CHAPTER 5
Engine and Cooling Systems

5

ENGINE SPECIFICATIONS

Fastener Torque Guide

COMPONENT	600 / 700 CFI	800 CFI	600 HO CARBURETED	550 FUJI	NOTE
Spark Plug	18 Ft. Lbs. (24 Nm)				Apply Nyogel
Head Cover	25 Ft.Lbs. (34 Nm)			17-20 Ft.Lbs.	Loctite 242
Cylinder Head Bypass Fitting	7 Ft.Lbs. (9.5 Nm)		N/A		
Bleed Screw	70 In.Lbs. (8 Nm)			N/A	
Knock Sensor	168 In.Lbs. (19 Nm)				Clean and Dry
Temp. Sensor	18 Ft.Lbs. (24 Nm)				
EV Housing Base / Cover	12 Ft.Lbs. (16 Nm)				Loctite 242
EV Bellows Nut	16 Ft.Lbs. (22 Nm)				Apply Loctite 2760 to the first 3 guillotine threads.
Cylinder Base Nuts	37 Ft.Lbs. (50 Nm)	N/A	37 Ft.Lbs. (50 Nm)	25-29 Ft.Lbs.	
Cylinder Bolts	N/A	42 Ft.Lbs. (57 Nm)	N/A	N/A	
PTO Crank Seal Guard	N/A	12 Ft.Lbs. (16 Nm)	N/A		
Intake Boots	9 Ft.Lbs. (12 Nm)			5 Ft.Lbs. (7 Nm)	
Exhaust Manifold	22 Ft.Lbs. (30 Nm)			18 Ft.Lbs. (24 Nm)	
Oil Pump	7 Ft.Lbs. (9.5 Nm)			48 - 72 In.Lbs.	
Water Pump Cover	9 Ft.Lbs. (12 Nm)			N/A	
Recoil Housing	9 Ft.Lbs. (12 Nm)			Hand Tight	
Recoil Hub	9 Ft.Lbs. (12 Nm)				
Flywheel Nut	90 Ft.Lbs. (122 Nm)			58-72 Ft.Lbs.	Loctite 242
Magneto	12 Ft.Lbs. (16 Nm)		5 Ft.Lbs. (7 Nm)	5 - 6.5 Ft.Lbs.	Loctite 242
Crankcase M6 M8	22 Ft.Lbs. (30 Nm)		9 Ft.Lbs. (12 Nm) Apply Loctite 242 22 Ft.Lbs. (30 Nm) Apply Loctite 242	ALL 15-18 Ft.Lbs. (78 - 98 Nm)	
Engine Straps	30 Ft.Lbs. (41 Nm)		45 Ft.Lbs. (61 Nm)		Loctite 242
Water Pump Impeller	10 Ft.Lbs. (13 Nm)			N/A	
Fuel Rail	9 Ft.Lbs. (12 Nm)		N/A		
Crankcase Drain Plugs	60 In.Lbs. (7 Nm)				Apply Pipe Sealant
Air Intake Gear Clamps	11 In.Lbs. (1.2 Nm)				

Vehicle/Engine Matrix

MODEL YEAR	VEHICLE	ENGINE MODEL NUMBER
2007	600 Carbureted 121 / Switchback	S3273-6044-PU6F
	600 Carbureted RMK	S3274-6044-PU6F
	600 CFI	S3206-6044-PU6H
	700 CFI 121	S3305-7044-PF7J
	700 CFI RMK	S3322-7044-PF7J
2008	600 Carbureted 121 / Switchback	S3466-6044-PU6F
	600 Carbureted RMK	S3467-6044-PU6F
	600 CFI 121 / Switchback / Touring	S3468-6044-PU6H
	600 CFI RMK	S3469-6044-PU6H
	700 CFI 121 / Switchback	S3470-7044-PU7J
	700 CFI RMK	S3471-7044-PU7J
	800 CFI RMK 155	S3489-8044-PU8E
	800 CFI RMK 163	S3741-8044-PU8E
	Early Build 2009 800 IQ 121	S3804-8044-PU8E
2009	550 IQ Shift	EC55PM120
	600 Carbureted Shift 121	S3675-6044-PN6F
	600 CFI-4 Injector Touring	S3677-6044-PN6H
	600 CFI-4 121/Dragon SP/Switchback/Dragon Switchback	S3908-6044-PN6H
	600 CFI-2 Injector Shift 136 / Shift RMK	S3747-6044-PN6K
	700 CFI RMK	S3680-7044-PN7J
	800 CFI 121/Switchback	S3683-8044-PN8E
	800 CFI RMK (w/bulkhead cooler)	S3685-8044-PN8E
	800 CFI RMK / Assault (w/o bulkhead cooler)	S3684-8044-PN8E
2010	550 IQ Shift	EC55PM121
	600 CFI-4 Injector Touring	S3996-6044-OP6H
	600 CFI-4 Injector 121 / Switchback	S4176-6044-OP6H
	600 CFI-4 Injector RMK	S4177-6044-OP6H
	600 CFI-2+2 Injector Widetrak	S4203-6044-OP6M
	700 CFI RMK	S4175-7044-OP7J
	800 121/Switchback/RMK 144/155	S4001-8044-OP8E
	800 RMK Dragon 155/163/Assault (w/o bulkhead cooler)	S4002-8044-OP8E
2011	550 IQ Shift/Shift 136/IQ LXT	EC55PM122
	600 IQ Shift/Shift 136/Switchback 136	S4217-6044-OO6H
	600 IQ LXT	S4216-6044-OO6H
	600 Widetrak IQ	S4219-6044-OO6N
	600 RMK 144/155	S4218-6044-OO6H

Engine Specifications

2007 - 2011 600/700 Engines

<table>
<tr><th>ENGINE MODEL NUMBER</th><th>INSTALLED HEAD VOLUME (CC)</th><th>HEAD SQUISH INCHES (MM)</th><th>PISTON-TO-CYLINDER CLEARANCE INCHES (MM)</th><th>PISTON RING END GAP INCHES (MM)</th><th>TRIGGER-TO-FLYWHEEL GAP (MM)</th></tr>
<tr><td>S3273-6044-PU6F
S3274-6044-PU6F
S3466-6044-PU6F
S3467-6044-PU6F
S3675-6044-PN6F</td><td>27.6 - 28.9</td><td>.050 - .060
(1.283 - 1.544)</td><td>.004 - .006
(.105 - .159)</td><td rowspan="3">.014 - .020
(.356 - .508)</td><td>.4 - .8</td></tr>
<tr><td>S3206-6044-PU6H</td><td rowspan="2">26.65 - 28.15</td><td rowspan="5">.045 - .058
(1.143 - 1.482)</td><td>.004 - .006
(.105 - .159)
Service Parts:
.0033 - .005
(.085 - .137)</td><td rowspan="6">.36 - 1.34</td></tr>
<tr><td>S3468-6044-PU6H
S3469-6044-PU6H
S3677-6044-PN6H
S3908-6044-PN6H
S4217-6044-OO6H</td><td>.0034 - .007
(.086 - .178)
Service Parts:
.0033 - .005
(.085 - .137)</td></tr>
<tr><td>S4176-6044-OP6H
S4177-6044-OP6H
S4218-6044-OO6H</td><td>25.65 - 27.15</td><td rowspan="3">.0033 - .005
(.085 - .137)</td><td rowspan="2">.0177 - .026
(.450 - .650)</td></tr>
<tr><td>S4203-6044-OP6M
S4219-6044-OO6N</td><td>24.40 - 28.40</td></tr>
<tr><td>S3747-6044-PN6K</td><td rowspan="2">25.65 - 27.15</td><td rowspan="2">.014 - .020
(.356 - .508)</td></tr>
<tr><td>S3996-6044-OP6H
S4216-6044-OO6H</td><td>.0034 - .007
(.086 - .178)</td></tr>
<tr><td>S3305-7044-PF7J
S3470-7044-PU7J
S3471-7044-PU7J
S3680-7044-PN7J
S4175-7044-OP7J</td><td rowspan="2">29.35 - 30.85</td><td rowspan="2">.046 - .059
(1.17 - 1.51)</td><td>.0044 - .00594
(.112 - .151)</td><td>.017 - .026
(.44 - .650)</td></tr>
<tr><td>S3322-7044-PF7J</td><td>.0042 - .006
(.109 - .163)</td><td>Upper
.010 - .018
(.25 - .45)
Lower
.014 - .020
(.35 - .50)</td></tr>
</table>

2008 - 2010 800 Engines

ENGINE MODEL NUMBER	INSTALLED HEAD VOLUME (CC)	HEAD SQUISH INCHES (MM)	PISTON-TO-CYLINDER CLEARANCE INCHES (MM)	PISTON RING END GAP INCHES (MM)	TRIGGER-TO-FLYWHEEL GAP (MM)
2008 800* S3489-8044-PU8E S3741-8044-PU8E S3804-8044-PU8E 2009 800* S3683-8044-PN8E S3684-8044-PN8E S3685-8044-PN8E 2010 800 S4001-8044-OP8E S4002-8044-OP8E	36.2 - 37.8	.054 - .066 (1.382 - 1.666)	.0047 - .0057 (.120 - .146) ***Service Parts:*** ***.0047 - .006*** ***(.120 - .153)***	.017 - .025 (.45 - .65)	.36 - 1.34

NOTE: * = 2008/2009 800 engines change to the 2010 specifications after completing Service Bulletins S-09-08 or S-09-09.

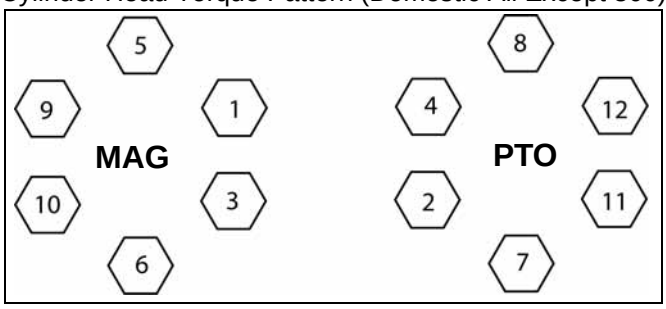
Piston / Cylinder Specifications

Engine Service Specifications - All Engines

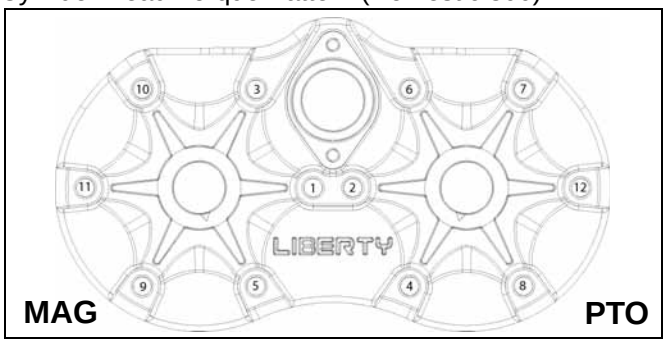
- Cylinder Head Warp Limit = .006" (.015mm)
- Cylinder Taper Limit = .002" (.051mm)
- Cylinder Out-of-Round Limit = .002" (.051mm)
- Main Bearing Interference Fit:
  Carbureted = .001" - .002" (.026 - .051mm)
  CFI = .0014 - .0024 (.036 - .061mm)
- Connecting Rod Side Clearance = .0114" - .0295" (.289 - .749mm)
- Crankshaft Runout Deflection Limit = .0025" (.07mm)

Component Torque Sequences

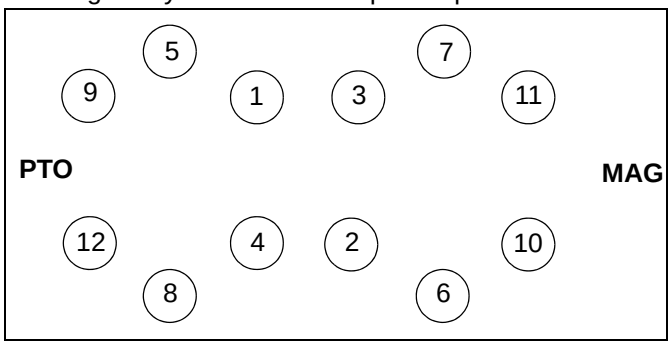
Cylinder Head Torque Pattern (Domestic All Except 800)



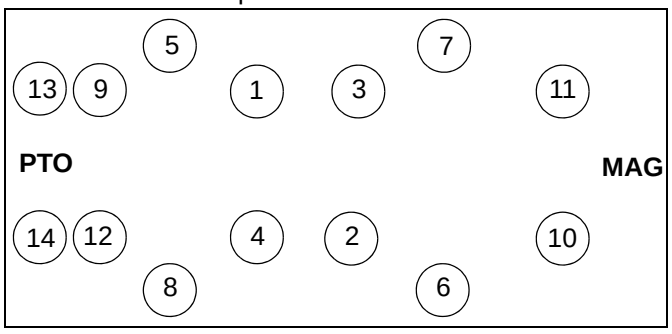
Cylinder Head Torque Pattern (Domestic 800)



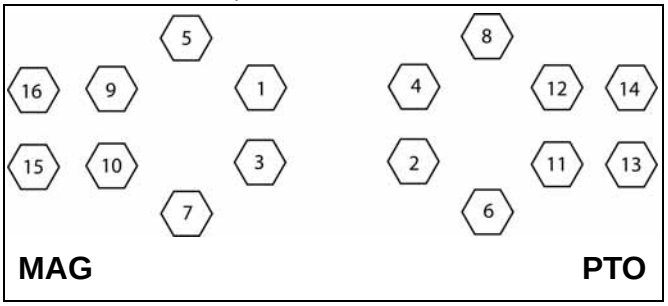
550 Engine Cylinder Head Torque Sequence



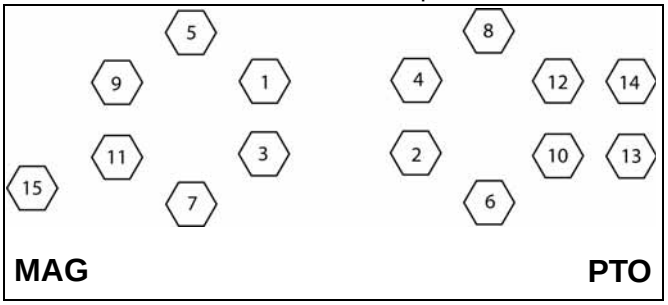
550 Crankcase Torque Pattern



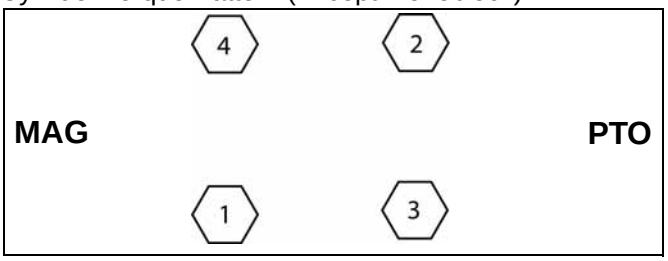
CFI Crankcase Torque Pattern



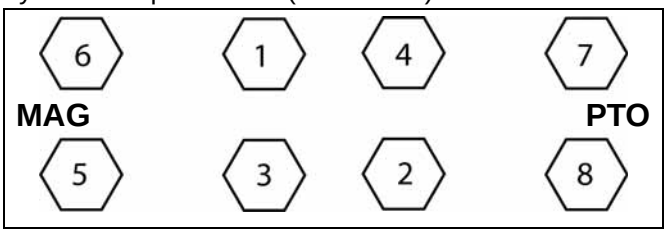
600 HO Carbureted Crankcase Torque Pattern



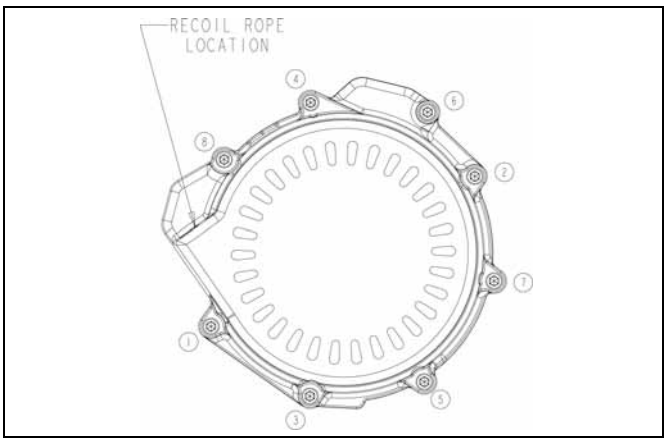
Cylinder Torque Pattern (Except Monoblock)



Cylinder Torque Pattern (Monoblock)



CFI Recoil Cover



SPECIAL TOOLS

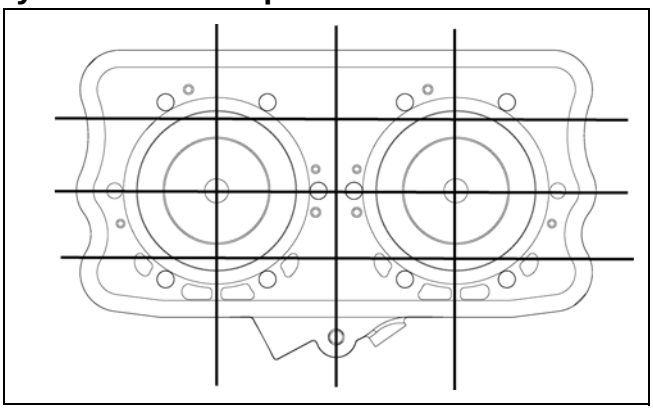
Special Tools - Engine

Special Tools - Engine

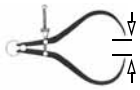
PART NUMBER	DESCRIPTION	NOTE
2870303-A	Ammco Hone Kit	Use to re-surface cylinder walls when installing new piston and/or rings.
2870588	Hone Oil	Provides better crosshatch pattern when honing cylinders.
PU-49876	Ammco 320 Grit Stone	Use to re-surface NiCaSil-lined big bore cylinders.
2870390	Piston Support Block	Supports piston when installing pin and c-clips.
2871043-A	Flywheel Puller	
PU-45255	22mm Piston Pin Puller	800 CFI Engines
PS-47055	Offset Piston Pin Puller Adapter	800 CFI Engines
2870386	Piston Pin Puller	
2871445	Pin Puller Adapter	Use with 2870386.
2871989	Engine Mount Socket	Removes tabbed rubber engine mounts.
2872389	Water Pump Seal Installation Tool	Used to install water pump seal on all 600 . 700/ 800 engines.
2872401-A	20mm C-Clip Tool	Install c-clips on all 600 / 700 engines.
2872622A	22mm C-Clip Tool	Install c-clips on all 800 engines.
PS-49001	Oil Cable Wrenches	Use to loosen or tighten oil pump cable jam nuts.
2870630	Battery Powered Timing Light	Check ignition timing.
2870852	14mm Compression Gauge	
PU-45149	Hose Pincher	
PU-45419	Strap Wrench	Secure drive clutch or flywheel.
PU-45423	Telescoping Gauge Set	Use to inspect cylinder bore diameter.
PU-45424	Dial Indicator Set	Use to measure run-out, piston degrees-to-TDC, etc.
PV-39776	Electronic Digital Caliper	
PU-45433	Seal Pick Set	
PU-45431	Depth Micrometer Set	
PV-34673	Precision Straight Edge	
PV-43554	V-Block Set	
PV-3009	75 - 100mm Micrometer	Use to measure piston diameter, etc.

ENGINE INSPECTIONS

Cylinder Head Inspection



Using a precision straight edge and a feeler gauge, to inspect cylinder head for warping. Replace head if warping exceeds .006" (.015mm).



= In. / mm.

