fuel is discharged into a cavity inside the direct injector.

Next, the direct injector opens and the fuel is discharged into the combustion chamber by the compressed air which breaks the fuel up into a very fine mist in the process. This air/fuel mixture is then ignited by the spark plug.

AIR/FUEL RAIL ASSEMBLY



TYPICAL
1. *Air/fuel rail*
2. *Fuel injector*
3. *Fuel pressure regulator*
4. *Air pressure regulator*
5. *Air inlet hose*
6. *Fuel inlet*
7. *Air return*
8. *Fuel return*

The air/fuel rail assembly is mounted on top of the cylinder head. It provides support for the air/fuel injectors and both air and fuel regulators. It also contains passages for the air and the fuel. The rail is a small reservoir for the injectors that keeps enough fluid at the proper pressure to supply the injectors demand.

Fuel Injector

Fuel injectors are used to provide fuel from the fuel rail to the to the direct injector.

Fuel Pressure Regulator

A fuel pressure regulator controls the pressure inside the fuel rail, and allows the excess of fuel to return to the fuel tank. The fuel pressure regulator regulates the fuel pressure at approximately 185 kPa (27 PSI) higher than the air pressure in the fuel rail. The back side of the diaphragm is exposed to the air rail pressure. As the air pressure increases in the fuel rail, the fuel pressure needed to open the regulator will increase equally.

The differential pressure regulation utilizes the air pressure reference signal to maintain constant pressure drop across fuel injector orifice.

The initial operating pressure of the regulator is preset by the manufacturer and is not adjustable.

Direct Injector

Also called air injector, two direct injectors (one per cylinder) are used to inject air/fuel mixture into the combustion chamber.

Air Pressure Regulator

An air pressure regulator regulates the pressure of air delivered by the air compressor.

It regulates the pressure developed inside the air passage to approximately 550 kPa (80 PSI).

The initial operating pressure of the regulator is preset by the manufacturer and is not adjustable.

FUEL PUMP MODULE

F12D0DA

The fuel pump module is located inside the fuel tank. The module includes the fuel pump and the fuel level sensor.

Fuel Pump

It operates at a nominal pressure of approximately 735 kPa (107 PSI).

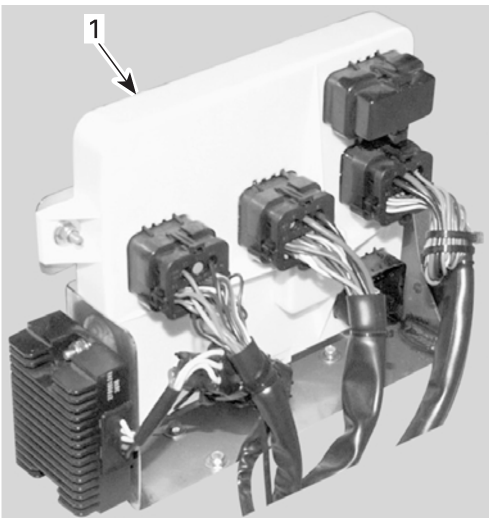
Fuel Filter

A mesh filter is located at the bottom of the fuel pump module inside the fuel tank. An inline fuel filter is also installed on the fuel line going to the fuel rail.

ELECTRONIC MANAGEMENT

MPEM (multi-purpose electronic module)

The electronic fuel injection is equipped with a MPEM. It is also called ECU (Electronic Control Unit). It is the brain of the electrical system/fuel injection system.



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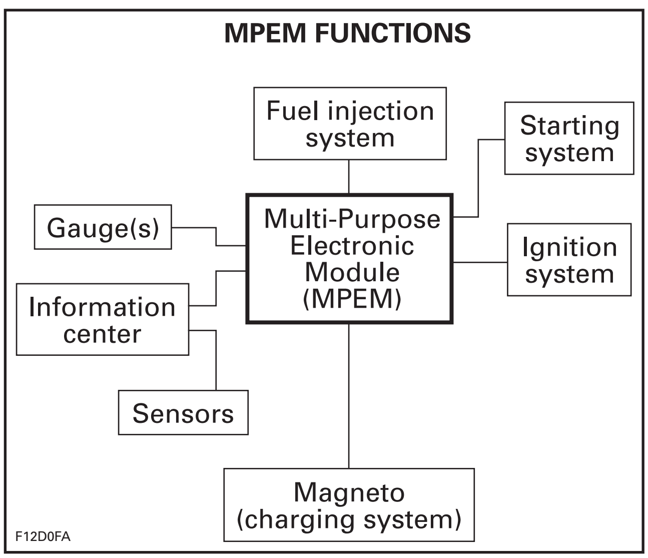
1. *Multi-Purpose Electronic Module (MPEM)*

The MPEM is mounted in the front of the watercraft.



The MPEM is directly powered by the battery. It is responsible for the following engine management/electrical functions:

– interpreting information
– distributing information
– start/stop function
– timer
– DESS (Digitally Encoded Security System)
– ignition timing maps
– injection maps (fuel injector and direct injector)
– MPEM contains a total of 34 maps (injection and ignition) for optimum engine operation in all conditions
– engine RPM limiter
– etc.

The MPEM features a permanent memory that will keep the programmed safety lanyard(s) active, fault codes and other vehicle information, even when the battery is removed from the watercraft.

MPEM — General 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 post 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 the start/stop button is not depressed, then the MPEM will be automatically powered down.

Antistart Feature

This system allows starting the vehicle only with safety lanyard(s) that has been programmed to operate a specific watercraft. This functionality is the DESS system. See below for details.

Digitally Encoded Security System (DESS)

The following components are specially designed for this system: Multi-Purpose Electronic Module (MPEM), safety lanyard cap and safety lanyard post.

The safety lanyard cap contains a magnet and a ROM chip. The magnet actually closes the reed switch inside the post which is the equivalent of a mechanical ON/OFF switch. 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 MPEM programmer (P/N 529 034 500) or the VCK (Vehicle Communication Kit) P/N 529 035 676. Refer to their operation manual or help system to program a safety lanyard.

The system is quite flexible. Up to 8 safety lanyards may be programmed in the memory of the watercraft MPEM. They can also be erased individually.

The MPEM also offers a special safety lanyard — the Sea-Doo LK™ (learning key) — which can be programmed so that the vehicle can be run only at a limited speed — approximately 48 km/h (30 MPH). Such feature is ideal for first time riders or renters.

⚠ WARNING

When programming a Sea-Doo LK™ (learning key), use only a lanyard that is identified for that purpose. Otherwise, a customer could use a vehicle with a greater speed than he was expecting.

NOTE: If desired, a safety lanyard can be used on other watercraft equipped with the DESS. It only needs to be programmed for that watercraft.

When connecting a safety lanyard cap on the post, the DESS is activated and will emit audible signals:

- 2 short beeps indicate a working safety lanyard. Engine starting can take place.
- 1 long beep indicates a wrong safety lanyard is being used or that something is defective. Engine starting is not allowed.

The memory of the MPEM features two self-diagnostic modes for the DESS operation. Refer to DIAGNOSTIC PROCEDURES section for more information.

The memory of the MPEM is permanent. If the battery is disconnected, no information is lost.

When ordering a new MPEM from the regular parts channel, the DESS circuitry will be activated.

Gauges Current Supply

The purpose of this function is to allow reading of gauges without the engine running. It will give access to most functions of the information center gauge without starting the engine.

Gauges are supplied with current for 33 seconds when connecting the safety lanyard cap on its post or when pressing the start/stop switch without the safety lanyard on the DESS post.

NOTE: The fuel pump will be activated for 2 seconds to build up pressure in the fuel injection system, only when connecting the safety lanyard cap to the post.

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 or removing and reinstalling the safety lanyard is required to allow the MPEM to read and validate the safety lanyard, the engine 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.

If start button is activated while the throttle lever is depressed more than 70%, the engine will not be allowed to start.

Engine RPM Limiter

The MPEM will limit the maximum engine speed.

Engine Stopping

There are 2 ways to stop the engine.

Press and hold start/stop switch or remove the safety lanyard cap from its post.

If the engine is stopped by removing the safety lanyard, it is possible to restart the engine as explained in the engine starting section.

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 and Low-Oil 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 and to the information center gauge.

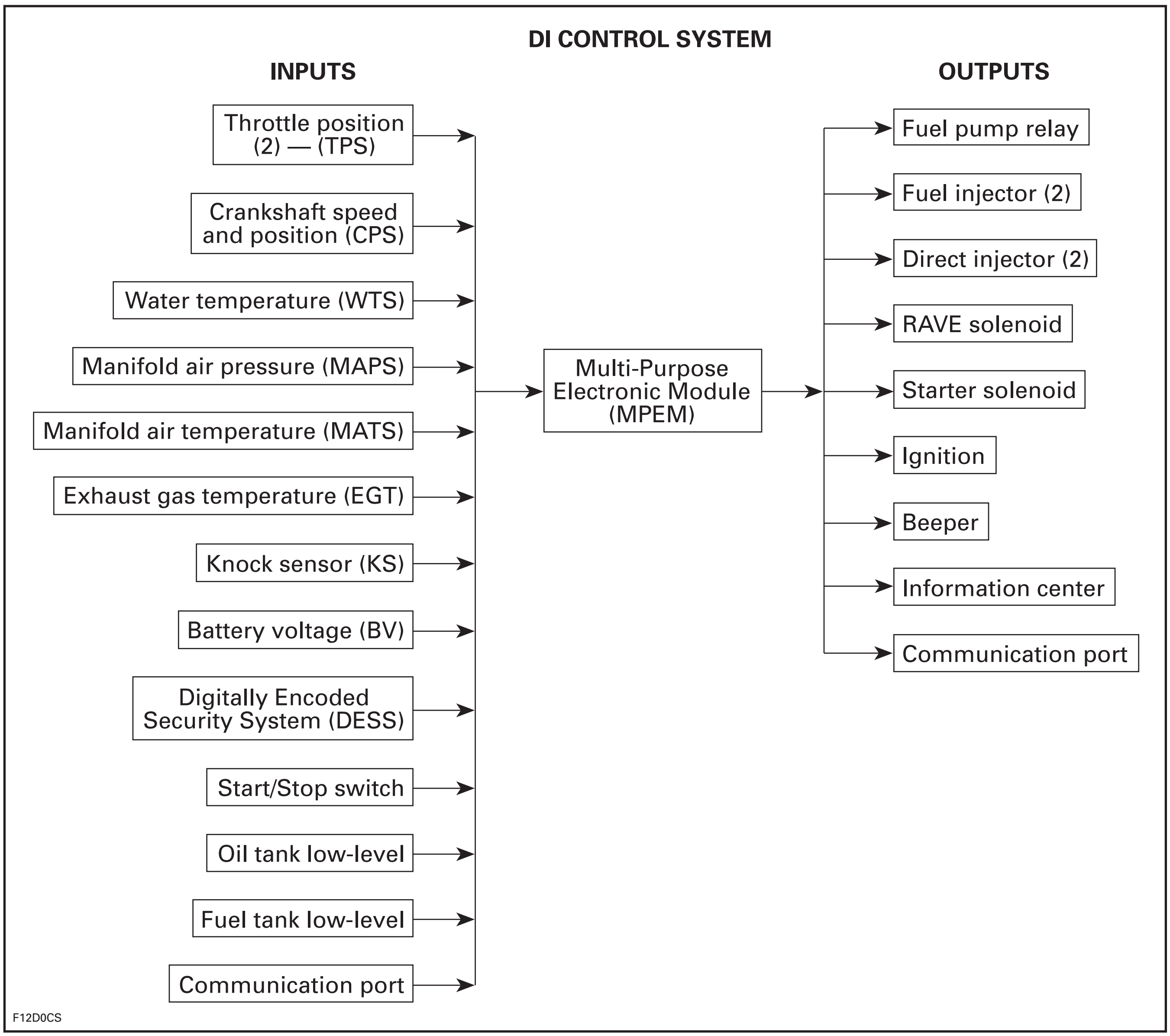
When the oil level is low in the reservoir, the MPEM sends out a signal to the information center gauge and the pilot lamp on the gauge will turn on.

Power Distribution

The MPEM distributes power from battery to all accessories. Accessories are protected by fuses integrated in the MPEM. Fuses are identified besides their holder.

IMPORTANT: The sensors and injectors are continuously powered with the supply from the battery. **The MPEM switches the ground to complete the electrical circuits it controls.** Take this into account when troubleshooting the electrical system.

MPEM — Engine Management Functions



This engine management system controls both the fuel injection and the ignition timing.

As shown in the DI CONTROL SYSTEM illustration, the MPEM is the central point of the fuel injection system. It reads the inputs, makes computations, uses pre-determined parameters and sends the proper signals to the outputs for proper engine management.

The MPEM also stores the fault codes and general information such as: operating conditions, vehicle hours, serial numbers, customer and maintenance information.

Electronic Fuel Injection

The MPEM receives the signals from different sensors which indicate engine operating conditions at milli-second intervals.

Signals from sensors are used by the MPEM to determine the injection parameters (fuel maps) required for optimum air-fuel ratio.

The CPS and both TPS are the primary sensors used to control the injection and ignition timing. Other sensors are used for secondary input.

NOTE: The EGT sensor does not provide control inputs to the MPEM. Its sole purpose is to protect the exhaust system components by emitting a warning signal in the event of overheating.

Ignition Timing

The MPEM is programmed with data (it contains ignition mappings) for optimum ignition timing under all operating conditions. Using engine operating conditions provided by the sensors, the MPEM controls the ignition timing for optimum engine operation.

Knock Sensor

A knock sensor is mounted on top of the cylinder head. It detects specific vibration that would be typically generated by engine detonation. If detonation occurs, the knock sensor detects it and the MPEM retards the ignition advance temporarily (it goes in a specific mode) until detonation stops.

Engine Modes of Operation

The MPEM controls different operation modes of the engine to allow proper operation for all possible conditions: Cranking, flare, idle, warm up, normal operation, Sea-Doo LK™ (learning key) (limited vehicle speed), engine speed limiter, drowned engine and limp home (see below).

Flooded Engine (drowned mode)

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.

While engine is stopped, depress and HOLD the throttle lever at full throttle position for cranking.

Crank the engine several times.

A 1 second beep every second indicates the drowned mode is active.

NOTE: Proceeding in this order, no fuel is injected, no ignition occurs and the accumulated fuel in the engine will be expelled.

In case of water-flooded engine, if water does not completely go out, it may be necessary to remove the air intake silencer then to lean the vehicle so that water can flow out from throttle bodies.

Reinstall spark plugs and connect cables.

Start engine normally without applying the throttle.

Monitoring System

The MPEM monitors the electronic components of the fuel injection system and some components of the electrical system. When a fault occurs, it sends visual messages through the information center and/or audible signals through a beeper to inform you of a particular condition. Refer to the DIAGNOSTIC PROCEDURES section for the displayed messages and the beeper coded signals chart.

Limp Home Modes

Besides the signals as seen above, the MPEM may automatically set default parameters to the engine management to ensure the adequate operation of the watercraft if a component of the fuel injection system is not operating properly.

Depending on the severity of the malfunction, the watercraft speed may be reduced and not allowed to reach its usual top speed as usual.

The engine RPM may be limited to idle if some critical components fail. In this case, removing and reinstalling the safety lanyard on its post may allow retrieving normal operation.

These performance-reduced modes allow the rider to go back home which would not be possible without this advanced system. Refer to the DIAGNOSTIC PROCEDURES for a complete chart.

If a fault occurs and involves a limp home mode operation, the DI system will reduce engine RPM gradually to the proper level.

Diagnostic Mode

The malfunctions are recorded in the memory of the MPEM. The memory of the MPEM can be checked using the VCK (Vehicle Communication Kit) (P/N 529 035 676) to see the fault codes. Refer to the DIAGNOSTIC PROCEDURES section.

IGNITION SYSTEM

The ignition system consist of different sub-systems where some are interrelated.

Unregulated AC current is produced by the magneto. Part of the AC current is rectified and regulated for the charging system.

A 12 Volts battery supplies the Multi-Purpose Electronic Module (MPEM) with DC current.

Refer to CHARGING SYSTEM.

The following type of ignition system is used:

– Digital Inductive System.

Magneto System

The magneto is the primary source of electrical energy. It transforms magnetic field into electric current (AC).

The magneto has a 3 phases, delta wound stator on 18 poles. Capacity is 270 watts.

Ignition Coil

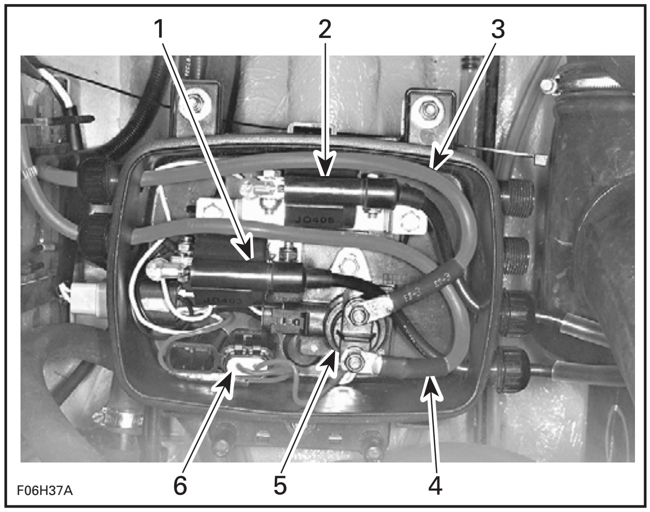
Ignition coil induces voltage to a high level in the secondary windings to produce a spark at the spark plug.

Two separate ignition coils receive input from the MPEM. Each coil provides high voltage to its corresponding spark plug.

This ignition system allows spark plugs to spark independently.

CAUTION: Do not interchange spark plug cables. The white tape on the ignition coil should match the white tape on the high tension cable.

Both coils are located inside the electrical box.



TYPICAL
1. *Ignition coil PTO*
2. *Ignition coil MAG*
3. *Starter cable*
4. *Positive battery cable*
5. *Solenoid*
6. *Fuse*

COMPONENT INSPECTION AND ADJUSTMENT

GENERAL

Engine problems are not necessarily related to the electronic fuel injection system.

It is important to ensure that the mechanical integrity of the engine/propulsion system is present:

– good jet pump/drive system operation
– good engine compression and properly operating mechanical components, no leaks etc.
– fuel pump connection and fuel lines without leaks.

Check the chart in TROUBLESHOOTING section to have an overview of problems and suggested solutions.

When replacing a component, always check its operation after installation.

⚠ WARNING

Air compressor hose may be hot. Use a rag or gloves or let hose cool down.

FUEL SYSTEM

⚠ WARNING

The fuel system of a fuel injection system holds much more pressure than on a carbureted watercraft. Prior to disconnecting a hose or to removing a component from the fuel system, follow the recommendation described here.

– Always disconnect battery properly prior to working on the fuel system.
– Use the VCK (Vehicle Communication Kit) (P/N 529 035 676) to release the fuel pressure in the system. Look in the **Activation** section of the software B.U.D.S.

⚠ WARNING

Fuel lines remain under pressure at all times. Always proceed with care and use appropriate safety equipment when working on pressurized fuel system. Wear safety glasses and work in a well ventilated area. Do not allow fuel to spill on hot engine parts and/or on electrical connectors. Proceed with care when removing/installing high pressure test equipment or disconnecting fuel line connections. Use the VCK (Vehicle Communication Kit) to release fuel pressure prior to removing a hose. Cover the fuel line connection with an absorbent shop rag. Slowly disconnect the fuel hose to minimize spilling. Wipe off any fuel spillage in the bilge. Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area. Always disconnect battery prior to work on the fuel system. After performing a pressure test, use the valve on the fuel pressure gauge to relase the pressure.

When the job is done, ensure that hoses from fuel rail going to fuel pump are properly secured in their support. Then, pressurize the fuel system. Perform the high pressure test as explained in this section and pressurize the fuel tank and fuel lines as explained in FUEL SYSTEM section.

Properly reconnect the battery.

⚠ WARNING

Ensure to verify fuel line connections for damage and that NO fuel line is disconnected prior to installing the safety lanyard on the DESS post. A pressure test must be done before connecting the safety lanyard. The fuel pump is started each time the safety lanyard is installed and it builds pressure very quickly.

CAUTION: Never use injector cleaning products. They may contain additive that could damage injector components. A copper wire brush may be used to clean the tip of the direct injectors if necessary.

ELECTRICAL SYSTEM

It is important to check that the electrical system is functioning properly:

– battery
– fuses
– DESS
– ignition (spark)
– ground connections
– wiring connectors.

It is possible that a component seems to operate in static condition but in fact, it is defective. In this case, the best way to solve this problem is to remove the original part and replace it with one which is in good condition.

Never use a battery charger to replace temporarily the battery, as it may cause the MPEM to work erratically or not to work at all. Check related-circuit fuse solidity and condition with an ohmmeter. Visual inspection could lead to false results.

⚠ WARNING

All electrical actuators (injectors, fuel pump, RAVE solenoid, ignition coil and starter solenoid) are permanently connected to the battery positive terminal, even when the safety lanyard is removed. Always disconnect the battery prior to disconnecting any electric or electronic parts.

To perform verifications, a good quality multimeter such as Fluke 73 (P/N 529 022 000) should be used.

Pay particular attention to ensure that pins are not out of their connectors or out of shape. The troubleshooting procedures cover problems not resulting from one of these causes.

⚠ WARNING

Ensure all terminals are properly crimped on wires and connector housings are properly fastened.

Before replacing a MPEM, always check electrical connections. Make sure that they are very tight and they make good contact and that they are corrosion-free. A "defective module" could possibly be repaired simply by unplugging and replugging the MPEM. The voltage and current might be too weak to go through dirty wire pins. Check carefully if posts show signs of moisture, corrosion or if they look dull. Clean pins properly and then coat them with silicon-based dielectric grease or other appropriate lubricant (except if otherwise specified) when reassembling them. If the newly replaced MPEM is working, try the old one and recheck if it works.

Ensure that all electronic components are genuine — particularly in the ignition system. Installing resistive caps, non-resistive spark plug cables (or modified length) or non-resistive spark plugs may lead to generate fault codes or bad operation.

NOTE: Diagnostics Communication Kit. See DIAGNOSTICS section.

After a problem has been solved, ensure to clear the fault(s) in the MPEM using the VCK. Refer to DIAGNOSTIC PROCEDURES.

Resistance Measurement

When measuring the resistance with an ohmmeter, all values are given for a temperature of 20°C (69°F). The resistance value of a resistance varies with the temperature. The resistance value for usual resistor or windings (such as injectors) **increases** as the temperature increases. However, our temperature sensors are NTC types (Negative Temperature Coefficient) and work the opposite which means that the resistance value **decreases** as the temperature increases. Take it into account when measuring at temperatures different from 20°C (69°F). Use this table for resistance variation relative to temperature for **temperature** sensors.

TEMPERATURE		**RESISTANCE**		
°C	°F	OHMS	LOW	HIGH
- 10	14	9500	8000	11,000
0	32	5900	4900	6900
10	50	3800	3100	4500
20	68	2500	2200	2800
30	86	1700	1500	1900
40	104	1200	1080	1320
50	122	840	750	930

CONVERSION CHART FOR TEMPERATURE SENSORS

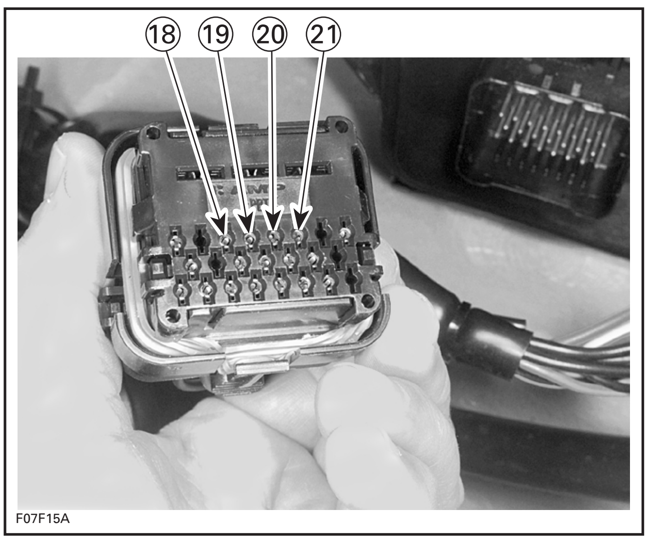
The resistance value of a temperature sensor may test good at a certain temperature but it might be defective at other temperatures. If in doubt, try a new sensor.

Also remember this validates the operation of the sensor at ambient temperature. It does not validate the over temperature functionality. To test it, the sensor could be removed from the engine/muffler and heated with a heat gun while it is still connected to the harness to see if the MPEM will detect the high temperature condition and generate a fault code.

When working with injectors, the resistance value might test good while the complete current would not flow through the wire when pulsating current is supplied to the injector in its normal operation. A solution would be to use a jumper wire to directly supply the injector from the MPEM. If it now works, replace the defective wire. A Noid light (available from after-market tool/equipment suppliers) may also be used to validate the injector operation.

AMP CONNECTOR PIN-OUT

Use this diagram to locate the pin numbers on the AMP connector no. 3 and no. 4 of the wiring harness when performing tests.



AMP CONNECTOR PIN-OUT (WIRING HARNESS SIDE)

AIR INDUCTION SYSTEM

THROTTLE BODY

Mechanical Inspection

Check that the throttle plates moves freely and smoothly when depressing throttle lever. Take this opportunity to lubricate the throttle cable.

IMPORTANT: The throttle bodies are designed to be tamper proof. Changing the idle stop or modifying them in any way will not increase performance or change the idle speed.

Before replacing any parts, check the following as these could be causing the fault. Perform the test while the engine is not running.

– Throttle cable adjustment too tight. Not returning fully to idle stop.
– Throttle body idle set screw is loose or worn.
– Throttle linkage between the two throttles has moved.
– TPS is loose.
– Corroded or damaged wiring or connectors.
– Throttle body has been replaced and the closed TPS reset has not been performed.
– MPEM has been replaced and the closed TPS reset has not been performed.

Electrical Inspection

Refer to **Throttle Position Sensor (TPS)** in **Electronic Management** below.

Replacement

Removal

To remove throttle bodies from engine, proceed as follows:

– Remove air intake silencer. Refer to AIR INTAKE section.
– Disconnect TPS connectors.
– Disconnect throttle cable and oil injection pump cable.
– Detach hoses and remove fasteners retaining throttle bodies and pull out together.

If only one throttle body replacement is required, detach them and remove the sealant on idle set screw head. Gently remove the plastic cap from the synchronization screw.

Remove TPS, throttle lever, spring and guide from the old throttle body.

Installation

Reinstall removed parts on the new throttle body. For TPS replacement procedures, refer to **Throttle Position Sensor (TPS)** in **Electronic Management** below.

Properly attach throttle bodies together if previously detached.

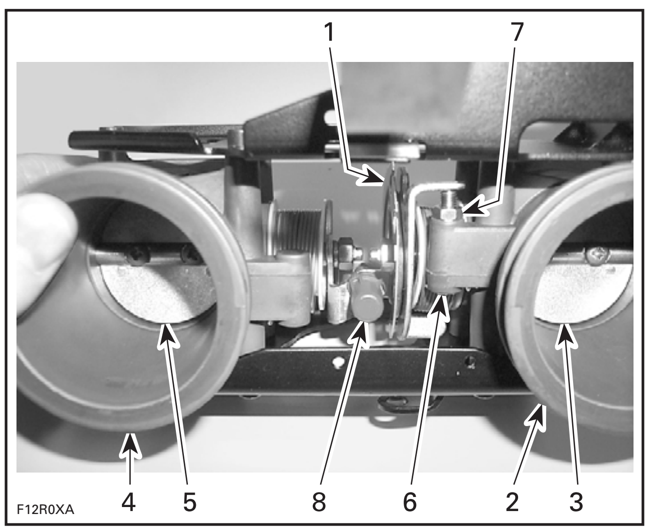
Adjustment

Throttle Bodies

NOTE: If both throttle bodies are replaced together with new parts, no adjustment is required as they have already been set at the factory. However, continue with throttle cable and closed TPS adjustments below. If only one throttle body is replaced, proceed with the complete following adjustments. Ensure to always perform complete and proper adjustments as described here prior to starting the engine. Otherwise, engine may run at a limited RPM.

IMPORTANT: The throttle body adjustment is required only when replacing one throttle body. Otherwise, do not tamper with this adjustment as this is NOT a regular maintenance procedure.

The master throttle body is the one driven by the throttle cable. The slave throttle body follows the master and must me synchronized with the master.

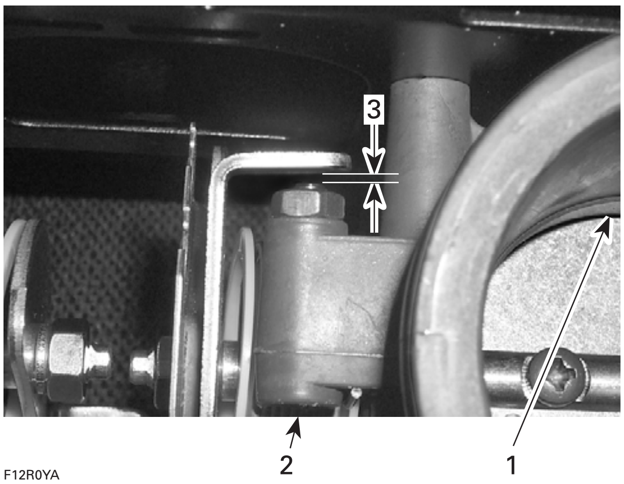


1. *Throttle cable attachment*
2. *Master throttle body*
3. *Master throttle plate*
4. *Slave throttle body*
5. *Slave throttle plate*
6. *Idle set screw*
7. *Lock nut*
8. *Synchronizing screw with its tamper proof cap*

NOTE: In the following illustrations, the lower link plate has been removed for clarity purposes only. It does not have to be removed to perform the adjustment.

Loosen lock nut of idle set screw.

Unscrew idle set screw so that **master** throttle plate completely closes in the throttle body. Ensure screw end clears the lever stopper.



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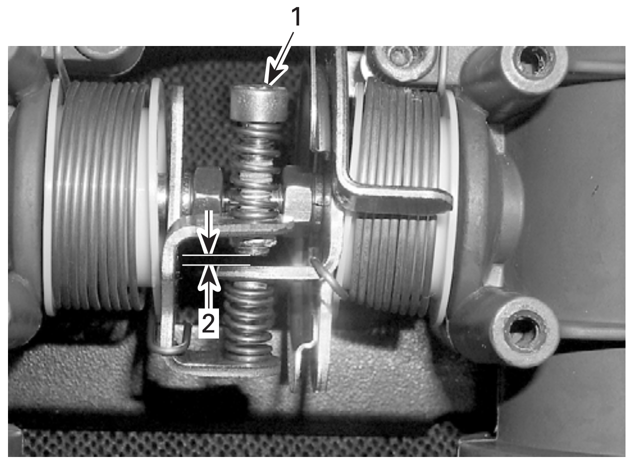
1. *Unscrew until **master** throttle plate is fully closed in throttle body*
2. *Unscrew here*
3. *Gap here*

Remove synchronizing screw. Install a new one and screw in making sure to keep **slave** throttle plate completely closed in the throttle body (ensure to properly reinstall the spring). Ensure screw end clears the lever stopper.

⚠ WARNING

Ensure to use a new screw which is coated with the proper threadlocker to avoid further loosening. Do not use the removed screw even if you would apply any threadlocker. The threadlocker may leak off the screw and onto the throttle mechanism and cause the throttle to stick.



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TURN SYNCHRONIZING SCREW CLOCKWISE AND KEEP SLAVE THROTTLE PLATE FULLY CLOSED IN THE THROTTLE BODY

1. *Screw here*
2. *Gap here*

Master TPS

Using an ohmmeter, measure resistance between pins 2 and 3.

Turn **idle set screw** clockwise until ohmmeter reading changes by 175 ± 20 Ω.

Tighten lock nut.

⚠ WARNING

Do not apply any threadlocker to the screw threads. The threadlocker may leak off the screw and onto the throttle mechanism and cause the throttle to stick.

Slave TPS

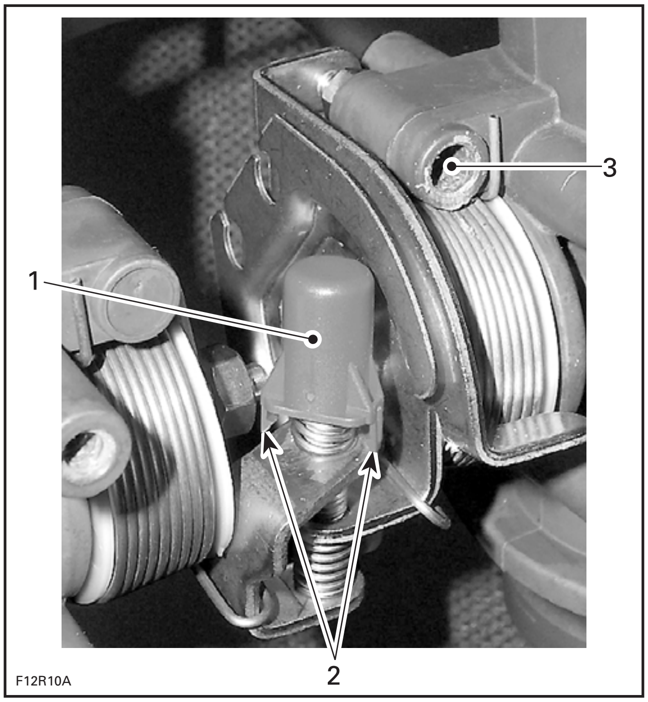
Measure resistance between pins 2 and 3.

Turn **synchronizing screw** clockwise until reading changes by 175 ± 20 Ω.

Ensure spring is still well positioned on stoppers.

Properly reinstall the plastic cap to the synchronization screw.

Apply Loctite Ultra Grey® Silicone Gasket Maker on idle set screw head.



1. Plastic cap
2. Wider spaced tabs here
3. Loctite Ultra Grey® Silicone Gasket Maker

Throttle Cable Adjustment

Mecanically adjust the throttle cable using the adjusting device underneath body, below steering. Free-play on lever should be between 2 and 3.5 mm (1/16 and 1/8 in).

NOTE: On **GTX DI models**, vent tube removal in front storage compartment may be necessary to reach the adjusting device.

CAUTION: Improper cable adjustment will cause strain on cable and/or damage cable bracket or throttle lever at handlebar.

Use the vehicle communication kit (VCK) with the B.U.D.S. software to perform this adjustment. Choose the **Monitoring** tab.

Press throttle lever to reach full throttle.

Turn cable adjustment until **Throttle Opening** meter indicates between 95% and 99%.

Closed TPS Adjustment

Perform the **Closed TPS adjustment** as described in **Throttle Position Sensor (TPS)** in **Electronic Management below**.

Injection Oil Pump Cable Adjustment

As oil injection cable is throttle dependent, always proceed with the oil injection pump cable adjustment after throttle cable adjustment. Refer to OIL INJECTION PUMP.

CAUTION: Improper oil injection pump synchronization with throttle bodies can cause serious engine damage.

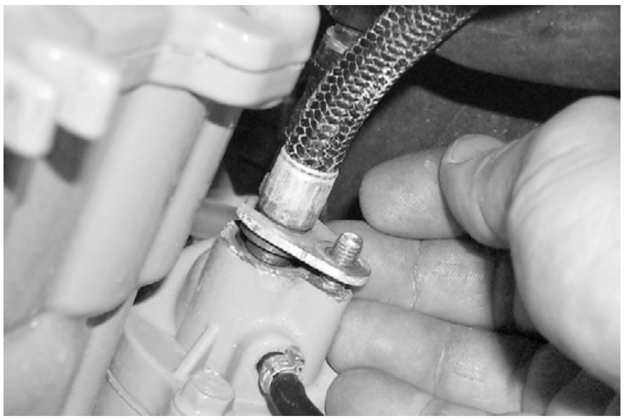
AIR COMPRESSOR

PRESSURE TEST

The pressure test will show the available pressure from the air compressor.

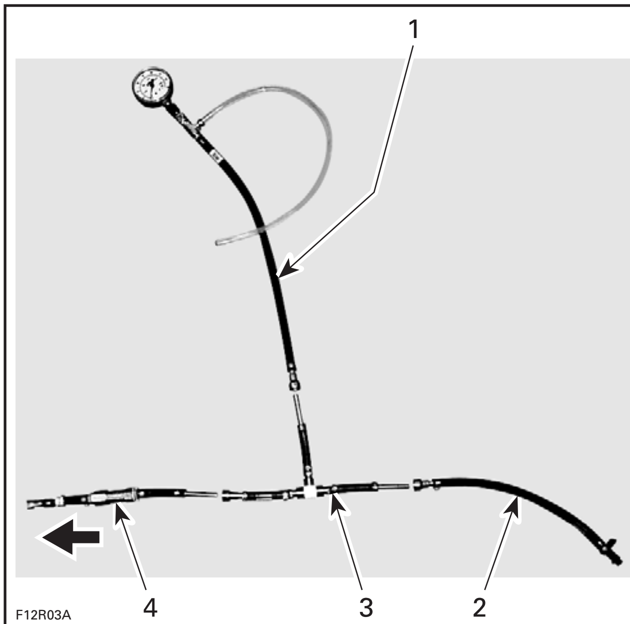
First ensure there is no leak from compressor gaskets, hoses and fittings. Soapy water can be sprayed on components. Repair any leak.

Disconnect hose outlet from air compressor.



F12R02A

Connect adapters and pressure relief valve to pressure gauge as shown.



F12R03A

1. *Pressure gauge (P/N 529 035 709)*
2. *Adapter for air compressor (P/N 529 035 712)*
3. *T-adapter (P/N 529 035 710)*
4. *Pressure relief valve (P/N 529 035 711)*

CAUTION: Ensure to install the pressure relief valve to allow excess pressure to go out. Note the arrow on the valve. Otherwise, air compressor components might be damaged.

Install pressure gauge to air compressor.

NOTE: To prevent fuel to be injected and thus going out the disconnected hose, use the drowned engine mode to crank engine. While engine is stopped, depress and HOLD the throttle lever at full throttle position for cranking.

Ensure the battery is in good condition to get the normal cranking speed.

Crank engine and observe air pressure

NOTE: A 1 second beep every second indicates the drowned mode is active.

⚠ WARNING

Be careful of pressure relief valve outlet. Compressed air may flow out there.

MINIMUM AIR PRESSURE (at cranking)
621 ± 14 kPa (90 ± 2 PSI)

If pressure is within limits, air compressor is working adequately.

If pressure is below limits, ensure inlet hose is not obstructed, bent or kinked. Otherwise, repair the air compressor.

Remove pressure gauge and reinstall air compressor hose.

REPAIR

Top End

Remove retaining screws.

Lift cover then remove compressor head.

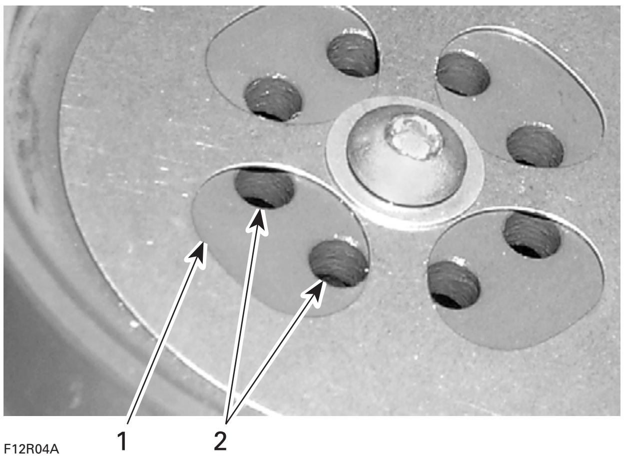
Clean all parts in a solvent and visually inspect for corrosion damage.

Check reed valve plates for cracks, deformation, dirt or other defects. The reed plates must lie completely flat against the reed valve body.

Inspect plane surfaces for warpage.

If reed valve is found defective, it is suggested to replace it then to temporarily reassemble the compressor to then make a pressure test. If it fails, check bottom end.

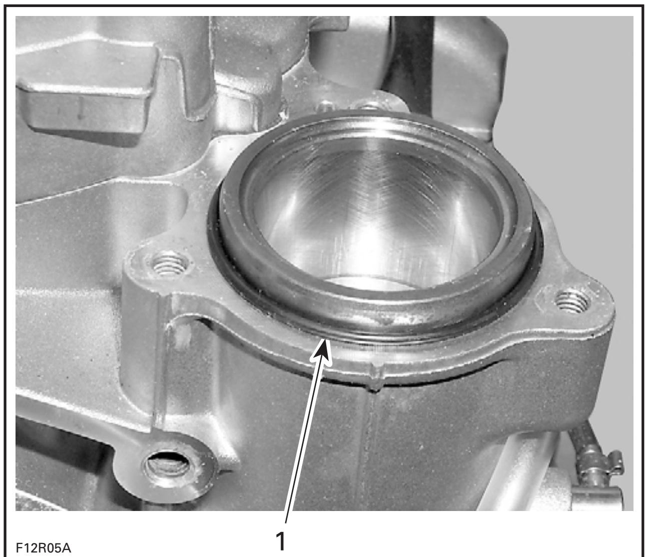
When changing reed valve, ensure to position ring plate opening so that 2 holes align inside the opening. Holes must not be obstructed by the opening edges.



F12R04A

1. *Reed valve opening*
2. *Rotate opening to align 2 holes inside without obstructing the holes*

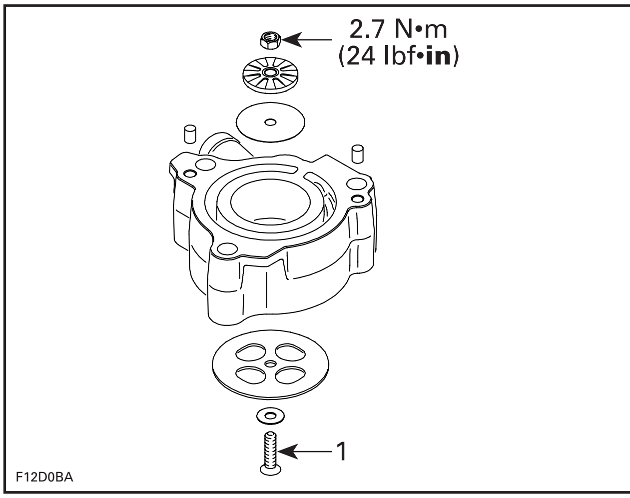
Ensure to position O-ring, around top of cylinder sleeve.



F12R05A

1. *O-ring on top of cylinder sleeve*

Ensure to position screw from the bottom up as show. Torque nut to 2.7 N•m (24 lbf•**in**).



F12D0BA

1. *Screw from bottom up*

CAUTION: Failure to properly position screw head will lead piston to hit it.

If pressure is still low then continue with Bottom End. Otherwise, remove components again. Install a new gasket, new O-ring, compressor head and cover. Apply synthetic grease below screw head and Loctite 243 on threads. Install screws then torque to 40 N•m (30 lbf•ft).

Bottom End

To gain access to piston, rings and connecting rod, engine PTO flywheel must be removed. Refer to ENGINE section.

Remove engine support and slightly lift engine to allow access. Block engine in this position.

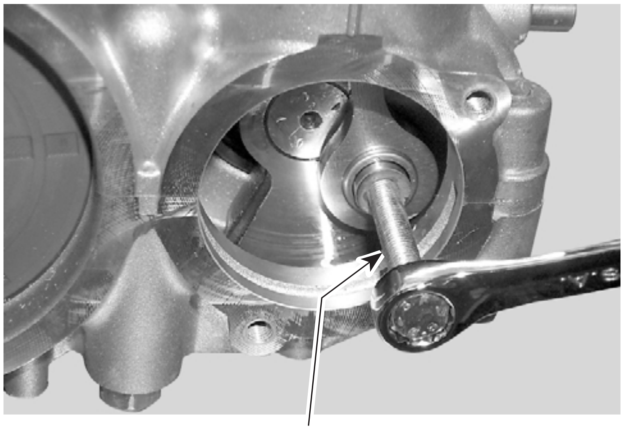
Remove top end as explained above.

Remove access plug of air compressor connecting rod.

Remove connecting rod retaining screw.

As a puller, use a M7 x 1.0 x 50 mm screw to release connecting rod “crankpin”.

IMPORTANT: Trace a mark on “crankpin” (bushing) outer end. This is needed for reinstallation.



1. Use a M7 x 1.0 x 50 mm screw as a puller

Push piston upward with or without the cylinder sleeve.

Remove rubber plug then push piston pin end to remove from connecting rod.

Inspection

Clean all parts in a solvent and visually inspect for corrosion damage.

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

Check bearings and pins for wear and heat discoloration. Check connecting rod for straightness. Replace damaged components.

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

If you find aluminum dust or debris in this area, they may have flowed toward the injection oil reservoir. In this case, the oil reservoir and lines must be flushed and the filter replaced.

CAUTION: Failure to properly clean the oil system will result in serious engine damage.

The inspection of top end should include the following measurements.

ENGINE MEASUREMENT	TOLERANCES		
	NEW PARTS (min.)	NEW PARTS (max.)	WEAR LIMIT
Piston/cylinder wall clearance	0.12 mm (.005 in)	N.A.	0.2 mm (.008 in)
Ring end gap	0.1 mm (.004 in)	0.25 mm (.010 in)	0.5 mm (.020 in)

N.A.: Not Applicable

Piston/Cylinder Wall Clearance

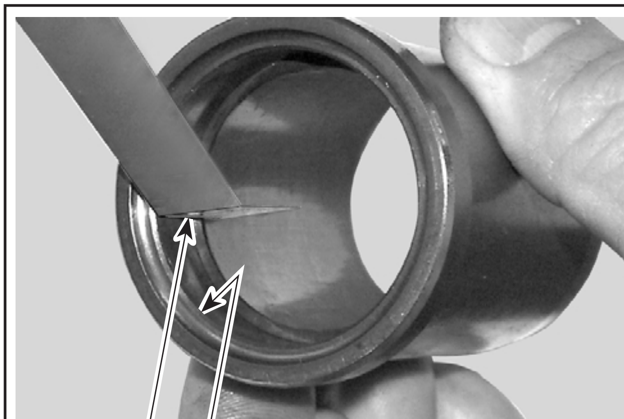
Clearance can be quickly checked with a feeler gauge. Insert feeler gauge in cylinder then slide piston (without piston rings installed). If clearance exceeds tolerance, check cylinder top area with your finger to feel if there is a ridge. If so, the cylinder sleeve is worn and needs replacement. Otherwise, replace piston.

Ring End Gap

Position ring close to top of cylinder top.

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.



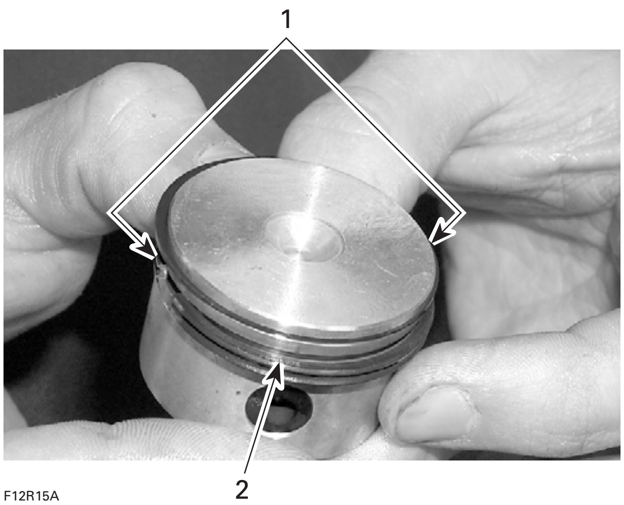
1. Top of cylinder
2. Ring end gap

Assembly

Apply injection oil in cylinder and on rings prior to installing.

Install the oil ring with the "TOP" marking on top.

Position ring openings 180° apart.



F12R15A

1. Ring openings 180° apart
2. TOP marking on this side

Use ring compressor (P/N 529 035 713) and insert piston in cylinder.

NOTE: Cylinder may be removed from crankcase to install piston more easily on the bench from the bottom if desired.

When attaching connecting rod to "crankpin", strictly follow this procedure:

1. Block counterbalance shaft to prevent any rotation.
2. Install the "crankpin" (bushing) with the previously marked end outside. If the mark is present anymore, place a straight edge against bushing end to find the tapered end (concave). A very small gap between the edge and the bushing will identify the tapered end to be installed against the counterweight.
3. Install a **NEW** screw and torque to 6.5 N•m (58 lbf•**in**). Do not apply any thread locker product.
4. Turn the screw clockwise an additional 80 degrees ± 5 degrees.

CAUTION: Failure to strictly follow this procedure may cause screw to loosen and lead to engine damage. The bushing tapered end must be against the counterweight. Besides, as the "crankpin" screw has been stretched from the previous installation, it is very important to use a new screw at assembly. Also, the new screw will have the proper threadlocking coating.

Ensure to correctly position O-ring on access cover and install cover.

Reinstall remaining removed parts. Ensure to check engine alignment.

FUEL DELIVERY

AIR/FUEL RAIL

Pressure Test

The pressure test will show the available pressure at the air/fuel rail. It validates the pressure regulator and leaks in the system.

IMPORTANT: Before checking air/fuel rail pressure, make sure the fuel pressure from the fuel pump and the air pressure from the air compressor are within specifications. See the procedures elsewhere in this section.

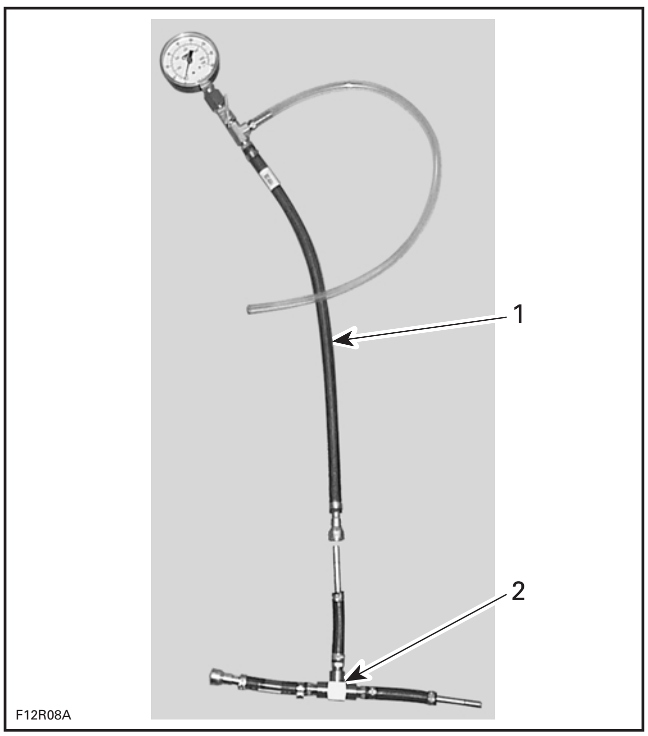
Also ensure there is no leak from hoses and fittings. Repair any leak.

Ensure there is enough gas in fuel tank.

Release the fuel pressure in the system.

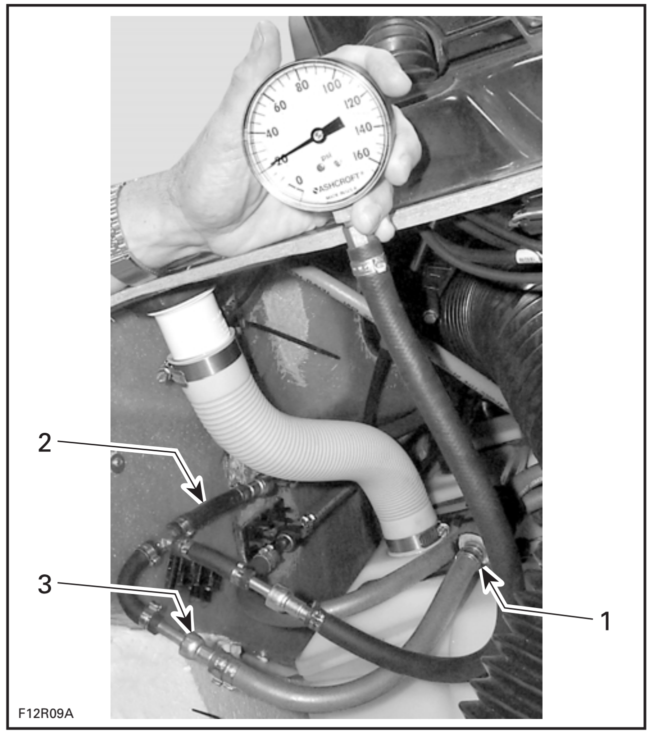
Disconnect outlet hose (the one with the fuel filter) from fuel pump using tool (P/N 529 035 714).

Connect adapter to pressure gauge as shown.



1. Pressure gauge (P/N 529 035709)
2. T-adapter (P/N 529 035 710)

Install pressure gauge between disconnected hose (inline installation).



1. Fuel filter
2. Fuel line going to air/fuel rail
3. Pressure gauge between disconnected hose (inline installation)

Install safety lanyard and observe fuel pressure. **Do not crank engine**.

FUEL REGULATOR PRESSURE (when installing safety lanyard)
185 ± 14 kPa (27 ± 2 PSI)

If pressure is within limits, air/fuel rail is working adequately.

A rapid pressure fall indicates excessive leakage either from the air/fuel rail or from the fuel pump check valve.

If pressure is not within limits, ensure there is no air/fuel leak between direct injector and air/fuel rail. Otherwise, replace the air/fuel rail as an assembly (rail, air and fuel regulators and fuel injectors).

Remove pressure gauge and reinstall fuel hose.

⚠ WARNING

Wipe off any fuel spillage in the bilge. Fuel is flammable and explosive under certain conditions. Always work in a well ventilated area.

Fuel Injector

When one fuel injector is defective, both have to be replaced as an assembly with the air/fuel rail.

Testing the fuel injector operation can be performed with the air/fuel rail installed.

Leakage Test

The leakage test is validated when performing the FUEL DELIVERY SYSTEM DIAGNOSTIC FLOW CHART elsewhere in this section.

Electrical Test

Safety lanyard must be on DESS post.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, energize the fuel injector from the **Activation** section.

If the injector does not work, disconnect the plug connector from the injector.

Install a temporary connector to the injector with wires long enough to make the connection outside the bilge and apply voltage (12 V) to this test harness.

This will validate the injector mechanical and electrical operation.

If it does not work, replace the air/fuel rail assembly.

Otherwise, check the resistance of the fuel injector circuit.

Reconnect the injector and disconnect the AMP plug connector number 4 on the MPEM.

Using a multimeter, check resistance value between terminals as follows.

COMPONENT	CONTACT LOCATION
Fuel injector MAG	7 and 13
Fuel injector PTO	8 and 14

The resistance should be between 1.7 and 1.9 Ω.

If resistance value is correct, try a new MPEM. Refer to MPEM replacement procedures elsewhere in this section.

If resistance value is incorrect, repair the wiring harness/connectors between AMP plug connector and fuel injector.

Replacement

The fuel injector is not available as a single spare part. Air/fuel rail must be replaced as an assembly.

Air/Fuel Rail Replacement

The fuel pressure regulator and the air pressure regulator are not available as single spare part. Air/fuel rail must be replaced as an assembly.

Removal

Release the fuel pressure in the system.

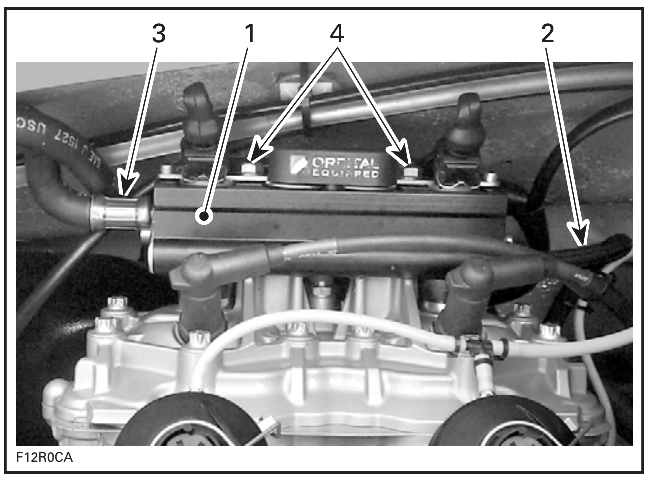
Disconnect air compressor supply hose from rail.

Disconnect fuel hoses (supply and return) at their inline connectors.

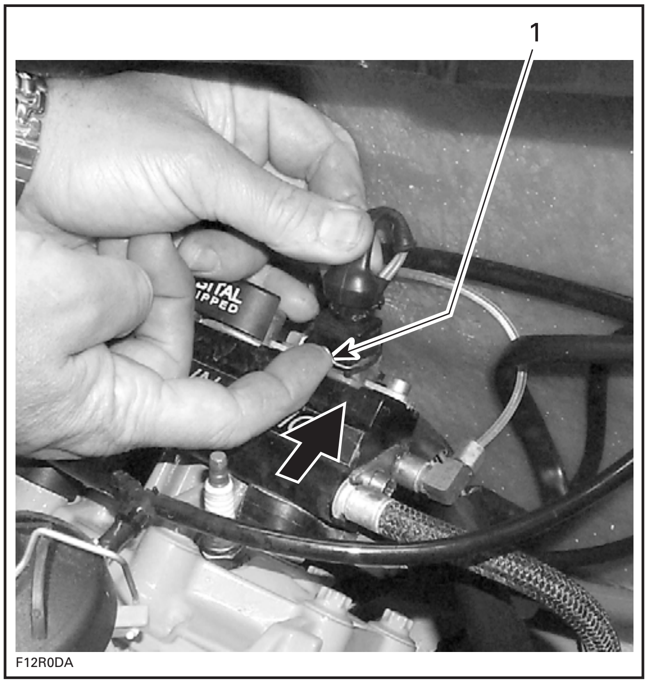
Temporarily connect those hose ends together to prevent rail draining.

Disconnect spark plug cables from spark plugs and fuel injector wires. Cut locking ties of wiring.

Unscrew rail retaining screws.



1. Air/fuel rail
2. Air supply hose
3. Fuel supply hose
4. Retaining screws



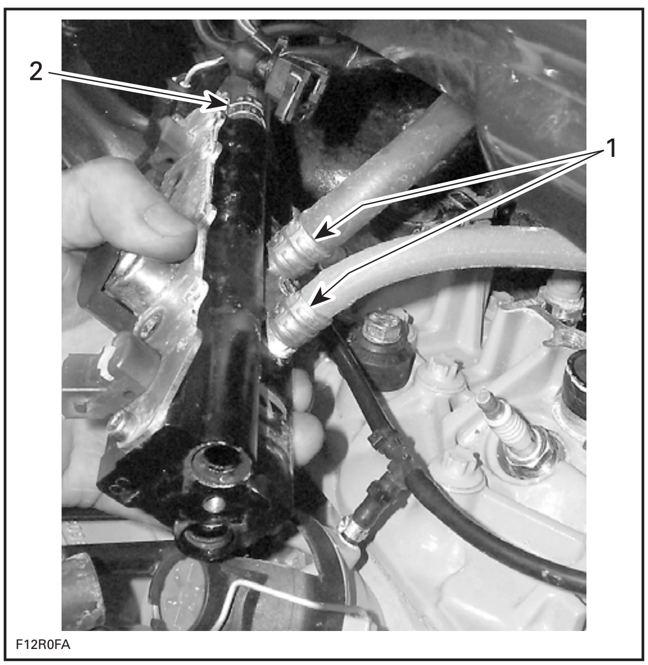
1. *Push clip toward injector to release connector*

Gently pull rail up by hand, working each side slightly at a time.

Pull rail out.

Disconnect hose ends at their inline connectors and drain fuel rail.

Disconnect air and fuel hoses from rail.



1. *Air and fuel return hoses*
2. *Fuel supply hose*

NOTE: When lifting/removing air/fuel rail, we recommend replacing carbon dams on direct injectors that have been running for 50 hours or more.

Installation

For installation, reverse the removal process but pay attention to the following.

A thin film of injection oil may be applyed to O-rings of fuel injectors to ease rail installation.

Apply Loctite 243 on rail retaining screws then torque to 25 N•m (18 lbf•ft).

When installing fuel or air hoses fitting to the air/fuel rail, use Loctite Krylox (no. 29-719).

Direct Injector

The direct injectors can be replaced individually by lifting the air/fuel rail.

Leakage Test

If direct injector leaks through its large top O-ring, there will be an air/fuel leak between the injector and the air/fuel rail. Replace O-ring of both injectors.

If there is an injector internal leak, the high temperature from the combustion chamber will make visible overheated area. Replace damaged components.

Electrical Test

Using the vehicle communication kit (VCK) with the B.U.D.S. software, energize the direct injector in the **Activation** section.

If the injector does not work, disconnect the plug connector from the injector.

Install a temporary connector to the injector with wires long enough to make the connection outside the bilge and apply voltage (12 V) to this test harness.

This will validate its mechanical and electrical operation.

If it does not work, replace the direct injector.

Otherwise, check the resistance of the direct injector circuit.

Reconnect the injector and disconnect the AMP plug connector number 4 on the MPEM.

Using a multimeter, check resistance value between terminals as follows.

COMPONENT	CONTACT LOCATION
Direct injector MAG	5 and 15
Direct injector PTO	6 and 21

The resistance should be between 1 and 1.6 Ω.

If resistance value is correct, try a new MPEM. Refer to MPEM replacement procedures elsewhere in this section.

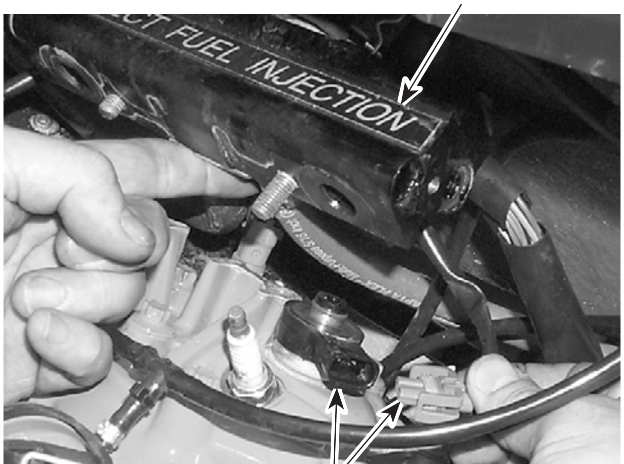
If resistance value is incorrect, repair the wiring harness/connectors between AMP plug connector and direct injector.

Direct Injector Replacement

IMPORTANT: Do not remove direct injector needlessly. They are sealed with a carbon dam that may expand when pulled out. A special tool is required to compress it prior to reinstalling. Otherwise, sealing efficiency might be affected.

Remove air/fuel rail retaining screws. Partially lift rail to allow direct injector removal.

Disconnect direct injector connector then pull injector out of cylinder head.



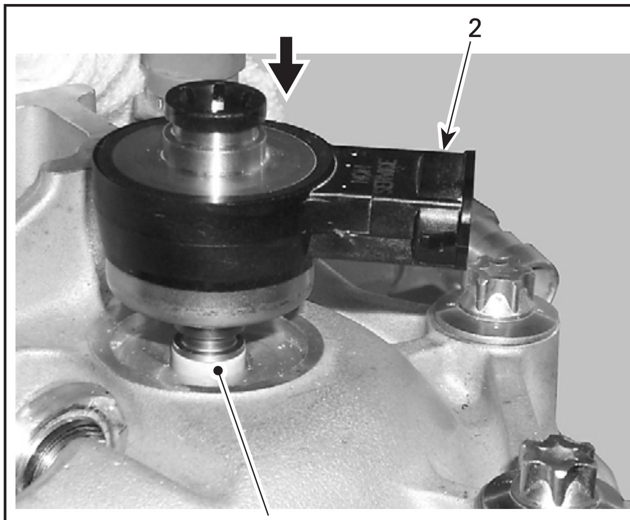
1. *Air/fuel rail*
2. *Disconnect and pull injector out*

Compress the carbon dam using tool (P/N 529 035 716).

Carefully install direct injector in cylinder head paying attention to carbon dam insertion. Ensure to position connector pointing toward bottom of cylinder head.

NOTE: A thin film of injection oil may be applyed to carbon dam if necessary to ease insertion in cylinder head.

Reconnect electrical connector.



1. *Carefully insert direct injector*
2. *Connector pointing toward bottom of cylinder head*

Reinstall air/fuel rail.

Carbon Dam Replacement

Remove direct injector. See procedure above.

NOTE: When replacing a carbon dam, it is recommended to replace it on both injectors. It is also recommended to replace all O-rings. We recommend replacing carbon dams that have been running for 50 hours or more.

CAUTION: Never reuse a carbon dam after it has been removed from the injector. Always install a new one.

Remove carbon dam and O-ring using a small pick.

Install seal guide (P/N 529 035 715) on end of injector. Carefully slide carbon dam in injector groove.

Use carbon dam compressor (P/N 529 035 716) to compress carbon dam evenly.

FUEL PUMP

Pressure Test

The pressure test will show the available pressure from the fuel pump.

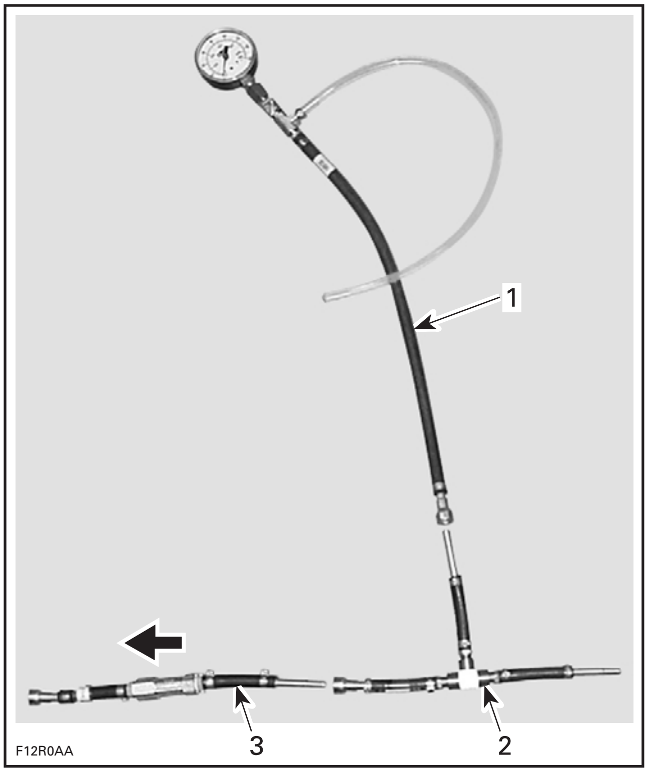
Ensure there is no leak from hoses and fittings. Repair any leak.

Ensure there is enough gas in fuel tank.

Use the VCK (Vehicle Communication Kit) to release the fuel pressure in the system. Look in the **Activation** section of the software B.U.D.S.

Disconnect inlet and outlet hoses from fuel pump using tool (P/N 529 035 714).

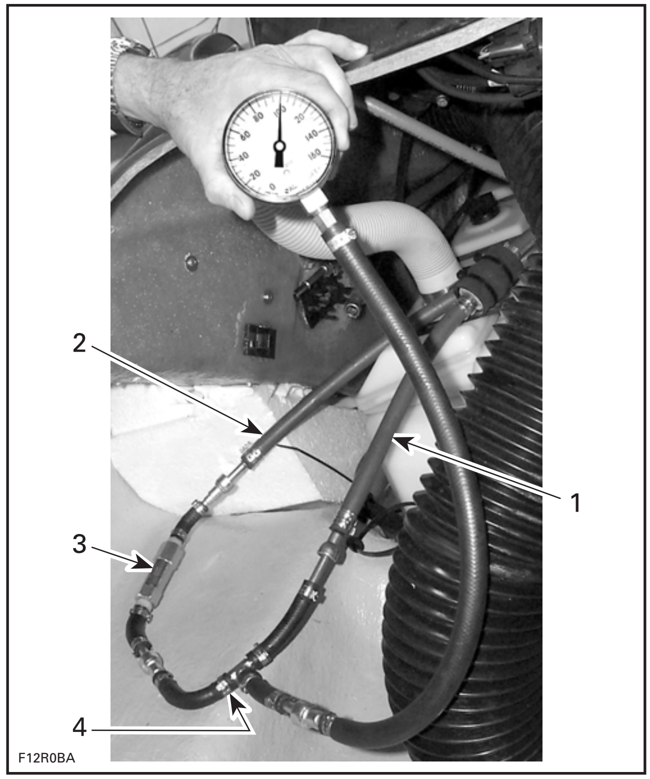
Connect adapters and pressure relief valve to pressure gauge as shown.



1. *Pressure gauge (P/N 529 035 709)*
2. *T-adapter (P/N 529 035 710)*
3. *Pressure relief valve (P/N 529 035 711)*

CAUTION: Ensure to install the pressure relief valve to allow excess pressure flowing back through return line. Note the arrow on the valve. Otherwise, fuel pump components might be damaged.

Install pressure gauge between disconnected hoses on fuel pump side (closed-loop installation on fuel pump). Make sure the pressure-relief valve is installed on the fuel pump return line side.



1. *Fuel pump outlet hose (fuel filter side)*
2. *Fuel pump return line*
3. *Fuel relief valve on the return line side*
4. *Pressure gauge between disconnected hose (inline installation)*

Crank engine and observe fuel pressure.

MINIMUM FUEL PUMP PRESSURE (at cranking)
721 kPa (105 PSI)

If pressure is within limits, fuel pump is working adequately.

If pressure is below limits, ensure fuel filters are not obstructed. There is one in-line fuel filter at the fuel pump outlet hose and one filter at the inlet underneath the pump. Otherwise, replace the fuel pump.

Remove pressure gauge and reinstall fuel hoses.

Electrical Test

When connecting the safety lanyard to the DESS post, the fuel pump should run for 2 seconds to build up the pressure in the system.

If the pump does not work, disconnect the plug connector from the fuel pump.

Install a temporary connector to the fuel pump with wires long enough to make the connection outside the bilge and apply voltage (12 V) to this test harness.

If pump does not run, replace the fuel pump.

Otherwise, check the continuity of the fuel pump circuit.

Disconnect the AMP plug connector number 4 on the MPEM.

Using a multimeter, check continuity between terminals of circuits 24 and 26.

If wiring harness is good, try a new MPEM. Refer to MPEM replacement procedures elsewhere in this section.

Otherwise, repair the wiring harness/connectors between AMP plug connector and fuel pump.

Fuel Pump Replacement

Removal

Open front storage compartment cover.

Remove the storage basket.

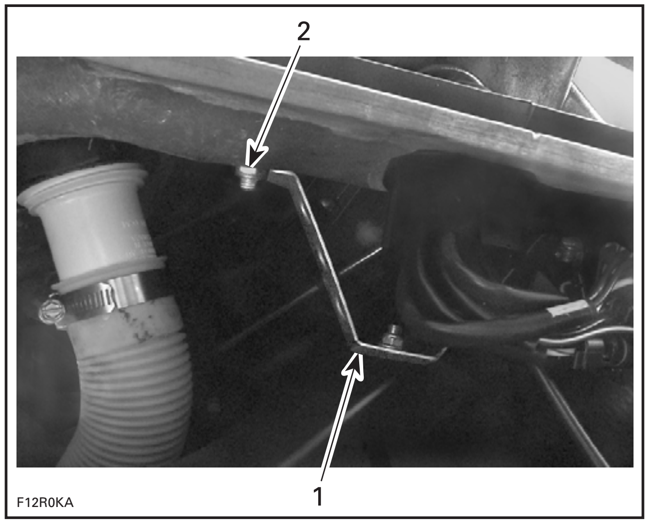
Remove glove box (see HULL/BODY section).

Remove front vent tubes.

RX DI

Remove tube Y-connector.

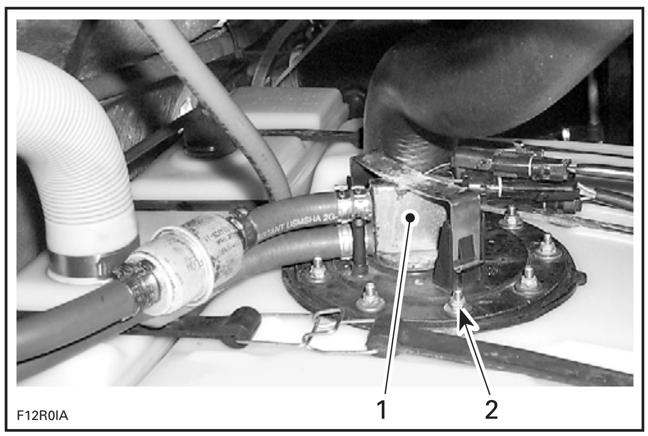
Remove tube bracket by unscrewing nuts from bilge (front storage area).



1. *Vent tube bracket*
2. *Nut*

All Models

From glove box opening, remove fuel pump retaining nuts.



1. *Fuel pump*
2. *Retaining screw*

Disconnect electrical connector.

Disconnect vent tube from fuel pump.

Release the fuel pressure in the system.

Disconnect inlet and outlet hoses from fuel pump using tool (P/N 529 035 714).

RX DI

Compress springs of pump module to reduce its height to allow pulling pump out.

All Models

Pull fuel pump toward front of vehicle. Wipe off any fuel spillage in the bilge.

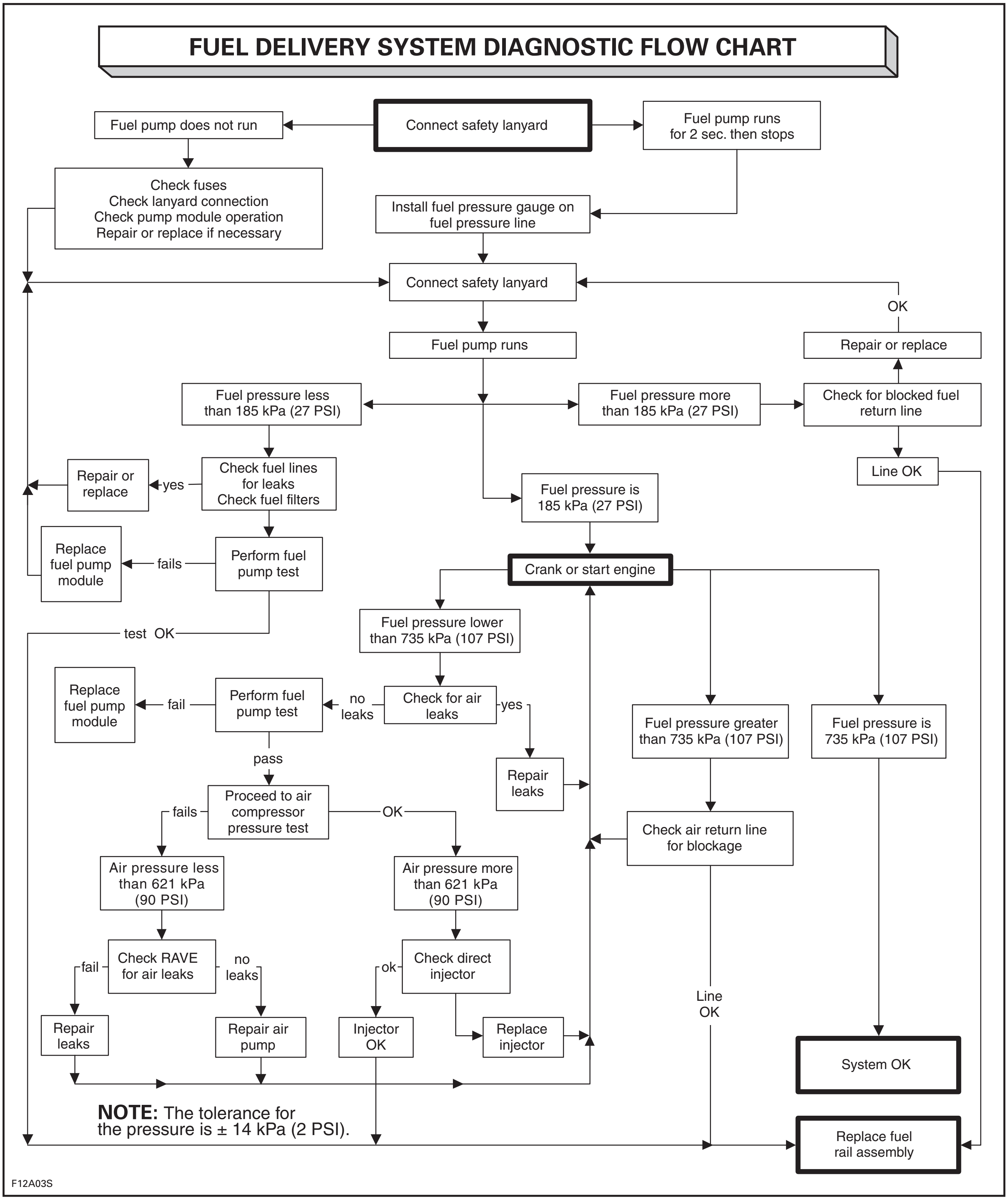
F12R0JA

1. *Pull fuel pump toward front*

Installation

For installation, reverse the removal process but pay attention to the following.

Tighten fuel pump screws in a criss-cross sequence.


FUEL DELIVERY SYSTEM DIAGNOSTIC FLOW CHART
Fuel pump does not run
Connect safety lanyard
Fuel pump runs for 2 sec. then stops
Check fuses
Check lanyard connection
Check pump module operation
Repair or replace if necessary
Install fuel pressure gauge on fuel pressure line
Connect safety lanyard
OK
Fuel pump runs
Repair or replace
Fuel pressure less than 185 kPa (27 PSI)
Fuel pressure more than 185 kPa (27 PSI)
Check for blocked fuel return line
Repair or replace
yes
Check fuel lines for leaks
Check fuel filters
Line OK
Fuel pressure is 185 kPa (27 PSI)
Replace fuel pump module
fails
Perform fuel pump test
Crank or start engine
test OK
Fuel pressure lower than 735 kPa (107 PSI)
Replace fuel pump module
fail
Perform fuel pump test
no leaks
Check for air leaks
yes
Fuel pressure greater than 735 kPa (107 PSI)
Fuel pressure is 735 kPa (107 PSI)
pass
Repair leaks
Proceed to air compressor pressure test
fails
OK
Check air return line for blockage
Air pressure less than 621 kPa (90 PSI)
Air pressure more than 621 kPa (90 PSI)
Check RAVE for air leaks
fail
no leaks
Check direct injector
ok
Line OK
Repair leaks
Repair air pump
Injector OK
Replace injector
System OK
NOTE: The tolerance for the pressure is ± 14 kPa (2 PSI).
Replace fuel rail assembly
F12A03S

ELECTRONIC MANAGEMENT

MPEM REPLACEMENT

General

Prior to replacing a suspected MPEM, ensure that all the recommendations in the general introduction of this section have been followed.

When MPEM is replaced, the safety lanyard(s), the TPS closed position and the TDC setting must be reprogrammed/reset. Refer to their specific section for adjustment.

To allow transferring the previous recorded information from the old MPEM to the new one, use the vehicle communication kit (VCK) with the B.U.D.S. software. Use **Replace** in the **MPEM** menu. Follows instructions in its help system.

NOTE: If the old MPEM is working, it must be read inside B.U.D.S. prior to removing it from the vehicle.

Replacement

Disconnect battery cables.

⚠ WARNING

Battery BLACK negative cable must always be disconnected first and connected last.

Disconnect AMP connectors from MPEM.

Remove MPEM.

Install the new MPEM to the vehicle.

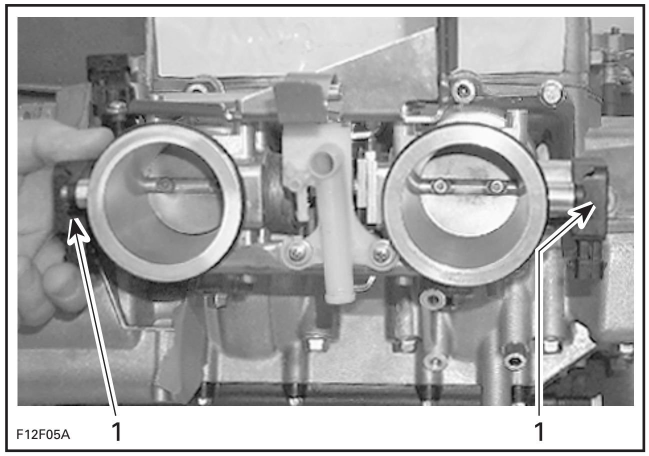
Reconnect AMP connectors to MPEM then battery cables.

Transfer the data from the previous MPEM to the new one using B.U.D.S. then proceed with the required programming.

THROTTLE POSITION SENSOR (TPS)

General

The throttle position sensor (TPS) is a potentiometer that sends a signal to the MPEM which is proportional to the throttle shaft angle. On the DI system, two sensors are used for redundancy purposes. The MPEM compares the signals from both sensors and determines if there is an error and uses the most appropriate sensor to operate the system.



1. *Throttle position sensor (TPS)*

IMPORTANT: Prior to testing the TPS, ensure that mechanical components/adjustments are adequate according to **Throttle Body** in **Air Induction System** above.

The MPEM may generate two types of fault codes pertaining to the TPS. Refer to **DI System Fault Codes** in DIAGNOSTIC PROCEDURES section for more information.

Wear Test

While engine is not running, activate throttle and pay attention for smooth operation without physical stops of the cable.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, use the **Throttle Opening** display under **Monitoring**.

Slowly and regularly depress the throttle. Observe the needle movement. It must change gradually and regularly as you move the throttle. If the needle “sticks”, bounces, suddenly drops or if any discrepancy between the throttle movement and the needle movement is noticed, it indicates a worn TPS that needs to be replaced.

NOTE: In this particular case, by comparing the signals from both sensors, the MPEM will generate a fault code when the TPS is malfunctioning due to specific “spots”.

To isolate the faulty TPS, disconnect one and test the other.

Voltage Test — Both TPS

Check the voltage output from MPEM to the desired throttle position sensor.

Disconnect plug connector from throttle position sensor and connect a voltmeter between pin 1 and 3 and also between pin 1 and 2 in the wiring harness.

Remove and reinstall the safety lanyard to activate the MPEM. There should be 5 Vdc in each test.

If voltage test is good, replace the TPS.

If voltage test is not good, check the resistance of the TPS circuit.

Resistance Test

Reconnect the TPS.

NOTE: Resistance values are different at idle on each TPS.

MAG Side

Disconnect the AMP plug connector number 3 on the MPEM.

Using a multimeter, check resistance value between terminal 10 and 14.

The resistance should be 1600 - 2400 Ω.

Check the resistance between terminal 5 and terminal 14 with the throttle plate in **idle** position.

The resistance should be 2500 Ω.

Check the resistance between terminal 5 and terminal 10 with the throttle plate in **idle** position.

The resistance should be 1200 Ω.

PTO Side

Disconnect the AMP plug connector number 4 on the MPEM.

Using a multimeter, check resistance value between terminal 3 and 18.

The resistance should be 1600 - 2400 Ω.

Check the resistance between terminal 1 and terminal 3 with the throttle plate in **idle** position.

The resistance should be 1000 Ω.

Check the resistance between terminal 1 and terminal 18 with the throttle plate in **idle** position.

The resistance should be 2500 Ω.

Test Results — Both TPS

If resistance values are correct, try a new MPEM. Refer to MPEM replacement procedures elsewhere in this section.