Cylinder Head Warp Limit
.006" (.015mm)

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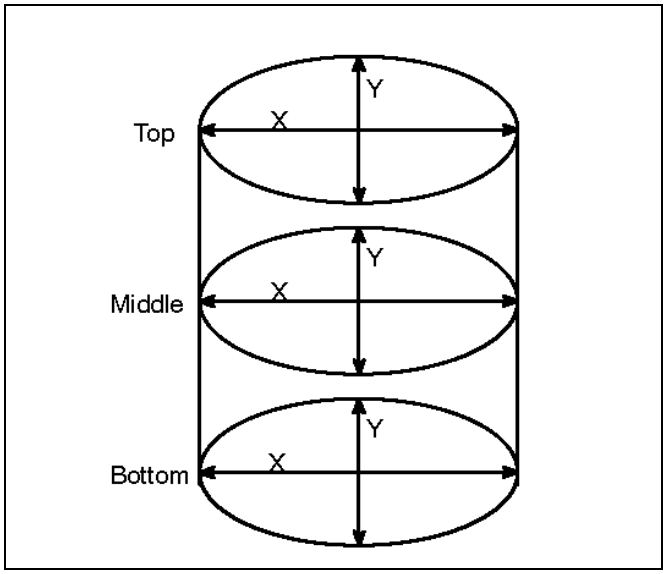
Cylinder Measurement

Inspect each cylinder for wear, scratches, or damage. If no damage is evident, measure the cylinder for taper and out of round with a telescoping gauge or a dial bore gauge. Measure the bore 1/2" from the top of the cylinder; in line with the piston pin and 90° to the pin to determine if the bore is out of round. Repeat the measurements at the middle and bottom of the cylinder. Use the chart below and record all measurements.

Cylinder Measurement Worksheet

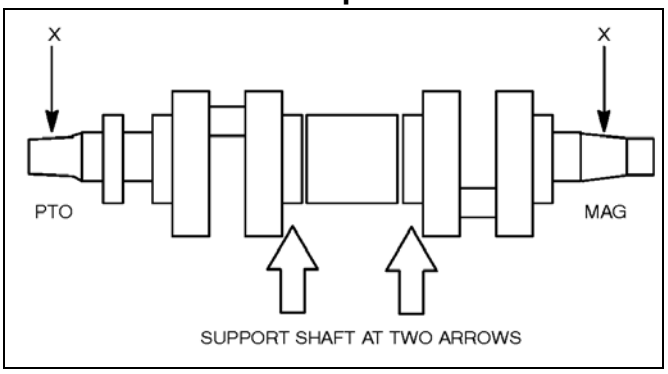
TOP	
X	Y
MIDDLE	
X	Y
BOTTOM	
X	Y
Out-of-Round = Top X - Top Y and Bottom Y - Bottom X	
Taper = Top Y - Bottom Y and Top X - Bottom X	



 = In. / mm.

Taper Limit = .002" (.051mm)
Out-of-Round Limit = .002" (.051mm)

Crankshaft Runout Inspection



1. Support the crankshaft in a set of “V” blocks as shown.
2. Use a dial indicator to measure the runout at the following locations:
   - PTO end = First taper after bearing flat.
   - MAG end = 1/2" from bearing flat.
3. Runout deflection cannot exceed .0025" (.07mm).
4. If the runout deflection exceeds the maximum specification, crankshaft trueing may correct the deflection.

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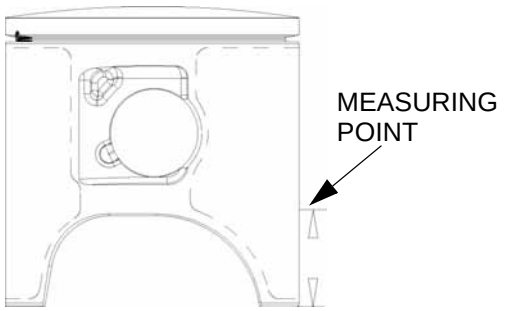
Piston Inspection

Check piston for scoring or cracks in piston crown or pin area. Excessive carbon buildup below the ring lands is an indication of piston, ring or cylinder wear. Measure piston outside diameter "at a 90° angle to the direction of the piston pin and at the specified measuring point.




= In. / mm.

2202258 / 2203319 / 2203312 Pistons = 8mm

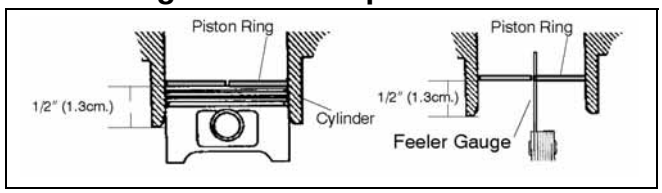
2203512 / 2203707 / 2203606 / 2203899 / 2204122 Pistons = 22mm

2204154 (800) Pistons = 24.5mm

Fuji Pistons = 12.7mm

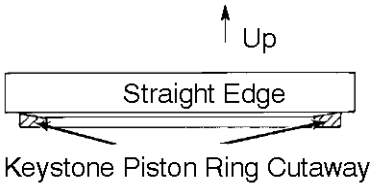
Subtract this measurement from the minimum cylinder measurement (90° to the pin). If clearance exceeds the service limit, the cylinder should be re-bored (replaced if Nicasil-lined) and new pistons and rings installed.

Piston Ring Installed Gap



Position the ring 1/2'' (1.3 cm) from the top of the cylinder using the piston to push it squarely into place. Measure installed gap with a feeler gauge at both the top and bottom of the cylinder.

NOTE: A difference in end gap indicates cylinder taper. The cylinder should be measured for excessive taper and out-of-round. Replace rings if the installed end gap exceeds the service limit. Always check piston ring installed gap after re-boring a cylinder or when installing new rings.



Piston rings are installed with marking or beveled side up.

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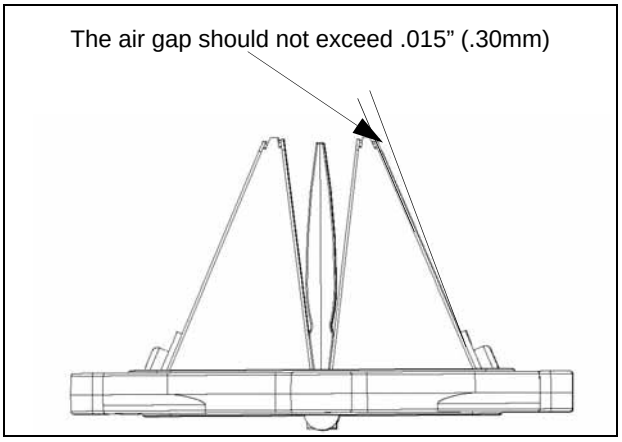
Reed Valve Inspection

1. Loosen he hose clamps
2. Remove the carburetor or the throttle body from the intake boots.
3. Remove the intake boot fasteners and hose holders (if applicable).
4. Remove the intake assembly.
5. Separate the intake boot(s) from the reed cage.
6. Separate the reed stuffer(s) from the reed cage and inspect the reeds before they are removed from the reed cage.

NOTE: Measure the air gap between the fiber reed and the reed block. The air gap should not exceed .015" (.38mm). If clearance is excessive DO NOT attempt to reverse the reeds to reduce the air gap. Always replace them if damaged or worn. Check each fiber reed for white stress marks or missing material.



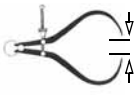
7. If damaged remove and replace the reeds on the reed cage.

Bearing Fit

Any time crankshaft bearing failure occurs and the case is reused, check the bearing fit into the case halves using the following procedure.

With case halves cleaned, reinstall the main bearings with a piece of Plastigage between the bearing race and crankcase.

Install and torque the crankcase fasteners to specification. Take the crankcase apart, and then measure the Plastigage. Compare Plastigage width to interference fit specification.



Bearing Interference Fit:
Carbureted = .001''-.002'' (.026 -.051mm)
CFI = .0014'' - .0024'' (.061mm)

Main Bearing

Clean crankshaft thoroughly and oil main and connecting rod bearings with Polaris engine oil. Carefully check each main bearing on the crankshaft.

Due to extremely close tolerances, the bearings must be inspected visually and by feel. Look for signs of discoloration, scoring or galling. Turn the outer race of each bearing. The bearings should turn smoothly and quietly. The inner race of each bearing should fit tightly on the crankshaft. The outer race should be firm with minimal side to side movement and no detectable up and down movement. Replace any loose or rough bearings.

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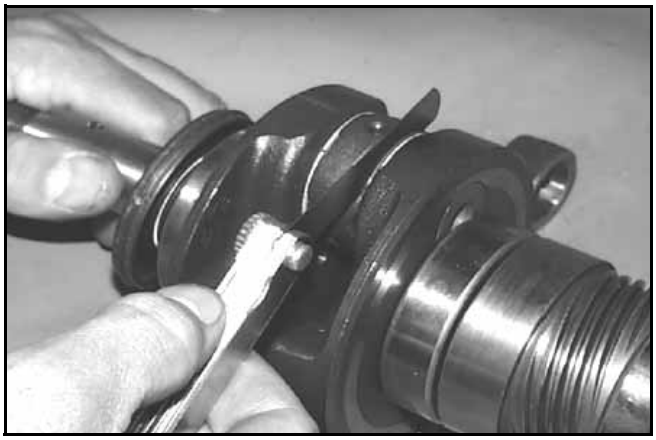
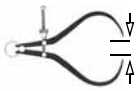
Connecting Rod Lower Bearing



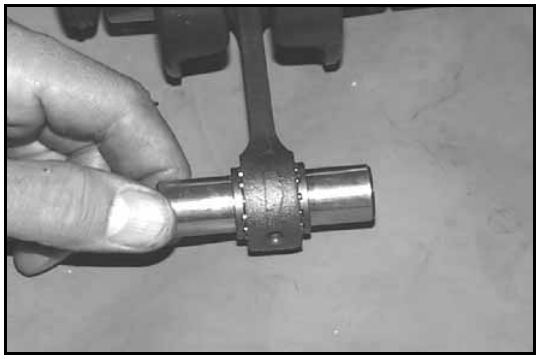
Measure connecting rod big end side clearance with a feeler gauge on both sides of the connecting rod. The side clearance on either side of the connecting rod cannot exceed the connecting rod side clearance specification. The difference between the two clearance measurements cannot exceed the maximum clearance differential specification.

 = In. / mm.
Connecting Rod Side Clearance: .0114"-.0295" (.289-.749mm) Maximum Clearance Differential .002" (.051mm)

Rotate the connecting rod on the crankshaft and feel for any rough spots. Check radial end play in rod by supporting rod against one thrust washer and alternately applying up and down pressure. Replace bearing, pin, and thrust washers if side clearance is excessive or if there is any up and down movement detectable in the big end bearing.

Piston Needle Bearing

1. Clean the end of the connecting rod and inspect inner bore with a magnifying glass. Look for any surface irregularities including pitting, wear, or dents.
2. Run a fingernail around the inside of the rod and check for rough spots, galling, or wear.
3. Oil and install needle bearing and pin in connecting rod.
4. Rotate pin slowly and check for rough spots or any resistance to movement.
5. Slide pin back and forth through bearing while rotating and check for rough spots.



6. With pin and bearing centered in rod, twist ends back and forth in all directions to check for excessive axial play.
7. Pull up and down evenly on both ends of pin to check for radial play.
8. Replace pin and bearing if there is any resistance to rotation or excessive axial or radial movement. If play or roughness is evident with a new pin and bearing, replace the connecting rod.

Crankshaft Index

Polaris crankshafts are pressed together. The connecting rod journal center lines are indexed 180° apart from each other.

It is sometimes necessary to check multi-cylinder crankshafts to verify that one cylinder has not been forced out of position relative to the other cylinder. Some causes for a “out of index” crankshaft include but are not limited to the following:

- Hydrolock from water or fuel
- Impact to drive clutch from object or accident
- Abrupt piston or other mechanical failure
- Engine lock-up due to drive belt failure

Symptoms of an out of index crankshaft can include but are not limited to the following:

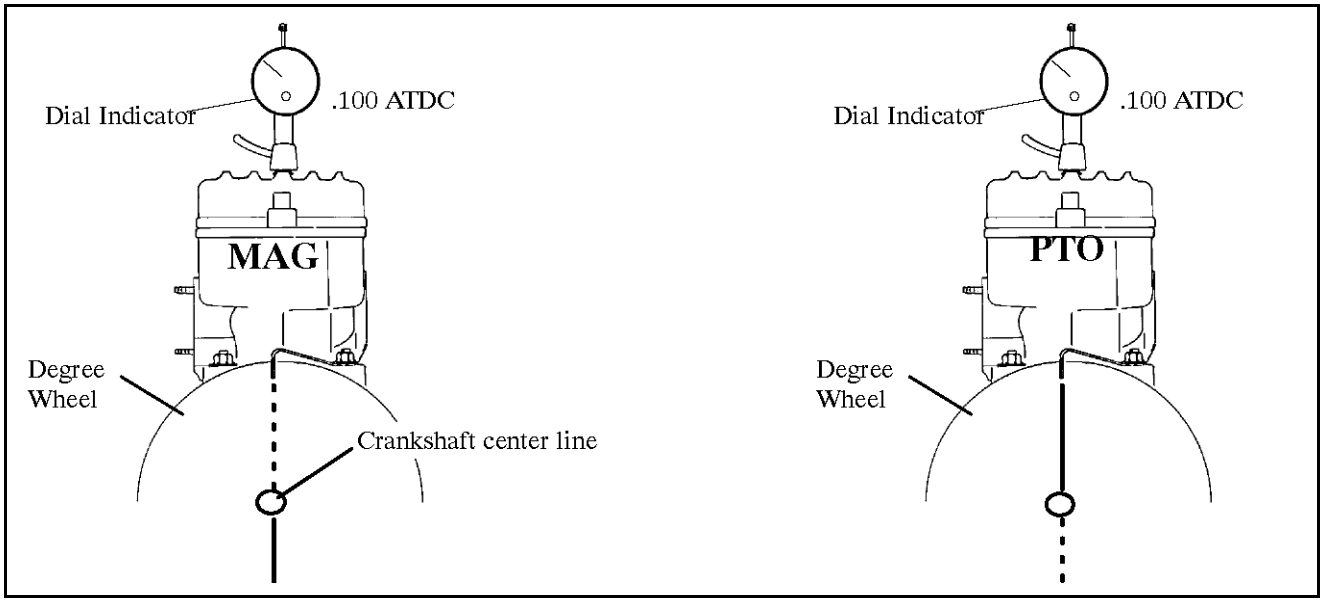
- Difficulty calibrating carburetor (repetitive plug fouling on one cylinder with no other cause)
- Unexplained piston failure on one cylinder (i.e. severe detonation, broken ring lands, etc.)
- Excessive vibration of engine, back-firing, etc.
- Rough idle, poor top speed.

Checking Crankshaft Index

1. Remove the drive belt and drive clutch.
2. Securely fasten a large degree wheel on the flywheel or PTO end of the crankshaft. Make sure that it is mounted concentrically with the crankshaft center line.
3. With a section of wire (wire coat hanger), anchor it to a convenient spot. Bend one end at the outer perimeter of the degree wheel as shown below.
4. Install a dial indicator into the magneto end cylinder spark plug hole. The ignition timing is referenced by the magneto end.
5. Locate TDC as accurately as possible by finding the center of the point where there is no piston movement note the “Zero” the dial indicator at this point.
6. Continue to rotate the crankshaft in the normal direction of rotation until the dial indicator reads .100" (2.54mm) after top dead center (ATDC).
7. Bend the pointer or move the degree wheel until the pointer aligns with a 180° mark on the degree wheel.
8. With the pointer aligned, make sure the degree wheel and pointer are secured and will not move out of position. Re-check accuracy of this location a few times. The pointer should align with the 180° mark when the dial indicator reads .100” (2.54mm) ATDC.

NOTE: Do not move the crankshaft, degree wheel or pointer after the initial setting on the MAG end cylinder - simply read the wheel and dial indicator.

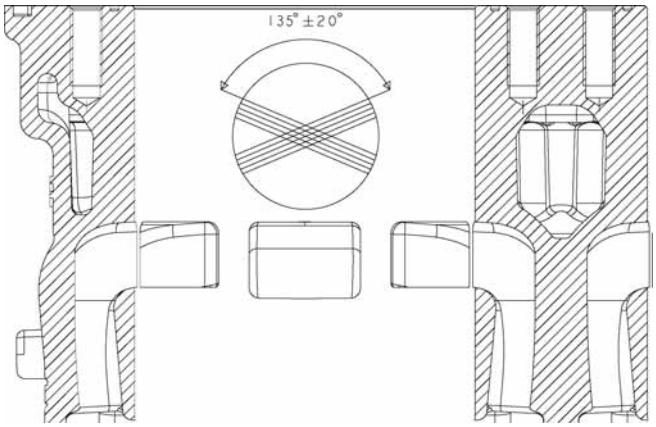
9. Remove the dial indicator and install in PTO cylinder. Repeat finding TDC process. Note the degree wheel indication when the dial indicator reads .100" ATDC. It should be 180° (+/-2°) from the MAG cylinder mark.



Cylinder Honing

The cylinder bore must be de-glazed whenever new piston rings are installed. A light honing with fine stones removes only a very small amount of material. A proper crosshatch pattern is important to provide a surface that will hold oil, and allow the rings to seat properly. If the crosshatch is too steep, oil retention will be reduced. A crosshatch angle which is too shallow will cause ring vibration, poor sealing, and overheating of the rings due to blow-by and reduced contact with the cylinder wall. Service life of the pistons and rings will be greatly reduced.

NOTE: A Nicasil cylinder can be lightly honed with a 320 grit stone hone but can not be oversized.



EXAMPLE OF A CROSS HATCH PATTERN

Honing Tools

The following tools are recommended:

- Ammco 3950 Hone Kit - SPX PN 2870303-A / commercially available
- Ammco 3956 Honing Stones (320 grit / Oversize) - SPX PN PU-49876
- Honing Oil - SPX PN 2870588/Commercially Available

Honing Procedure

1. Wash the cylinder with cleaning solvent.
2. Clamp the cylinder in a soft jawed vise by the cylinder studs.
3. Place hone in cylinder and tighten stone adjusting knob until stone contacts the cylinder walls (DO NOT OVERTIGHTEN).
4. Apply honing oil to the stones and cylinder walls. Wet honing removes more material faster and leaves a more distinct pattern in the bore.
5. Using a 1/2" (13 mm) drill motor rotating at a speed of 300-500 RPM, run the hone in and out of the cylinder rapidly until cutting tension decreases. Remember to keep the hone drive shaft centered to prevent edge loading and always bring the stone approximately 1/2" (1.2 cm) beyond the bore at the end of each stroke.
6. Release the hone at regular intervals to inspect bore size and finish.

Cleaning The Cylinder After Honing

It is very important that the cylinder be thoroughly cleaned after honing to remove all grit material. Wash the cylinder in a solvent, then in hot soapy water. Pay close attention to areas where the cylinder sleeve meets the aluminum casting (transfer port area). Use electrical contact cleaner if necessary to clean these areas. Rinse thoroughly, dry with compressed air, and oil the bore immediately with Polaris Premium 2 Cycle Lubricant.

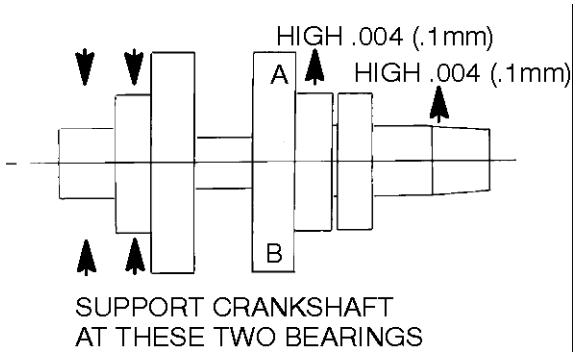
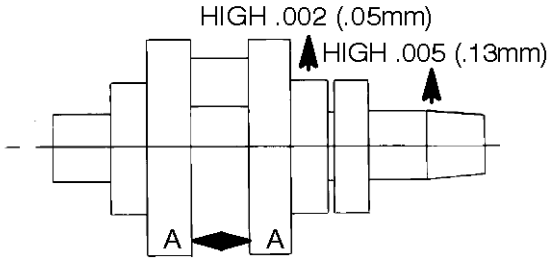
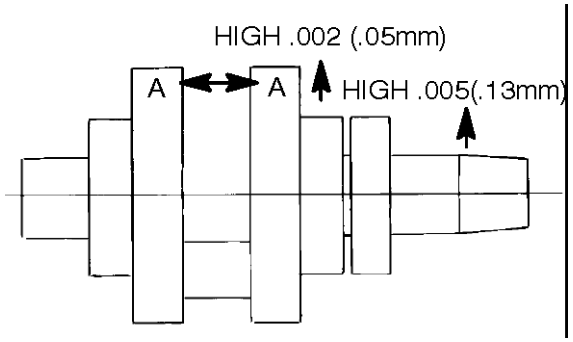
NOTE: Always check piston to cylinder clearance and piston ring installed gap after honing or boring is complete.

Crankshaft Truing

Lubricate the bearings and clamp the crankshaft securely in the holding fixture. If truing the crankshaft requires striking with a hammer, always be sure to re-check previously straightened areas to verify truing. Refer to the illustrations below. Use Crankshaft alignment kit PN 2870569.

NOTE: The rod pin position in relation to the dial indicator tells you what action is required to straighten the shaft.

Truing Examples

To correct a situation like this. Strike the shaft at point A with a brass hammer.	
To correct a situation like the one shown in this. Squeeze the crankshaft at point A. You will use the tool from the alignment kit PN 2870569.	
If the crank rod pin location is 180° from the dial indicator (opposite of above), it will be necessary to spread the crankshaft at the A position as shown in illustration 3. When rebuilding and straightening a crankshaft, straightness is of utmost importance. Runout must be as close to zero as possible.	

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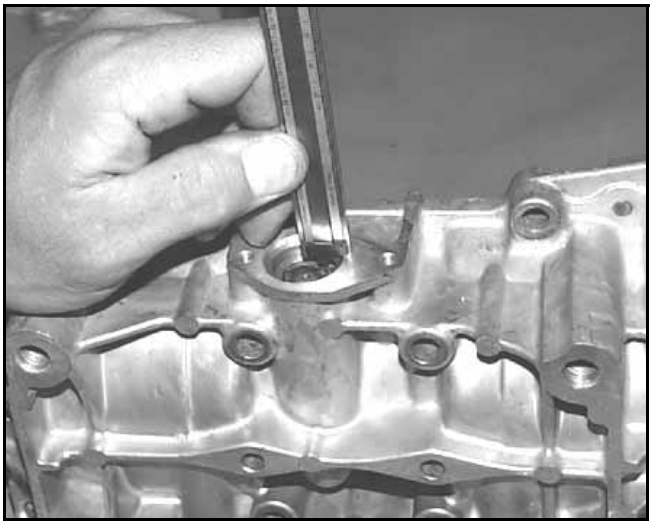
Oil Pump Bushing End Play - Fuji Engines

When removing the oil pump, always retain the original shims installed between the pump and bushing. These shims can be re-used if the original oil pump and bushing are installed into the engine. If any one of these parts are replaced with new components, the oil pump and pump bore must be measured to determine if shims will be added or subtracted from the assembly.

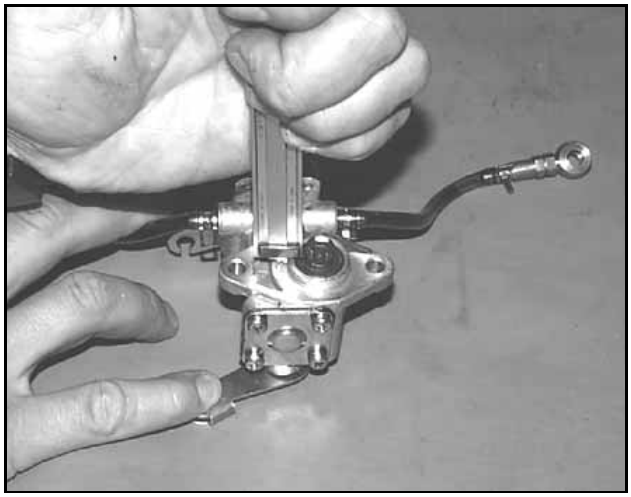
1. Install oil pump drive gear into crankcase. Install bushing into bore. Verify the bushing is fully seated.
2. Measure from the oil pump mounting surface to the top of the bushing. Record measurement as MEASUREMENT A.



- MEASUREMENT A = _____

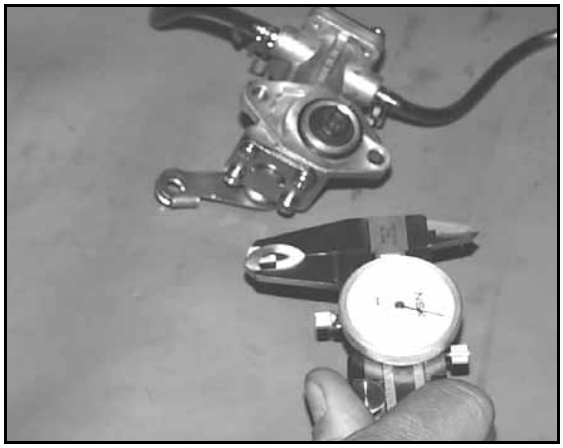
3. Measure the distance between the oil pump mounting flange surface to end of seal flange as shown below. Record measurement as MEASUREMENT B.

NOTE: On 550 engines, make sure the gasket is installed on the oil pump before taking measurement.

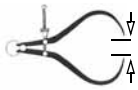


- MEASUREMENT B = _____

4. Subtract measurement B from A to determine the total bushing end play.
5. Measure the total thickness of the original shims. Subtract this number from the number obtained in step 4.



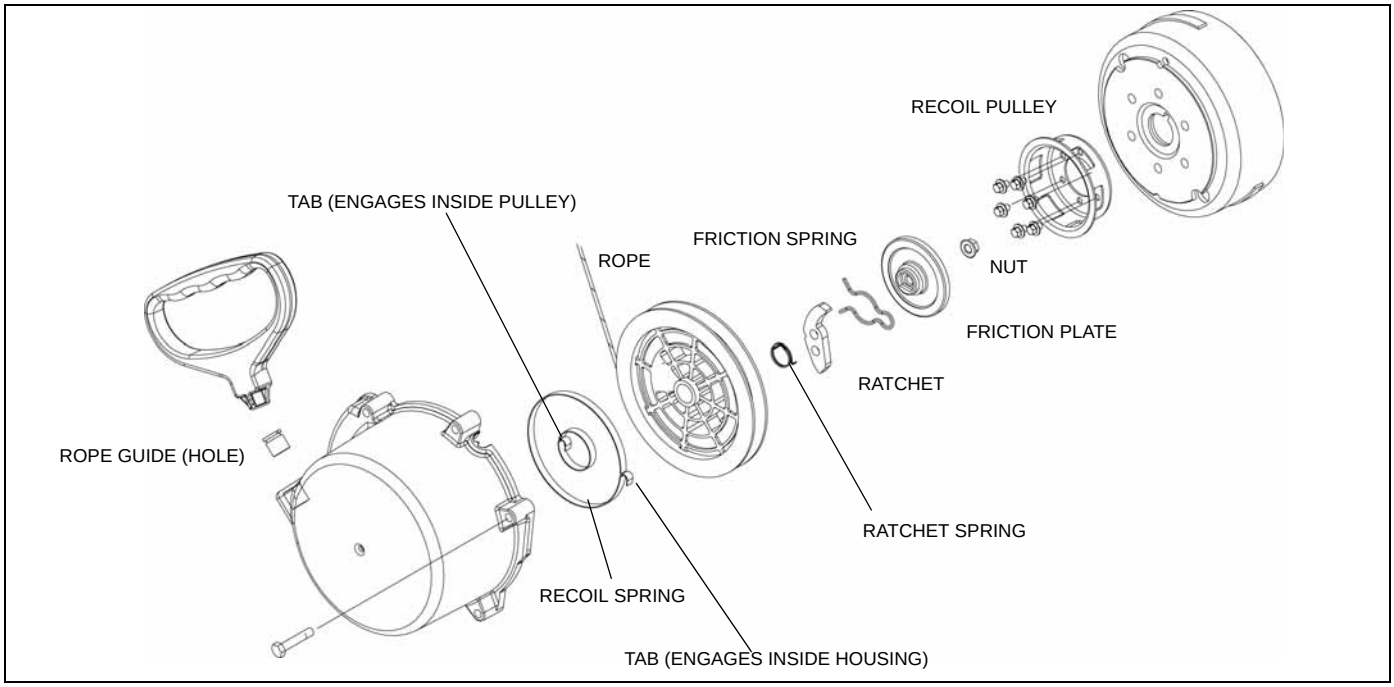
6. Add or subtract shims to obtain the specified oil pump bushing end play.

 = In. / mm.
Oil Pump Oil Pump Bushing End Play .008" - .016" (.203 - .406mm)

Available Shims
30803671 - .006" (.15mm)
30803672 - .012" (.30mm)
30803673 - .024" (.60mm)

CARBURETED RECOIL ASSEMBLY

Rope Removal and Installation



⚠ CAUTION

Recoil spring under high tension. Always wear eye protection when working with recoil housing components.

1. With the recoil housing removed from the engine, un-tie any knots (handle) in the recoil rope and allow the pulley to slowly unwind.
2. Remove the nut, friction plate, friction spring, ratchet and ratchet spring from the pulley.
3. Lift the pulley straight out of the housing making sure the spring is no longer connected to the backside of the pulley.

NOTE: If all of the recoil spring tension was removed, the spring should stay inside the housing when the pulley is removed.

4. Inspect all components for signs of abnormal wear and tear. Replace components as required. If replacing the rope, tie a small square knot at one end. Push the knot firmly into the pocket on the pulley.
5. If the pulley recoil spring was removed during disassembly, install the spring by spiraling the spring counterclockwise toward the center of the housing.
6. Lubricate the center shaft and spring with Premium grease.
7. Wind the rope counterclockwise around the pulley as viewed from the ratchet-side of the pulley.
8. Pass the end of the rope through the hole in the housing. If the rope guide was removed from the housing, reinstall it before attaching the rope handle.
9. Slide the pulley down the center shaft and into the housing making sure the recoil spring re-engages the pulley tab.
10. Install the ratchet spring and ratchet into the pulley face. The ratchet spring leg fits in the notch on the ratchet and holds the ratchet in (retracted).
11. Install friction spring with one leg inserted in the bottom hole on the ratchet.
12. Install nut and torque to 5 ft.lbs. (7 Nm).
13. Pull rope out to its full extension and align pulley notch with rope hole in housing.
14. Using a needle nose pliers or hooked wire, pull a loop of rope through the notch in the pulley.
15. Prevent the rope from being retracted by tieing a knot in the rope on the outside of the housing at the rope guide hole.
16. Wind the recoil pulley counterclockwise until the spring begins to bind. Unwind the pulley clockwise two revolutions.
17. Pull on the rope to disengage it from the notch in the pulley. Un-tie the knot in the rope and allow it to retract into the housing.
18. Pull on the handle to verify proper operation.

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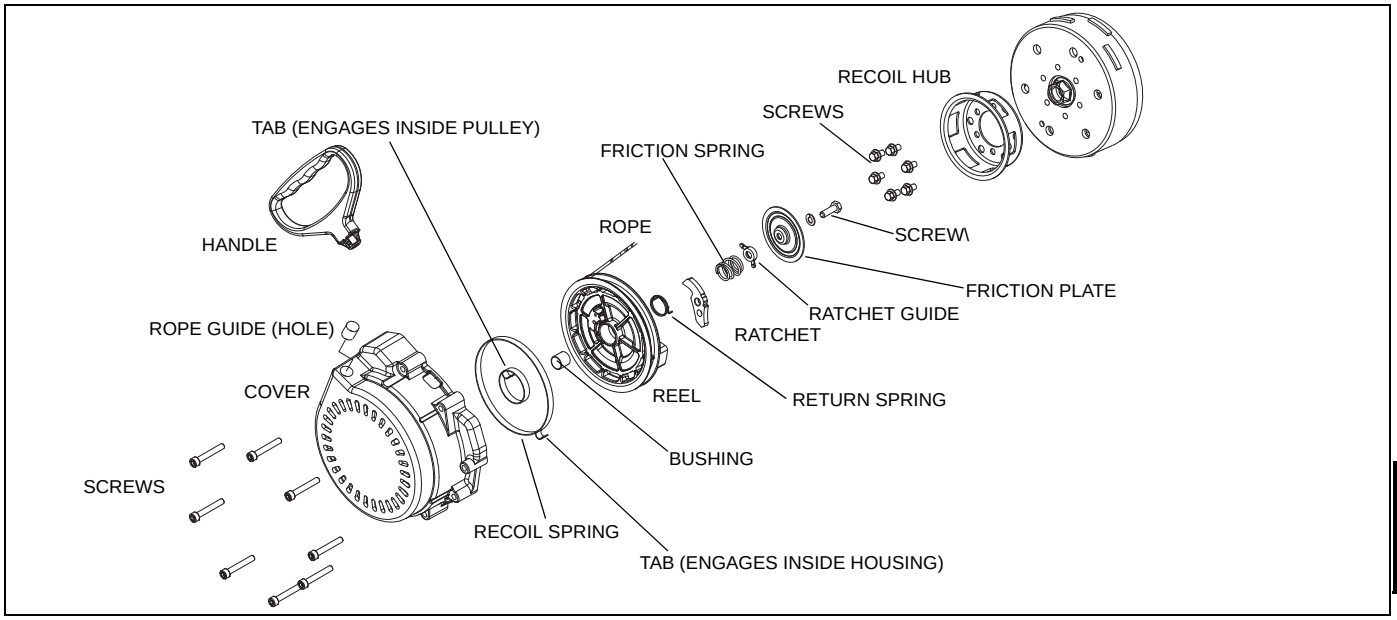
CFI RECOIL ASSEMBLY

Rope Removal and Installation



= T
Cover/Hub Screws = 9 Ft.Lbs. (12Nm) Friction Plate Screw 1204173 Recoil Assembly = 9 Ft.Lbs. (12 Nm) 1204331 Recoil Assembly = 14 Ft.Lbs. (12 Nm)

CAUTION
Recoil spring under high tension. Wear eye protection.

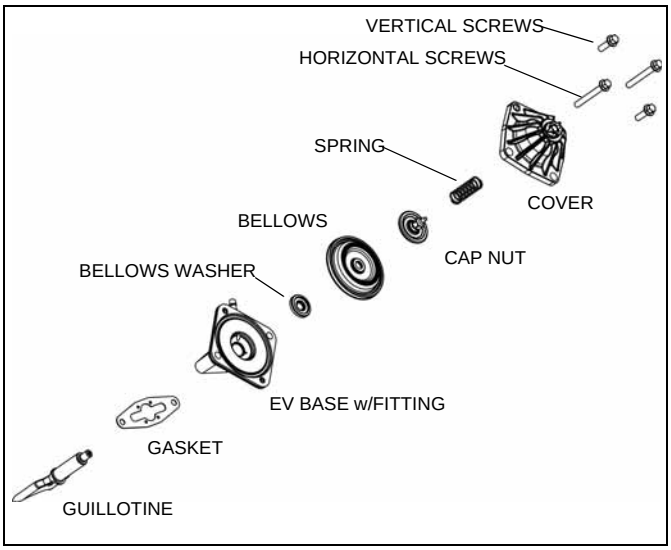
1. Remove recoil housing from the engine. Un-tie knot in the recoil rope and allow the reel to slowly unwind.
2. Remove the screw, washer, friction plate, ratchet guide, friction spring, ratchet and return spring from the reel.
3. Lift the reel straight out of the housing making sure the spring is no longer connected to the backside of the reel.

NOTE: If the recoil spring tension is removed, the spring should stay inside the housing.

4. Inspect all components for signs of abnormal wear and tear. Replace components as required. If replacing the rope, tie a small square knot at one end. Push the knot firmly into the pocket on the reel.
5. If the reel recoil spring was removed during disassembly, install the spring by spiraling the spring counterclockwise toward the center of the housing.
6. Lubricate the center shaft and spring with Premium grease.
7. Wind the rope counterclockwise around the pulley as viewed from the ratchet-side of the reel.
8. Pass the end of the rope through the hole in the housing. If the rope guide was removed from the housing, reinstall it before attaching the rope handle.
9. Slide the reel down the center shaft and into the housing making sure the recoil spring re-engages the reel tab.
10. Install the return spring and ratchet into the reel face. The return spring leg fits in the notch on the ratchet and holds the ratchet in (retracted).
11. Install friction spring with one leg inserted in the bottom hole on the ratchet.
12. Apply Loctite 242 and install screw and washer and torque to specification.
13. Pull rope out to its full extension and align pulley notch with rope hole in housing.
14. Using a needle nose pliers or hooked wire, pull a loop of rope through the notch in the reel.
15. Prevent the rope from being retracted by tieing a knot in the rope on the outside of the housing at the rope guide hole.
16. Wind the recoil pulley counterclockwise until the spring begins to bind. Unwind the pulley clockwise two revolutions.
17. Pull on the rope to disengage it from the notch in the pulley. Un-tie the knot in the rope and allow it to retract into the housing.
18. Pull on the handle to verify proper operation.

EXHAUST VALVE MAINTENANCE

Exhaust Assembly View



Exhaust Valve Disassembly

CAUTION

EV spring under tension. Use care when removing housing from assembly base.

1. Remove the vent hose from the base.
2. Remove the two horizontal cover fasteners securing the valve assembly to the cylinder.
3. Remove exhaust valve assembly from cylinder.
4. Remove the gasket and discard. Remove the two vertical cover screws to access the spring and bellows.
5. Secure the guillotine, then apply heat to remove the bellows cap nut. Discard the nut.
6. Separate the cap nut, bellows and bellows washer from the guillotine.
7. Remove the guillotine from the base.
8. Thoroughly clean the guillotine using a parts solvent, stiff brush, emery cloth or similar material. Do not scratch the blade surface during cleaning.
9. Inspect the bellows for tears and wear. Replace as required.
10. Inspect each spring's free length. Replace if springs are rusted or excessively worn.
11. Thoroughly clean each base housing with parts solvent and a stiff bristle brush. Ensure transfer ports are clean and no carbon residue remains inside the chambers.

Exhaust Valve Assembly

1. Clean the threads of the guillotine with Loctite Primer N.
2. Insert the guillotine into the base housing.
3. Apply Loctite 2760 to the first 3 threads on the guillotine.
4. Place the bellows washer, bellows and a new cap nut onto the guillotine. Ensure the bellows is seated correctly between the washer and cap nut.
5. Torque the cap nut to specification.

= T

Guillotine Cap Nut Torque: 16 Ft.Lbs. (22 Nm)

6. Lubricate the guillotine blade and shaft with engine oil.
7. Actuate the guillotine to ensure full and free motion.
8. Install the spring, and cover.
9. Torque the vertical cover fasteners to specification.

= T

Cover/Base Fastener Torque: 12 Ft.Lbs. (16 Nm)

10. Install a new gasket on the cylinder, then install the EV assembly. The guillotine shaft will only fit into the cylinder the correct way. If the shaft will not slide in, verify it is installed correctly.
11. Torque the horizontal cover screws to specification.