If resistance values are incorrect, repair the wiring harness/connectors between AMP plug connector and the TPS.

Replacement

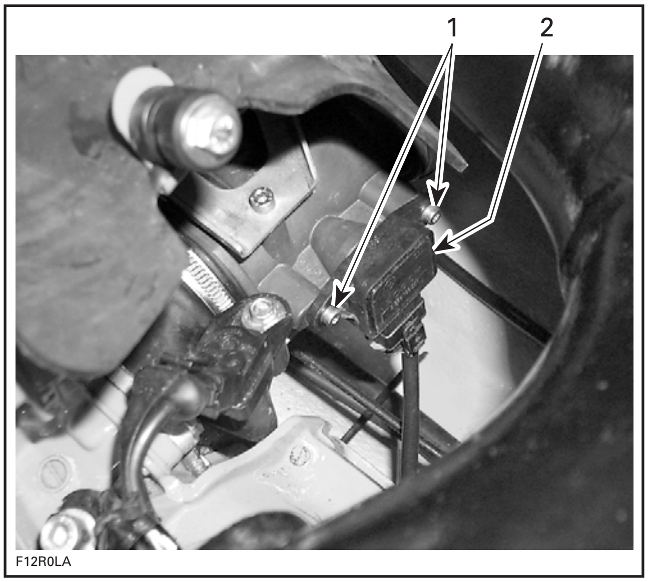
Remove the air intake silencer.

Remove the air duct.

Disconnect the connector of the TPS.

Loosen two Allen screws retaining the TPS.

Remove TPS.



MAG SIDE THROTTLE BODY
1. *Throttle position sensor (TPS)*
2. *Allen screws*

Apply Loctite 243 on screw threads, install the new TPS.

NOTE: Both TPS do not need to be replaced at the same time.

Reinstall remaining removed parts.

Proceed with the **Closed TPS Adjustment**. See below.

Closed TPS Adjustment

NOTE: Although this operation is called "adjustment", it is not really an adjustment. Rather, it performs a reset of the values in the MPEM.

This reset is very important. The setting of the TPS will determine the basic parameters for all fuel mapping and several MPEM calculations.

NOTE: Reset must be done each time the throttle position sensor (TPS) is loosened or removed or throttle body(ies) is(are) replaced or MPEM is replaced.

CAUTION: An improperly adjusted TPS may lead to poor engine performance and emission compliance could possibly be affected.

Use the vehicle communication kit (VCK) with the B.U.D.S. software to perform this adjustment.

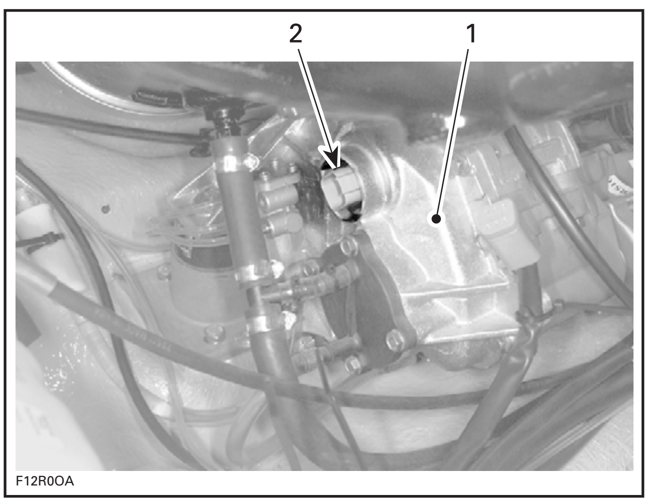
Ensure the throttle body plate stop lever rest against its stopper. Open throttle approximately one quarter then quickly release. Repeat 2 - 3 times to settle throttle plate. If stopper does not rest against its stop lever, perform throttle cable adjustment. Refer to **Throttle Body** in **Air Induction System** above.

Push the **Reset** button in the **Setting** section of B.U.D.S.

NOTE: There is no idle speed adjustment to perform. The MPEM takes care of that. If TPS are not within the allowed range while resetting the closed TPS, the MPEM will generate a fault code and not accept the setting.

Start engine and make sure it operates normally through its full engine RPM range. If fault codes appear, refer to **DI System Fault Codes** in DIAGNOSTIC PROCEDURES section for more information.

CRANKSHAFT POSITION SENSOR (CPS)



1. *Magneto cover*
2. *CPS connector*

Check for RPM display at the information center **while cranking** engine. If it displays approximately 300 RPM, the CPS circuitry is properly working.

Otherwise, validate the information center is working by activating the tachometer using the software B.U.D.S. under **Activation**. If it does not display 3000 RPM, the information center may be faulty and needs to be tested.

If the information center correctly displayed 3000 RPM, perform the following tests.

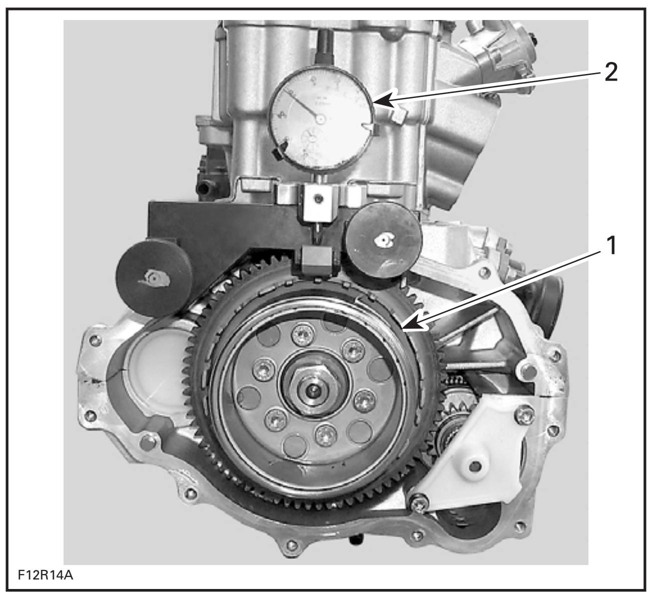
NOTE: Take into account that a CPS fault can be triggered by bent or missing encoder wheel teeth. Check the teeth condition. Also, bad connections in magneto connector could generate electrical noise that would make you wrongly think the CPS is faulty. Check pins and wires.

Encoder Wheel Inspection

To check the encoder wheel for bent teeth, proceed as follows.

Remove magneto cover. Refer to magneto system in ENGINE section.

Install a dial indicator on cranckase casting. Position the gauge on a tooth and set it to zero (0). Rotate flywheel and check needle movement. The maximum allowed difference between teeth is 0.15 mm (.006 in). Otherwise, straighten the tooth or replace the encoder wheel.



1. *Encoder wheel*
2. *Dial indicator*

Properly reinstall cover.

Voltage Test

Unplug magneto connector.

Check connector pins for corrosion or damage.

Remove and reinstall the safety lanyard to activate the MPEM.

Check the voltage readings on the harness side as follows:

CONNECTION	VOLTAGE
Pin 4 with engine ground	0 V ± a small mV tolerance
Pin 5 with engine ground	12 V
Pin 6 with engine ground	5 V

If voltage tests good, the CPS is defective and needs replacement.

If voltage does not test good, perform the following tests.

Resistance Test

Check the continuity of the wiring harness.

Disconnect the AMP plug connector number 2 on the MPEM.

Using a multimeter, check continuity of circuits 6, 7 and 14.

If wiring harness is good, it could be either the CPS or the MPEM. Try a new part one at a time. When trying a new MPEM, refer to MPEM replacement procedures elsewhere in this section.

Otherwise, repair the wiring harness/connectors between AMP plug connector and the CPS.

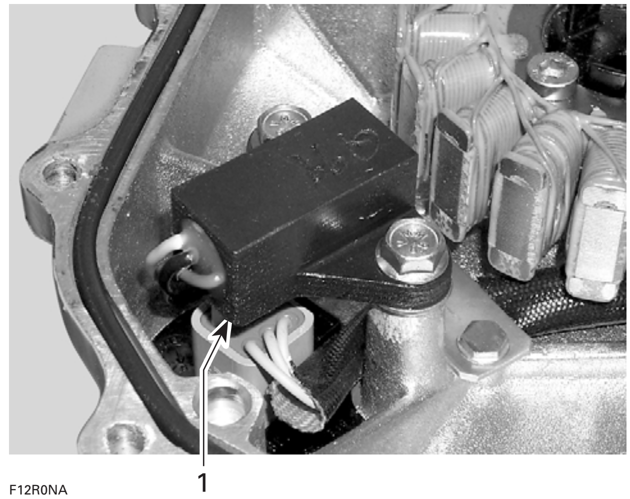
Replacement

Remove tuned pipe.

Unscrew front engine support and slightly lift engine to have access to magneto cover screws. Block engine in this position.

Disconnect connector and remove magneto cover.

Remove CPS.

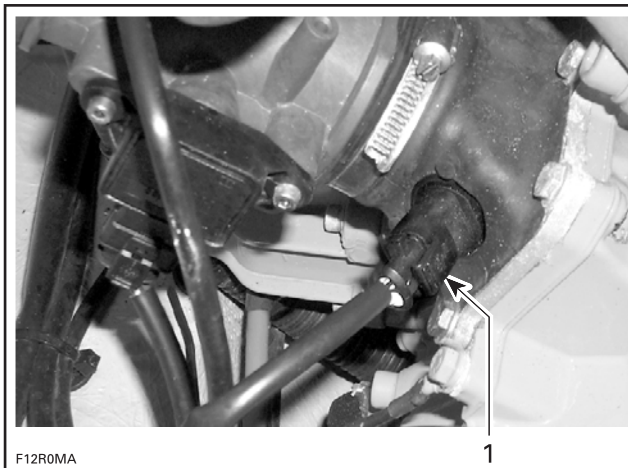


1. *CPS inside magneto cover*

Apply Loctite 243 on screw threads then install the new CPS.

Reinstall remaining removed parts.

MANIFOLD AIR TEMPERATURE SENSOR (MATS)



PTO SIDE THROTTLE BODY
1. *Manifold air temperature sensor (MATS)*

Resistance Test

Disconnect the plug connector from the MATS and check the resistance of the sensor itself.

The resistance should be between 2280 Ω and 2740 Ω.

Otherwise, replace the MATS.

If resistance tests good, **reconnect** the MATS and disconnect the AMP plug connector number 4 on the MPEM.

Using a multimeter, recheck resistance value between terminals 16 and 19.

If resistance value is correct, try a new MPEM. Refer to MPEM replacement procedures elsewhere in this section.

If resistance value is incorrect, repair the wiring harness/connectors between AMP plug connector and the MATS.

Replacement

Remove the air intake silencer.

Remove the air duct.

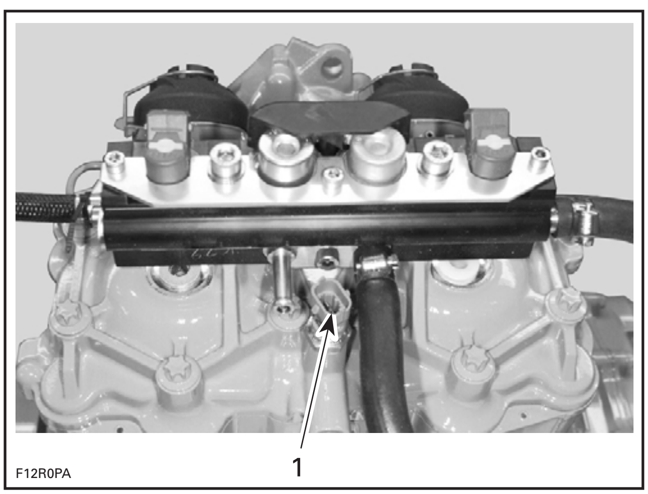
Disconnect the connector of the MATS.

Pull MATS out while turning right and left.

Install the new MATS.

Reinstall remaining removed parts.

WATER TEMPERATURE SENSOR (WTS)



1. *Water temperature sensor (WTS)*

Resistance Test

Disconnect the plug connector from the WTS and check the resistance of the sensor itself.

The resistance should be between 2280 Ω and 2740 Ω.

Otherwise, replace the WTS.

If resistance tests good, **reconnect** the WTS and disconnect the AMP plug connector number 4 on the MPEM.

Using a multimeter, recheck resistance value between terminals 9 and 11.

If resistance value is correct, try a new MPEM. Refer to MPEM replacement procedures elsewhere in this section.

If resistance value is incorrect, repair the wiring harness/connectors between AMP plug connector and the WTS.

Replacement

Remove air/fuel rail retaining screws.

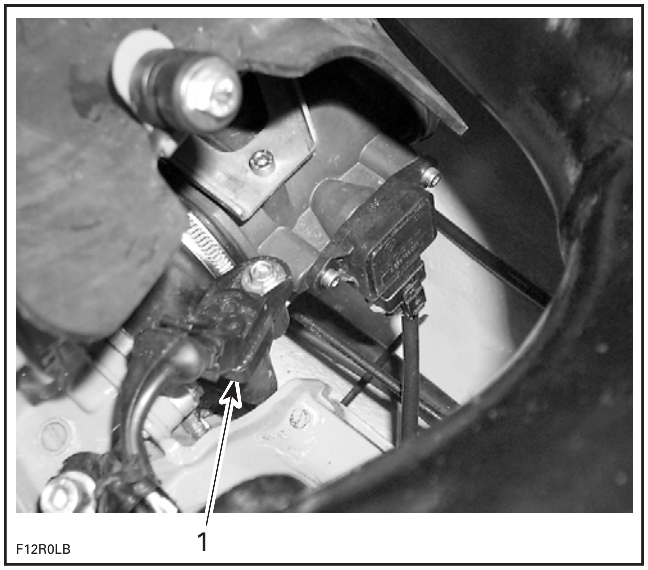
Cut locking ties as necessary to allow lifting of air/fuel rail in order to give access to the temperature sensor.

Disconnect WTS connector and remove WTS.

Apply Loctite 518 on threads of the WTS then install.

Reinstall remaining removed parts.

MANIFOLD AIR PRESSURE SENSOR (MAPS)



MAG SIDE THROTTLE BODY
1. *Manifold air pressure sensor (MAPS)*

NOTE: This sensor is a dual function device. When engine is started and it runs at idle speed, the sensor takes the atmospheric pressure and stores it in the MPEM. Thereafter, it takes the manifold air pressure at operating RPMS.

Ensure sensor is correctly installed elbow adaptor. Otherwise, the MAPS could generate a fault code for an unexpected sensor range at idle when it reads the atmospheric pressure. Ensure the correct connector is plugged and not mixed with the MAG TPS. Remove sensor and check for oil or dirt on its end and if problem persists, check throttle plate condition/position and the wiring harness. Perform the following tests.

Voltage Test

Check the voltage output from MPEM to the manifold air pressure sensor (MAPS).

Disconnect plug connector from throttle position sensor and connect a voltmeter between pin 1 and 3 and also between pin 1 and 2 of wiring harness.

Remove and reinstall the safety lanyard to activate the MPEM. There should be 5 Vdc in each test.

If voltage test is good, replace the MAPS.

If voltage test is not good, check the continuity of the MAPS circuit.

Resistance Test

Disconnect the AMP plug connector number 3 on the MPEM.

Using a multimeter, check continuity of circuits 3-3, 3-6 and 3-7.

If wiring harness is good, try a new MPEM. Refer to MPEM replacement procedures elsewhere in this section.

Otherwise, repair the wiring harness/connectors between AMP plug connector and the MAPS.

Replacement

Remove the air intake silencer.

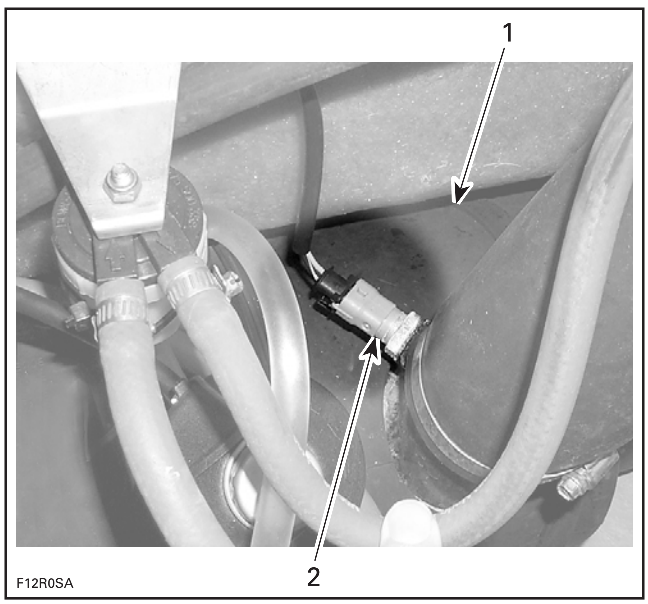
Remove the air duct.

Disconnect MAPS connector and remove the MPAS.

Install the new MAPS paying attention to index its tab into the adaptor notch.

Reinstall remaining removed parts.

EXHAUST GAS TEMPERATURE SENSOR (EGT)



1. *Muffler*
2. *Exhaust gas temperature sensor (EGT)*

Resistance Test

Disconnect the plug connector from the EGT and check the resistance of the sensor itself.

The resistance should be between 2280 Ω and 2740 Ω.

Otherwise, replace the EGT.

If resistance tests good, **reconnect** the EGT and disconnect the AMP plug connector number 4 on the MPEM.

Using a multimeter, recheck resistance value between terminals 10 and 12.

If resistance value is correct, try a new MPEM. Refer to MPEM replacement procedures elsewhere in this section.

If resistance value is incorrect, repair the wiring harness/connectors between AMP plug connector and the EGT.

Replacement

Disconnect EGT connector and remove EGT.

Apply Loctite 518 on threads of the EGT then install.

Replug connector.

KNOCK SENSOR (KS)

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1. *Knock sensor (KS)*

Dynamic Test

Using the vehicle communication kit (VCK) with the B.U.D.S. software, monitor the knock sensor using the **Faults** section.

Start the engine and bring engine RPM above 4500 RPM. If no fault code occurs, the knock sensor is good.

Otherwise, do the following.

Ensure sensor and head contact surfaces are clean and mounting bolt and washer are correct and properly torqued down.

Check the knock sensor resistance.

Disconnect the AMP plug connector number 4 from the MPEM module.

Static Resistance Test

Using a multimeter, check the resistance between terminal 2 and terminal 17 on the plug connector.

The resistance should be approximately 5 MΩ.

Otherwise, check the continuity of the knock sensor circuit 4-2 and 4-17.

If wiring harness is good, try a new MPEM. Refer to MPEM replacement procedures elsewhere in this section.

Otherwise, repair the wiring harness/connectors between AMP plug connector and knock sensor.

Replacement

Unscrew and remove knock sensor.

Clean contact surface, apply Loctite 243 on screw threads then install the new knock sensor.

Replug connector.

RAVE SOLENOID

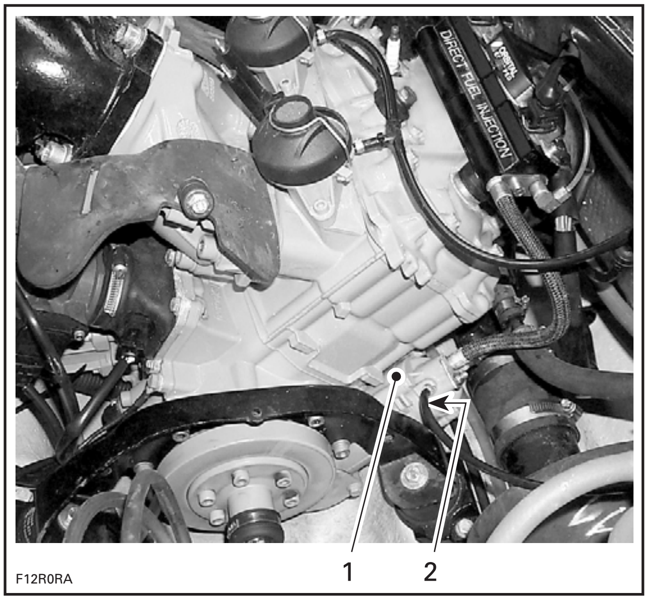
A quick check can be done as follows. When engine is being stopped, the RAVE valves will open and close. This can be heard or seen by carefully removing the cap and feeling the movement with a hand.

Another test can be done using the vehicle communication kit (VCK) with the B.U.D.S. software, using the **Monitoring** section. Start engine and bring its RPM to approximately 6000 and look at the RAVE solenoid LED. It should turn on, indicating the RAVE system is working on the electronic side. However, pneumatic test still have to be performed to validate the mechanical operation.

Leakage/Voltage Test

NOTE: The solenoid activates both RAVE valves at the same time.

Unplug the RAVE solenoid supply hose from air compressor.



1. *Air compressor*
2. *Disconnect RAVE supply hose*

Install leak test pump (P/N 529 021 800) on hose end and pressurize air line to 69 - 103 kPa (10 - 15 PSI). Wait some time to see if pressure drops. If so, check line for leaks. Otherwise, the solenoid is defective and needs to be replaced.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, energize the RAVE solenoid from the **Activation** section.

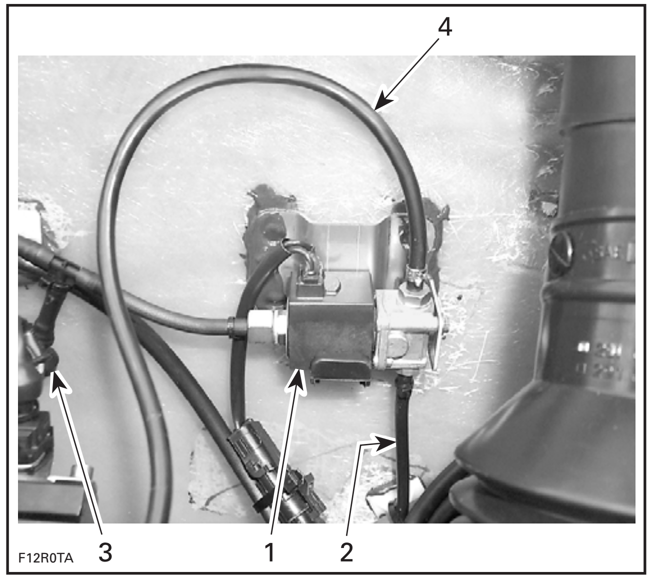
The pressure should drop when the solenoid is activated. If the solenoid does not work, disconnect the plug connector from the solenoid.

Install a temporary connector to the solenoid with wires long enough to make the connection outside the bilge and apply voltage (12 V) to this test harness.

If it does not work, replace the solenoid. Otherwise, proceed with the resistance test below.

Reconnect hose to compressor.

Unplug the outlet hose from RAVE solenoid.



1. *RAVE solenoid*
2. *Supply hose from air compressor*
3. *Check valve*
4. *Outlet hose to RAVE valves*

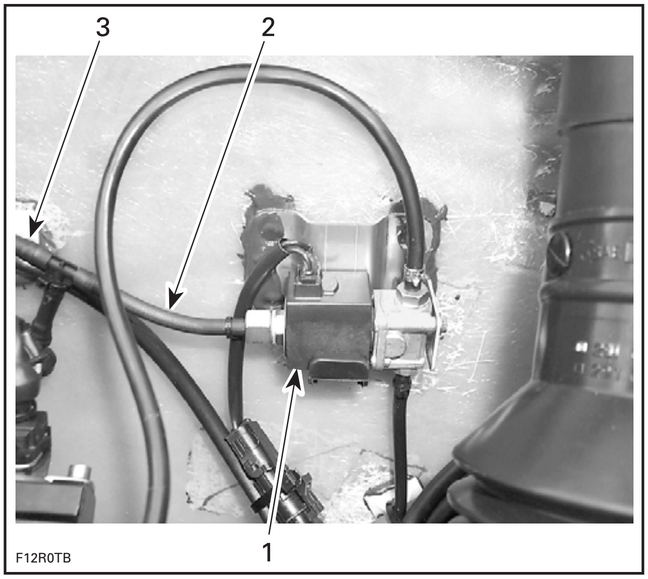
Install leak test pump on hose end and apply pressure. If pressure can not be held, check hoses for leaks. If hoses test good, connect pump directly to each RAVE valve nipple and pressurize. If pressure drops, replace the defective seal inside RAVE valve.

Take into account that the RAVE may be mechanically stuck in the cylinder slot. Open the RAVE and check for free operation. Refer to ENGINE and look in **Top End**.

Pressure Relief Circuit

When RAVE valve is released, the pressure escape from this vented hose. If the RAVE valves does not return when the solenoid is released, ensure the return spring is in good condition, this hose is not kinked or plugged and the solenoid allows pressure to bleed there.

Although it is not related with RAVE operation, we suggest to verify the check valve operation which prevent the pressure going down to crankcase. Install a hose pincher after the T-fitting to adequately pressurize the check valve portion.



1. *RAVE solenoid*
2. *Pressure relief hose*
3. *Install hose pincher here*

Resistance Test

Reconnect the solenoid and disconnect the AMP plug connector number 4 on the MPEM.

Using a multimeter, check resistance value between terminals 20 and 23.

The resistance should be 24 Ω.

If resistance value is correct, try a new MPEM. Refer to MPEM replacement procedures elsewhere in this section.

If resistance value is incorrect, repair the wiring harness/connectors between AMP plug connector and solenoid.

IGNITION COIL

NOTE: The MPEM energizes the primary side of each ignition coil individually. It can detect open and short circuit in the primary winding but it does not check the secondary winding.

Using the vehicle communication kit (VCK) with the B.U.D.S. software, energize the ignition coil from the **Activation** section.

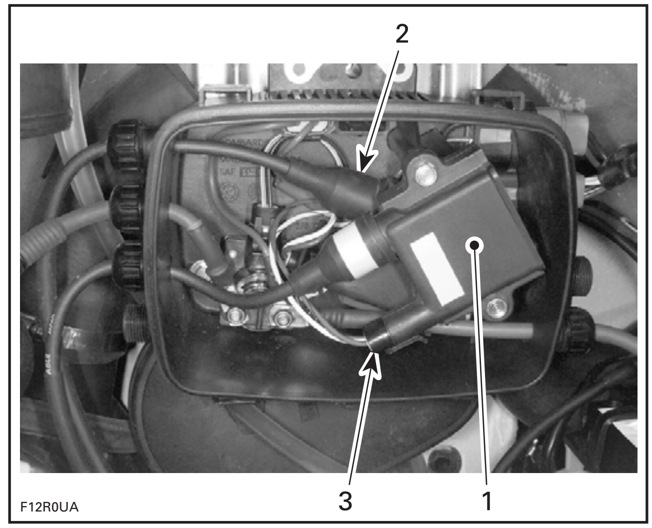
You should hear the spark occurring. In doubt, use an inductive spark tester or a sealed tester — available from after-market tool/equipment suppliers — to prevent spark occurring in the bilge. Otherwise, perform the following checks.

⚠ WARNING

Never make a spark test with spark plug removed. Flammable vapors may be present in the bilge and ignited which could cause an explosion.

Primary Winding

Disconnect the plug connector from the ignition coil and check the resistance of the primary circuit.



1. *PTO side ignition coil*
2. *Mag side ignition coil*
3. *Primary winding connector*

The resistance should be between .45 - .55 Ω at 20°C (68°F).

Otherwise, replace the ignition coil.

If resistance tests good, **reconnect** the ignition coil connector and disconnect the AMP plug connector number 3 on the MPEM.

Using a multimeter, recheck resistance value between terminals 21 and 22 for MAG side and terminals 20 and 23 for PTO side.

If resistance value is correct, try a new MPEM. Refer to MPEM replacement procedures elsewhere in this section.

If resistance value is incorrect, repair the wiring harness/connectors between AMP plug connector and the ignition coil.

Secondary Winding

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. A dynamic test is more effective.

Remove high tension lead from ignition coil.

Using a multimeter, check the resistance between the terminals C and the coil post.

The resistance should be between 6800 and 10200 Ω at 20°C (68°F).

If not within specification, replace the ignition coil. Otherwise, perform the **Dynamic Test** below.

Measure resistance of the high tension leads. They must be as follows. Otherwise, replace the lead.

NOTE: It is not necessary to remove the spark plug cap.

IMPORTANT: Always replace leads with genuine parts. Otherwise, fuel injection system operation may be impaired.

MODEL	SIDE	VALUE OHM
RX DI	MAG	5700
	PTO	4300
GTX DI	MAG	5700
	PTO	4900

Check continuity between ignition coil ground circuits and engine.

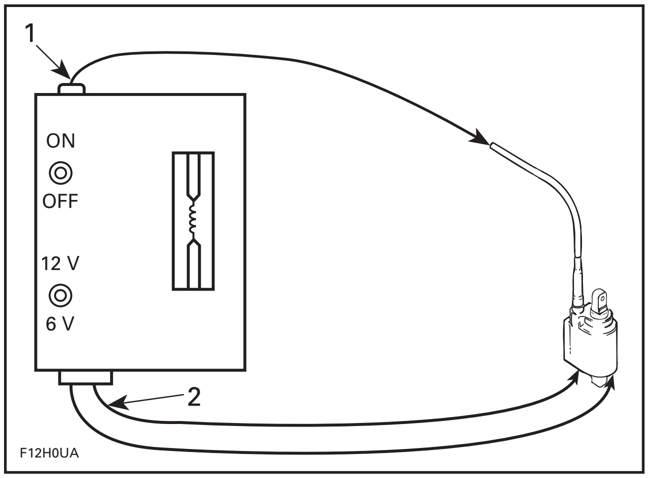
Dynamic Test

Use an ignition coil tester, available from after-market tool/equipment suppliers.

⚠ WARNING

Do NOT use coil tester on metal work bench. Follow manufacturer instructions.

1. With ignition coil removed from craft, hook high tension leads from tester to ignition coil high tension cables.
2. Connect 2 smaller tester leads to primary of ignition coil.



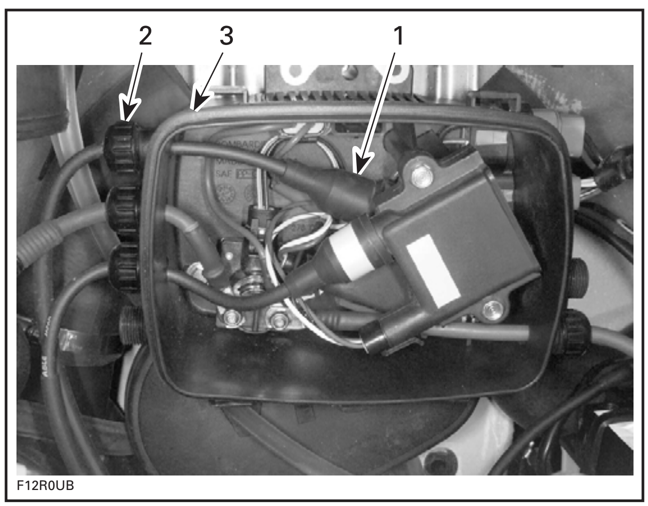
TYPICAL
1. *Lead to secondary*
2. *Leads to primary*

3. 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.

⚠ WARNING

Always reconnect spark plug cables at the same spark plugs where they come from. The cable coming out the edge of the electrical box must be connected to the MAG side spark plug. Otherwise, sever backfire may occur with possible damage to exhaust system components. The white tape on the ignition coil should match the white tape on the high tension cable.



1. *MAG side ignition coil at bottom*
2. *Mag side ignition coil wire on edge of electrical box*
3. *Edge of electrical box*

NOTE: If PTO ignition coil is replaced, ensure to reinstall the white tape on the new coil on if it is not present.

TDC SETTING

General

Before checking TDC setting 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 mark scribed on the PTO flywheel can be used to troubleshoot a broken magneto woodruff key.

NOTE: Do not use the factory mark found on the PTO flywheel to check TDC setting or troubleshoot any problems.

Normally TDC setting should not be required. It has been set at factory and it should remain correctly set since every part is fixed and not adjustable. The only time the TDC setting might have to be changed would be when replacing the crankshaft, the magneto rotor, the CPS, the encoder wheel or the MPEM. If the TDC setting is found to be incorrect, you should first check for proper crankshaft alignment. This might be the indication of a twisted crankshaft.

With this ignition system, the TDC setting can be checked with either the engine hot or cold. Also, the TDC setting is to be checked at any RPM with the timing light. The TDC setting is best checked at idle speed as it is more accurate and easier than at higher speed, also it will keep the engine temperature lower for a longer time. Ensure to properly cool the engine through the flushing fitting.

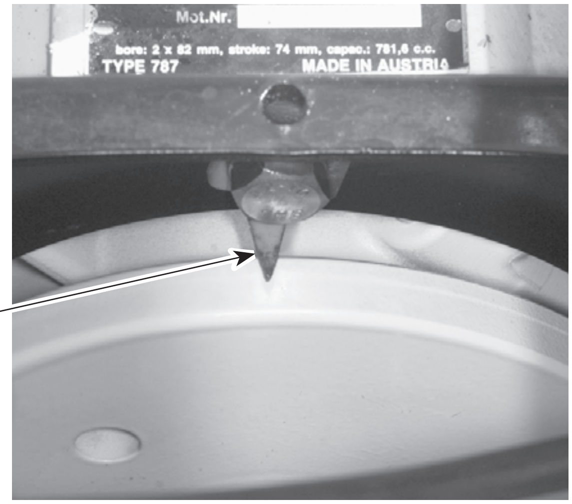
NOTE: When checking the TDC setting, the spark advance has to be locked to allow proper verification of the TDC marks. See **TDC Setting** below.

Static Test

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.
3. Remove middle screw securing the engine to the rear engine mount. Reinstall screw with timing mark pointer tool.



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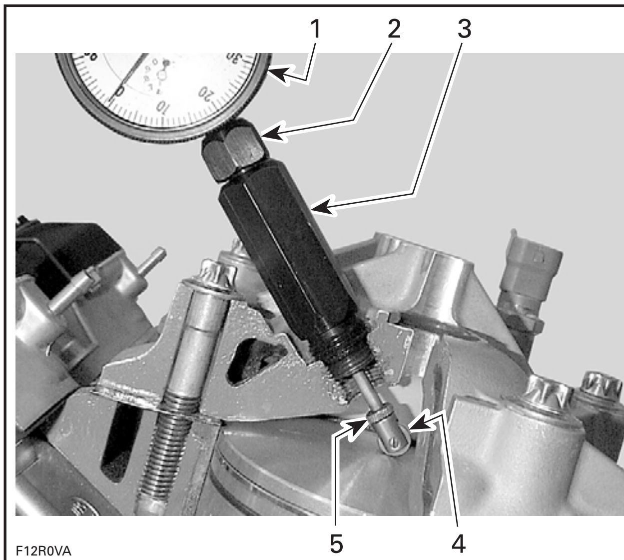
1. *Timing mark pointer tool (P/N 295 000 135)*

4. Install and adjust a TDC gauge (P/N 295 000 143) in MAG side spark plug hole.
5. Ensure to install its roller to allow proper reading of the gauge. Proceed as follows:
   – Rotate magneto flywheel clockwise until piston is just Before Top Dead Center.



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1. *Outer ring*
2. *Adaptor lock nut*
3. *Adaptor*
4. *Roller*
5. *Roller lock nut*

   – Install roller on dial gauge end. Ensure to position roller edge parallel with the dial gauge face. Secure in this position by tightening roller lock nut. This will keep the roller in the proper axis for measurement accuracy.

- Loosen adaptor lock nut then holding gauge with dial face directed toward you when you are in line with the crankshaft, screw adaptor in spark plug hole.
- Slide gauge far enough into adaptor to obtain a reading then finger tighten adaptor lock nut.
- Since we are working with an indirect measurement, ensure that dial gauge face is positioned in the same direction as the connecting rod.
- Rotate magneto flywheel clockwise until piston is at Top Dead Center.
- Unlock outer ring of dial and turn it until "0" (zero) on dial aligns with pointer.
- Lock outer ring in position.

6. From this point, rotate magneto flywheel back 1/4 turn then rotate it clockwise to reach 7.87 mm (.310 in).

NOTE: This specification is of the type "indirect measurement" relative to the piston movement since we are measuring at a 45° angle through the spark plug hole.

7. Scribe a thin mark on PTO flywheel aligned with timing mark pointer tool.

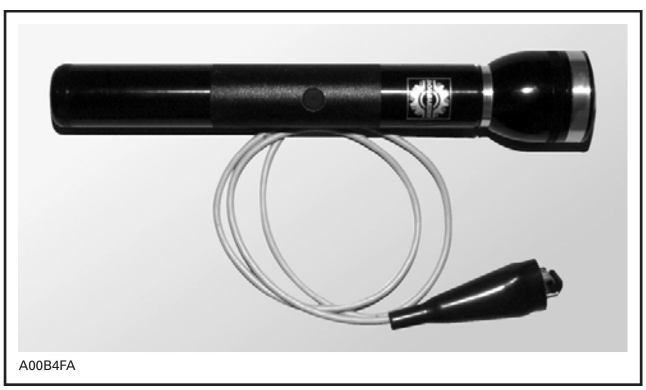
NOTE: This mark becomes the reference when using the stroboscopic timing light.

CAUTION: The static test cannot be used as a TDC setting procedure, therefore, always check the TDC setting with a stroboscopic timing light.

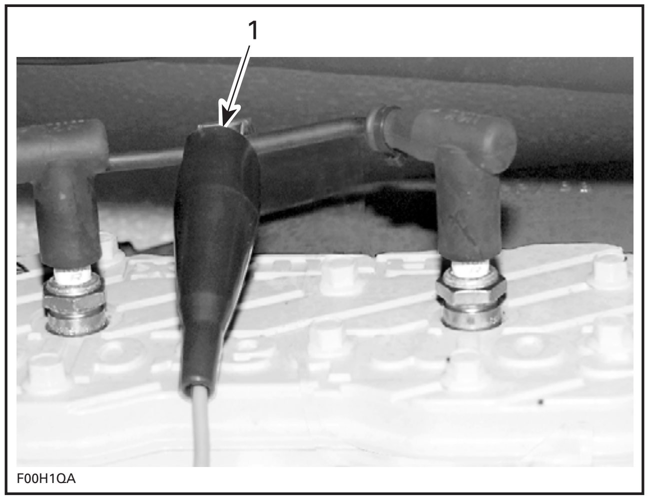
8. Remove TDC gauge.
9. Reinstall spark plug and connect wire.

Dynamic Test

To check TDC setting, use Bombardier timing light (P/N 529 031 900).



10. Connect timing light pick-up to MAG side spark plug wire.



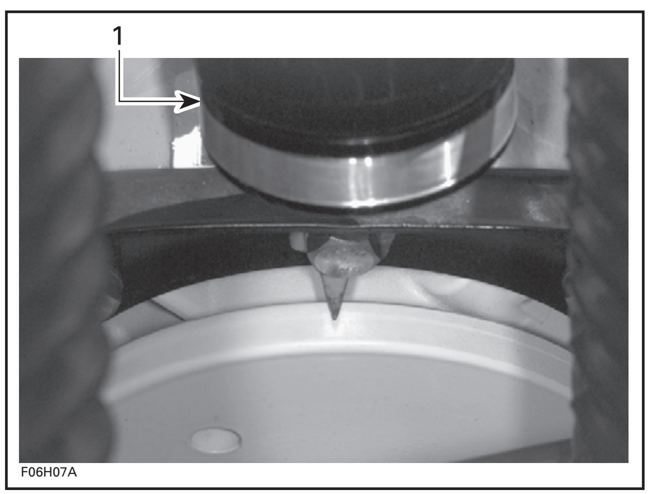
TYPICAL
1. *Timing light pick-up*

IMPORTANT: To check the TDC setting, the spark advance curve must be locked first. This allows to perform TDC setting at **any RPM** by keeping the ignition timing "frozen" so that it does not vary with engine RPM. See **TDC Setting** below for more information.

CAUTION: If the spark advance curve is not locked using B.U.D.S. then a wrong ignition timing will be seen as the ignition curve does not match the locked ignition timing.

11. Start engine and check marks **at idle speed.** Point beam of timing light straight in line with timing mark pointer.

NOTE: Look at the mark at the same angle as it was scribed so that parallax error is minimized.



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 performing the TDC setting to ensure PTO flywheel has not loosen or tightened.

TDC Setting

General

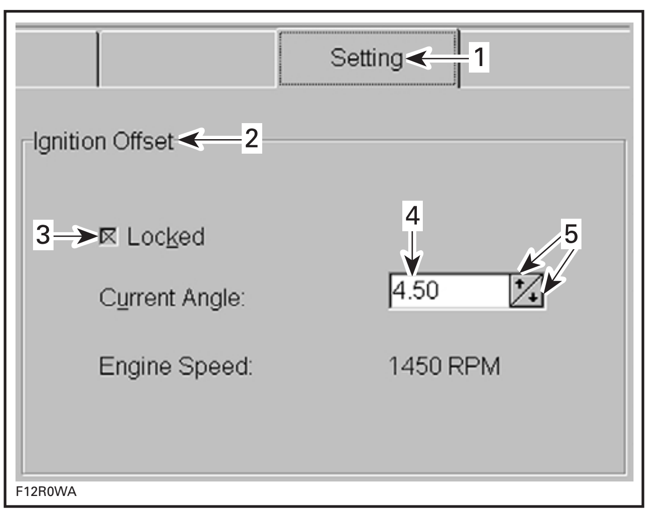
To correct the TDC setting, the data of the MPEM is changed using the VCK (Vehicle Communication Kit) (P/N 295 035 676). Look in **Setting** section of the software B.U.D.S.

NOTE: For more information on the VCK, refer to its online help. The MPEM programmer will not work to perform this operation on the **DI engines**.

CAUTION: If the TDC setting is adjusted too advanced, this will cause serious damage to the engine.

Adjustment

In this operation, the ignition timing light and B.U.D.S. are used to synchronize the MPEM TDC reference with the engine crankshaft. This timing adjustment will affect the timing of ignition as well as direct injector timings. The aim of the adjustment is to align the mark on the flywheel with the pointer at idle using the timing light and B.U.D.S. When this is achieved, then the MPEM TDC reference is synchronized with the engine crankshaft.



1. "Setting" tab
2. Ignition offset section
3. "Locked" box
4. Current angle in MPEM
5. Arrows to change the angle

1. Choose the **Setting** tab and look under **Ignition Offset**.
2. Check the **Locked** box to "freeze" the timing at the correct value.
3. The VCK displays the number that is stored in the MPEM.
4. Now click the up or down arrow to change the number of the current angle so that the TDC setting marks align when checking with the timing light. Each step makes an adjustment of 1/4 degree.

NOTE: Each time the setting is changed on the screen, the new value is also changed in the MPEM, so there may be a slow response, do not make changes too quickly.

5. When marks align, uncheck the **Locked** box to finish.

NOTE: This will write the new value immediately to the MPEM. There is no need to write the document to the MPEM for the TDC setting unless other changes were made. However, we recommend to reset the service hours when you perform a service action such as the TDC setting.

NOTE: The MPEM features a permanent (nonvolatile) memory and keeps the TDC setting programmed even when the watercraft battery is disconnected.

Engine Start/Stop Switch Verification

A quick operation test can be done using the vehicle communication kit (VCK) with the B.U.D.S. software, using the **Monitoring** section. Press the start button and look at the Start button LED. It should turn on, indicating the starting system is working on the input side (start button, MPEM and wiring). You know now the problem is on the output side (MPEM output signal to starting solenoid, wiring harness going to the solenoid, starter motor. Refer to STARTING SYSTEM for testing procedures). Otherwise, check the input side as follows.

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. Otherwise, replace switch.

If the switch tests good, check continuity of circuits 2-8 and 2-11 using a multimeter.

If wiring harness tests good, it could be the MPEM. Try a new MPEM referring to MPEM replacement procedures elsewhere in this section.

Safety Lanyard Switch Verification

If 2 short beeps are not heard when installing the safety lanyard, refer to DIAGNOSTIC PROCEDURES.

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.

SPARK PLUGS

Disassembly

First unscrew the spark plug one turn.

Clean the spark plug and cylinder head with pressurize air then completely unscrew.

Heat Range

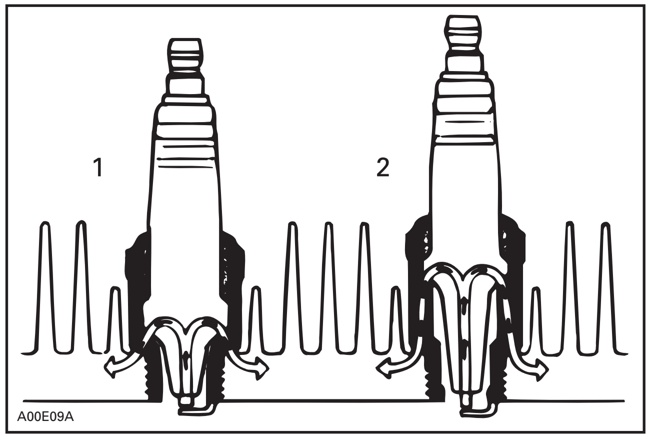
The proper heat range of the spark plugs is determined by the spark plugs ability to dissipate the heat generated by combustion.

The longer the heat path between the electrode tip to the plug shell, the hotter the spark plug operating temperature will be — and conversely, 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.

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

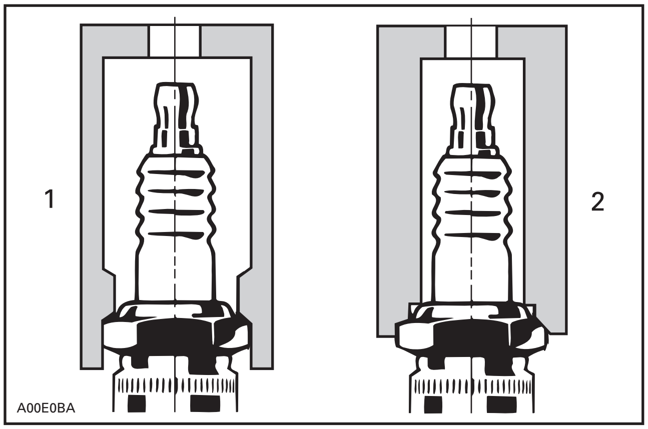
Fouling of the spark plug is indicated by irregular running of the engine, decreased engine speed due to misfiring, reduced performance, and increased fuel consumption. This is due to a loss of compression. Other possible causes are: prolonged idling, or running on a too rich mixture or incorrect fuel. 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 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. Then, tighten the spark plug clockwise an additional 1/4 turn with a proper socket.



1. *Proper socket*
2. *Improper socket*

ENGINE	SPARK PLUG	TORQUE	GAP mm (in)
DI	NGK ZFR4F-11	Hand tighten + 1/4 turn with a socket	1.1 (.043)

CRANKING SYSTEM

See above for start/stop switch and the DESS post testing. Refer to STARTING SYSTEM section for other tests.

DI SYSTEM TEST SUMMARY

Pressure Tests

COMPONENT	VALUE kPa (PSI)
Air compressor	621 ± 14 (90 ± 2) at cranking
Fuel pressure regulator	185 ± 14 (27 ± 2) when installing safety lanyard
Fuel pump	721 (105) minimum at cranking

Electrical Tests

COMPONENT	CONNECTOR	TERMINAL NUMBER	WIRE COLOR	VALUE
Fuel pump	AMP no. 4	26 and pin B	PU/PK	0 ohm (continuity)
		24 and pin D	BK/PK	
Fuel injector MAG	AMP no. 4	7 and 13	BL/PU and BL/BK	1.7 - 1.9 ohms
Fuel injector PTO		8 and 14	GR/PU and GR/BK	
Direct injector MAG	AMP no. 4	5 and 15	BL/BW and BL/PK	1 - 1.6 ohms
Direct injector PTO		6 and 21	GR/BW and GR/PK	
Throttle position sensor MAG (TPS)	TPS	1 and 3	PU/BW and WH/BW	5 V
		1 and 2	PU/BW and BK/BW	
	AMP no. 3	10 and 14	PU/BW and BK/BW	1600 - 2400 ohms
		5 and 14	WH/BW and BK/BW	2500 ohms at idle
		5 and 10	WH/BW and PU/BW	1200 ohms at idle
Throttle position sensor PTO (TPS)	TPS	1 and 3	PU/RD and WH/RD	5 V
		1 and 2	PU/RD and BK/RD	
	AMP no. 4	3 and 18	BK/RD and PU/RD	1600 - 2400 ohms
		1 and 3	WH/RD and BK/RD	1000 ohms at idle
		1 and 18	WH/RD and BK/RD	2500 ohms at idle
Crankshaft position sensor (CPS)	CPS (Deutsch conn.)	Pin 4 and ground	BK	0 V (with a small mV tolerance)
		Pin 5 and ground	GY/RD	12 V
		Pin 6 and ground	GY/YL	5 V
	AMP no. 2	Pin 7 and pin 6 of CPS	GY/YL	0 ohm (continuity)
		Pin 6 and pin 5 of CPS	GY/RD	
		Pin 14 and pin 4 of CPS	BK	

<table>
<tr><th>COMPONENT</th><th>CONNECTOR</th><th>TERMINAL NUMBER</th><th>WIRE COLOR</th><th>VALUE</th></tr>
<tr><td>Manifold air temperature sensor (MATS)</td><td>AMP no. 4</td><td>16 and 19</td><td>WH/GY and BK/WH</td><td>2280 - 2740 ohms</td></tr>
<tr><td>Water temperature sensor (WTS)</td><td>AMP no. 4</td><td>9 and 11</td><td>TA/OR and BK/OR</td><td>2280 - 2740 ohms</td></tr>
<tr><td rowspan="3">Manifold air pressure sensor (MAPS)</td><td rowspan="3">AMP no. 3</td><td>Pin 3 and pin 1 of MAPS</td><td>PU/BL</td><td rowspan="3">0 ohm (continuity)</td></tr>
<tr><td>Pin 6 and pin 3 of MAPS</td><td>WH/BL</td></tr>
<tr><td>Pin 7 and pin 2 of MAPS</td><td>BK/BL</td></tr>
<tr><td>Exhaust gas temperature (EGT)</td><td>AMP no. 4</td><td>10 and 12</td><td>TA/GY and BK/TA</td><td>2280 - 2740 ohms</td></tr>
<tr><td>Knock sensor (KS)</td><td>AMP no. 4</td><td>2 and 17</td><td>BK/BL and YL/BL</td><td>5 Mohms</td></tr>
<tr><td>Rave solenoid (RS)</td><td>AMP no. 4</td><td>20 and 23</td><td>PU/GY and BK/GY</td><td>24 ohms</td></tr>
<tr><td rowspan="2">Ignition coil MAG</td><td>AMP no. 3</td><td>21 and 22</td><td>RE/GN and WH/GN</td><td>.45 - .55 ohms primary winding</td></tr>
<tr><td>—</td><td>Coil terminal C and coil post</td><td>—</td><td>6800 - 10200 ohms secondary winding w/o high tension leads</td></tr>
<tr><td rowspan="2">Ignition coil PTO</td><td>AMP no. 3</td><td>20 and 23</td><td>RE/BL and WH/BL</td><td>.45 - .55 ohms primary winding</td></tr>
<tr><td>—</td><td>Coil terminal C and coil post</td><td>—</td><td>6800 - 10200 ohms secondary winding w/o high tension leads</td></tr>
<tr><td rowspan="2">High tension leads RX DI models</td><td>MAG</td><td>—</td><td>—</td><td>5700 ohms lead alone</td></tr>
<tr><td>PTO</td><td>—</td><td>White tape</td><td>4300 ohms lead alone</td></tr>
<tr><td rowspan="2">High tension leads GTX DI models</td><td>MAG</td><td>—</td><td>—</td><td>5700 ohms lead alone</td></tr>
<tr><td>PTO</td><td>—</td><td>White tape</td><td>4900 ohms lead alone</td></tr>
</table>

DIAGNOSTIC PROCEDURES

GENERAL

Here is the basic order suggested to diagnose a suspected fuel injection related problem:

– Check the chart in TROUBLESHOOTING section to have an overview of problems and suggested solutions.
– Check if there is a MAINT signal reported by the vehicle information center. If so, use the VCK (Vehicle Communication Kit) and look for fault codes to diagnose the trouble.
– Check all fuses.
– Check air/fuel rail pressure.
– Check spark plugs condition.
– Check RAVE valves if stuck.
– Check fuel pump pressure.
– Check air compressor pressure.

DESS SYSTEM

Basic Self-Diagnostic Mode

It is self-activated when the safety lanyard cap is being installed on the watercraft post. 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 post)	• Safety lanyard is recognized by the MPEM. • Good contact between safety lanyard cap and DESS post.	• Ignition is authorized, engine can be started normally.
1 long beep (while installing safety lanyard on watercraft post or when pressing start/stop button)	• Bad connection between safety lanyard cap and post.	• Remove and replace the safety lanyard on the post until 2 short beeps are heard to indicate the system is ready to allow engine starting.
	• Unprogrammed or defective safety lanyard.	• 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.
	• Salt water or dirt in safety lanyard cap.	• Clean safety lanyard cap to remove dirt or salt water.
	• Improper operation of MPEM or defective wiring harness.	• Enable advanced diagnostic mode to obtain more detail about the failure.
8 short beeps	• Defective MPEM (memory).	• Replace MPEM.
Other beeps		• Refer to COMPONENT FAILURE WARNING SYSTEM below.

Advanced Self-Diagnostic Mode

It needs to be enabled manually. Proceed as follows:

1. Remove safety lanyard cap from watercraft post.
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 post.
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	• Engine actually starts.	• Everything is correct.
1 LONG AND 1 SHORT BEEPS	• No safety lanyard has ever been programmed in watercraft MPEM.	• Use MPEM programmer or the VCK 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	• MPEM can not read the digital code of the safety lanyard cap or the magnet is defective. • Mixed wires at safety lanyard post connectors or bad connections.	• Check safety lanyard cap condition with the MPEM programmer or the VCK. Replace safety lanyard if reported defective. • Check post wiring harness.
2 LONG BEEPS	• Wrong safety lanyard or bad connection of the DESS wires.	• 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 or the VCK. Replace safety lanyard if reported defective.
3 SHORT BEEPS	• Wiring harness of DESS post is grounded or there is a short circuit.	• Check wiring harness and safety lanyard post.

If you need to listen again to 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.

FAULT DETECTION AND COMPENSATORY ACTIONS

For a basic overview of the monitoring system and the limp home modes, see OVERVIEW section.

COMPONENT FAILURE WARNING SYSTEM

Sensor Failures

Refers to open or short circuit failures on sensors, drivers, injectors or ignition.

PROBLEM	INFO CENTER	RED LED	BUZZER	BUZZER CODE	LIMP HOME MODE ①
Manifold air pressure sensor (MAPS)	"MAINT"	ON	OFF	6	Limited RPM
Manifold air temperature sensor (MATS)	"MAINT"	ON	OFF	6	Limited RPM
Throttle position sensor (single TPS)	"MAINT"	ON	**ON**	4	Limited RPM (idle speed if both TPS's fail)
Water temperature sensor (WTS)	"MAINT"	ON	OFF/(**ON**)	6/(4)	Limited RPM (code 4 if EGT also fails)
Direct injector (single injector)	"MAINT"	ON	OFF	6	Limited RPM
Fuel injector (single injector)	"MAINT"	ON	OFF	6	Limited RPM
Ignition (no firing on one cylinder)	"MAINT"	ON	OFF	6	Limited RPM
RAVE solenoid	"MAINT"	ON	OFF	6	Limited RPM
Starter solenoid	"MAINT"	ON	OFF	6	Engine may not start
Fuel pump	"MAINT"	ON	OFF	6	Limited RPM
Exhaust gas temperature sensor (EGT)	"MAINT"	ON	OFF/(**ON**)	6/(4)	Limited RPM (code 4 if WTS also fails)
Fuel level sensor	"MAINT"	ON	OFF	6	None
Diagnostic cap fault	"MAINT"	ON	OFF	6	None
Knock sensor	"MAINT"	ON	OFF	6	Limited RPM
Engine drowned mode activated (it is not a fault)	None	None	**ON**	2	Engine will not run. Release throttle

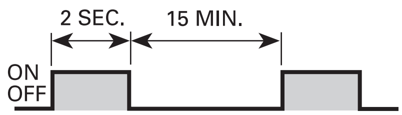
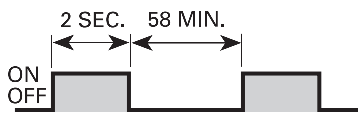
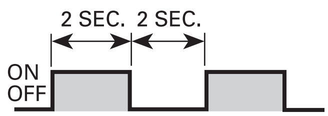
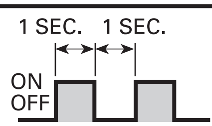
System Failures

Refers to operating conditions outside normal and/or safe ranges such as demand system failures, extreme voltages, over temperature conditions or low fuel/oil levels.

PROBLEM	INFO CENTER	RED LED	BUZZER	BUZZER CODE	LIMP HOME MODE ①
Manifold air pressure sensor (MAPS), ATM fault (bad atmospheric pressure reading)	"MAINT"	ON	OFF	6	Limited RPM
Throttle position sensor (single TPS)	"MAINT"	ON	**ON**	3	Limited RPM
Throttle position sensor (dual TPS)	"MAINT"	ON	**ON**	4	Idle RPM
Throttle position sensor (single adaption fault)	None	OFF	OFF	6	None
Throttle position sensor (dual adaption fault)	"MAINT"	ON	OFF	6	Limited RPM
Sensor supply fault (TPS and MAPS)	"MAINT"	ON	**ON**/OFF	4/(6)	Limited RPM (code 6 and idle RPM if both in fault)
Encoder (CPS) fault (bad pattern)	"MAINT"	ON	OFF	6	Limited RPM
Low battery voltage	"12 V LOW"	ON	OFF	6	None
Very low battery voltage	"12 V LOW" "MAINT"	ON	**ON**	4	Limited RPM
High battery voltage	"MAINT"	ON	OFF	6	None
Very high battery voltage	"MAINT"	ON	OFF	6	Idle RPM
High water temperature	"HI-TEMP"	ON	**ON**	1	None
Exhaust over temperature	"HI-TEMP"	ON	**ON**	3	None
Low oil level	"OIL-LOW"	ON	**ON**	5	None
Low fuel level	"FUEL-LO"	ON	**ON**	4	None
Setup fault (TDC or TPS not set on a new MPEM)	"MAINT"	ON	OFF	6	Idle RPM
MPEM fault	"MAINT"	ON	OFF	6	Engine will not start

① To see how the normal operation is recovered from the limp home mode, see the **DI Fault Codes** chart elsewhere in this section. Look in column "Normal operation resumes if fault removed and...".

Buzzer Code

BUZZER CODE	BUZZER PATTERN	NOTE
6		Always OFF
5		2 second beep every 15 minutes
4		2 second beep every 58 minutes
3		2 second beep every 2 seconds
2		1 second beep every second
1		Always ON (continuously beep)

F12H0TS

VCK (vehicle communication kit)

The VCK (Vehicle Communication Kit) (P/N 529 035 676) is the primary tool to diagnose fuel injection related problems.

B.U.D.S. is designed for the DI model to allow sensor inspection, diagnostic options and adjustment such as the Throttle Position Sensor (TPS) and the TDC setting.

For more information pertaining to the use of the software B.U.D.S., use its help which contains detailed information on its functions.

⚠ WARNING

If the computer you are using is connected to the 110 Vac power outlet, there is a potential risk of electrocution when working in contact with water. Be careful not to touch water while working with the VCK.

IMPORTANT: When using the software B.U.D.S., with the DI engines, ensure that the protocol "947 DI" is properly selected in "**MPI**" under "**Choose protocol**".

Refer to the tables below for the fault codes you will find in the B.U.D.S.

DI SYSTEM FAULT CODES

General

The faults registered in the MPEM are kept when the battery is disconnected.

Be aware that a red light blinking with the MAINT message may not be for a fault code. It may be a maintenance inspection reminder. Press and hold the **SET** button of the information center for 2 seconds. If the blinking continues, it is a fault code. Use the VCK (Vehicle Communication Kit) to see it. Otherwise, it was a maintenance reminder.

IMPORTANT: After a problem has been solved, ensure to clear the fault(s) in the MPEM using the VCK. This will properly reset the appropriate counter(s). This will also records that the problem has been fixed in the MPEM memory.

Many fault codes at the same time is likely to be burnt fuse(s).

For more information pertaining to the code faults (state, count, first etc.) and report, refer to B.U.D.S. online help.

Supplemental Information for Some Specific Faults

ECU fault code P0606: This code may occur in the following situations:

– Electrical noise is picked up by the MPEM. Ensure that all connections are in good condition, also grounds (battery, MPEM, engine and ignition system), they are clean and well tightened and that all electronic components are genuine — particularly in the ignition system. Installing resistive caps, non-resistive spark plug cables (or modified length), non-resistive spark plugs or knock sensor wiring/routing may lead to generate this fault code.
– Electrical noise might also lead engine to occasional cutout without generating a fault code when engine is restarted. When looking at the fault code, pay attention to the “count” value in the software B.U.D.S. A value between 1 and 9 confirms an electrical noise problem. A value of 10 and above will generate a fault code.
– When installing a new MPEM. It is not properly programmed from the factory. The MPEM must be returned to be properly “activated”.
– If everything is in good condition, replace the MPEM.

When using the service action suggested in the Fault section of B.U.D.S., the system circuits are referred as 4-23 for instance. It means Amp connector no. 4 and the circuit wire no. 23 as found in the wiring diagram.

TPS (Throttle Position Sensor) Faults

Faults which are reported in B.U.D.S. fall into two groups TPS faults and adaption faults. These are displayed on the B.U.D.S. system as TPS OUT OF RANGE and TPS ADAPTION FAILURE.

TPS “OUT OF RANGE” Fault

It is caused by the sensor reading going out of its allowable range. This fault can occur during the whole range of movement of the throttle.

To diagnose this fully, it is recommended to operate the throttle through its full range. It is also recommended to release the throttle quickly as this may also show up a fault that is intermittent.

POSSIBLE CAUSES	RESULT	ACTION
Check if wrong connector is connected to TPS	Yes	• Fix.
Check if sensor is loose	Yes	• Fix and reset closed TPS.
Inspect sensor for damage or corrosion	Yes	• Replace and reset closed TPS.
Inspect wiring (voltage test)	Failed	• Repair.
Inspect wiring and sensor (resistance test)	Failed	• If bad wiring, repair. • If bad TPS, replace and reset closed TPS.
Test sensor operation (wear test)		• Replace and reset closed TPS.

TPS “ADAPTATION FAILURE” Fault

It is caused by the idle position moving out of an acceptable range.

POSSIBLE CAUSES	RESULT	ACTION
Sensor has been replaced and TPS closed position not reset	Yes	• Reset closed TPS.
Throttle body has been replaced and TPS closed position not reset	Yes	• Reset closed TPS.
MPEM has been replaced and TPS closed position not reset	Yes	• Reset closed TPS.
Throttle cable too tight	Yes	• Fix and reset closed TPS.
Sensor is loose	Yes	• Fix and reset closed TPS.
Throttle bracket is loose	Yes	• Fix and reset closed TPS.
Idle screw or synchronization screw worn or loose	Yes	• Fix and reset closed TPS.

DI System Fault Code Chart

FAULT CODE	DIAGNOSED COMPONENT/ SENSOR/CIRCUIT	ECU INTERNAL NAME	FAULT DETECTED	FAULT DETECTED WHILE ENGINE RUNNING	FAULT DETECTED WHILE ENGINE **NOT** RUNNING	NORMAL OPERATION RESUMES IF FAULT REMOVED AND...	SERVICE ACTION AND POSSIBLE CAUSES
P1100	Direct injector MAG	AIR_INJ_1	Open or short circuit	Yes	No	Return to idle	**Service action:** Check for 2.0 ohm resistance between system circuits 4-15 and 4-5. Check for + 12 volts on pin A of injector connector (color). **Possible causes:** Damaged injector, damaged circuit wires, damaged connector, damaged ECU output pins. ECU failure.
P1101	Direct injector PTO	AIR_INJ_2	Open or short circuit	Yes	No	Return to idle	**Service action:** Check for 2.0 ohm resistance between system circuits 4-21 and 4-6. Check for + 12 volts on pin A of injector connector (color). **Possible causes:** Damaged injector, damaged circuit wires, damaged connector, damaged ECU output pins. ECU failure.
P0201	Fuel injector MAG	FUEL_INJ_1	Open or short circuit	Yes	No	Return to idle	**Service action:** Check for 2.5 ohm resistance between system circuits 4-13 and 4-7. Check for + 12 volts on pin A of injector connector (color). **Possible causes:** Damaged injector, damaged circuit wires, damaged connector, damaged ECU output pins. ECU failure.
P0202	Fuel injector PTO	FUEL_INJ_2	Open or short circuit	Yes	No	Return to idle	**Service action:** Check for 2.5 ohm resistance between 4-14 and 4-8. Check for + 12 volts on pin A of injector connector (color). **Possible causes:** Damaged injector, damaged circuit wires, damaged connector, damaged ECU output pins. ECU failure.
P0351	Ignition coil, primary winding MAG	IGN_CYL_1	Open or short circuit on ignition primary circuit	Yes	No	Return to idle	**Service action:** Check for 1.0 ohm resistance between system circuits 3-21 and 3-22. Check for + 12 volts on pin A of coil connector (color). **Possible causes:** Damaged coil, damaged circuit wires, damaged connector, damaged ECU output pins. ECU failure.
P0352	Ignition coil, primary winding PTO	IGN_CYL_2	Open or short circuit on ignition primary circuit	Yes	No	Return to idle	**Service action:** Check for 1.0 ohm resistance between system circuits 3-20 and 3-23. Check for + 12 volts on pin A of coil connector (color). **Possible causes:** Damaged coil, damaged circuit wires, damaged connector, damaged ECU output pins. ECU failure.
P0335	Encoder	Encoder	Wrong pattern sensed	Yes	No	Return to idle	**Service action:** Check for 12 volts on pin 5 and 5 volts on 6 and 0 volts on pin 4 of encoder harness connector. Check system circuits 2-6, 2-7, 2-14. **Possible causes:** Damaged sensor, damaged circuit wires, damaged connector, damaged ECU pins. ECU failure. Damaged tooth wheel. Check correct rectifier regulator operation.

FAULT CODE	DIAGNOSED COMPONENT/ SENSOR/CIRCUIT	ECU INTERNAL NAME	FAULT DETECTED	FAULT DETECTED WHILE ENGINE RUNNING	FAULT DETECTED WHILE ENGINE **NOT** RUNNING	NORMAL OPERATION RESUMES IF FAULT REMOVED AND...	SERVICE ACTION AND POSSIBLE CAUSES
P0120	TPS, PTO	TPI_1	Sensor out of range	Yes	No	Return to idle	**Service action:** Check for 5 volts on pin 1 and 0-0.5 volts on pin 3 and 0 volts on pin 2. Check system circuits 4-1, 4-2, 4-18. Check with throttle closed the resistance between 1 and 2 is 2000 ohms and between 2 and 3 is 1000 ohms and between 1 and 3 2500 ohms. Check for linear resistance rise when opening throttles. Check physical stops for wear. **Possible causes:** Damaged Sensor, damaged circuit wires, damaged connector, damaged ECU pins, ECU failure, damaged or out of alignment throttle bodies or sensor.
P0220	TPS, MAG	TPI_2	Sensor out of range	Yes	No	Return to idle	**Service action:** Check for 5 volts on pin 1 and 4.75-5.0 volts on 3 and 0volts on pin 2. Check system circuits 3-5, 3-10, 3-14. Check with throttle closed the resistance between 1 and 2 is 2500 ohms and between 2 and 3 is 2500 ohms and between 1 and 3 1200 ohms. Check for linear resistance rise when opening throttles. Check physical stops for wear. **Possible causes:** Damaged Sensor, damaged circuit wires, damaged connector, damaged ECU pins, ECU failure, damaged or out of alignment throttle bodies or sensor.
P1102	TPS, PTO	TPI_1_ADAP	Throttle position adaption failure	Yes	No	Full reset. Key off and on	**Service action:** Check cable adjustment. Check Idle stop for wear check throttle angles at idle. **Possible causes:** No initialisation after throttle body or ECU changes throttle idle stop drifted.
P1103	TPS, MAG	TPI_2_ADAP	Throttle position adaption failure	Yes	No	Full reset. Key off and on	**Service action:** Check cable adjustment. Check Idle stop for wear. Check throttle angles at idle. **Possible causes:** No initialisation after throttle body or ECU changes throttle idle. Stop drifted.
P0116	WTS	COOL_SENS	Sensor out of range	Yes	No	Return to idle	**Service action:** Check for resistance approx. 2280 ohms to 2736 ohms at temperature of 19 to 21°C (66° to 70°F) between system circuits 4-9 and 4-11. **Possible causes:** Damaged sensor, damaged circuit wires, damaged connector, damaged ECU pins. ECU failure.
P0217	WTS	COOL_RED	Overheat warning	Yes	No	As soon as fault is not present	**Service action:** Check for debris or blockage in cooling system. Check for resistance approx. 2280 ohms to 2736 ohms at temperature of 19 to 21°C (66° to 70°F) between system circuits 4-9 and 4-11. **Possible causes:** Engine overheated, damaged sensor.
P0110	MATS	MCT_SENS	Sensor out of range	Yes	No	Return to idle	**Service action:** Check for resistance approx. 2280 ohms to 2736 ohms at temperature of 19 to 21°C (66° to 70°F) between system circuits 4-16 and 4-19. **Possible causes:** Damaged sensor, damaged circuit wires, damaged connector, damaged ECU pins. ECU failure.

FAULT CODE	DIAGNOSED COMPONENT/ SENSOR/CIRCUIT	ECU INTERNAL NAME	FAULT DETECTED	FAULT DETECTED WHILE ENGINE RUNNING	FAULT DETECTED WHILE ENGINE **NOT** RUNNING	NORMAL OPERATION RESUMES IF FAULT REMOVED AND...	SERVICE ACTION AND POSSIBLE CAUSES
P0106	MAPS	MAP	Sensor out of range	Yes	No	Return to idle	**Service action:** Check system circuits 3-3, 3-6, 3-7. Check sensor connector for 5 volts on pin 1 and 0 volts on pin 3 and 0 volts on pin 2. Check Sensor housing is correctly inserted into manifold. **Possible causes:** Check sensing port for dirt or blockage. Sensor failure, unexpected reading at idle. Sensor fallen out of housing. Leaking Inlet system, ECU failure.
P0105	MAPS	MAP_ATM	Bad atmospheric reading	Yes	No	Full reset. Key off and on	**Service action:** Check system circuits 3-3, 3-6, 3-7. Check sensor connector for 5 volts on pin 1 and 0 volts on pin 3 and 0 volts on pin 2. **Possible causes:** Check sensing port for dirt or blockage, damaged sensor, damaged circuit wires, damaged connector, damaged ECU pins. ECU failure.
P1400	EGT	EXH_SENS	Sensor out of range	Yes	No	Return to idle	**Service action:** Check for resistance approx. 2280 ohms to 2736 ohms at temperature of 19 to 21°C (66° to 70°F) between system circuits 4-10 and 4-12. **Possible causes:** Damaged sensor, damaged circuit wires, damaged connector, damaged ECU pins. ECU failure.
P1401	EGT	EXH_RED	Overheat warning	Yes	No	As soon as fault is not present	**Service action:** Check for debris or blockage in cooling system. Check tune pipe injection valve. **Possible causes:** Exhaust system overheated, damaged sensor damaged circuit wires.
P0460	Fuel level sensor	FUEL_SENS	Sensor out of range	Yes	No	As soon as fault is not present	**Service action:** TBD. **Possible causes:** Damaged sensor, damaged circuit wires, damaged connector, damaged ECU pins. ECU failure.
P0230	Fuel pump	FUEL_PUMP	Open or short circuit	Yes, short circuit	Yes, open circuit	Return to idle	**Service action:** Check for resistance of 6-8 ohms between system circuits 4-24 and 4-26. **Possible causes:** Damaged pump, damaged circuit wires, damaged connector, damaged ECU output pins. ECU failure.
P0475	RAVE solenoid	RAVE	Open or short circuit	Yes, open and short circuit	Yes, open circuit	Return to idle	**Service action:** Check for resistance of 30 ohms between system circuits 4-23 and 4-20. **Possible causes:** Damaged solenoid, damaged circuit wires, damaged connector, damaged ECU output pins. ECU failure.
P1300	Starting system solenoid (winding)	CRANK	Open or short circuit	Yes, open and short circuit	Yes, open circuit	As soon as fault is not present	**Service action:** Check for resistance of 6ohms between system circuits 3-19 and 3-15. **Possible causes:** Damaged solenoid, damaged circuit wires, damaged connector, damaged ECU output pins. ECU failure.
P0563	Battery voltage	BV_HI_WARN	Battery voltage high	Yes	Yes	As soon as fault is not present	**Possible causes:** Battery failure, rectifier failure, battery terminal connection.

FAULT CODE	DIAGNOSED COMPONENT/ SENSOR/CIRCUIT	ECU INTERNAL NAME	FAULT DETECTED	FAULT DETECTED WHILE ENGINE RUNNING	FAULT DETECTED WHILE ENGINE **NOT** RUNNING	NORMAL OPERATION RESUMES IF FAULT REMOVED AND...	SERVICE ACTION AND POSSIBLE CAUSES
P1500	Battery voltage	BV_HI_RED	Battery voltage very high	Yes	Yes	Full reset. Key off and on	**Possible causes:** Battery failure, rectifier failure, battery terminal connection.
P0562	Battery voltage	BV_LO_WARN	Battery voltage low	Yes	Yes	As soon as fault is not present	**Service action:** Check fuse. Check system circuits 3-25 to battery + terminal, 2-26 to regulator 2 pin connector pin A, 2-25 to regulator 2 pin connector pin B. **Possible causes:** Battery failure, rectifier failure, damaged circuit wires, battery terminal connection, damaged magneto, damaged connectors.
P1501	Battery voltage	BV_LO_RED	Battery voltage very low	Yes	Yes	Return to idle	**Service action:** Check fuse, check system circuits 3-25 to battery + terminal, 2-26 to regulator 2 pin connector pin A, 2-25 to regulator 2 pin connector pin B. **Possible causes:** Battery failure, rectifier failure, damaged circuit wires, battery terminal connection, damaged magneto, damaged connectors.
P0122	Sensor supply (TPS, MAG and MAPS)	XDRP_1	Sensor 5 volt supply failure	Yes	Yes	Return to idle	**Service action:** Check for shorts to ground or corrosion on the following system circuits 3-10 or 3-3. **Possible causes:** Damaged circuit wires, associated sensor failure (TPI 2 or MAP), ECU fault.
P0222	Sensor supply (TPS, PTO)	XDRP_2	Sensor 5 volt supply failure	Yes	Yes	Return to idle	**Service action:** Check for shorts to ground or corrosion on system circuit 4-18. **Possible causes:** Damaged circuit wires, associated sensor failure (TPI 1), ECU fault.
P1600	ECU	SETUP	TDC and ECU not initialised	Yes	Yes	Reinitialised from B.U.D.S.	**Service action:** Initialize ECU. **Possible causes:** ECU not initialised, TDC not setup, throttle sensors not initalised.
P0606	ECU	ECU_FAULT	Internal ECU faults	Yes	Yes	Full reset. Key off and on	**Service action:** Check ignition leads, coils and correct spark plugs, replace ECU. **Possible causes:** Incorrect software, ignition noise causing errors, internal EEPROM failure.
P0325	Knock sensor	KNOCK_SENS	Knock sensor failure	Yes, over 4500	No	Return to idle	**Service action:** Bring engine to 4500 RPM. If fault code appears, check for resistance approx. 4.8 ohms between system circuits 4-2 and 4-17. **Possible causes:** Damaged sensor, damaged circuit wires, damaged connector, damaged ECU pins. ECU failure.
P1601	Diagnostic cap	COMMS_CAP	Diagnostic cap is not installed on wiring harness	Yes	Yes	As soon as fault is not present	**Service action:** Reinstall cap on wiring harness. **Possible causes:** Cap is not installed on wiring harness.

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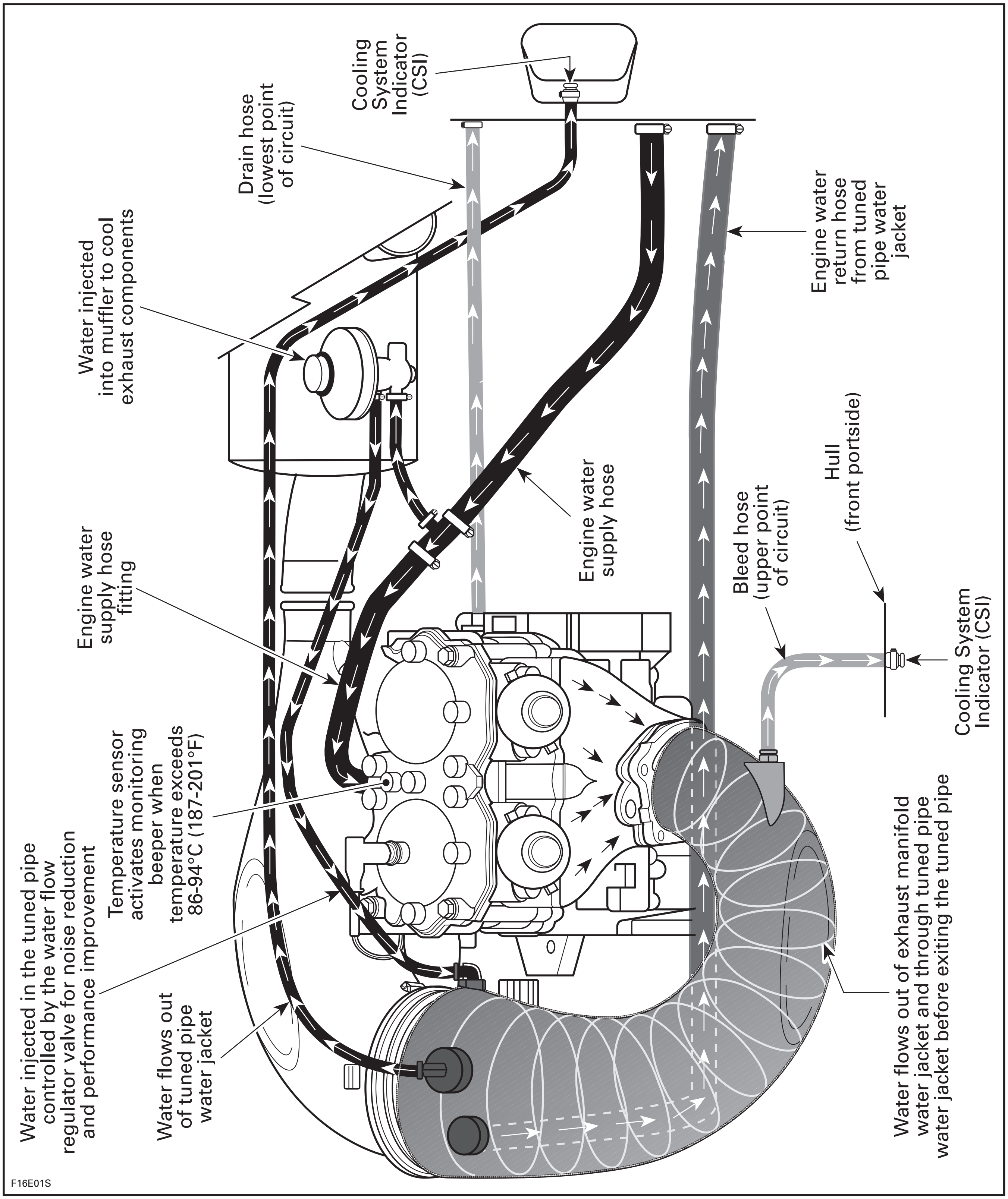
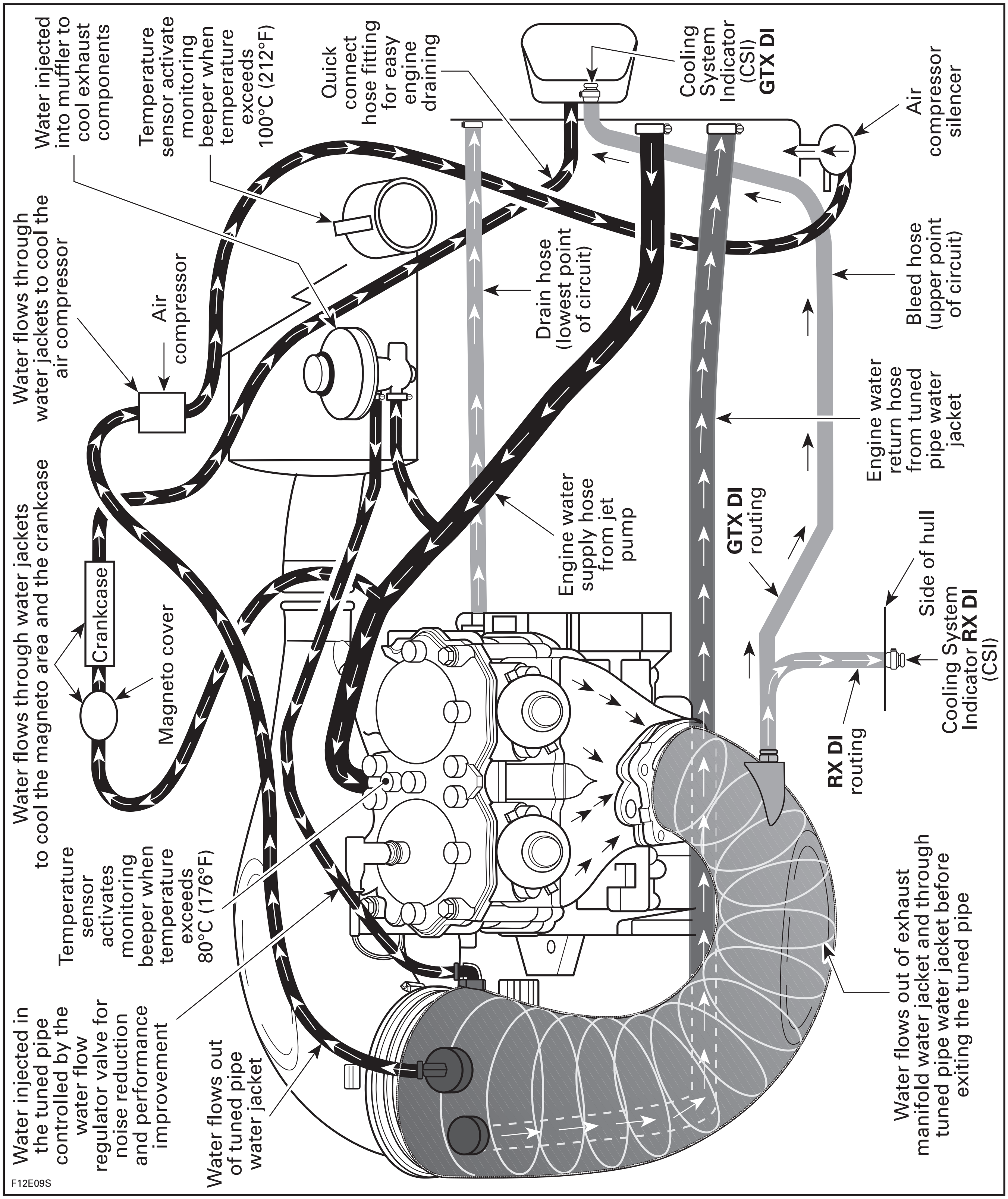
CIRCUIT, COMPONENTS AND CARE



947 ENGINE — CARBURETOR-EQUIPPED MODELS



947 ENGINE — DI MODELS

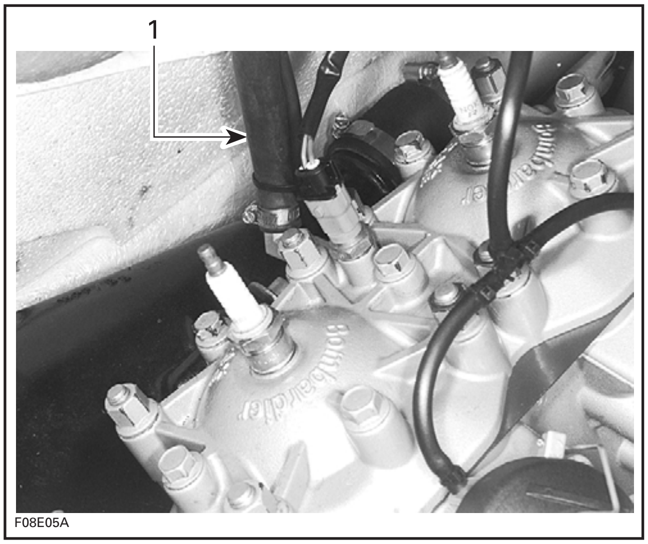
CIRCUIT

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.