Exhaust Valve Springs

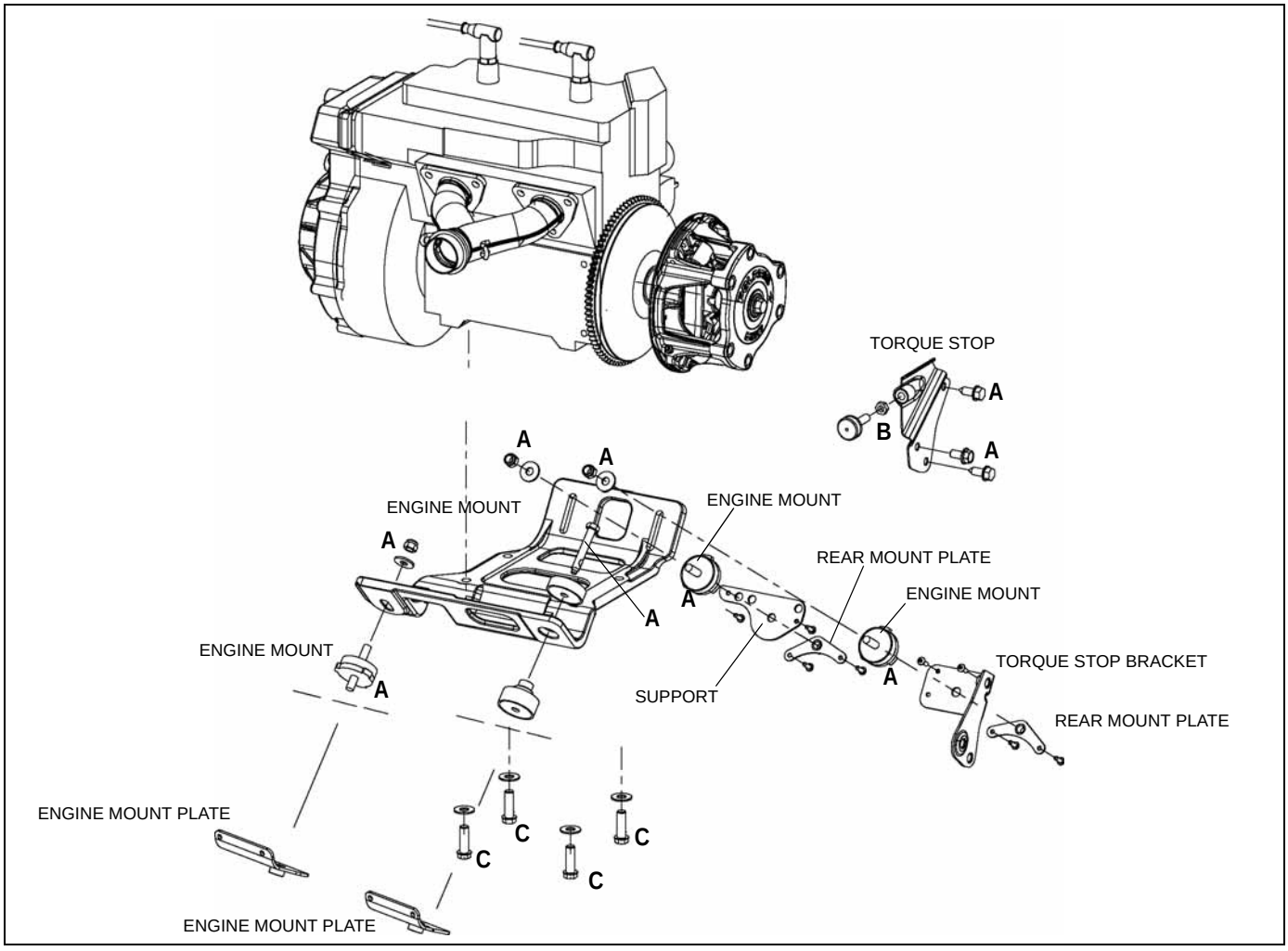
CAUTION

Do not substitute different color springs on solenoid controlled EV engines.

SPRING	COLOR	FREE LENGTH (INCHES)
7041704-01	Blue	1.752
7041704-02	Orange	1.729
7041704-03	Pink	1.734
7041704-04	Purple	1.726
7041704-05	Yellow	1.734
7041704-06	White	1.537

ENGINE MOUNTING SYSTEMS

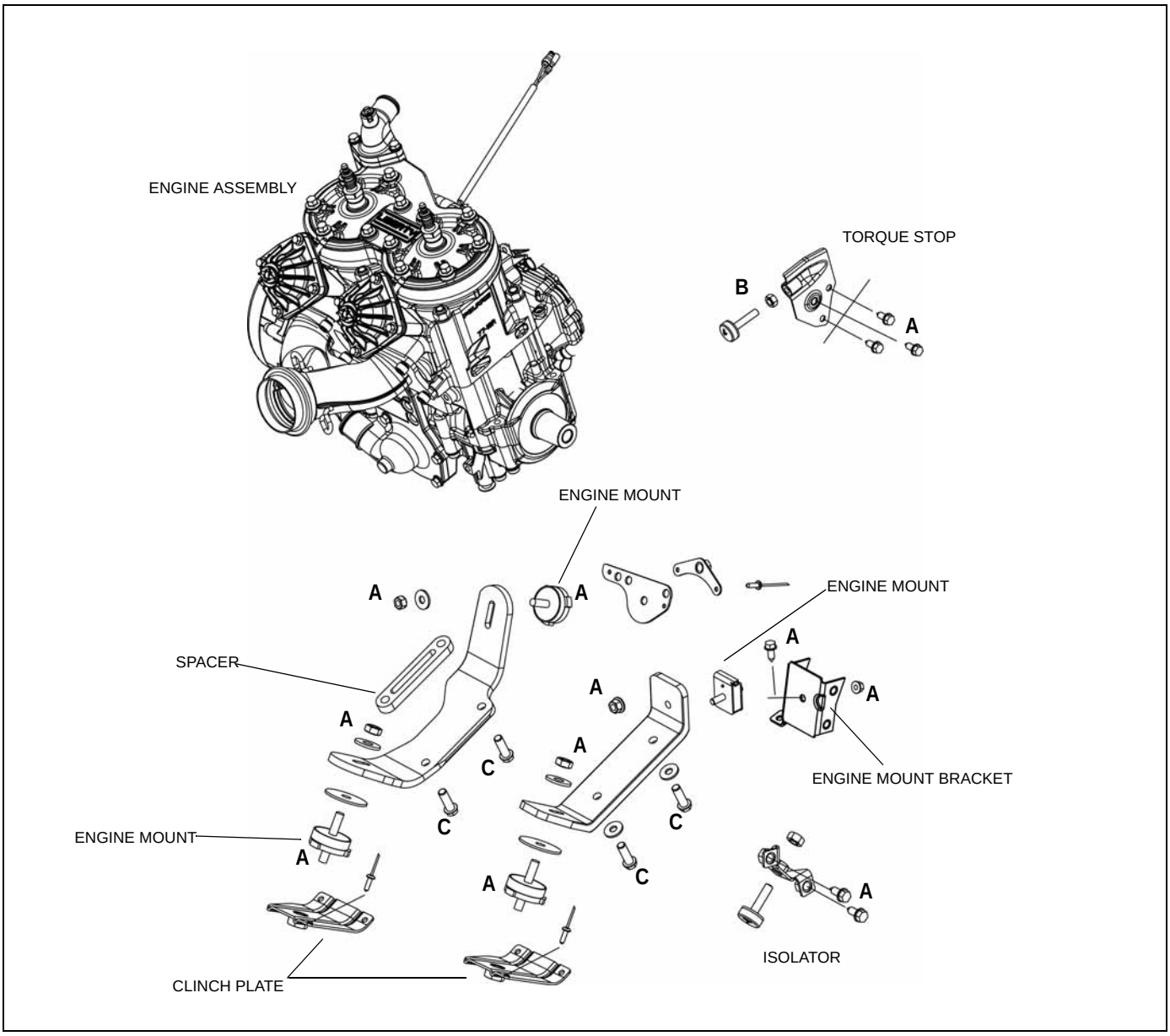
550 IQ Engine Mounting



= T
A = 28 Ft.Lbs. (38 Nm) B = 15 Ft.Lbs. (20 Nm) C = 45 Ft.Lbs. (61 Nm)

NOTE: Use an engine mount socket, PN: 2871989 to remove the engine mounts from the bulkhead.

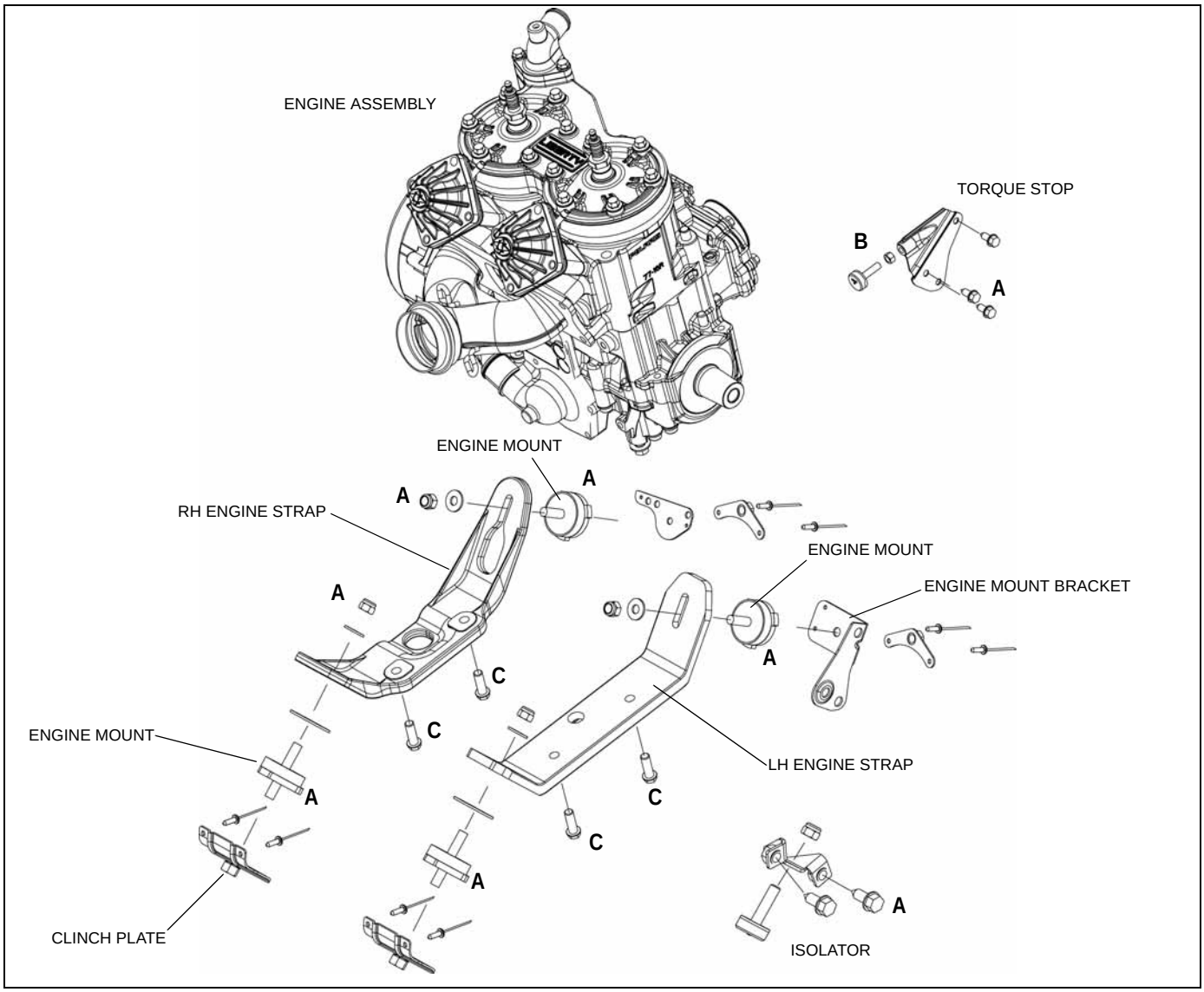
2007 IQ Carbureted Engine Mounting



= T
A = 28 Ft.Lbs. (38 Nm) B = 15 Ft.Lbs. (20 Nm) C = 45 Ft.Lbs. (61 Nm)

NOTE: Use an engine mount socket, PN: 2871989 to remove the engine mounts from the bulkhead.

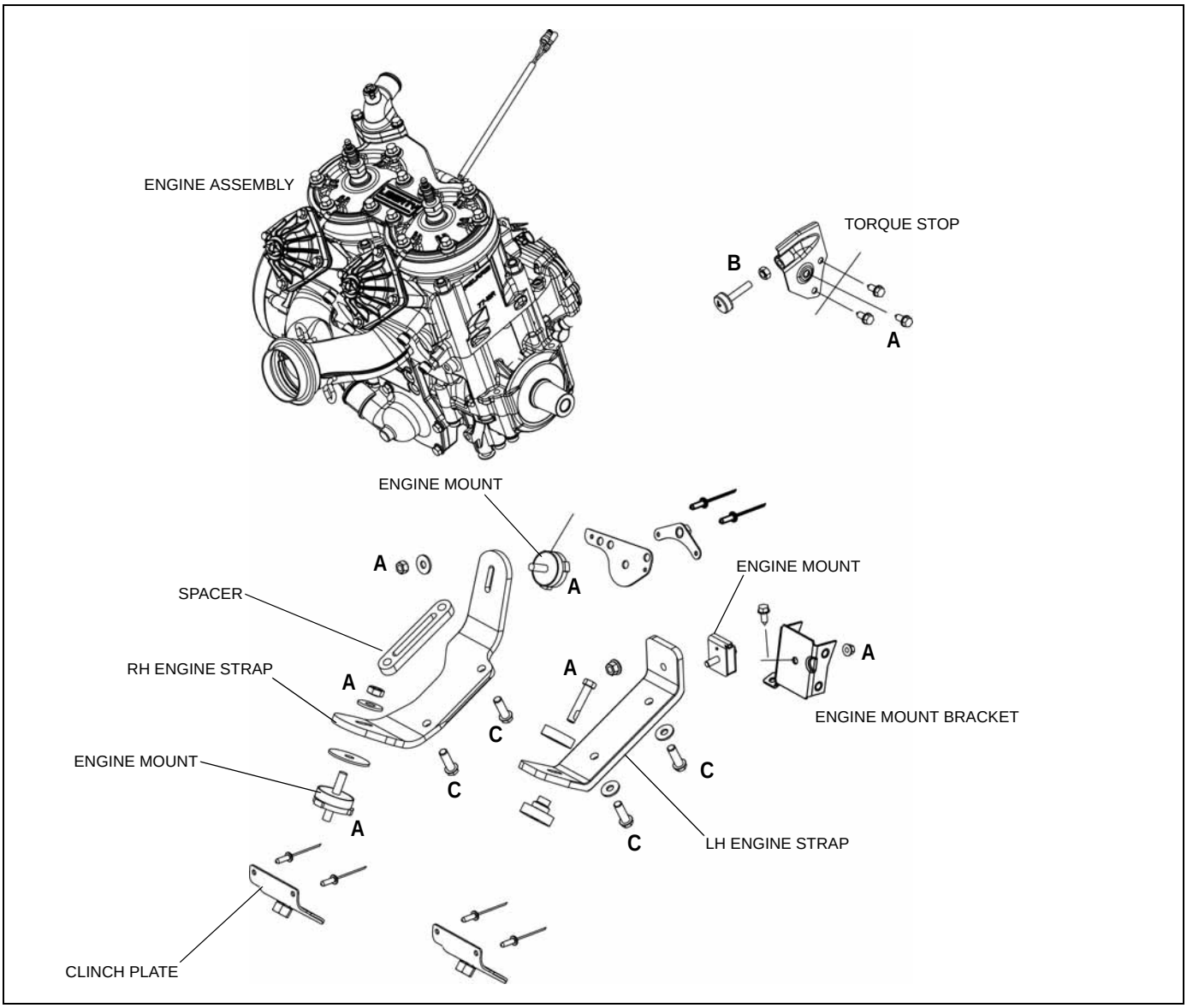
2007 IQ 600 CFI Engine Mounting



= T
A = 28 Ft.Lbs. (38 Nm) B = 15 Ft.Lbs. (20 Nm) C = 30 Ft.Lbs. (41 Nm)

NOTE: Use an engine mount socket, PN: 2871989 to remove the engine mounts from the bulkhead.

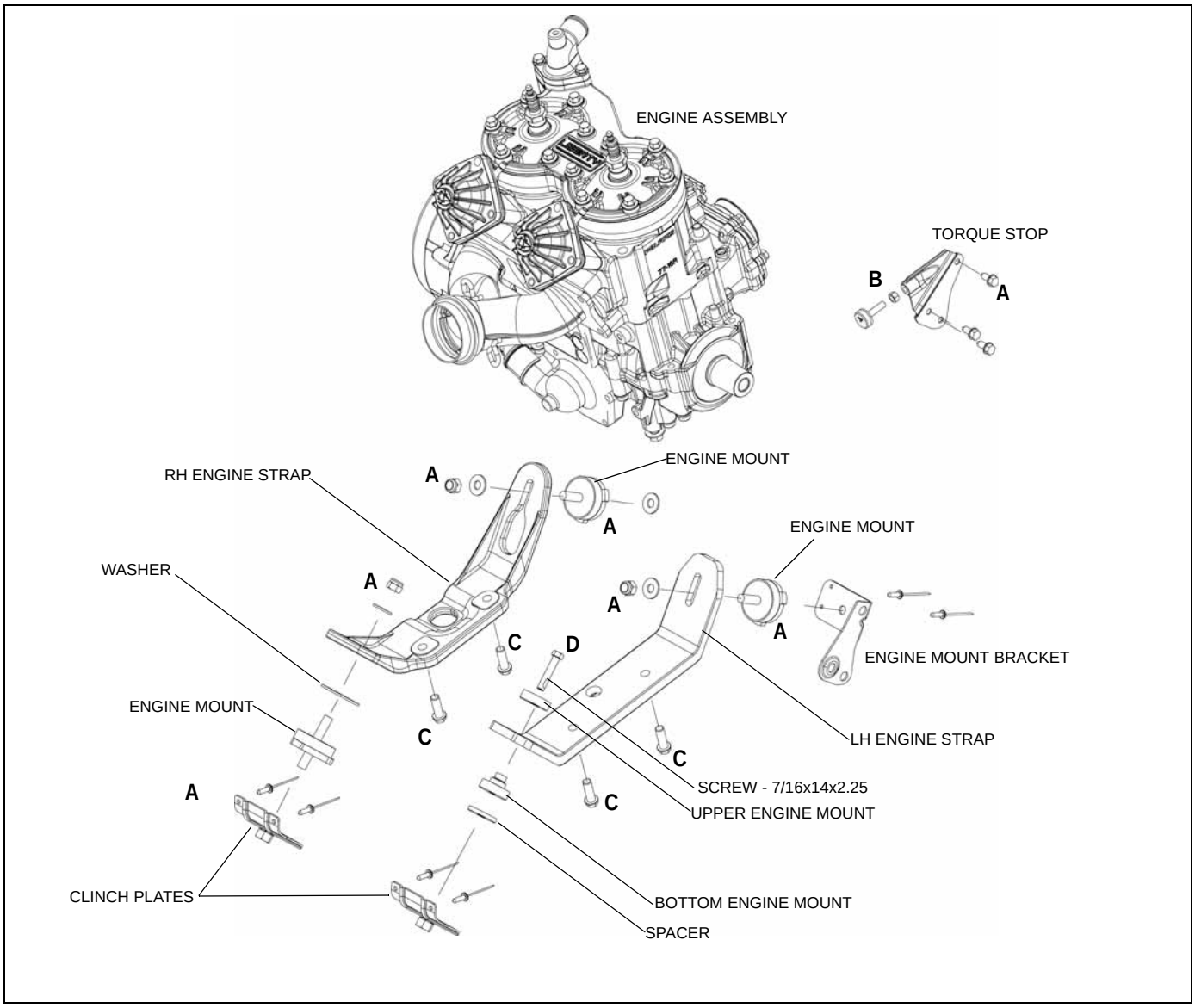
2008-2009 IQ Carbureted Engine Mounting



= T
A = 28 Ft.Lbs. (38 Nm) B = 15 Ft.Lbs. (20 Nm) C = 45 Ft.Lbs. (61 Nm)

NOTE: Use an engine mount socket, PN: 2871989 to remove the engine mounts from the bulkhead.