The water is entering the engine by the water inlet fitting at the cylinder head.

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*

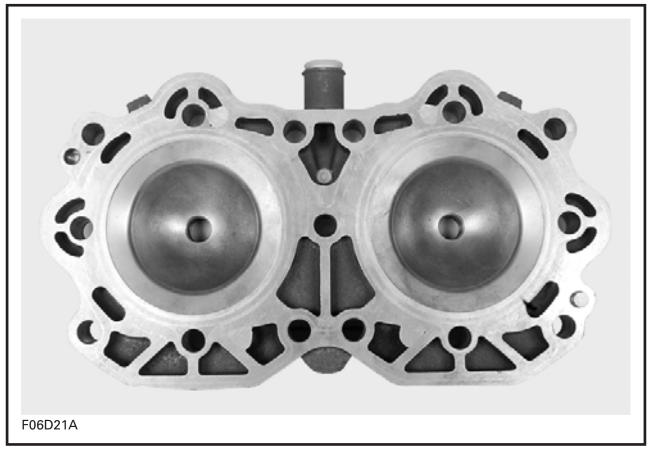
DI Models

Water from inlet hose also supplies the water regulator on muffler and magneto cover and crankcase cover.

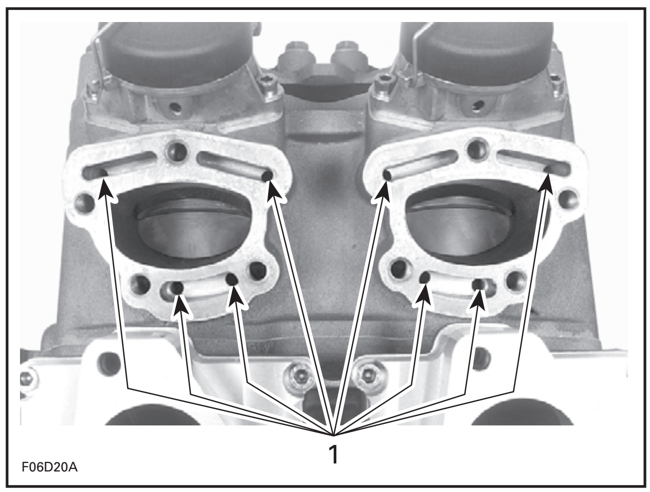
Water then is expulsed through the pump support drain.

All Models

Water continues to circulates from inlet hose through the one piece cylinder head which features improved combustion chamber and better spark plug cooling.

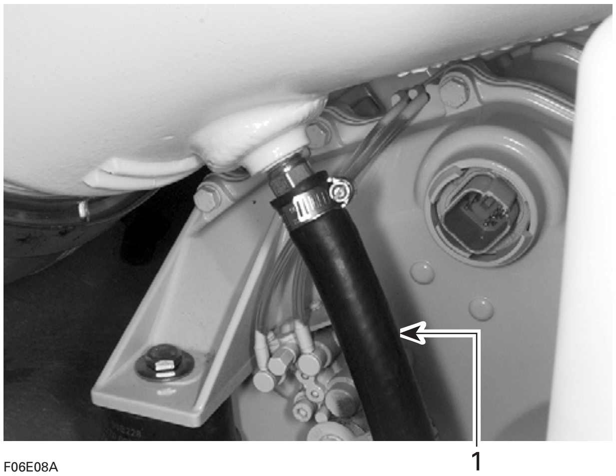


Water enters cylinder block water jackets and is directed to the water jackets of the exhaust manifold and tuned pipe head through passages located above and below exhaust ports.



1. *Water passages*

Water exits tuned pipe water jackets through an outlet fitting.



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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.

Carburetor-Equipped Models

Water flows out of tuned pipe water jacket from upper fitting of tuned pipe and is expulsed to the cooling system indicator.

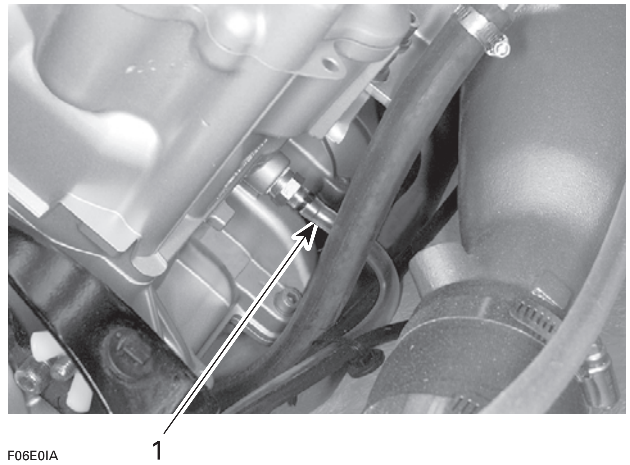
DI Models

Water flows out of tuned pipe water jacket from upper fitting of tuned pipe and is directed to the air compressor, then to the air silencer at the transom.

Water continues to flow in the crankcase water jacket to cool the crankcase area to then be expulsed to the transom area.

All Models

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.



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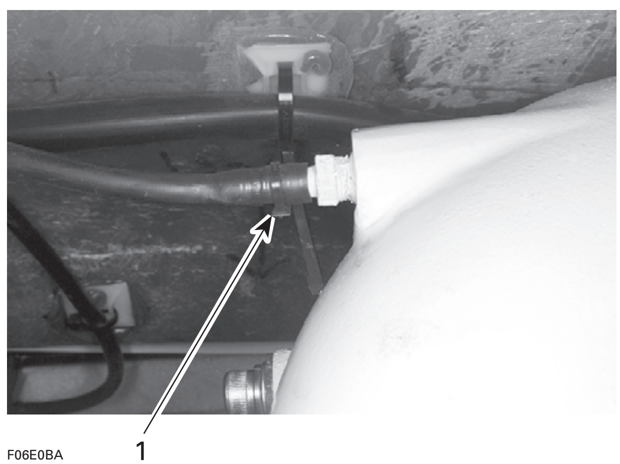
1. *Drain hose*

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).



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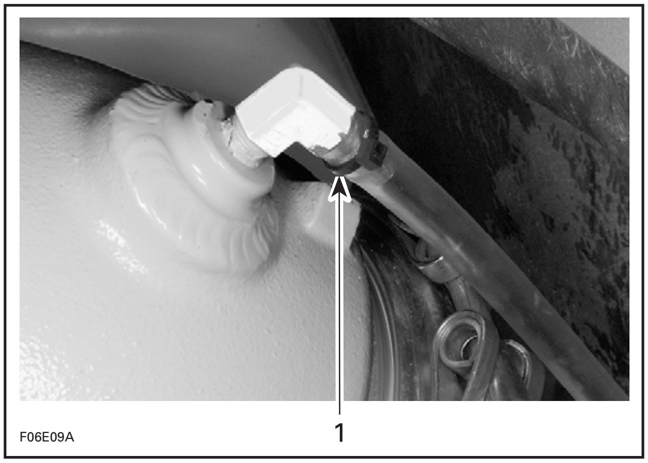
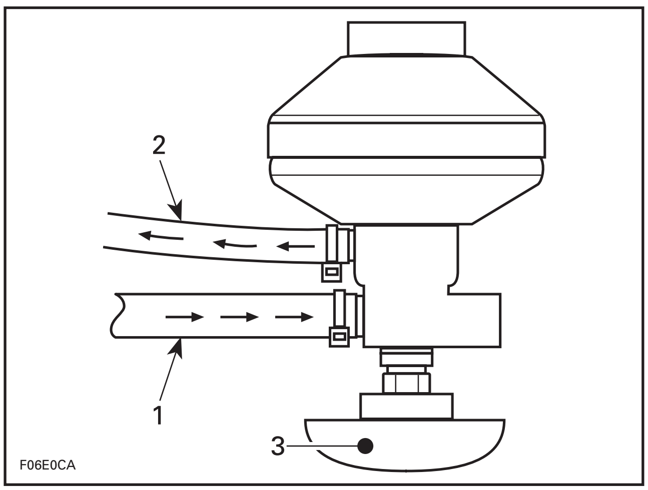
1. *Bleed hose*

The water supply of the water flow regulator is provided by the water supply hose coming from the pump.



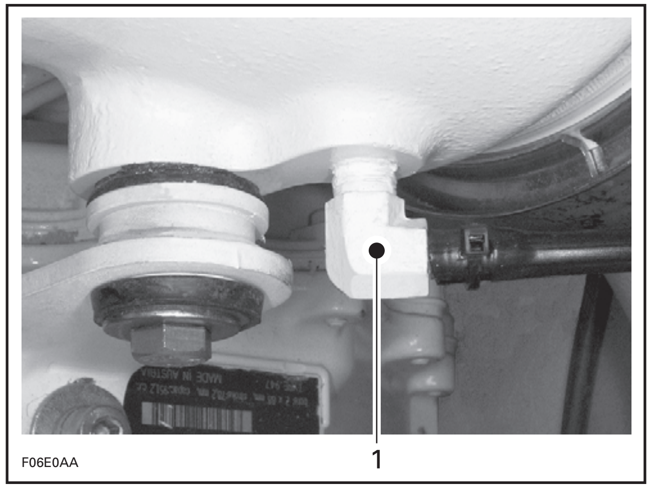
1. *Water flow going to CSI*

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. *Muffler*

Regulated water is injected in the tuned pipe by a calibrated fitting.



1. *Injection fitting*

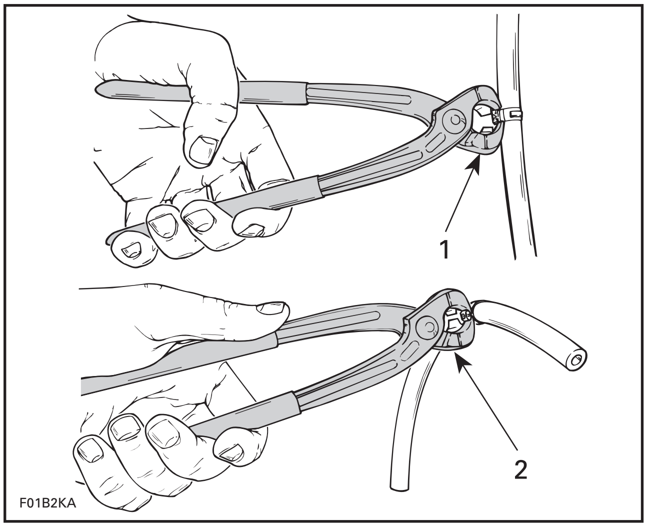
CAUTION: Never modify cooling system arrangement, otherwise serious engine damage could occur.

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: **Carburetor-Equipped models:** Turns on at 86 - 94°C (187 - 201°F). **DI models:** Turns on at 80°C (176°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 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.

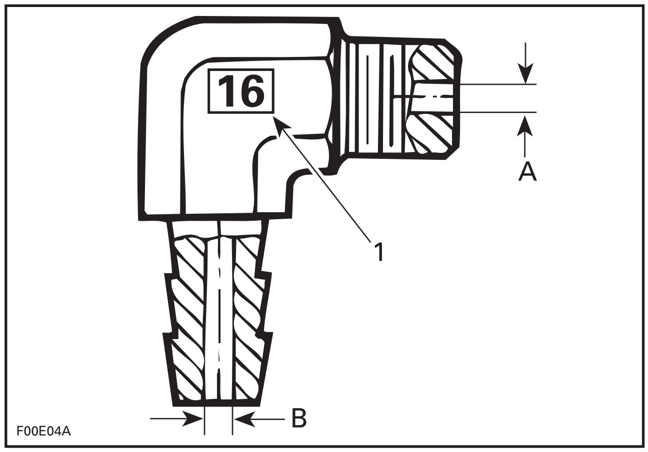
Elbow Fitting

Water injection used on exhaust system cools the exhaust gases to obtain maximum performance from the tuned pipe. The elbow fitting 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.



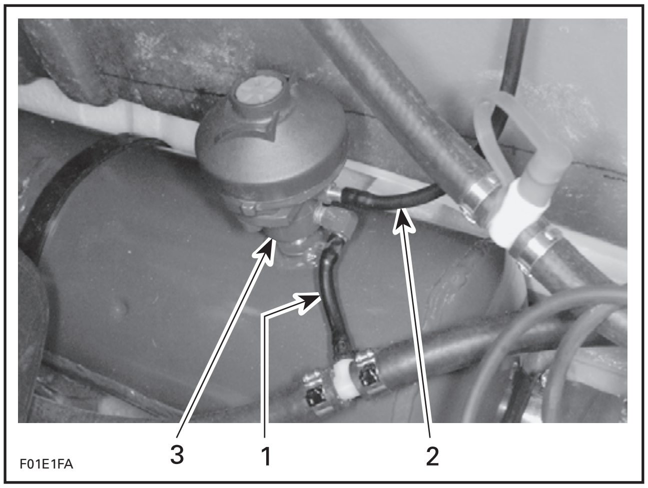
1. *Stamped number*
A. *Outlet diameter = 4.6 mm (.181 in)*
B. *Inlet diameter = 5.5 mm (.219 in)*

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 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 is mounted directly onto the muffler.



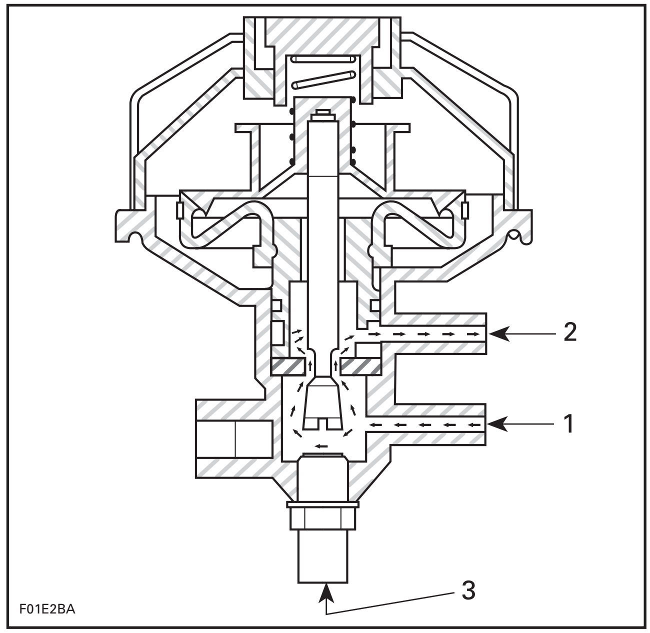
TYPICAL
1. *Water supply hose of regulator valve*
2. *Regulated water to injection fitting*
3. *Water injected into the muffler*

NOTE: The water injected into the muffler is not regulated by the valve. A calibrated water injection fitting of 3.0 mm (.118 in) on **carburetor-equipped models** and 4.0 mm (.156 in) on **DI models** 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.

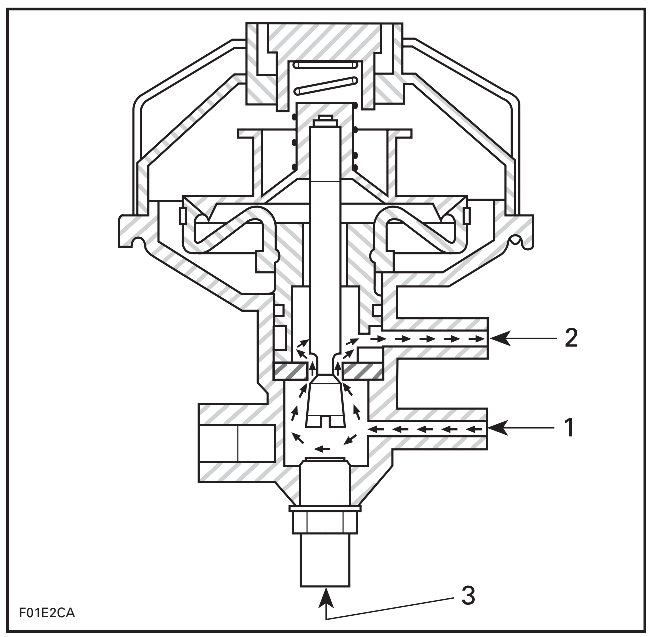
CAUTION: Do not change the calibration of the spring, otherwise serious engine damage can occur.

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*

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. The valve cap on the DI models is sealed and it is not adjustable.

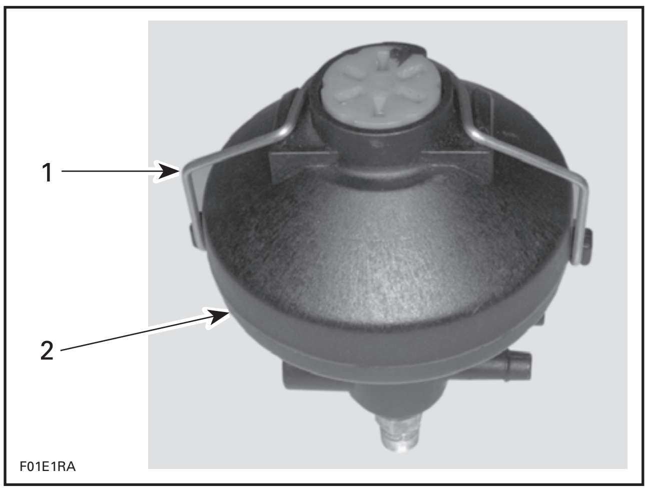
If the maximum engine speed cannot be attained or if the engine has poor performance, the water flow regulator valve should be considered in the troubleshooting of the problem.

Disassembly

Remove the cover of the valve by releasing the spring.

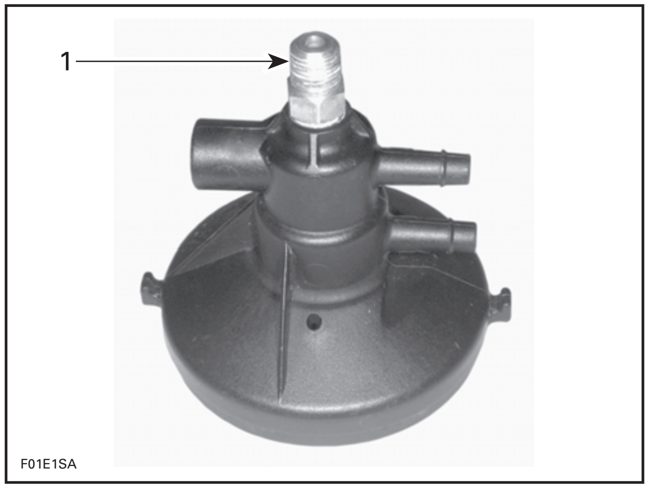
⚠ WARNING

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



1. Spring
2. Cover

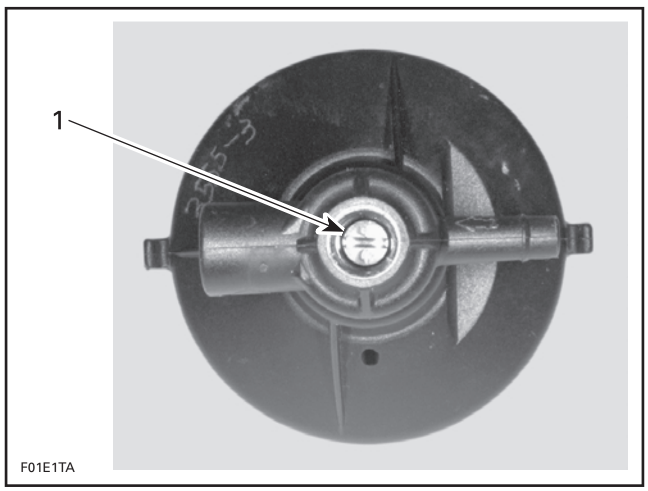
Remove fitting from valve housing.



TYPICAL
1. Fitting

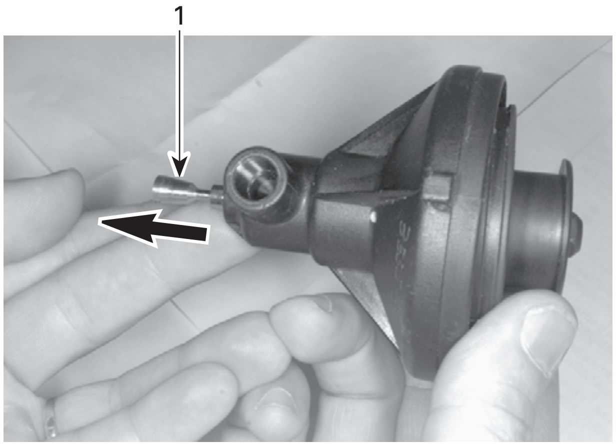
Unscrew the tapered needle.

NOTE: Hold the valve to prevent it from turning.



1. Tapered needle

Remove the tapered needle from valve housing.

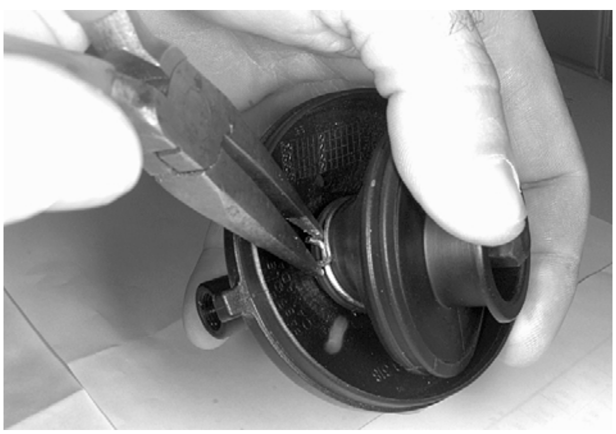


F01E20A

1. *Remove tapered needle*

Pull the valve slightly. Using pliers, release the clamp which retains the bellows.

Remove valve and bellows.



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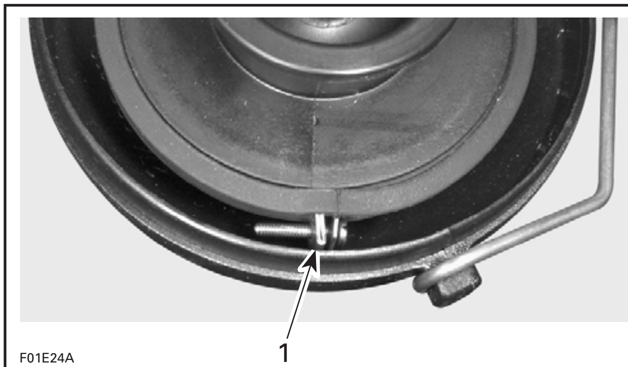
Loosen clamp to separate valve from bellows.



F01E24A

1. *Clamp*

Inspection

Inspect parts for damage. Verify especially bellows for cracks.

Assembly

Assembly is essentially the reverse of disassembly procedures.

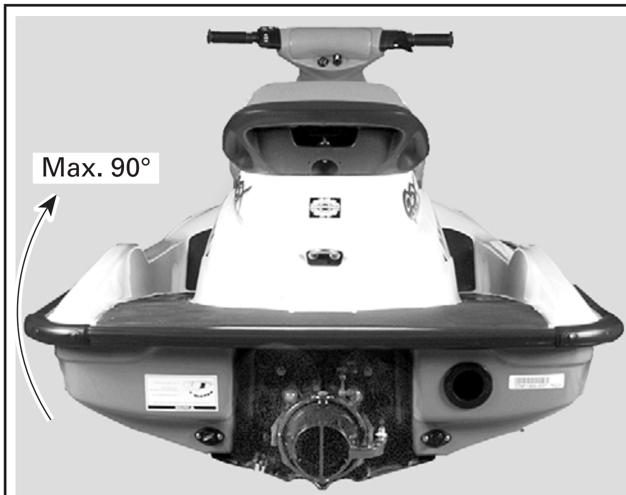
CARE

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.

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.



F06L11B

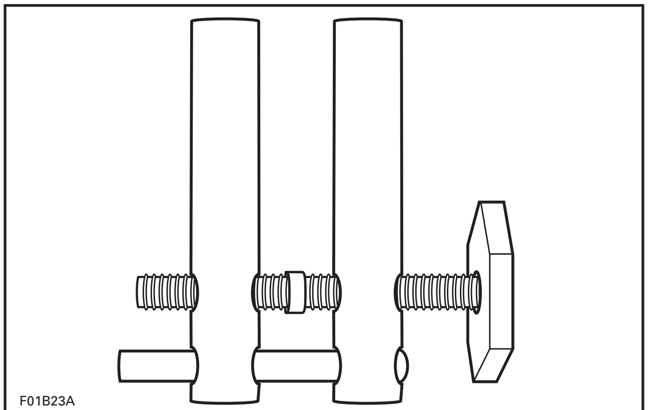
TYPICAL

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).



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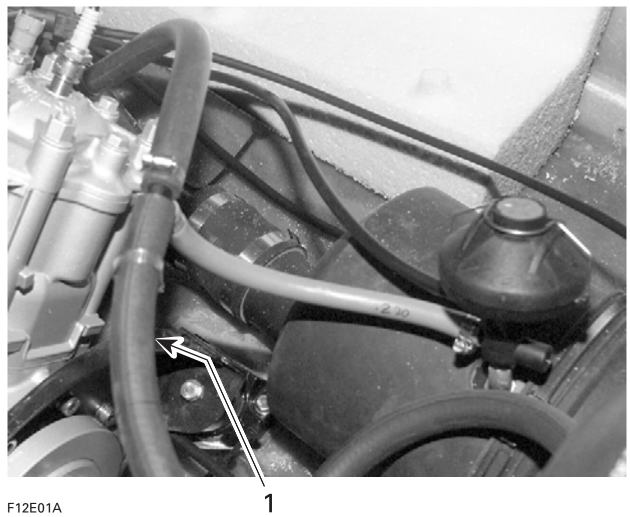
This will prevent the cooling system from filling which may lead to water being injected into and filling the exhaust system. Without the engine running there isn't any exhaust pressure to carry the water out the exhaust outlet.

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 illustration.



F12E01A

1. *Hose pincher on water supply hose*

CAUTION: When finished towing the watercraft, the hose pincher must be removed before operating it.

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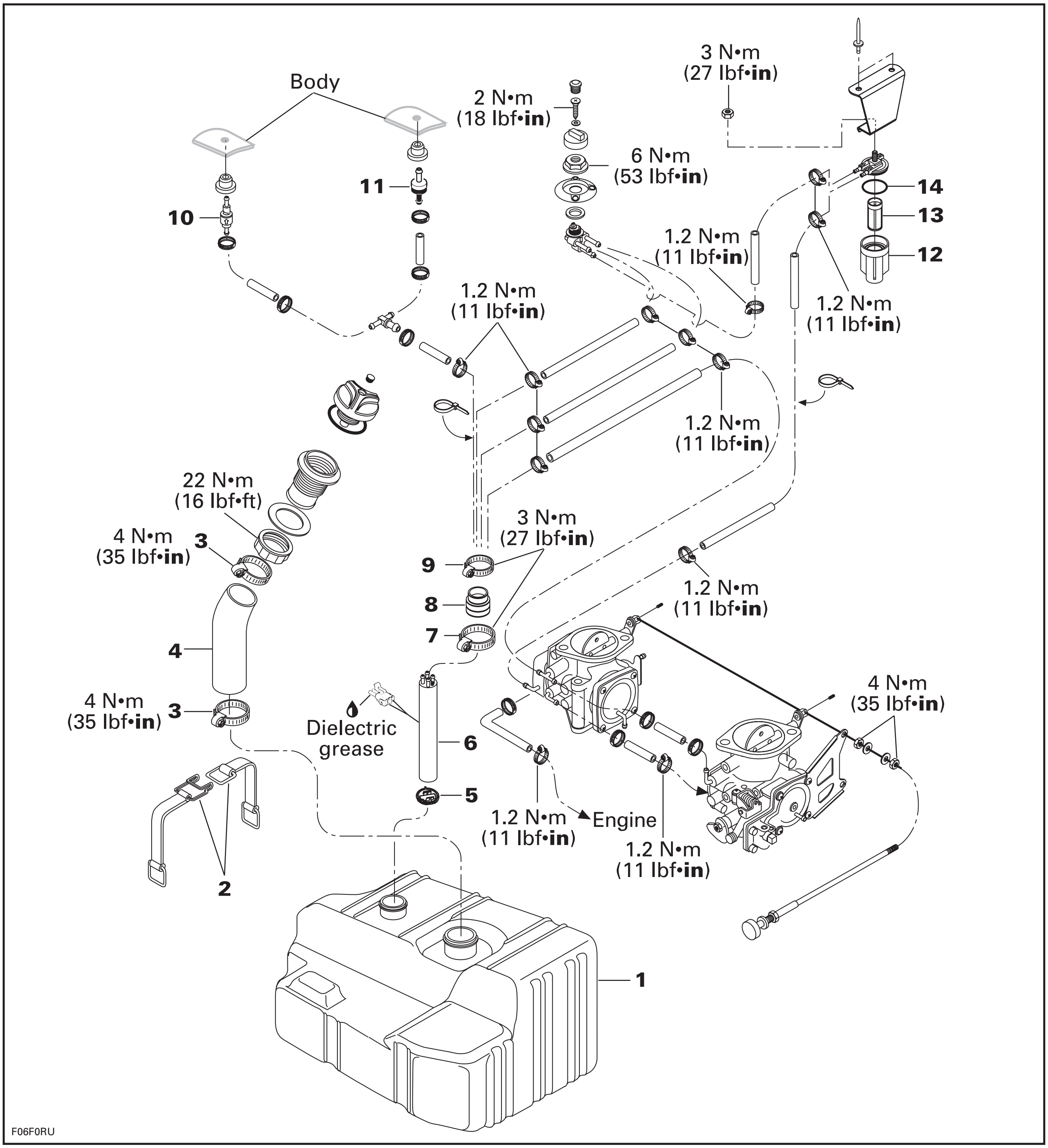
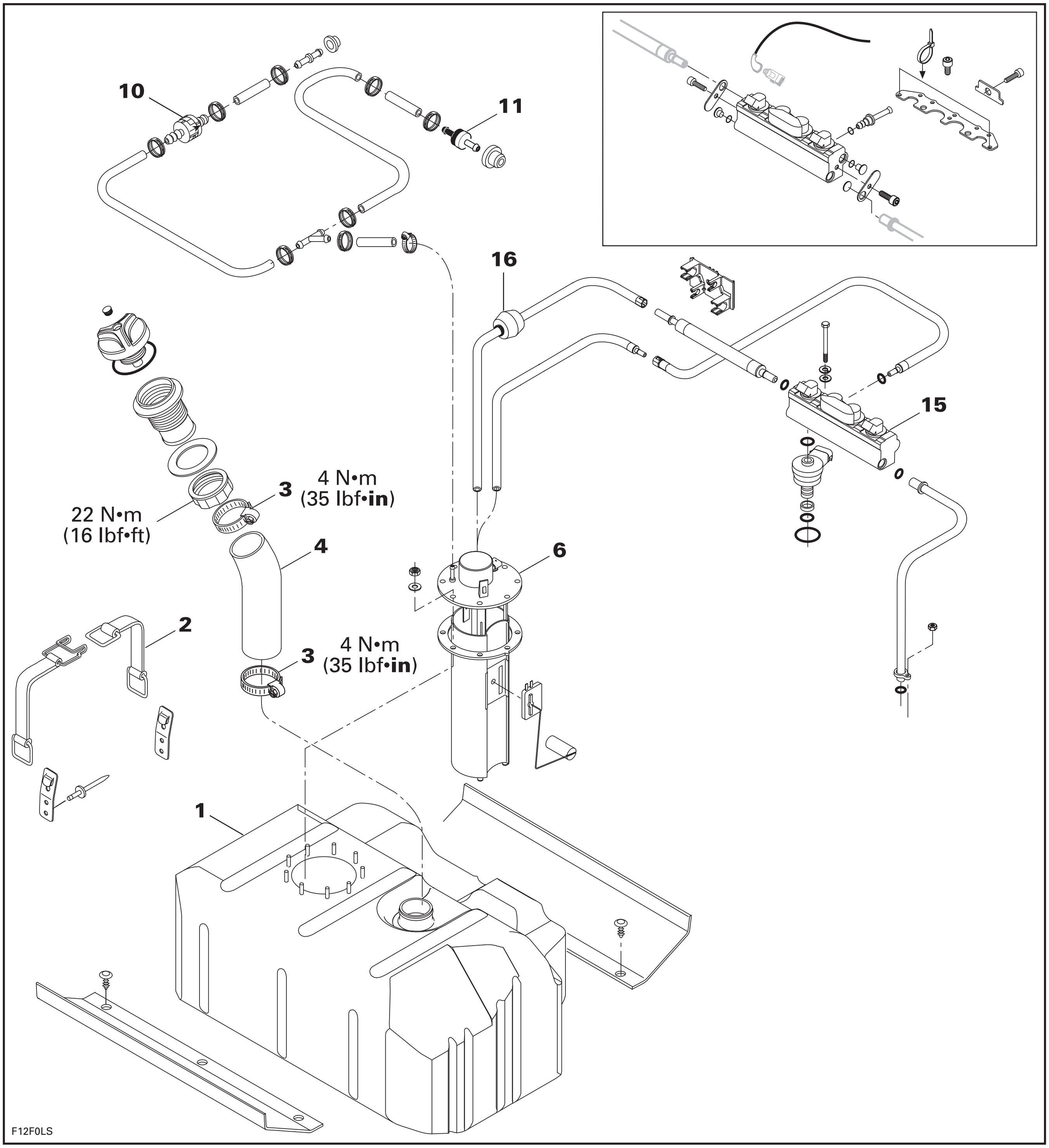
FUEL CIRCUIT

RX (carburetor-equipped models)



GTX DI Models



GENERAL

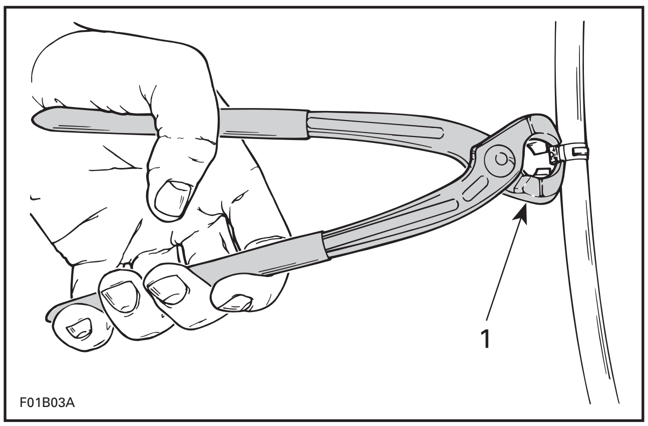
⚠ WARNING

DI Models: The fuel system of a fuel injection system hold much more pressure than on a carbureted watercraft. Prior to disconnecting a hose or to removing a component from the fuel system, follow the recommendation described in ENGINE MANAGEMENT (DI) under **Fuel System.**

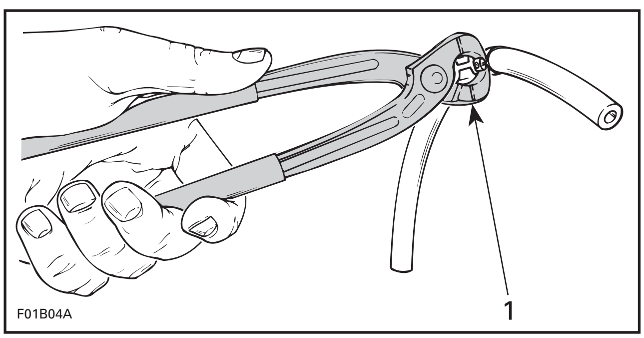
⚠ WARNING

Whenever repairing the fuel system, always verify for water infiltration in reservoir. If so, flush reservoir. Replace any damaged, leaking or deteriorated fuel lines.

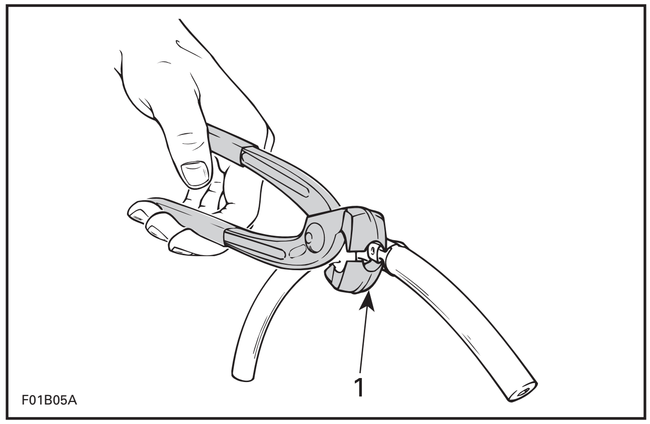
To secure or cut Oetiker clamps on fuel lines, use pliers (P/N 295 000 070).



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. On **DI models**, use hoses ass'y available as parts replacement. This will ensure continued proper and safe operation.

⚠ WARNING

Use of improper fuel lines could compromise fuel system integrity.

REMOVAL

Fuel Filter

Carburetor-Equipped Models

Open storage compartment cover.

Remove basket.

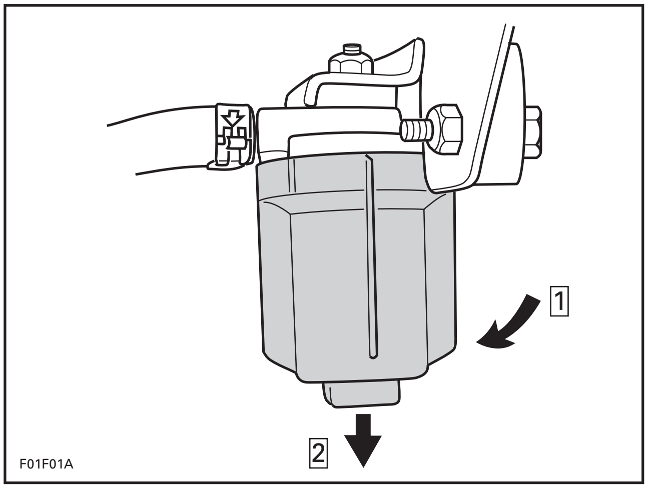
Turn the fuel valve to OFF position.

⚠ 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.

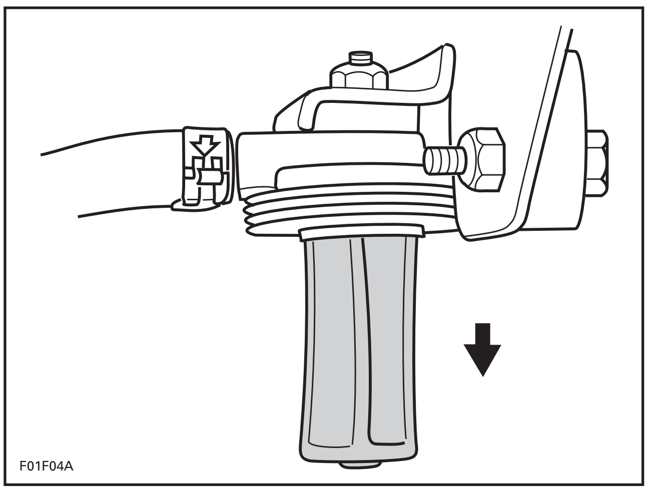
Unscrew the fuel filter bowl **no. 12** counterclockwise then pull toward the bottom.



TYPICAL

Step 1: Loosen counterclockwise
Step 2: Pull

Pull fuel filter **no. 13** toward the bottom.



TYPICAL

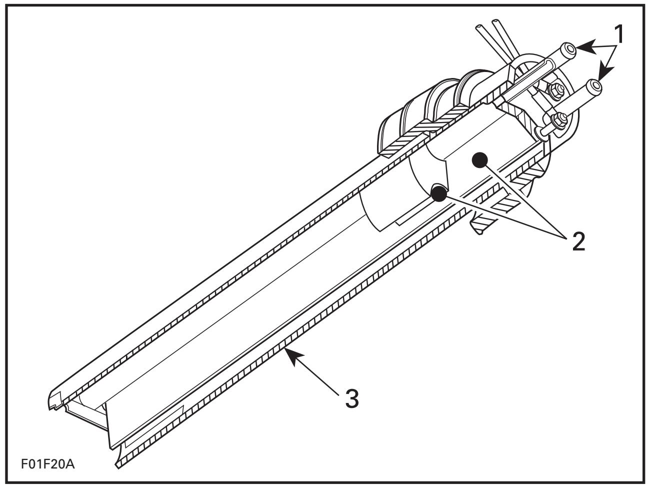
DI Models

A replaceable inline filter is located near the fuel tank. A strainer is located at the air/fuel rail fuel inlet. Another filter is located at the electric fuel pump inlet. The pump has to be removed from the fuel tank to have access to its filter. Refer to ENGINE MANAGEMENT (DI) section.

Fuel Baffle Pick Up

Carburetor-Equipped Models

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.

Open storage compartment cover.

Remove storage basket from watercraft.

Remove front air intake.

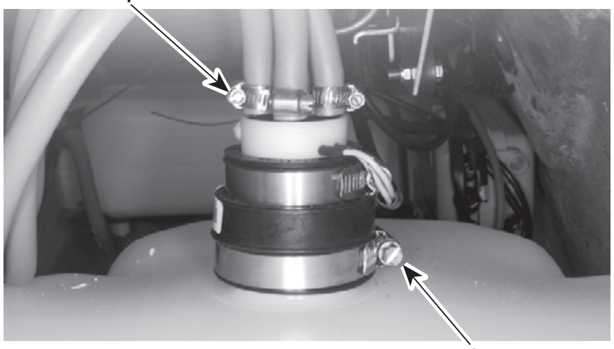
Siphon fuel tank.

⚠ 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.

Disconnect fuel lines from baffle pick up and loosen lower clamp **no. 7**.



TYPICAL
1. *Disconnect fuel hoses*
2. *Loosen lower clamp*

Disconnect wiring harness of fuel sender.

Remove baffle from fuel tank.

Remove upper clamp **no. 9** from adapter **no. 8** 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).

Electric Fuel Pump

DI Models

Refer to ENGINE MANAGEMENT (DI) section.

Fuel Tank

RX/RX DI Models

NOTE: It is necessary to remove the engine. Refer to ENGINE section.

All 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 fuel baffle pick up or electric fuel pump on **DI models**. See above.

Detach all fuel tank straps.

Pull out fuel tank.

INSPECTION

Fuel Filter

Carburetor-Equipped Models

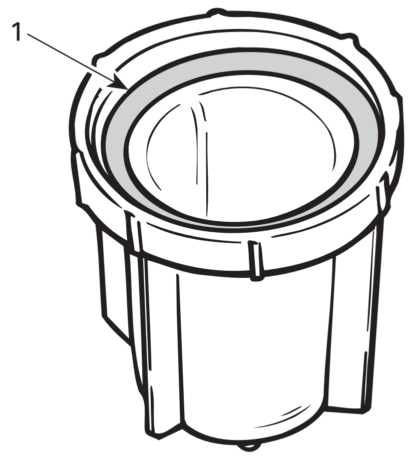
Inspect fuel filter condition. Carefully use low pressure compressed air to clean fuel filter. Replace filter if permanently clogged or damaged.

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.

DI Models

Inspect filter/strainer condition. Carefully use low pressure compressed air to clean. Replace if permanently clogged or damaged.

The filter at fuel pump inlet is not replaceable individually. The complete fuel pump unit has to be replaced.

Fuel Filler Hose

All Models

Verify fuel filler hose **no. 4** for damage. Always ensure that clamps **no. 3** 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. 11** is the valve outlet. It allows air to get in reservoir.

Baffle Pick Up Filter

Carburetor-Equipped Models

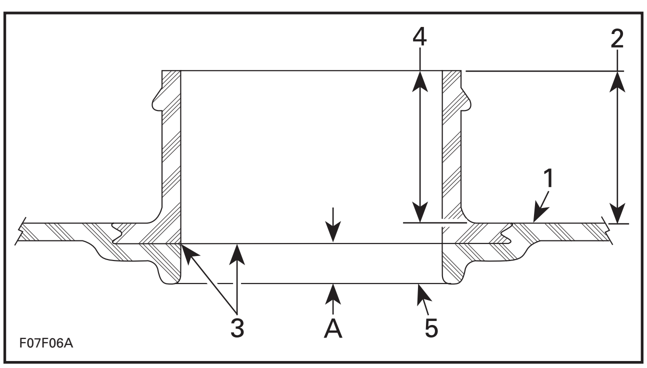
Inspect filter **no. 5** of baffle pick up. Clean or replace as necessary.

Fuel Tank

All Models

Visually inspect the inside and outside of the fuel tank necks for crack(s). If crack(s) are existing, **replace fuel tank no. 1**.

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

Carburetor-Equipped Models

Slide adapter **no. 8** onto baffle pick up **no. 8** until it stops on rib. Install clamp **no. 9**.

Install baffle pick up **no. 6** into fuel tank and push it until it sits on fuel tank neck. Install clamp **no. 7** and torque both clamps to 3 N•m (27 lbf•**in**).

FUEL SYSTEM PRESSURIZATION

⚠ WARNING

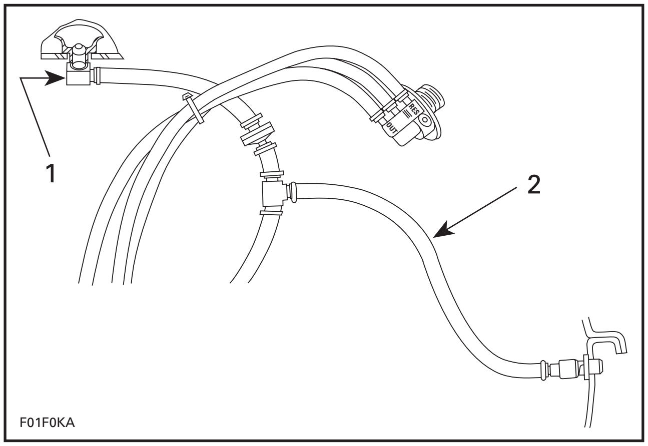
Whenever doing any type of repair on watercraft or if any components of the fuel system are disconnected, a pressure test must be done before starting engine. Ensure to verify fuel line ends for damage. Always cut damaged end before reinstallation.

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 — CARBURETOR-EQUIPPED MODELS
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 (**carburetor-equipped models only**).
– Pressurize fuel system to 34 kPa (5 PSI).
– If no leaks are found, turn fuel valve to ON position and pressurize once more (**carburetor-equipped models only**).
– 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

DI Models

Refer to ENGINE MANAGEMENT section.

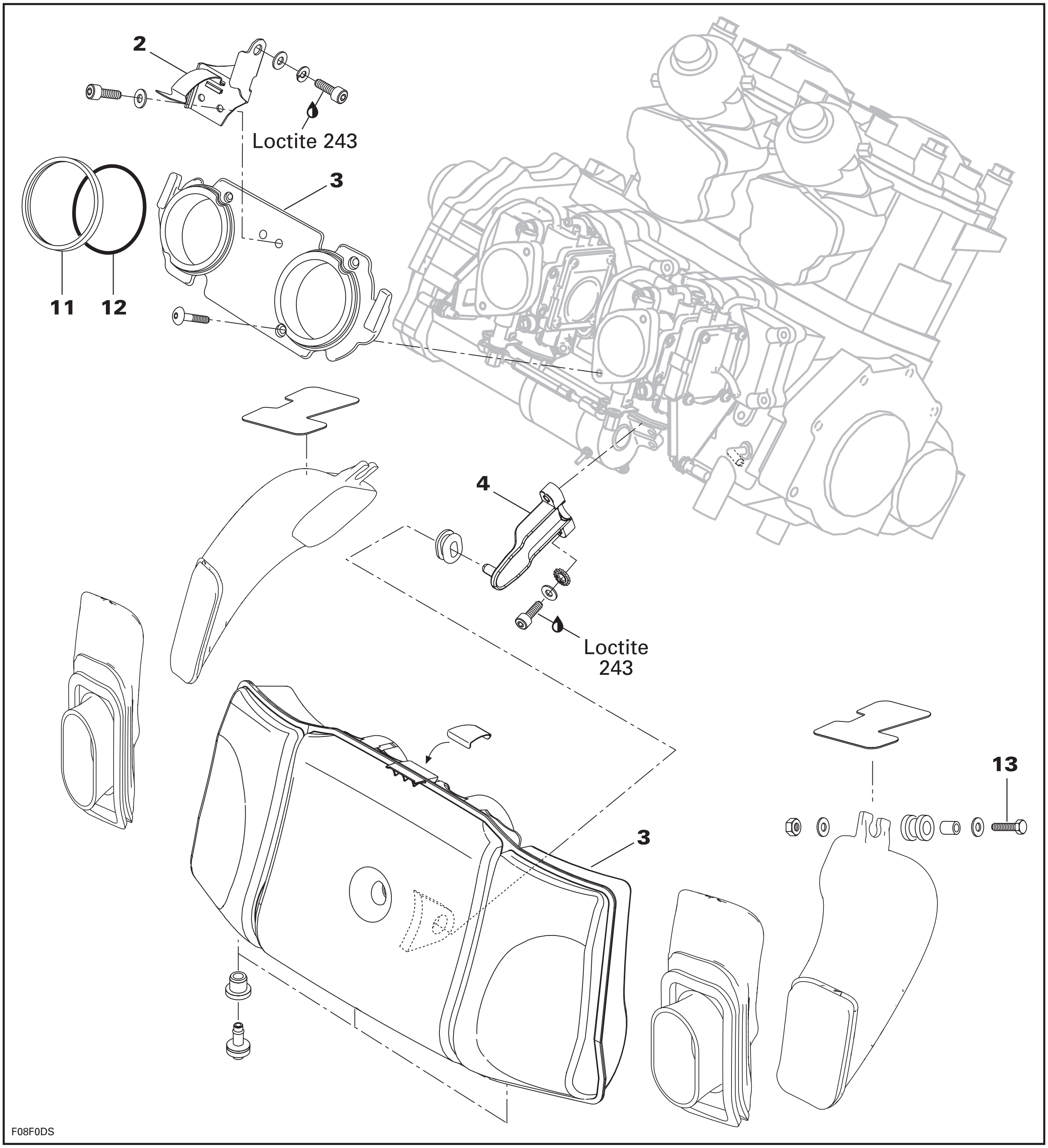
⚠ WARNING

Prior to installing the safety lanyard, refer to ENGINE MANAGEMENT (DI) under Fuel System for safety precautions to take.

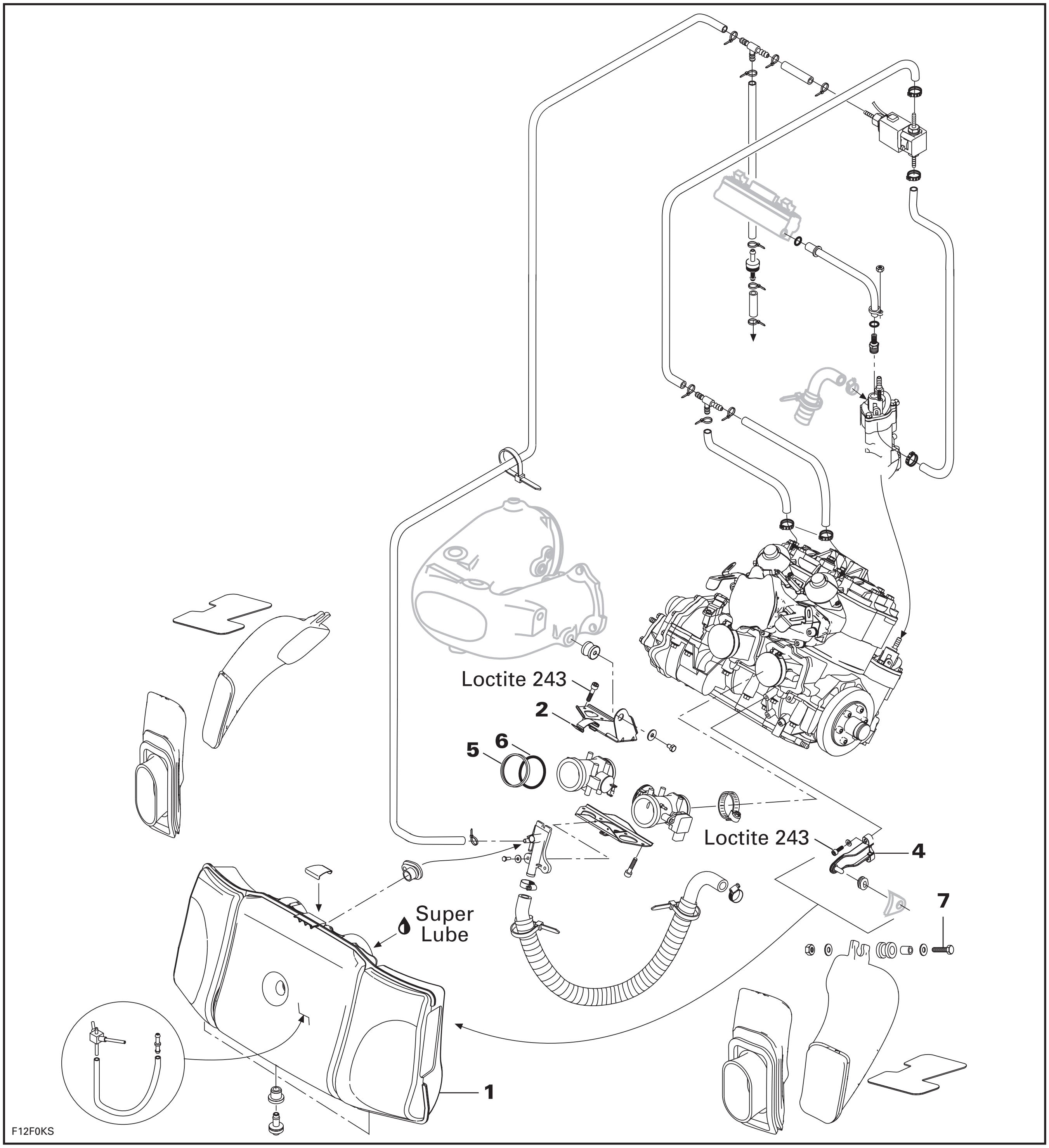
NOTE: It may be necessary to remove and reinstall the safety lanyard 2 - 3 times to prime the fuel system.

AIR INTAKE

Carburetor-Equipped Models



DI Models

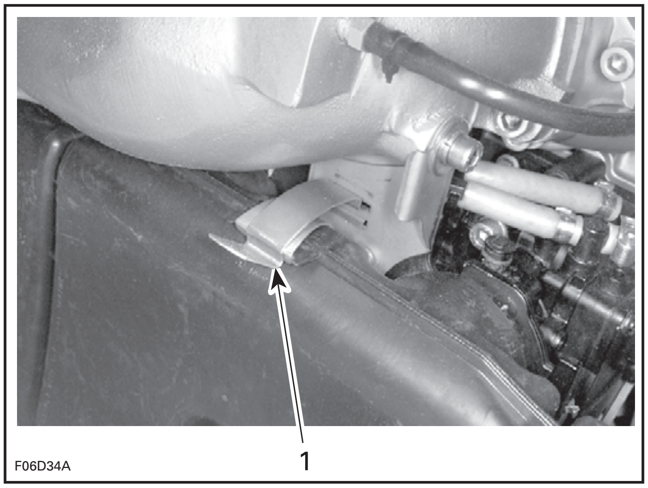


REMOVAL

Air Intake Silencer

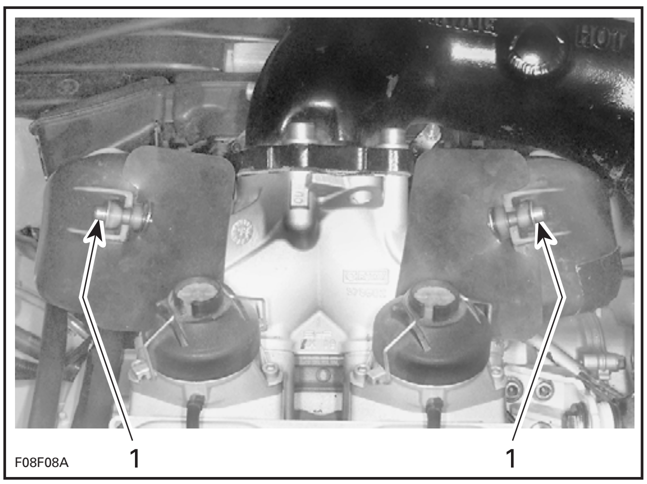
Remove seat support (**GTX DI models**).

Unlock the clip **no. 2** on top of air intake silencer.



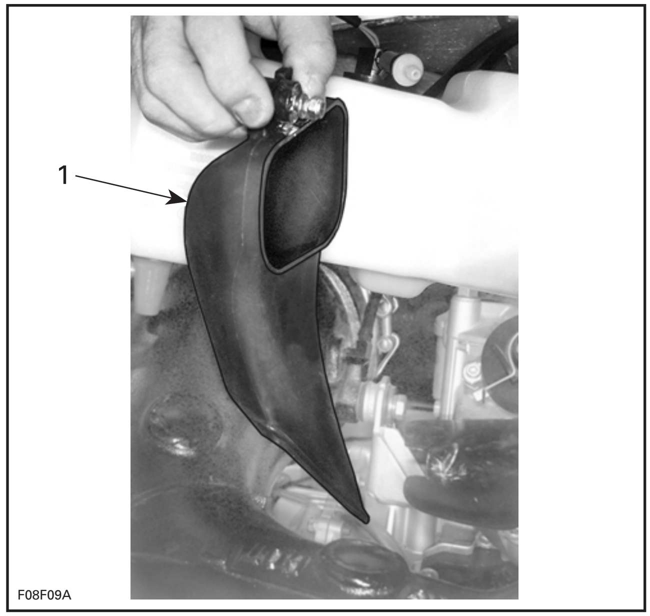
1. *Clip*

Remove bolts retaining both air ducts to engine (both sides).



1. *Remove bolts*

Pull air ducts out.



1. *Air duct*

NOTE: Do not disconnect oil lines.

Push the air intake silencer out of the carburetor adapter **no. 3** or the throttle bodies on the **DI models**.

Pull the air intake silencer rearward to remove it from the lower bracket **no. 4** and remove it in a rotating movement.

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.

Air Intake Silencer

Make sure that gaskets **no. 5** are installed into carburetor holes of air intake silencer or throttle bodies **on DI models**.

Check O-rings **no. 6** on carburetor intake adaptors or throttle bodies **on DI models** 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 or throttle bodies **on DI models** and latch in place.

DI Models

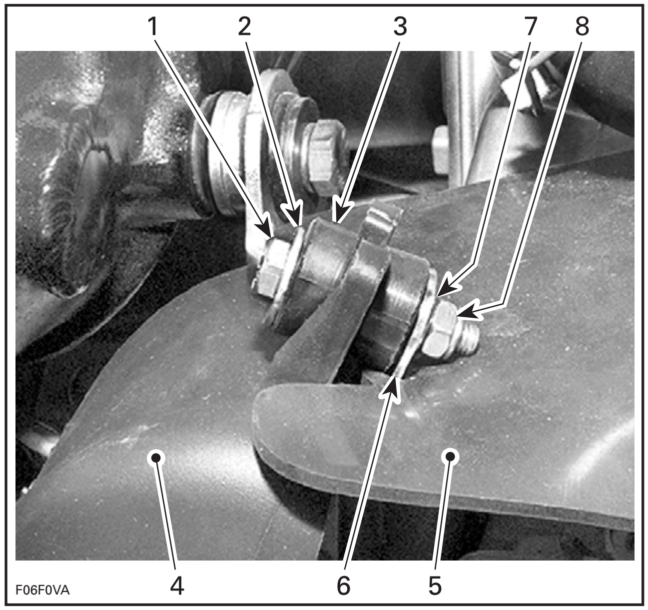
Ensure the elbow adaptor is well inserted and that it has not pushed the gasket inside the air box.

All Models

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.

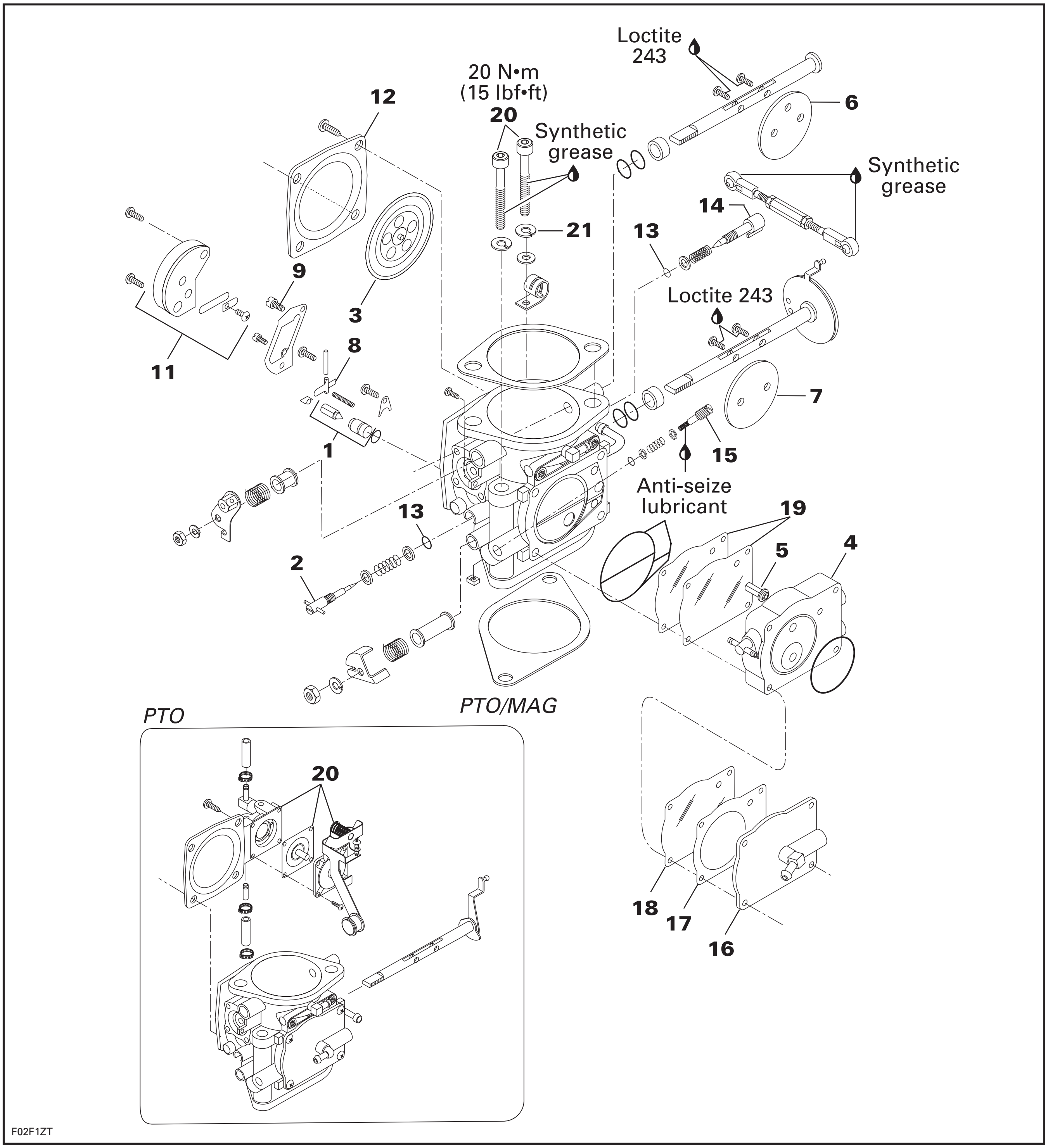
Put air ducts in intake adapters and secure them on duct supports with hexagonal screws **no. 7**, wide washers , narrow washers and elastic stop nuts. A slight lift will be required to make the bolts line up with brackets.



TYPICAL — CARBURETOR-EQUIPPED MODELS
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*

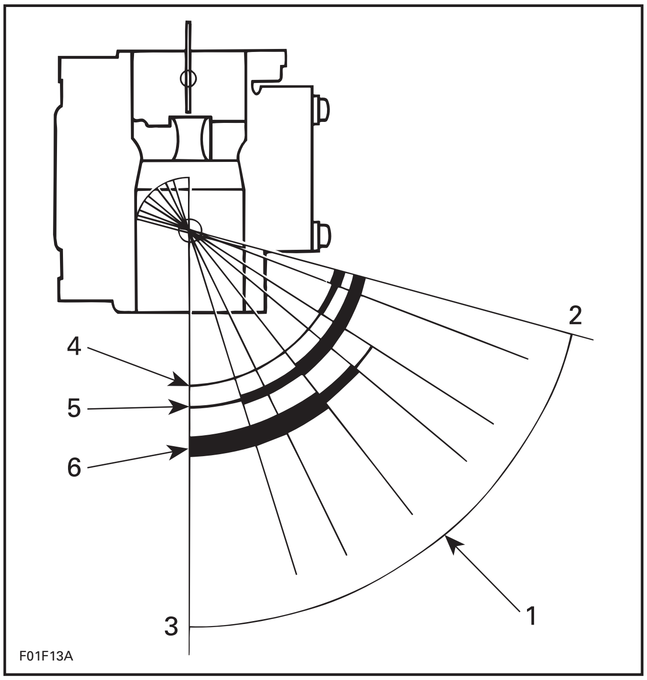
CARBURETOR

Mikuni BN-46i



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 carburetors 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.

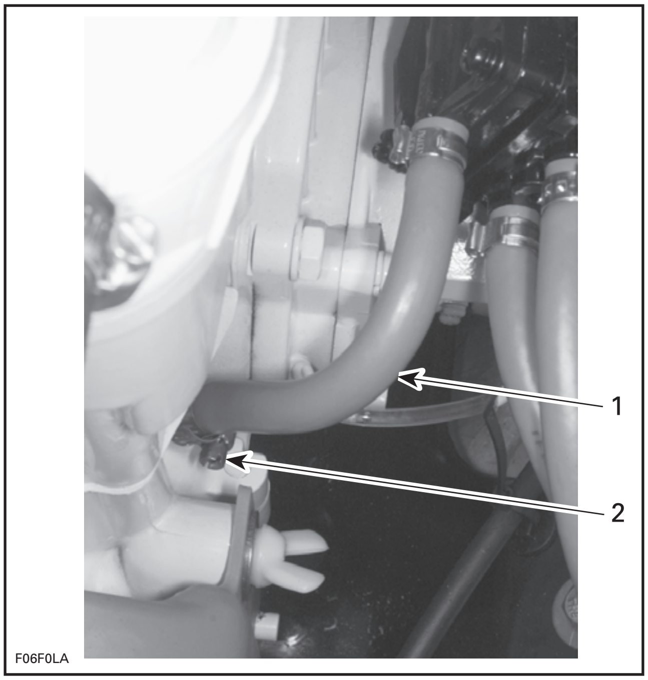
REMOVAL

To remove carburetors from engine, proceed as follows:

Remove air intake silencer. Refer to AIR INTAKE.

Turn fuel valve to OFF position.

Disconnect pulse line.



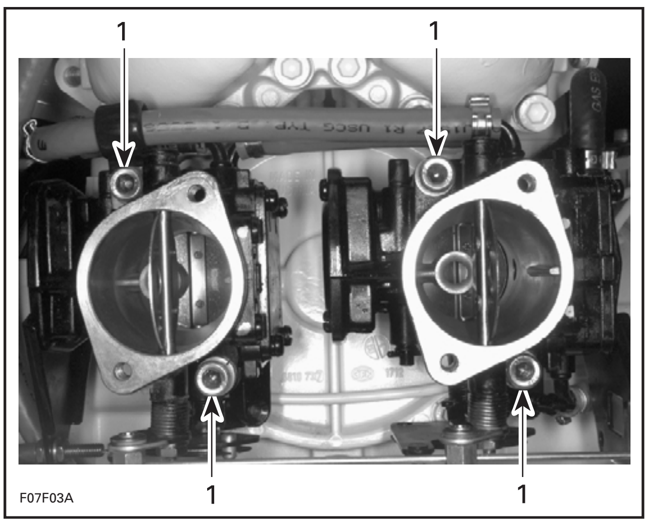
TYPICAL
1. *Pulse line*
2. *Loosen gear clamp*

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 carburetors.

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.

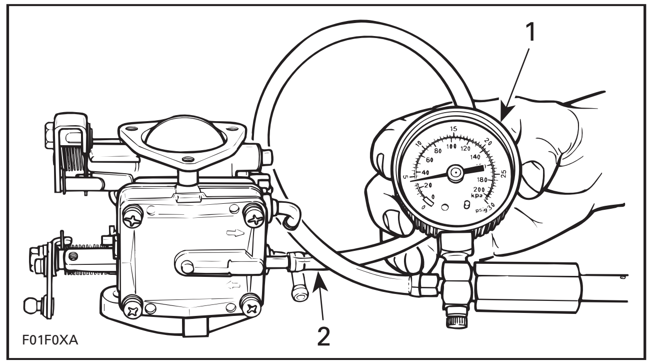
Diaphragm

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**.

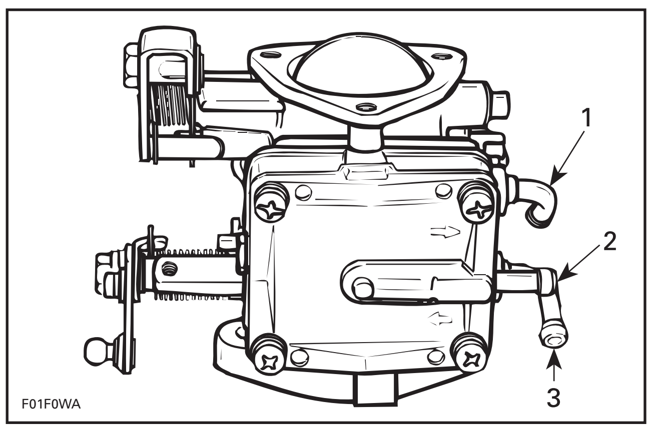
Fuel Pump Valve

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.

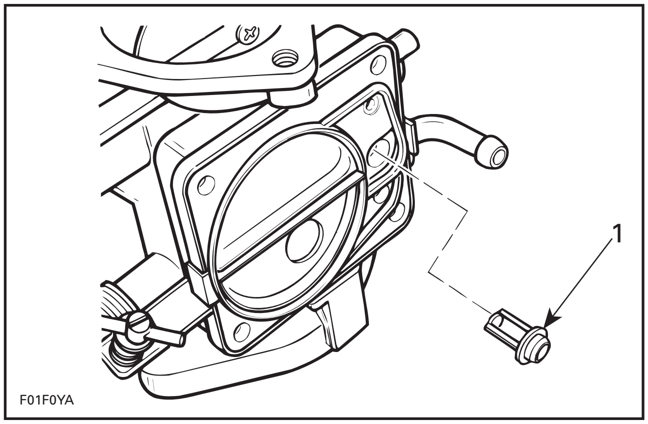
Internal Fuel Filter

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).

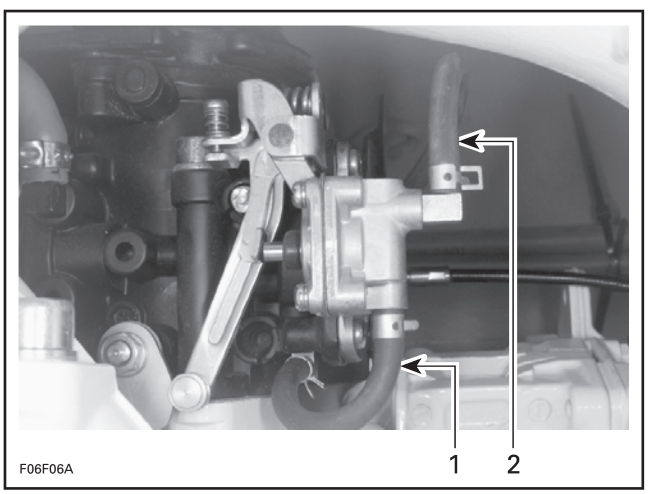
Replace filter if damaged.



TYPICAL
1. Filter

Fuel Accelerator Pump

Disconnect inlet and outlet hoses from accelerator pump nipples.



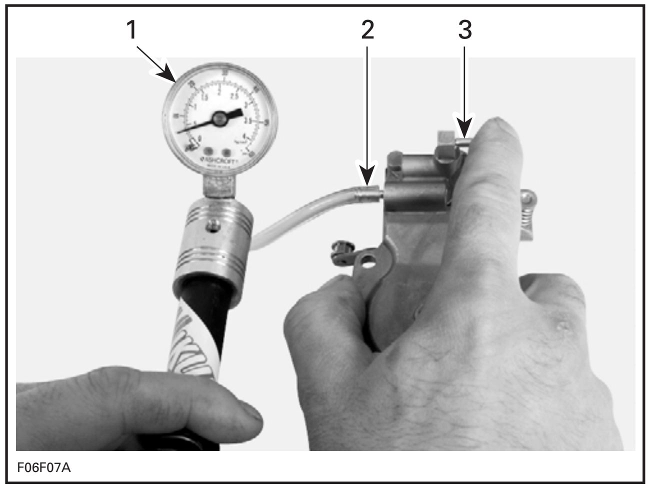
TYPICAL
1. Fuel inlet hose
2. Fuel outlet hose

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).



1. Pump gauge tester
2. Hose installed to inlet nipple
3. Outlet nipple obstructed

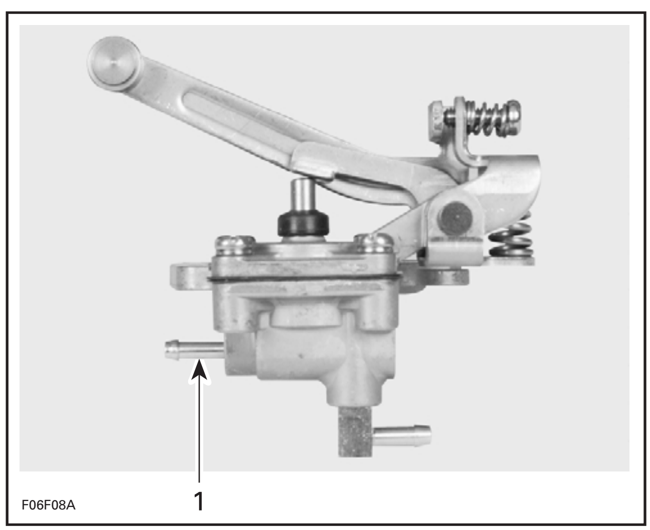
Diaphragm must stand pressure for 10 seconds. If pressure drops, replace accelerator pump diaphragm.

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

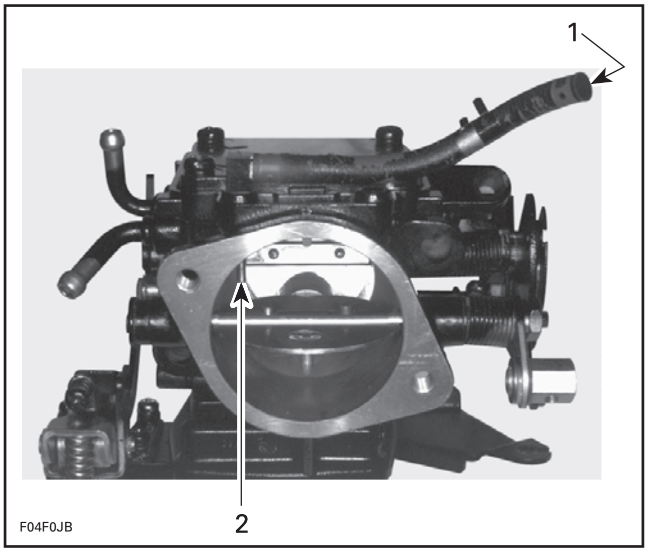
Some fuel may be present in fuel pump.



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.

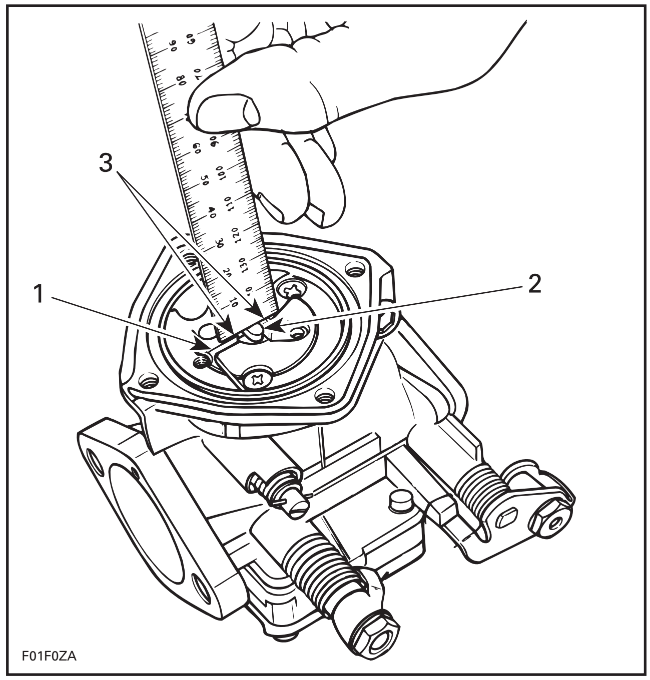
Choke Plate and Throttle Plate

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

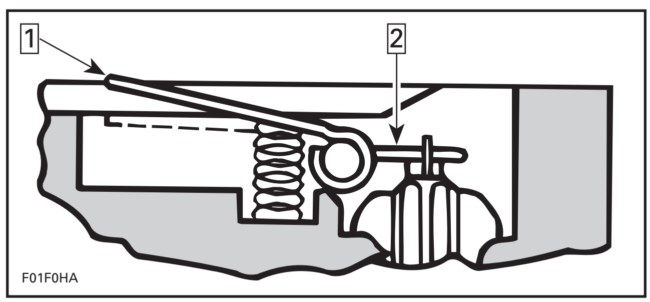
Rounded end of needle valve lever **no. 8** must be flush with surrounding metering chamber floor and not with body assembly. Place the end of a ruler over lever to check adjustment.



1. *Metering chamber floor*
2. *Lever end*
3. *Flush*

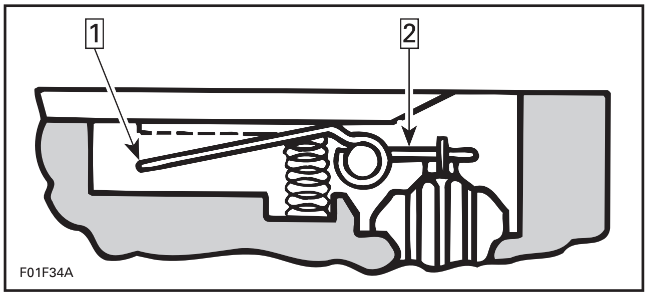
To adjust, bend lever very slightly to change its height.

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*

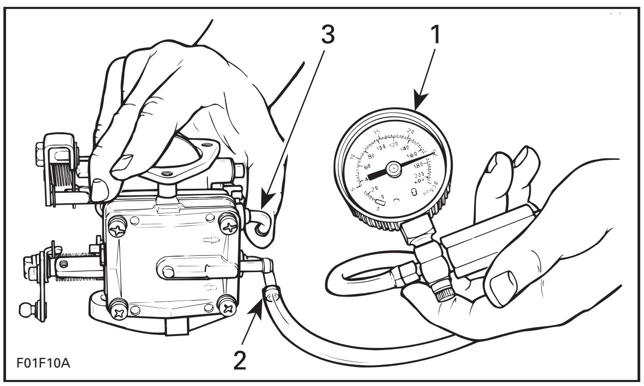


LOW LEVER
Step 1: Depress here
Step 2: Pry up here

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:

MODEL	POP OFF PRESSURE min./max. (PSI)
RX	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.

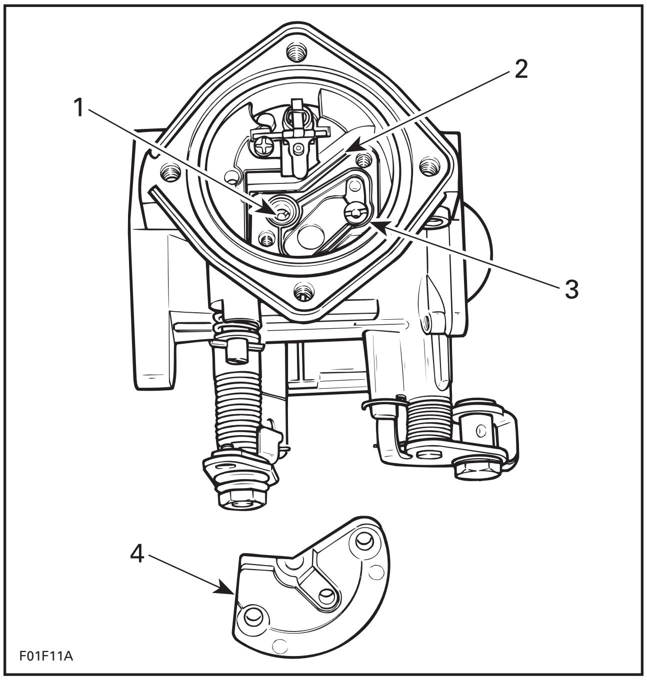
If bubbles come from needle, replace needle and seat.

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.

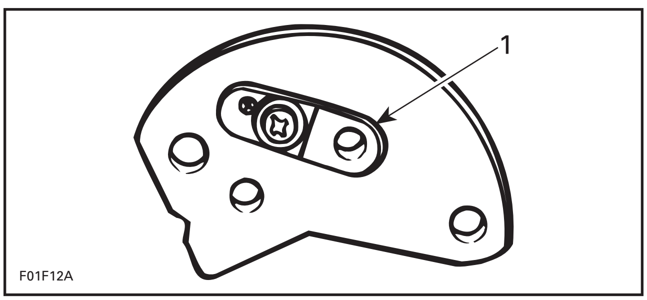


TYPICAL
1. *Pilot jet*
2. *Gasket*
3. *Main jet*
4. *Check valve housing removed*

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

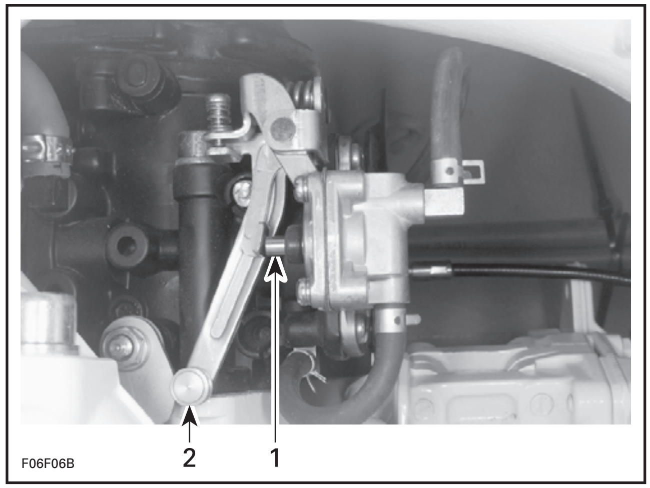
Install diaphragm **no. 3** with its integrated O-ring into carburetor groove. Make sure that the tab of cover **no. 12** is inserted into carburetor notch.

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

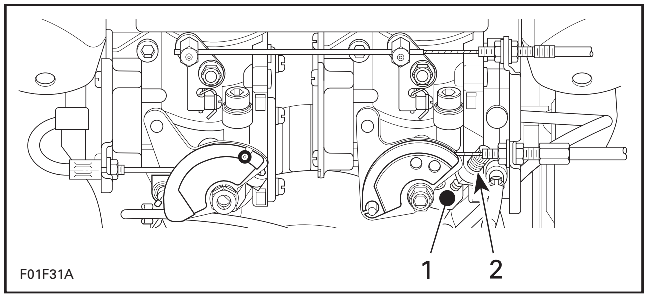
Make sure there is no leak in fuel system.

For fuel system pressurization, refer to FUEL CIRCUIT.

ADJUSTMENTS

Twin Carburetor Synchronization

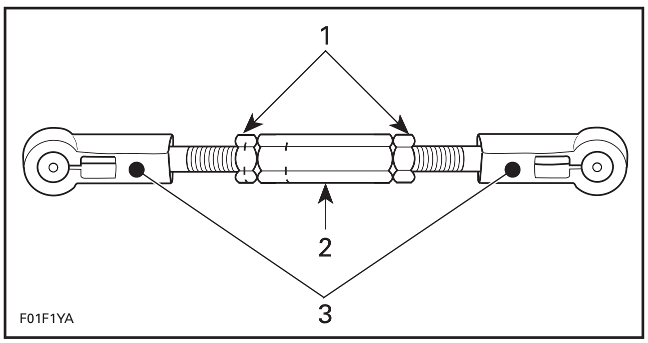
With idle speed screw not touching throttle lever stopper on MAG carburetor, both throttle plates are in closed position.



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.



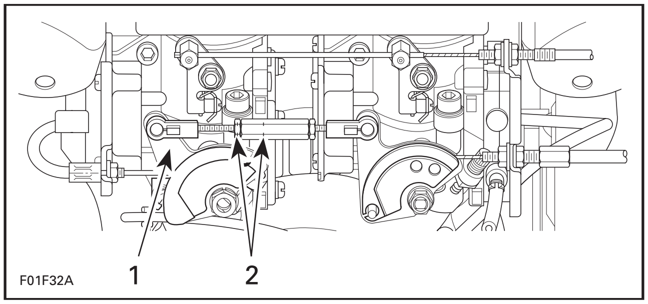
1. *Jam nuts*
2. *Adjustment nut*
3. *Flat surfaces*

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.



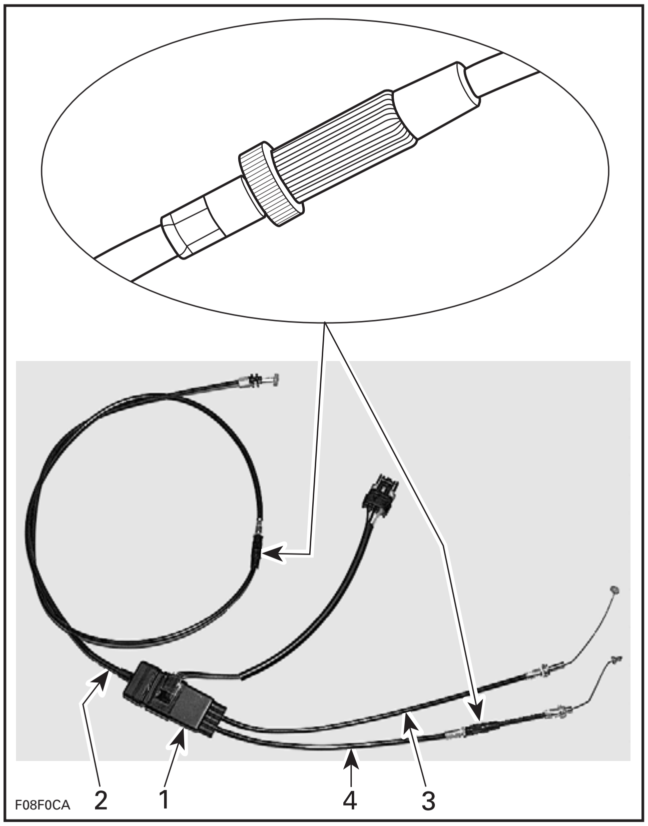
TYPICAL
1. *Throttle lever PTO side*
2. *Marks*

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.

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.

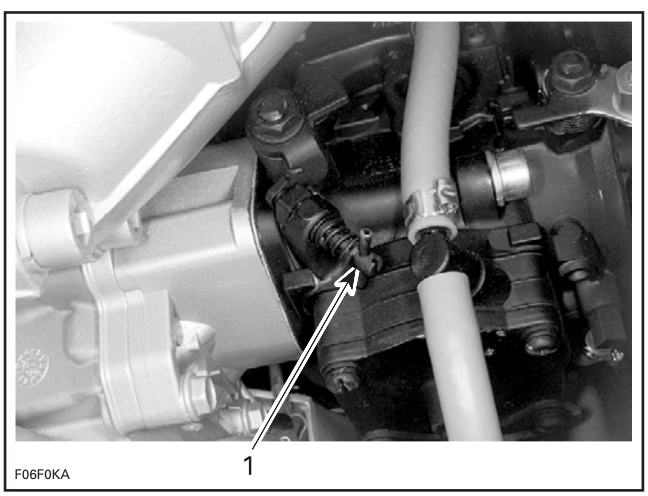


THROTTLE CABLE ASSEMBLY

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.

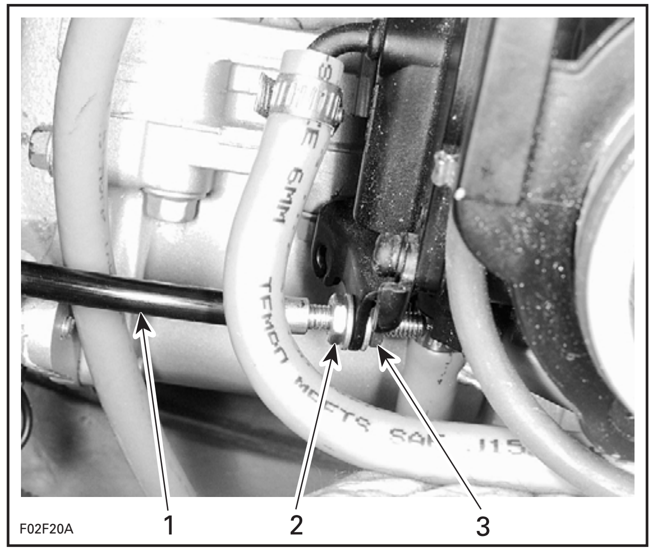


1. *Idle speed screw*

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.



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.

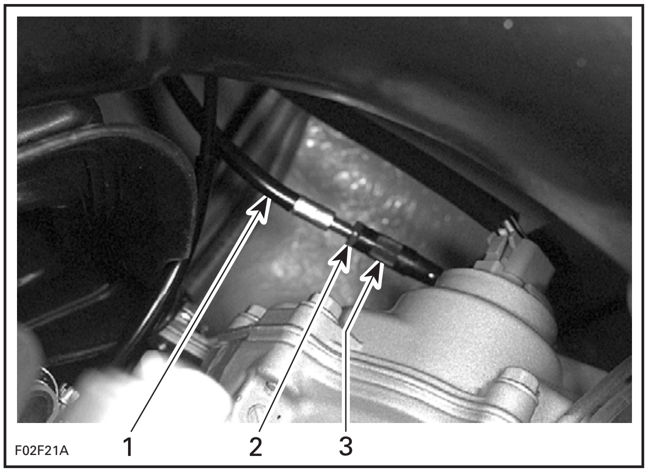
Adjust oil pump cable. Refer to OIL INJECTION PUMP.

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.

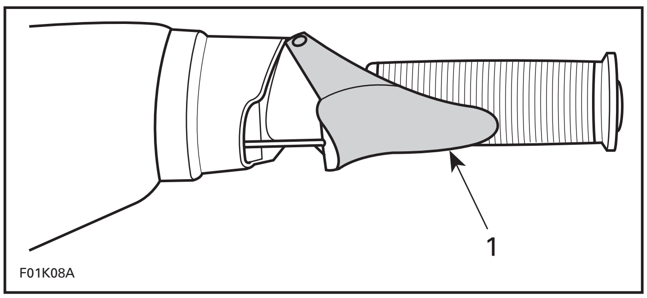
Adjust throttle cable to obtain proper lever position at full throttle.

Turn adjuster knob as required to obtain proper throttle lever adjustment.



1. *Jam nut*
2. *adjustment nut*
3. *Throttle cable*

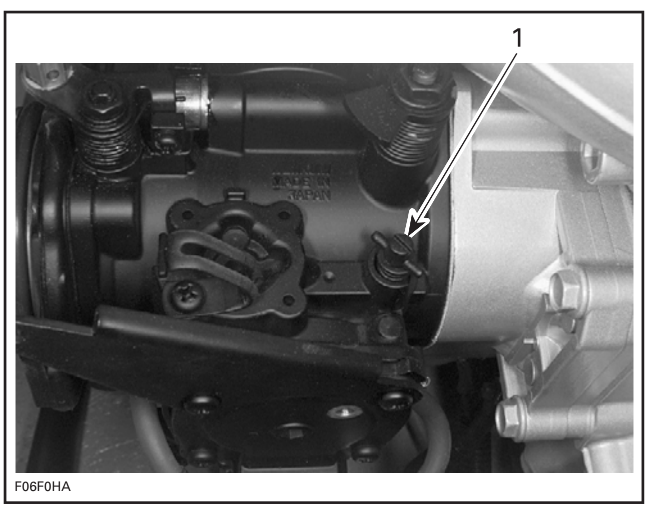
Throttle lever must reach handlebar grip without causing strain to cable or carburetor cable bracket.



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



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
RX	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).

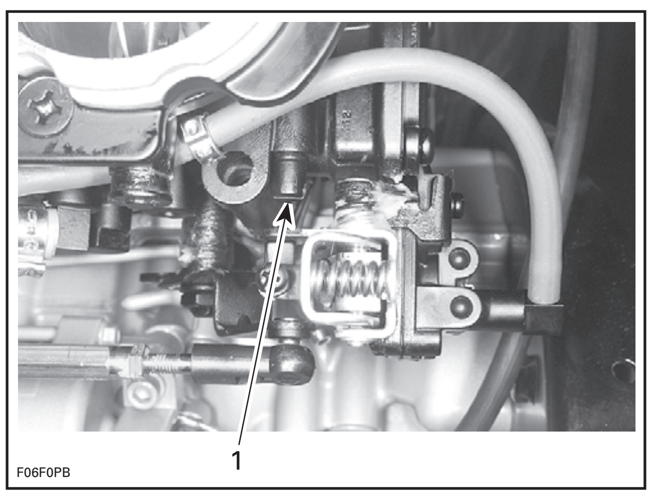
NOTE: Both low speed screws must be adjusted exactly the same way. Never adjust screws more than 1/4 turn at a time.

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.

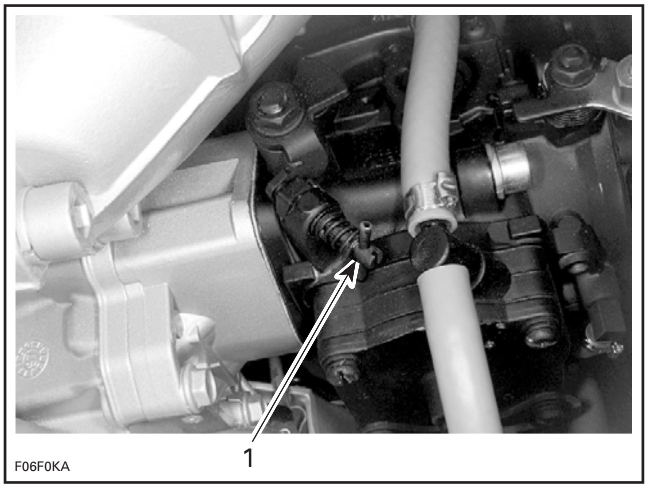
CAUTION: **Do not attempt to adjust high speed screw by removing plastic cap.**



1. *High speed screw (PTO side shown)*

Idle Speed Screw

Turning screw **no. 15** clockwise increases engine idle speed and turning screw counterclockwise decreases engine idle speed.



1. *Idle speed screw*

NOTE: 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.

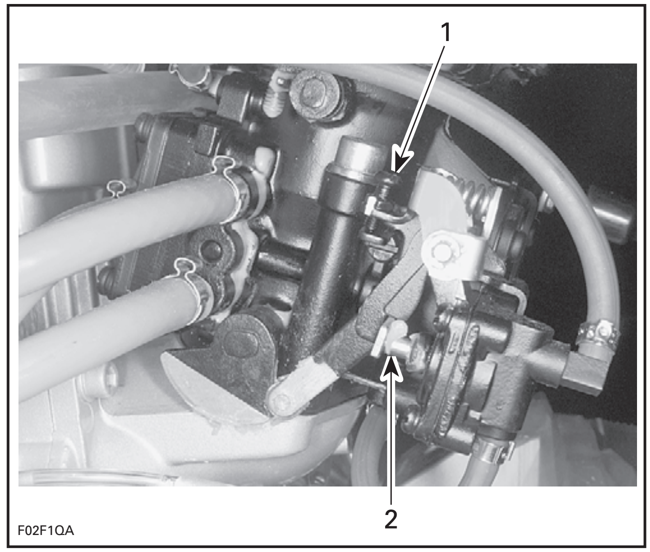
CAUTION: If watercraft is out of water, engine must be cooled using the flush kit.

Turn screw so that engine idles at 1400 RPM in water or 3000 RPM out of water.

Fuel Accelerator Pump

Ensure throttle cable is properly adjusted and idle speed is set at 1400 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.



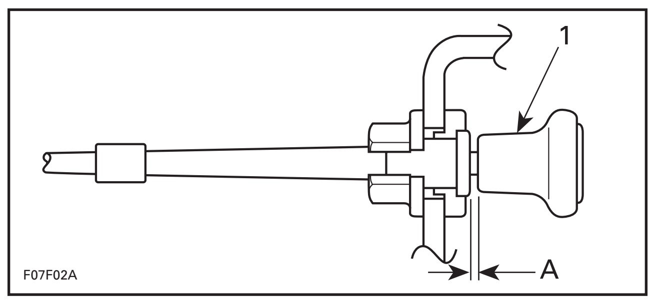
TYPICAL

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.

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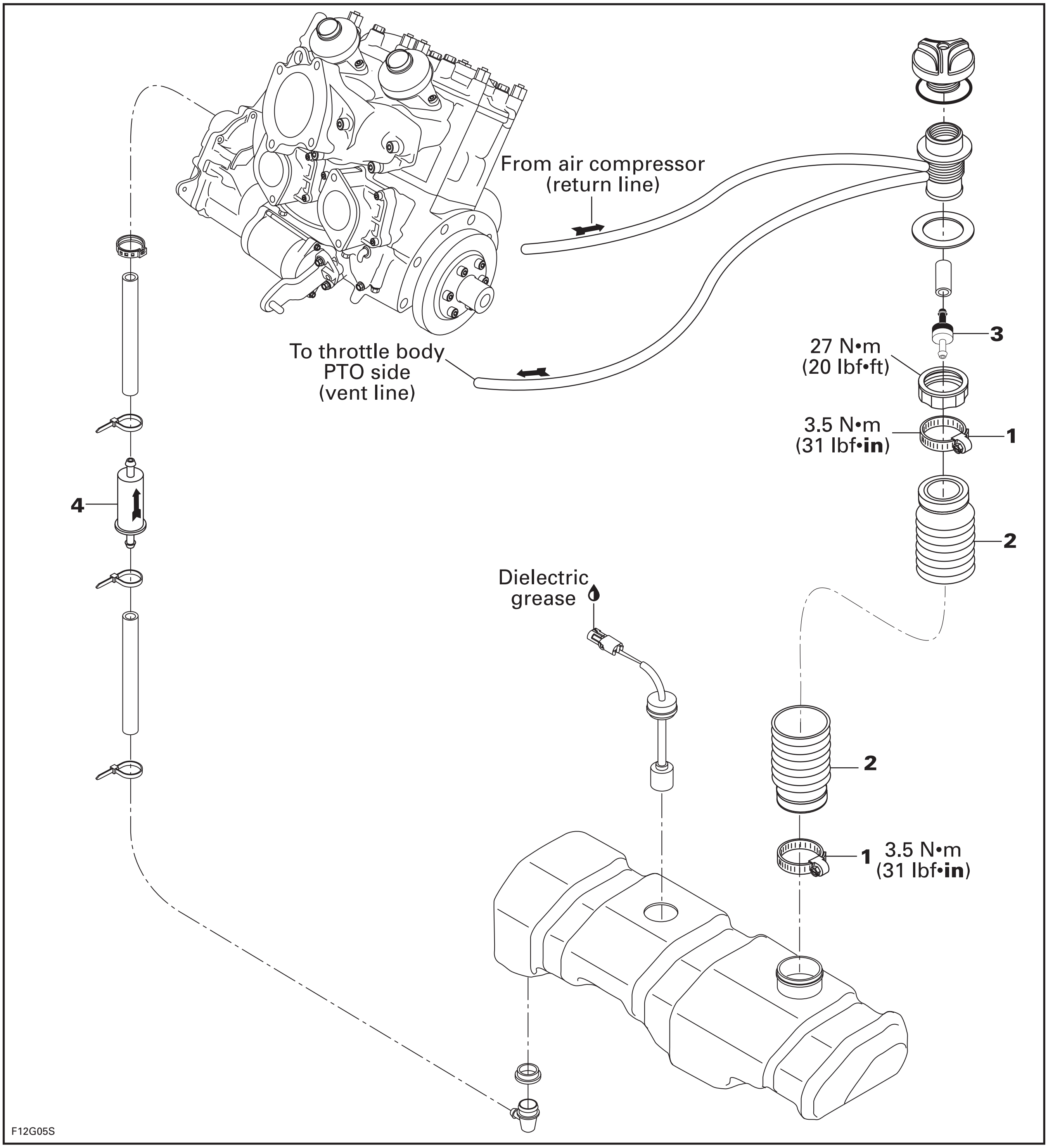
OIL INJECTION SYSTEM

GTX DI Models



GENERAL

Whenever repairing the oil injection system, always verify for water infiltration in reservoir.

Perform also a pressure test of the oil injection system.

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**).

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 oil injection pump supply hose.

DI Models

Install a hose pincher to return line of air compressor.

Disconnect return line on PTO side throttle body.

Carburetor-Equipped Models

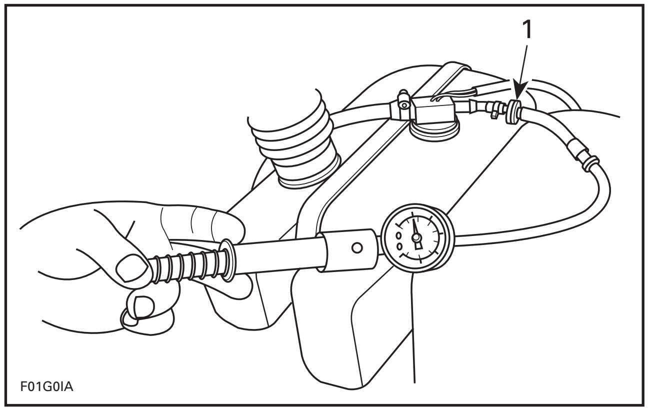
– Connect pump gauge tester (P/N 529 021 800) to check valve of oil injection reservoir vent.

DI Models

Connect pump gauge tester (P/N 529 021 800) to disconnected tube at throttle body.

All Models

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.

DI Models

Verify check valve inside filler neck if pressure does not hold. Also ensure air can enter through check valve in the opposite direction.

All Models

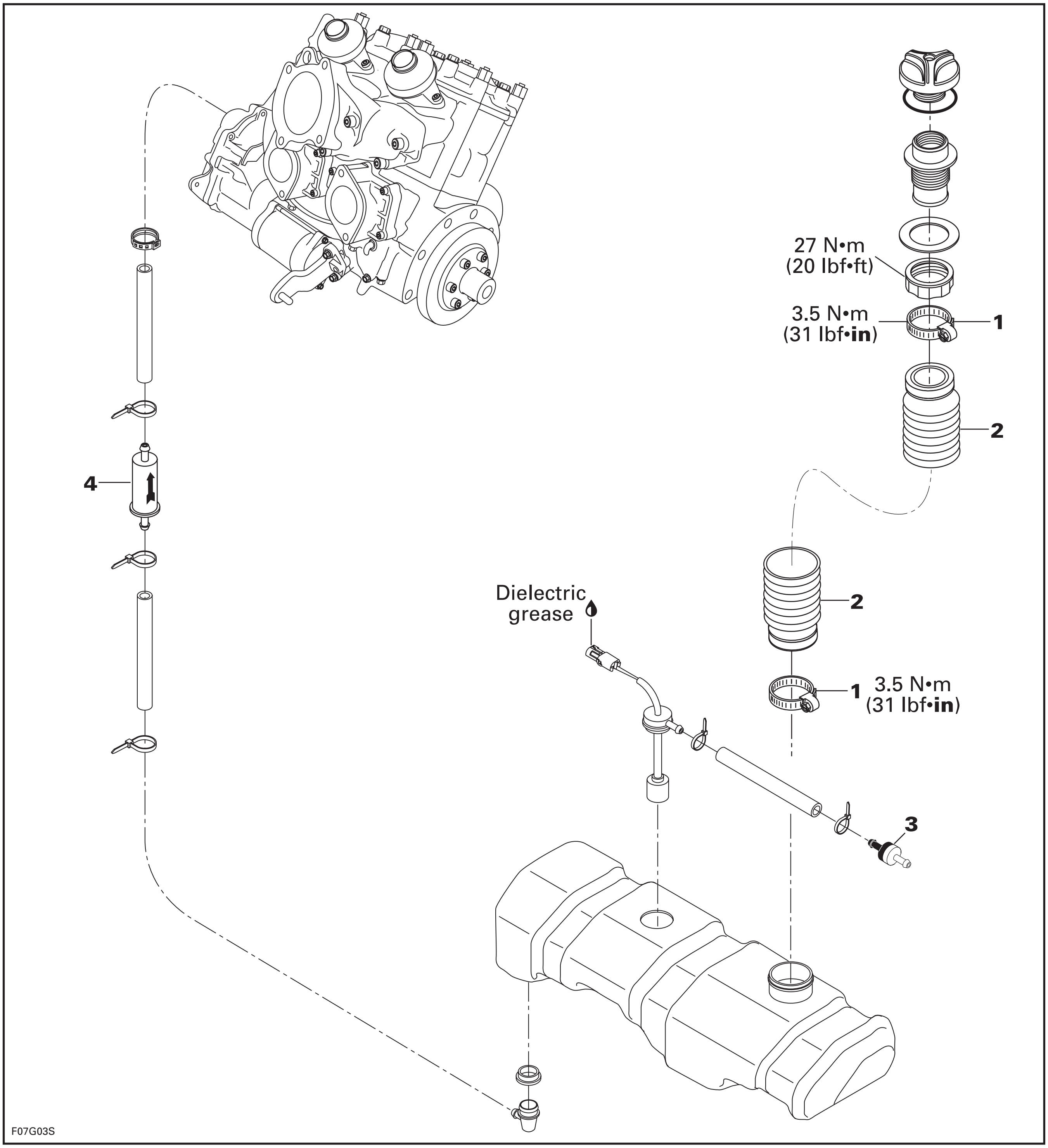
NOTE: The system must maintain a pressure of 21 kPa (3 PSI) for at least 10 minutes. Never pressurize over 21 kPa (3 PSI).

CAUTION: If any leak is found, do not start the engine and wipe off any oil leakage.

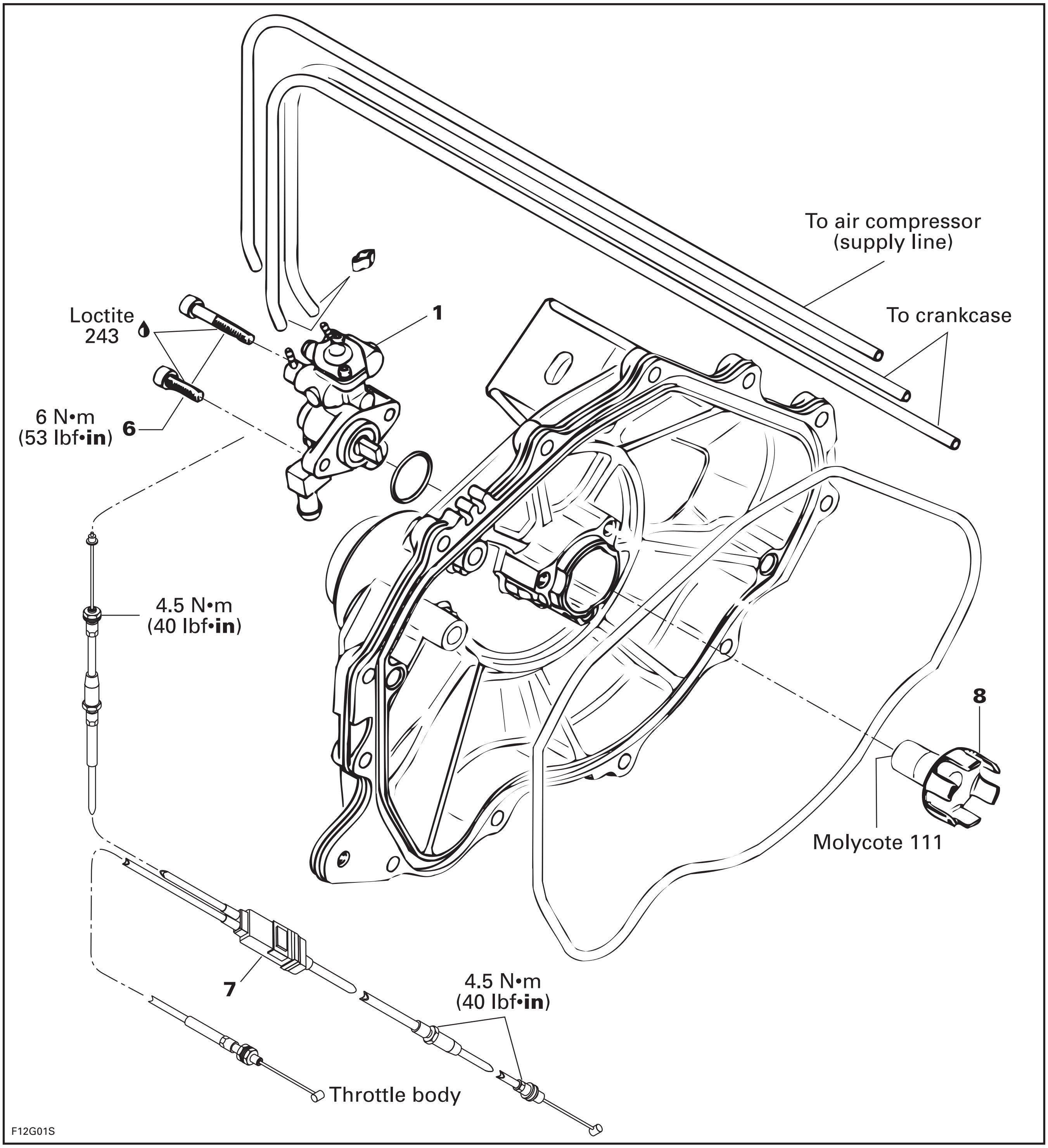
– Disconnect pump gauge tester and remove hose pinchers. On **DI models**, reconnect line at throttle body.

OIL INJECTION PUMP

Carburetor-Equipped Models



DI Models


To air compressor
(supply line)
To crankcase
Loctite
243
1
6 N•m
(53 lbf•**in**)
6
4.5 N•m
(40 lbf•**in**)
8
Molycote 111
7
4.5 N•m
(40 lbf•**in**)
Throttle body
F12G01S

NOTE: The following procedures can be done without removing the engine from hull.

REMOVAL

Pump Cable

The cable end has a slight press fit in the lever. Using a small screwdriver, pry cable end out.

Oil Injection Pump

Remove tuned pipe head. Refer to EXHAUST SYSTEM.

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.

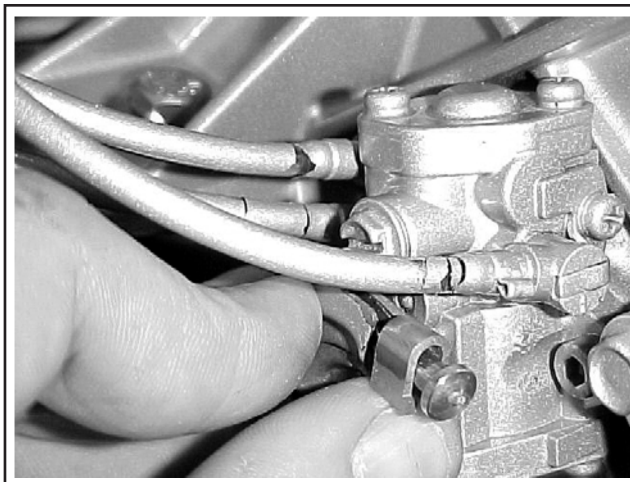
ASSEMBLY

Oil Injection Pump and Shaft

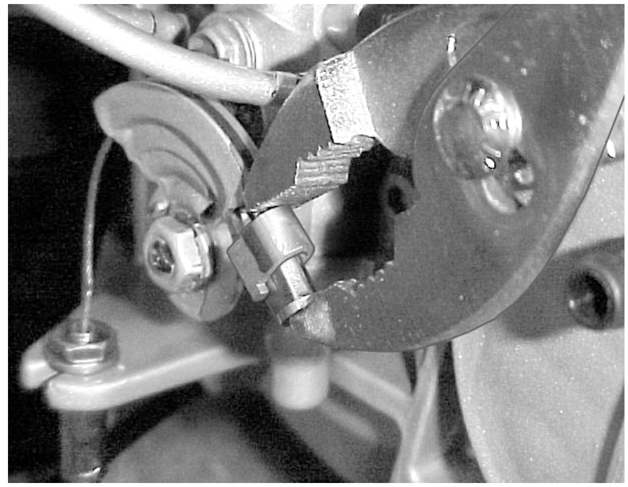
Make sure shaft **no. 8** is installed in crankshaft end.

Install pump. Secure with flat washers and screws **no. 6**. Torque to 6 N•m (53 lbf•**in**).

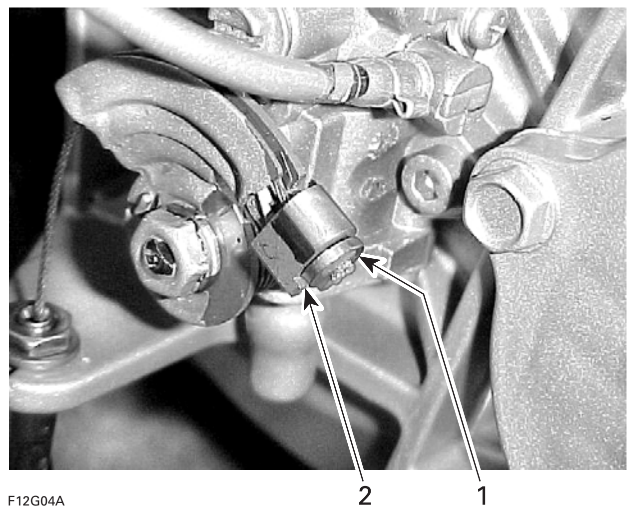
Install oil injection pump cable as per the following illustrations.



F12G02A



F12G03A



F12G04A

1. *Cable end completely inserted*
2. *Cable end NOT seated on the steps*

CAUTION: Ensure cable end is completely entered in its housing. Ensure it is NOT seated on the steps.

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 on **Carburetor-Equipped Models**.

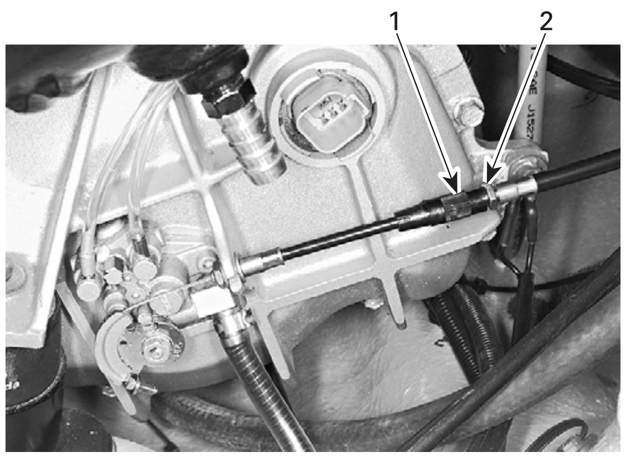
Refer to CARBURETOR or THROTTLE BODY for throttle cable adjustment procedure.

NOTE: On **Carburetor-Equipped Models**, 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.

NOTE: The adjuster knob and jam nut for the oil injection pump cable are located on the oil pump cable.



F07G08A

1. *Adjuster knob*
2. *Jam nut*

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 on **Carburetor-Equipped Models**. Refer to CARBURETOR.

NOTE: On **DI models**, there is no idle speed adjustment to perform.

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.

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.

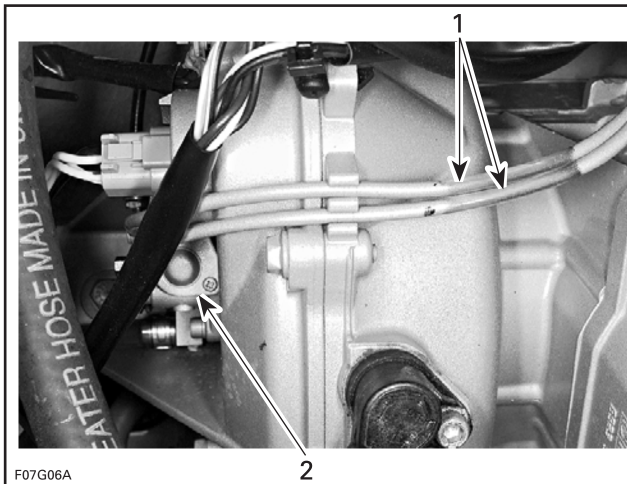
Loosen bleed screw to allow oil to flow.

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, proceed as follows.

Carburetor-Equipped Models

Run engine at idle speed while manually holding pump lever in fully open position. Do not activate throttle lever.

DI Models

– Use the VCK (Vehicle Communication Kit) P/N 529 035 676. Look in the **Monitoring** section of the software B.U.D.S.
– Use the "Oil lines bleeding" function that allows to "lock" the engine RPM in idle speed while the throttle is fully depressed to ease the bleeding operation.

All Models

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.

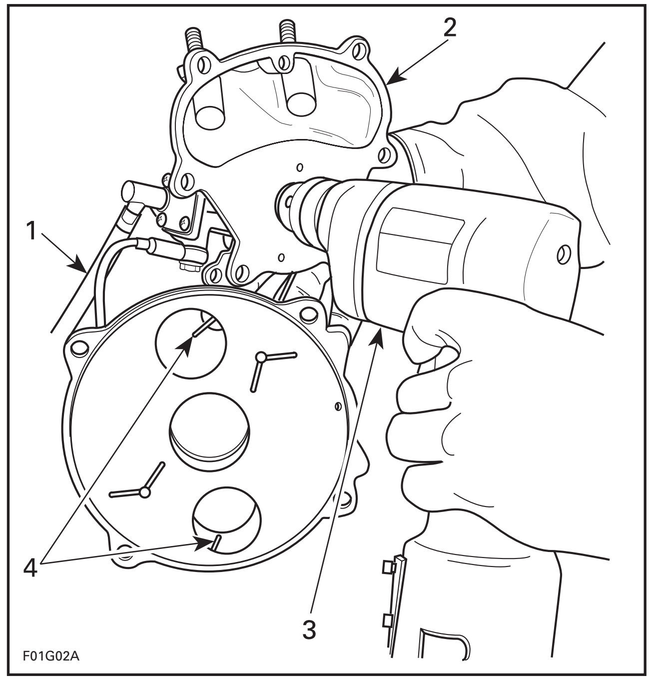
NOTE: The engine should have a rich mixture, idling irregularly and emitting smoke at exhaust outlet.

If not, remove pump assembly and check the pump shaft 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.



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*

For an accurate test, each port should be checked separately to ensure equal delivery on each port.

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)
947 carburetor-equipped engines	8.3 - 10.1 mL (each port)
947 DI engines	7.5 - 9.1 mL (each port)

NOTE: Test can also be done at 3000 RPM. Double quantities in chart.

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IGNITION SYSTEM

Carburetor-Equipped Models

NOTE: For DI models, refer to ENGINE MANAGEMENT section.

GENERAL

The ignition system consist of different sub-systems where some are interrelated.

Unregulated AC current is produced by the magneto. Part of the AC current is rectified and regulated for the charging system.

MAGNETO OUTPUT	
MODEL	WATT
Carburetor-equipped models	180 @ 6000 RPM

A 12 volts battery supplies the Multi-Purpose Electronic Module (MPEM) with DC current.

Refer to CHARGING SYSTEM.

The following type of ignition system is used:

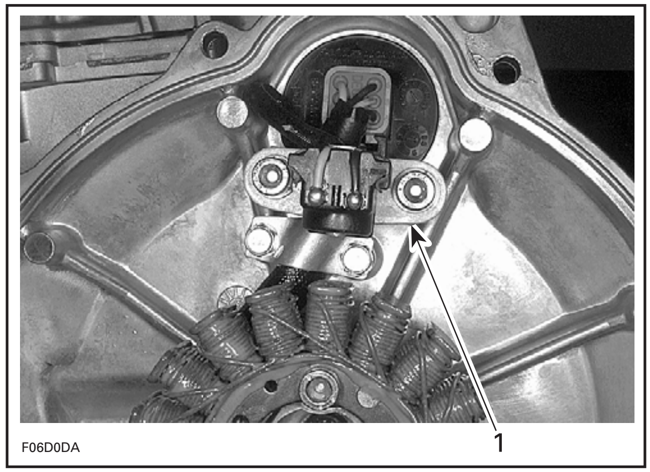
– Direct Current-Digital Capacitor Discharge Ignition (DC-CDI).

Magneto System

The magneto is the primary source of electrical energy. It transforms magnetic field into electric current (AC).

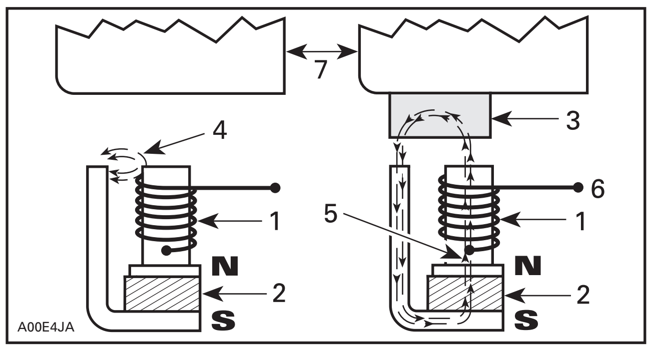
Trigger Coil

The trigger coil is mounted outside the rotor (inside the magneto housing of the engine) and is not adjustable.



1. *Trigger coil*

Its purpose is to signal the piston position to the Multi-Purpose Electronic Module. The rotor has four protrusions (90 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

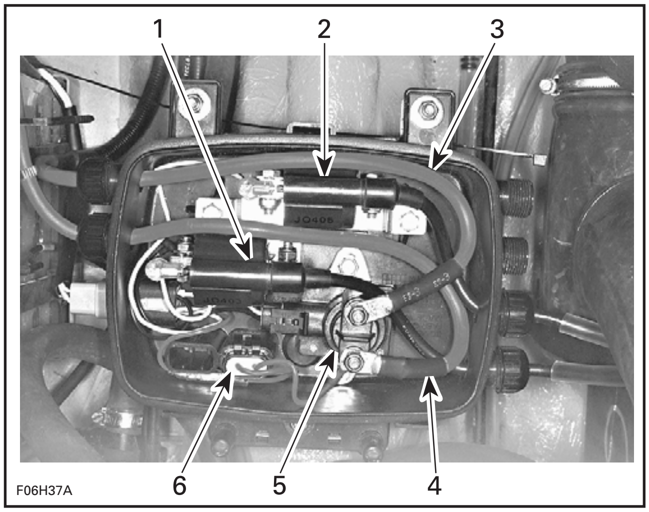
Ignition coil induces voltage to a high level in secondary windings to produce a spark at spark plug.

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.



1. *Ignition coil PTO*
2. *Ignition coil MAG*
3. *Starter cable*
4. *Positive battery cable*
5. *Solenoid*
6. *Fuse*

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 loosing 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.

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 700 or 1000 RPM depending on the MPEM used.

Engine RPM Limiter

The MPEM will limit the maximum engine speed.

Engine Stopping

There are 2 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.

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.

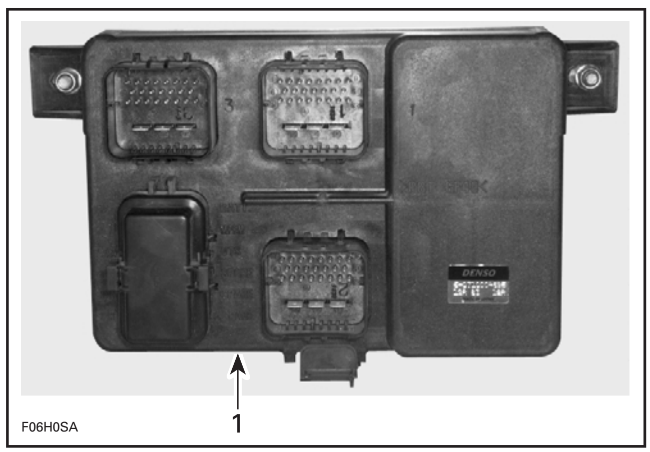
Overheat Sensor

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.

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.



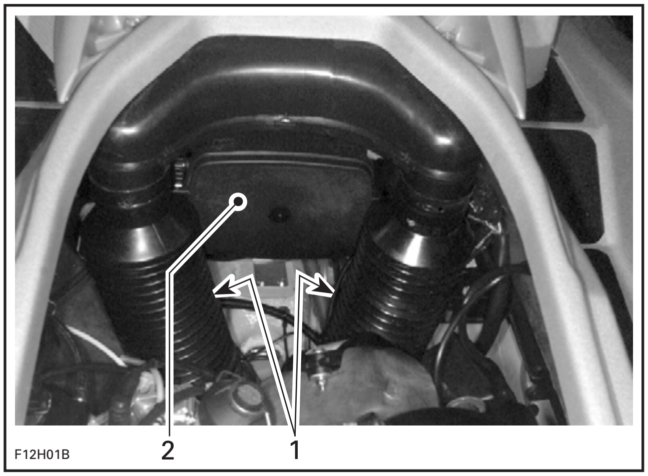
TYPICAL
1. MPEM

Compared to the magneto system, the DC-CDI system offers a more powerful and stable ignition at low RPM.

Electrical Box

The high amperage/voltage components are located into the electrical box.

The electrical box is located at the rear of the watercraft.



1. *Rear electrical box*
2. *Remove vent tubes*

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.

NOTE: Do not use the factory mark found on the PTO flywheel to check ignition timing or troubleshoot any problems.

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.

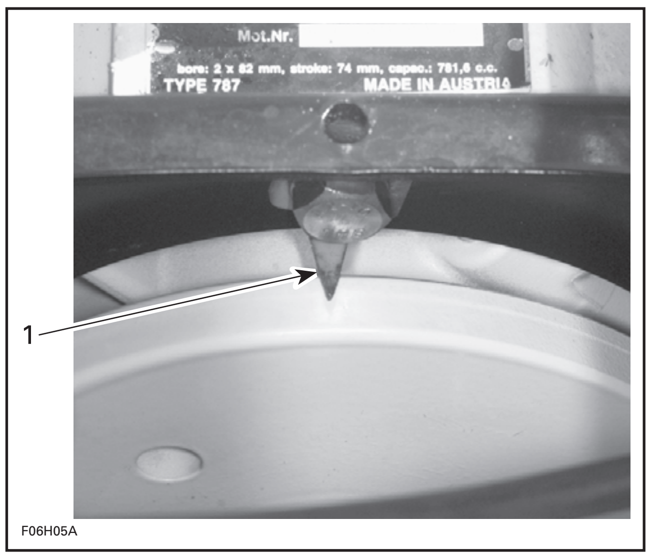
NOTE: Between 3000 and 4000 RPM, the spark advance does not change. So when checking ignition timing at 3500 RPM, a change in engine speed within ± 500 RPM will not affect the timing mark when checked with the timing light.

Static Test

1. Disconnect MAG side spark plug wire and connect wire to grounding device then remove spark plug.

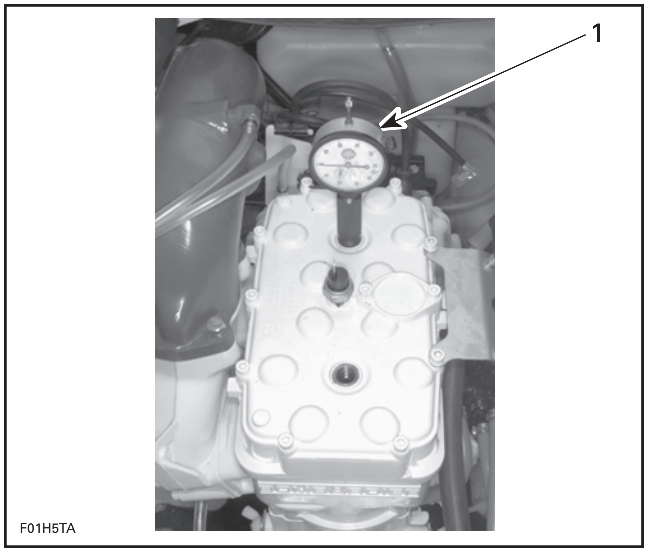
CAUTION: Never crank engine with spark plugs removed unless spark plug cables are connected to the grounding device.

2. Remove PTO flywheel guard.
3. Remove middle screw securing the engine to the rear engine mount. Reinstall screw with timing mark pointer tool.



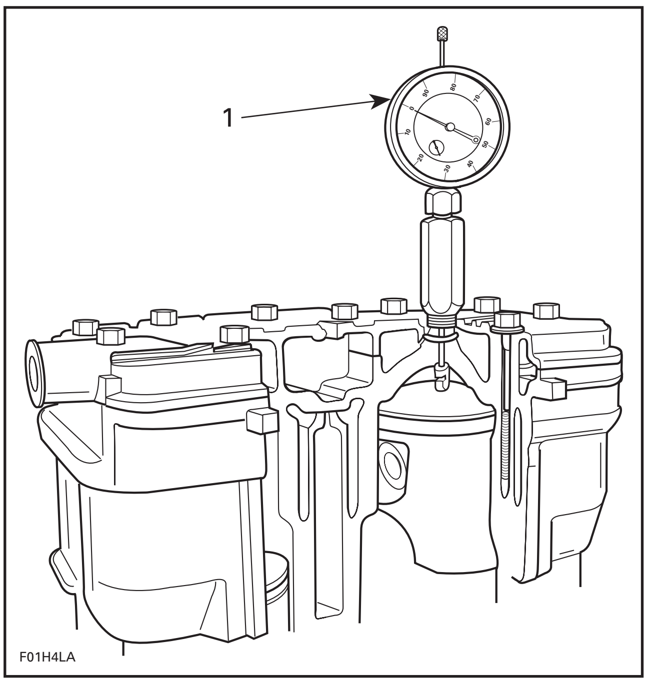
1. *Timing mark pointer tool (P/N 295 000 135)*

4. Install and adjust a TDC gauge (P/N 295 000 143) in MAG side spark plug hole.



TYPICAL
1. TDC gauge on MAG side

5. Rotate PTO flywheel counterclockwise (when facing it) until piston is at Top Dead Center.



TYPICAL
1. Adjust gauge dial at zero

6. From this point, rotate flywheel clockwise to reach proper specification according to engine. Refer to the following chart.

ENGINE	IGNITION TIMING (BTDC)
947	2.99 mm (.118 in)

7. Scribe a thin mark on PTO flywheel aligned with timing mark pointer tool.

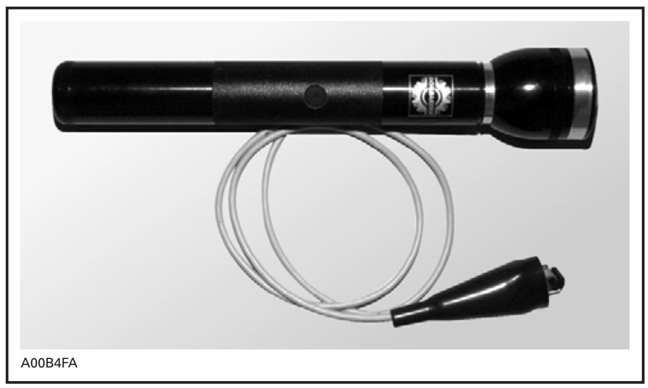
NOTE: This mark becomes the reference when using the stroboscopic timing light.

CAUTION: The static test cannot be used as a timing procedure, therefore, always check the timing with a stroboscopic timing light.

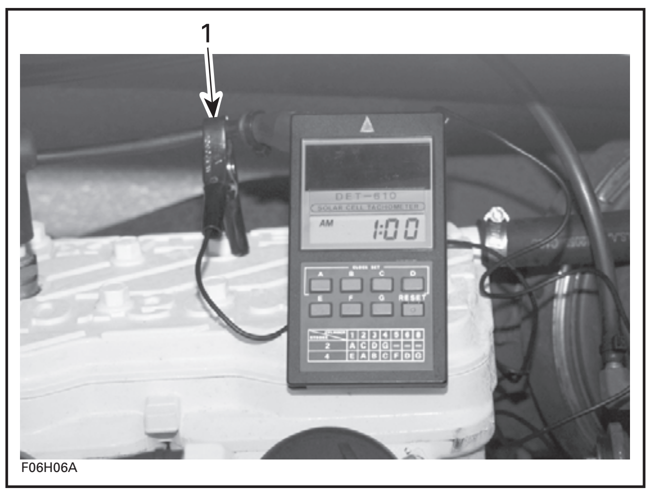
8. Remove TDC gauge.
9. Reinstall spark plug and connect wire.

Dynamic Test

To check ignition timing, use Bombardier timing light (P/N 529 031 900).

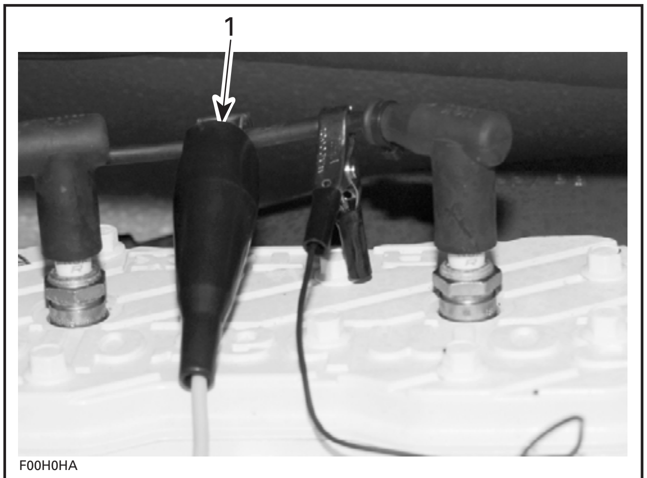


1. Connect an induction-type tachometer (P/N 295 000 100) to spark plug wire.



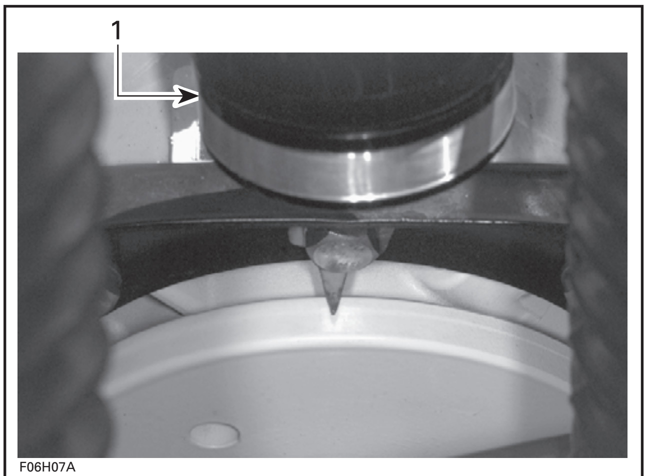
TYPICAL
1. Tachometer pick-up

2. Connect timing light pick-up to MAG side spark plug wire.



1. Timing light pick-up

3. Rev the engine 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.

Ignition Timing Adjustment

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 occurs. 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.

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 ⟷ 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.

VCK (Vehicle Communication Kit)

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.

NOTE: For more information about VCK, refer to its online help.

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. 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.

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
947	7200 ± 50

Multi-Purpose Electronic Module (MPEM) Verification

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.

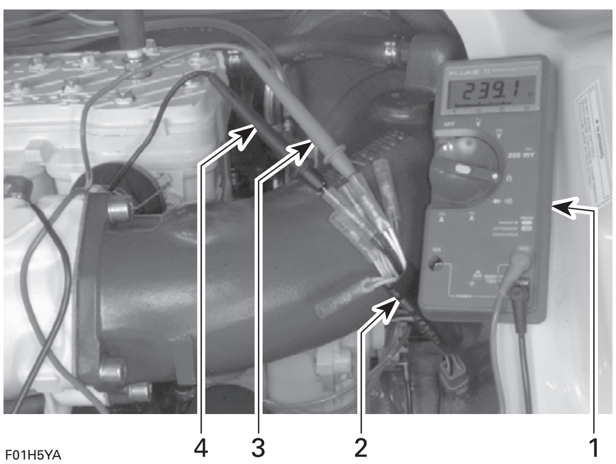
Trigger Coil Verification

STATIC TEST: CONTINUITY

1. Disconnect magneto wiring harness connector.
2. Install the 6-pin magneto harness adapter (P/N 295 000 136).

F01B28A

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. Measure resistance; it should be between 18 - 25 ohms.



F01H5YA

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

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

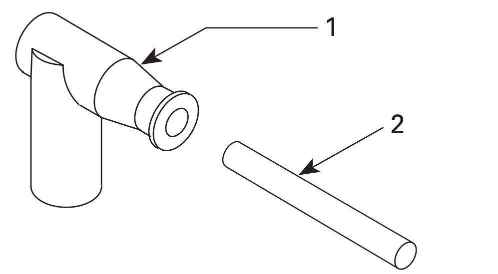
NOTE: An ignition coil with good resistance measurement can still be faulty. Voltage leak can occur at high voltage level which is not detectable with an ohmmeter.

Primary Winding

1. Remove the 2 female spade connectors 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 0.33 - 0.62 ohm.

Secondary Winding

The spark plug caps must be removed from high tension cables, because they are resistor caps. The cap resistance is 4.48 K ohms.



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1. *Resistor cap*
2. *High-tension cable*

IGNITION COIL SECONDARY WINDING		
MODEL	WIRE	RESISTANCE
947	End of each spark plug cable, spark plug caps removed	8.4 - 15.6 kΩ

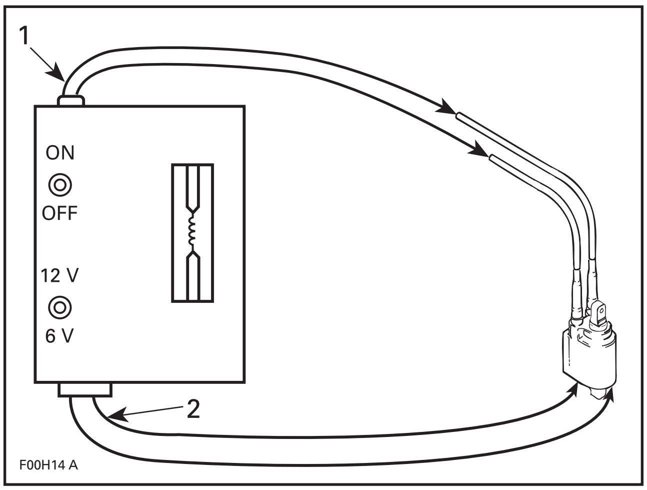
NOTE: A short circuit will read 0 ohm (or close to) on ohmmeter.

DYNAMIC TEST

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 pressurize air then completely unscrew.

Heat Range

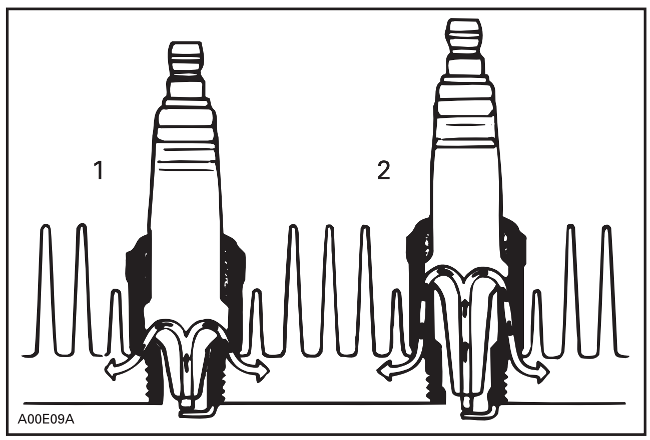
The proper heat range of the spark plugs is determined by the spark plugs ability to dissipate the heat generated by combustion.

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.

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.

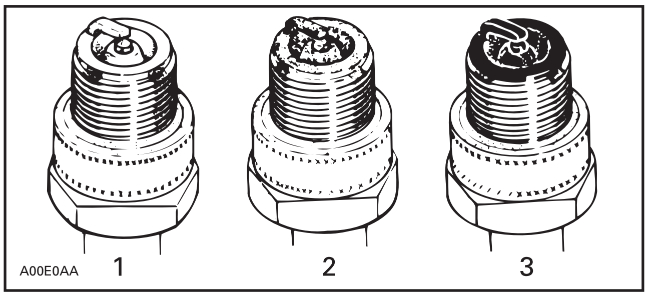
A too “hot” plug will result in overheating and pre-ignition, etc.

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



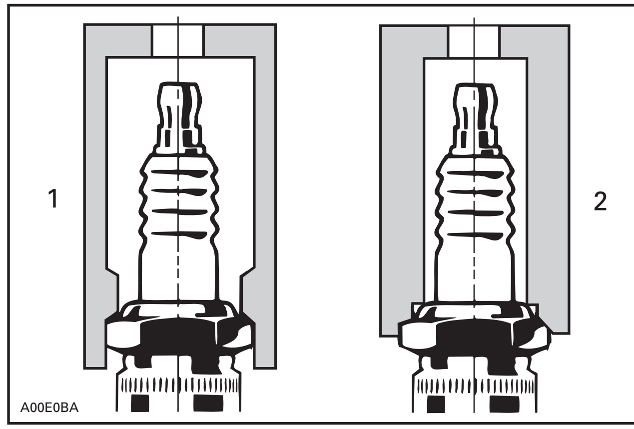
1. *Overheated (light grey)*
2. *Normal (brownish)*
3. *Fouled (black)*

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.



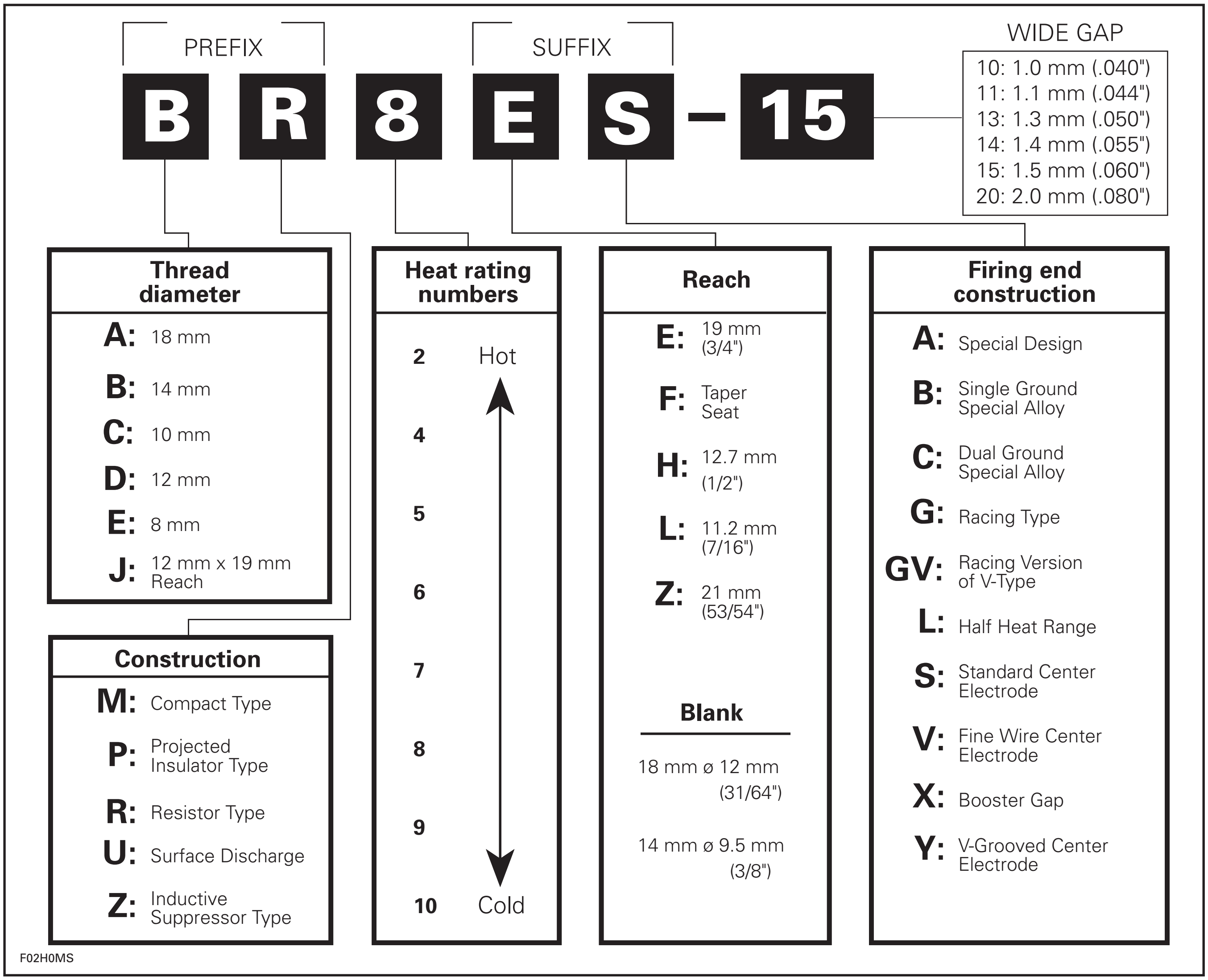
1. *Proper socket*
2. *Improper socket*

Spark Plug Chart

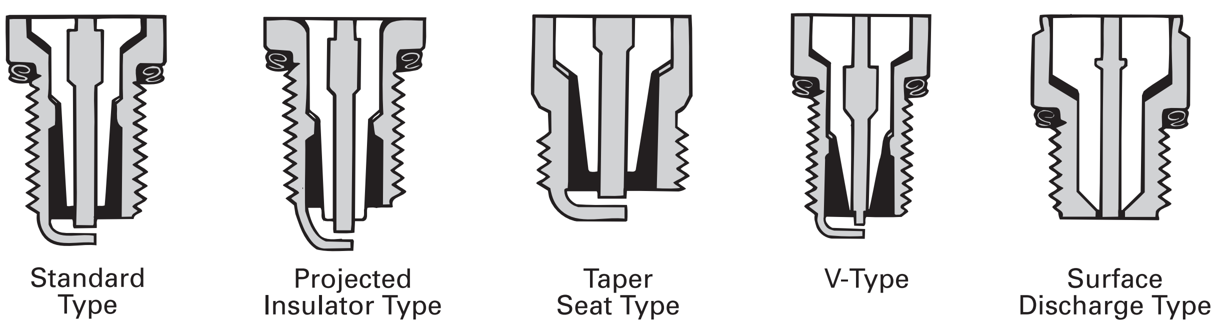
ENGINE	SPARK PLUG	TORQUE N•m (lbf•ft)	GAP mm (in)
947	NGK BR8ES	24 (17)	0.5 - 0.6 (.020 - .024)

NOTE: Refer to next page for NGK Spark Plug Symbol Explanation.

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).

Carburetor-Equipped Models

The magneto has a 3 phase, "Y" wound stator on 18 poles. Capacity is 180 watts.

DI Models

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 (13.8 - 14.2 volts) to prevent any damage to components.

Carburetor-Equipped Models

A dual 1/2 wave series rectifier receives the magneto AC current and transforms it into direct current (DC) to allow battery charging.

DI Models

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, the ignition system 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.

Carburetor-Equipped 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.

DI Models

The charging system is protected by 2 fuses.

A 25 A fuse is mounted on the MPEM and a 30 A fuse 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

Carburetor-Equipped Models

The rectifier/regulator is integrated in the MPEM.

All Models

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.

Depending on battery charge, current reading should be approximately 5 amperes on the **carburetor-equipped models** and 7 amperes on the **DI models**. 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 6000 RPM.

If multimeter reads over 15 volts, regulator is defective. Replace it.

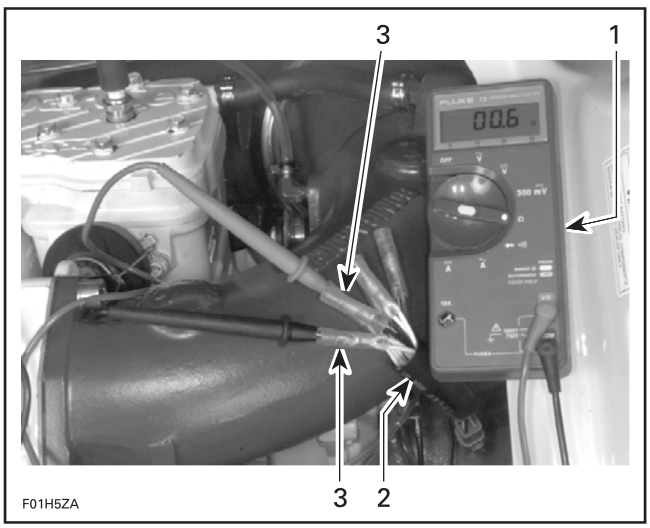
NOTE: If it is continually necessary to add distilled water to the battery, this indicates an over voltage situation, requiring replacement of the rectifier/regulator. If, on the other hand, the battery will not stay charged, the problem can be any of the charging circuit components. If these all check good, you would be accurate in assuming the problem to be in the rectifier/regulator.

Stator

Carburetor-Equipped Models

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.

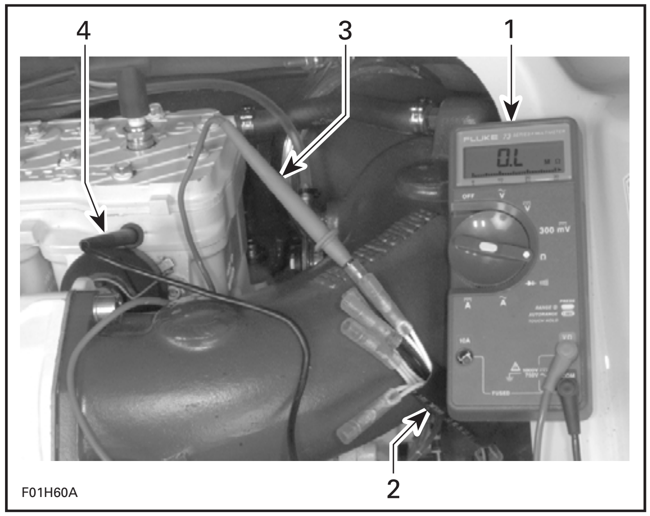


TYPICAL
1. *Multimeter*
2. *Magneto harness adapter*
3. *YELLOW wires*

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.



TYPICAL
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.

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.

RX Models

Remove LH side bilge vent tube at rear.

1. LH side vent tube

All Models

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.
5. Withdraw battery from watercraft being careful not lean it so that electrolyte flows out of vent elbow.

⚠ 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

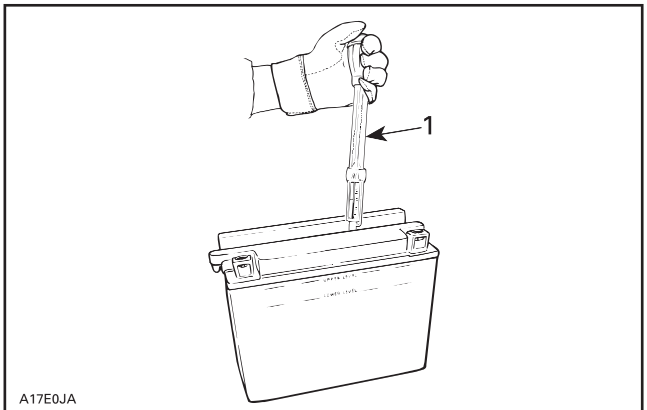
There are 2 types of battery tests: electrolyte reading and load test. An electrolyte reading is made on a battery without discharging current. It is the simplest and commonly used. A load test gives more accuracy of the battery condition.

Electrolyte Reading

Check charge condition using either a hydrometer.

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).



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 32 27	100 90 80	.012 .008 .004	Add to the reading
21	**70**	correct reading	
16 10 4 - 1	60 50 40 30	.004 .008 .012 .016	Subtract from the reading

EXAMPLE NO. 1	EXAMPLE NO. 2
Temperature above 21°C (70°F):	**Temperature above 21°C (70°F):**
Hydrometer reading: 1.250	Hydrometer reading: 1.235
Electrolyte temperature: - 1°C (30°F)	Electrolyte temperature: 38°C (100°F)
Subtract .016 Sp. Gr.	Add .012 Sp. Gr.
Corrected Sp. Gr. is 1.234	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

CAUTION: Battery storage is critical for battery life. Regularly charging the battery during storage will prevent cell sulfation. Keeping the battery in vehicle for storage may lead to contacts degradation/corrosion and case damage if freezing occurs. A discharged battery will freeze and break in area where freezing point is experienced. Electrolyte leakage will damage surrounding parts. Always remove battery from vehicle for storage and regularly charge to keep an optimal condition.

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.

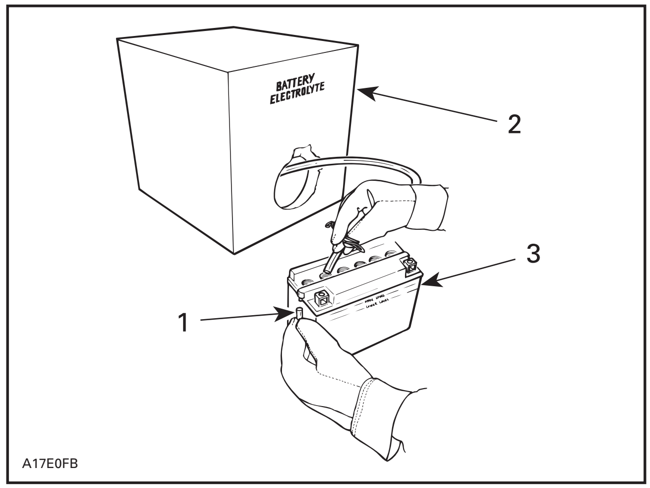
1. Remove the sealing tube from the vent elbow.

⚠ WARNING

Failure to remove the sealing tube could result in an explosion.

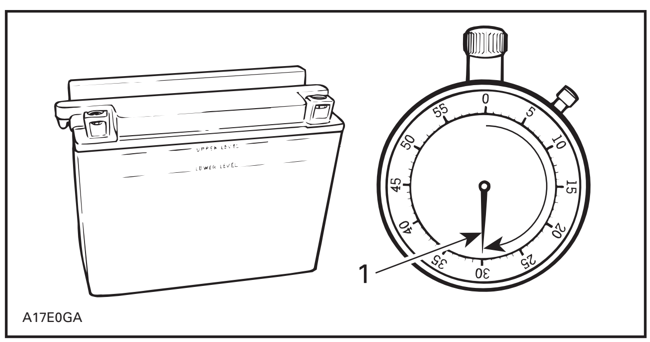
2. Remove caps and fill battery to UPPER LEVEL line with electrolyte (specific gravity: 1.265 at 21°C (70°F)).

NOTE: This battery may fill slower than others due to the anti-spill check ball design.



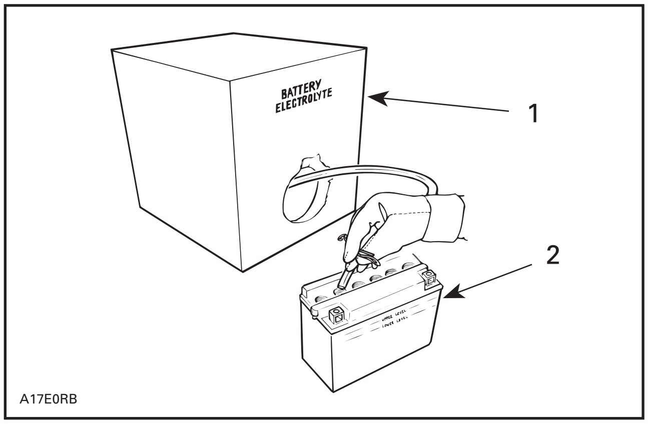
1. Sealing tube removed
2. Battery electrolyte
3. Upper level line

3. Allow the battery to stand for 30 minutes MINIMUM so that electrolyte soak through battery cells.



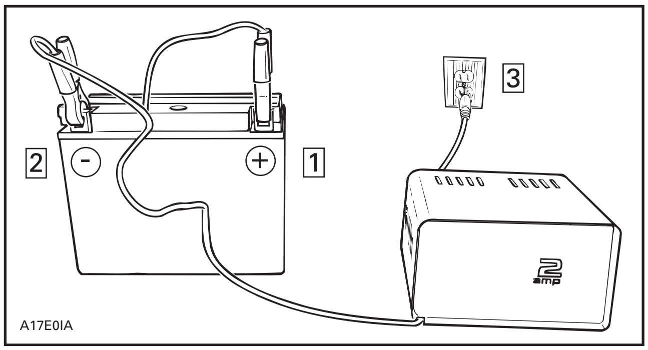
1. 30 minutes

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.



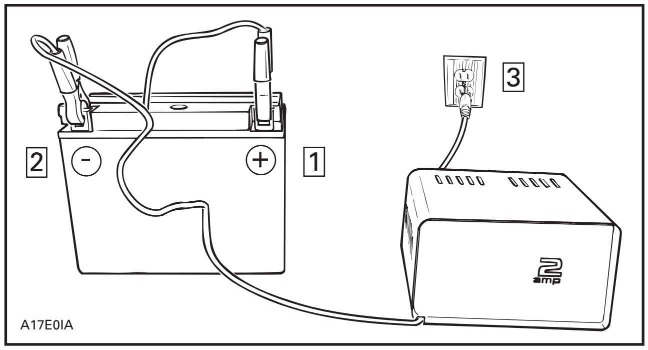
Step 1: Connect + lead to battery + post
Step 2: Connect - lead to battery - post
Step 3: Plug battery charger

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.

⚠ WARNING

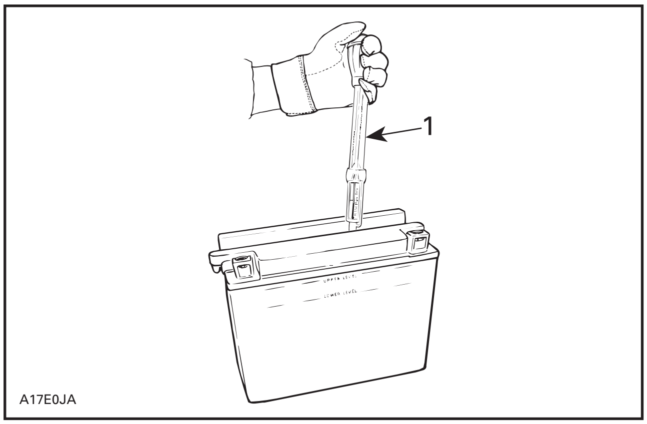
Always charge in a well ventilated area. Always turn battery charger off prior to disconnecting cables.

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.

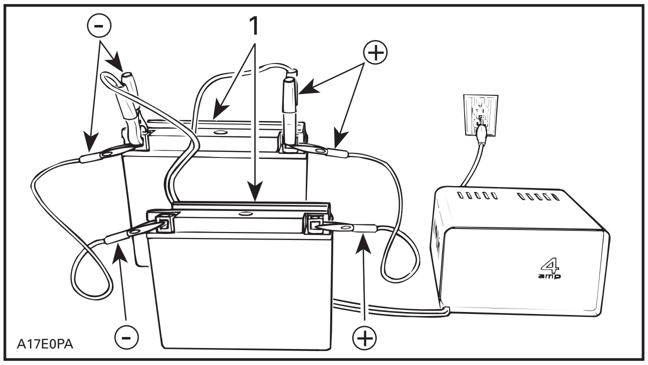
NOTE: Some chargers have a polarity protection feature which prevents charging unless the charger leads are connected to the correct battery terminals. A completely discharged battery may not have enough voltage to activate this circuitry, even though the leads are connected properly. This will make 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 x 2 A = 10 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

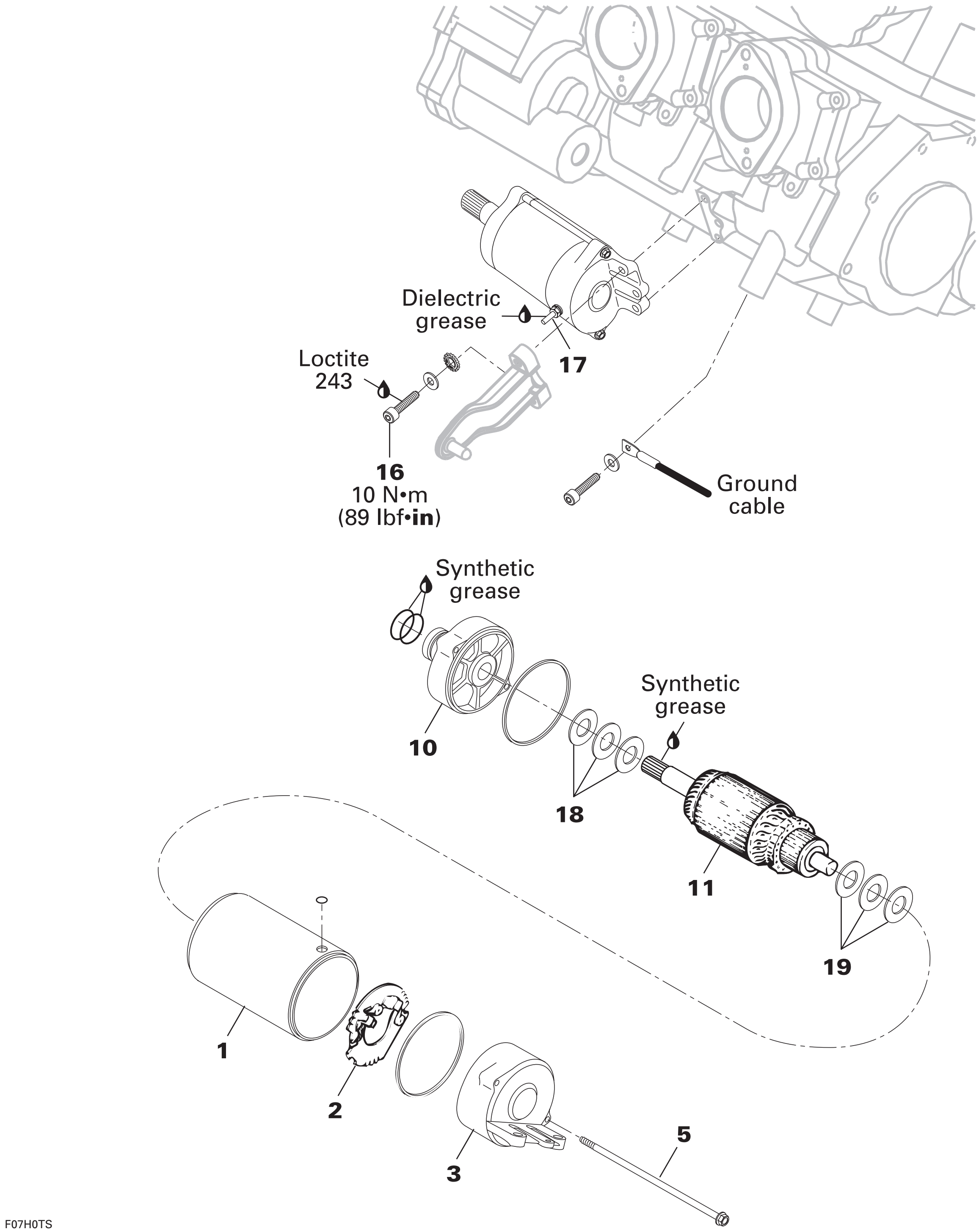
Vent line must be free and open. Avoid skin contact with electrolyte.

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.

RX Models

Reinstall bilge vent tube.

STARTING SYSTEM



F07H0TS

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 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 or ENGINE MANAGEMENT.

Engine Start/Stop Switch and Safety Lanyard Switch

Refer to IGNITION SYSTEM or ENGINE MANAGEMENT.

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 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.	Check and 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 or ENGINE MANAGEMENT.
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.

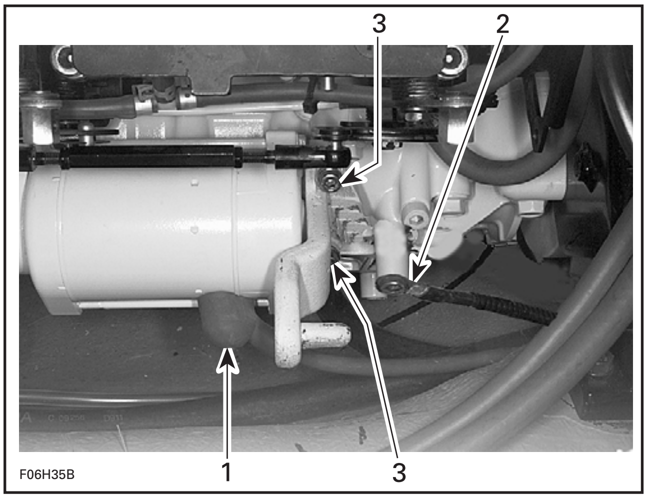
STARTER REMOVAL

Disconnect BLACK cable ground connection from battery.