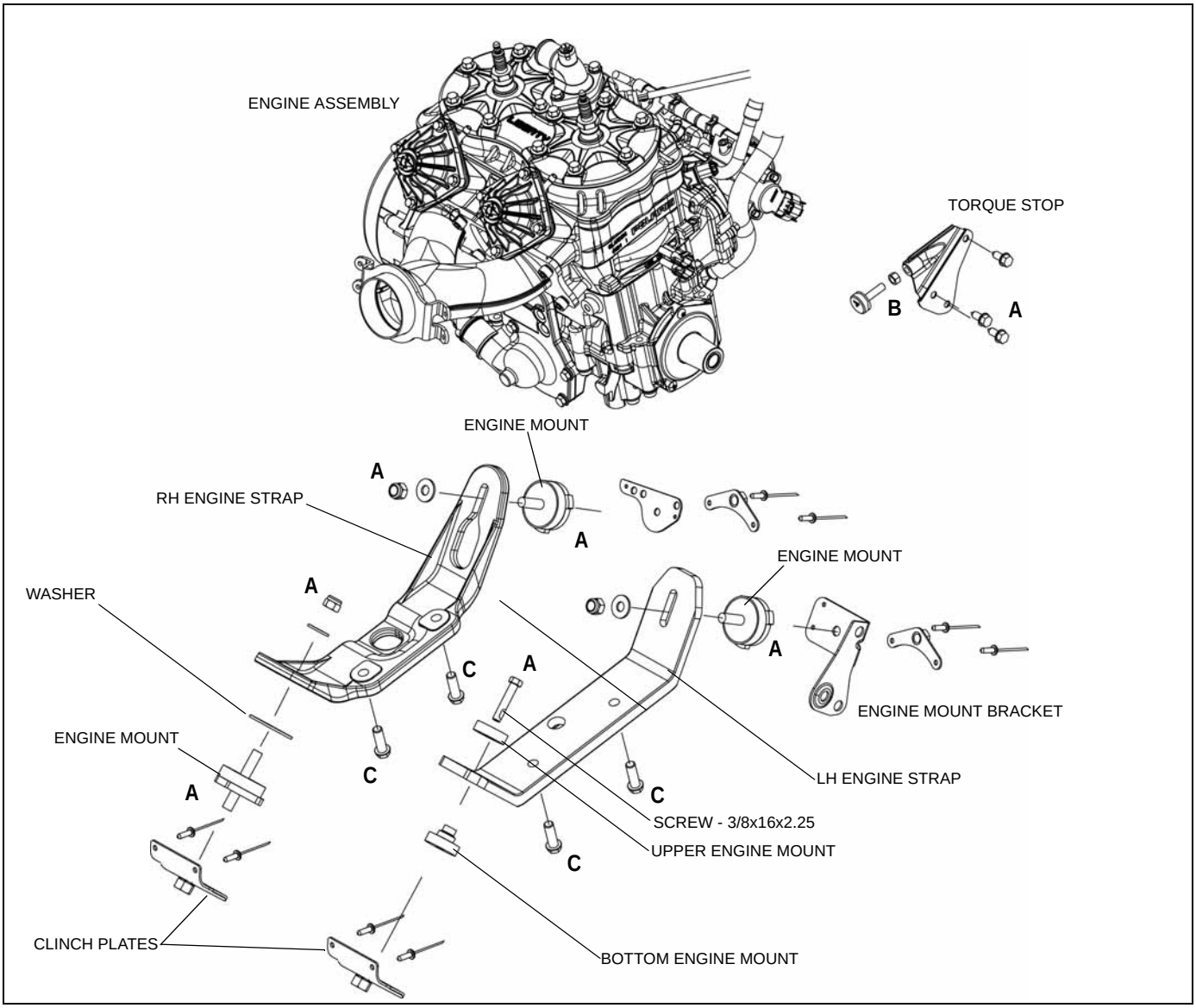
2007 IQ 700 CFI/2010-2011 IQ CFI Engine Mounting



= T
A = 28 Ft.Lbs. (38 Nm) B = 15 Ft.Lbs. (20 Nm) C = 30 Ft.Lbs. (41 Nm) D = 40 Ft.Lbs. (54 Nm)

NOTE: Use an engine mount socket, PN: 2871989 to remove the engine mounts from the bulkhead.

2008-2009 IQ CFI/2010-2011 IQ CFI Touring/ 600 IQ Widetrak Engine Mounting

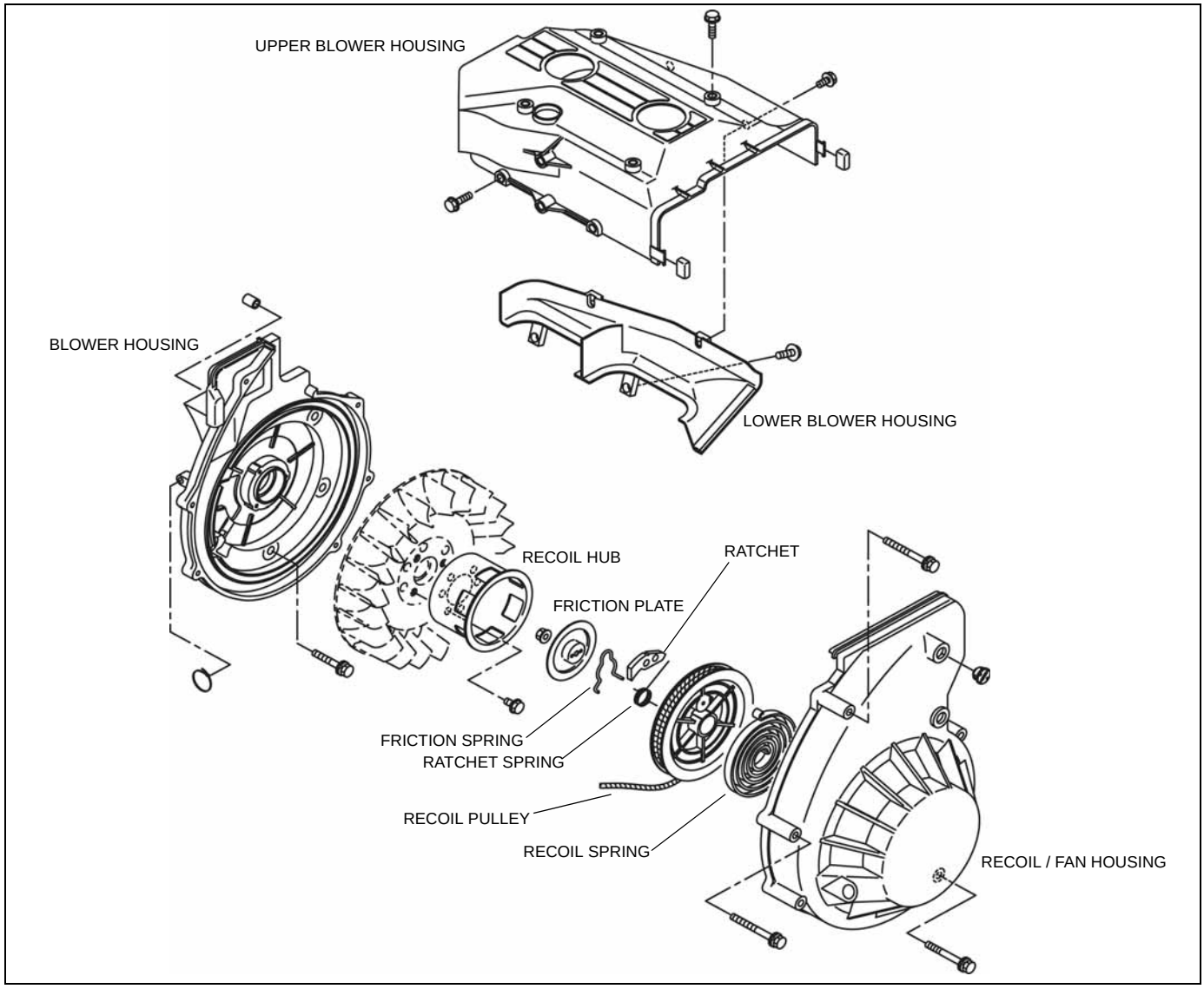


= T
A = 28 Ft.Lbs. (38 Nm) B = 15 Ft.Lbs. (20 Nm) C = 30 Ft.Lbs. (41 Nm)

NOTE: Use an engine mount socket, PN: 2871989 to remove the engine mounts from the bulkhead.

ENGINE COMPONENT ASSEMBLIES

550 Blower Housing Assembly

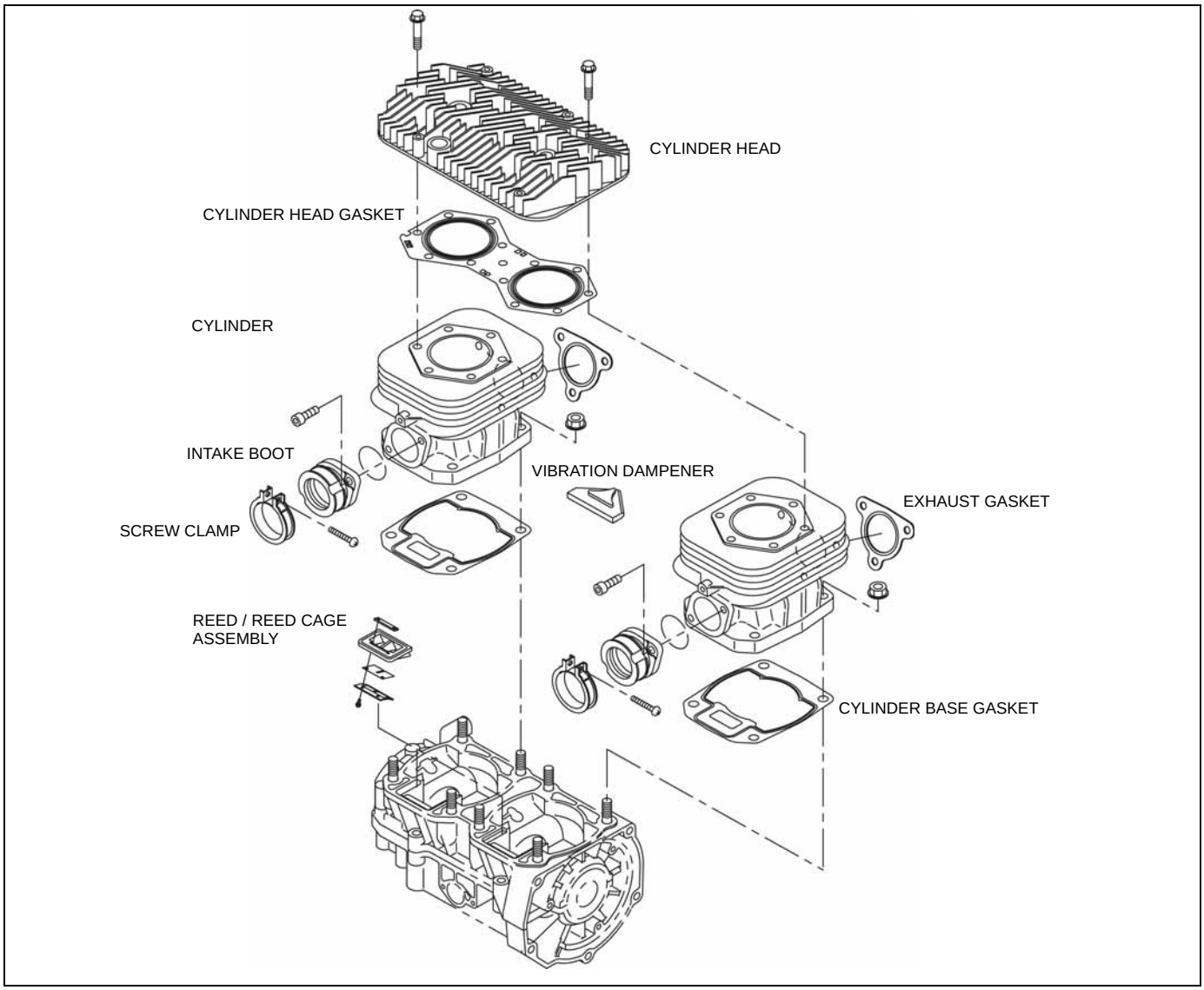


Disassembly / Assembly Process

1. Clamp recoil rope with a pliers at the engine. Remove recoil handle from rope, pull the rope through the console, then tie a knot just above the pliers. Remove the pliers.
2. Remove the screws that mount the upper and lower blower housings to the engine.
3. Remove the recoil / fan housing from the engine. The recoil pulley is located inside the housing.
4. Reference RECOIL PULLEY section for recoil disassembly / assembly information.
5. The fan / flywheel and stator must be removed to remove the rear blower housing.

Fastener	Torque	Note
Recoil Hub	9 ft.lbs. (12 Nm)	
Friction Plate / Recoil Pulley	5 ft.lbs. (7 Nm)	
Recoil / Fan Housings		Secure fasteners after all covers are in place and snapped together.

550 Cylinder Assembly

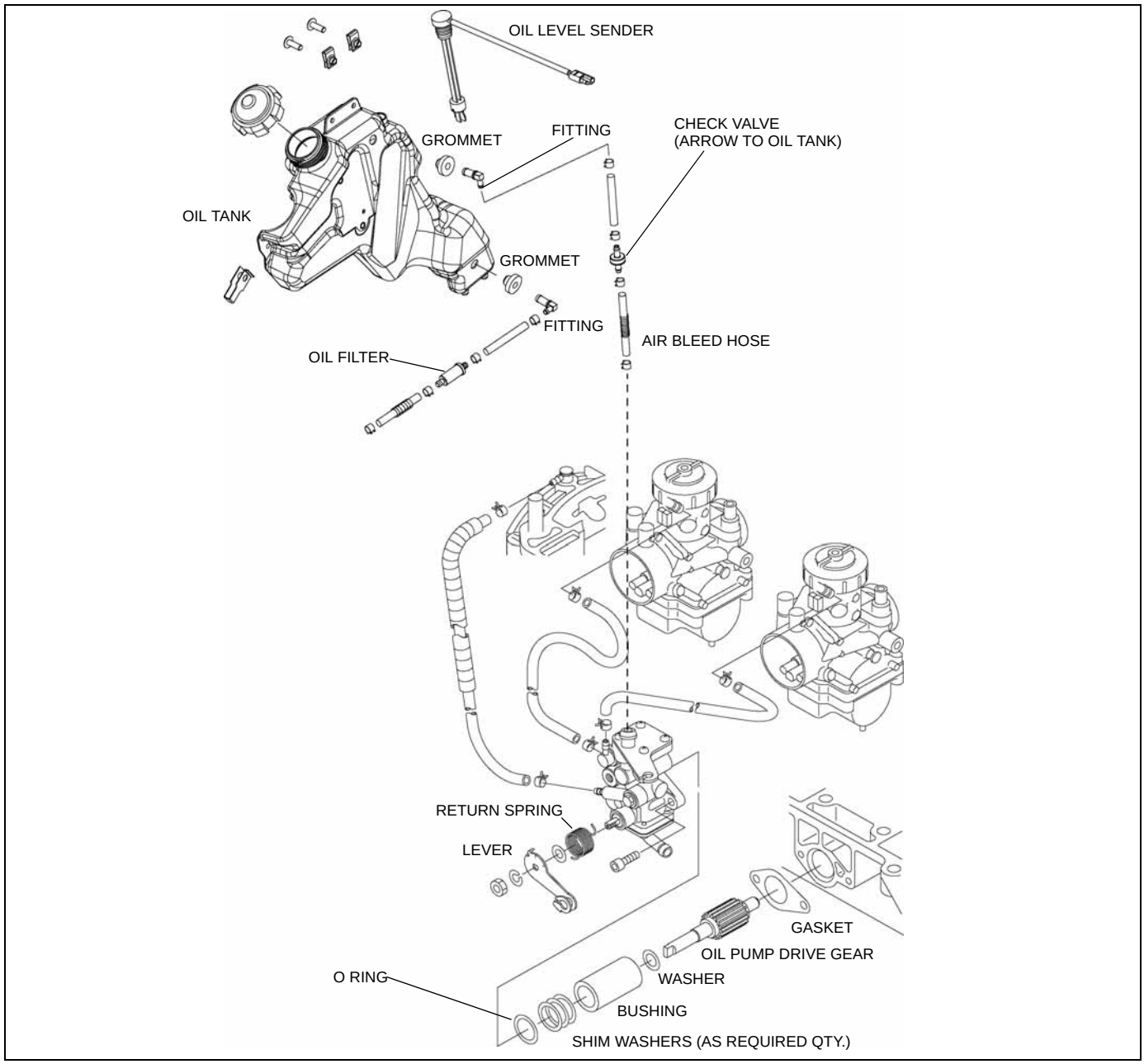


Disassembly / Assembly Process

1. Remove the carburetors, intake boots, exhaust manifold, and blower housing from the engine assembly. Discard all used gaskets.
2. Remove cylinder head screws. Remove cylinder head, then discard gasket. Note the orientation of the head for use during assembly.
3. Remove the cylinder base nuts. Lift the cylinder off of the crankcase. Discard the cylinder base gasket.
4. Remove reed valve cage and inspect for abnormal wear and damage. Replace reed pedal and/or cage if damage or wear is found.
5. During assembly, the reed valve assembly is installed under the cylinder base gasket. Install the base gasket with the sealing strip facing upwards.
6. Lubricate cylinder walls and piston with two-stroke engine oil when installing each cylinder.
7. Install head gasket with “EX” on the exhaust-side of the engine and “UP” on the intake-side of the engine.
8. Verify vibration dampener is installed between cylinders before installing blower housing covers.

Fastener	Torque	Note
Cylinder Base Nut	25 - 29 ft.lbs. (34 - 40 Nm)	
Cylinder Head Screws	17 - 20 ft.lbs. (23 - 28 Nm)	
Intake Boots	5 ft.lbs. (7 Nm)	

550 Oil Pump Assembly



Disassembly / Assembly Process

1. Remove the two pump mounting screws. Pull pump out of crankcase bore. Discard o ring.
2. Extract shim(s) behind pump body. Count the number of shims and retain.
3. Extract bushing and inspect. Replace if abnormal wear and tear is found.
4. Remove drive gear using a needle nose pliers.
5. Lubricate all parts with Polaris Two-Stroke engine oil during re-assembly.
6. Install the exact amount of shim(s) that were removed. Verify return spring works and applies tension to the lever.
7. Follow the oil pump bleed procedure outlined in the Maintenance chapter.

Fastener	Torque	Note
Oil Pump Screws	48 - 72 in.lbs. (5.5 - 8.3 Nm)	Oil pump is not serviceable.

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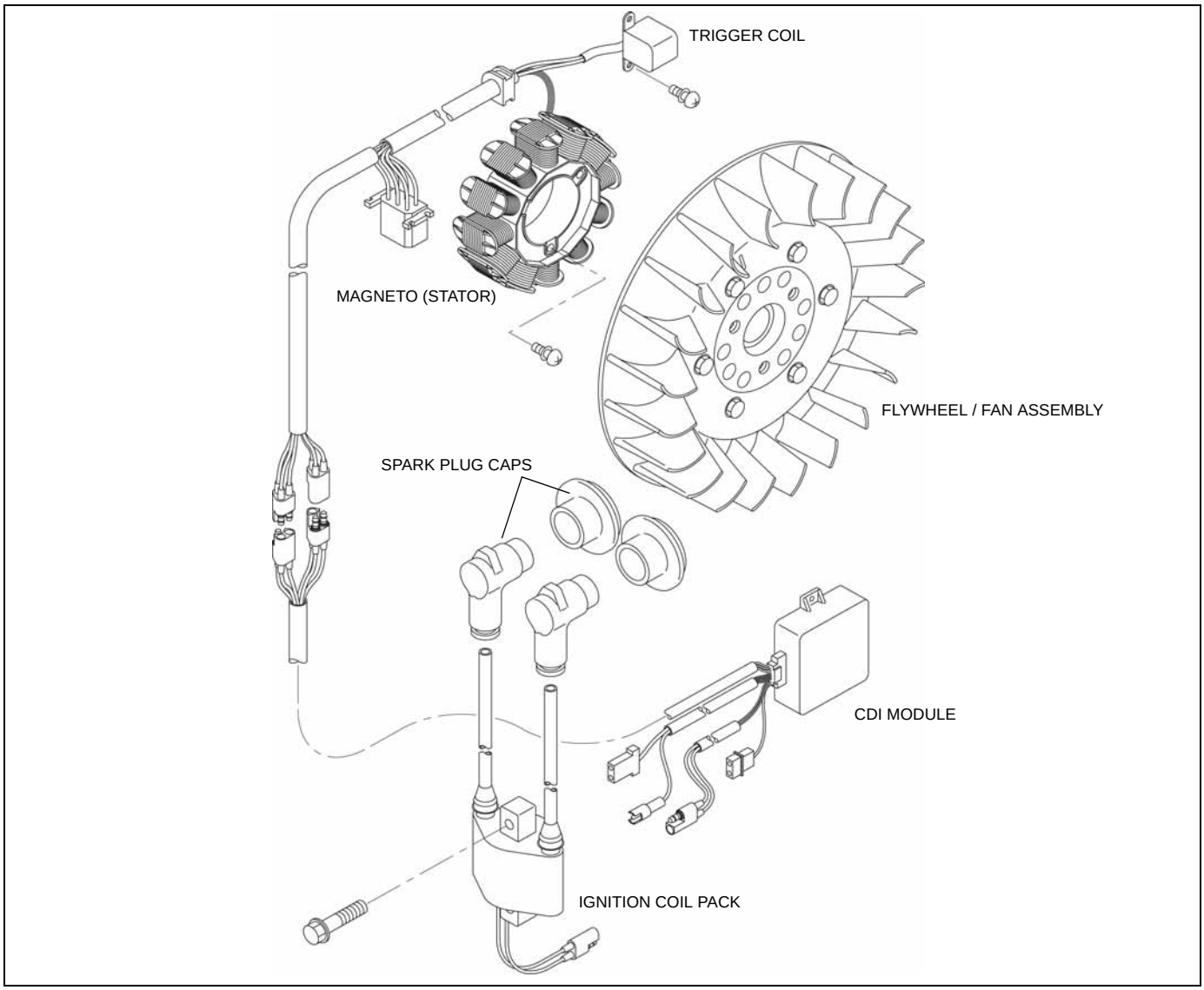
550 Magneto Assembly



Disassembly / Assembly Process

1. Remove the blower / recoil housing from the engine.
2. To remove the flywheel nut and washer, secure the flywheel using the flywheel holding wrench, PN 8700229.