> ⚠ **WARNING**
>
> **Always disconnect BLACK ground cable first and reconnect last.**

Disconnect RED cable connection from battery.

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*

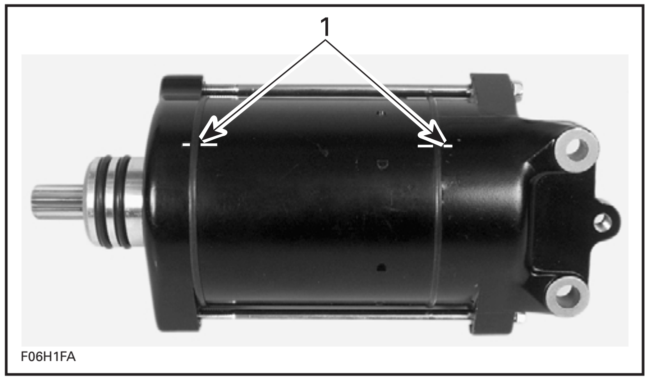
Remove bracket and starter.

NOTE: To remove the starter drive assembly, magneto flywheel has to be removed. Refer to MAGNETO SYSTEM and BOTTOM END.

To check and replace the starter end bearing, refer to BOTTOM END of ENGINE section.

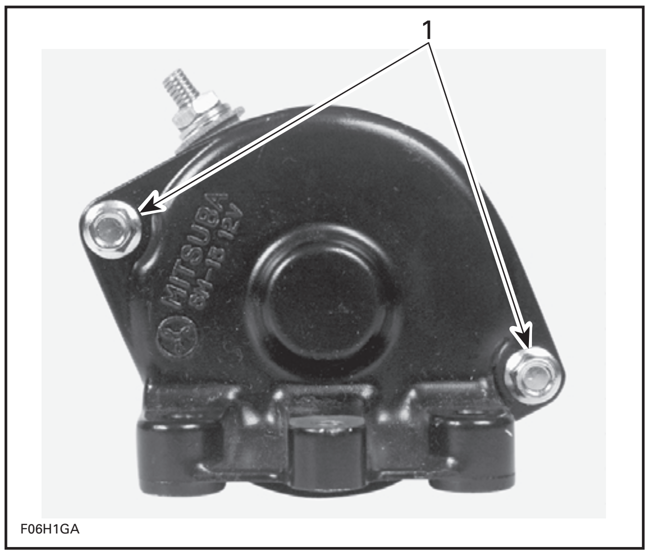
STARTER DISASSEMBLY

Locate index marks on yoke **no. 1** and end covers **no. 3** and **no. 10**.



1. *Index marks*

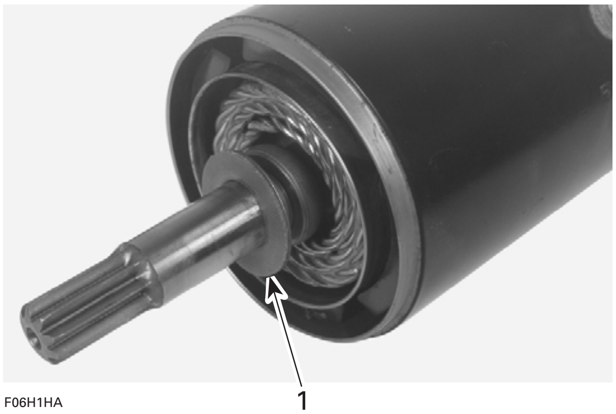
Loosen through bolts **no. 5**.



1. *Through bolts*

Remove end cover **no. 3** and gasket on armature shaft side.

Remove thrust washers **no. 19** from armature shaft.

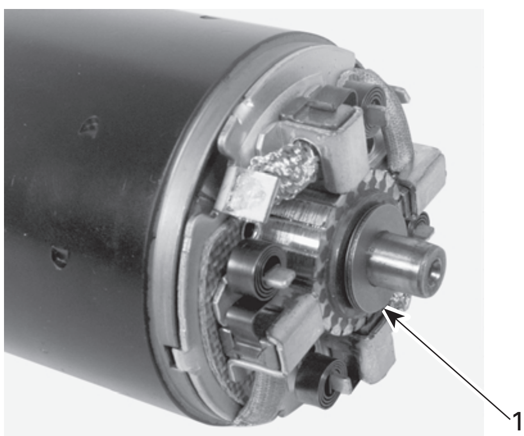


F06H1HA

1. *Thrust washers*

Remove the other end cover **no. 10** and gasket.

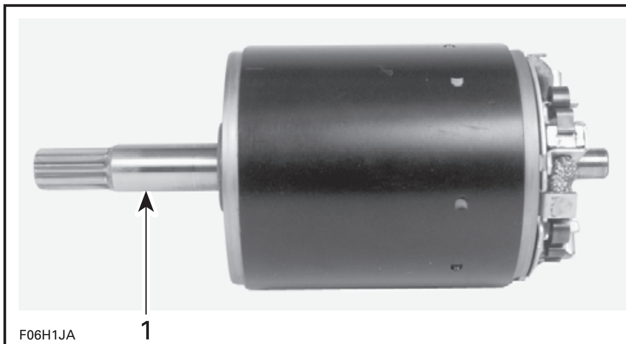
Remove the 3 washers **no. 18** from armature shaft.



F06H1IA

1. *Washers*

Remove armature **no. 11**.

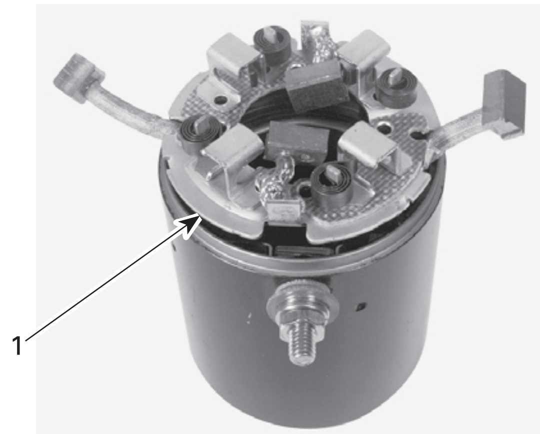


F06H1JA

1. *Pull armature shaft*

Release brush wires of yoke from brush holder **no. 2**.

Remove brush holder **no. 2**.



F06H1KA

1. *Remove brush holder*

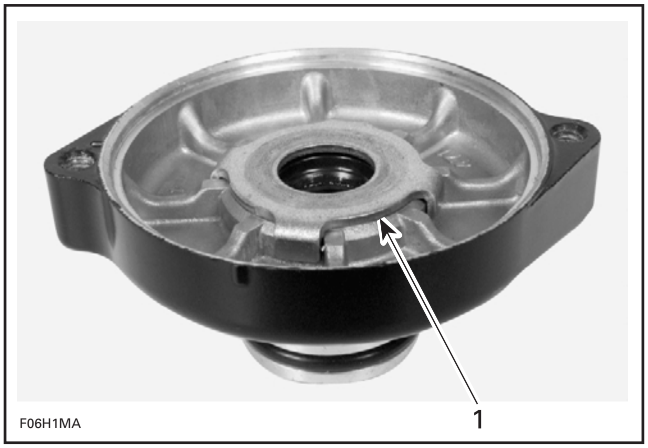
To remove brushes from yoke **no. 1**, loosen nut and remove washers.

F06H1LA

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 assembly 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.

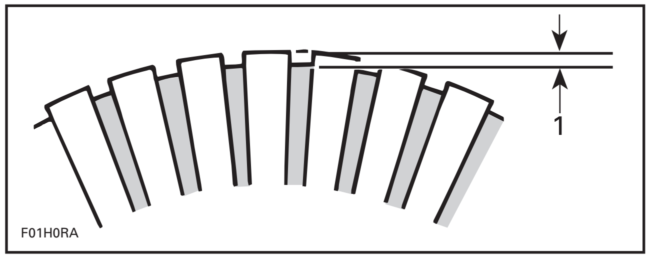
PARTS INSPECTION

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.

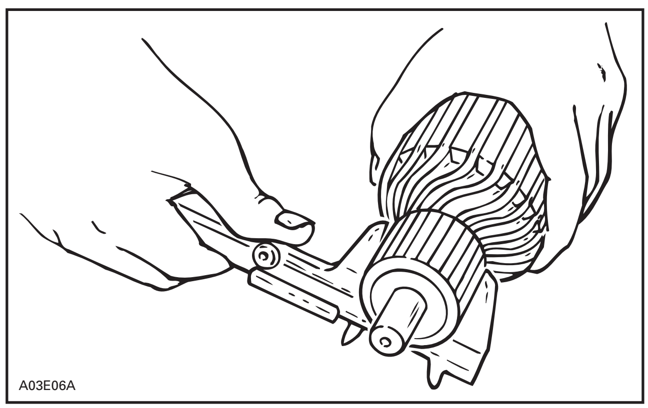
Check commutator for mica depth. If depth is less than 0.20 mm (.008 in), undercut mica. Be sure that no burrs are left and no copper dust remains between segments after undercutting operation is completed.



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.



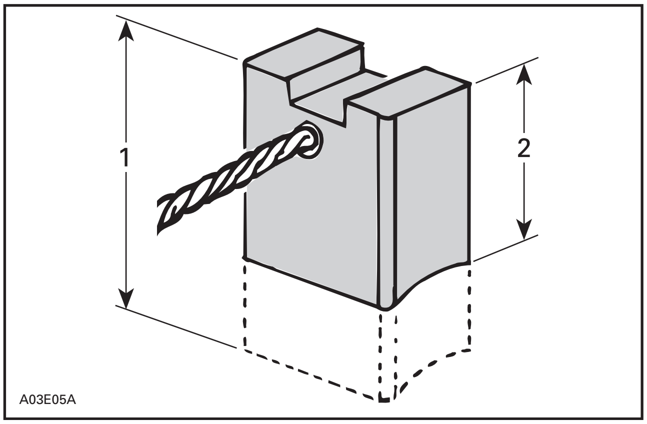
Brush Holder

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.

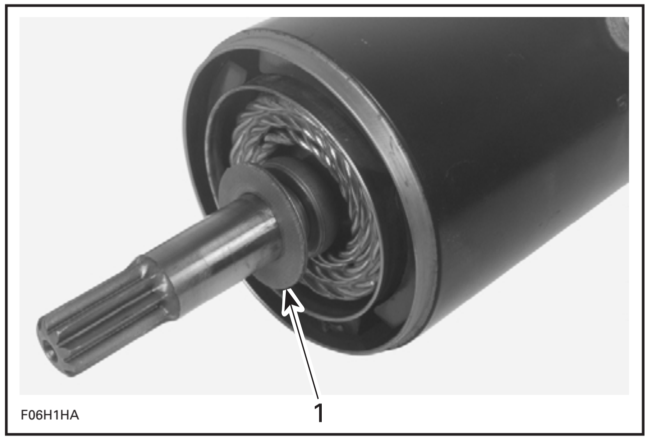
NOTE: Always check engine ring gear teeth for wear and damage. If defective replace ring gear. Refer to MAGNETO.

STARTER ASSEMBLY

Reverse the order of disassembly to reassemble starter. However, attention should be paid to the following operations.

Install new O-rings and gaskets.

Insert thrust washers **no. 19** onto armature shaft.



1. Non metallic surface on the side

Install the 3 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.

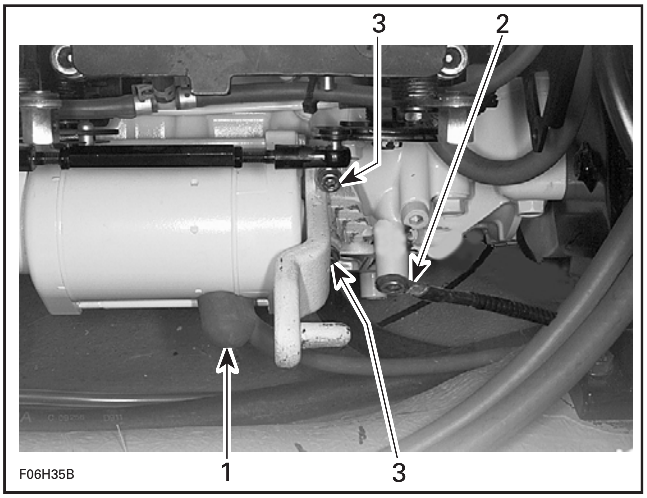
Make sure that starter and engine mating surfaces are free of debris. Serious trouble may arise if starter is not properly aligned.

Screw

Apply Loctite 243 (blue) to Allen screws **no. 16** of starter bracket and torque to 10 N•m (89 lbf•**in**).

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.



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

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.

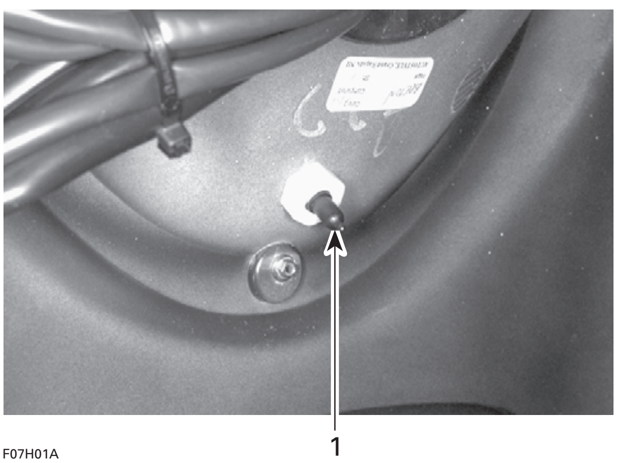
INSPECTION

GTX DI

Air Temperature Sensor

The temperature sensor is located in the storage cover.

Remove the back panel of the storage cover to access the temperature sensor.



F07H01A

1. *Temperature sensor*

To check if the temperature sensor is operational, activate the Information 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 (L TEMP)

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 Information Center and select the lake temperature mode.

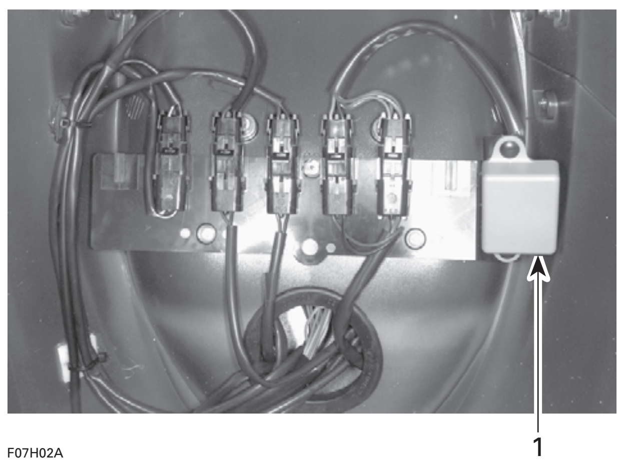
With a garden hose, spray the speed sensor with water. The temperature reading on the Information Center should adjust to the water temperature.

If not, replace the speed sensor.

Compass

The compass is located in the storage cover.

Remove the back panel of the storage cover to access the compass.



F07H02A

1. *Compass*

Remove the compass from the support.

Activate the Information Center.

Change the direction of the compass and keep it horizontal (± 10°). There should be a change of direction on the Information Center.

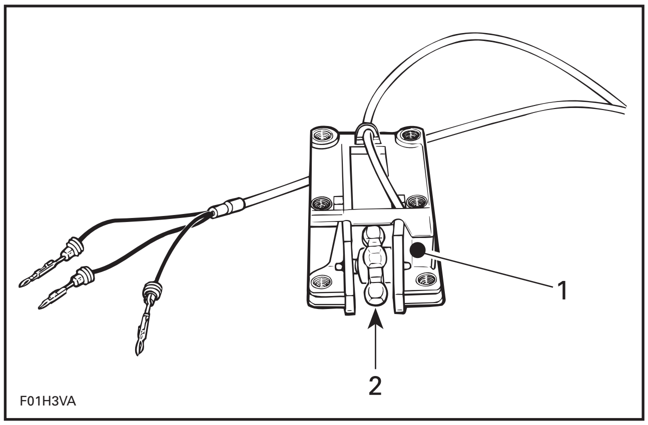
NOTE: To check the accuracy of the compass, you can use a portable compass and point it in the same direction. Compare the given directions, they should be the same.

All Models

Speed Sensor

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.

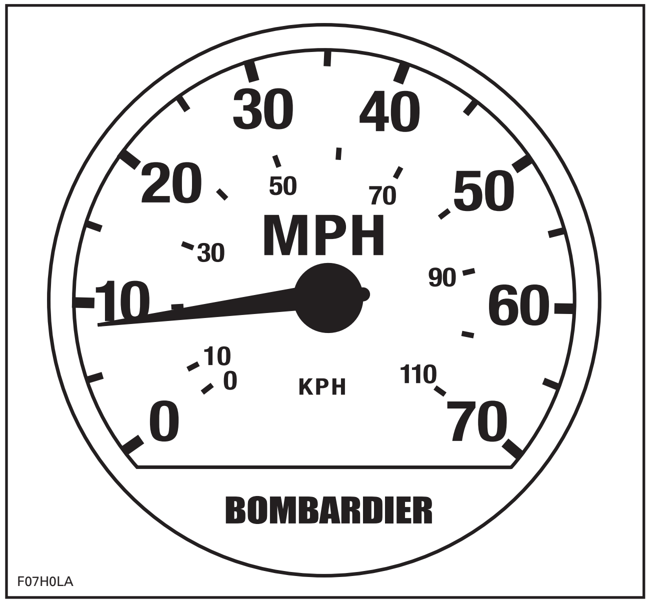
Reconnect the PURPLE/YELLOW and BLACK/ORANGE wires in the receptacle housing.

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)



TYPICAL

The PURPLE wire is the 12 Vdc power source of the speedometer.

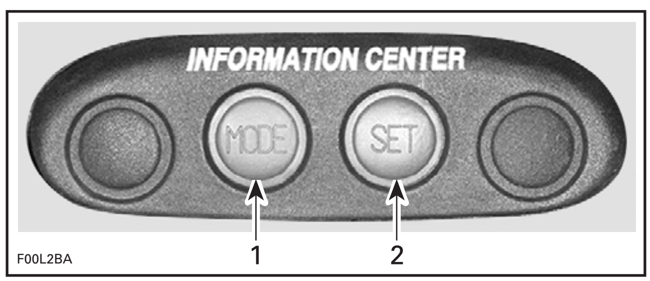
The BLACK wire is the ground.

The PURPLE/YELLOW wire is the pulse signal from the speed sensor.

Information Center

NOTE: With the safety lanyard disconnected, information center can be activated for approximately 33 seconds by depressing the engine start/stop button.

This is a LCD multifunction gauge. Different displays and functions can be activated using 2 buttons — MODE and SET — following specific sequences as described below.

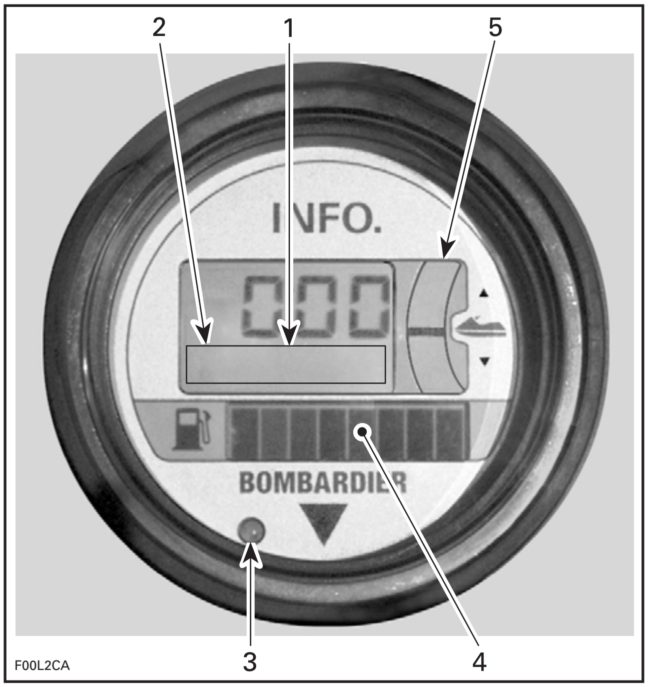


1. *To change display mode*
2. *To set or reset a function*

Resetting a Function

To reset a function (such as the chronometer, peak speed, distance, etc.,) press and hold the SET button for 2 seconds while in the appropriate mode.

The information center includes the following display areas.

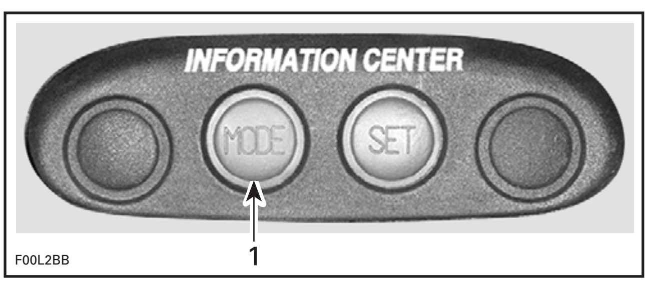


1. General display
2. Message/units display
3. Warning light
4. Fuel level display
*5. VTS position indicator (**if so equipped**)*

General Display

The default display is the clock (or clock/compass **if so equipped**) unless another mode has been selected. See **Display Priorities** below.

Repeatedly pressing the MODE button scrolls the following displays: Tachometer, speedometer, peak speed, average speed, trip meter, hourmeter, water temperature, exterior temperature (**if so equipped**) and chronometer.



1. Press to change display mode

When you are satisfied with your choice, stop pressing the button.

Clock: Indicates the actual time in hours and minutes (hh:mm).

Clock/Compass (if so equipped): Displays the cardinal points to indicate the orientation of the watercraft.

> ⚠ **WARNING**
> **Use the compass as a guide only. Not to be used for navigation purposes.**

Tachometer: Indicates the revolutions per minute (RPM) of the engine.

Speedometer: Indicates the speed of watercraft in kilometers per hour (KPH) or miles per hour (MPH).

Peak Speed: Indicates the top speed the watercraft reached (PK KPH or PK MPH).

Average Speed: The information center approximately calculates and displays the average speed (AV KPH or AV MPH) of the watercraft since the last engine start.

Trip Meter: The information center approximately calculates the distance based on the operation time and the watercraft speed and displays the result in kilometers (KM) or miles (MILES).

Hourmeter: Displays the time in hours of the watercraft usage.

Water Temperature: Displays the water temperature (L TEMP) in degrees Celsius (°C) or Farenheit (°F).

Exterior Temperature (if so equipped): Displays the exterior air temperature (E TEMP) in degrees Celsius (°C) or Fahrenheit (°F).

Chronometer: Allows to measure an interval of time in hours and minutes (hh:mm).

Message Display

The Information Center features a display area that blinks a message whenever one of the following circumstances occurs:

- compass error (COMPAS)
- maintenance (MAINT)
- engine overheating (H-TEMP)
- low fuel (FUEL-LO)
- low oil (OIL LOW)
- low voltage (12 V LOW)
- fuel injection system sensors and major components (**DI models**).

Except for low fuel and low oil, which can be corrected by refilling, refer to DIAGNOSTIC PROCEDURES section when other messages occur.

The warning light will blink at the same time.

Warning Light

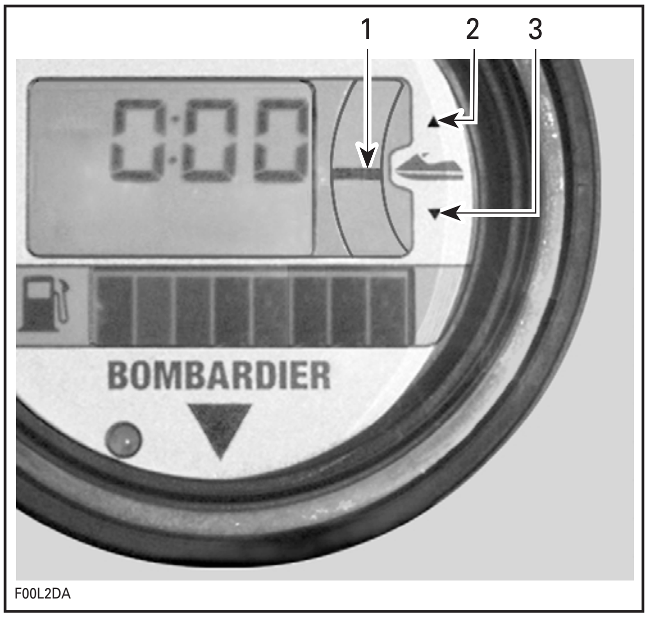
The red warning LED (Light-Emitting Diode) blinks along with the message display to catch your attention.

Fuel Level Display

Bar gauge continuously indicates the amount of fuel in the fuel tank while riding. A low-fuel condition is also indicated when it occurs. See **Message Display** above.

VTS Position Indicator (if so equipped)

The VTS position indicator shows the riding angle of the watercraft.



1. *Position indicator*
2. *Bow up*
3. *Bow down*

Display Priorities

The clock, (clock/compass, **if so equipped**) is the default display mode. The default display is the one that appears when the information center is first activated or displayed back after an alternate display was chosen.

The tachometer, speedometer and chronometer, are the only other modes that may be chosen to replace the default display. When one of these is selected, it will become the default display until it is changed again.

When another display mode is chosen, the default display will be displayed back after 4 seconds.

As a self test, all LCD segments and the LED will turn on for 3 seconds each time the information center is activated.

In the event of a warning message, the message will blink and override the units display.

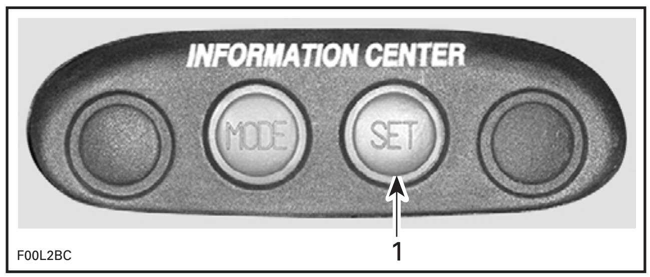
If more than one warning message occurs, the blinking messages will scroll every 4 seconds.

Other Functions

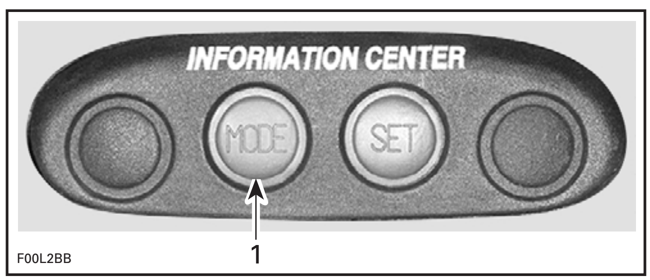
The following describes how to select other available functions.

Language Option

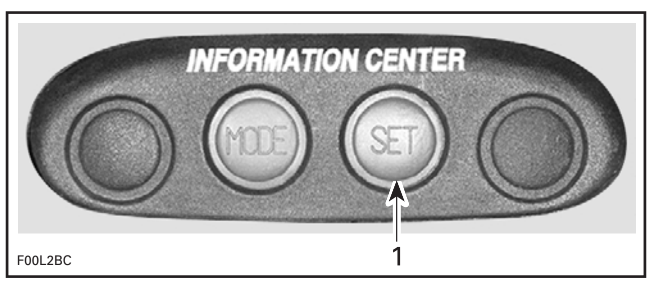
While in the clock/compass mode:



1. *Press and hold for 2 seconds*



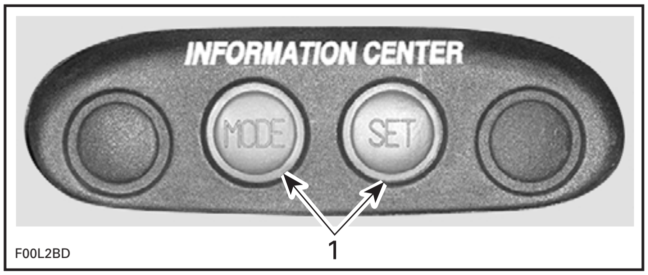
1. *Repeatedly press*



1. *Press to end*

English/Metric System

Allows to display the units in the metric system or in the SAE English system.

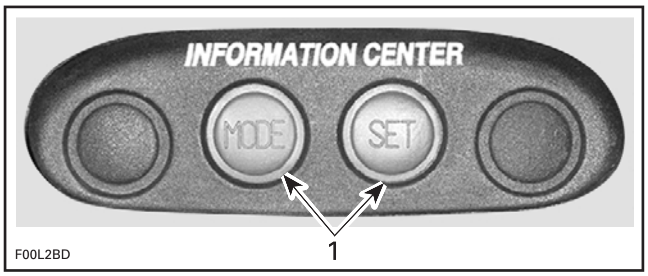


F00L2BD

1. *Press TOGETHER and hold for 2 seconds*

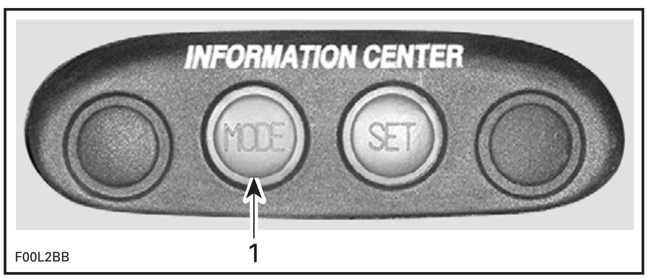
Clock Adjustment

While in the clock/compass mode:



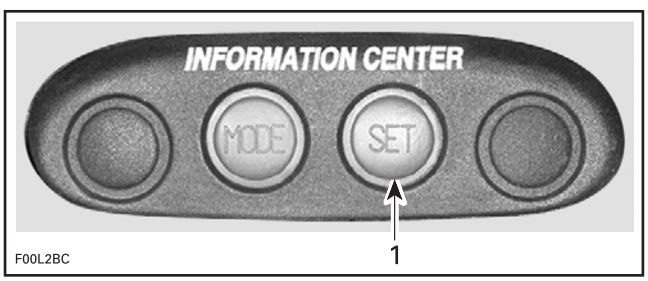
F00L2BD

1. *Press TOGETHER and hold for 2 seconds*



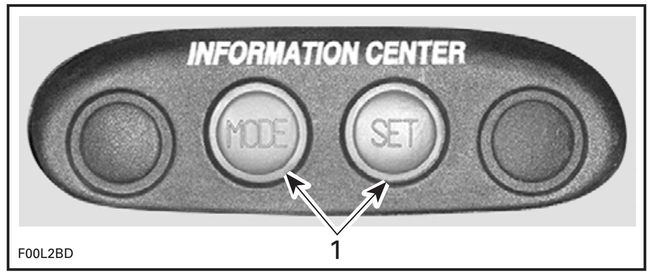
F00L2BB

1. *Repeatedly press to adjust HOURS*



F00L2BC

1. *Repeatedly press to adjust MINUTES*



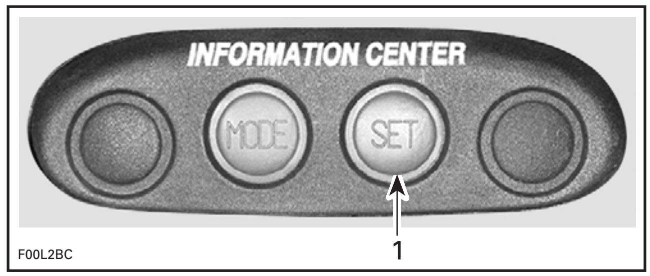
F00L2BD

1. *Press TOGETHER to end*

NOTE: If MODE and SET buttons are not pressed at the end, the default display will come back after 10 seconds and the time entered will remain.

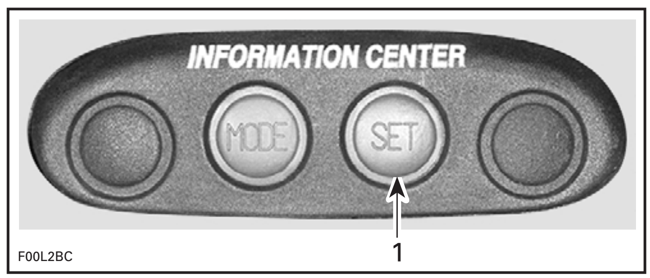
Chronometer

While in the chronometer mode:



F00L2BC

1. *Press to start or stop chronometer*



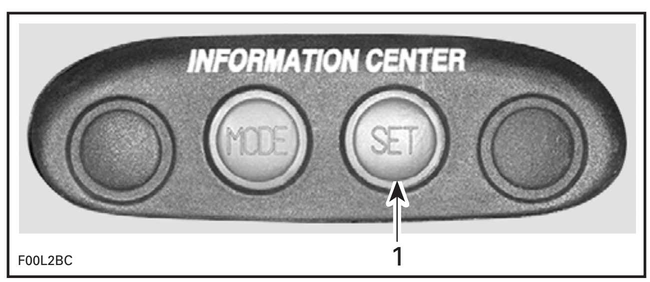
F00L2BC

1. *Press and hold for 2 seconds to reset*

Maintenance Information

When the watercraft is due for a maintenance inspection, the message MAINT will blink.

To clear the warning message while it is blinking:



F00L2BC

1. *Press and hold for 2 seconds to reset*

NOTE: If maintenance message (MAINT) continues to blink, it indicates a fault with the fuel injection system on **Di models**. Refer to DIAGNOSTIC PROCEDURES section.

Verification

The PURPLE wire is the 12 Vdc power source of the Information Center.

The BLACK wire is the ground.

The RED/PURPLE wire is the 12 Vdc from the battery. It is protected by a fuse on the MPEM; the fuse "MPEM" on the **carburetor-equipped models** and the fuse "ACC" fuse on **DI models**.

The accuracy of some features of the Information Center can be checked with a potentiometer.

Fuel Level

Disconnect the 4-circuit connector housing of the Information 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.

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

RX and RX DI

VTS

Disconnect the 2-circuit connector housing of the Information 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)

All Models

Water Temperature (L temp)

Disconnect the 2-circuit connector housing of the Information 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

RESISTANCE (Ω)	DISPLAY TEMPERATURE (°C)
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

Exterior Temperature (if so equipped)

Disconnect the 2-circuit connector housing of the Information 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.

NOTE: The gauge must be activated to obtain a reading.

RESISTANCE (Ω)	DISPLAY TEMPERATURE (°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

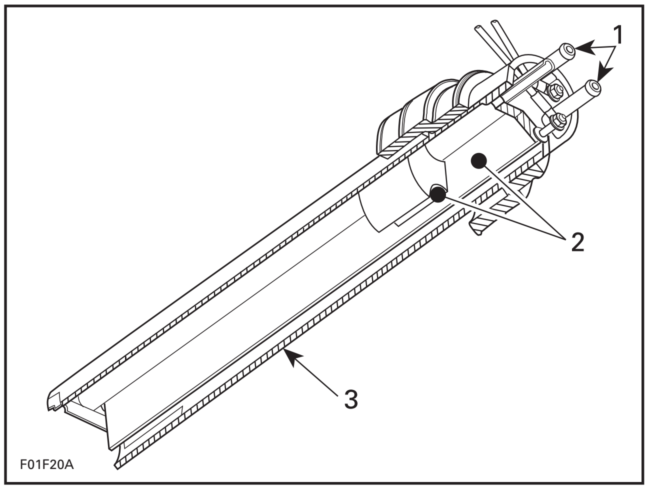
RESISTANCE (Ω)	DISPLAY TEMPERATURE (°F)
22919.8	45 ± 4
17491.7	55 ± 4
13487.5	65 ± 4
10501.5	75 ± 4
8252.0	85 ± 4
6518.7	95 ± 4

Fuel Baffle Pick Up Sender

Carburetor-Equipped Models

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	
FUEL LEVEL (mm)	RESISTANCE (Ω)
From 248.9 ± 5 and more	0 + 2.2
From 234.4 to 248.8 ± 5	17.8 ± 2.2
From 200.9 to 234.3 ± 5	27.8 ± 2.2
From 167.4 to 200.8 ± 5	37.8 ± 2.2
From 134.0 to 167.3 ± 5	47.8 ± 2.2
From 100.5 to 133.9 ± 5	57.8 ± 2.2
From 67.0 to 100.4 ± 5	67.8 ± 2.2
From 40.1 to 66.9 ± 5	77.8 ± 2.2
From 0 to 40.0 ± 5	89.8 ± 2.2

DI 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.

F07F09A

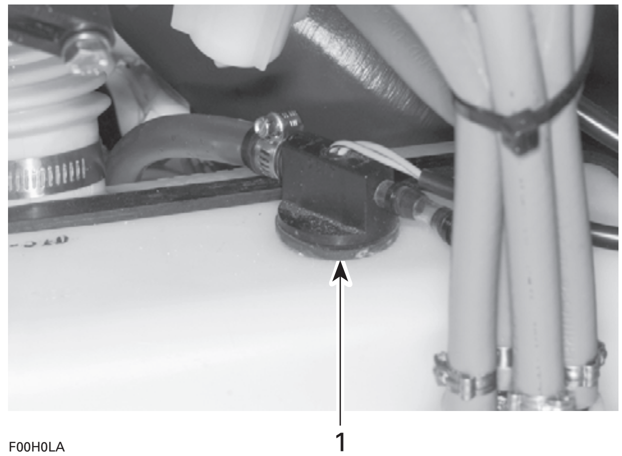
TYPICAL FUEL LEVEL GAUGE SENDER MOUNTED ON FUEL PUMP MODULE

Refer to ENGINE MANAGEMENT.

All Models

Injection Oil Low-Level Sensor

The sensor sends the signal to the low-oil level light in the fuel gauge or the LED in the Information Center.



F00H0LA

TYPICAL
1. Injection oil low-level 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.

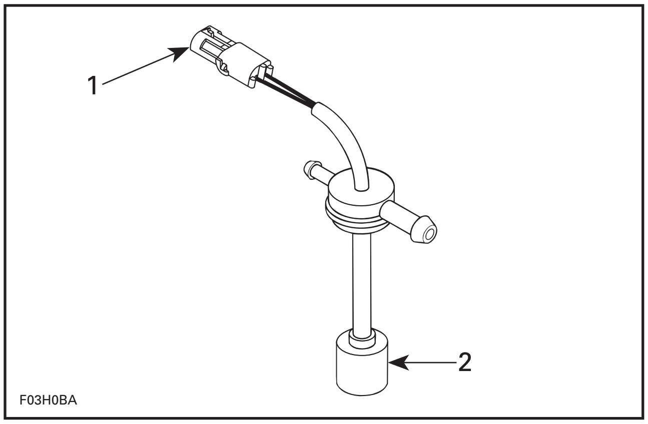
Using a multimeter, check the continuity between the BLUE and BLUE/BLACK terminals.

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)



TYPICAL
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.

RX Models

VTS Switch

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 tests it should be high when button is released and must be close to zero when activated.

VTS Motor

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

It receives its current from the battery. It is protected by its own 7.5 A fuse, located on the MPEM module.

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 ± 1%.

Push on VTS switch up position until motor stops.

Read the resistance on the ohmmeter, it should indicate a resistance of 167 ohms ± 1%.

RESISTANCE (Ω)	NOZZLE POSITION
167 ± 1%	UP
↕	↕
24 ± 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

Carburetor-Equipped Models

NOTE: For DI models, refer to ENGINE MANAGEMENT section.

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 MPEM programmer (P/N 529 034 500) or the VCK (P/N 529 035 676). Refer to its *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.

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)	• Safety lanyard is recognized by the MPEM. • Good contact between safety lanyard cap and DESS post.	• Ignition is authorized, engine can be started normally.
1 long beep (while installing safety lanyard on watercraft switch or when pressing start/stop button)	• Bad connection between safety lanyard cap and switch.	• 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.
	• Unprogrammed or defective safety lanyard.	• 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.
	• Salt water or dirt in safety lanyard cap.	• Clean safety lanyard cap to remove dirt or salt water.
	• Improper operation of MPEM or defective wiring harness.	• Enable advanced diagnostic mode to obtain more detail about the failure.
8 short beeps	• Defective MPEM (memory).	• Replace MPEM.
Continuous beep	• Engine overheating.	• Refer to TROUBLESHOOTING CHART.

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	• Engine actually starts.	• Everything is correct.
1 long and 1 short beeps	• No safety lanyard has ever been programmed in watercraft MPEM.	• 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	• 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.	• Check safety lanyard cap condition with the MPEM programmer. Replace safety lanyard if reported defective. • Check switch wiring harness.
2 long beeps	• Wrong safety lanyard or bad connection of the DESS wires.	• 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	• Wiring harness of DESS switch is grounded or there is a short circuit.	• Check wiring harness and safety lanyard switch.

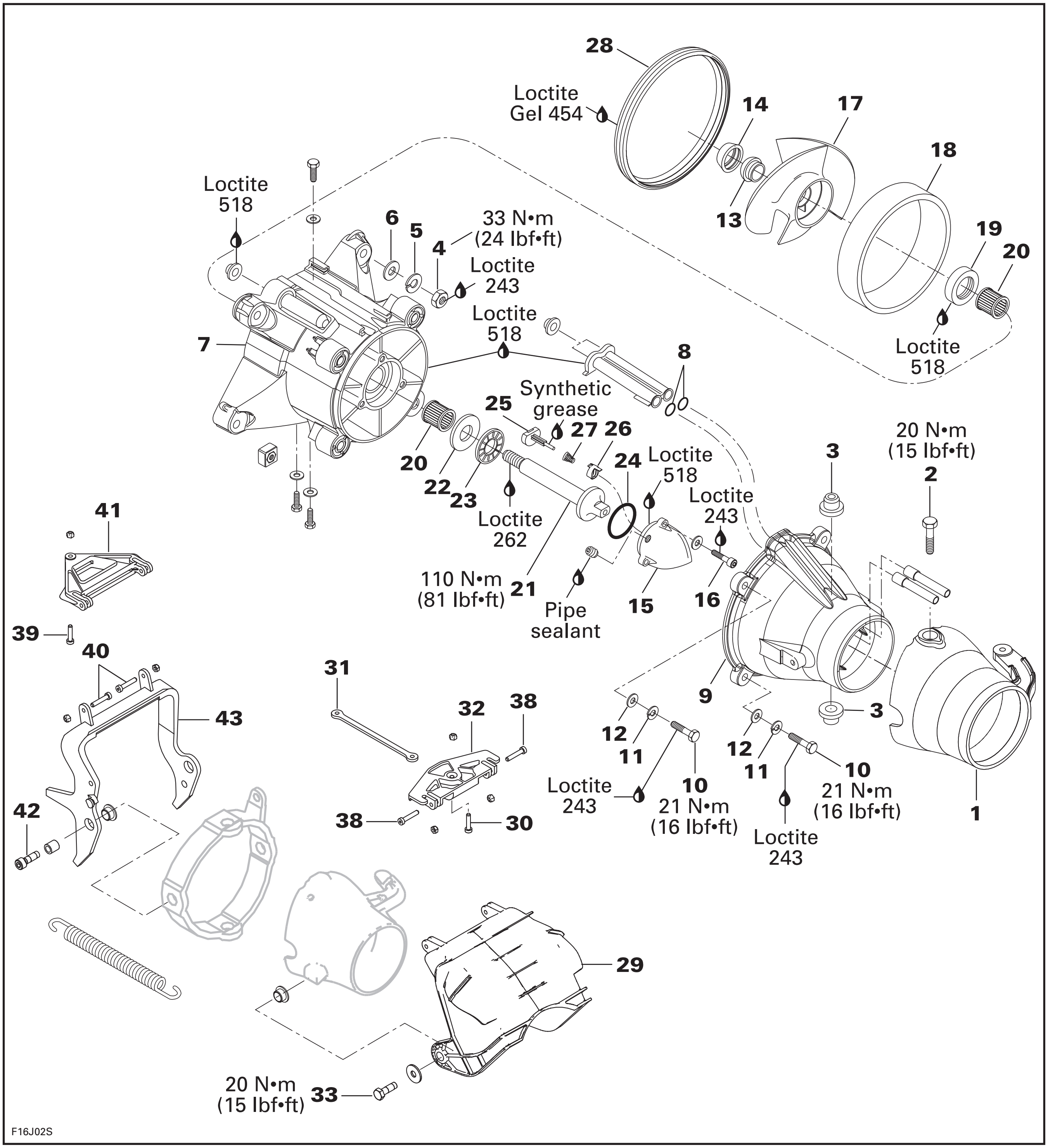
If you need to listen again the coded beeps, remove safety lanyard and repeat the procedure to activate the diagnostic mode.

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.

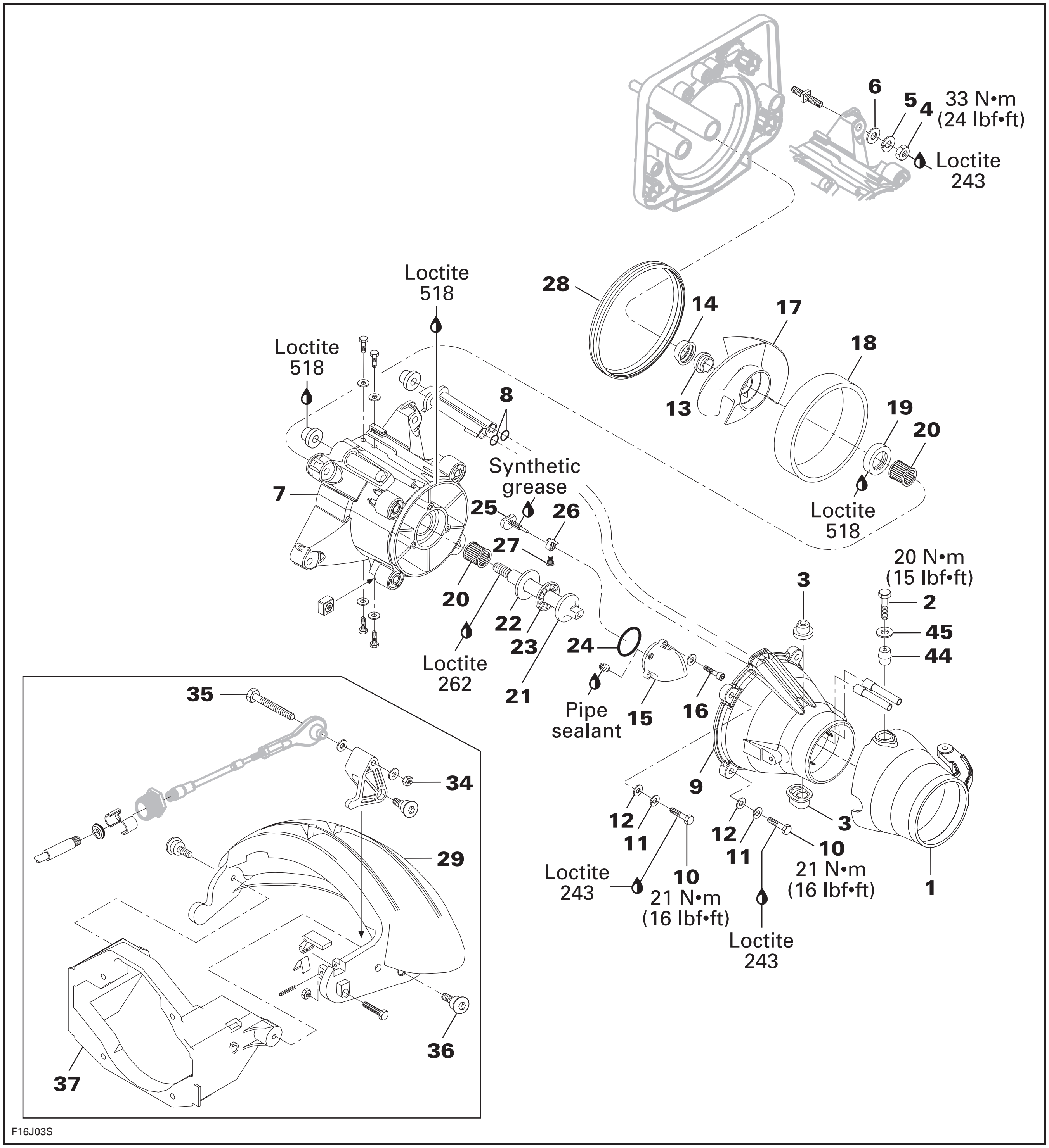
TABLE OF CONTENTS

JET PUMP

RX and RX DI Models



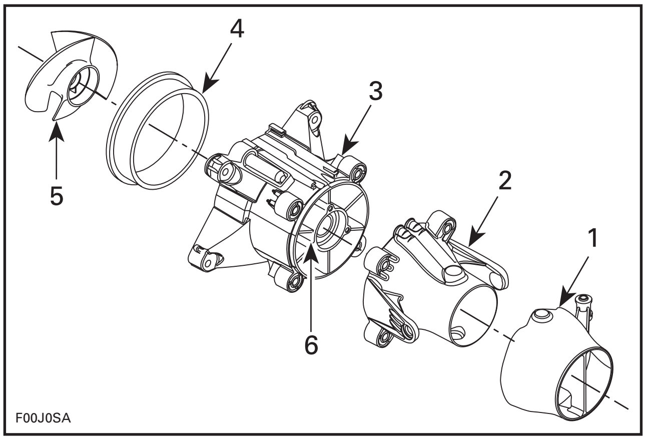
GTX DI Model


6
5
4
33 N•m
(24 lbf•ft)
Loctite
243
28
Loctite
518
14
17
18
Loctite
518
13
8
19
20
Synthetic
grease
7
25
26
Loctite
518
27
20 N•m
(15 lbf•ft)
3
20
2
22
45
23
24
44
Loctite
262
21
35
Pipe
sealant
15
16
34
9
3
12
11
12
10
11
29
Loctite
243
10
21 N•m
(16 lbf•ft)
21 N•m
(16 lbf•ft)
1
Loctite
243
36
37
F16J03S

GENERAL

The jet pump housing is made of plastic. It is a one piece plastic unit, including the stator.

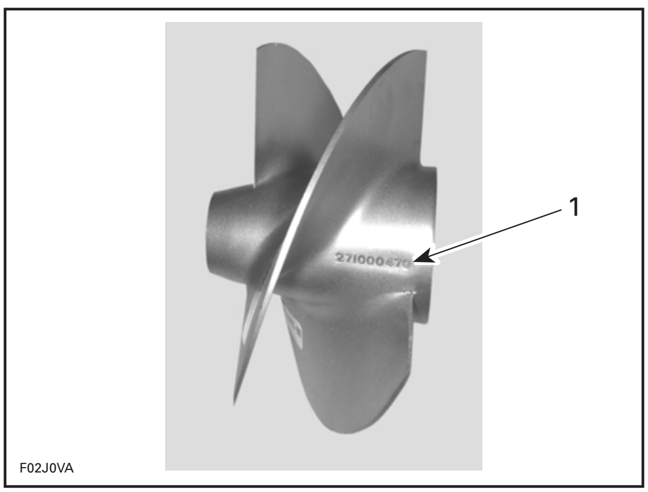
The venturi and the nozzle are made of aluminum on all models.



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.



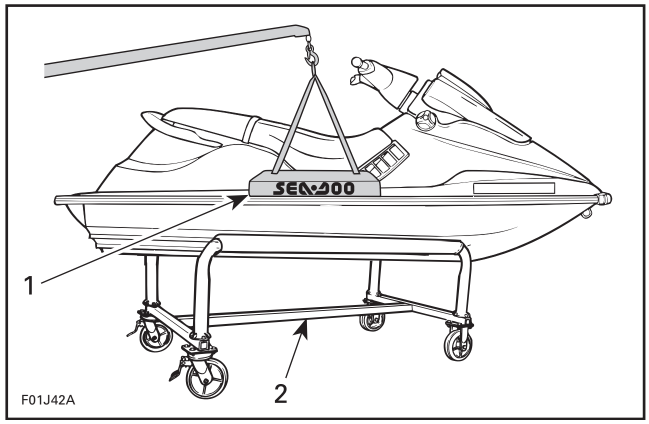
1. *Stamped part number*

WATERCRAFT MODEL	IMPELLER P/N	MATERIAL	PITCH
RX	271 000 920	Stainless steel	Progressive pitch 15° - 21°
RX DI and GTX DI	271 000 128	Stainless steel	Progressive pitch 15° - 21°

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.

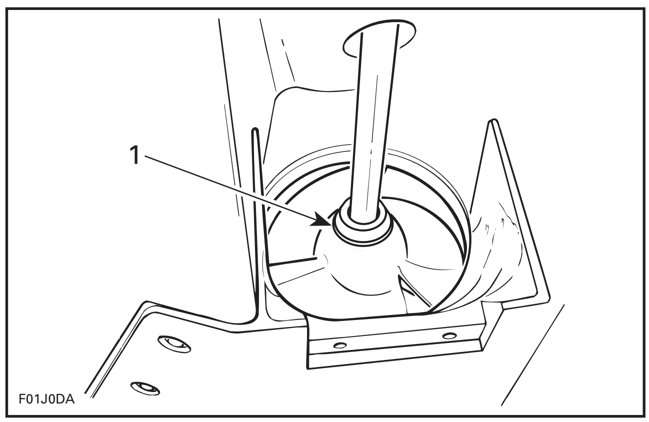


TYPICAL

1. *Lift kit*
2. *Work stand*

Impeller Condition

Condition of impeller **no. 17**, boot **no. 13** and ring **no. 14** 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

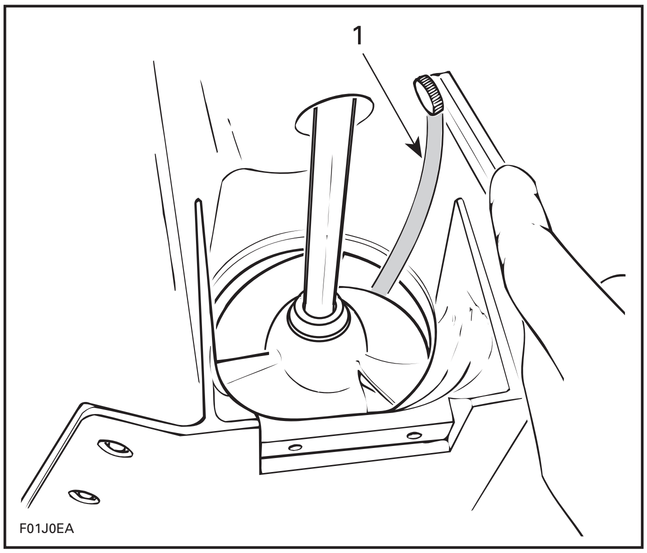
This clearance is critical for jet pump performance.

Clearance can be checked from water inlet opening or from venturi side. However, the last method requires more work.

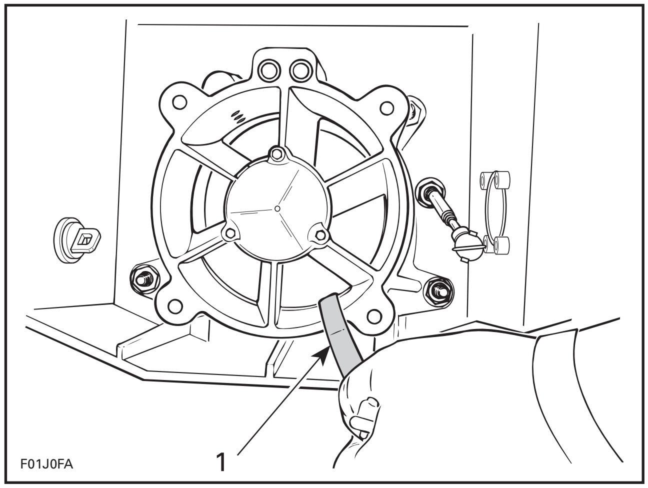
To check clearance from water inlet side, remove inlet grate.

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*

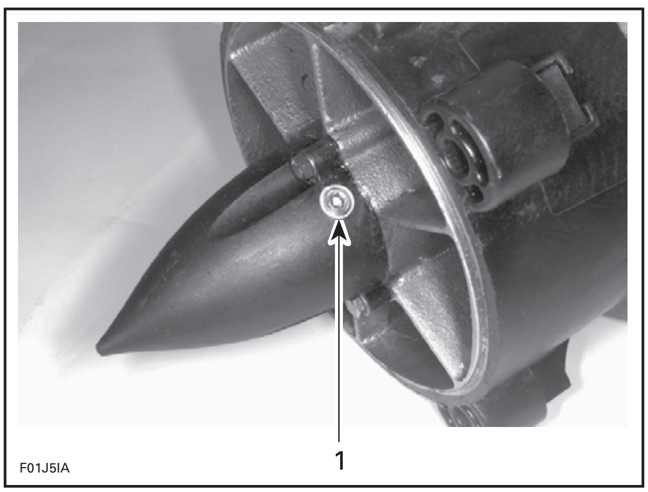
Oil Inspection

Remove:

– reverse gate cable
– VTS rod
– steering cable
– bolts **no. 10** retaining venturi to the housing.

Pull venturi.

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.

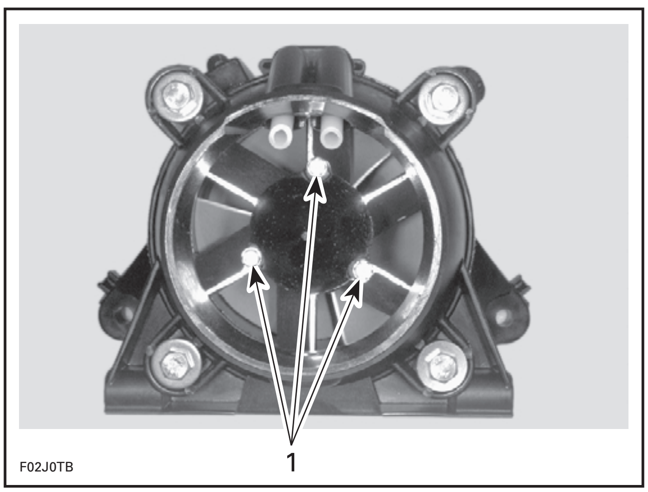
Oil Replacement

Remove:

– reverse gate cable
– VTS rod
– steering cable
– bolts **no. 10** retaining venturi to the housing.

Pull venturi.

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 7.5 N•m (66 lbf•**in**).

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.

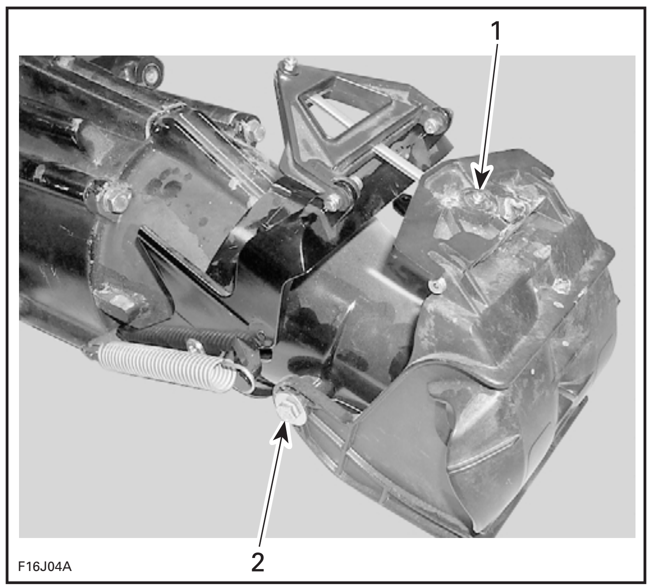
REMOVAL

Reverse Gate

RX and RX DI Models

To remove reverse gate **no. 29**, put shift lever in reverse position.

Unscrew pivot bolt **no. 30** retaining connecting rod **no. 31** and pivot support **no. 32**.



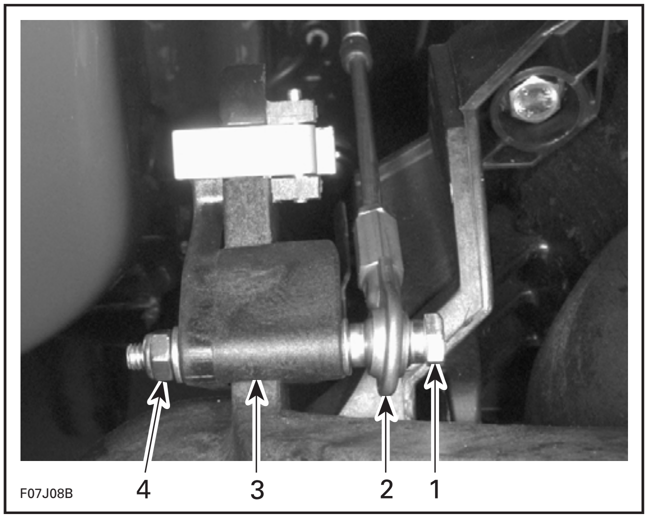
1. *Pivot bolt*
2. *Reverse gate retaining bolt (each side)*

Remove screws **no. 33**.

GTX DI

Put shift lever in reverse position.

Disconnect reverse cable from reverse gate. Remove lock nut **no. 34** and bolt **no. 35** retaining cable end to cable lever.



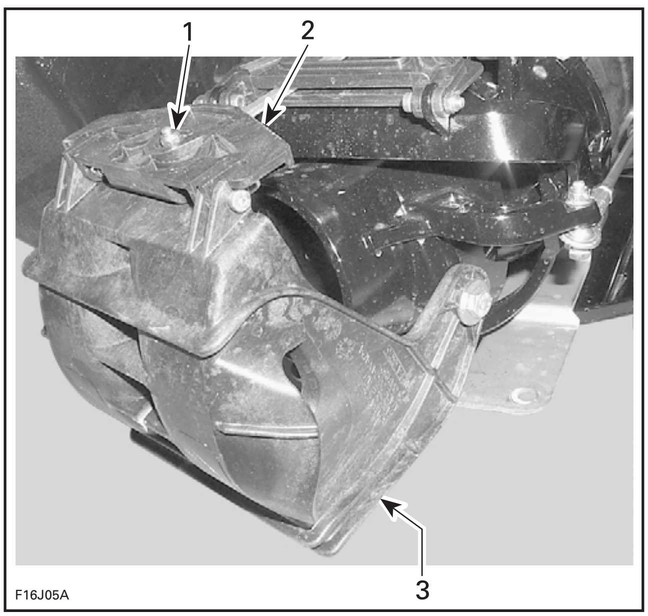
1. *Bolt*
2. *Cable end*
3. *Cable lever*
4. *Lock nut*

Unscrew and remove 2 Allen screws **no. 36** retaining reverse gate to support **no. 37** and remove reverse gate.

Pivot Support

Remove reverse gate.

Unscrew pivot bolts **no. 38**.



1. *Pivot bolts*
2. *Pivot support*
3. *Reverse gate*

Withdraw pivot support.

Connecting Rod

Remove:

– reverse gate
– pivot bolt **no. 89**.

Withdraw connecting rod.

Pivot Triangle

Remove:

– reverse gate
– connecting rod
– pivot bolts **no. 40**.

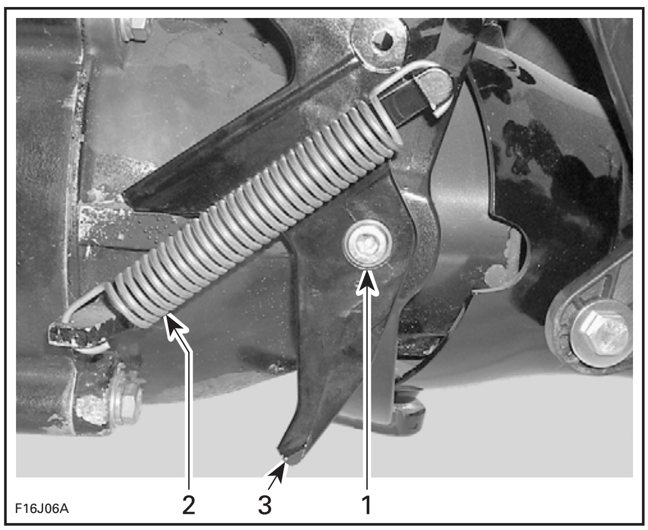
Withdraw pivot triangle **no. 41**.

Pivot Arm

Remove:

– reverse gate
– connecting rod
– spring
– pivot bolts **no. 42**. Take note of bushing size for reinstallation.

Withdraw pivot arm **no. 43**.



1. *Pivot bolts (each side)*
2. *Spring*
3. *Pivot arm*

Nozzle

RX and RX DI Models

Disconnect steering cable from jet pump nozzle **no. 1**.

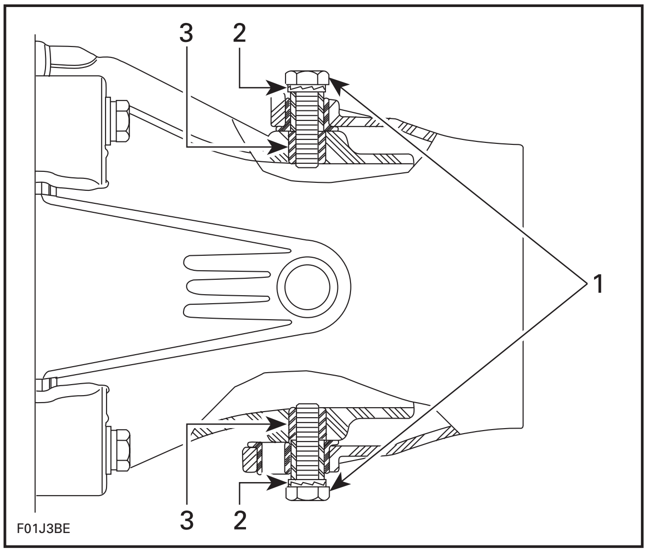
Remove:

– reverse gate
– spring
– pivot bolts **no. 42** retaining pivot arm and VTS ring to nozzle.

Remove nozzle.

GTX DI Model

Remove 2 retaining screws **no. 2**, 2 sleeves **no. 44**, 4 locking disks **no. 45**.



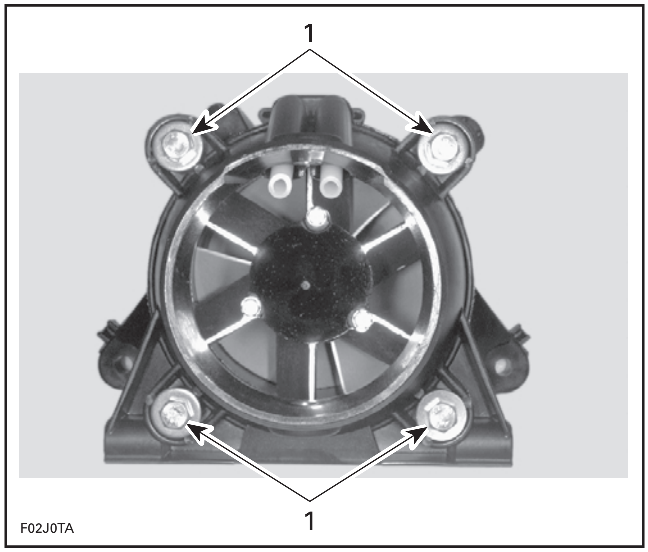
TYPICAL
1. *Screw*
2. *Locking disks*
3. *Sleeve*

Remove nozzle.

Venturi

Remove nozzle **no. 1** prior removing venturi **no. 9**.

Remove 4 retaining screws and withdraw venturi.



1. *Remove screws*

Jet Pump Housing

RX and RX DI Models

Detach:

– reverse cable
– VTS link rod.

GTX DI Model

Detach ball joint of reverse cable from reverse gate.

All Models

Disconnect steering cable from jet pump nozzle.

Loosen 4 hexagonal nuts **no. 4** and remove flat washers and lock washers from jet pump housing.

Remove jet pump with a wiggle movement.

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, 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.

Cover

With pump assembly in horizontal position (venturi and nozzle removed), remove 3 retaining screws **no. 16**.

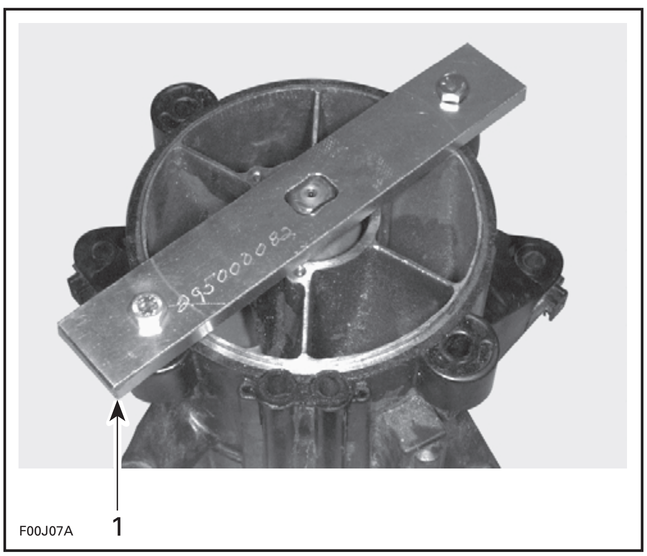
Place container under cover **no. 15** to catch oil.

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.

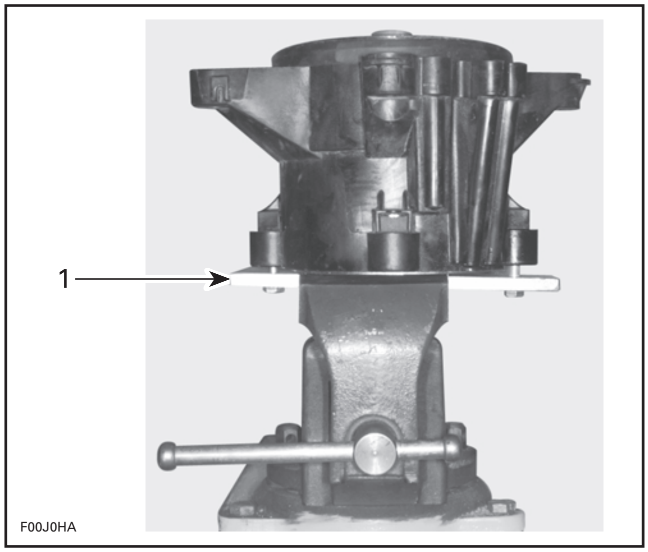
Using 2 screws previously removed from venturi, secure shaft holder to housing.



1. *Shaft holder*

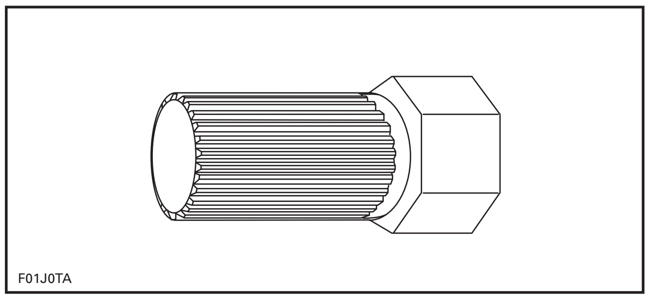
Heat impeller shaft end with a propane torch to approximately 150°C (300°F) to break the Loctite bond before to remove impeller. Do not heat impeller directly.

Install shaft holder in a vice.

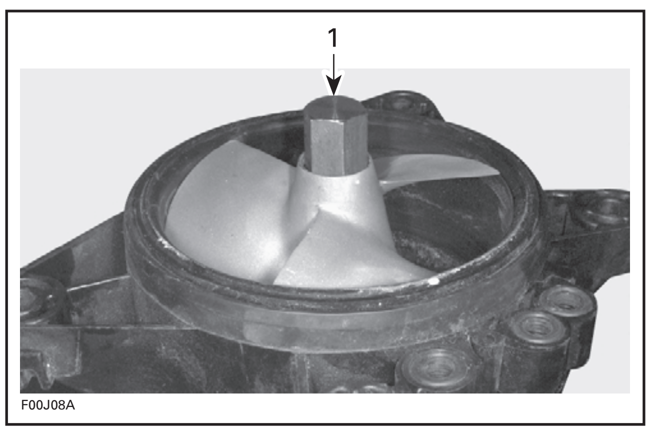


1. *Shaft holder*

Impeller is loosened using impeller remover tool (P/N 295 000 001).



Insert special tool in impeller splines.



1. *Impeller remover tool*

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

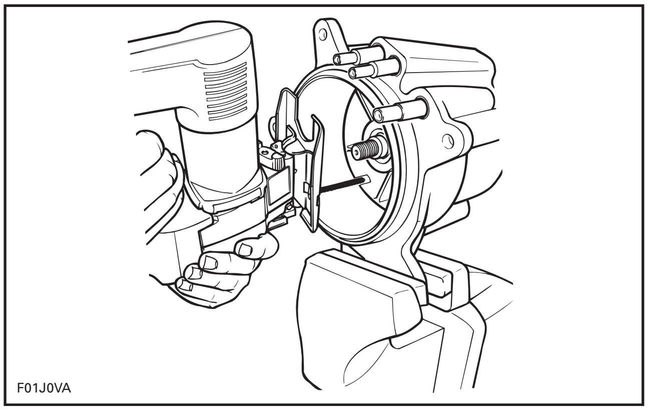
Place jet pump housing in a vise with soft jaws. It is best to clamp housing using a lower ear.

Remove wear ring screws.

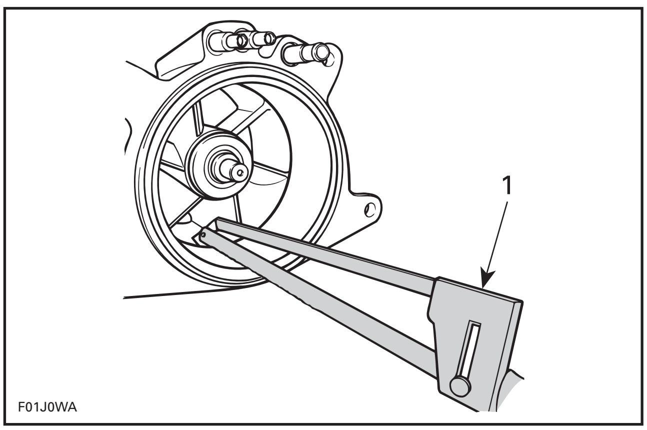
Cut wear ring at two places.

NOTE: Wear ring can be cut using a jigsaw, a small grinder or a low clearance hacksaw such as Snap-on HS3 or equivalent.

CAUTION: When cutting ring, be careful not to damage jet pump housing.



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.

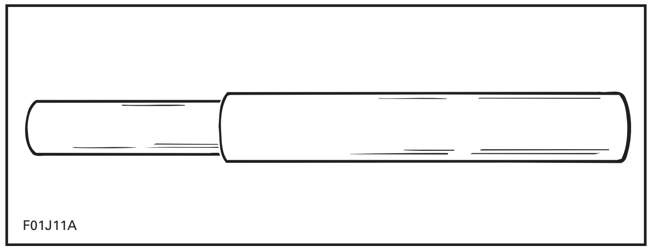
Impeller Shaft

Remove shaft holder tool.

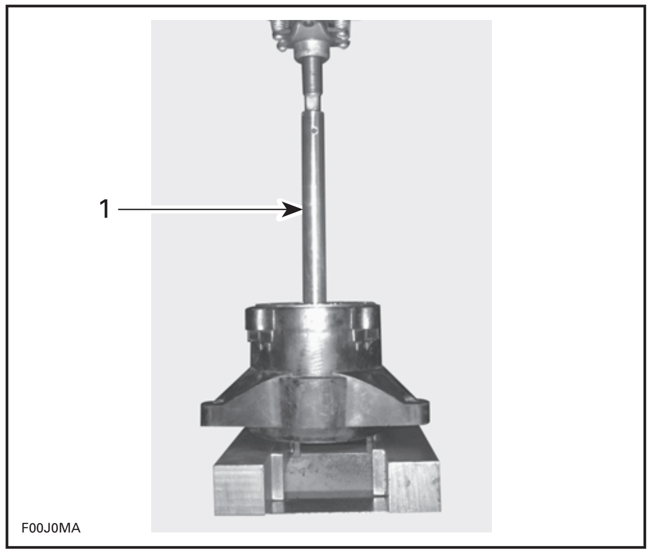
Remove impeller shaft **no. 21** with thrust washer and thrust bearing.

Seal and Needle Bearing

Remove seal **no. 19** and bearings **no. 20** 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

Thoroughly clean jet pump housing by applying Loctite Stripper (P/N 293 110 004). Allow it some time to dissolve the old dried Loctite (10 to 15 minutes).

⚠ WARNING

Technician should wear gloves when using this cleaning product.

CAUTION: **DO NOT use Loctite Stripper on wear ring since it will cause irreparable damage to it.**

Wipe Loctite Stripper with a clean cloth.

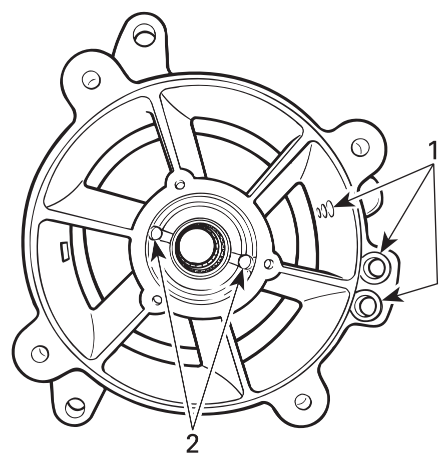
Make sure surface is cleaned and dried of Loctite Stripper.

Sealant 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.



F01J13A

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.

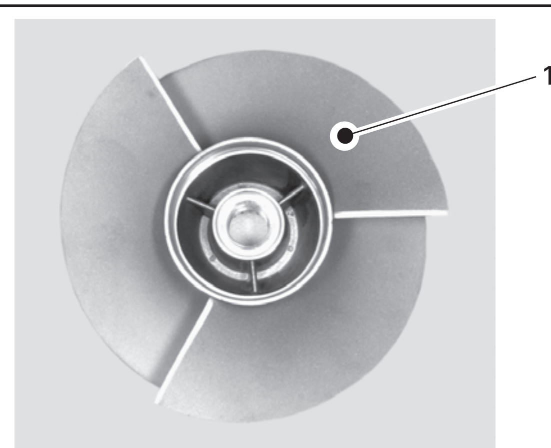
Examine impeller in wear ring for distortion.

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.

F02J0VB

1. *Replaced if blunted round or damaged*

Check impeller for cavitation damage, deep scratches or any other damage.



F02J0UA

1. *Check for cavitation, deep scratches or other damage*

Wear Ring

Check wear ring **no. 18** 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.

Needle Bearing and Impeller Shaft

WEAR

Inspect needle bearings **no. 19** 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. 21**.

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.

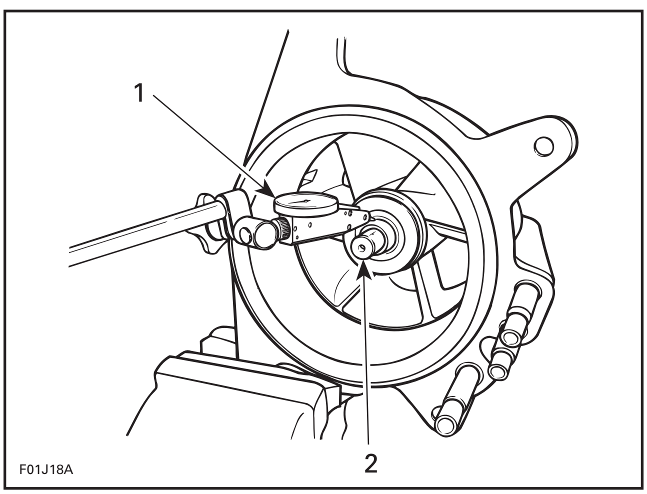
Radial play of impeller shaft is checked with shaft in housing, without impeller.

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.

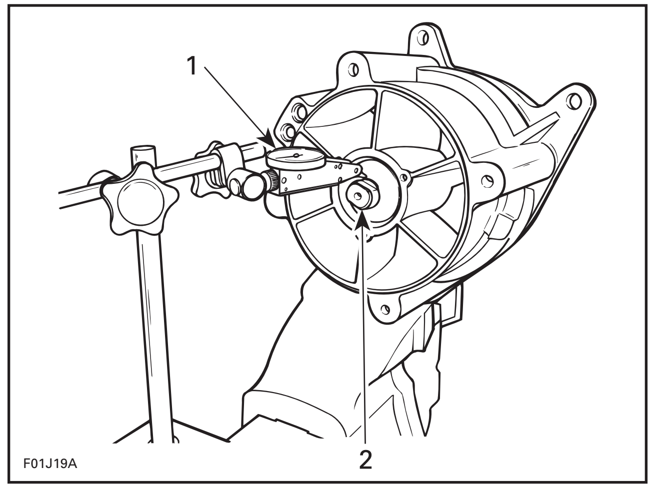
Move shaft end up and down. Difference between highest and lowest dial gauge reading is radial play.

Maximum permissible radial play is 0.05 mm (.002 in).



TYPICAL — MEASURING IMPELLER SHAFT RADIAL PLAY
1. *Dial gauge*
2. *Measure close to 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.

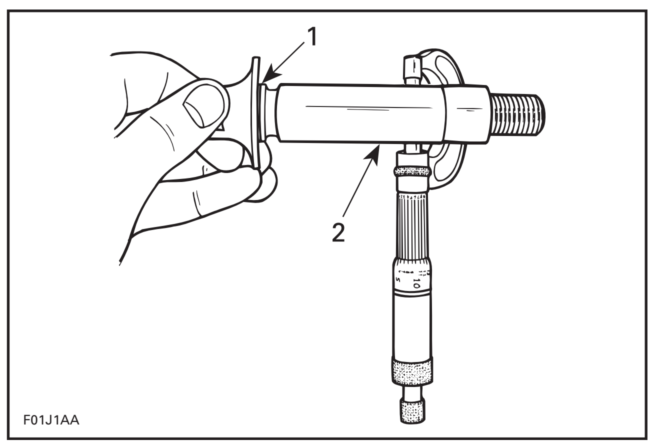


TYPICAL — MEASURING IMPELLER SHAFT RADIAL PLAY
1. *Dial gauge*
2. *Measure close to flats at shaft end*

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).

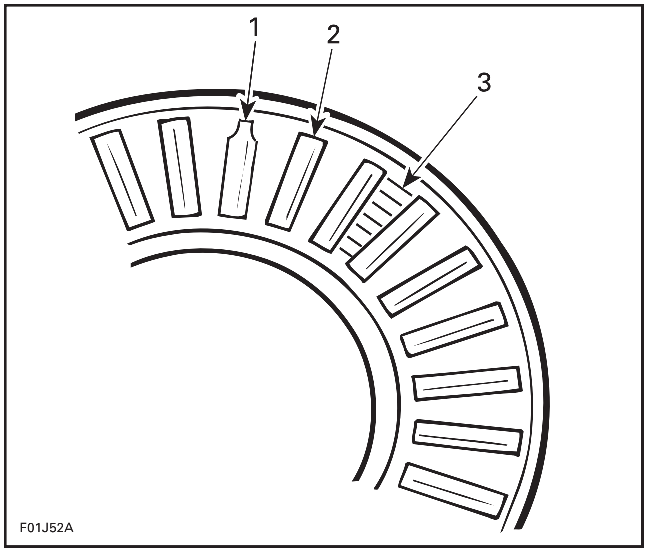


1. *Inspect for wear at the bearing pilot*
2. *Radial bearing raceway*

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. 22**, thrust bearing **no. 23** 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*

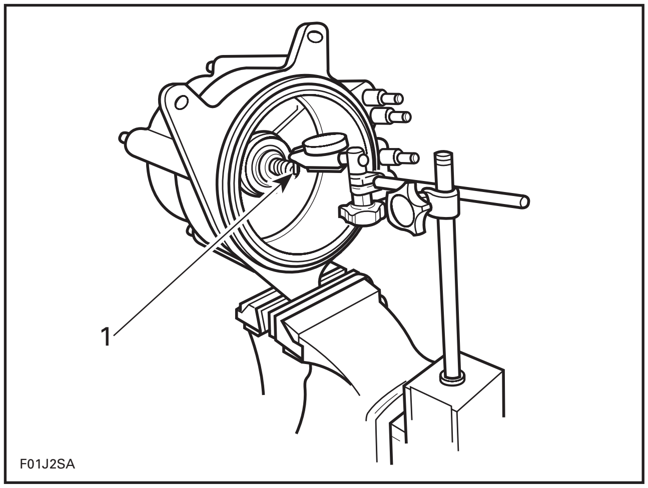
NOTE: When replacing either washer or bearing, it is recommended to renew both.

Cover and Impeller Shaft

END PLAY

End play of impeller shaft **no. 21** is checked with shaft in housing, without impeller and with cover **no. 15** 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.

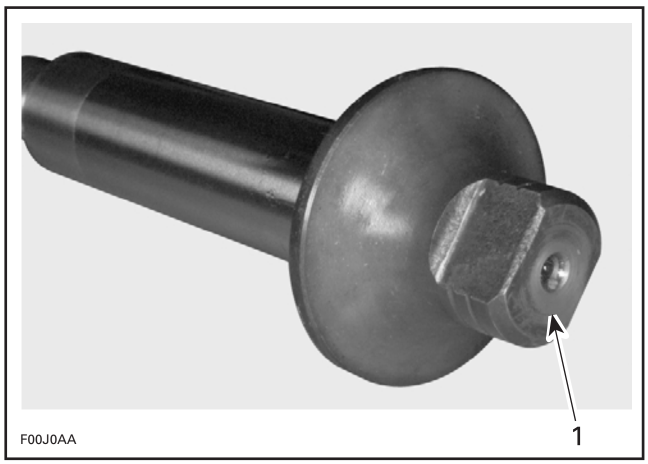


1. *Tip on shaft end*

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.

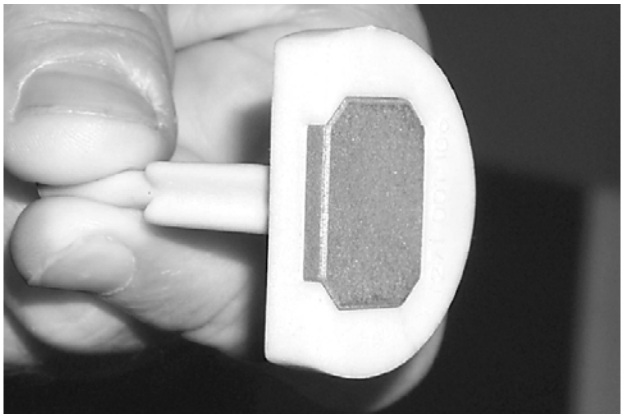
Inspect impeller shaft nose for wear.



1. *Impeller shaft nose*

Anti-Rattle Pusher

Check for melted plastic around metal pad. If so, replace it.



F08J05A

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 event if it seems good.

ASSEMBLY

Wear Ring

Apply Loctite 648 (P/N 420 899 788) on outer side of wear ring before reassembly.

To install ring in housing, use a square steel plate of approximately 180 × 180 mm × 6 mm thick (7 × 7 in × 1/4 in) and a press.

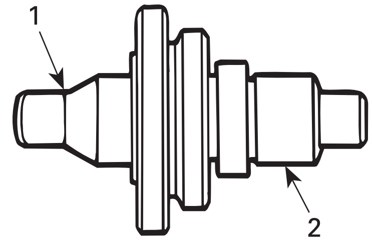
Manually engage ring in housing making sure it is equally inserted all around. Press ring until it seats into bottom of housing.

If a press is not readily available, a piece of wood such as a 2 × 4 in × 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.

Seal and Needle Bearing

Bearings **no. 20** and seal **no. 19** will be properly installed in housing using bearing/seal installer tool (P/N 295 000 107).



F01J4KA

BEARING/SEAL INSTALLER TOOL

1. *Seal side*
2. *Bearing side*

For outlet end of housing use inner bearing installer tool P/N 529 035 609.

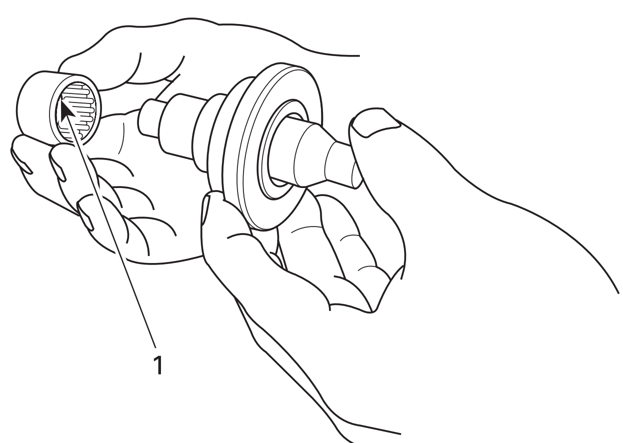
F08B01A

CAUTION: Failure to use this tool will cause major damage to the pump.

NOTE: Install seal with the spring toward the outside.

Stamped end of bearings (showing identification markings) must be located toward outside of housing.

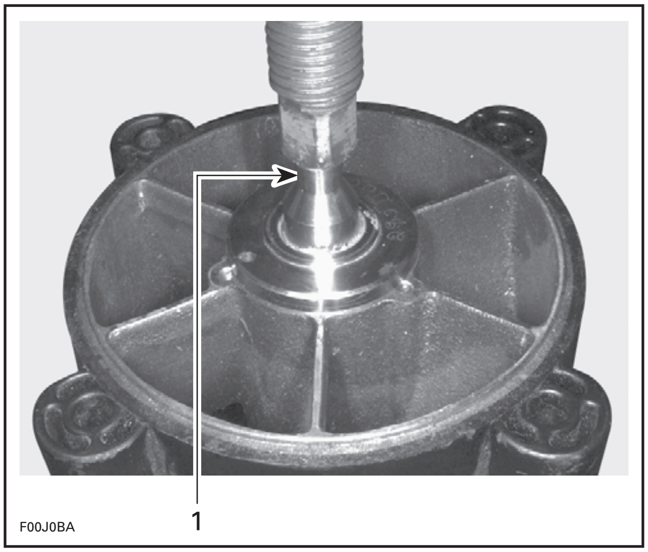
Properly insert bearing on tool. Using an arbor press only, push tool until tool flange contacts housing. Proceed the same way for both bearings.



F01J1HA

1. *Stamped end this side*

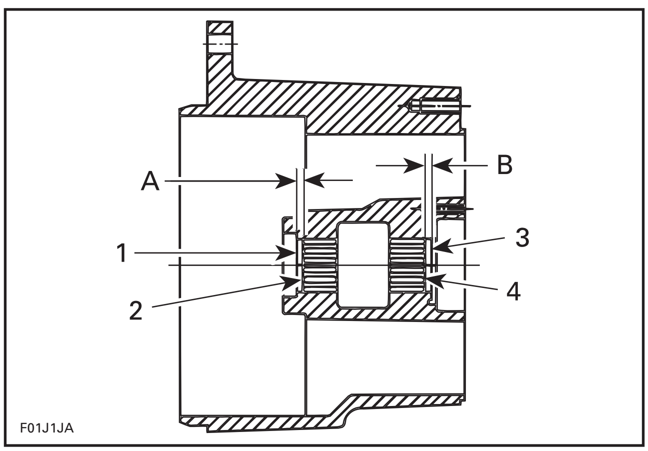
CAUTION: Never hammer the bearing into its housing.



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 3 mm (.080 - .120 in) inside reservoir measured from thrust washer seat. Refer to following illustration.



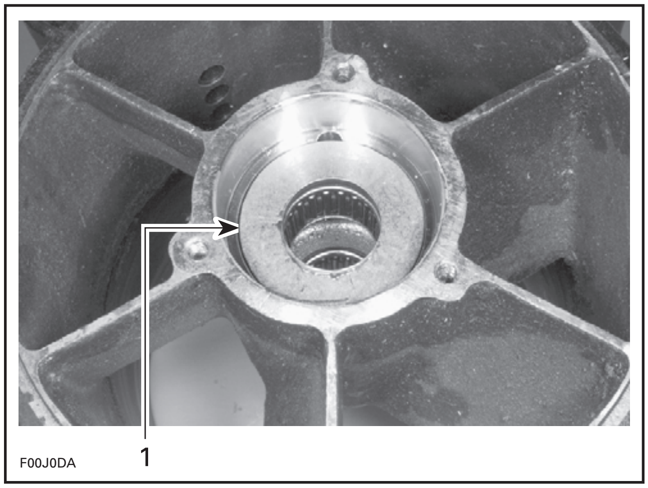
1. *Seal seat*
2. *Stamped end of bearing*
3. *Thrust washer seat*
4. *Stamped end of bearing*

A. *1.5 - 2.5 mm (.060 - .100 in)*
B. *2 - 3 mm (.080 - .120 in)*

Thrust Washer

Position jet pump housing **no. 7** with the stator vanes on top.

Insert thrust washer **no. 22** in the stator seat.

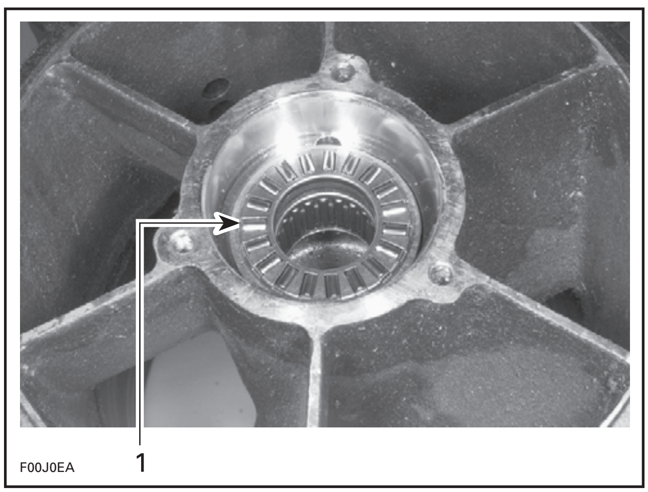


1. *Thrust washer properly installed in stator seat*

Thrust Bearing

Apply SEA-DOO JET PUMP SYNTHETIC OIL (P/N 293 600 011) on both sides of thrust bearing.

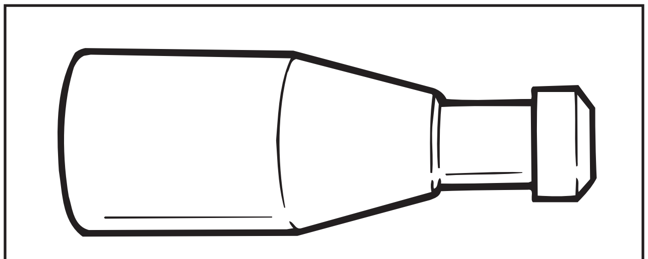
Position thrust bearing **no. 23** on thrust washer **no. 22**.



1. *Thrust bearing on top of thrust washer*

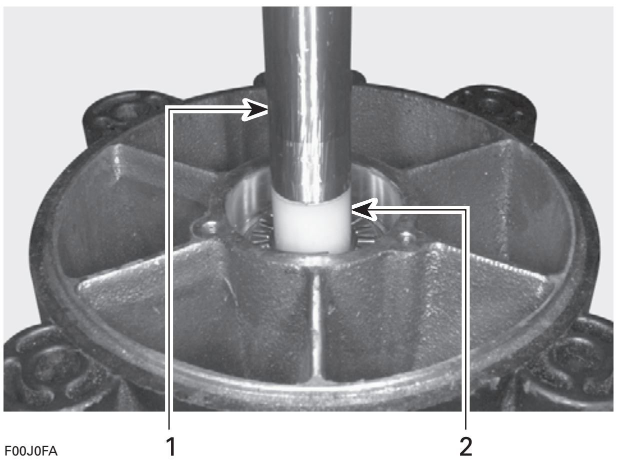
Impeller Shaft

To prevent seal lip damage when inserting impeller shaft, use impeller shaft guide (P/N 295 000 002).



F01J1OA

Insert tool onto shaft end then carefully install shaft in jet pump housing.



F00J0FA

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.

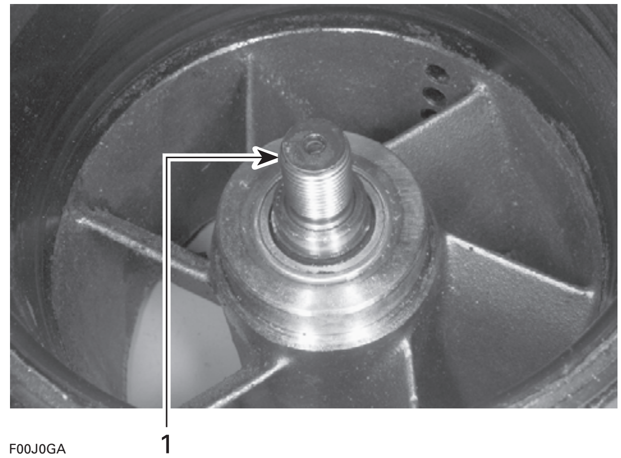
Remove shaft guide.

Impeller

Apply Loctite primer N (P/N 293 600 012) on threads of impeller shaft **no. 21**. 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.

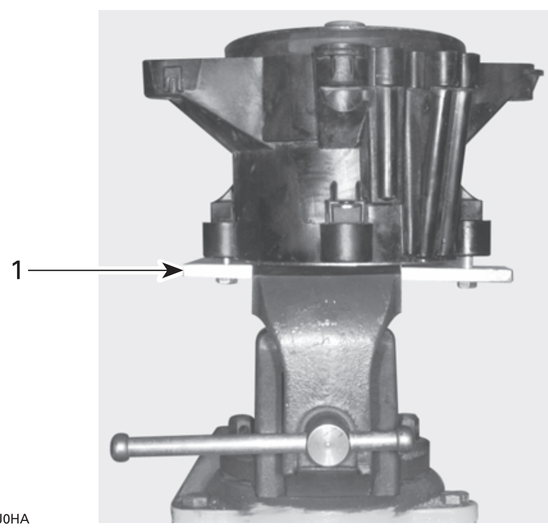


F00J0GA

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.



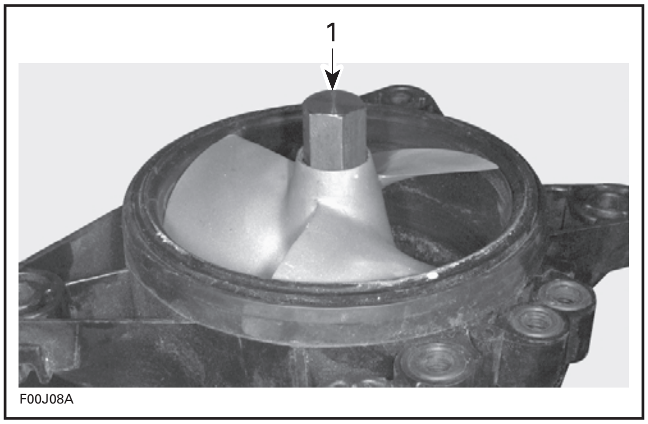
F00J0HA

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*

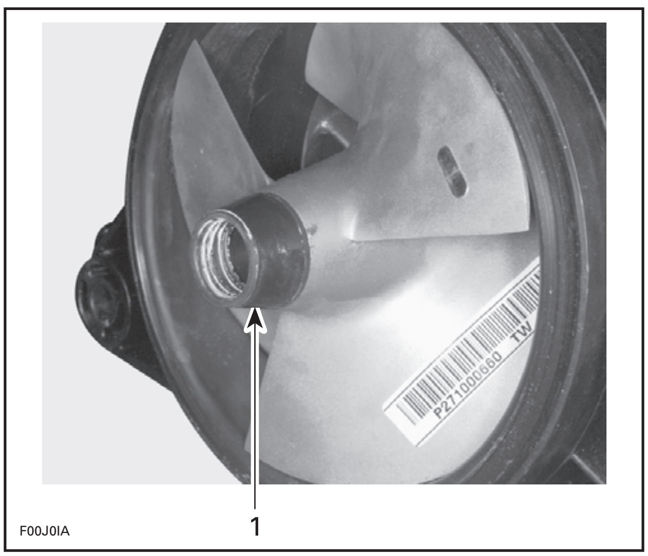
CAUTION: Make sure thrust washer and bearing are not wedged in shaft groove. To check, manually pull and push jet pump housing, some axial play must be felt.

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.

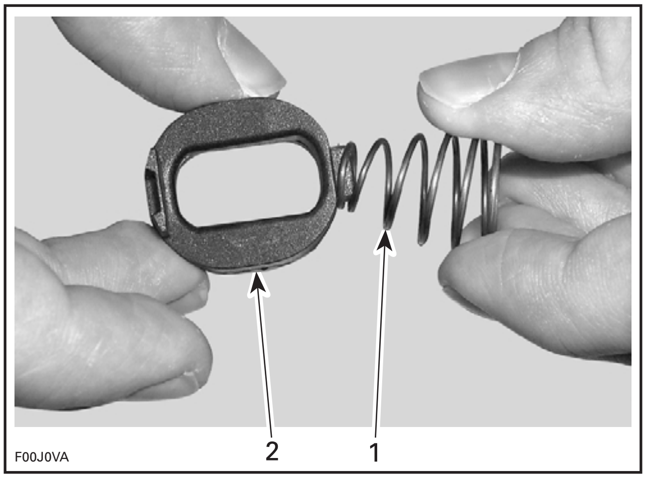
Insert a new boot **no. 13** and ring **no. 14** to impeller.



1. *Boot and ring*

Anti-Rattle System

Install spring **no. 27** on slider **no. 26**.



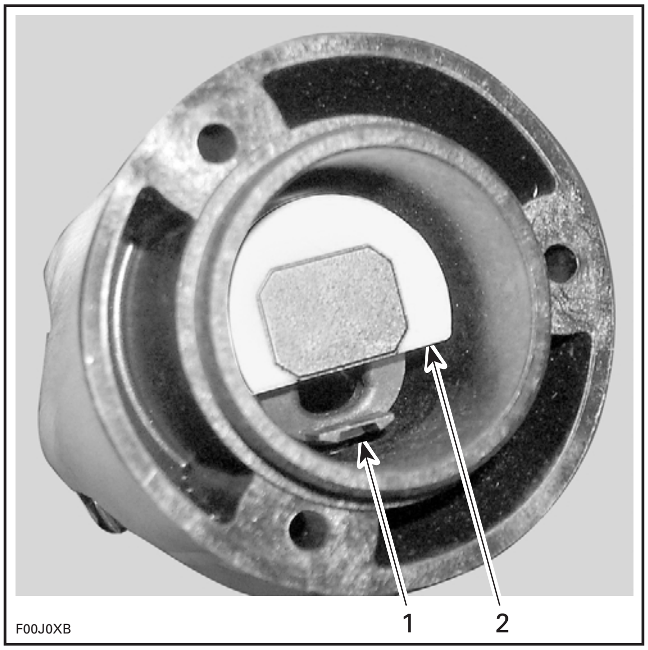
1. *Spring*
2. *Slider*

Insert slider and spring into cover.

NOTE: Align the longer slider tab with hole.

Apply synthetic grease on the stem of pusher **no. 25**.

Install pusher into cover. Place the flat side in front of slider tab.



1. *Flat side of pusher*
2. *Slider tab*

Install O-ring **no. 24** 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 tools for 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 corrected. If not, redo the procedure.

Add oil.

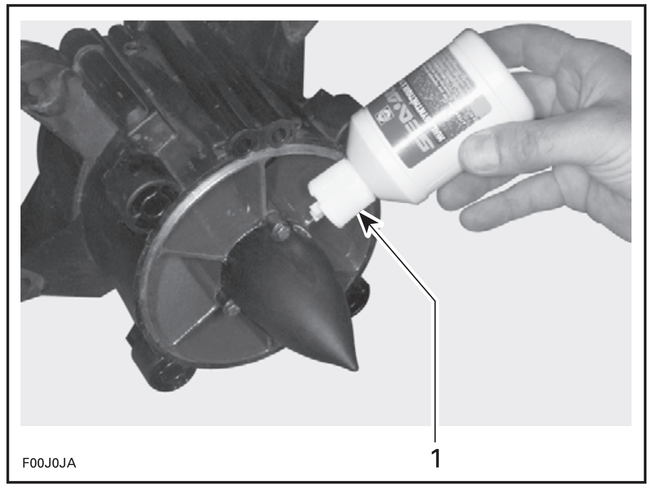
Oil Fill

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.

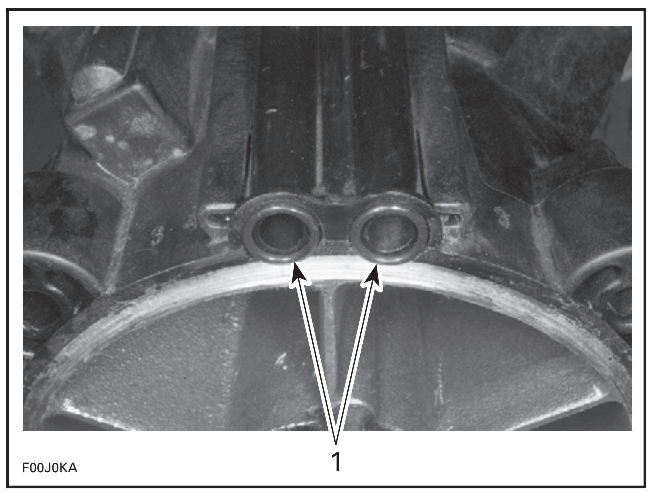


TYPICAL

1. *Pour oil slowly until it is level with bottom of filler hole*

Venturi

If needed, install new O-rings **no. 8** around bailer passages.



1. *O-rings*

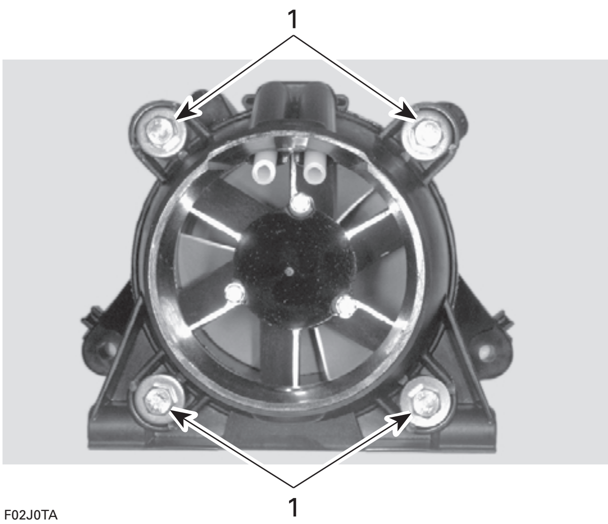
Apply Loctite 518 (Gasket Eliminator) on mating surface.

Position venturi **no. 9** with bailer passages on top.

Apply Loctite 243 (blue) on threads of screws **no. 10**.

NOTE: On the GTX DI model, install the reverse support with the venturi.

Install screws **no. 10**, lock washers **no. 11** and flat washers **no. 12** then torque to 21 N•m (16 lbf•ft).



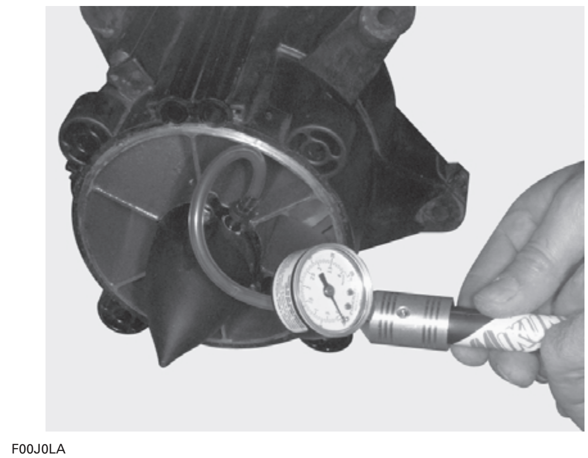
1. *Torque screws to 21 N•m (16 lbf•ft)*

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. 19** 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.

INSTALLATION

Jet Pump Housing

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. 6**, lock washers **no. 5** and nuts **no. 4**. 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.

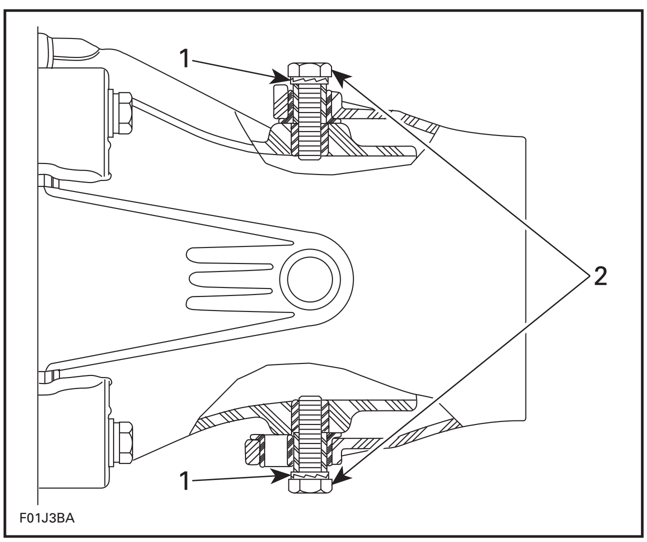
Nozzle

GTX DI Model

Insert bushings **no. 3** in nozzle **no. 1**, positioning their flanges from inside of nozzle.

Insert sleeves **no. 44** in bushings **no. 3**.

Install nozzle on venturi; 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. 2** and locking disks **no. 45** then torque to 20 N•m (15 lbf•ft).



TYPICAL
1. *Locking disks*
2. *Torque screws to 20 N•m (15 lbf•ft)*

> ⚠ **WARNING**
> Whenever removing screw always renew locking disks. Screw must be torqued as specified.

Pivot Triangle

Install head bolts toward inside.

NOTE: Make sure the pivot triangle turn freely.

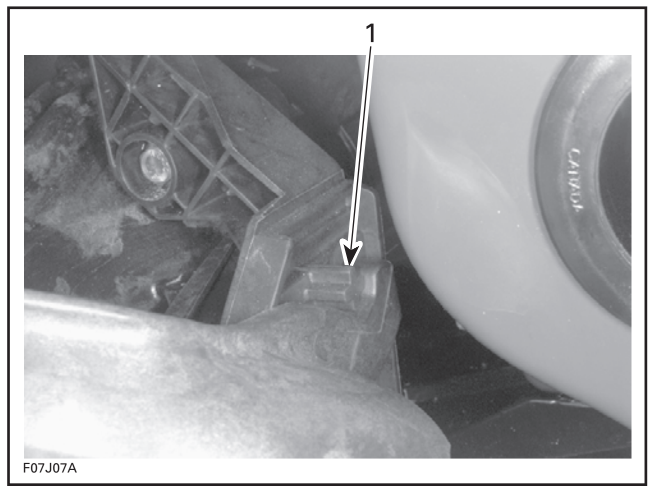
Reverse Gate

RX and RX DI

Install reverse gate with spacer and washer. Torque to 20 N•m (15 lbf•ft).

GTX DI Model

When installing the reverse gate, pay attention to position its lever behind the reverse gate support stopper.



1. *Stopper*

Steering Cable

Refer to STEERING SYSTEM section.

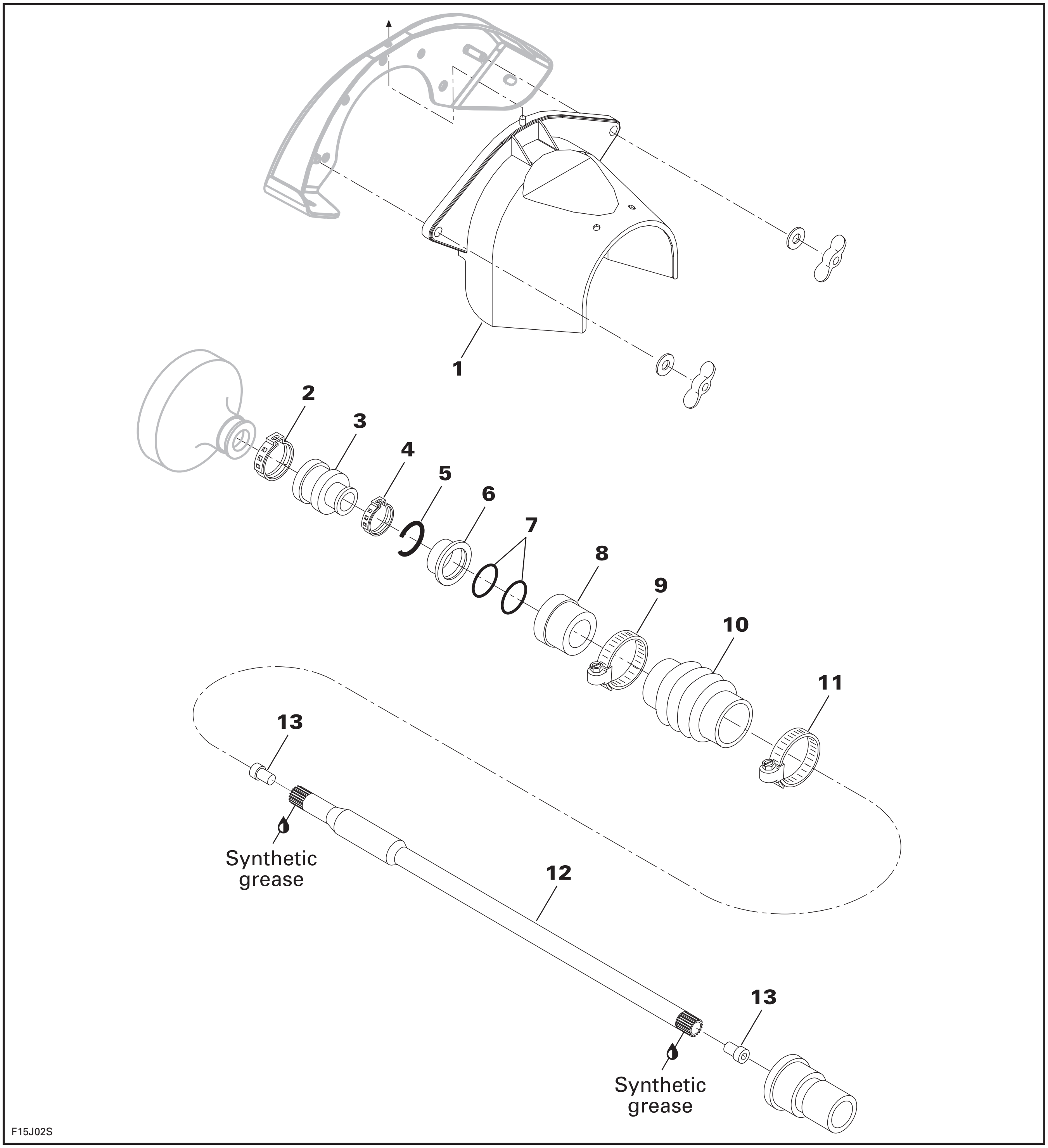
Trim System

Refer to VARIABLE TRIM SYSTEM section.

Reverse Cable

Refer to REVERSE SYSTEM section.

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

Remove seat(s).

Remove vent tube support or seat support.

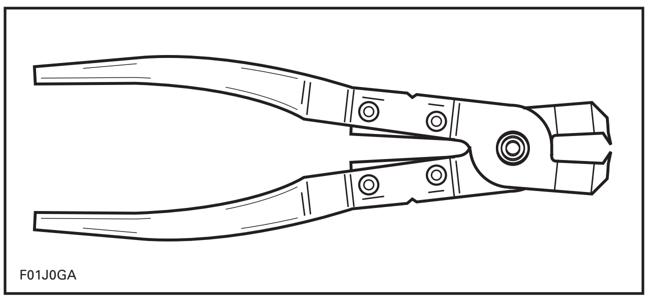
Remove plastic wing nuts retaining PTO flywheel guard **no. 1** to engine support.

Detach PTO flywheel guard from engine and withdraw from bilge.

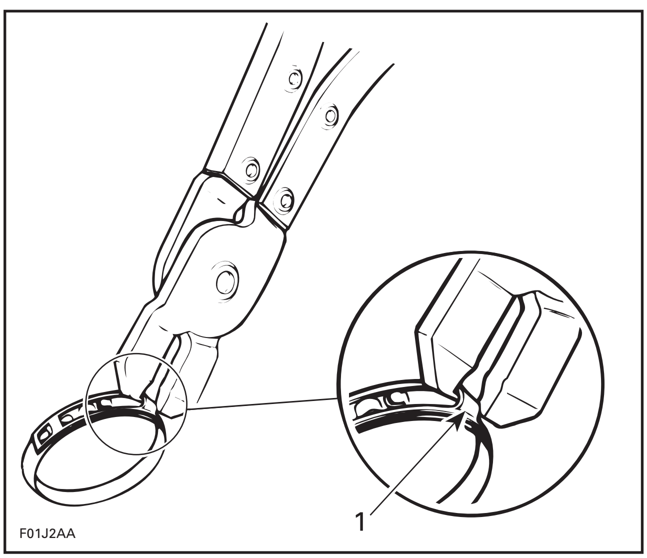
Large Clamp

Unfasten large clamp of PTO flywheel boot **no. 3** as follows:

– Use pliers (P/N 295 000 069).

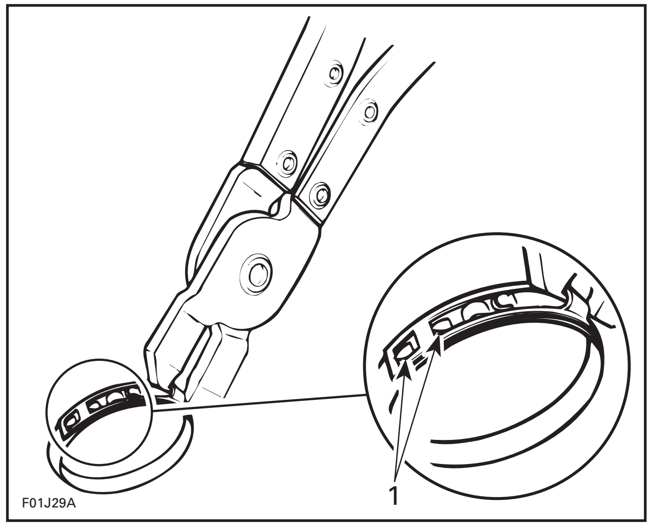


– Insert pointed tips of pliers in closing hooks.



TYPICAL
1. Closing hooks

– Squeeze pliers to draw hooks together and disengage windows from locking hooks.

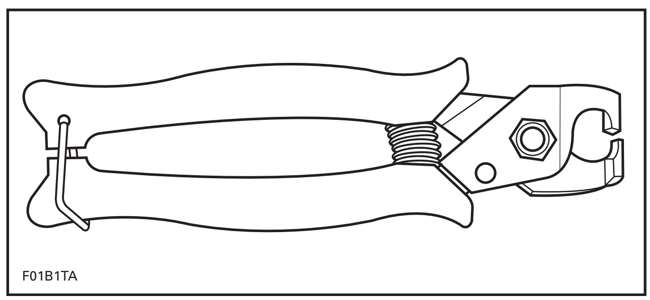


TYPICAL
1. Locking hooks

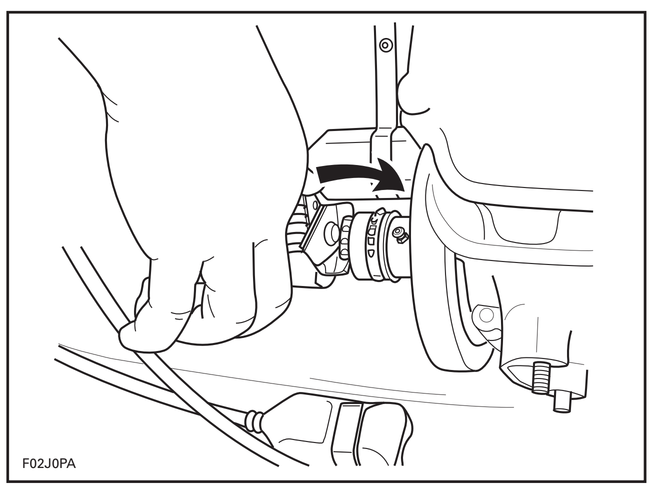
Small Clamp

Unfasten small clamp of PTO flywheel boot as follows:

– Use pliers (P/N 295 000 054).

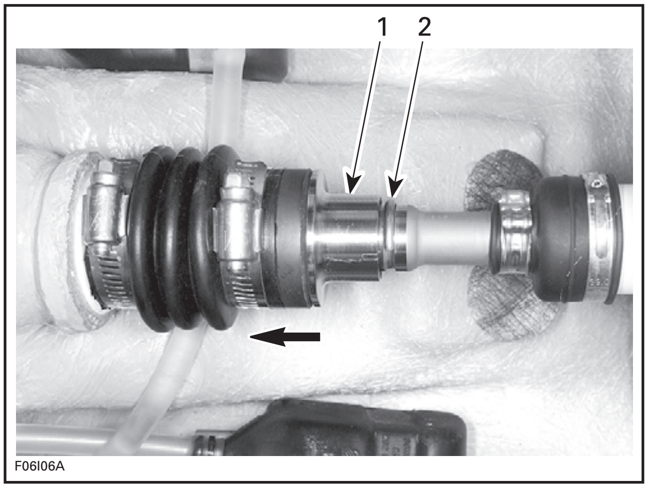


– To open clamp, place flat side of plier on clamp embossment, squeeze and twist plier.



Circlip and Floating Ring

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*

Drive Shaft

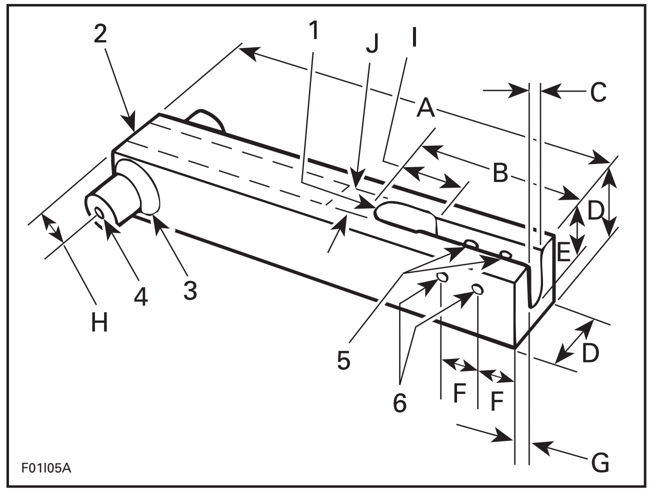
Simply pull out drive shaft.

NOTE: If the drive shaft is jammed into PTO flywheel, 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) × 305 mm (12 in)

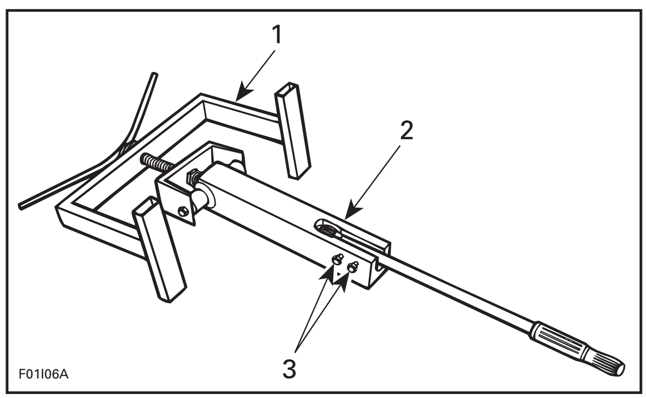
– 2 aluminum rods of 28.5 mm (1-1/8 in) dia. × 30 mm (1-3/16 in).



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)

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.

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**.

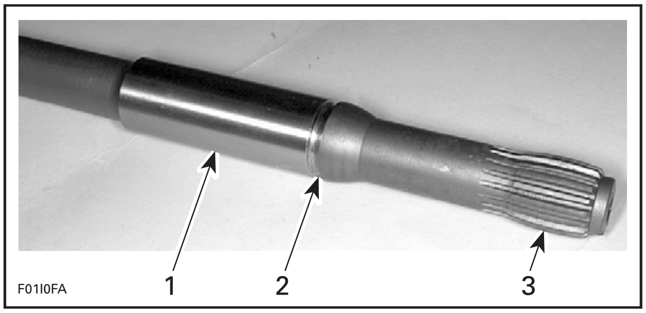
INSPECTION

Drive Shaft

Inspect condition of drive shaft and PTO flywheel splines.

Inspect condition of groove.

With your finger nail, feel machined surface of drive shaft. If any irregular surface is found, renew drive shaft.

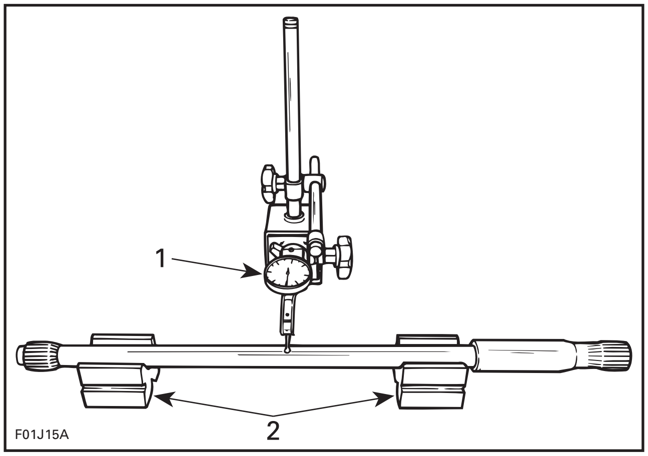


1. Surface condition
2. Groove condition
3. Splines condition

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).



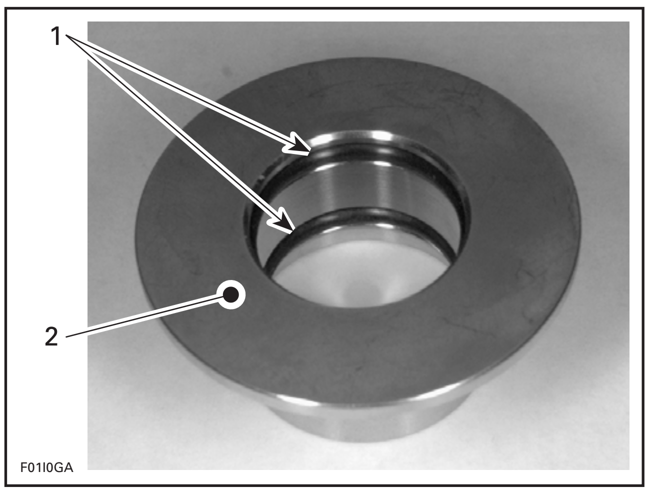
MEASURING DRIVE SHAFT DEFLECTION
1. Dial gauge
2. V-blocks

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.



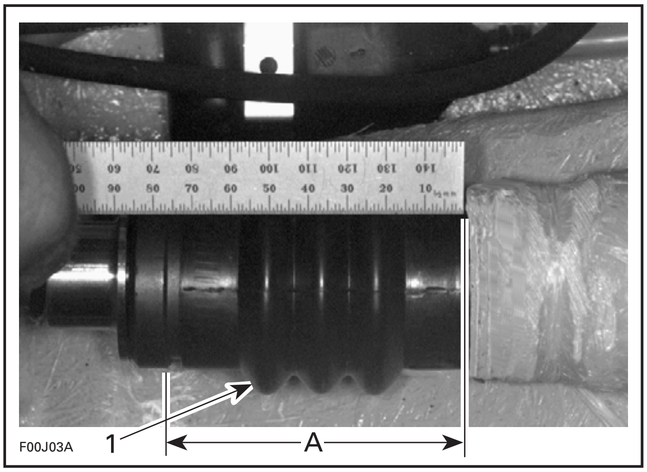
1. O-rings
2. Floating ring contact surface

Boot

To verify the preload of the boot **no. 10**, proceed as follows:

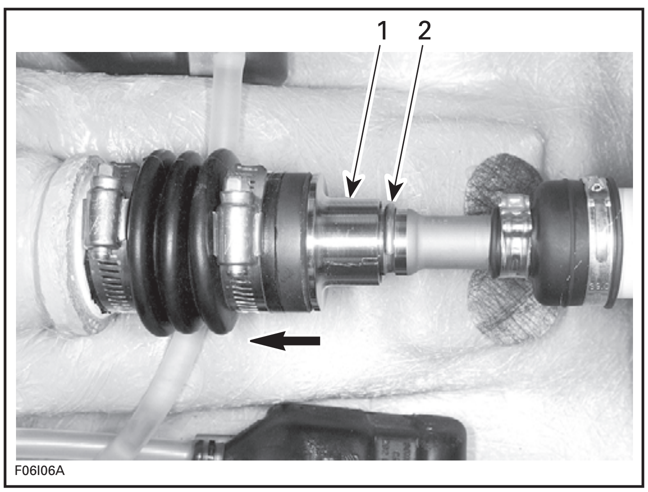
NOTE: To verify the boot preload and free length, jet pump and drive shaft must be installed.

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.



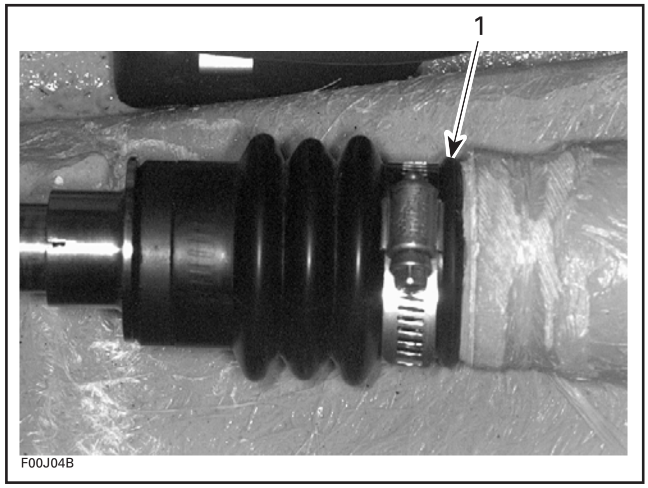
1. Push floating ring
2. Remove circlip

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.

INSTALLATION

Installation is essentially the reverse of removal procedure. However, pay particular attention to the following.

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.

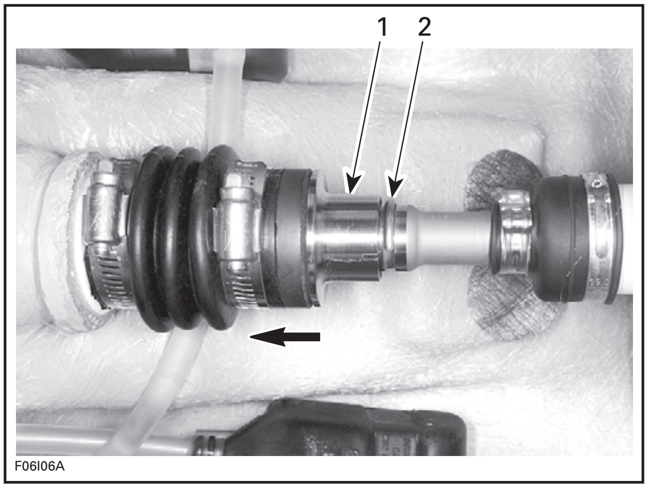
Insert drive shaft through carbon ring **no. 8** and floating ring **no. 6**.

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.

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*

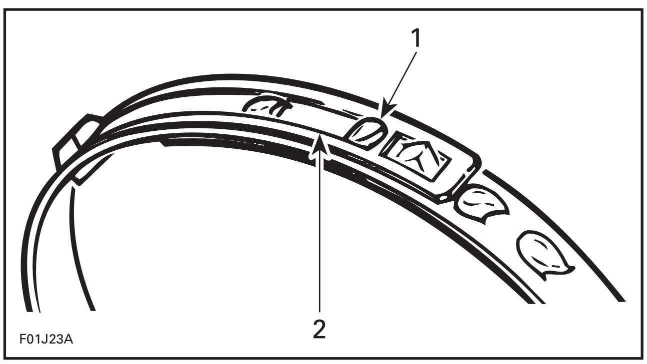
Slide the floating ring onto the circlip.

Large Clamp

Secure large clamp **no. 2** as follows:

– Use pliers (P/N 295 000 069) as for removal.

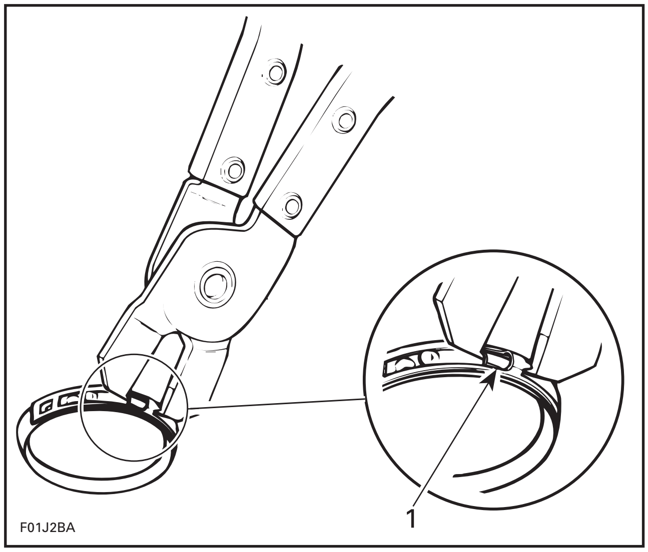
– Manually engage holding hook in large window. This is a pre-clamping position only.



PRE-CLAMPING POSITION

1. *Holding hook*
2. *Large window*

– Insert pointed tips of pliers first in closing hooks.

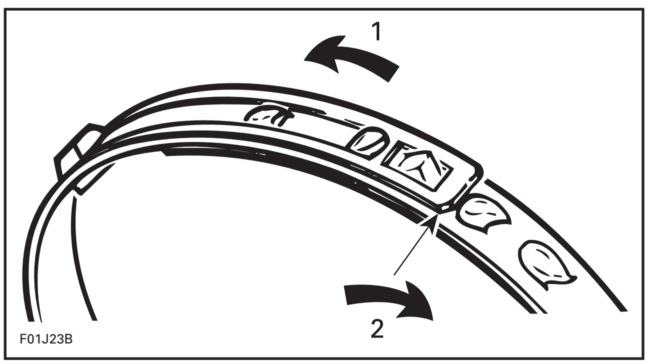


TYPICAL

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.

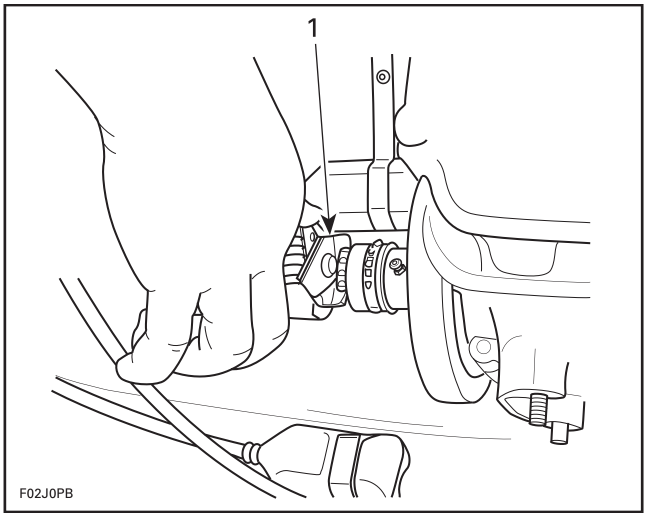
NOTE: At installation, clamp tail should be in opposite direction of engine rotation.



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.

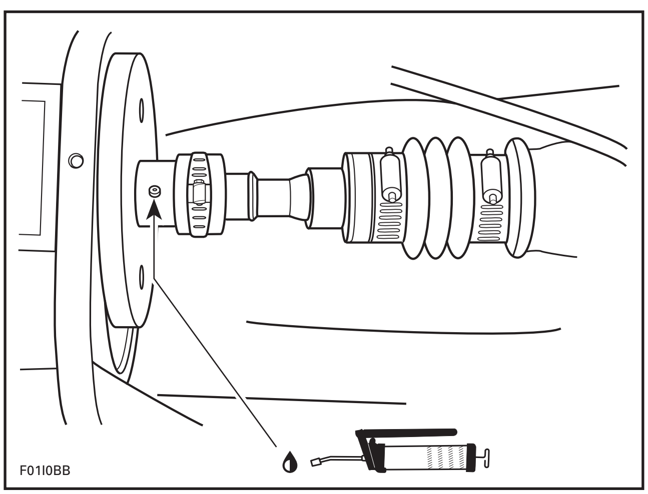


1. *Squeeze plier*

LUBRICATION

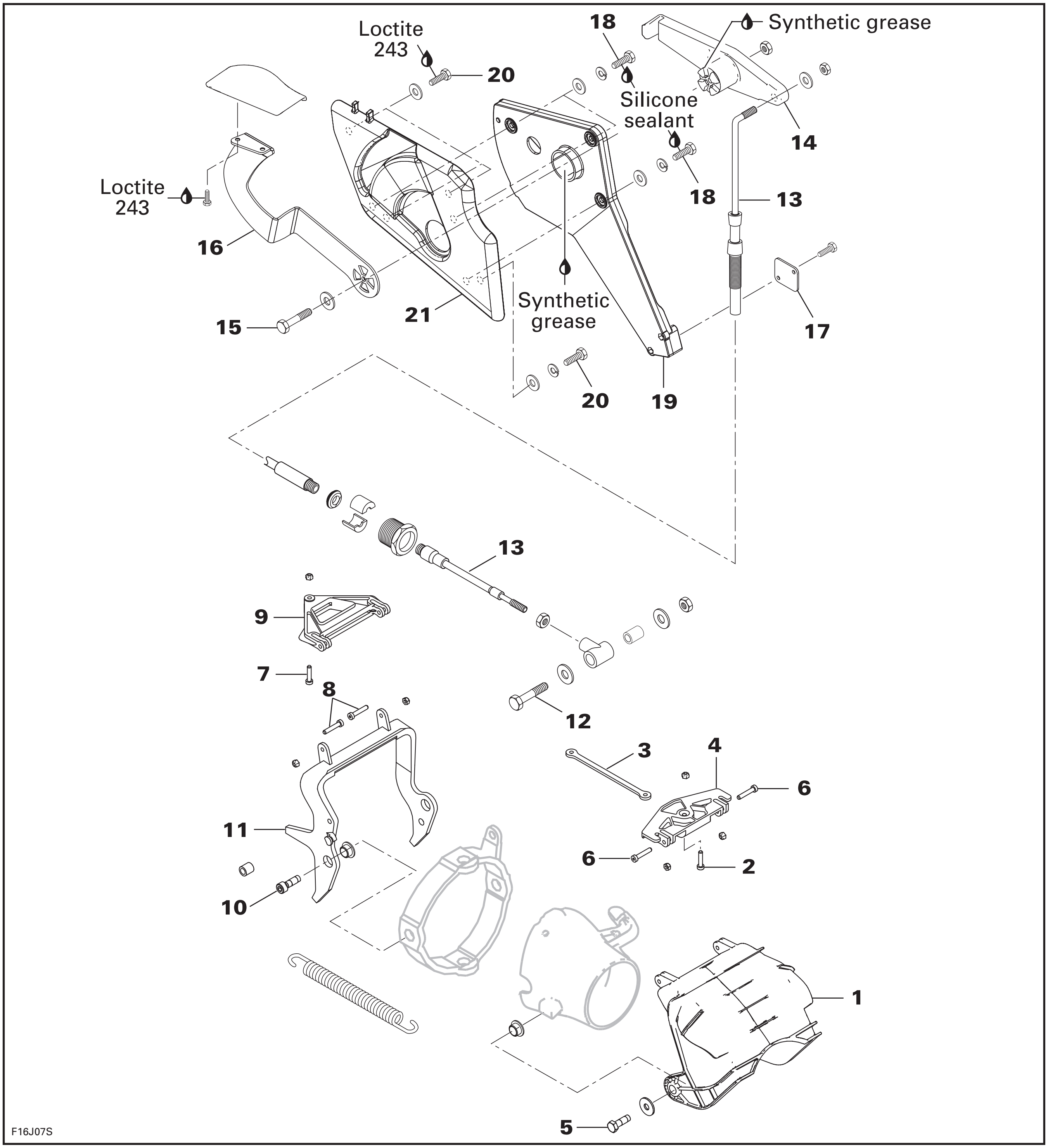
PTO Flywheel

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.



REVERSE SYSTEM

RX and RX DI Models



DISASSEMBLY

Reverse Gate

To remove reverse gate, refer to JET PUMP section.

Reverse Cable

Unscrew bolt **no. 12**, washers and the elastic stop nut retaining reverse cable **no. 13** on pivot arm.

Remove the glove box. Refer to HULL/BODY.

On the interior lever **no. 14**, unscrew the elastic stop nut and the washer retaining the reverse cable.

NOTE: Before removing reverse cable from hull, note cable routing for reinstallation.

Inner Lever

Detach the reverse cable from inner lever **no. 14**.

Unscrew the shift lever retaining bolt **no. 15**, washer and nut, then remove inner lever.

Shift Lever

Unscrew the shift lever retaining bolt **no. 15**, washer and nut.

Disengage the shift lever slots from inner lever tabs, then remove the shift lever **no. 16**.

Reverse Cable Support

Remove:

- shift lever
- inner lever
- bracket **no. 17**
- bolts **no. 18**.

Withdraw reverse cable support **no. 19**.

Handle Housing

Remove:

- shift lever
- inner lever
- reverse cable support
- bolts **no. 20**.

Then, remove handle housing **no. 21**.

INSPECTION

Visually inspect parts for wear or cracks. Replace all defective parts.

ASSEMBLY

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

Inner Lever

Apply synthetic grease on the inner lever pivot and in the reverse cable support hole.

Install the inner lever in a rotating movement. Engage properly the inner lever tabs in the shift lever slots.

Make sure the shift lever action is smooth and precise. Forward and reverse positions should be easy to select with a detent position between each.

Reverse Gate

Refer to JET PUMP section.

Reinstall glove box.

ADJUSTMENT

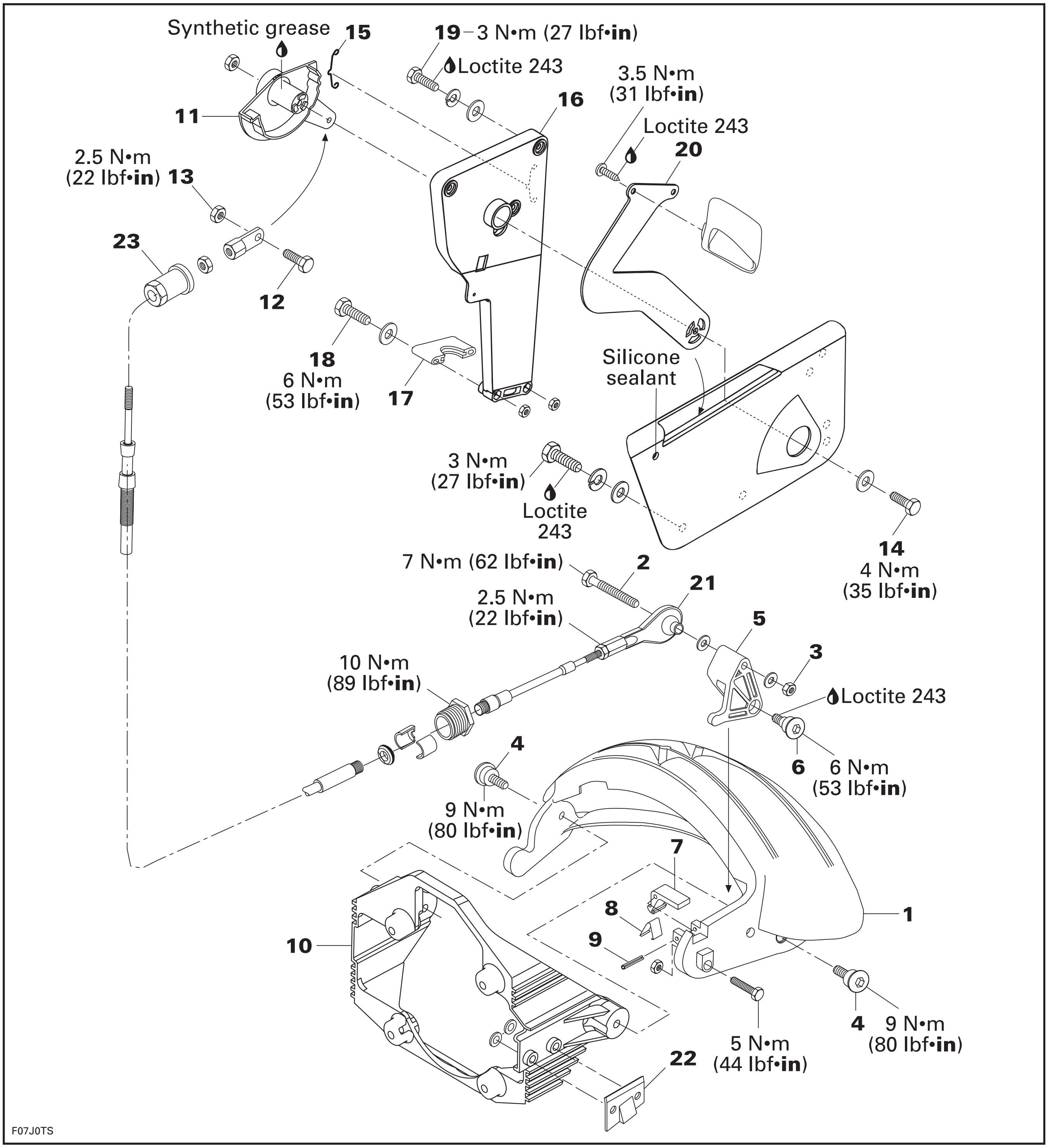
Put shift lever in forward position.

Place reverse gate in the up position.

Turn the joint at the end of reverse cable and place the hole in pivot arm and joint face to face.

Secure with bolt, washers, spacer and elastic stop nut. Torque to 7 N•m (62 lbf•**in**).

GTX DI Model


Synthetic grease
15
19
3 N•m (27 lbf•in)
Loctite 243
3.5 N•m
(31 lbf•in)
16
11
Loctite 243
20
2.5 N•m
(22 lbf•in)
13
23
12
18
6 N•m
(53 lbf•in)
17
Silicone
sealant
3 N•m
(27 lbf•in)
Loctite
243
14
4 N•m
(35 lbf•in)
7 N•m (62 lbf•in)
2
21
2.5 N•m
(22 lbf•in)
5
3
10 N•m
(89 lbf•in)
Loctite 243
4
6
6 N•m
(53 lbf•in)
9 N•m
(80 lbf•in)
7
8
1
9
10
4
9 N•m
(80 lbf•in)
5 N•m
(44 lbf•in)
22
F07J0TS

DISASSEMBLY

Reverse Gate

To remove reverse gate, refer to JET PUMP section.

Cable Lever

Remove Allen screw **no. 6** and detach cable lever from reverse gate.

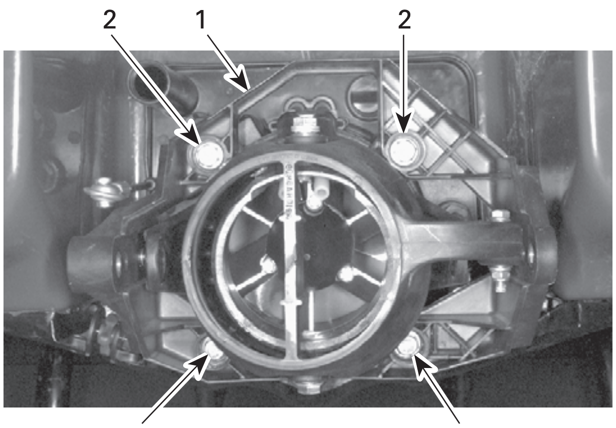
Pawl Lock and Spring

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.



F07J02A

1. *Reverse gate support*
2. *Remove bolts*

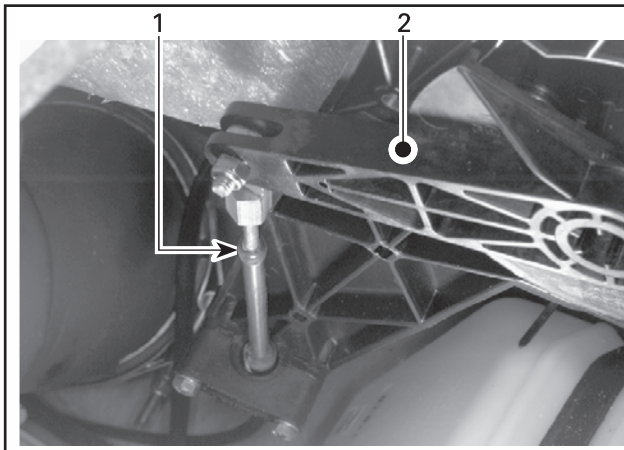
Inside Lever

Remove glove box to have access to the shifting lever mechanism.

F07L1FA

1. *Remove glove box*

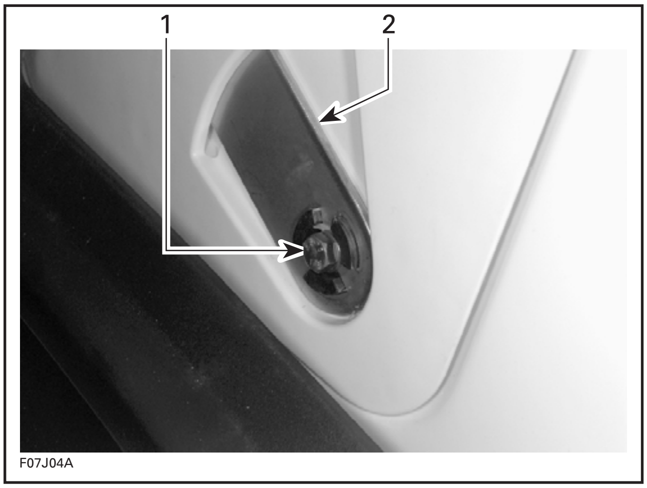
Remove bolt **no. 12** and lock nut **no. 13** retaining reverse cable end to interior lever **no. 11**.



F07J03A

1. *Reverse cable*
2. *Inner 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.

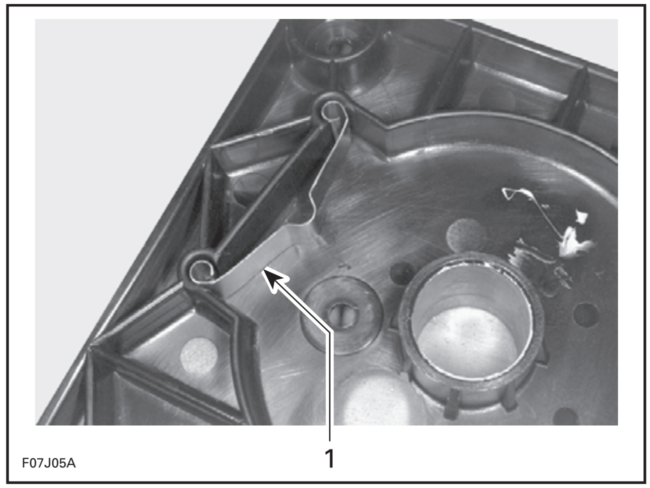
ASSEMBLY

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

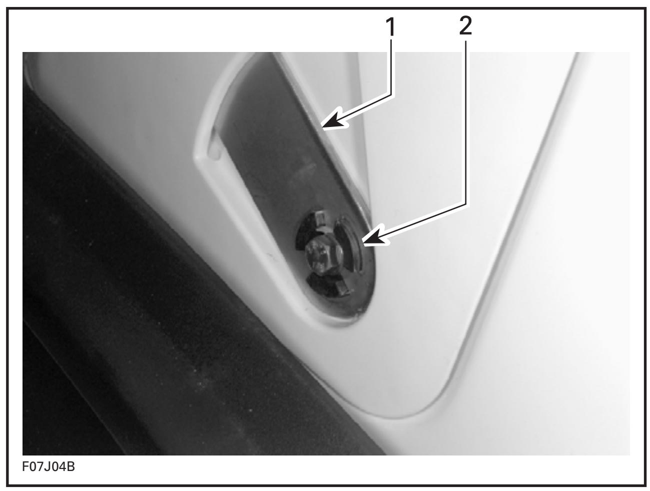
Make sure to properly install spring **no. 15** into interior lever **no. 11** as per following illustration.



1. *Spring*

Inner Lever and Shift Lever

Install the inner lever **no. 11** in a rotating movement. Engage properly the inner lever tabs in the shift lever slots.

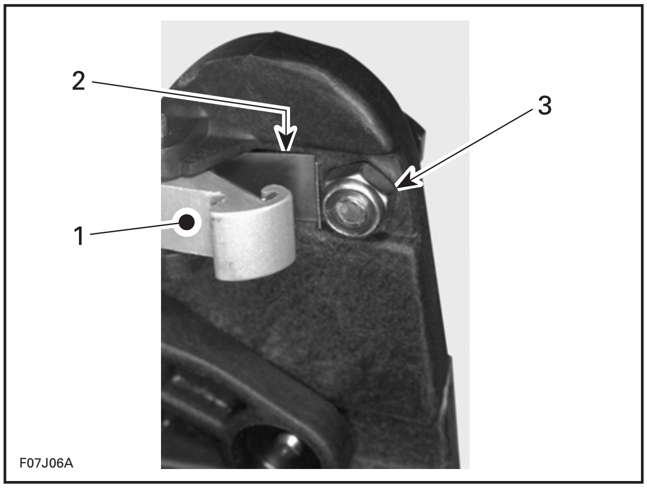


1. *Shift lever*
2. *Interior lever tabs*

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.



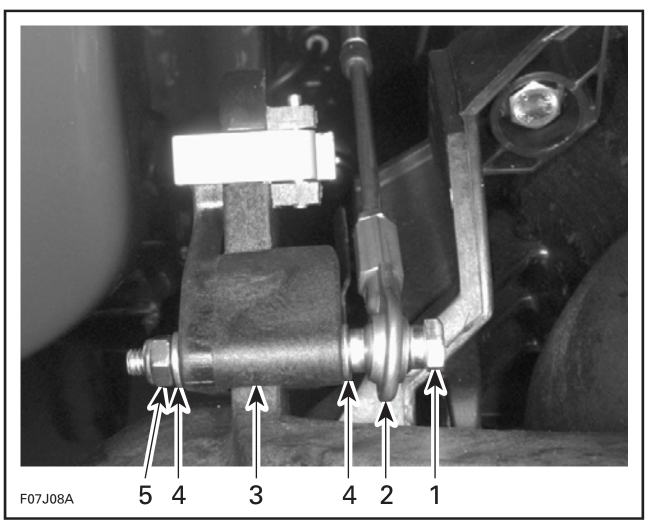
1. *Pawl lock*
2. *Spring*
3. *Stopper lock nut*

Reverse Gate

Refer to JET PUMP section.

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° ± 5°) to minimize tension on cable. Adjust as required.

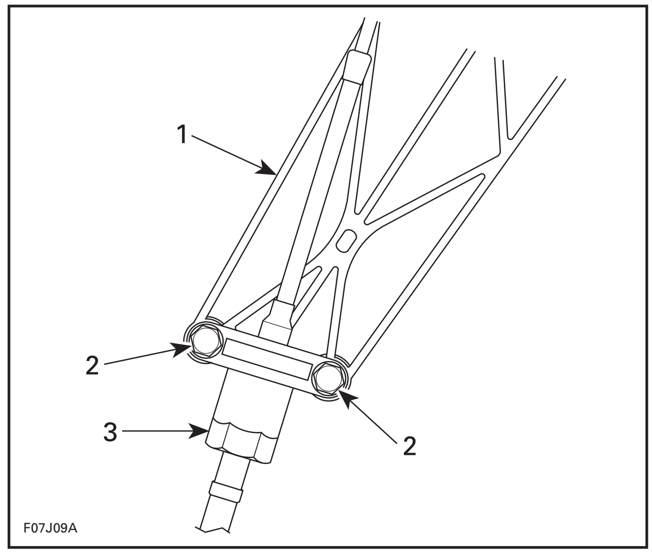
ADJUSTMENT

Put shift lever in forward position.

Pull shift lever approximately 50 mm (2 in) and push it back slowly in forward position.

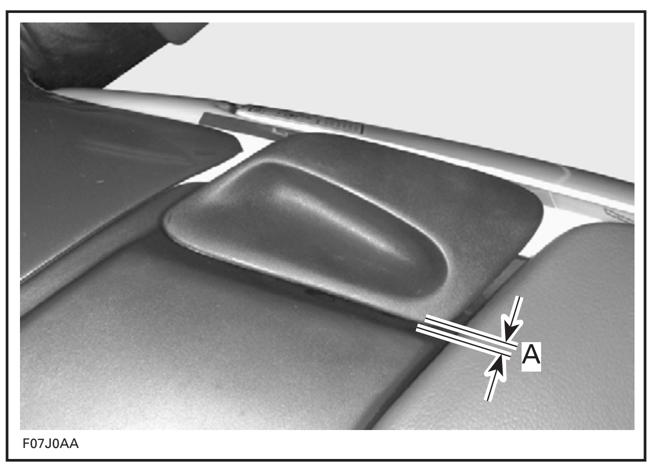
The pawl lock **no. 7** should be engaged in the anchor **no. 22**.

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*

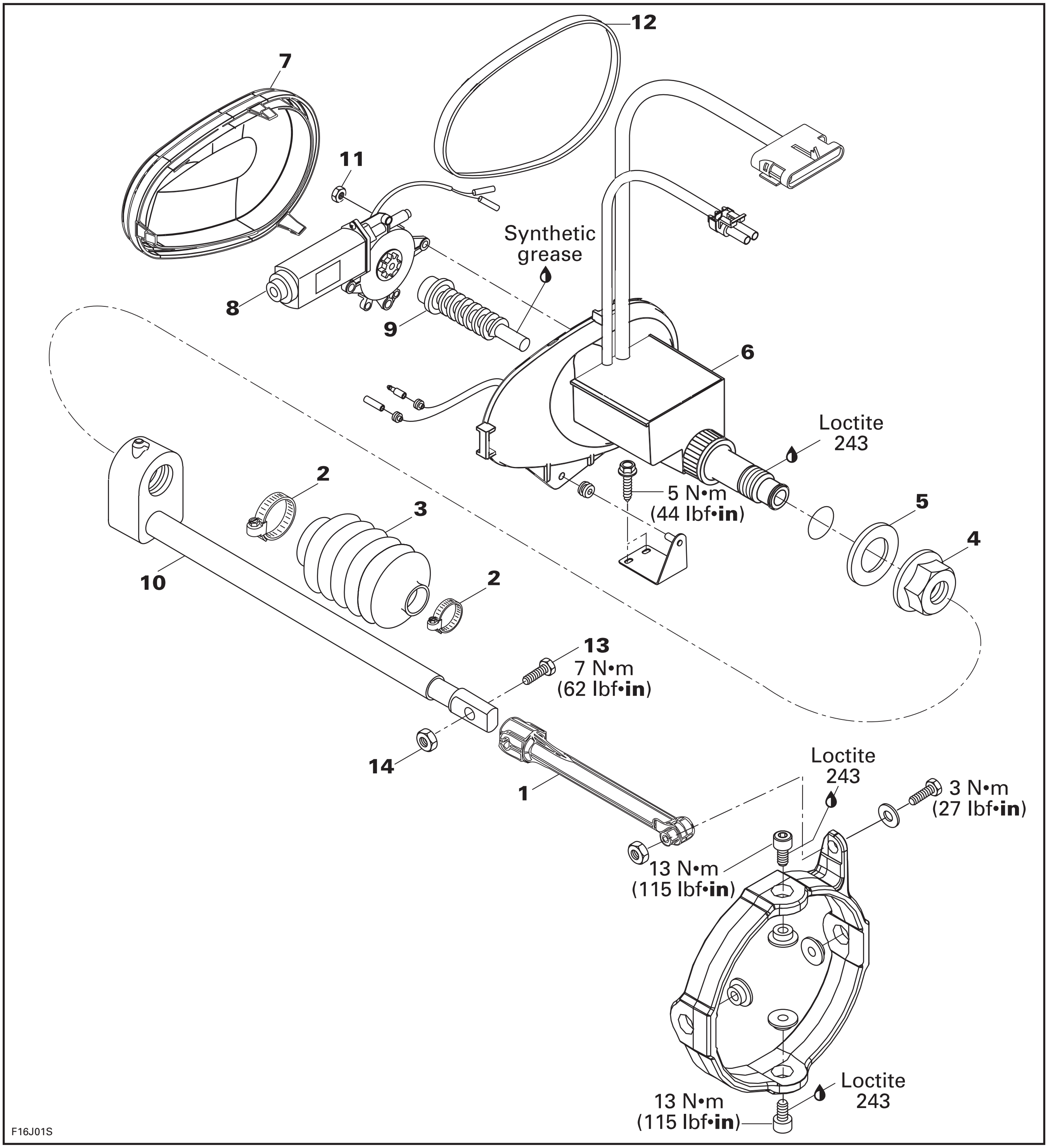
When adjustment is completed, there should be gap of 2 to 3 mm (5/64 to 7/64 in) between handle and left cover.



A. 2 to 3 mm (5/64 to 7/64 in)

VARIABLE TRIM SYSTEM

RX and RX DI Models



GENERAL

To test VTS control module, motor or switch, refer to INSTRUMENTS AND ACCESSORIES.

To have access to VTS module, remove seat.

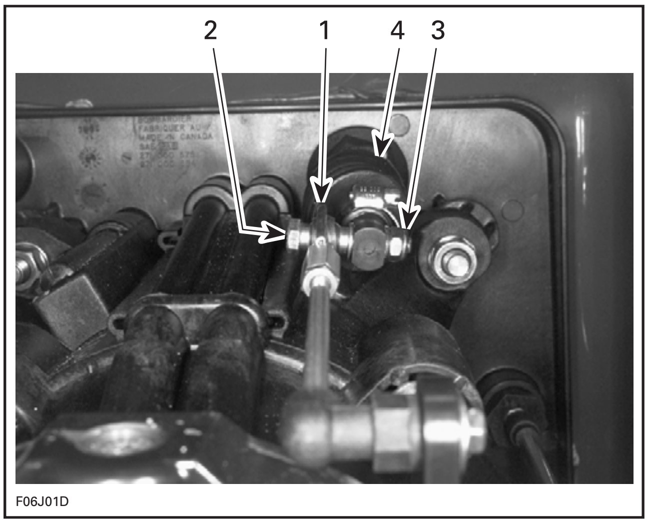
Remove screws retaining electrical box support and move it aside.

REMOVAL

Remove nut **no. 14** and bolt **no. 13** retaining VTS rod **no. 1** to sliding shaft **no. 10**.

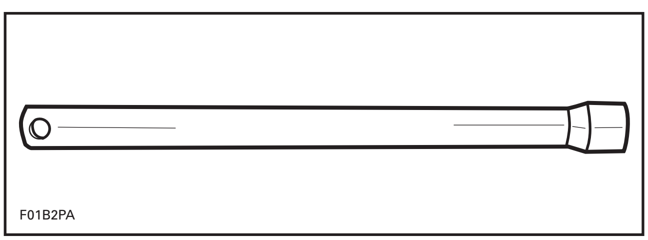
Remove clamps **no. 2**.

Remove boot **no. 3**.



TYPICAL
1. *VTS rod*
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**.

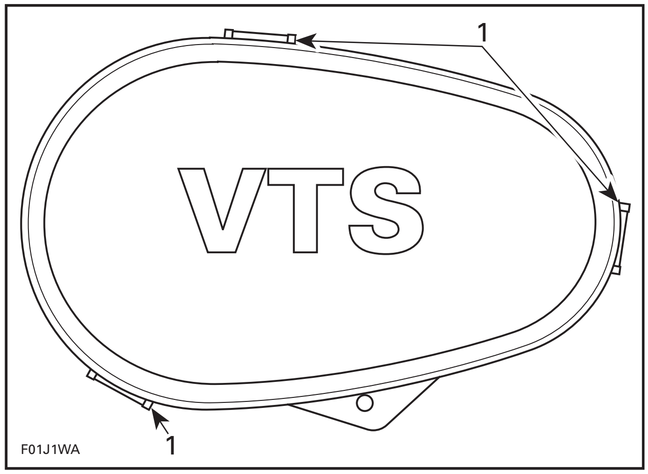
Disconnect wiring harnesses.

Pull out VTS assembly **no. 6** from bilge.

DISASSEMBLY

Cover

Remove VTS cover **no. 7** by pressing on tabs.

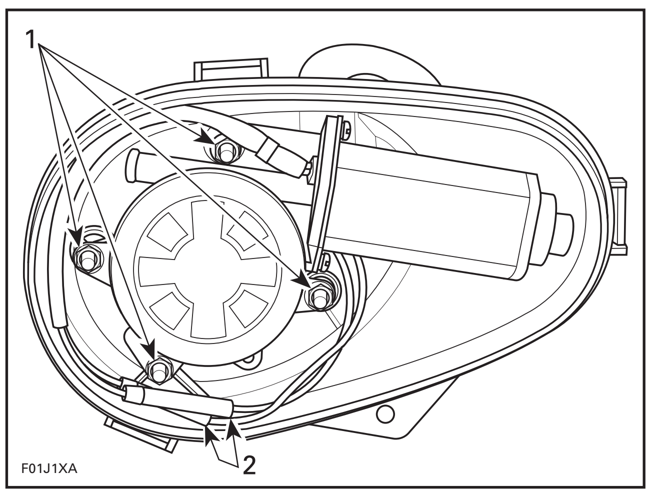


1. *Press tabs to remove cover*

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.

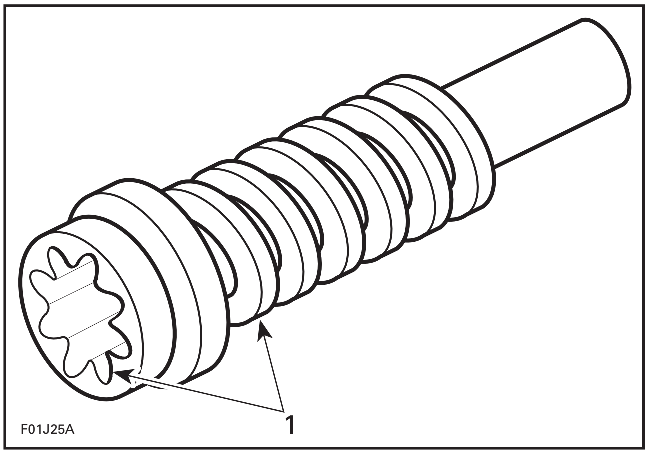
INSPECTION

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

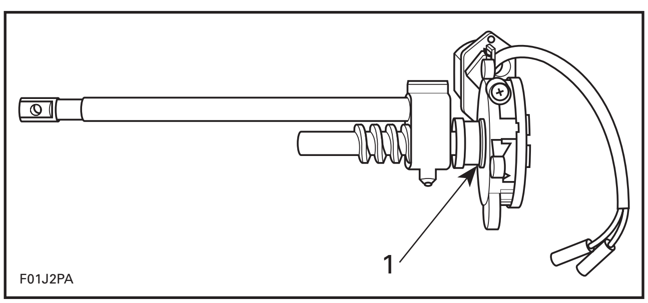
Assembly is essentially the reverse of disassembly procedures. However pay particular attention to the following.