NOTE: Do not secure the flywheel with a strap wrench around the fan blades as blade damage may occur.

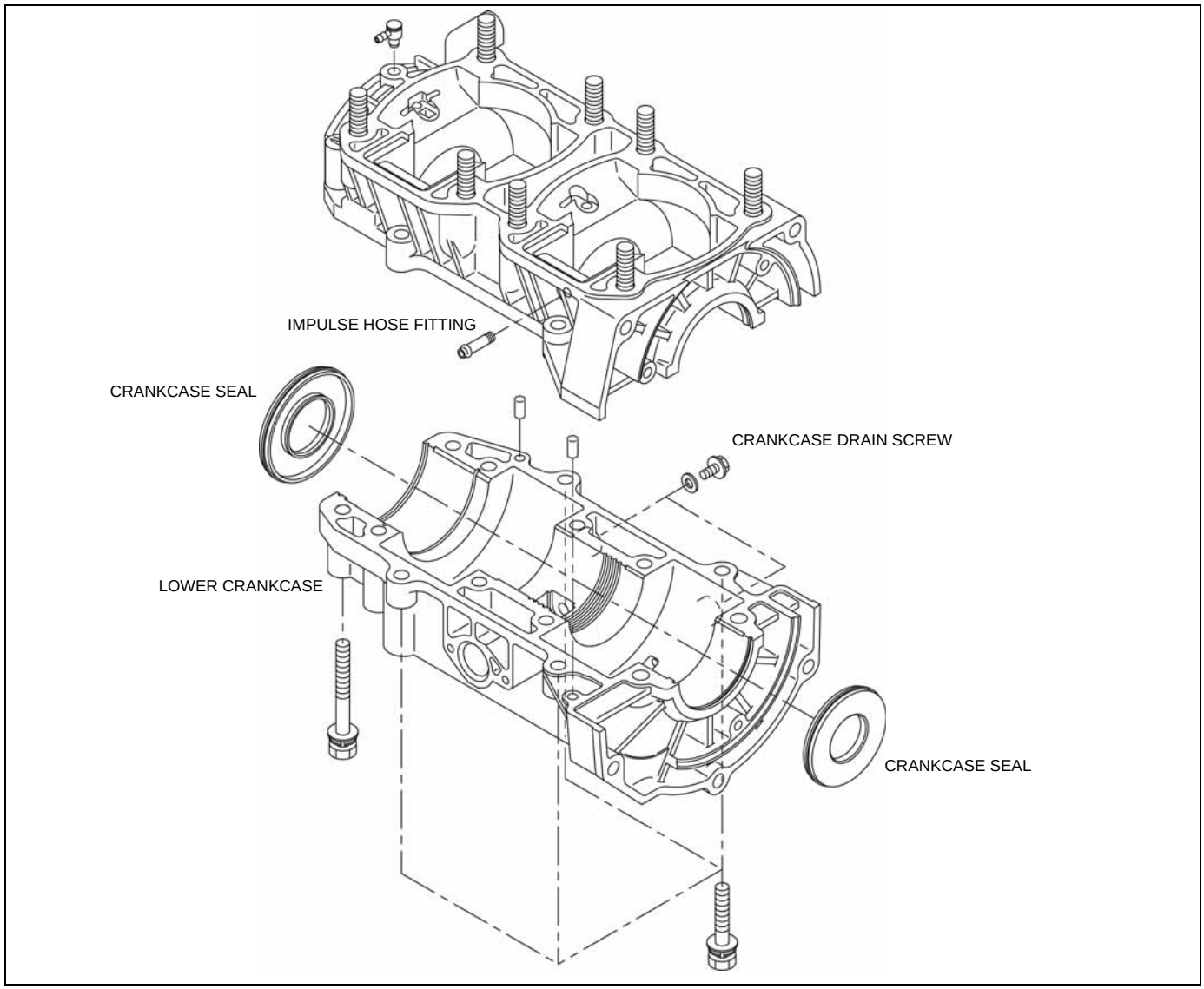
3. Remove the flywheel from the crankshaft using the heavy duty flywheel puller, PN 2871043-A.

NOTE: Do not thread the flywheel puller bolts into the magneto (stator) located behind the flywheel.

4. Thoroughly clean the crankshaft nose and flywheel nut threads. Inspect the flywheel key for damage. Replace if damage is found.
5. Scribe a line in the magneto plate and crankcase to ensure alignment when re-assembled.
6. Assembly is the reverse of disassembly.

Fastener	Torque	Note
Flywheel Nut	58 - 72 ft.lbs. (78.5 - 98 Nm)	Flywheel and crankshaft tapers to be clean and dry.
Magneto Magneto Plate	5 - 6.5 ft.lbs. (7 - 9 Nm)	

550 Crankcase Assembly

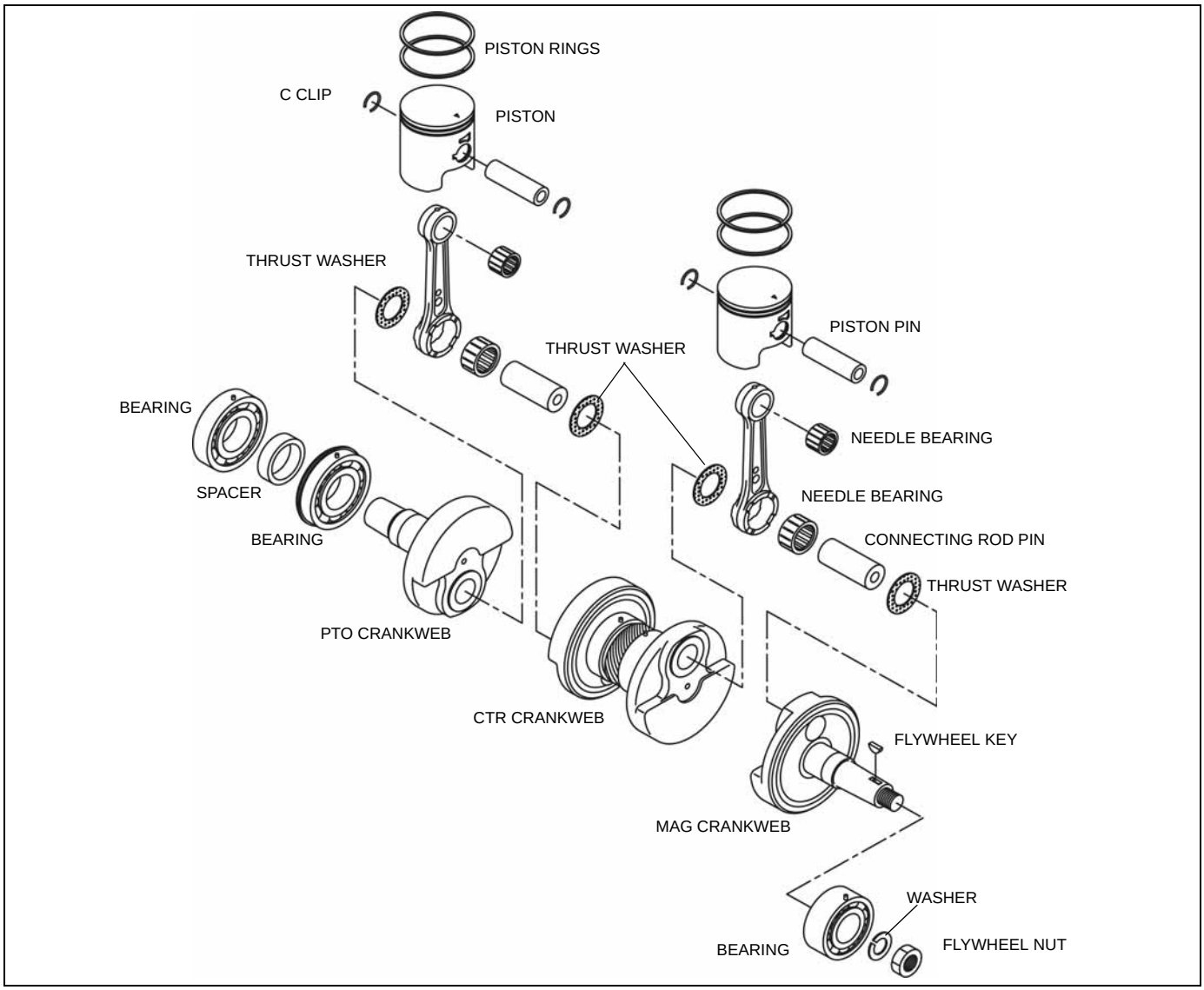


Disassembly / Assembly Process

1. Remove the blower housing assembly, oil pump, flywheel and magneto, and cylinders from the crankcase assembly. Discard all gaskets and o rings.
2. Remove engine mount plate fasteners from the lower crankcase.
3. Remove the crankcase fasteners. Thoroughly clean the fasteners to remove any locking agents.
4. Discard both crankshaft seals.
5. Thoroughly clean the two crankcase mating surfaces and the inner crankcases. Inspect for cracks. Verify both crankcase drain screws are securely installed.
6. Apply a thin bead of Three Bond 1217H to both crankcase mating surfaces.
7. Lubricate the oil pump drive gear with two-stroke engine oil and install into crankcase.
8. Install crankshaft and two new crankcase seals. Verify seal lips face the inside of the engine. Ensure crankshaft retaining ring and bearing locating pins are seated correctly before installing upper crankcase.
9. Torque crankcase fasteners to specified torque and sequence outlined at beginning of chapter.

Fastener	Torque	Note
Crankcase	15 - 18 ft.lbs. (20 - 25 Nm)	Apply Three Bond 1217H to crankcase mating surfaces.

550 Piston and Crankshaft Assembly



Disassembly / Assembly Process

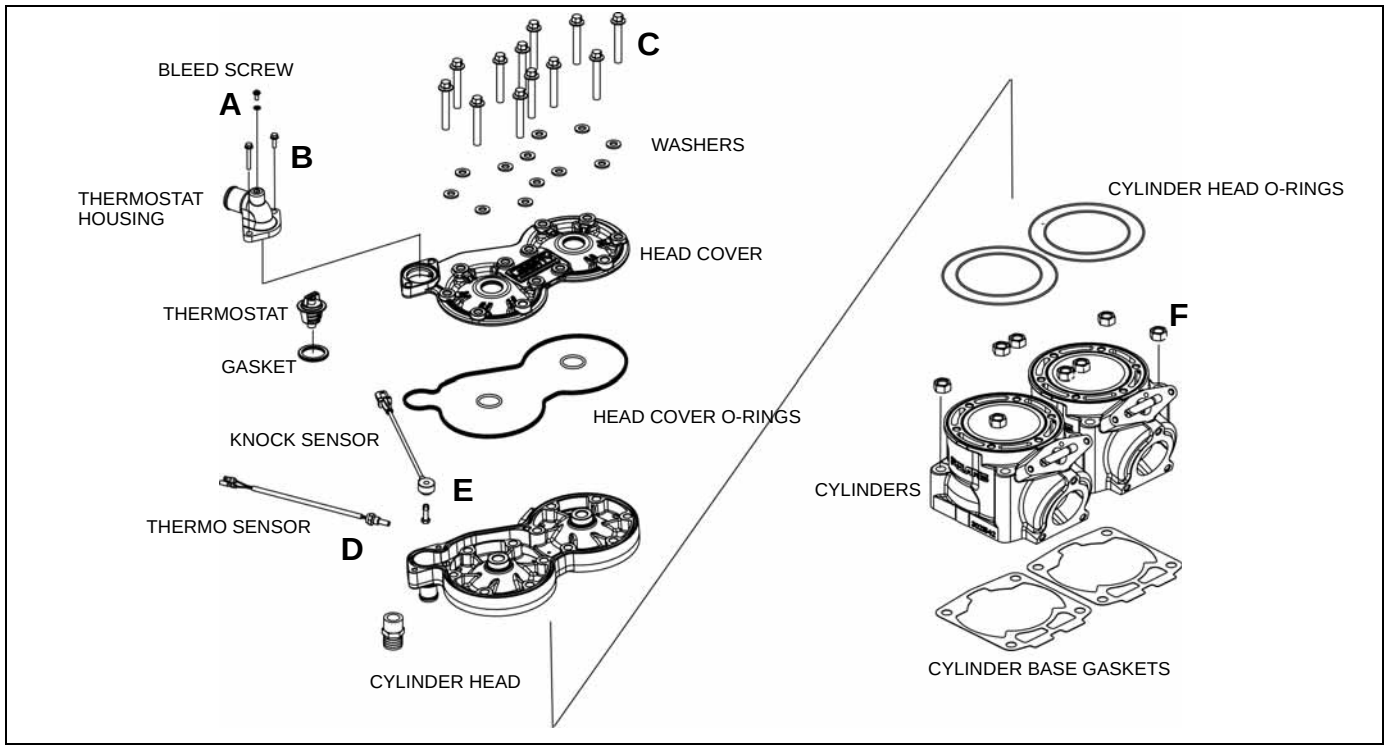
CAUTION

Wear eye protection when removing or installing piston c-clips.

1. Using a small, flat-blade screwdriver, remove the c-clips. Discard the c-clips.
2. Remove the piston pins using the piston pin puller, PN 2870386.
3. When replacing a piston, always replace the rings, c-clips, pins and needle bearings with new parts.
4. Inspect the crankshaft as outlined in the Engine Inspection section within this chapter.
5. Install the piston rings with the beveled edge facing upwards.
6. The piston ring locator pins and ring open-ends always face the intake-side of the engine.
7. Always lubricate the piston assembly and cylinder with two-stroke engine oil when installing the cylinder over the piston.

Fastener	Torque	Note
Flywheel Nut	58 - 72 ft.lbs. (78.5 - 98 Nm)	Flywheel and crankshaft tapers to be clean and dry.

600 HO Carbureted Cylinders / Cylinder Head

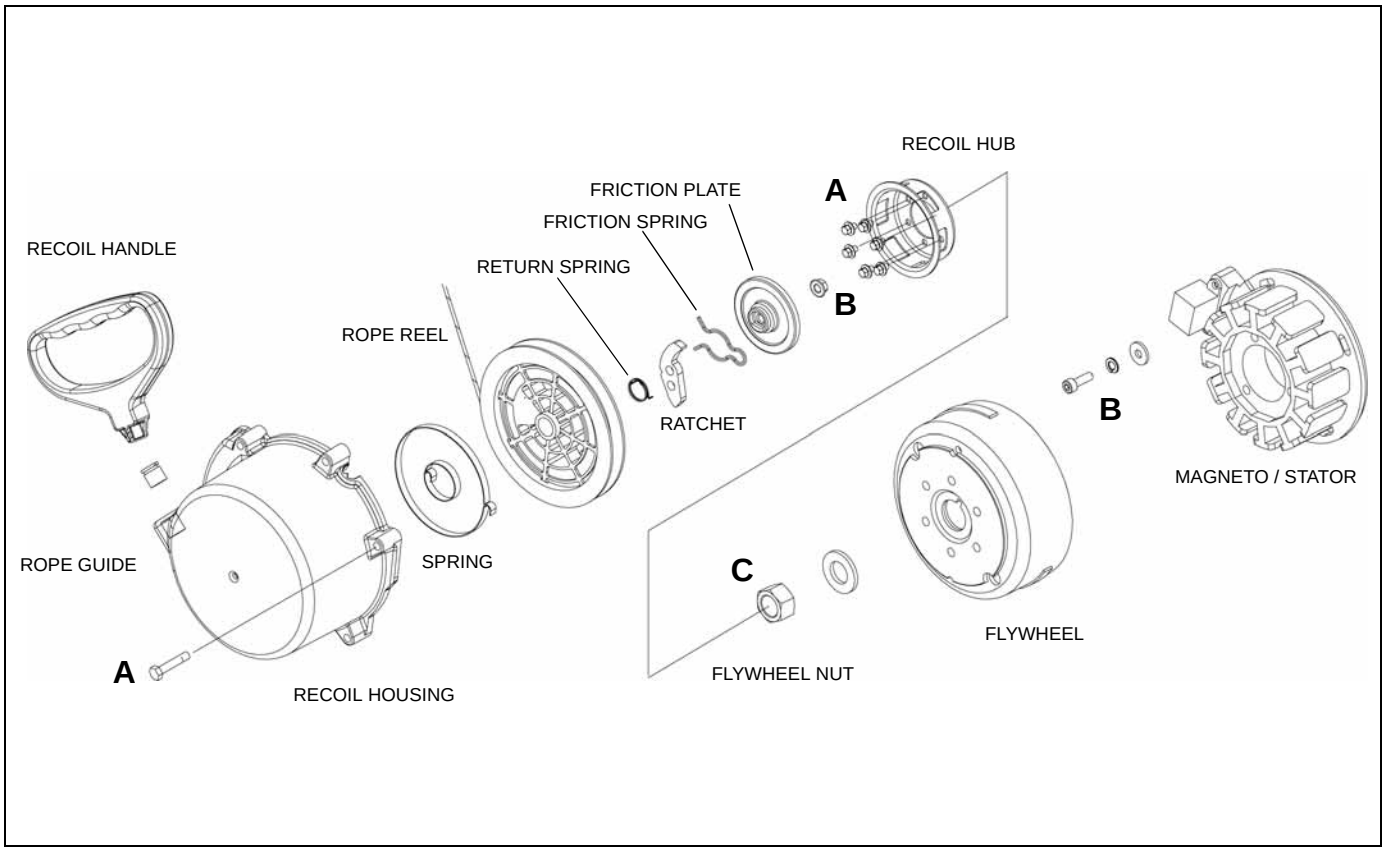


= T
A = 70 In.Lbs. (8 Nm) B = 9 Ft.Lbs. (12 Nm) - Apply Loctite 242 C = 25 Ft.Lbs. (34 Nm) - Apply Loctite 242 D = 18 Ft.Lbs. (24 Nm) - Apply Pipe Sealant E = 168 In.Lbs. (19 Nm) - Clean and Dry F = 37 Ft.Lbs. (50 Nm)

Disassembly / Assembly Process

1. Remove the coolant from the engine using a siphon, wet/dry vac, or drain pan.
2. Remove the air box, exhaust pipe and resonator from the engine compartment.
3. Remove the high tension wires and spark plugs from the cylinder head.
4. Remove the thermostat housing outlet cooling hose from the housing.
5. Loosen all, then remove all head cover fasteners. Clean the fastener threads to remove any thread locking residue.
6. Discard the head cover and cylinder head o-rings. Always use new o-rings during assembly.
7. Inspect the cylinder head / combustion domes for any damage. Measure cylinder head flatness. Replace cylinder head if required.
8. Loosen all, then remove the cylinder bolts. Clean the bolt threads to remove any thread locking residue.
9. Carefully pull each cylinder upwards taking care not to drop the piston and rod abruptly against the crankcase.
10. Remove the cylinder base gaskets. Use a gasket scraper to clean the gasket residue from the crankcase and cylinder bases.
11. Inspect the cylinder walls. Nicasil cylinders can only be lightly honed. Damage that cannot be removed with a light hone requires cylinder replacement or re-lining.
12. The assembly process is the reverse of disassembly.
13. Always use new gaskets and o-rings during assembly. Liberally coat the inside of each cylinder and the outside of each piston with Polaris two-stroke engine oil.
14. When installing a piston into a cylinder, verify each piston ring opening is located at each piston ring locating pin. Squeeze the top ring, then carefully slide the cylinder over the compressed ring. Do the same with the bottom ring.
15. Follow the torque specifications and torque sequences located at beginning of chapter when tightening fasteners.

600 HO Carbureted Recoil / Magneto



= T
A = 9 Ft.Lbs. (12 Nm) B = 5 Ft.Lbs. (7 Nm) - Apply Loctite 242 (Stator) C = 90 Ft.Lbs. (122 Nm) - Apply Loctite 242

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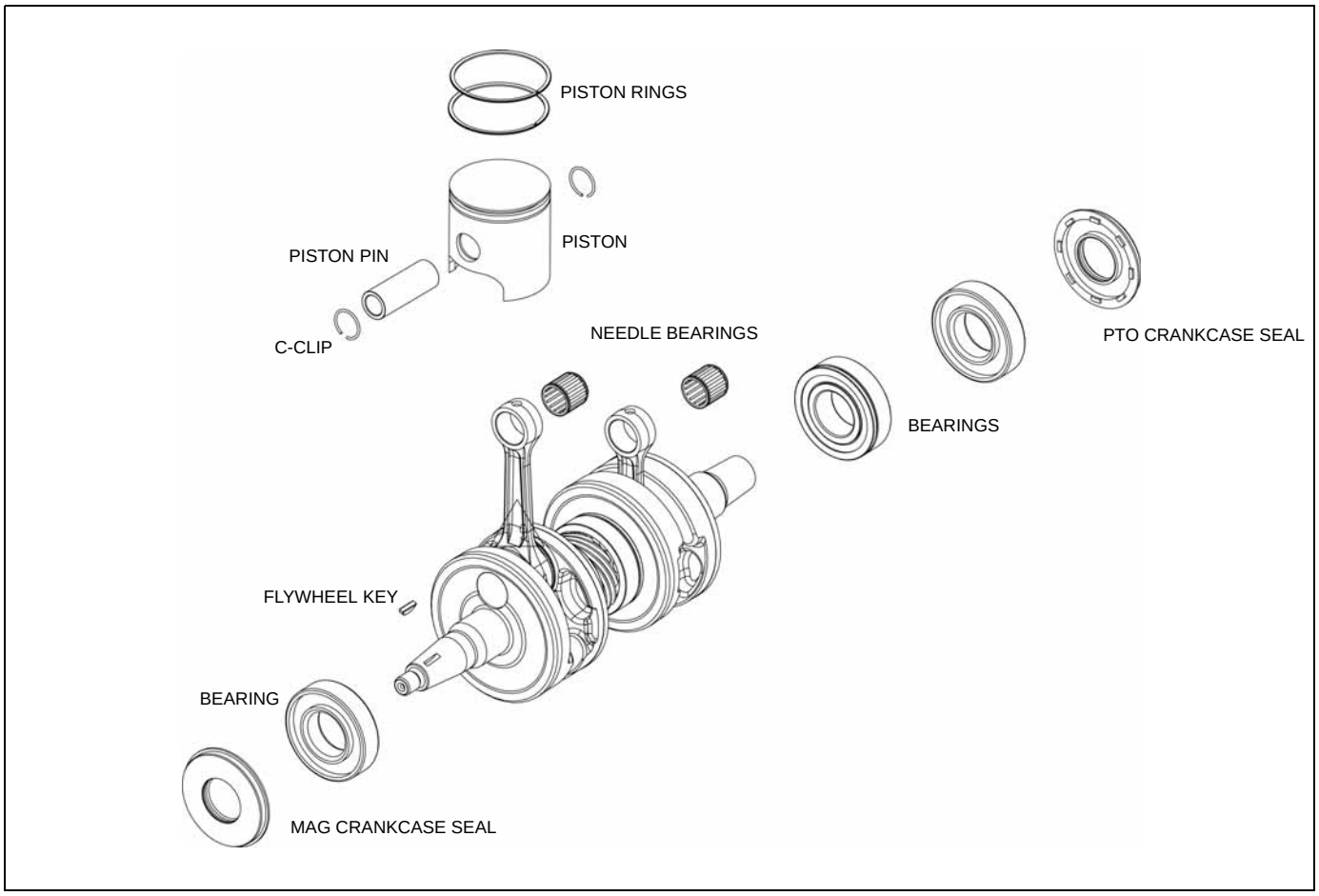
Disassembly / Assembly Process

1. Remove the exhaust pipe and resonator.
2. If the recoil assembly does not require attention, the recoil rope can remained attached to the handle. If recoil component work is desired, reference the Recoil Assembly section. See “Carbureted Recoil Assembly” on page 5.16.
3. Remove the recoil / magneto housing cover. The recoil assembly is located inside the housing.
4. Remover the recoil hub from the flywheel. Secure the flywheel with a strap wrench, PN PU-45419. Remove the flywheel nut and washer.
5. Using the flywheel puller tool, PN 2871043, insert the puller’s three screws into the flywheel.

NOTE: Do not thread the puller screws into the magneto/stator located behind the flywheel.

6. Turn the puller center bolt in until the flywheel “pops” off of the crankshaft.
7. Mark the location of the magneto / stator plate in several places using a scribe.
8. Remove the magneto / stator from the crankcase.
9. Clean the crankshaft and flywheel tapers with a solvent such as clutch cleaner.
10. Assembly is reverse of disassembly. Reference the fastener torque specifications at the beginning of the chapter.
11. Do not use an impact wrench to install the flywheel nut.

600 HO Carbureted Pistons / Crankshaft



Piston Matrix

Engine Model	Piston PN	Piston ID
S3273-6044-PF6F	2202258 (Subs to 2203319)	EK-2202b
S3274-6044-PF6F		
S3466-6044-PU6F S3467-6044-PU6F S3675-6044-PN6F	2203319	EK-2202c

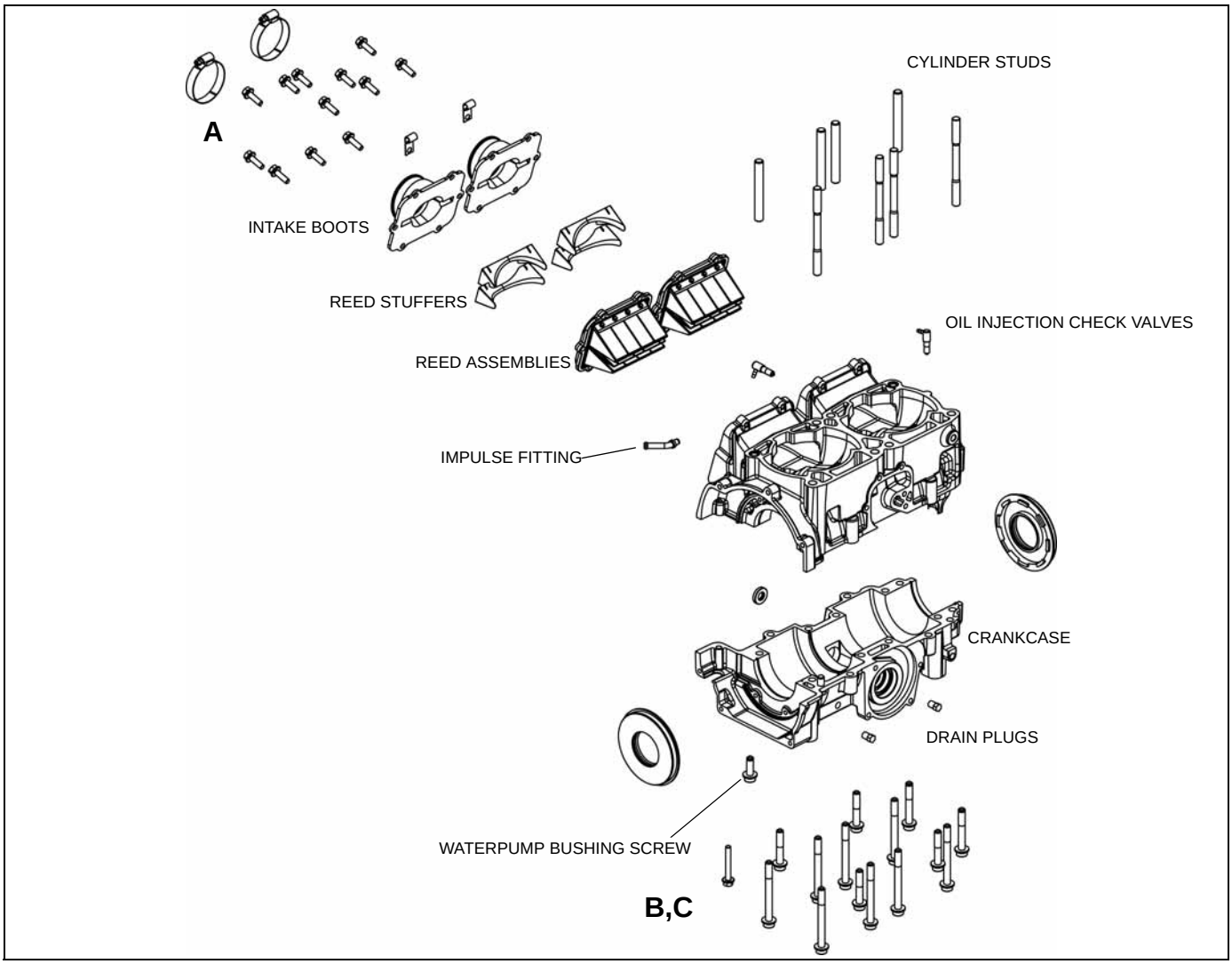
Disassembly / Assembly Process

1. To remove the pistons, follow the process for removing the cylinder head and cylinders from the engine.
2. To remove the crankshaft, follow the process for disassembling the crankcase assembly.
3. With the piston out of the cylinder, remove one of the c-clips and discard. Never re-use piston c-clips.
4. Push the piston pin out of the piston and upper rod bearings. Inspect the pin for galling and abnormal wear. Inspect the needle bearing by feel and replace as required.
5. New pistons are supplied with new rings and a piston pin. It is recommended that new needle bearings be installed as well.
6. When installing a new piston, insert one c-clip into the piston making sure the open end is 180° opposite of the groove opening.
7. Apply a liberal amount of Polaris two-stroke engine oil to the needle bearings, piston pin and piston assembly.
8. Push the pin in to the piston, then through the needle bearing. Install the remaining c-clip with the open end is 180° opposite of the groove opening.

NOTE: Always use new cylinder base gaskets.

9. Apply a liberal amount of Polaris two-stroke oil to the cylinder wall. Align the piston ring gaps around the piston locating pins. Compress the upper ring, then carefully slide the cylinder down over the ring.
10. Compress the lower ring, then slide the cylinder down over the ring.

600 HO Carbureted Crankcase



= T
A = 9 Ft.Lbs. (12 Nm) B = (M8) - 22 Ft.Lbs. (30 Nm) - Apply Loctite 242 C = (M6) - 9 Ft.Lbs. (12 Nm) - Apply Loctite 242

= In. / mm.
Long Studs Height (Exhaust side) = 3.66'' (93mm) Small Stud Height (Intake side) = 2.16'' (55mm)

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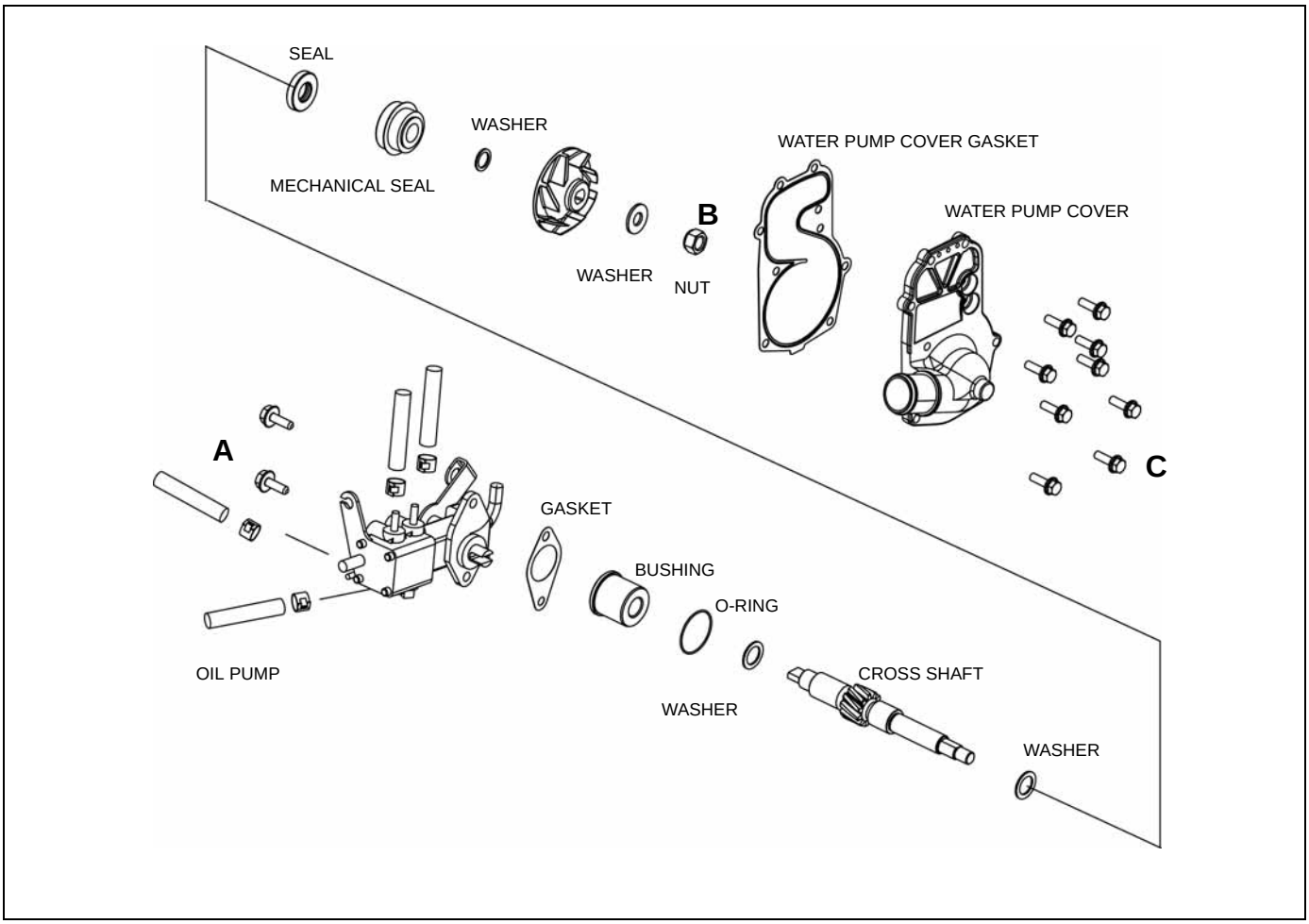
Disassembly / Assembly Process

1. Remove the engine from the engine compartment.
2. Follow the process for removing the cylinder head, cylinders, pistons, flywheel / recoil housing, and the water / oil pump.
3. Remove the intake boots, and reed assemblies. Discard any seals or gaskets.
4. Remove the crankcase fasteners then carefully pry apart the crankcase halves. Discard the PTO and MAG crankshaft seals.
5. Clean the two crankcase mating surfaces with carburetor cleaner and a gasket remover. Flush out the crankcase.
6. Reinstall the crankshaft back into the lower crankcase using two new crankcase seals.
7. Apply a thin bead of Three Bond 1217H to the lower crankcase mating surface. Install the upper crankcase.
8. Loosely install the crankcase fasteners, then torque to the specifications at the beginning of the chapter. Use the correct torque sequence when tightening the screws.

600 HO Carbureted Water / Oil Pump



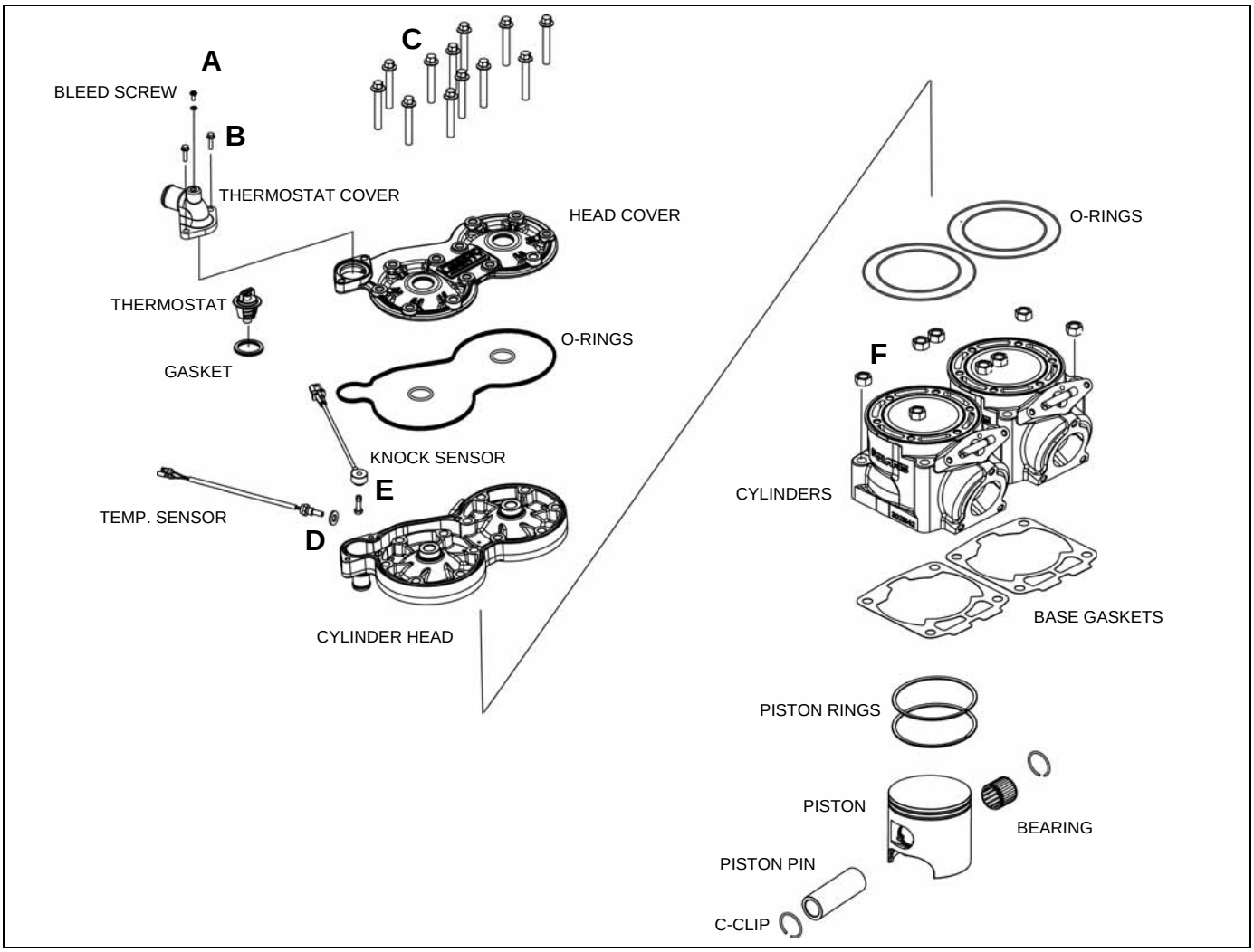
= T
A = 7 Ft.Lbs. (9.5 Nm) B = 10 Ft.Lbs. (13 Nm) C = 9 Ft.Lbs. (12 Nm)

Disassembly / Assembly Process

IMPORTANT: Use the mechanical seal installation tool to install the water pump seal, PN: 2872010.