Motor, Worm and Sliding Shaft

Apply synthetic grease to worm.

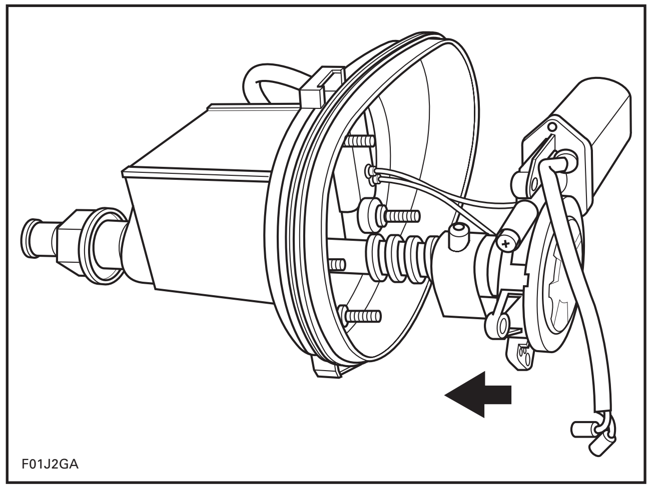
Screw worm **no. 9** to sliding shaft **no. 10**.

Mesh worm splines to gear of motor.



1. *Mesh worm spline to gear of motor*

Install motor, worm and sliding shaft in VTS housing.



Install and torque nuts **no. 11** to 7 N•m (62 lbf•**in**).

Connect wires of motor.

CAUTION: Make sure wire color codes match.

Install cover **no. 7**.

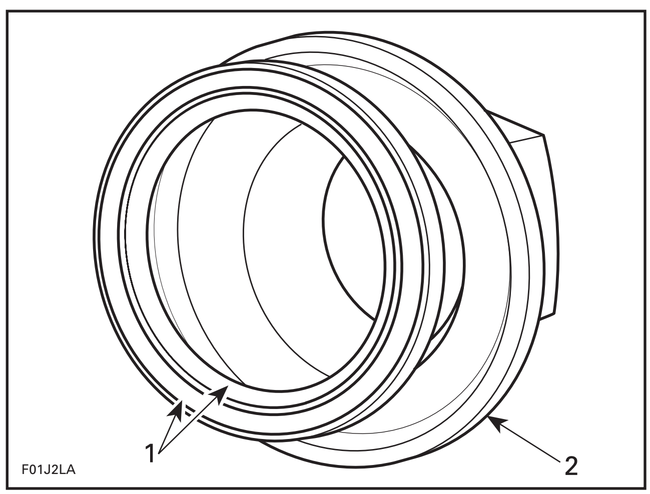
NOTE: Make sure seal **no. 12** is in place.

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*

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.

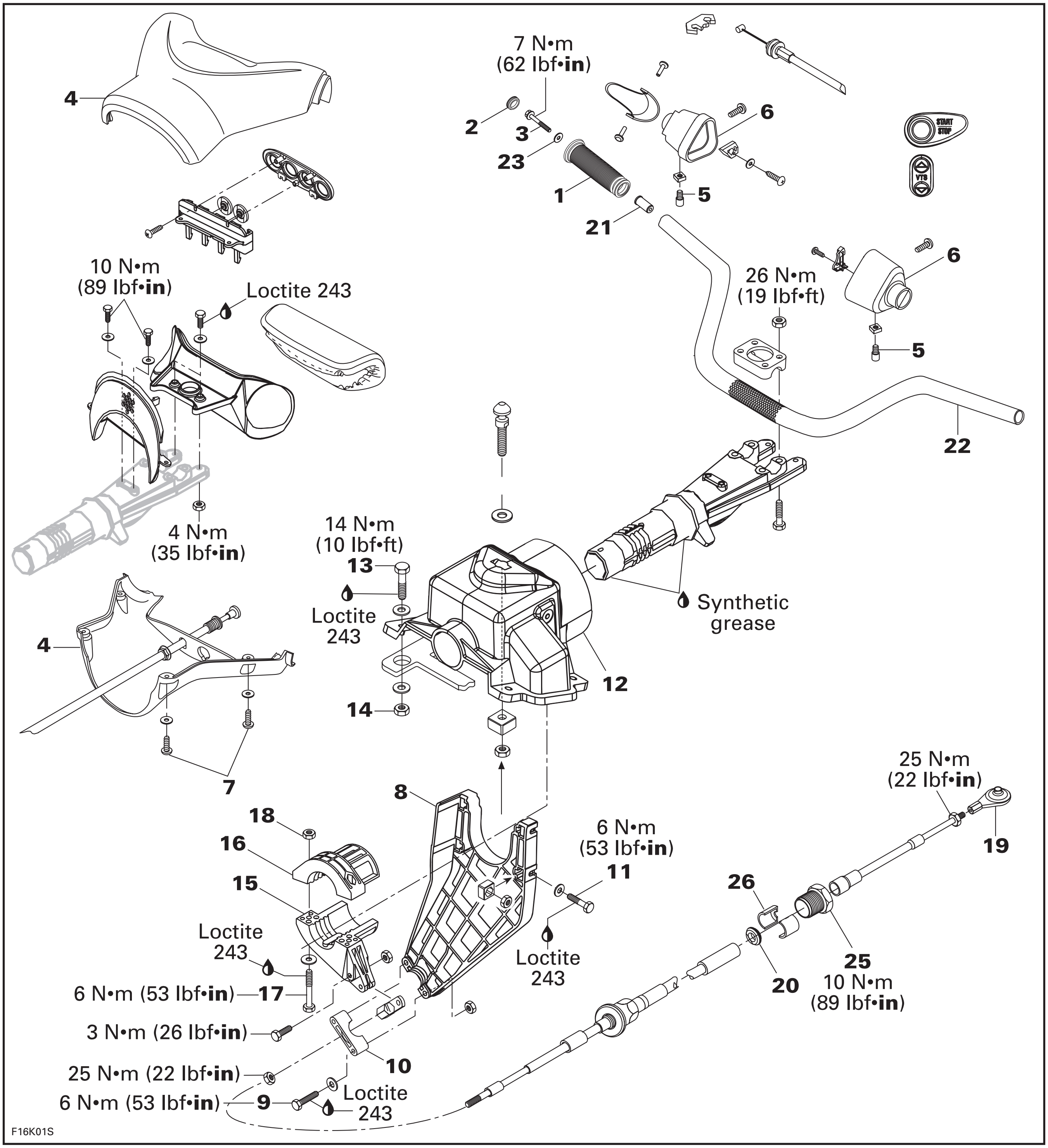
ADJUSTMENT

On these models, no adjustment is required.

TABLE OF CONTENTS

STEERING SYSTEM

RX and RX DI Models



DISASSEMBLY

Handle Grip and Grip Insert

To remove handle grip **no. 1**, pull out cap **no. 2** and remove screw **no. 3**.

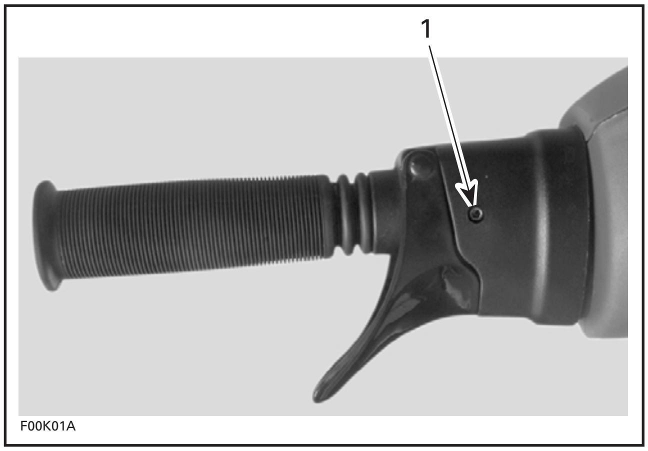
Pull out grip and remove grip insert from handlebar **no. 22**.

NOTE: Verify grip insert for damage.

Steering Cover

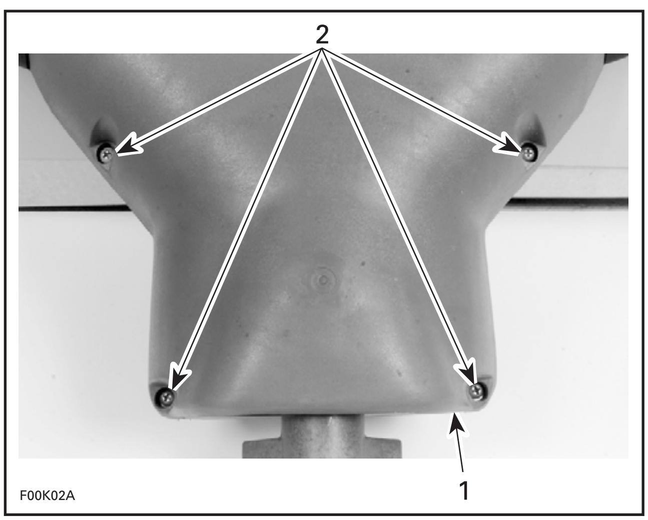
Remove grips **no. 1**.

Loosen set screws **no. 5** of handlebar housings **no. 6**.



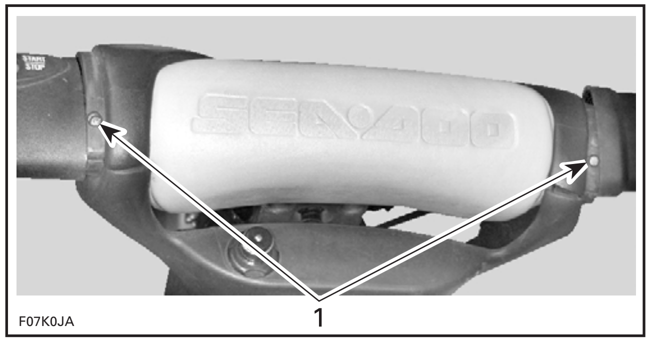
1. Set screw

Remove 4 screws **no. 7**.



TYPICAL
1. Cover
2. Screws

Remove 2 screws and flat washers each side of cover.

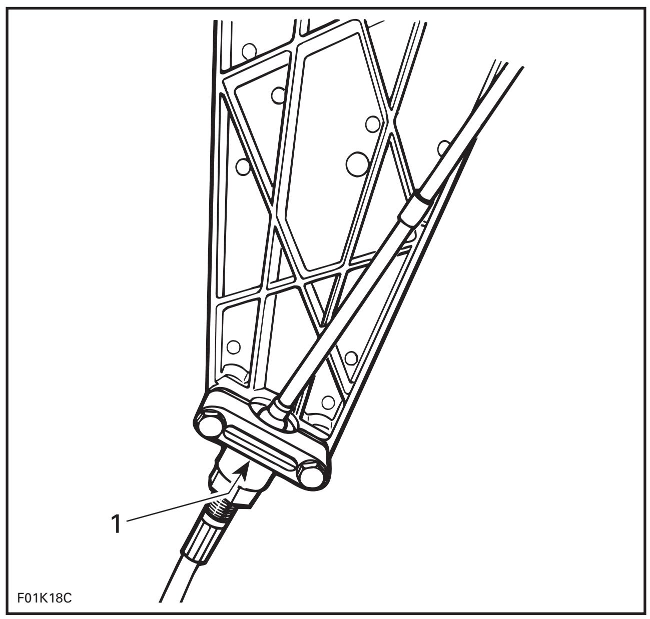


1. Remove screws

Remove cover.

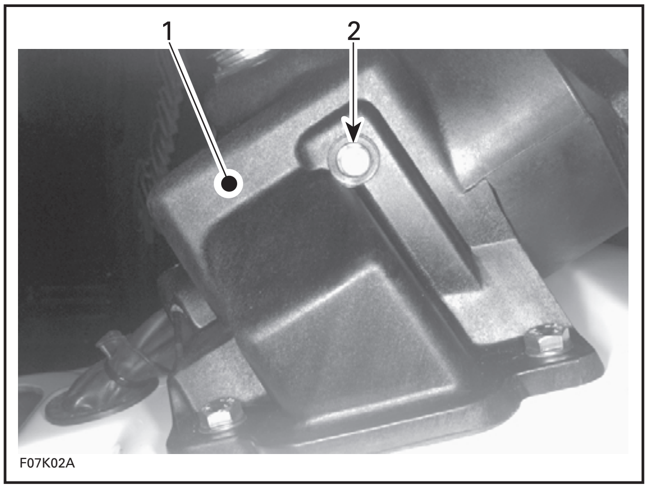
Cable Support

Loosen bolts **no. 9** and remove retaining block **no. 10**.

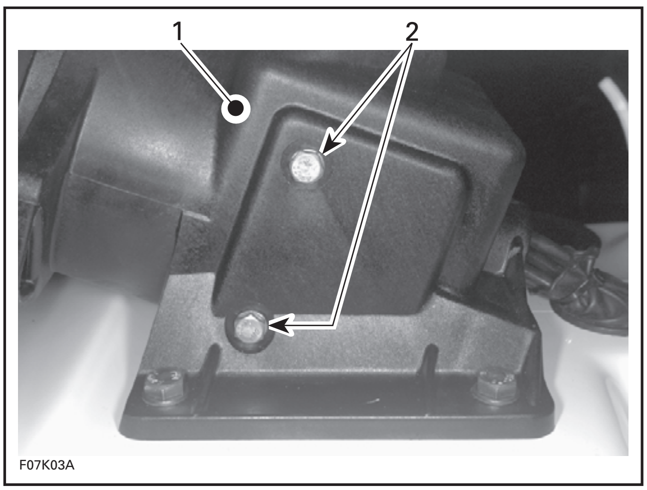


1. Retaining block

Loosen bolts **no. 11** each side of steering support **no. 12**.



1. *Steering support*
2. *Bolt*

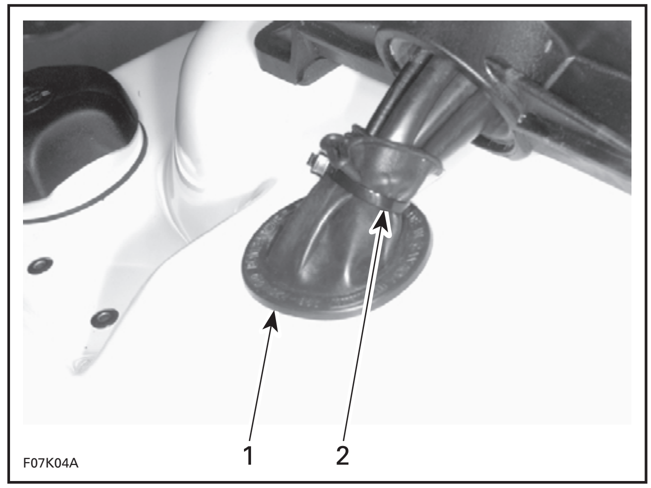


1. *Steering support*
2. *Bolts*

Remove cable support **no. 8**.

Steering Support

Cut locking tie securing wiring harness boot.



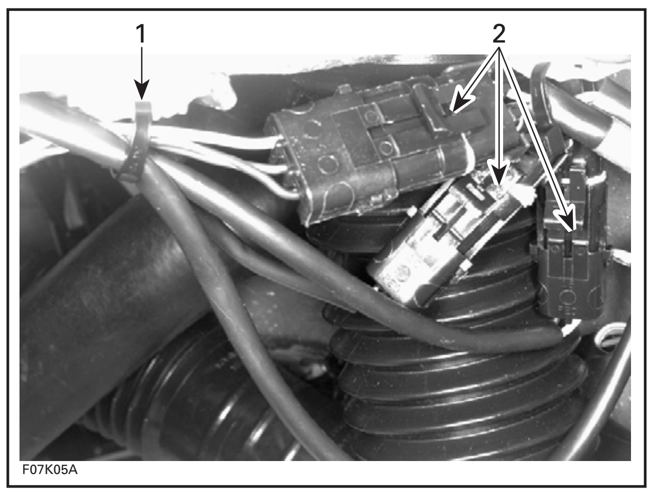
1. *Boot*
2. *Locking tie*

Carburetor-Equipped Models

Disconnect the throttle and choke cables from carburetor levers.

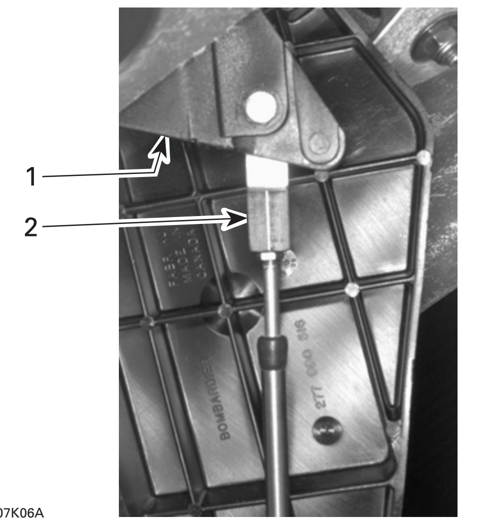
All Models

Disconnect the wiring harnesses leading out of steering stem and cut locking tie.



1. *Tie rap*
2. *Connectors*

Disconnect the steering cable from the steering stem arm **no. 15**.

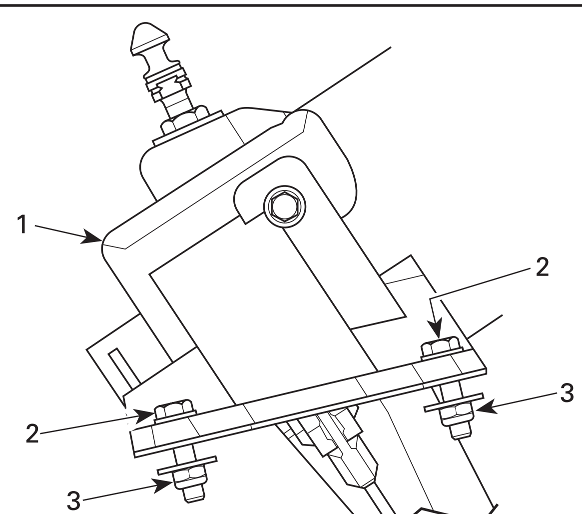


F07K06A

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**.



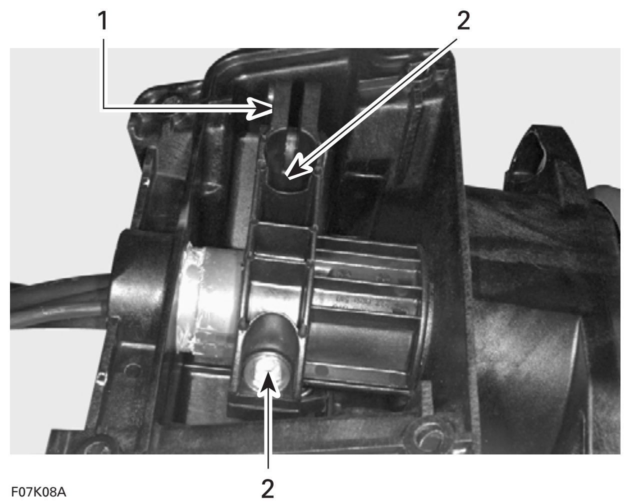
F07K07A

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**.



F07K08A

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. 20**.

NOTE: To loosen nut, use steering cable tool (P/N 295 000 145).

Remove steering cable from watercraft.

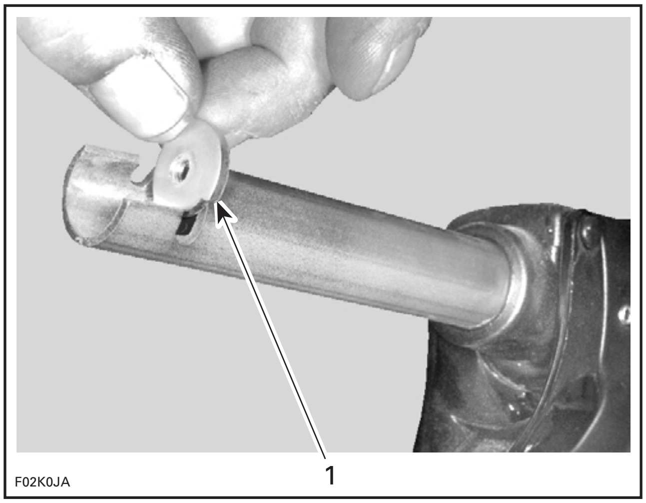
ASSEMBLY

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.



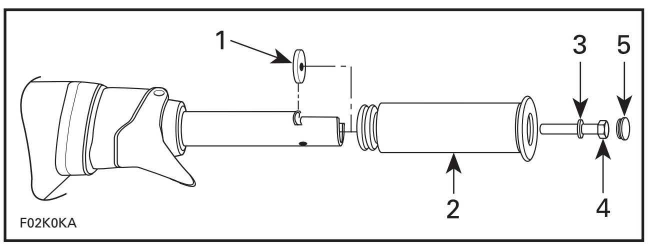
1. Grip insert

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

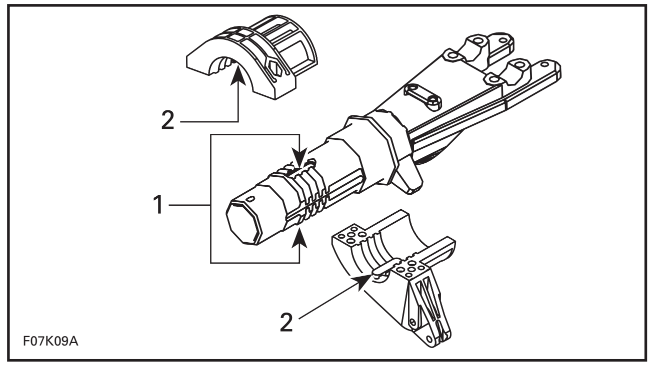
CAUTION: Ensure to install flat washer otherwise screw will damage grip end.

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

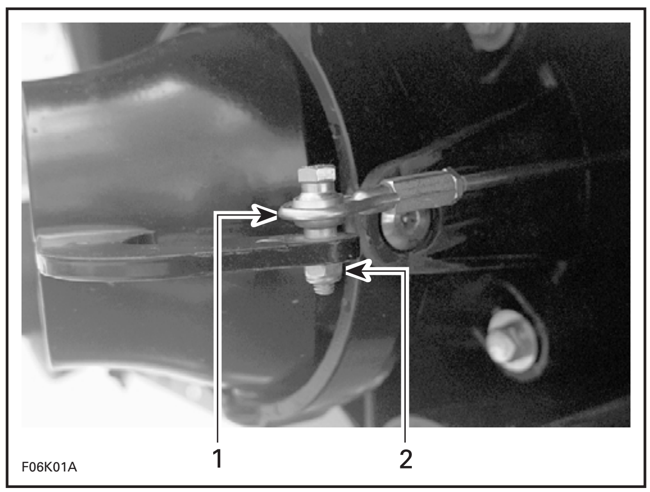
Replace lock nuts **no. 18** by new ones.

Torque bolts **no. 17** of steering stem arm to 6 N•m (53 lbf•**in**).

Ball Joint

Secure the steering cable ball joint **no. 19** to the nozzle as per following illustration.

CAUTION: Ensure the ball joint is parallel (± 5°) to the nozzle arm.

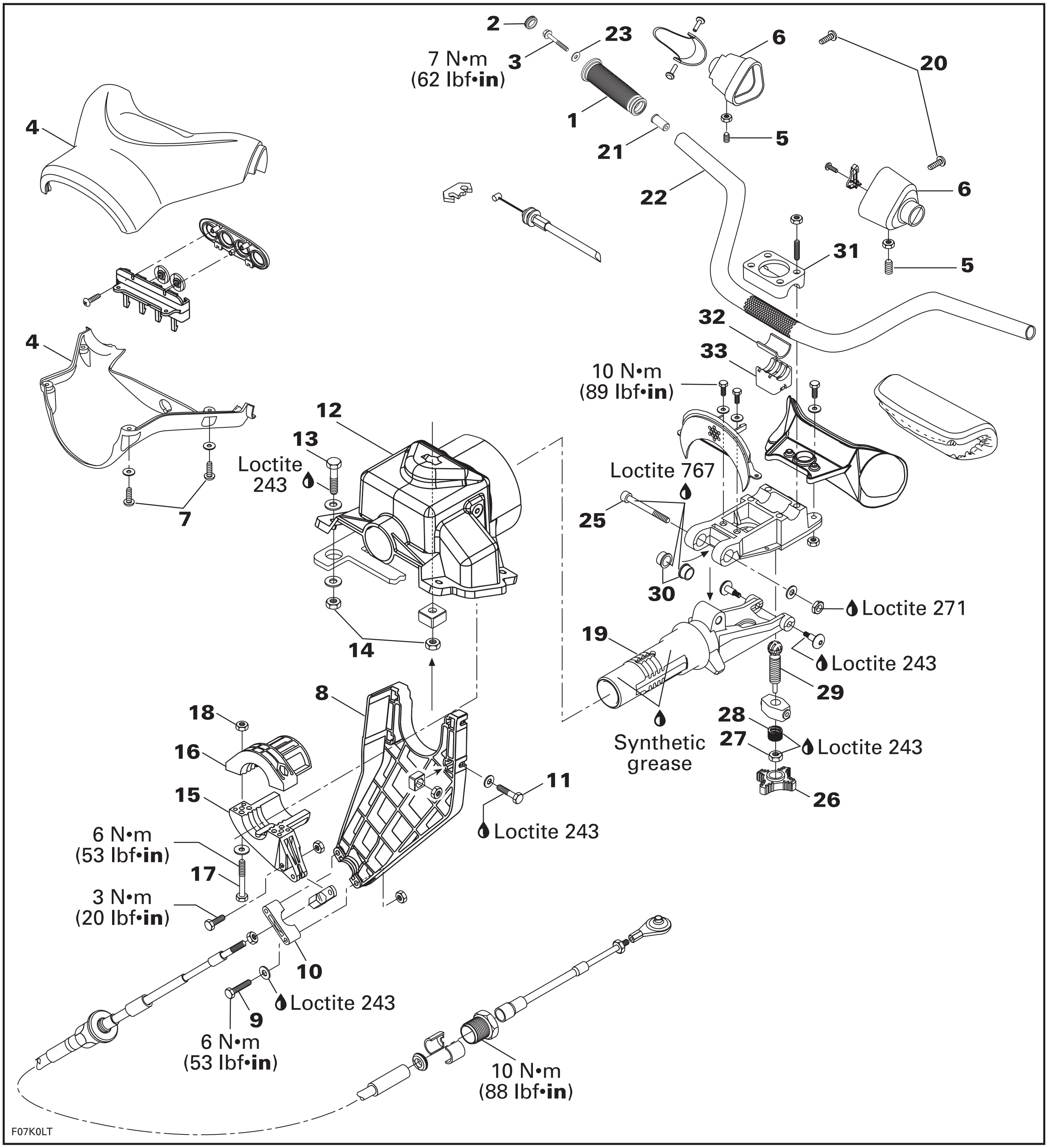


TYPICAL
1. Ball joint on top of steering arm
*2. Torque nut to 7 N•m (62 lbf•**in**)*

STEERING ALIGNMENT

For steering alignment procedure, refer to ALIGNMENT.

ADJUSTABLE STEERING

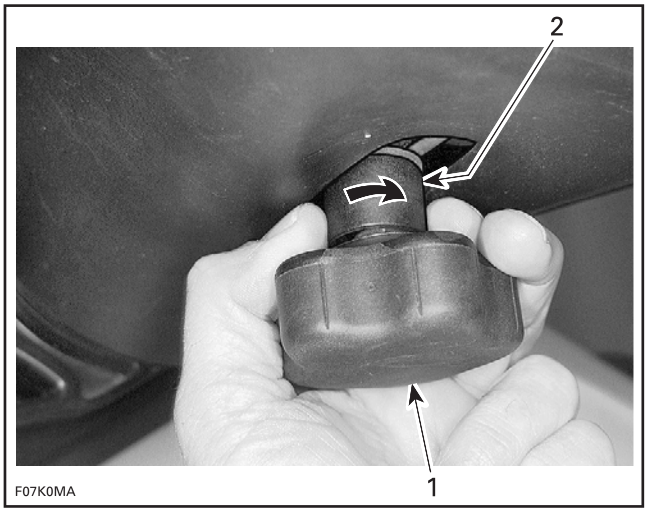


DISASSEMBLY

Adjustment Handle

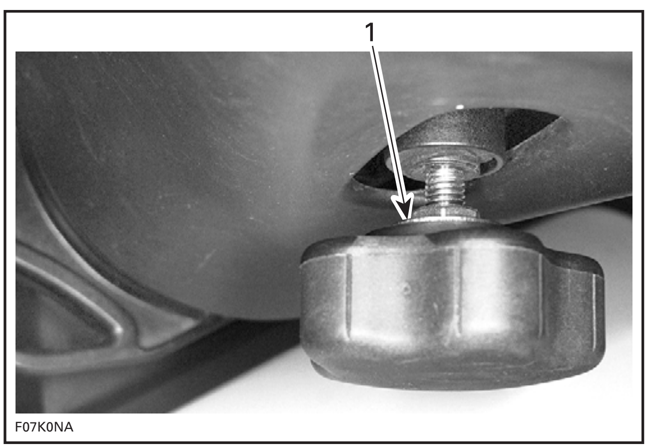
Set handle bar to its lowest position by turning adjustment handle **no. 26** counterclockwise.

While holding adjustment handle **no. 26**, turn support bushing **no. 28** clockwise.



1. Adjustment handle
2. Support bushing

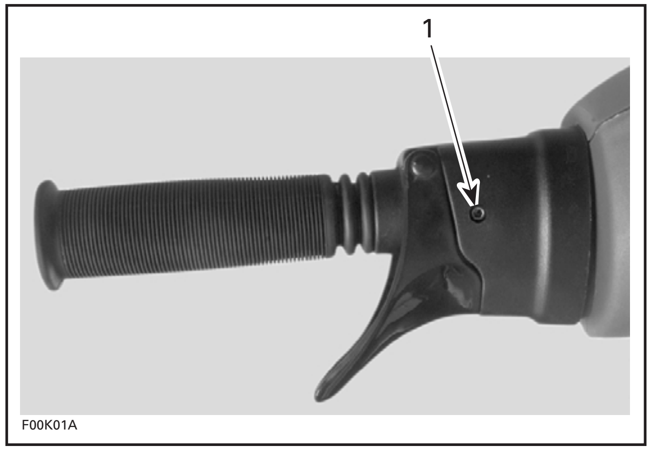
Hold jam nut **no. 27** and unscrew adjustment handle **no. 26** from adjuster screw **no. 29**.



1. Loosen jam nut

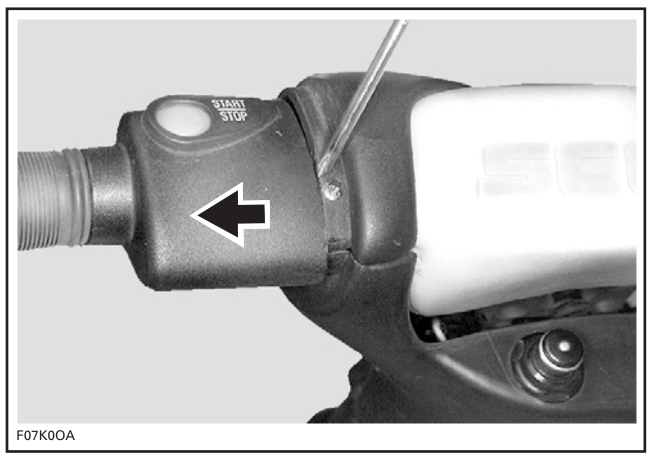
Steering Cover

Loosen set screws **no. 5** of handlebar housings **no. 6**.

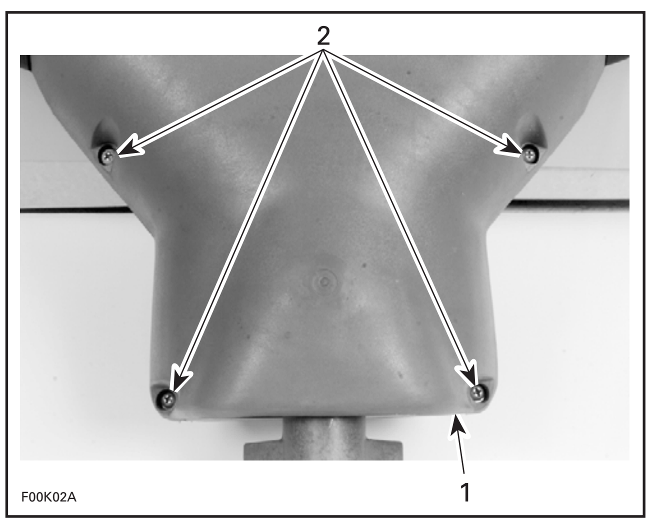


1. Set screw

Pull handle bar housings to disengage from steering cover.

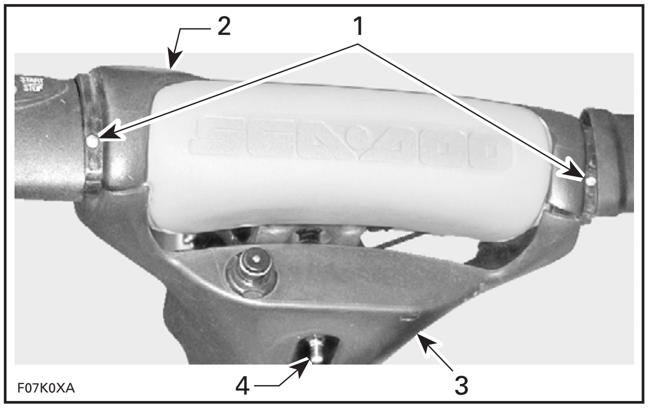


Remove 4 screws **no. 7**.



TYPICAL
1. Cover
2. Screws

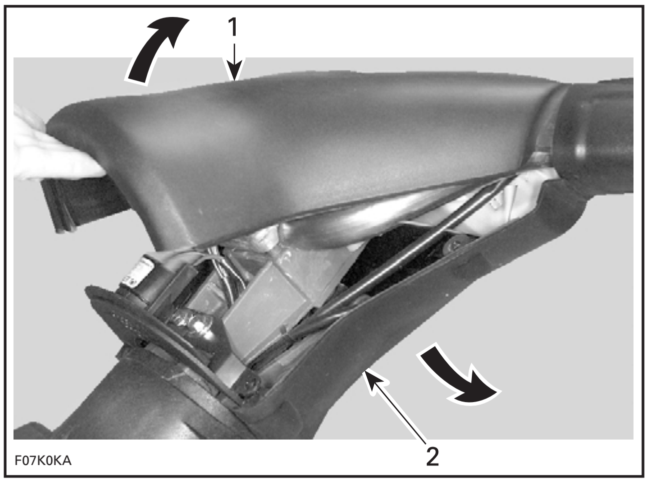
Remove 2 screws **no. 20** each side of cover.



F07K0XA

1. *Remove screws*
2. *Upper cover*
3. *Lower cover*
4. *Adjuster screws*

Remove both upper and lower steering covers.

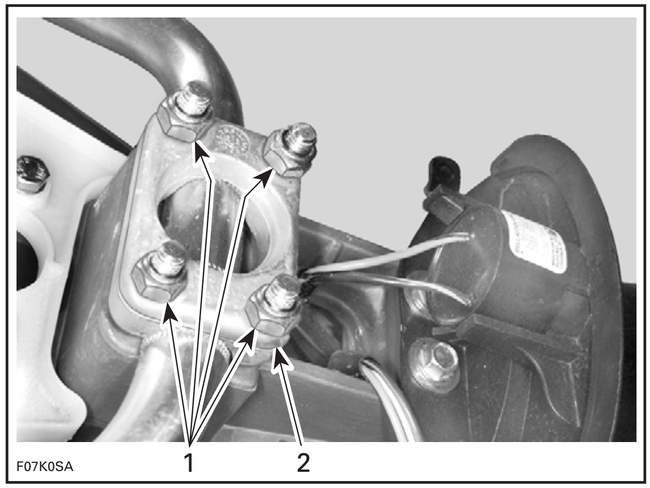


F07K0KA

1. *Upper cover*
2. *Lower cover*

Handle Bar

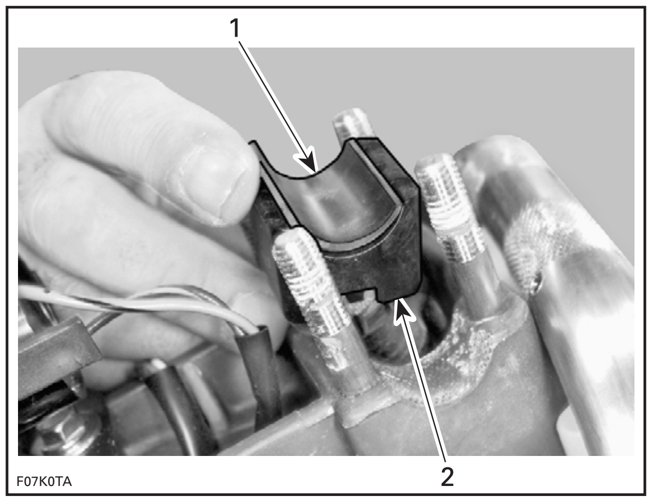
Remove 4 elastic stop nuts M8 retaining steering clamp **no. 31**.



F07K0SA

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**.

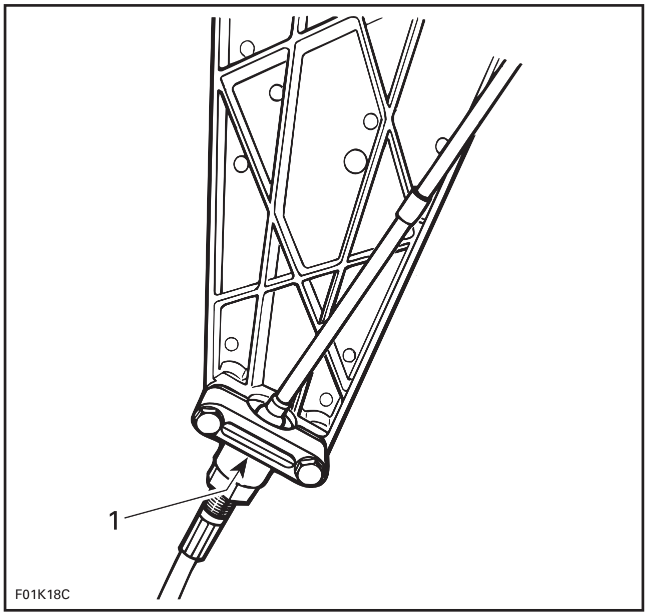


F07K0TA

1. *Rubber pad*
2. *Stopper*

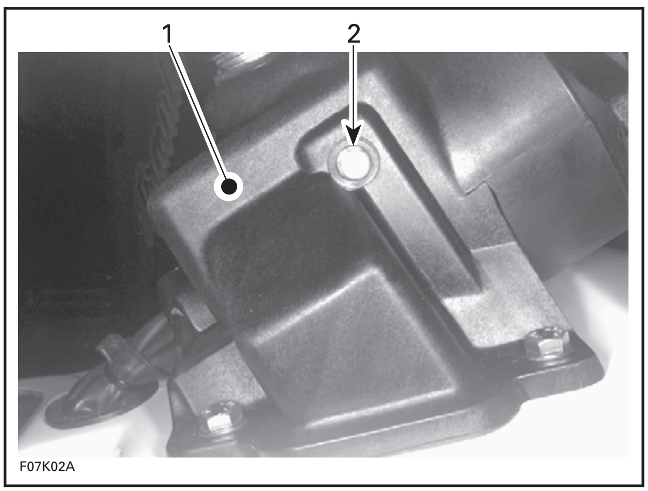
Cable Support

Loosen bolts **no. 9** and remove retaining block **no. 10** holding cable adjusting nut to cable support **no. 8**.

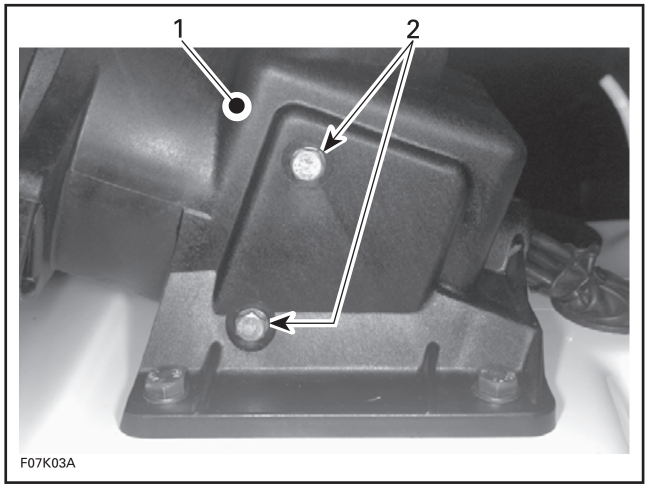


1. *Retaining block*

Remove bolts **no. 11** each side of steering support **no. 12**.



LEFT SIDE
1. *Steering support*
2. *Bolt*

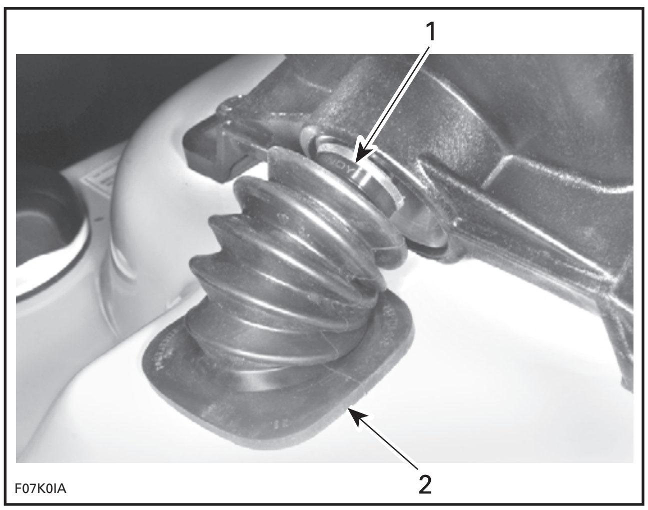


RIGHT SIDE
1. *Steering support*
2. *Bolts*

From inside bilge, pull down cable support **no. 8** to detach it from steering support **no.12**.

Steering Support

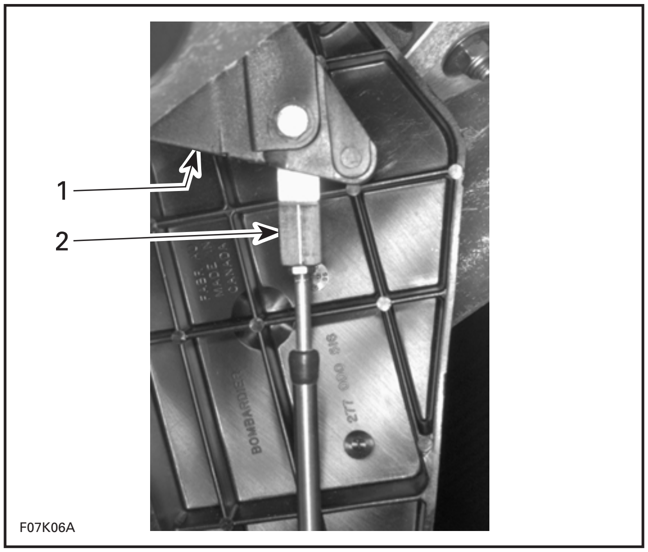
Cut locking tie securing wiring harness boot.



1. *Locking tie*
2. *Boot*

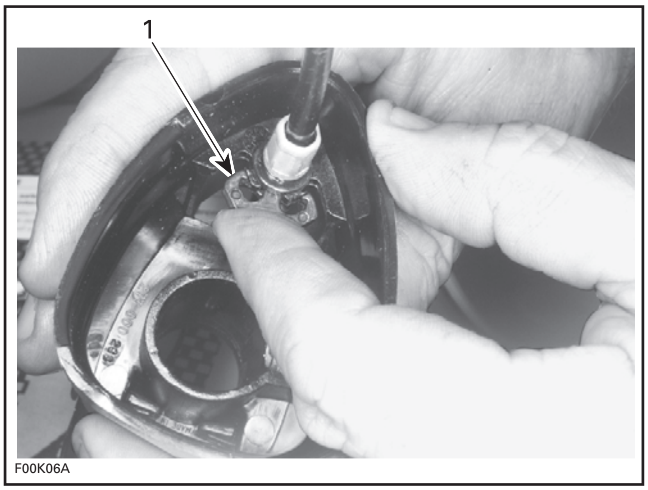
Disconnect the wiring harnesses leading out of steering stem and cut locking tie.

Disconnect the steering cable from the steering stem arm **no. 15**.



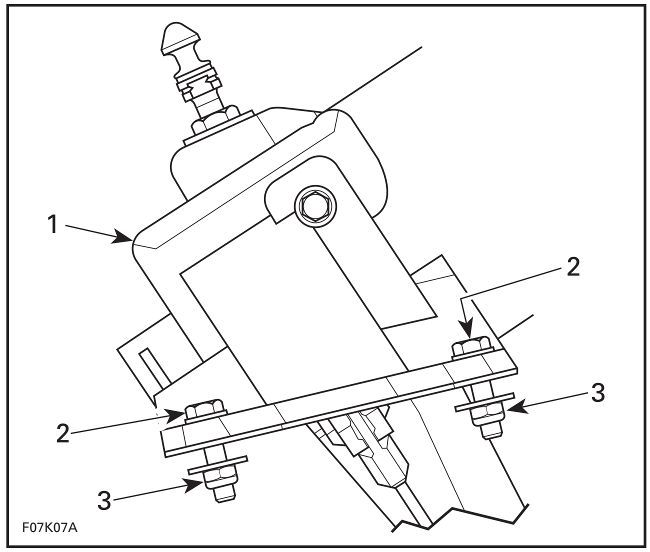
1. *Steering stem arm*
2. *Steering cable*

Detach throttle cable from throttle handle.



1. *Locking tab*

From inside bilge, remove lock nuts **no. 14**.

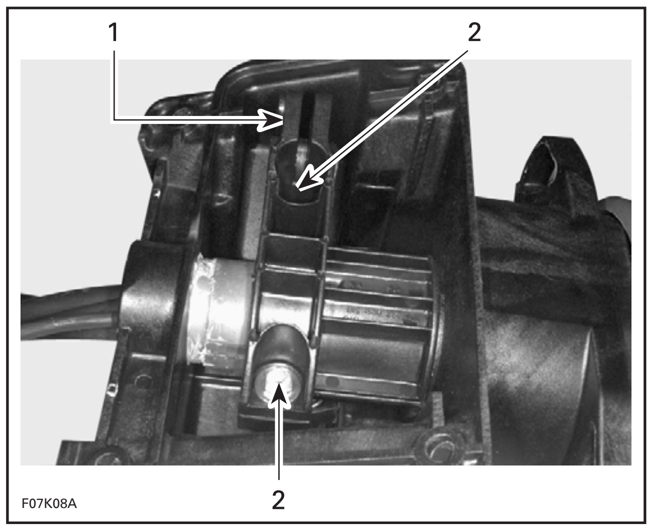


1. *Steering support*
2. *Bolt*
3. *Lock nut*

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.

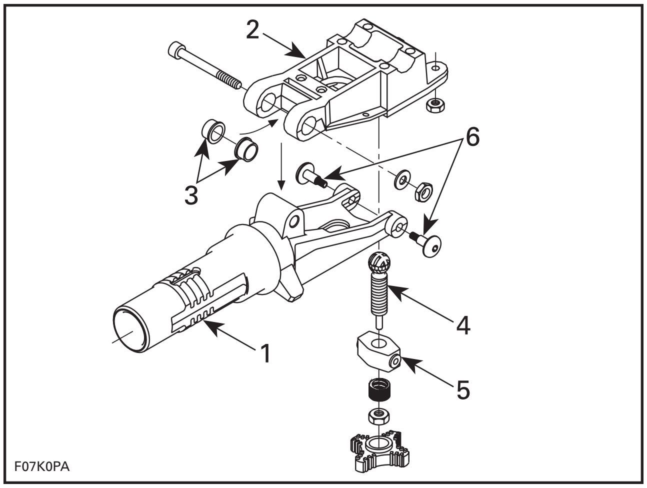
Remove steering stem.

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.

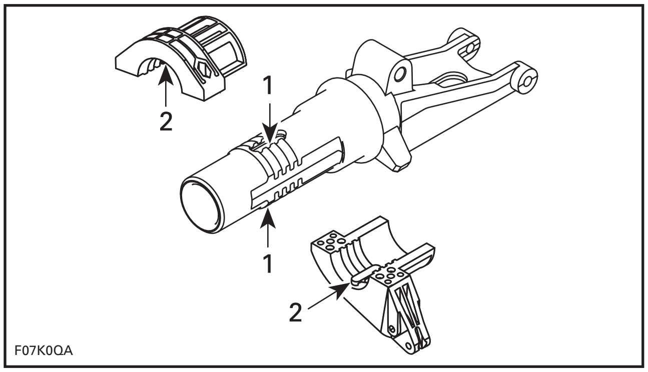
CAUTION: Apply all specified torques and service products as per main illustration at the beginning of this subsection.

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.

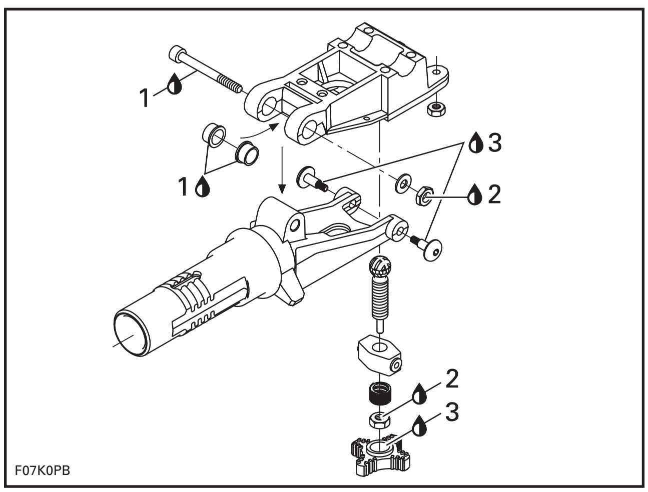
Torque bolts **no. 17** of steering stem arm to 6 N•m (53 lbf•**in**).

Steering Stem and Steering Support

Install support bushings **no. 30** on steering support.

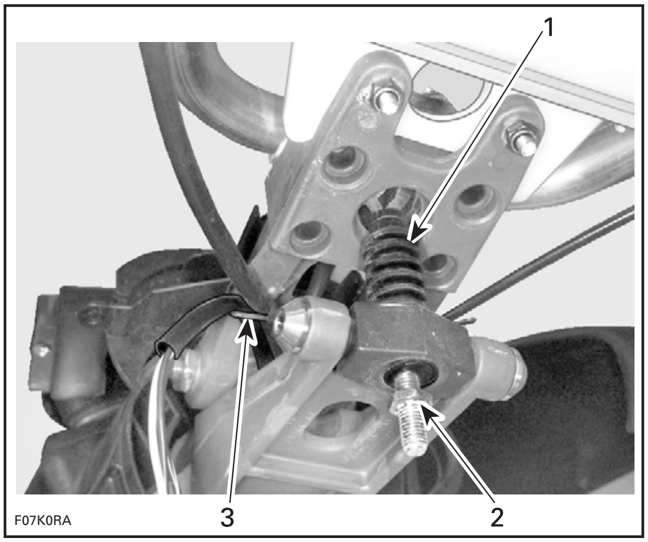
Apply Loctite 767 antiseized lubricant (P/N 413 701 000) on pivot bolt **no. 25**.

CAUTION: Make sure antiseize lubricant does not come in contact with threads of bolt.



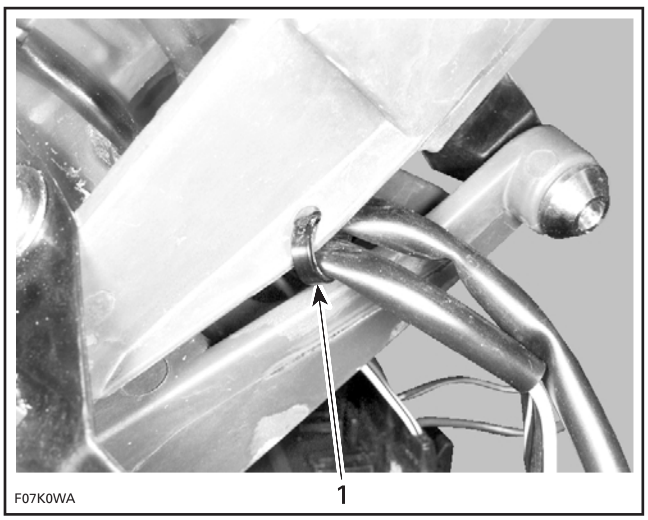
1. Antiseize lubricant
2. Loctite 271
3. Loctite 243

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.

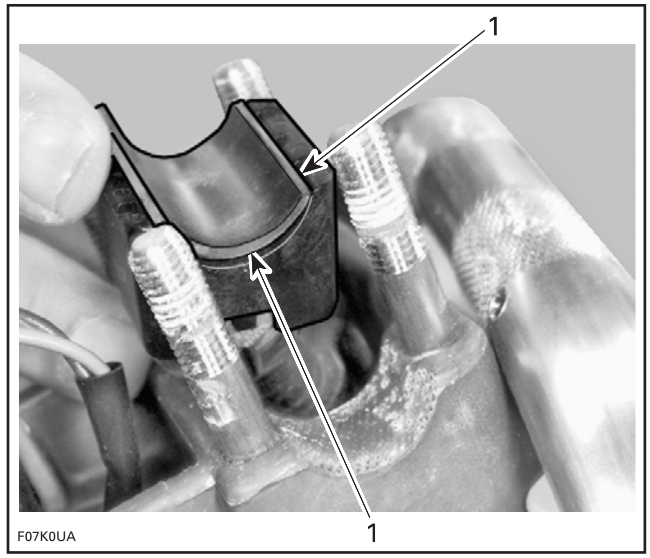


1. *Locking tie holding harness to steering support*

Handle Bar

Before installing handle bar, position stopper **no. 33** and rubber pad **no. 32**.

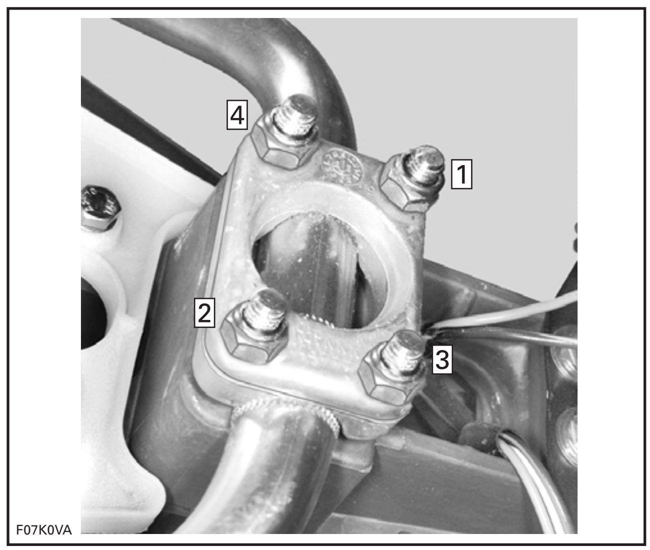
CAUTION: Rubber pad must not exceed stopper.



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.



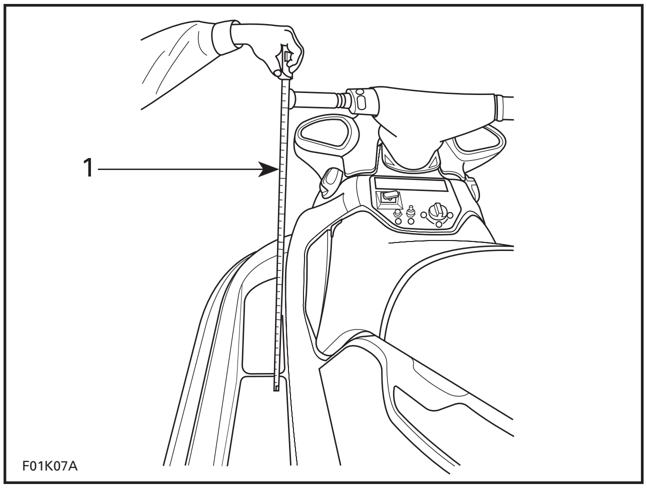
TORQUE SEQUENCE

STEERING ALIGNMENT

For steering alignment procedure, refer to ALIGNMENT.

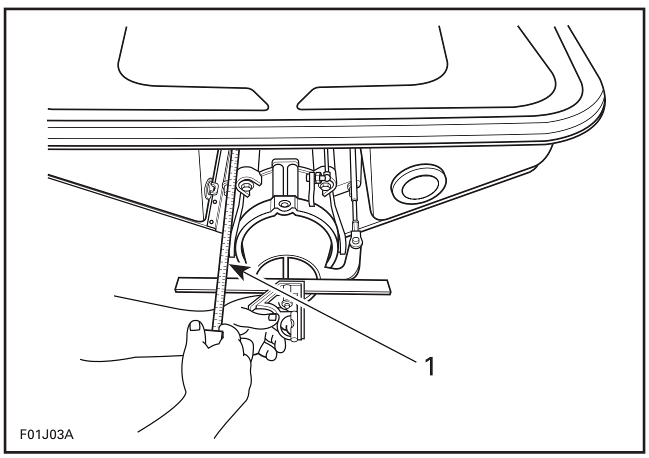
ALIGNMENT

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.



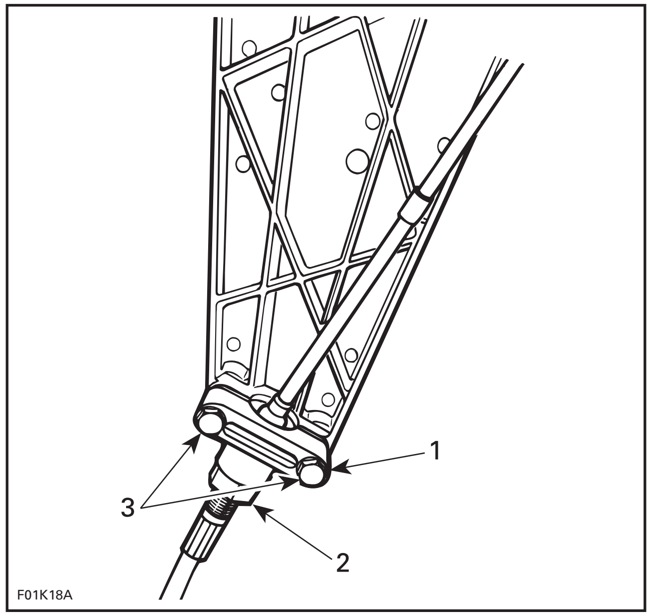
TYPICAL
1. *Measure the distance on each side of the straight edge*

If necessary, steering alignment adjustment should be performed at steering cable support.

Open storage compartment cover and remove basket.

Loosen 2 bolts retaining block at cable support.

Turn adjustment nut as required.



1. *Retaining block*
2. *Adjustment nut*
3. *Loosen bolts*

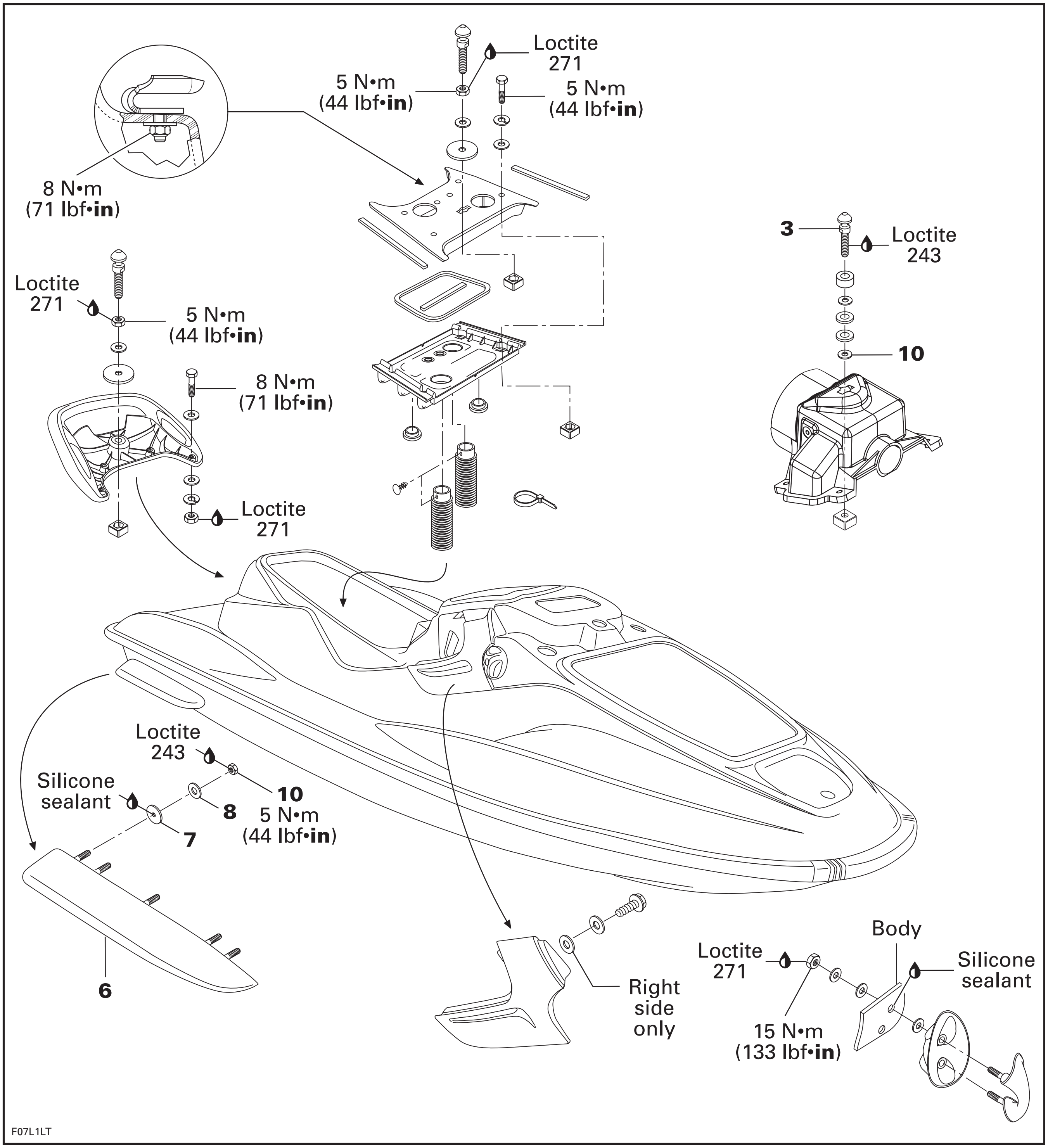
After adjustment, torque retaining block bolts to 6 N•m (53 lbf•**in**).

CAUTION: Verify when the handlebar is turned completely to the left or right side, that there is no interference with venturi.

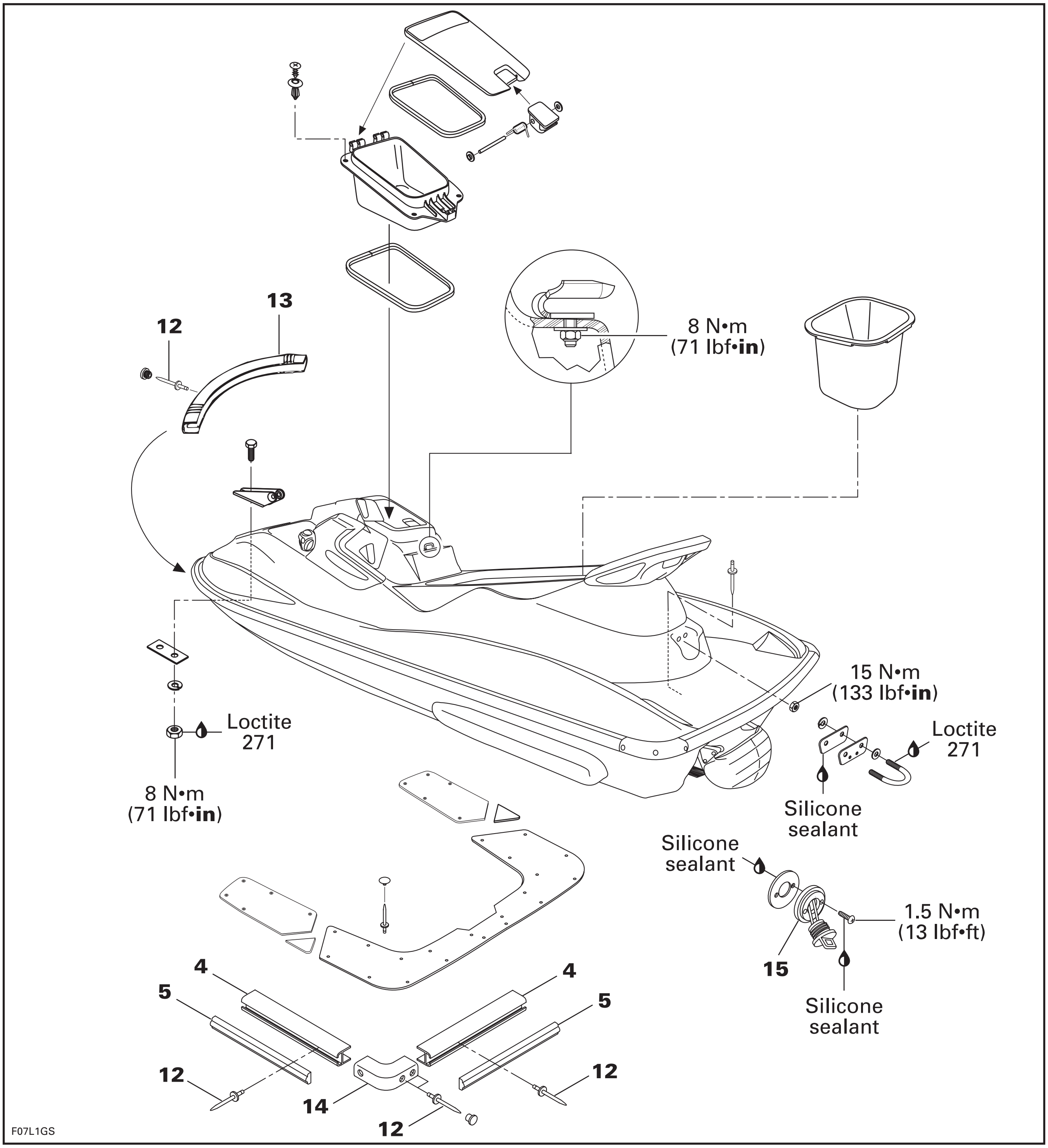
TABLE OF CONTENTS

ADJUSTMENT AND REPAIR

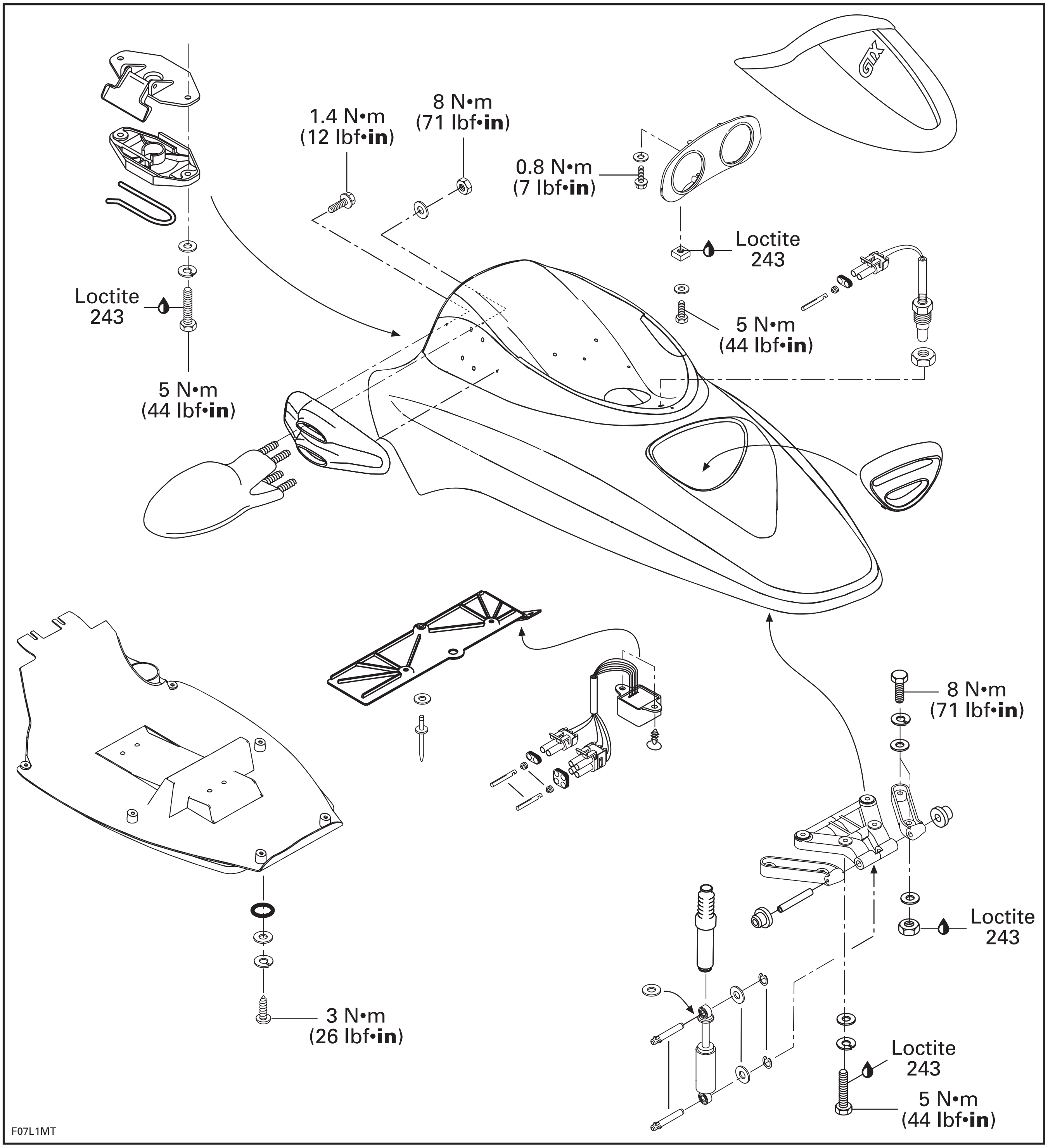
GTX DI (bow)



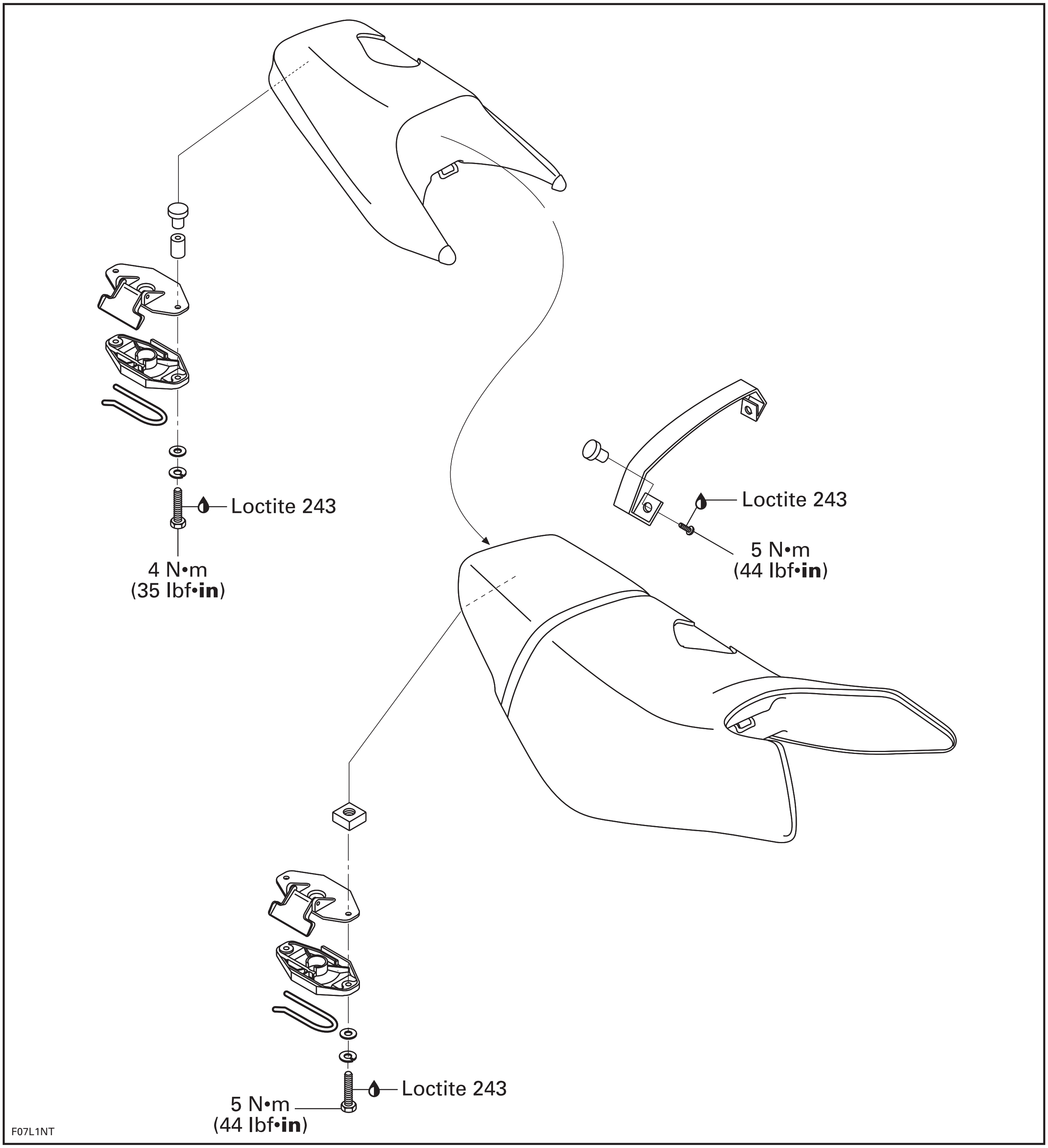
GTX DI (stern)


13
12
8 N•m
(71 lbf•**in**)
15 N•m
(133 lbf•**in**)
Loctite
271
8 N•m
(71 lbf•**in**)
Loctite
271
Silicone
sealant
Silicone
sealant
1.5 N•m
(13 lbf•ft)
15
Silicone
sealant
4
5
4
5
12
12
14
12
F07L1GS

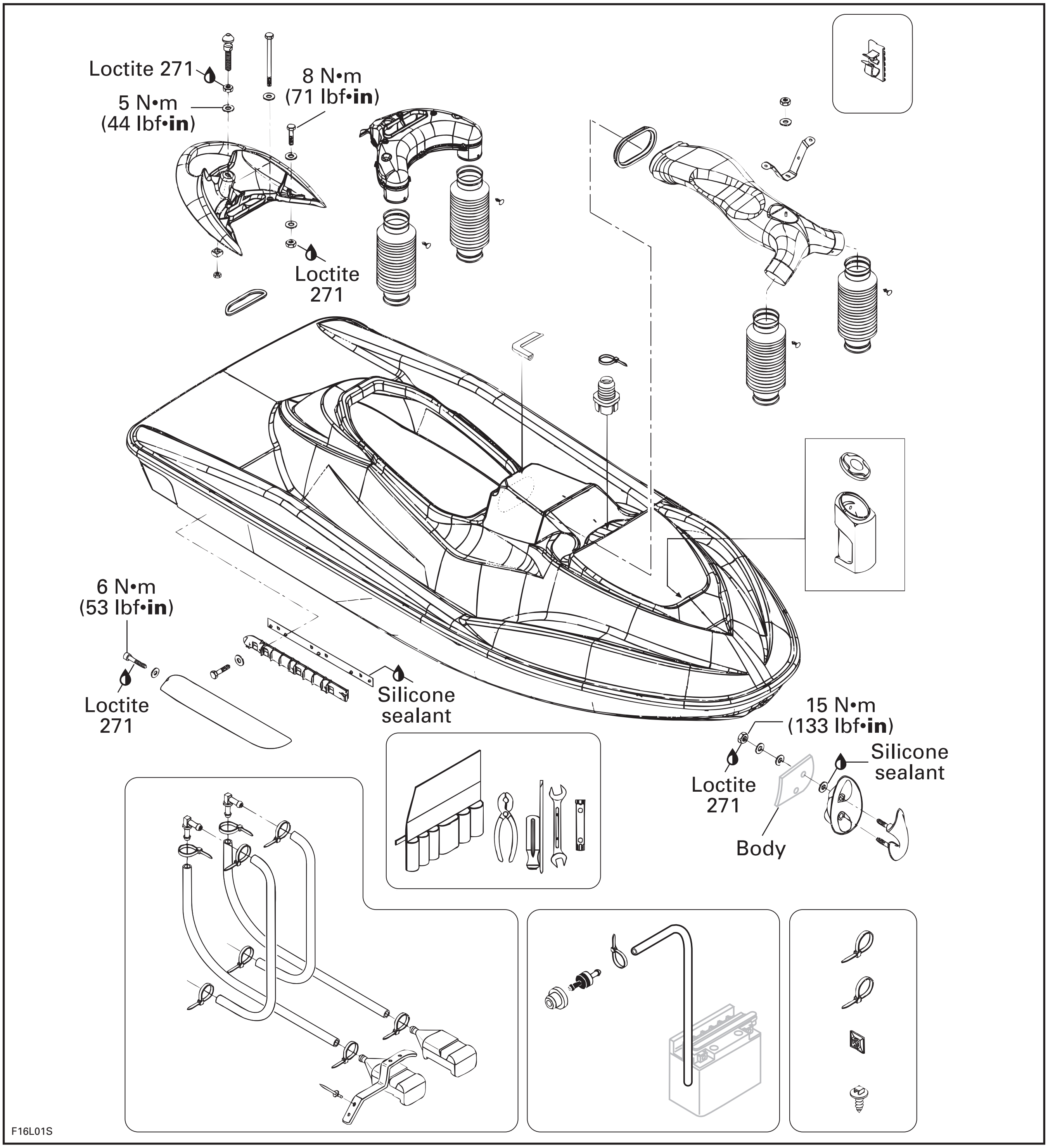
GTX DI (cover)


1.4 N•m
(12 lbf•**in**)
8 N•m
(71 lbf•**in**)
0.8 N•m
(7 lbf•**in**)
Loctite
243
Loctite
243
5 N•m
(44 lbf•**in**)
5 N•m
(44 lbf•**in**)
8 N•m
(71 lbf•**in**)
Loctite
243
3 N•m
(26 lbf•**in**)
Loctite
243
5 N•m
(44 lbf•**in**)
F07L1MT

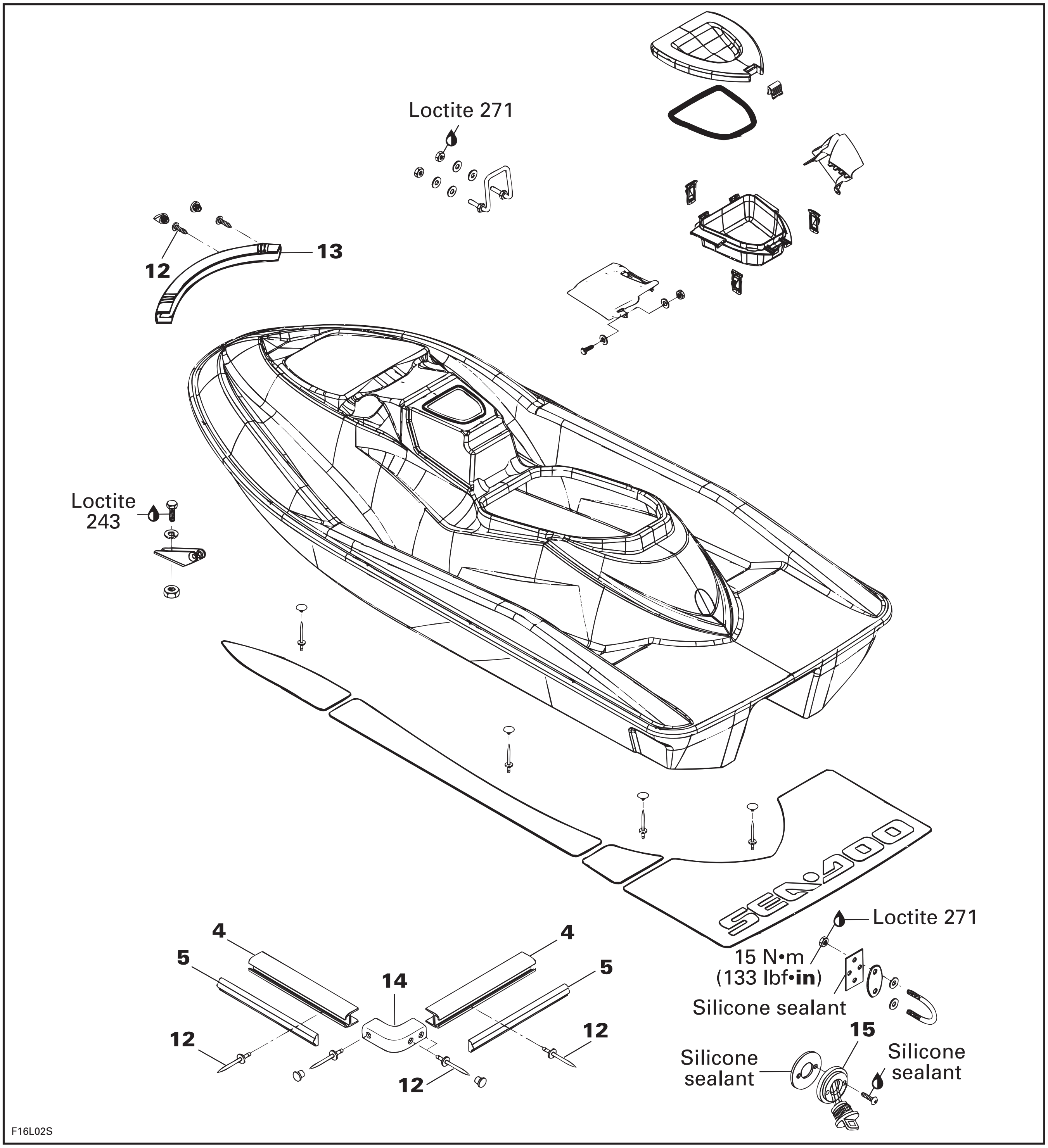
GTX DI (seat)


Loctite 243
4 N•m
(35 lbf•in)
Loctite 243
5 N•m
(44 lbf•in)
Loctite 243
5 N•m
(44 lbf•in)
F07L1NT

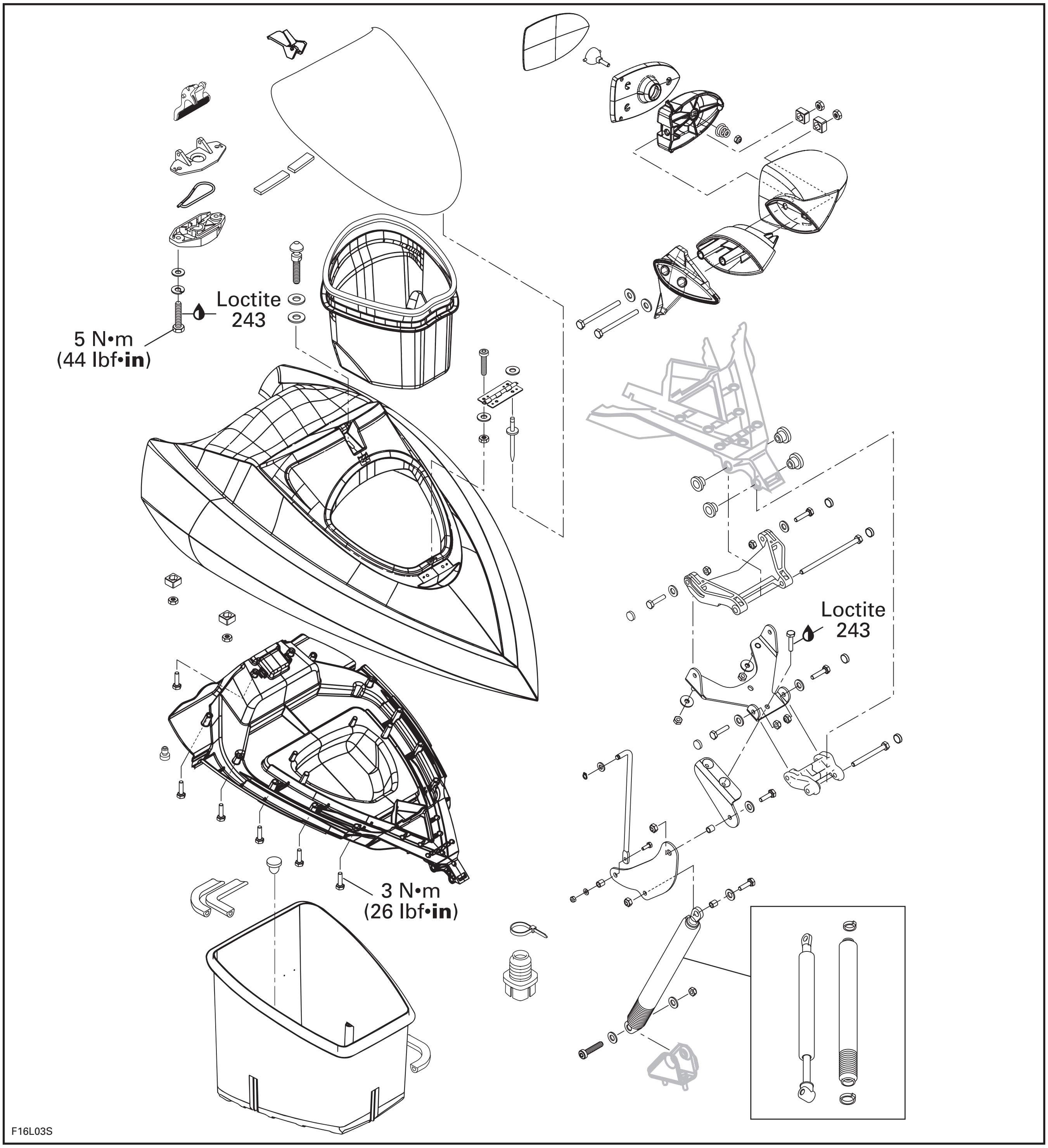
RX (bow)


Loctite 271
5 N•m
(44 lbf•in)
8 N•m
(71 lbf•in)
Loctite
271
6 N•m
(53 lbf•in)
Loctite
271
Silicone
sealant
15 N•m
(133 lbf•in)
Loctite
271
Silicone
sealant
Body
F16L01S

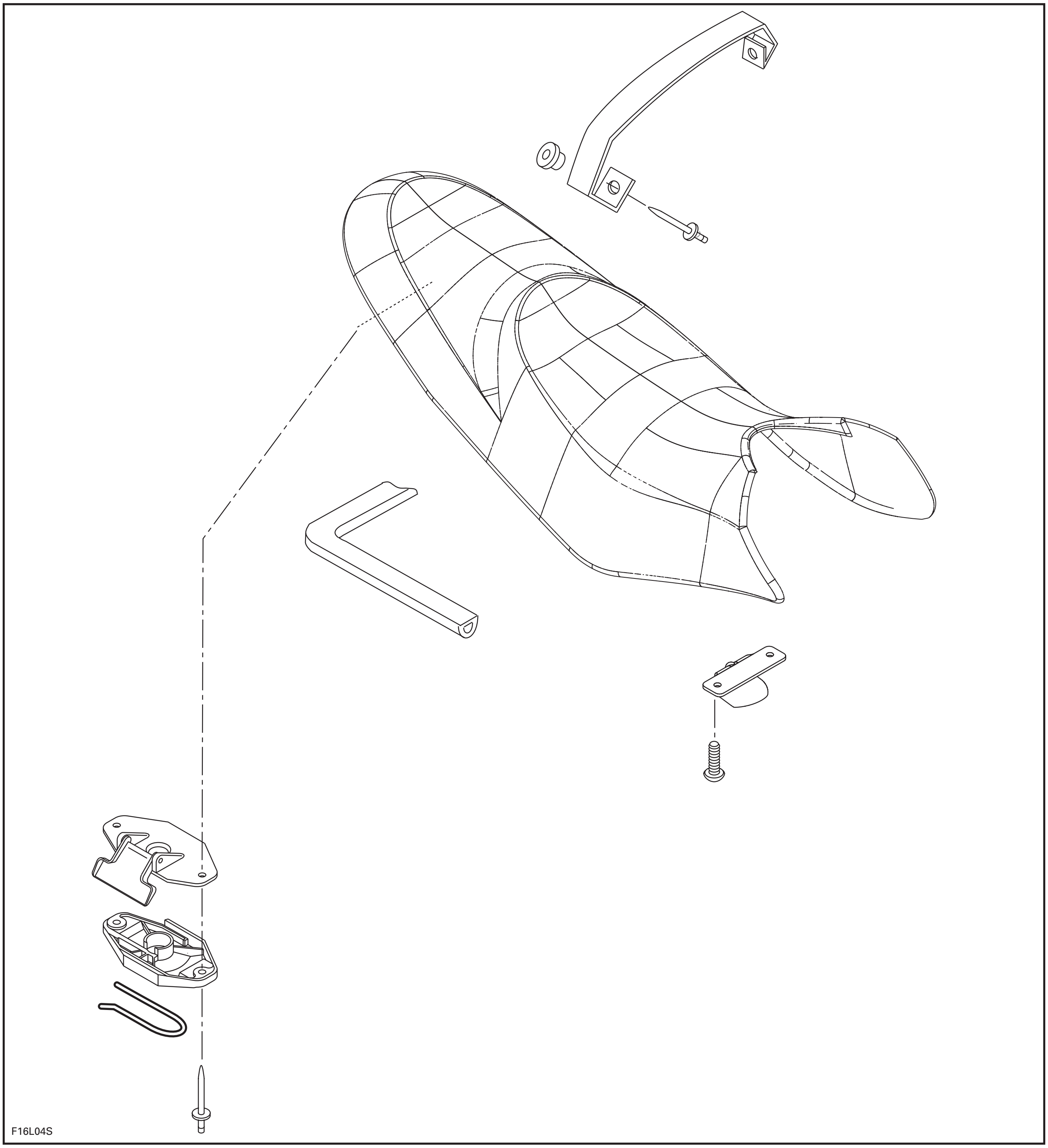
RX (stern)


Loctite 271
13
12
Loctite 243
4
5
14
4
5
12
12
12
Loctite 271
15 N•m (133 lbf•in)
Silicone sealant
15
Silicone sealant
Silicone sealant
F16L02S

RX (cover)



RX (seat)

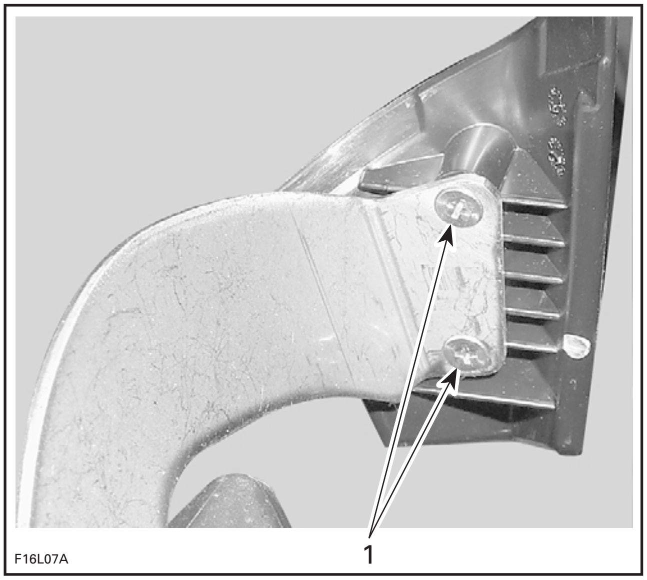


GLOVE BOX

RX/RX DI models

Removal

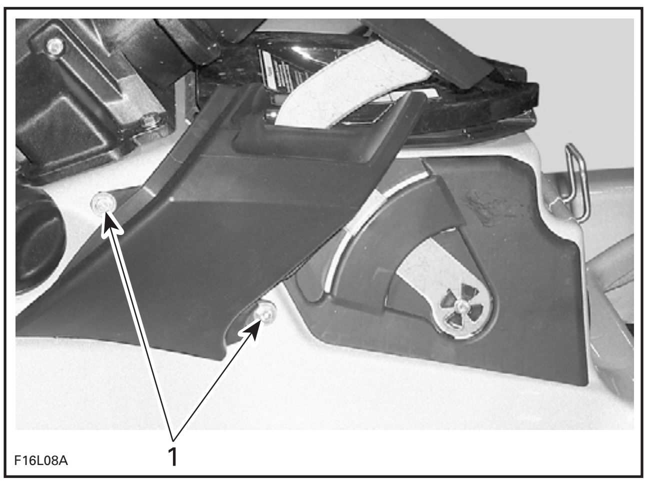
Remove handle from shift lever.



F16L07A

1. *Unscrew*

Unscrew retaining screws then remove side panels.

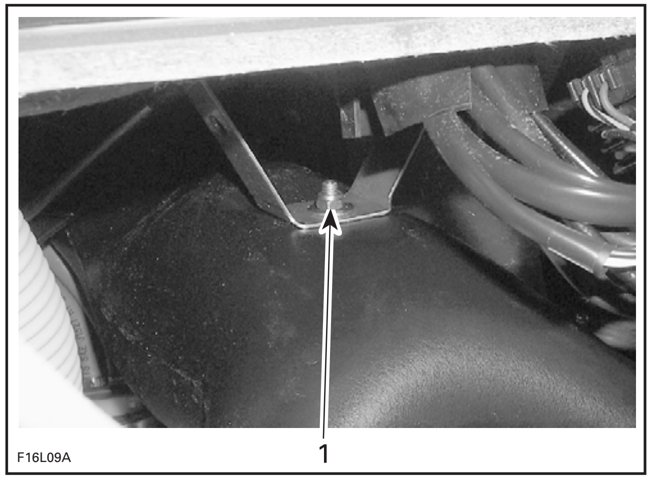


F16L08A

1. *Unscrew*

Open front storage cover and remove basket.

Unscrew nut retaining vent tube to bracket.

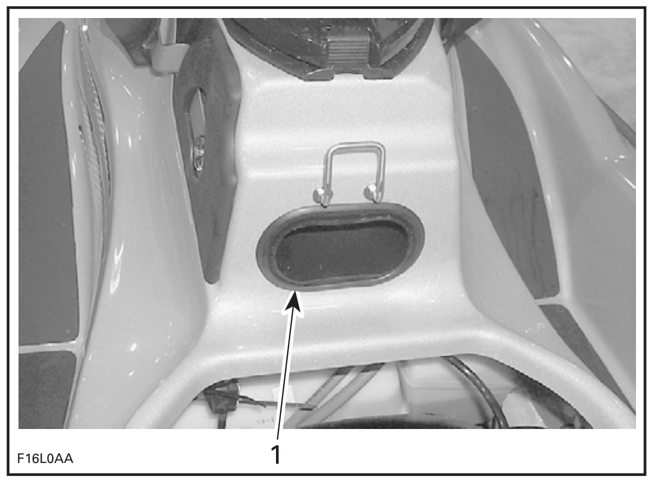


F16L09A

1. *Unscrew*

Pull vent tube out.

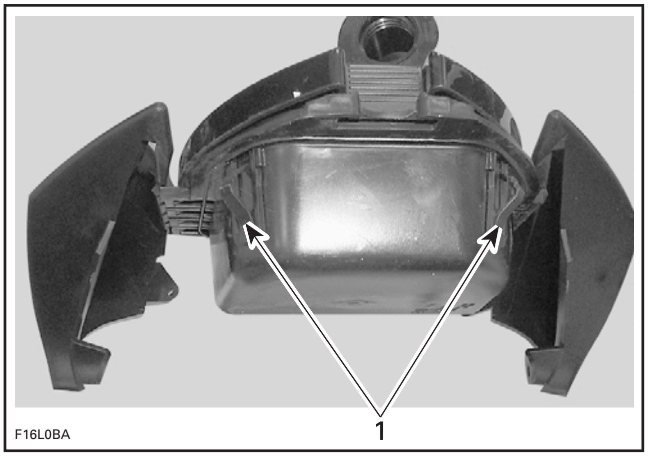
From the engine compartment, insert a hand through the vent tube hole and press glove box lock tabs to release.



F16L0AA

1. *Insert your hand here to release the lock tabs*

From front storage compartment, pull glove box out.



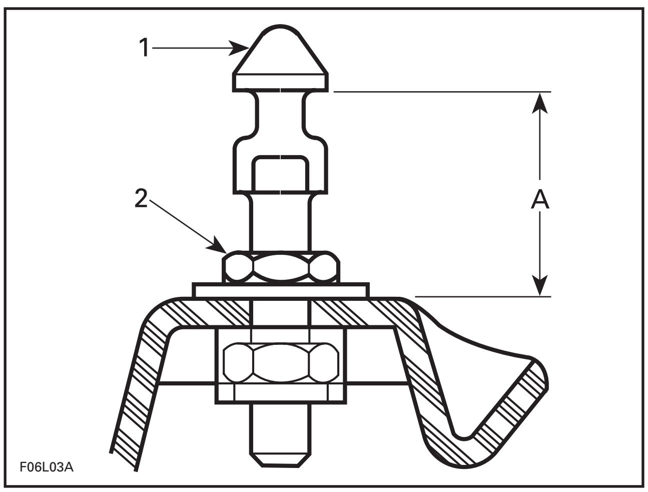
1. Lock tabs

Installation

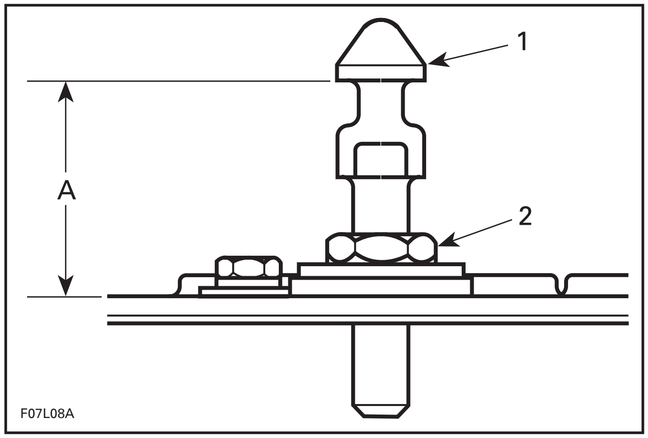
Reverse the removal procedure.

SEAT ADJUSTMENT

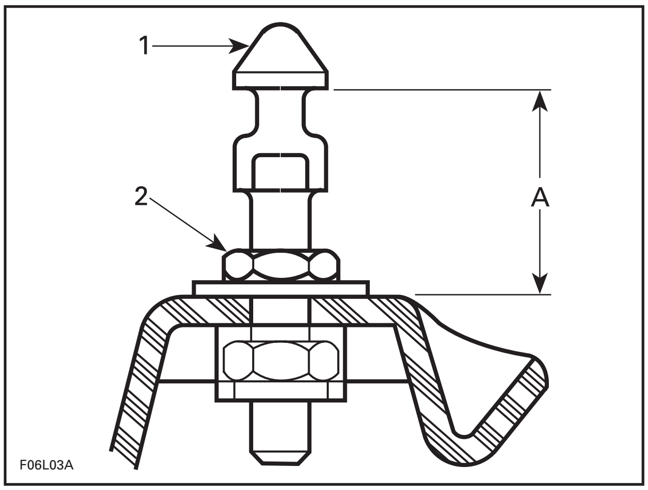
Seat Retainer



RX MODELS
1. *Lock pin*
2. *Adjustment nut (apply Loctite 271)*
A. *36 ± 1 mm (1-5/16 ± 13/32 in)*



GTX DI MODELS — FRONT SEAT
1. *Lock pin*
2. *Adjustment nut (Loctite 271)*
A. *39 ± 1 mm (1-35/64 ± 3/64 in)*



GTX DI MODELS — REAR SEAT
1. *Lock pin*
2. *Adjustment nut (apply Loctite 271)*
A. *33.5 ± 1 mm (1-5/16 ± 3/64 in)*

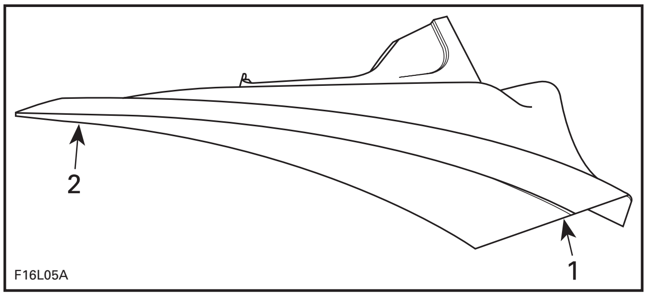
STORAGE COMPARTMENT INNER SHELL

To remove inner shell, proceed as follows:

CAUTION: Failure to follow this order may lead to damaging inner plastic studs.

Remove retaining screws.

Gently pull on large end (rear end) and pull apart towards the small end (front). See illustration.



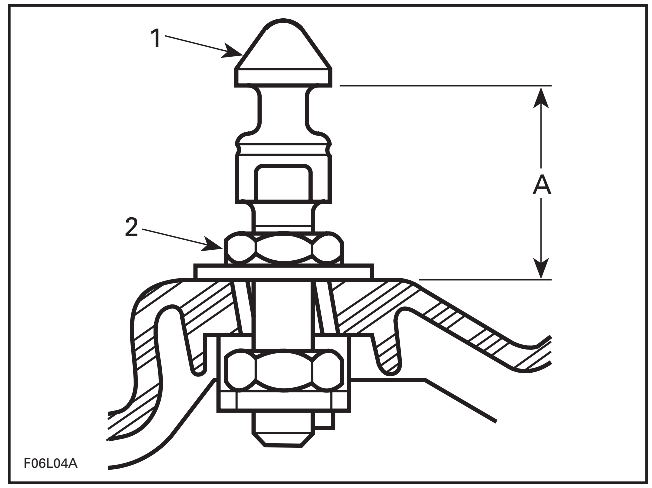
1. Gently pull starting this end
2. Finish with this end

For installation, proceed as follows:

- Sand both inner and outer shells in area to be glued.
- Clean to remove any dust with isopropylic alcohol. Let dry.
- Apply a 2 mm (3/32 in) bead of Loctite 454.
- Reinstall inner shell with its retaining screws.
- Tighten screws starting with the one at the small end (front) and finish with rear end. Carefully hand tighten.

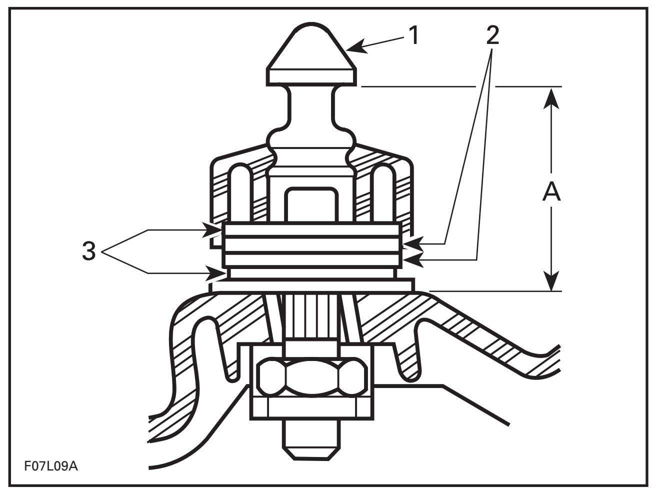
STORAGE COMPARTMENT COVER ADJUSTMENT

Adjust lock pin **no. 3** as per following specifications:



RX AND SOME GTX DI MODELS

1. Lock pin (apply Loctite 271)
2. Adjustment nut
A. 34 ± 1 mm (1-11/32 ± 3/64 in)



SOME GTX DI MODELS

1. Lock pin (apply Loctite 243)
2. Rubber washer
3. Flat washers
A. 39.2 ± 1 mm (1-35/64 ± 3/64 in)

NOTE: Some **GTX DI models** 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.

MIRROR

RX Models

Place the mirror frame in hot water to “soften” the material to allow mirror installation in its frame.

INLET GRATE

All Models

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).

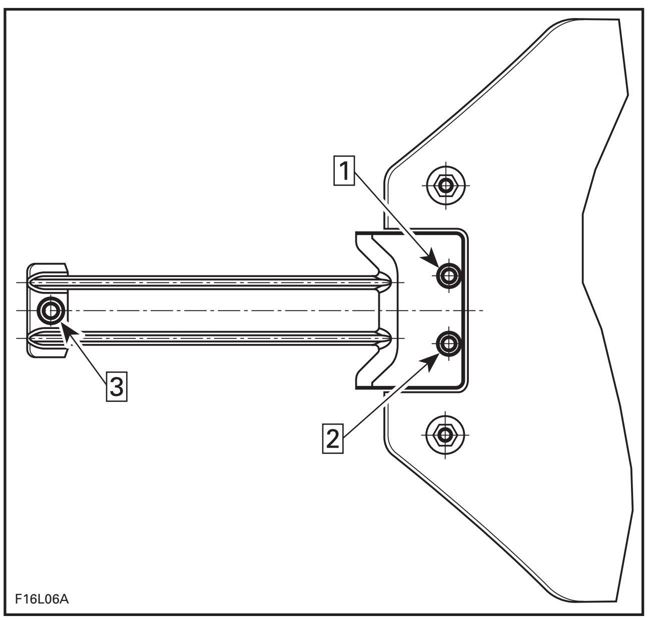
RX/RX DI models

Follow this sequence referring to the illustration:

Hand tighten screw numbers ①, ② then ③.

Torque screw numbers ① and ② to 11 N•m (97 lbf•**in**).

Torque screw number ③ to 26 N•m (19 lbf•ft).



All Models

RIDING PLATE

Removal

Remove inlet grate.

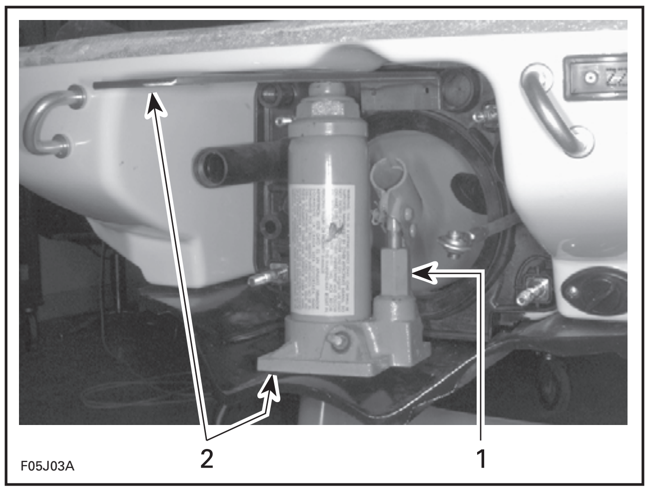
Remove jet pump. Refer to JET PUMP.

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*

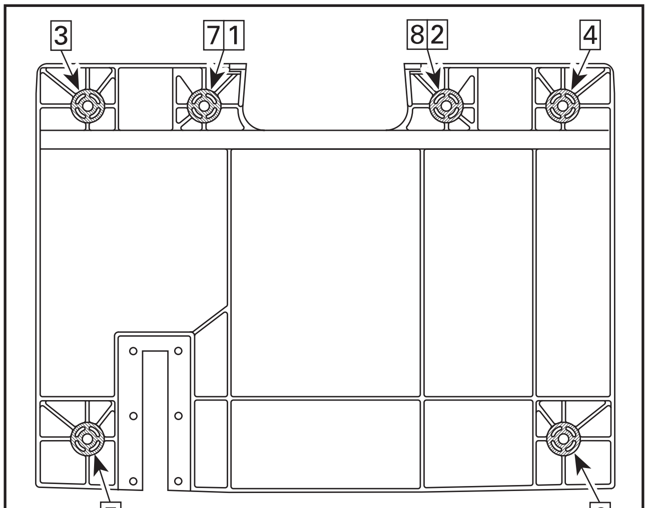
Cleaning

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

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.



F07L0DA

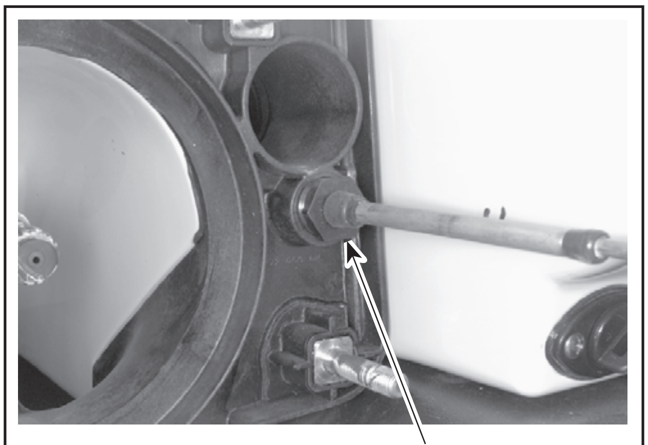
JET PUMP SUPPORT

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.



F05K02A

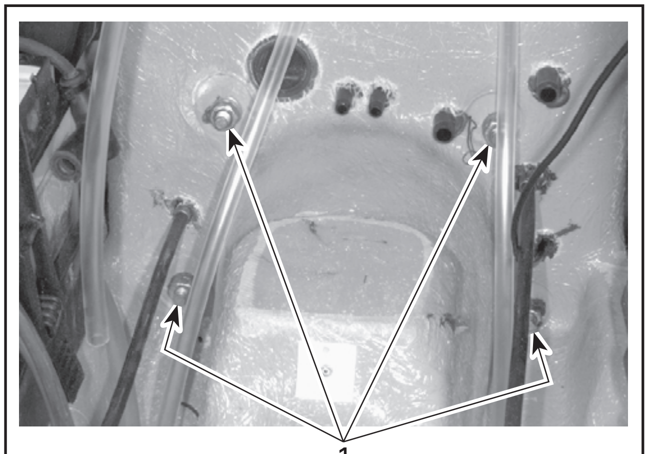
TYPICAL
1. Unscrew nut

Remove ball joint, boot, nut, half rings and O-rings from reverse cable.

Remove boot and nut from VTS sliding shaft (**RX models**).

Disconnect water supply hose, water return hose and bailer hoses.

Remove nuts, lock washers and flat washers retaining jet pump support.



F07L0AA

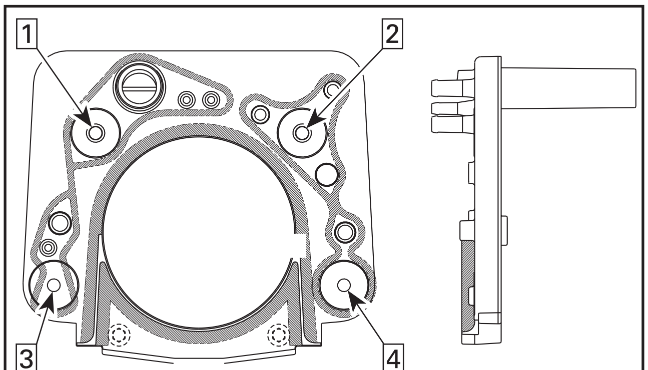
TYPICAL
1. Remove nuts

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.



F07L23A

DEFLECTOR

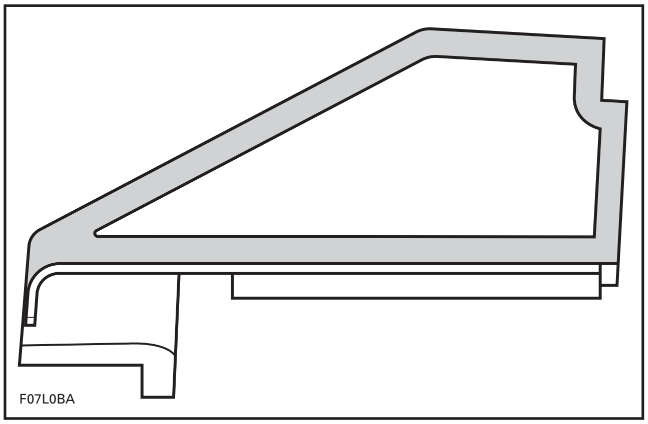
GTX DI Models

Removal

Using a heat gun, heat deflector and pry it using a piece of wood.

Installation

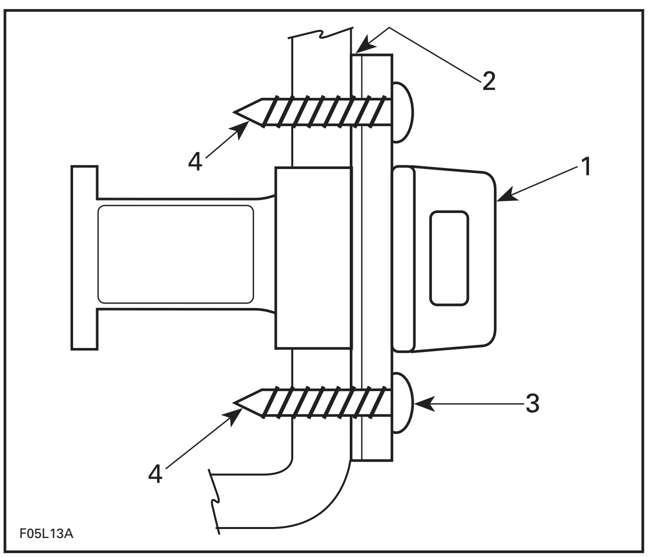
Apply Loctite The Right Stuff Gasket as indicated by the shaded area in the following illustration.



All Models

DRAIN PLUG INSTALLATION

Refer to the following illustration to install drain plug no. 15.



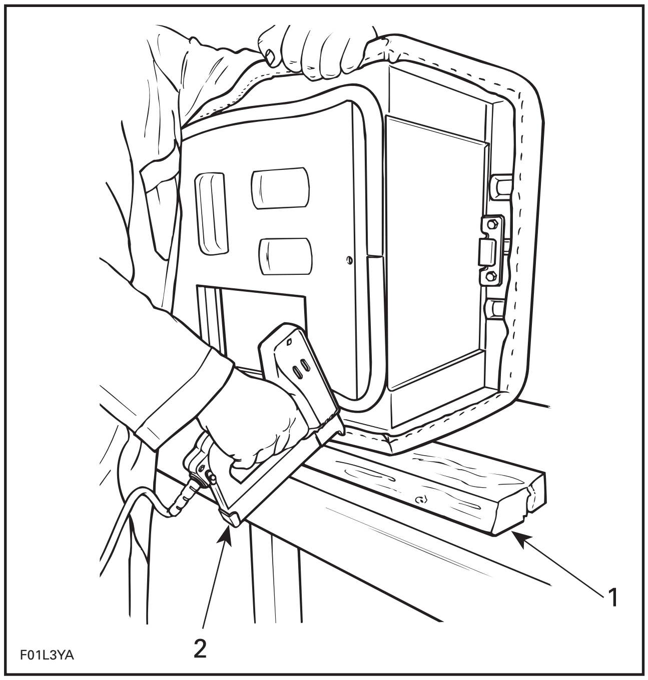
1. *Drain plug*
2. *Gasket and 732 sealant*
3. *Torque screws to 1.5 N•m (13 lbf•**in**)*
4. *From inside bilge, apply 732 sealant on screws*

SEAT 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.

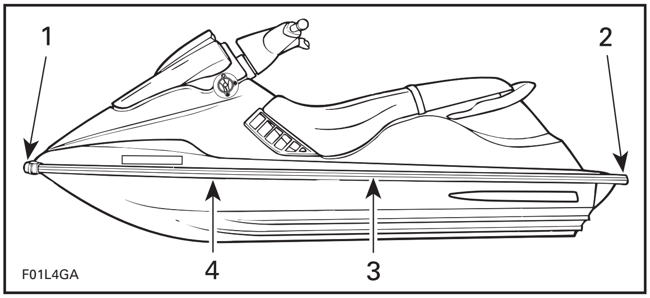


TYPICAL
1. *Piece of wood*
2. *ETN-50 (electric) or T-50 (manual)*

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.



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

RX Models

Remove retaining screw from rear of sponson.

Pull sponson out.

At installation, apply Loctite 271 (red) on screw threads and on sponson nut. Torque screw to 6 N•m (53 lbf•**in**).

⚠ WARNING

Recommended torques and use of Loctite must be strictly followed.

GTX DI Models

Remove seat support.

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**.

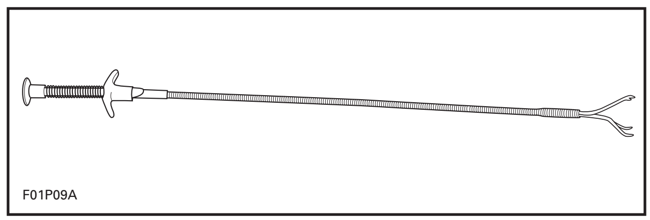
Apply silicone sealant (P/N 293 800 033) around sponson studs.

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.

All Models

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 ACRYLI-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 ACRYLI-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**.

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

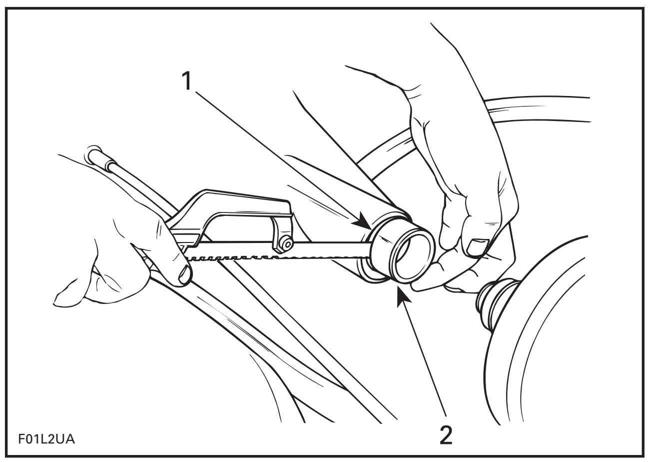
Materials

- 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

THRU-HULL FITTING INSTALLATION

For hull insert repair proceed as follows:

Cut plastic hull insert flush with hull using a saw.

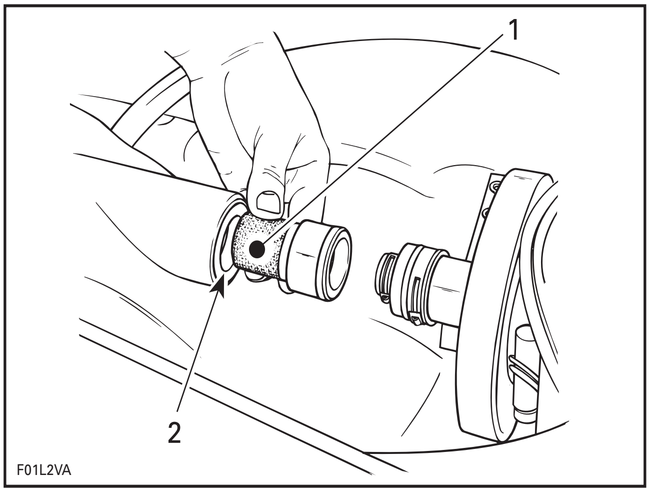


1. Hull
2. Plastic hull insert

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.

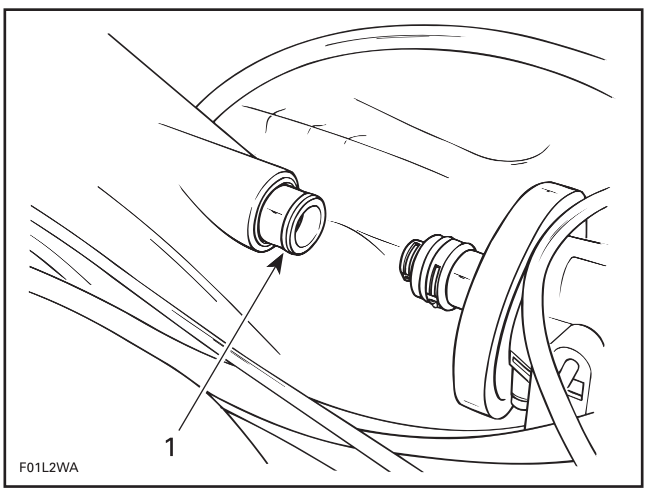
CAUTION: If you notice any clearance between plastic insert and aluminum insert, fill gap with epoxy glue to obtain good adhesion of aluminum insert.



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.

RX MODELS

ENGINE		RX (5513/5514)
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	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 side: 0.050 mm (.002 in); PTO side: 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:		

ELECTRICAL		RX (5513/5514)
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		RX (5513/5514)
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	RX (5513/5514)
Type	Open circuit — Direct flow from jet propulsion unit
Thermostat	None
Monitoring beeper setting	86 - 94°C (187 - 201°F)
ADDITIONAL INFORMATION:	

PROPULSION		RX (5513/5514)
Propulsion system		BOMBARDIER Formula Pump
Jet pump type		Axial flow single stage
Impeller rotation (seen from rear)		Counterclockwise
Transmission		Direct drive
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	RX (5513/5514)
Number of passenger (driver incl.)	2
Overall length	285 cm (112 in)
Overall width	120 cm (47 in)
Overall height	104 cm (40.9 in)
Dry weight	275 kg (605 lb)
Load limit (passenger and 10 kg (22 lb) luggage)	181 kg (398 lb)
ADDITIONAL INFORMATION:	

CAPACITIES		RX (5513/5514)
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	115 mL (3.88 U.S. oz)
	Oil level height	Up to plug
ADDITIONAL INFORMATION:		

MATERIALS	RX (5513/5514)
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	Thermoplastic
Fuel tank	Polyethylene
Oil injection reservoir	Polyethylene
Seat	Polyurethane foam
ADDITIONAL INFORMATION:	

STANDARD EQUIPMENT	RX (5513/5514)
Safety lanyard	Standard
Sea-Doo learning Key™ Safety lanyard	Standard
Digitally Encoded Security System	Standard
Fuel tank reserve	Standard
Monitoring beeper	Standard
Speedometer	Standard
Fuel/oil gauge (analog)	Not applicable
Tachometer	Not applicable
Variable trim system (VTS)	Standard
Information Center	Standard
Storage compartment	Standard
Glove box	Standard (2)
Rear grab handle	Standard
Tool kit	Standard
ADDITIONAL INFORMATION: Information 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/lake temperature/chronometer/maintenance information.	

PERFORMANCE		RX (5513/5514)
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:		

TIGHTENING TORQUES			RX (5513/5514)		
ENGINE	Exhaust manifold screw		40 N•m	(30 lbf•ft)	
	Magneto flywheel nut		115 N•m	(85 lbf•ft)	(1)
	Flywheel screw (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		113 N•m	(83 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		7.5 N•m	(66 lbf•**in**)	(1)
	Inlet grate screws		11 N•m	(97 lbf•**in**)	(1)
	Riding plate screws		22 N•m	(17 lbf•ft)	(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.

RX DI AND GTX DI MODELS

ENGINE		RX DI (5646/5656)	GTX DI (5649/5659)
Engine type		BOMBARDIER-ROTAX 947 DI, 2-stroke	
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)	4 mm (.157 in)	
Exhaust valve		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 DI (synthetic injection oil **only**)	
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		51.4 ± 0.6 cc	
Cylinder head warpage (maximum)		0.10 mm (.004 in) total	
Piston ring type and quantity		2 semi-trapez chrome coated steel rings	
Ring end gap	New	0.55 - 0.7 mm (.022 - .028 in)	
	Wear limit	1.1 mm (.043 in)	
Ring/piston groove clearance	New	0.044 - 0.089 mm (.002 - .003 in)	
	Wear limit	0.2 mm (.008 in)	
Piston/cylinder wall clearance	New (minimum)	0.12 mm (.0047 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 side: 0.050 mm (.002 in); PTO side: 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)	
Air compressor	Type	Piston	
	Displacement	43 cm^3 (2.6 in^3)	
	Drive	Balancing shaft	
	Intake side	Reed valves	
	Exhaust side	Reed valves	
ADDITIONAL INFORMATION:			

ELECTRICAL		RX DI (5646/5656)	GTX DI (5649/5659)
Magneto generator output		270 W @ 6000 RPM	
Ignition system type		Digital Inductive	
Spark plug	Make and type	NGK ZFR4F	
	Gap	1.1 mm (.04 in)	
TDC setting (BTDC)	mm (in)	5.39 mm (.212 in) (direct) measured through direct injector hole 7.87 (.310) (indirect) measured through spark plug hole	
	Degrees	27 @ at idle speed (locked)	
Generating coil		Not applicable	
Battery charging coil		0.1 - 1 Ω	
Trigger coil		Not applicable	
Ignition coil	Primary	0.45 - 0.55 Ω	
	Secondary	6.8 - 10.2 kΩ without high tension leads	
Engine rev limiter setting		7200 (± 50) RPM	
Battery		12 V, 19 A•h (Yuasa/Exide)	
Fuses	Main	30 A	
	Injection system (INJ)	15 A	
	Charging system (REG)	25 A	
	Information center (ACC)	2 A	
	Fuel pump (FP)	15 A	
	VTS system (VTS)	7.5 A	Not applicable
ADDITIONAL INFORMATION:			

FUEL SYSTEM		RX DI (5646/5656)	GTX DI (5649/5659)
Fuel injection type		Orbital Direct Fuel Injection, twin throttle body (46 mm (1.81 in))	
Idle speed (in water/out of water)		1450 ± 50 RPM	
Throttle Position Sensor (TPS)		1.6 kΩ - 2.4 kΩ	
Crankshaft Position Sensor (CPS)		5 Volts	
Manifold Air Temperature Sensor (MATS)		2.28 kΩ - 2.74 kΩ	
Water Temperature Sensor (WTS)		2.28 kΩ - 2.74 kΩ	
Exhaust Gas Temperature Sensor (EGT)		2.28 kΩ - 2.74 kΩ	
Manifold Air Pressure Sensor (MAPS)		0 Ω (continuity between terminals 3 and 1)	
Knock Sensor (KS)		5 MΩ	
RAVE solenoid		24 Ω	
Fuel injector		1.7 Ω - 1.9 Ω	
Direct injector		1.0 Ω - 1.6 Ω	
Fuel	Type	Super unleaded gasoline	
	Minimum octane no.	91	
ADDITIONAL INFORMATION:			

COOLING	RX DI (5646/5656)	GTX DI (5649/5659)
Type	Open circuit — Direct flow from jet propulsion unit	
Thermostat	None	
Monitoring beeper setting	86 - 94°C (187 - 201°F)	
ADDITIONAL INFORMATION:		

PROPULSION		RX DI (5646/5656)	GTX DI (5649/5659)
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		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	RX DI (5646/5656)	GTX DI (5649/5659)
Number of passenger (driver incl.)	2	3
Overall length	285 cm (112 in)	315 cm (124 in)
Overall width	120 cm (47 in)	123 cm (48 in)
Overall height	104 cm (41 in)	107 cm (42 in)
Dry weight	275 kg (625 lb)	309 kg (681 lb)
Load limit (passenger and 10 kg (22 lb) luggage)	181 kg (398 lb)	243 kg (536 lb)
ADDITIONAL INFORMATION:		

CAPACITIES		RX DI (5646/5656)	GTX DI (5649/5659)
Fuel tank (including reserve)		56.5 L (15 U.S. gal)	
Fuel tank reserve (from low level signal)		9.8 L (2.6 U.S. gal)	
Oil injection reservoir		6 L (1.6 U.S. gal)	
Jet pump impeller shaft reservoir	Capacity	115 mL (3.88 U.S. oz)	
	Oil level height	Up to plug	
ADDITIONAL INFORMATION:			

MATERIALS	RX DI (5646/5656)	GTX DI (5649/5659)
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	Thermoplastic	
Fuel tank	Polyethylene	
Oil injection reservoir	Polyethylene	
Seat	Polyurethane foam	
ADDITIONAL INFORMATION:		

STANDARD EQUIPMENT	RX DI (5646/5656)	GTX DI (5649/5659)
Safety lanyard	Standard	
Sea-Doo learning Key™ Safety lanyard	Standard	
Digitally Encoded Security System	Standard	
Fuel tank reserve (from low level signal)	Standard	
Monitoring beeper	Standard	
Speedometer	Standard	
Fuel/oil gauge (analog)	Not applicable	
Tachometer	Not applicable	
Information Center	Standard	
Storage compartment	Standard	
Glove box	Standard (2 on **RX models**)	
Rear grab handle	Standard	
Tool kit	Standard	
ADDITIONAL INFORMATION: Information 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		RX DI (5646/5656)	GTX DI (5649/5659)
Estimated pump power		52.1 kW (69.8 HP)	50.2 kW (67.3 HP)
Maximum fuel consumption at wide open throttle		47 L/h (12.4 U.S. gal/h)	
Cruising time at full throttle	Fuel tank without reserve	60 minute	
	Fuel tank reserve (from low level signal)	12 minutes	
ADDITIONAL INFORMATION:			

TIGHTENING TORQUES			RX DI (5646/5656)	GTX DI (5649/5659)
ENGINE	Exhaust manifold screw		40 N•m (30 lbf•ft)	
	Magneto flywheel nut		115 N•m (85 lbf•ft)	(1)
	Flywheel screw (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		40 N•m (30 lbf•ft)	(1) (4)
	Cylinder screws		24 N•m (30 lbf•ft)	(4)
	Tuned pipe flange screws/nut		48 N•m (35 lbf•ft)	(1)
	Tuned pipe fixation screws		25 N•m (18 lbf•ft)	(1)
	Magneto housing cover screws		9 N•m (80 lbf•**in**)	(5)
	Starter mounting screws		10 N•m (89 lbf•**in**	(1)
	Spark plugs		Hand-tighten then tighten an additional 1/4 turn	
JET PUMP	Impeller		113 N•m (83 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		7.5 N•m (66 lbf•**in**)	(1)
	Inlet grate screws		11 N•m (97 lbf•**in**)	(1)
	Riding plate screws		22 N•m (17 lbf•ft)	(2)
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)		7 N•m (62 lbf•**in**)	
	Steering support bolts		12 N•m (9 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

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).

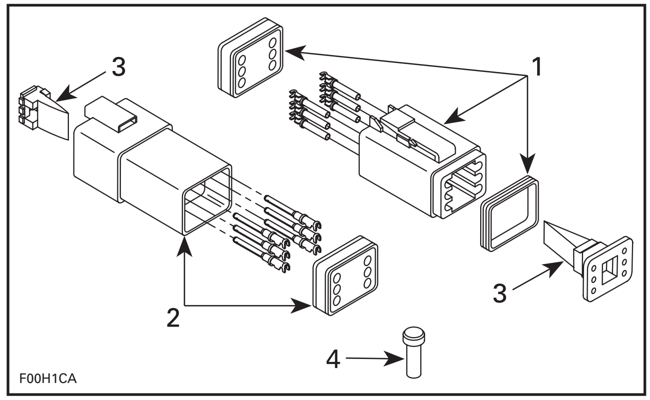
The first number indicates that the wire is positioned in the connector **no. 2** of the MPEM.

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, to electrical box (**some models**) and to diagnostic tool (VCK) on **DI models**.

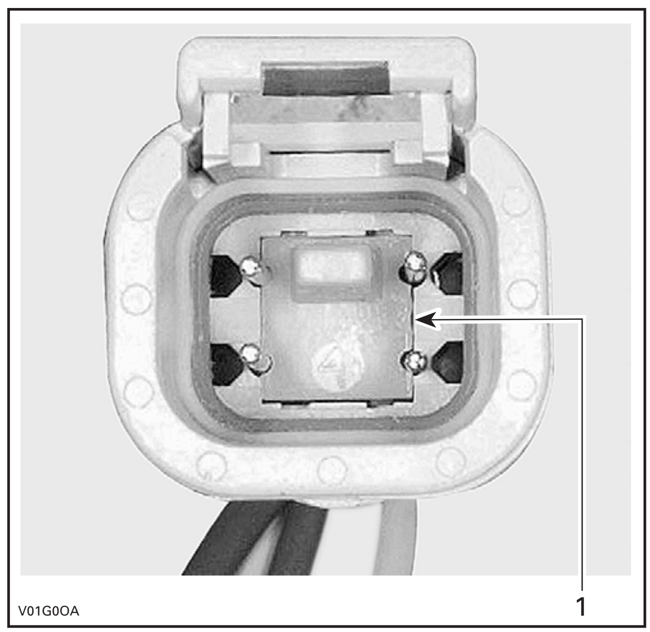


1. *Male housing*
2. *Female housing*
3. *Secondary lock*
4. *Sealing cap*

CAUTION: Do not apply dielectric grease on contacts inside plug connector.

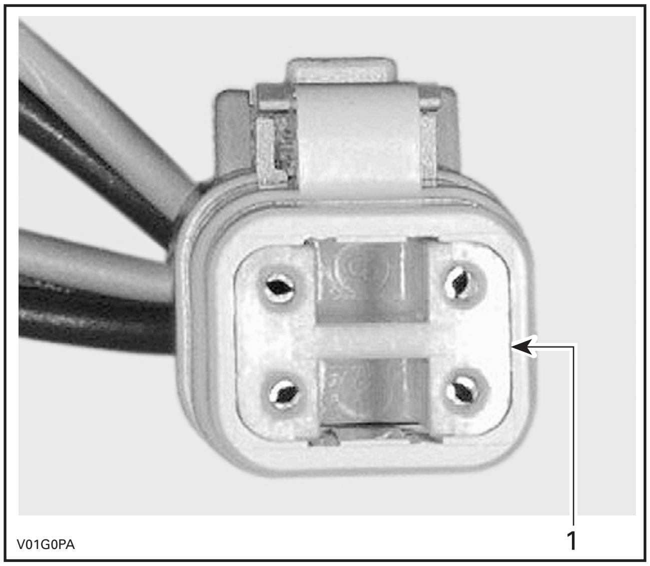
To remove wire contacts from housing, proceed as follows:

– Using a long nose pliers, pull out the lock.



FEMALE HOUSING

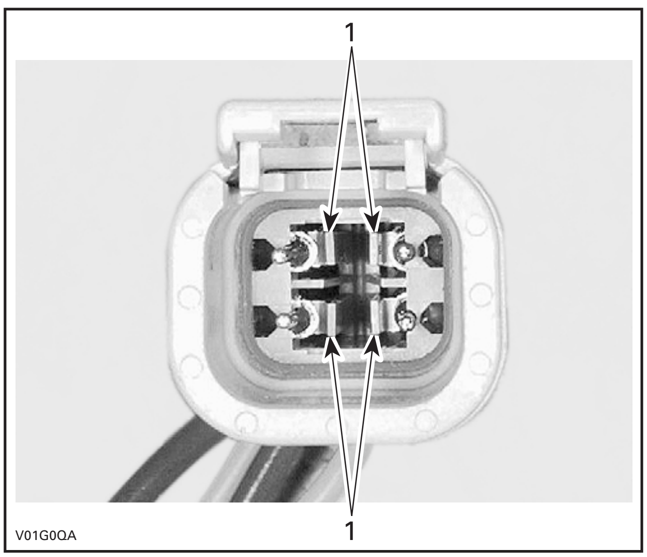
1. *Female lock*



MALE HOUSING
1. *Male lock*

NOTE: Before extraction, push wire forward to relieve pressure on retaining tab.

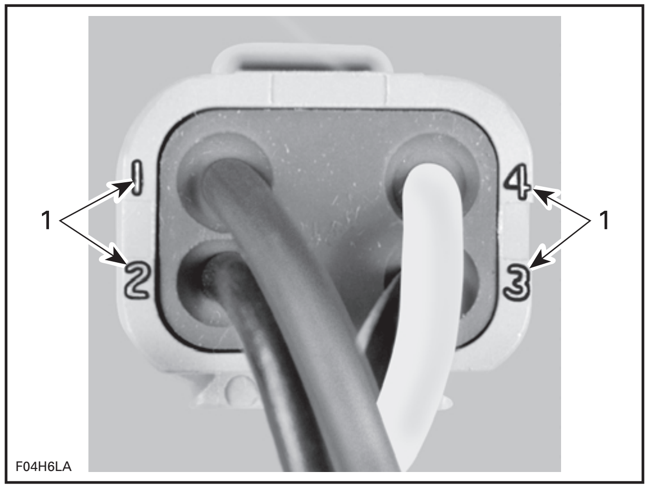
– Insert a 4.8 mm (0.189 in) wide screwdriver blade inside the front of the contact cavity.
– Pry back the retaining tab while gently pulling wire back until contact is removed.



FEMALE CONNECTOR HOUSING
1. *Retaining tab*

To install:

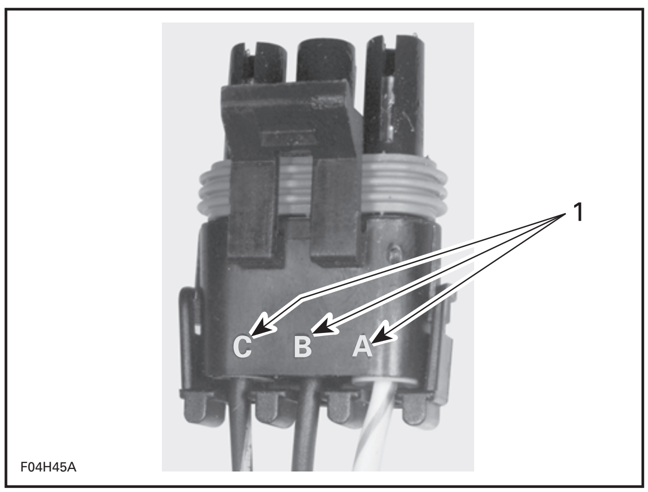
– For insertion of signal contact, make sure the lock is removed.
– Insert contact into appropriate circuit cavity and push as far as it will go.
– Pull back on the contact wire to be sure the retention fingers are holding the contact.
– After all required contacts have been inserted, the lock must be installed.



1. *Wire identification numbers*

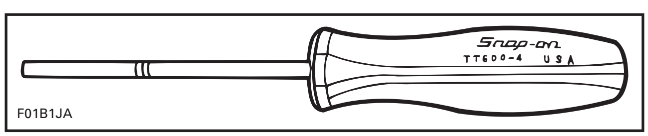
PACKARD CONNECTOR

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

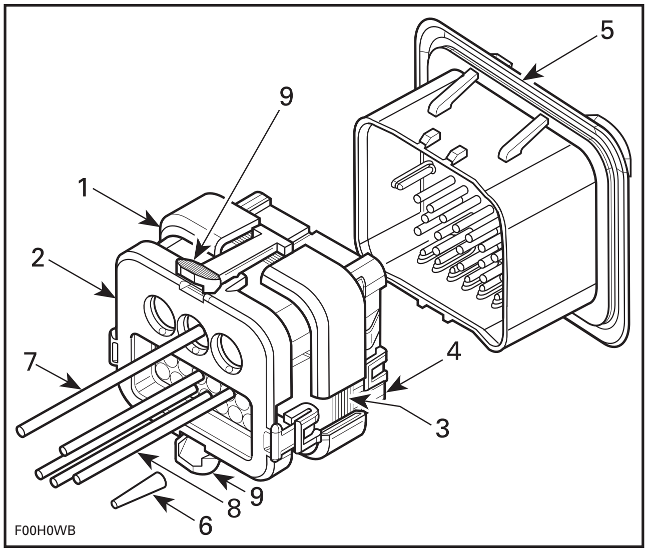
Ensure all terminals are properly crimped on wires and connector housings are properly fastened.

AMP PLUG CONNECTOR

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

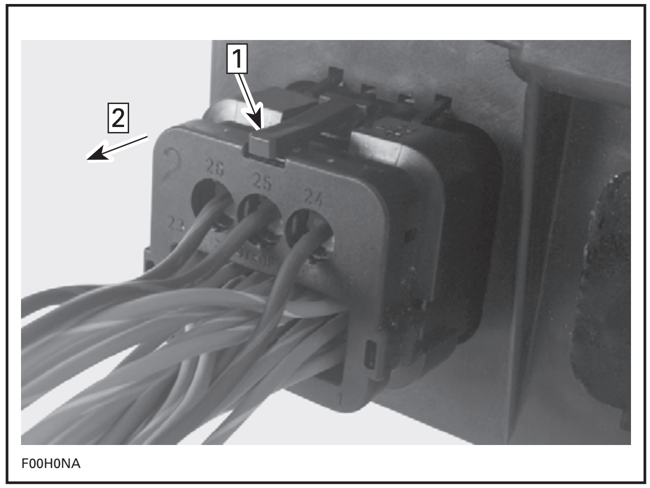


AMP PLUG CONNECTOR

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

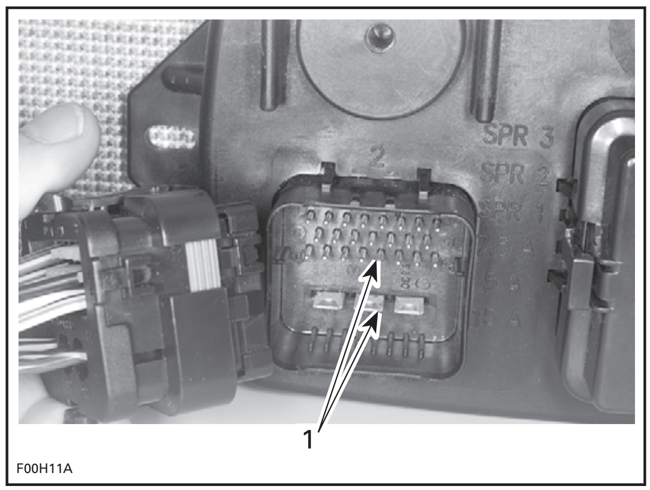
To remove the plug connector from the header assembly, press both tabs and pull plug.



Step 1: Press tabs (both sides)
Step 2: Pull plug

Installation

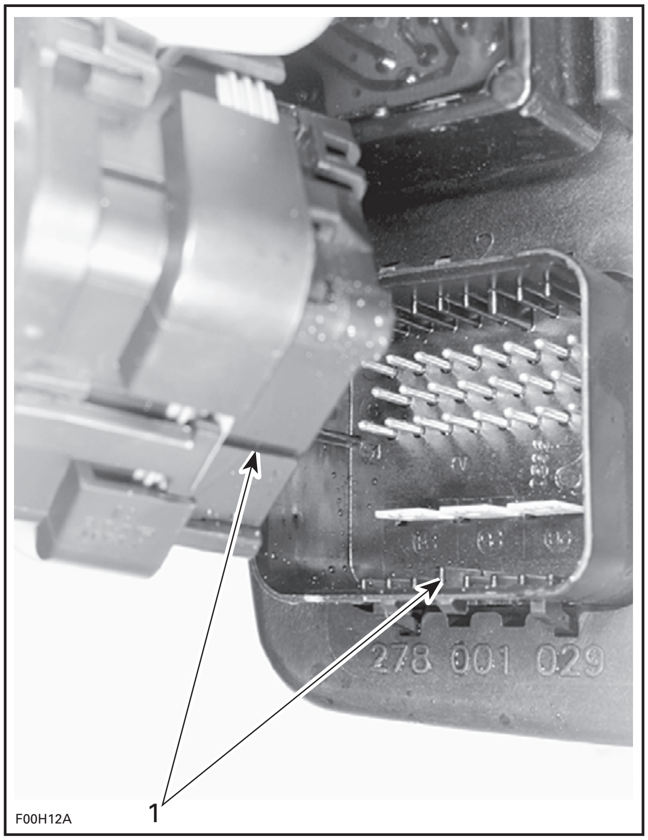
Apply a thin coat of DEOXIT contact lubricant (P/N 293 550 015) to the pins of the header on the MPEM only.



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 loose 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.



1. *Mechanically keyed*

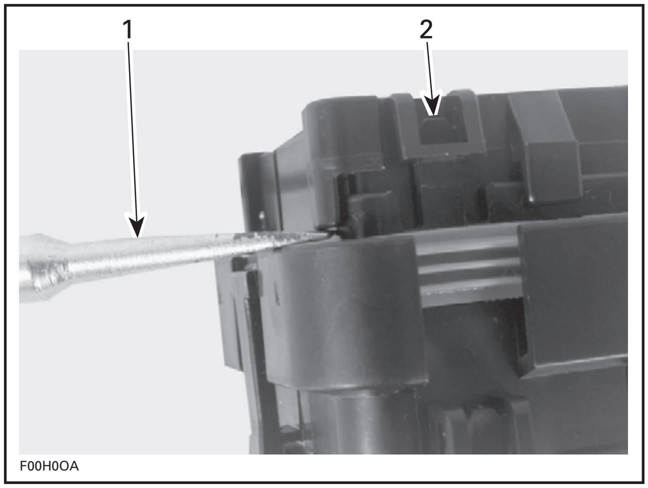
Contact Removal

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.

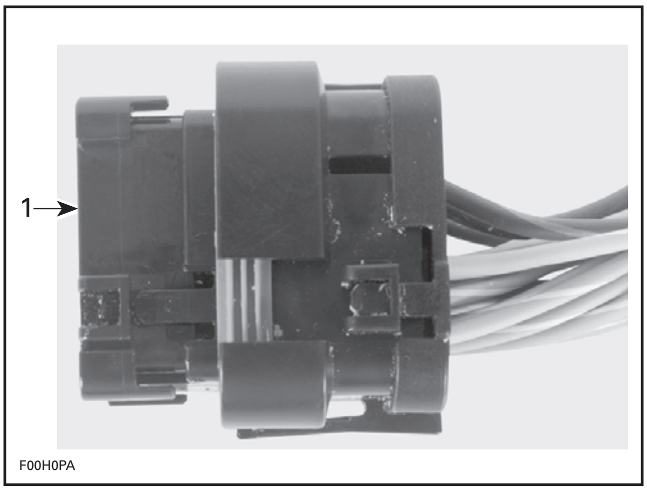
CAUTION: The wedge lock should never be removed from the connector for insertion or removal of the signal wire contacts.



1. *Screwdriver between wedge lock and connector*
2. *Locking tab*

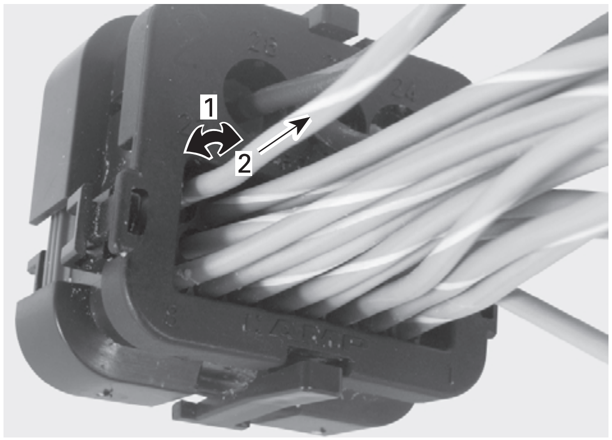
Repeat the same steps for the other locking tab retaining the wedge lock.

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.



F00H0QA

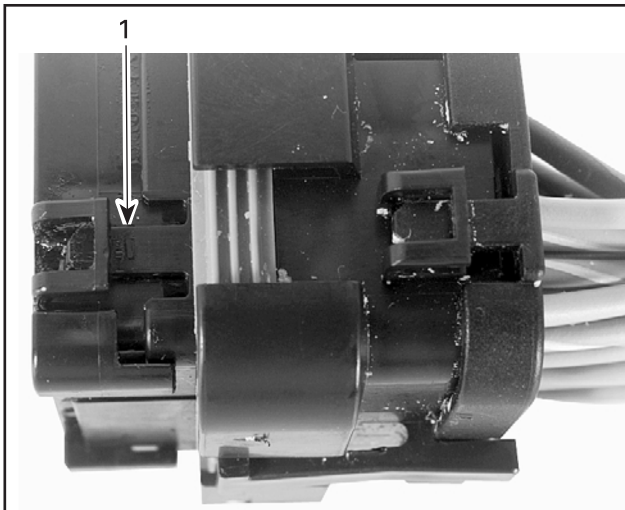
1. *Rotate wire back and forth*
2. *Pull wire*

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.

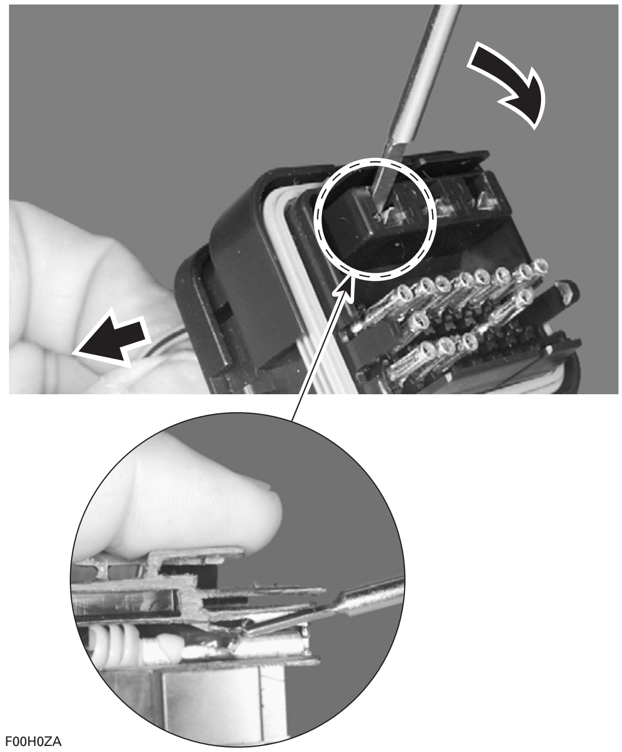


F00H0RA

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.



F00H0ZA

Pry back the retaining tab while gently pulling wire back until contact is removed.

Contact Crimping

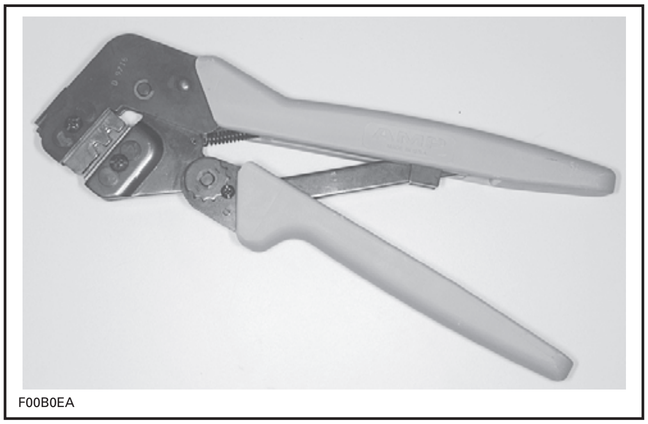
The size of the wires must be 20 to 16 AWG with a wire insulation diameter having a minimum dimension of 1.7 mm (.067 in) and a maximum dimension of 2.78 mm (.106 in).

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.

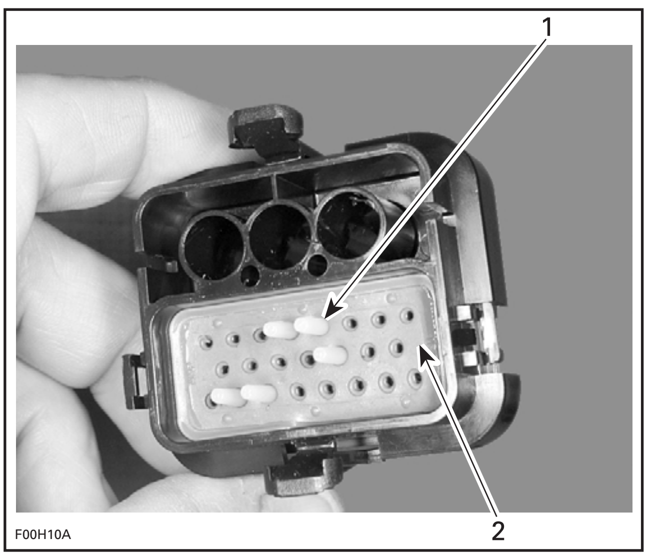


CRIMPING TOOL (P/N 295 100 164)

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.



1. *Seal plug*
2. *Wire seal*

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.

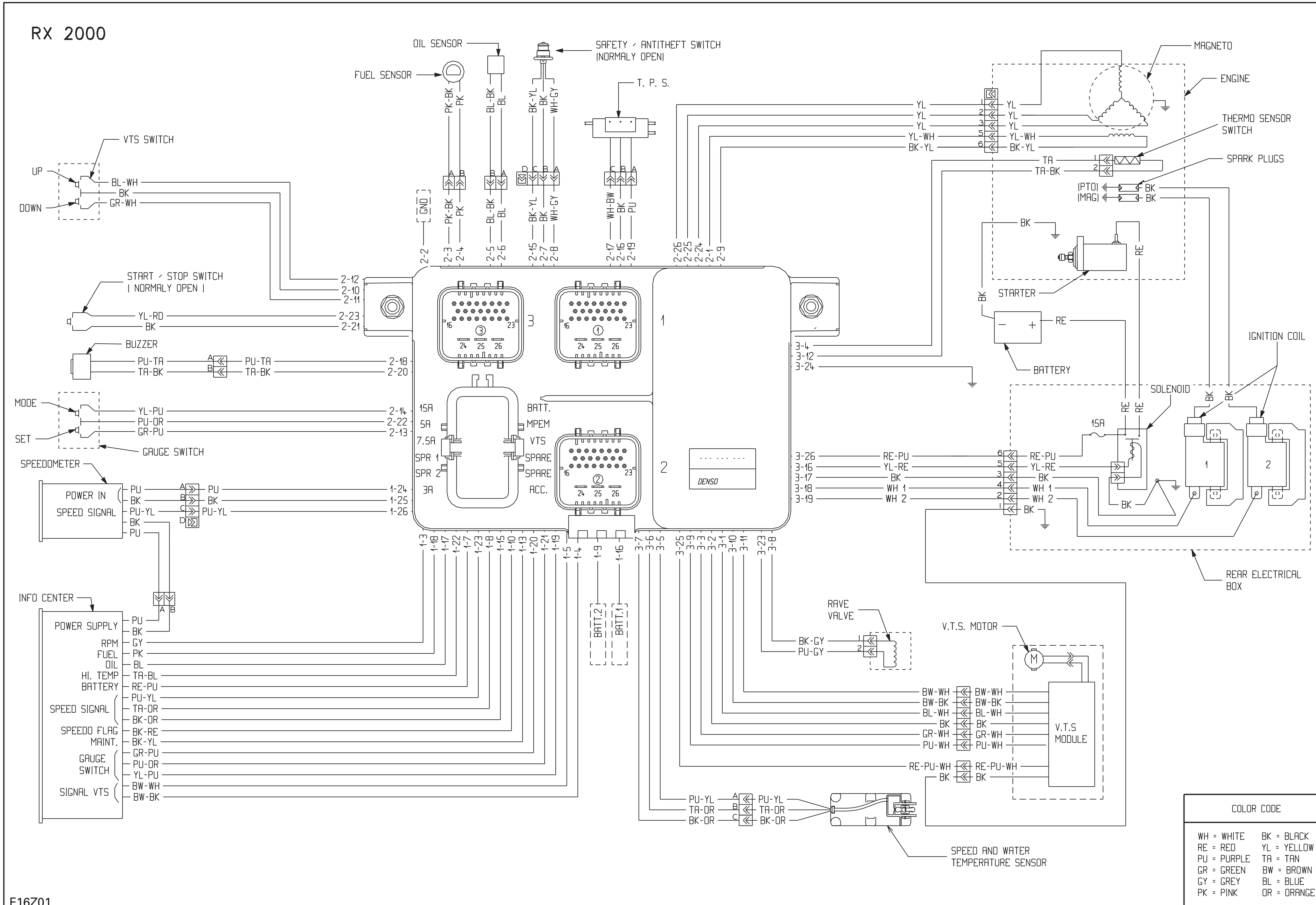
NOTE: For insertion of power contact, the wedge lock may or may not be on the open position.

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.

RX MODEL 5513/5514



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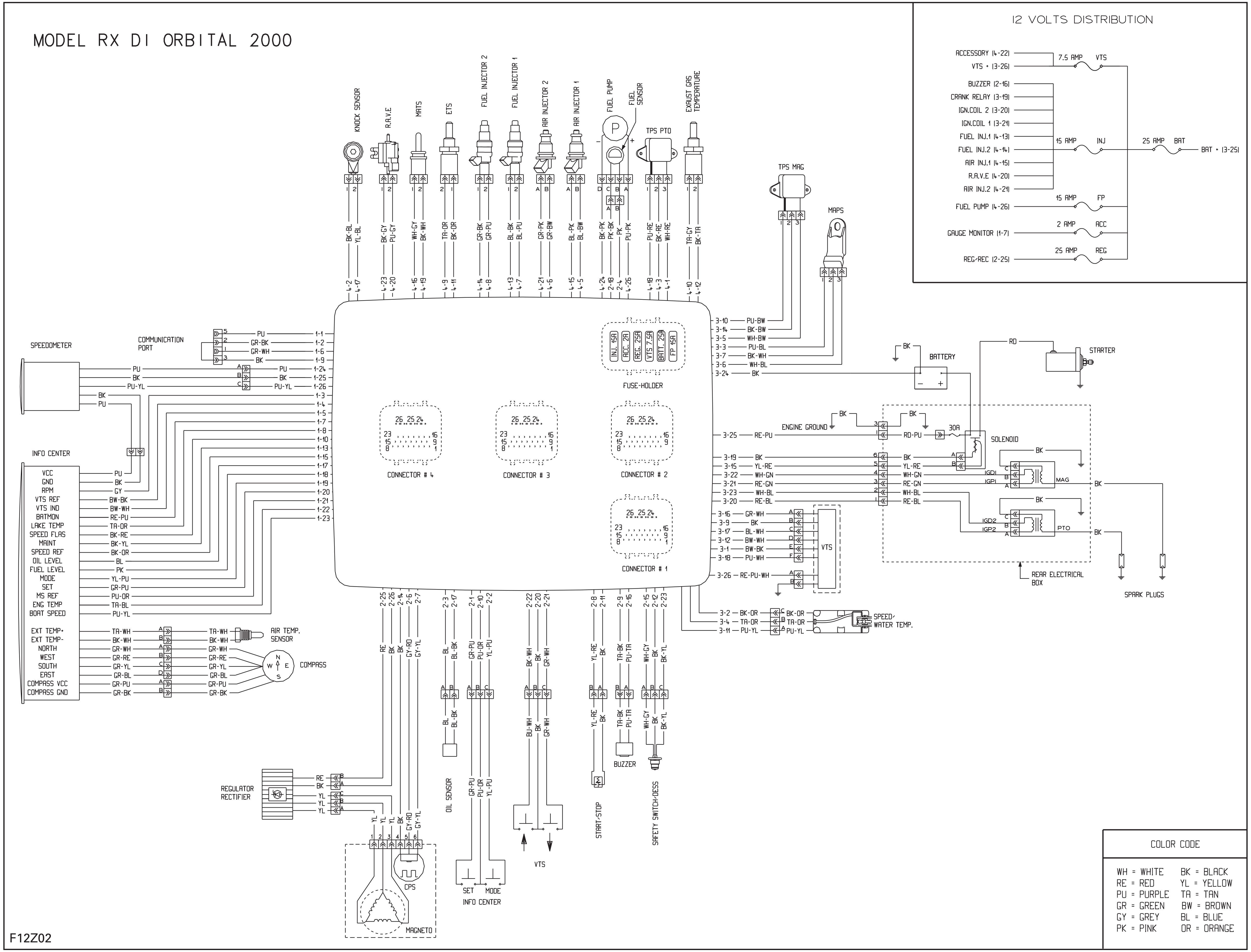
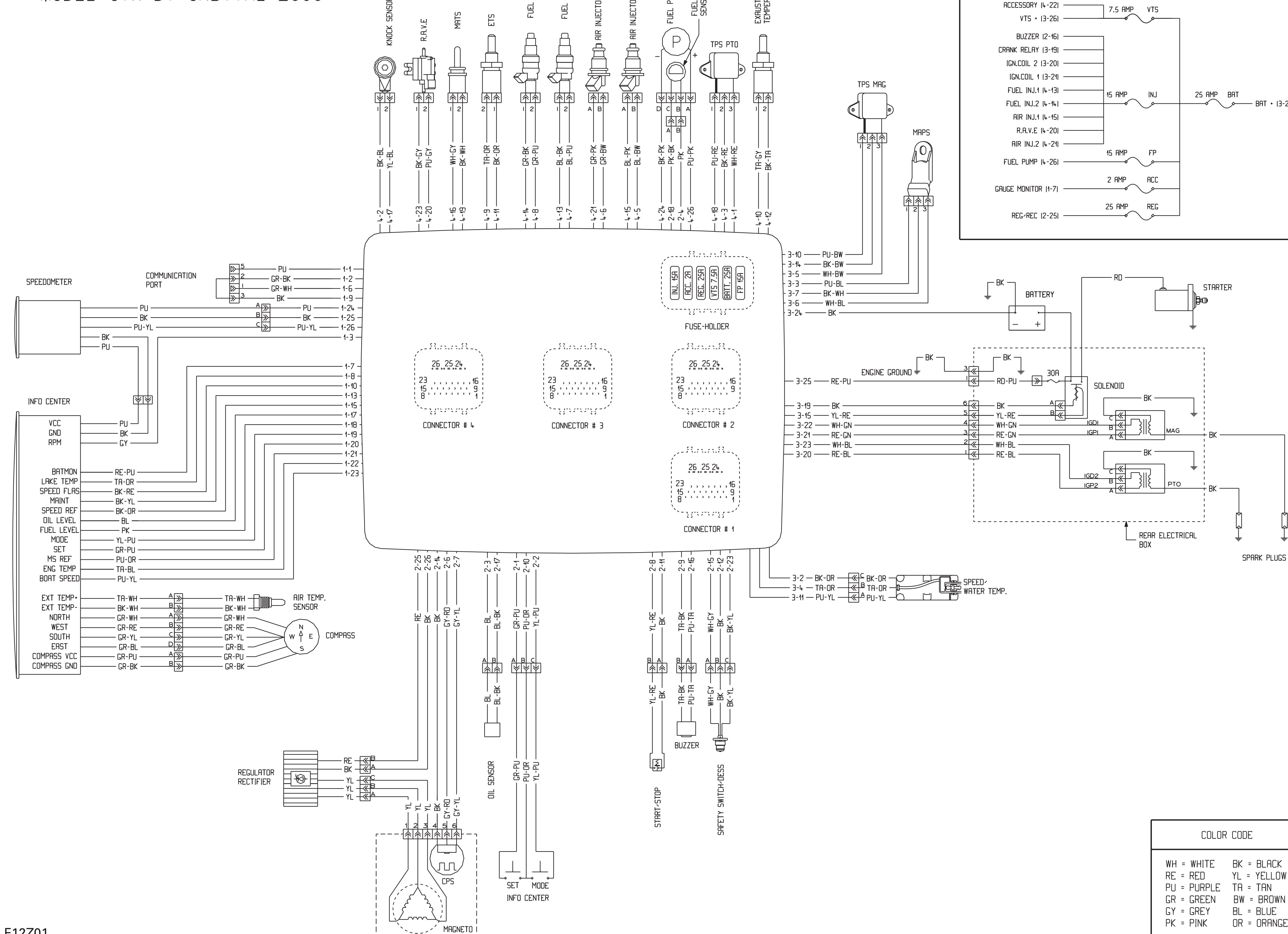
RX DI MODEL 5646/5656


MODEL RX DI ORBITAL 2000
12 VOLTS DISTRIBUTION
ACCESSORY (4-22)
VTS • (3-26)
BUZZER (2-16)
CRANK RELAY (3-19)
IGN.COIL 2 (3-20)
IGN.COIL 1 (3-21)
FUEL INJ.1 (4-13)
FUEL INJ.2 (4-14)
AIR INJ.1 (4-15)
R.A.V.E (4-20)
AIR INJ.2 (4-21)
FUEL PUMP (4-26)
GAUGE MONITOR (1-7)
REG-REC (2-25)
7.5 AMP VTS
15 AMP INJ
25 AMP BAT
BAT • (3-25)
15 AMP FP
2 AMP ACC
25 AMP REG
KNOCK SENSOR
R.A.V.E
MATS
ETS
FUEL INJECTOR 2
FUEL INJECTOR 1
AIR INJECTOR 2
AIR INJECTOR 1
FUEL PUMP
FUEL SENSOR
TPS PTO
EXHAUST GAS TEMPERATURE
TPS MAG
MAPS
BATTERY
STARTER
SOLENOID
30A
ENGINE GROUND
MAG
PTO
REAR ELECTRICAL BOX
SPARK PLUGS
SPEEDOMETER
COMMUNICATION PORT
INFO CENTER
VCC
GND
RPM
VTS REF
VTS IND
BATMON
LAKE TEMP
SPEED FLAS
MAINT
SPEED REF
OIL LEVEL
FUEL LEVEL
MODE
SET
MS REF
ENG TEMP
BOAT SPEED
EXT TEMP+
EXT TEMP-
NORTH
WEST
SOUTH
EAST
COMPASS VCC
COMPASS GND
AIR TEMP. SENSOR
COMPASS
FUSE-HOLDER
INJ. 15A
ACC. 2A
REG. 25A
VTS 7.5A
BATT. 25A
FP 15A
CONNECTOR # 4
CONNECTOR # 3
CONNECTOR # 2
CONNECTOR # 1
VTS
SPEED/WATER TEMP.
REGULATOR RECTIFIER
MAGNETO
CPS
OIL SENSOR
SET
MODE
INFO CENTER
START/STOP
BUZZER
SAFETY SWITCH/DESS
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
F12Z02

GTX DI MODEL 5649/5659

MODEL GTX DI ORBITAL 2000



F12Z01

BOMBARDIER
RECREATIONAL PRODUCTS

BOMBARDIER

VERSION FRANÇAISE ÉGALEMENT DISPONIBLE