1. Remove the coolant from the engine using a siphon, wet/dry vac. or a drain pan.
2. Remove the airbox, exhaust pipe and resonator. Remove the hose connected to the water pump cover.
3. To access the impeller and mechanical seal, remove the water pump cover. Discard the water pump cover gasket.
4. Remove the impeller nut, impeller and washers from the cross shaft.
5. Carefully pry the mechanical seal and seal out of the crankcase.
6. Water pump assembly is the reverse of disassembly. Always use new seals and gaskets during assembly.
7. To remove the oil pump / cover, remove the two fasteners then pull the pump / cover out of the crankcase bore. Discard the gasket.
8. The cross shaft can be extracted from the water pump side of the crankcase.
9. Assembly is the reverse of disassembly. Always use new o-rings, seals and gaskets during assembly.
10. Install a new seal onto the shaft from the water pump side.
11. To install a new water pump seal, use the seal installation tool, PN 2872010. Verify the seal lips are facing the cross shaft gear.

600/700 CFI Cylinder Head / Cylinders / Pistons



= T
A = 70 In.Lbs. (8 Nm) B = 9 Ft.Lbs. (12 Nm) - Apply Loctite 242 C = 25 Ft.Lbs. (34 Nm) - Apply Loctite 242 D = 18 Ft.Lbs. (24 Nm) - Apply Pipe Sealant E = 168 In.Lbs. (19 Nm) - Clean and Dry F = 37 Ft.Lbs. (50 Nm)

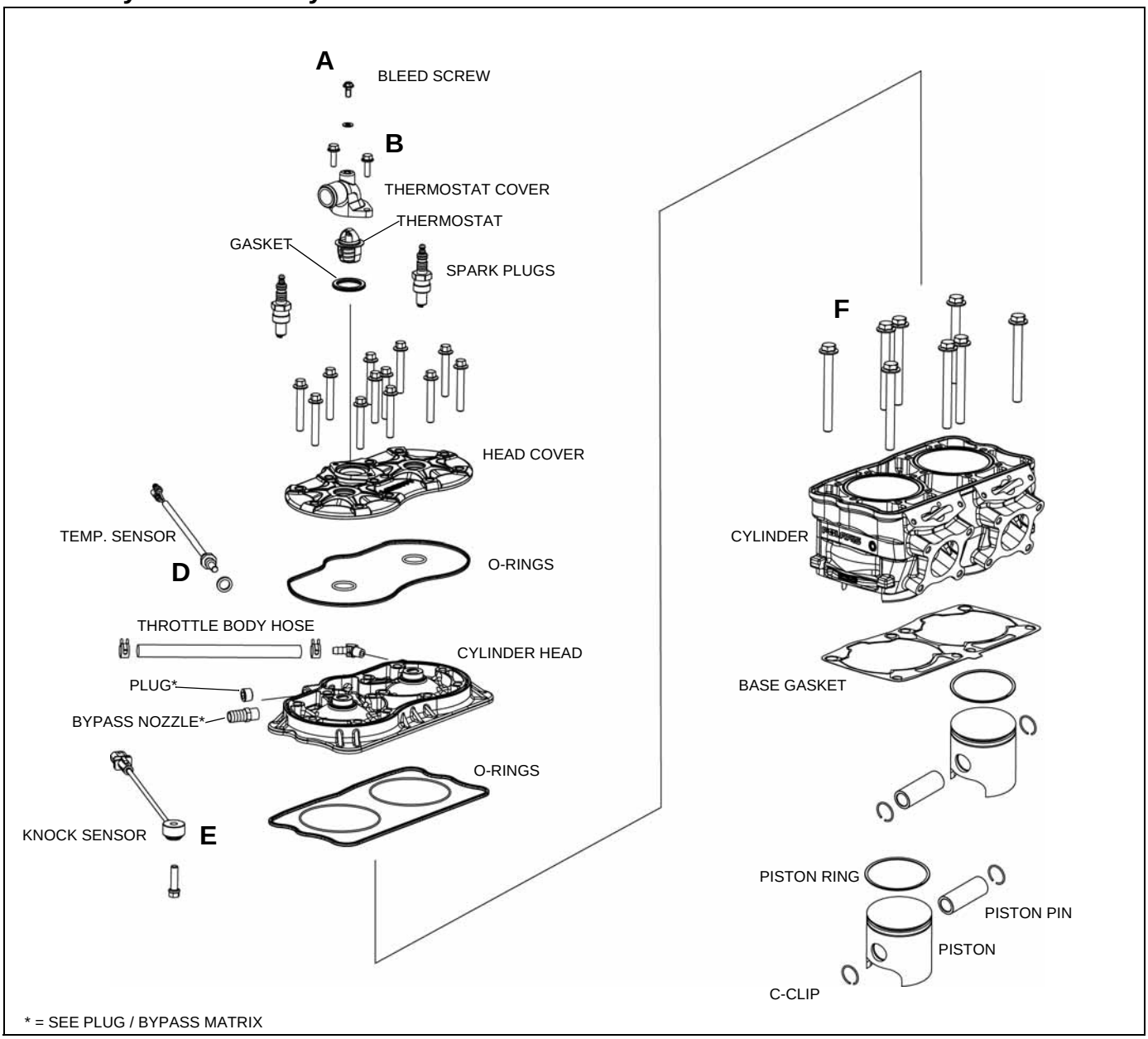
Disassembly / Assembly Process

Piston Matrix

Engine Model	Piston PN	Piston ID
S3206-6044-PF6G S3468-6044-PU6H S3469-6044-PU6H	2203319	EK-22202c
S3305-7044-PF7J	2203512	2922-06
S3322-7044-PF7J	2203312 (Subs to 2203512)	EK-2486a
S3470-7044-PU7J	2203707	3050-00
S3471-7044-PU7J S3680-7044-PN7J S4175-7044-OP7J	2203606 (Single Ring)	2975-01
S3677-6044-PN6H S3908-6044-PN6H S3747-6044-PN6K	2203899 (Subs to 2204122)	3090-00
S3996-6044-OP6H S4176-6044-OP6H S4177-6044-OP6H S4216-6044--OO6H S4218-6044-OO6H	2204122	3090-01
S4203-6044-OP6M S4219-6044-OO6N	2204152	3222-00

1. Remove the coolant from the engine using a siphon, wet/dry vac, or drain pan.
2. Remove the air box, exhaust pipe and resonator from the engine compartment.
3. Remove the high tension wires and spark plugs from the cylinder head.
4. Remove the thermostat housing outlet cooling hose from the housing.
5. Loosen all, then remove all head cover fasteners. Clean the fastener threads to remove any thread locking residue.
6. Discard the head cover and cylinder head o-rings. Always use new o-rings during assembly.
7. Inspect the cylinder head / combustion domes for any damage. Measure cylinder head flatness. Replace cylinder head if required.
8. If only the cylinders are going to be removed, remove the fuel rail from the upper fuel injectors. See “Fuel Rail and Injector Removal / Installation” on page 4.38.
9. Loosen all, then remove the cylinder bolts. Clean the bolt threads to remove any thread locking residue.
10. Carefully pull each cylinder upwards taking care not to drop the piston and rod abruptly against the crankcase.
11. Remove the cylinder base gaskets. Use a gasket scraper to clean the gasket residue from the crankcase and cylinder bases.
12. Inspect the cylinder walls. Nicasil cylinders can only be lightly honed. Damage that cannot be removed with a light hone requires cylinder replacement or re-chroming.
13. The assembly process is the reverse of disassembly.
14. Always use new gaskets and o-rings during assembly. Liberally coat the inside of each cylinder and the outside of each piston with Polaris two-stroke engine oil.
15. Always refresh the cylinder crosshatch pattern using a 320 grit stone. See “Cylinder Honing” on page 5.13.
16. When installing a piston into a cylinder, verify each piston ring opening is located at each piston ring locating pin. Squeeze the top ring, then carefully slide the cylinder over the compressed ring. Do the same with the bottom ring.
17. Follow the torque specifications and torque sequences located at beginning of chapter when tightening fasteners.

800 CFI Cylinder Head/Cylinder/Pistons



= T
A = 70 In.Lbs. (8 Nm) B = 9 Ft.Lbs. (12 Nm) - Apply Loctite 242 C = 25 Ft.Lbs. (34 Nm) - Apply Loctite 242 D = 18 Ft.Lbs. (24 Nm) - Apply Pipe Sealant E = 168 In.Lbs. (19 Nm) - Clean and Dry F = 42 Ft.Lbs. (57 Nm)

800 CFI Cylinder Head/Cylinder/Pistons Compatibility

Piston Matrix

Engine Model	Piston PN	Piston ID
All 800s	2204154	3265-00

800 dual ring pistons feature two different rings thicknesses. The upper ring is 1.8mm thick, while the lower ring is 1.5mm thick.

800 CFI engines used in all non-RMK or RMK vehicles featuring a front bulkhead cooler are equipped with a bypass nozzle that directs coolant to the front bulkhead cooler.

800 CFI engines used in RMK vehicles that do not feature a front bulkhead cooler are equipped with a plug.

Plug/Bypass Matrix

Engine Model	Cylinder Head Plug	Cylinder Head Bypass Nozzle
S3489-8044-PU8E S3683-8044-PN8E S3685-8044-PN8E S4001-8044-OP8E		X
S3471-8044-PU8E S3684-8044-PN8E S4002-8044-OP8E	X	

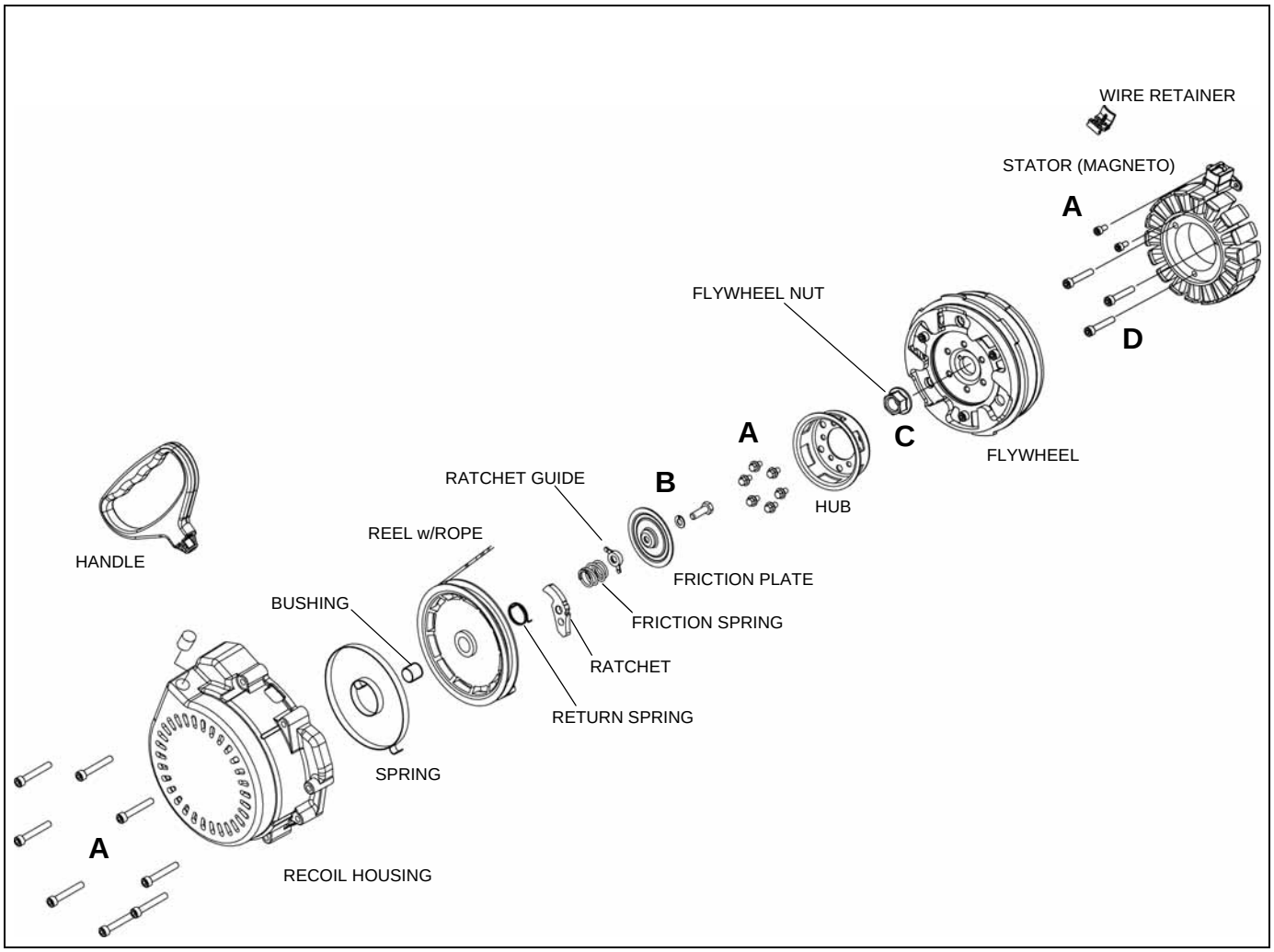
800 CFI Cylinder Head/Cylinder/Pistons Disassembly and Assembly.

1. Remove the coolant from the engine using a siphon, wet/dry vac, or drain pan.
2. Remove the air box, exhaust pipe and resonator from the engine compartment.
3. Remove the high tension wires and spark plugs from the cylinder head.
4. Remove the thermostat housing outlet cooling hose from the housing.
5. Loosen all, then remove all head cover fasteners. Clean the fastener threads to remove any thread locking residue.
6. Discard the head cover and cylinder head o-rings. Always use new o-rings during assembly.
7. Inspect the cylinder head / combustion domes for any damage. Measure cylinder head flatness. Replace cylinder head if required.
8. If only the cylinder is going to be removed, remove the fuel rail from the upper fuel injectors. See “Fuel Rail and Injector Removal / Installation” on page 4.38.

NOTE: Leave the exhaust Y-pipe attached to the cylinder assembly. Remove Y-pipe after removing cylinder from crankcase.

9. Loosen all, then remove the cylinder bolts. Clean the bolt threads to remove any thread locking residue.
10. Carefully pull the cylinder upwards taking care not to drop the pistons and rods abruptly against the crankcase.
11. Remove the cylinder base gasket. Use a gasket scraper to clean the gasket residue from the crankcase and cylinder base.
12. Inspect the cylinder walls. Nicasil cylinders can only be lightly honed using a 320 grit stone. Damage that cannot be removed with a light hone requires cylinder replacement or re-chroming.
13. Inspect the crankcase and cylinder mating surfaces for warping.
14. The assembly process is the reverse of disassembly.
15. Always use new gaskets and o-rings during assembly. Liberally coat the inside of each cylinder bore and the outside of each piston with Polaris two-stroke engine oil.
16. Always refresh the cylinder crosshatch pattern using a 320 grit stone. See “Cylinder Honing” on page 5.13.
17. When installing a piston into a cylinder, verify each piston ring opening is located at each piston ring locating pin. Squeeze the top ring, then carefully slide the cylinder over the compressed ring. Do the same with the bottom ring.
18. Follow the torque specifications and torque sequences located at beginning of chapter when tightening fasteners.

600/700/800 CFI Recoil / Stator Assembly



= T
A = 9 Ft.Lbs. (12 Nm) B = 2007-2010 Engines = 9 Ft.Lbs. (12.3 Nm) Apply Loctite 242 2011 Engines = 15 Ft.Lbs. (20Nm) Apply Loctite 242 C = 90 Ft.Lbs. (122 Nm) - Apply Loctite 242 D = 12 Ft.Lbs. (16 Nm) - Apply Loctite 242

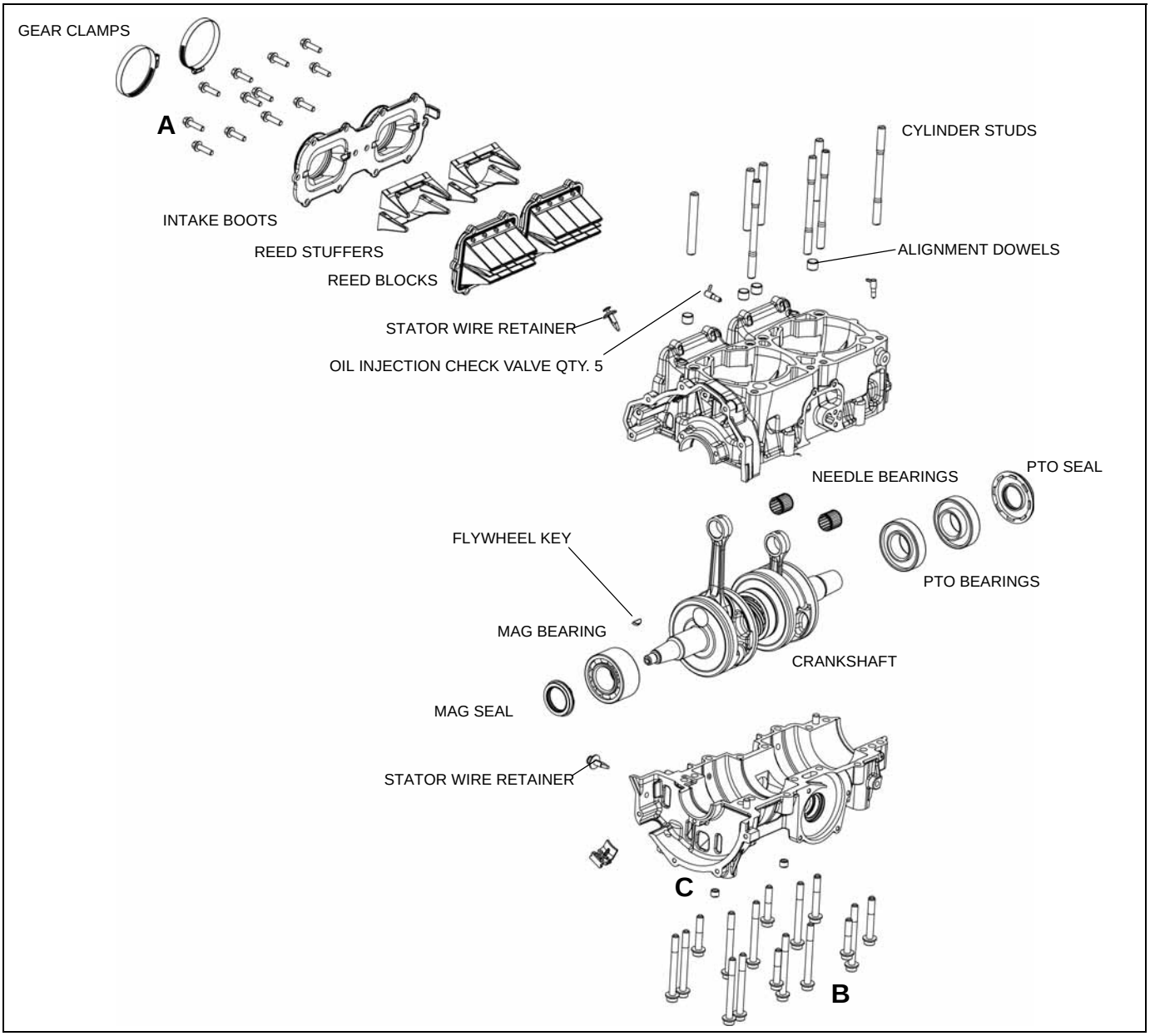
Disassembly / Assembly Process

1. Remove the exhaust pipe and resonator.
2. If the recoil assembly does not require attention, the recoil rope can remained attached to the handle. If recoil component work is desired, reference the Recoil Assembly section.
3. Remove the recoil / magneto housing cover. The recoil assembly is located inside the housing.
4. Remover the recoil hub from the flywheel. Secure the flywheel with a strap wrench, PN PU-45419. Remove the flywheel nut and washer.
5. Using the flywheel puller tool, PN 2871043, insert the puller's three screws into the flywheel.

NOTE: Do not thread the puller screws into the magneto/stator located behind the flywheel.

6. Turn the puller center bolt in until the flywheel "pops" off of the crankshaft.
7. Mark the location of the magneto / stator plate in several places using a scribe.
8. Remove the magneto / stator from the crankcase.
9. Assembly is reverse of disassembly. Reference the fastener torque specifications at the beginning of the chapter.
10. Do not use an impact wrench to install the flywheel nut.

600/700 CFI Crankcase/Crankshaft Assembly



= In. / mm.

Long Stud Height (Exhaust side) = 4.13" (105mm)
Small Stud Height (Intake side) = 2.16" (55mm)

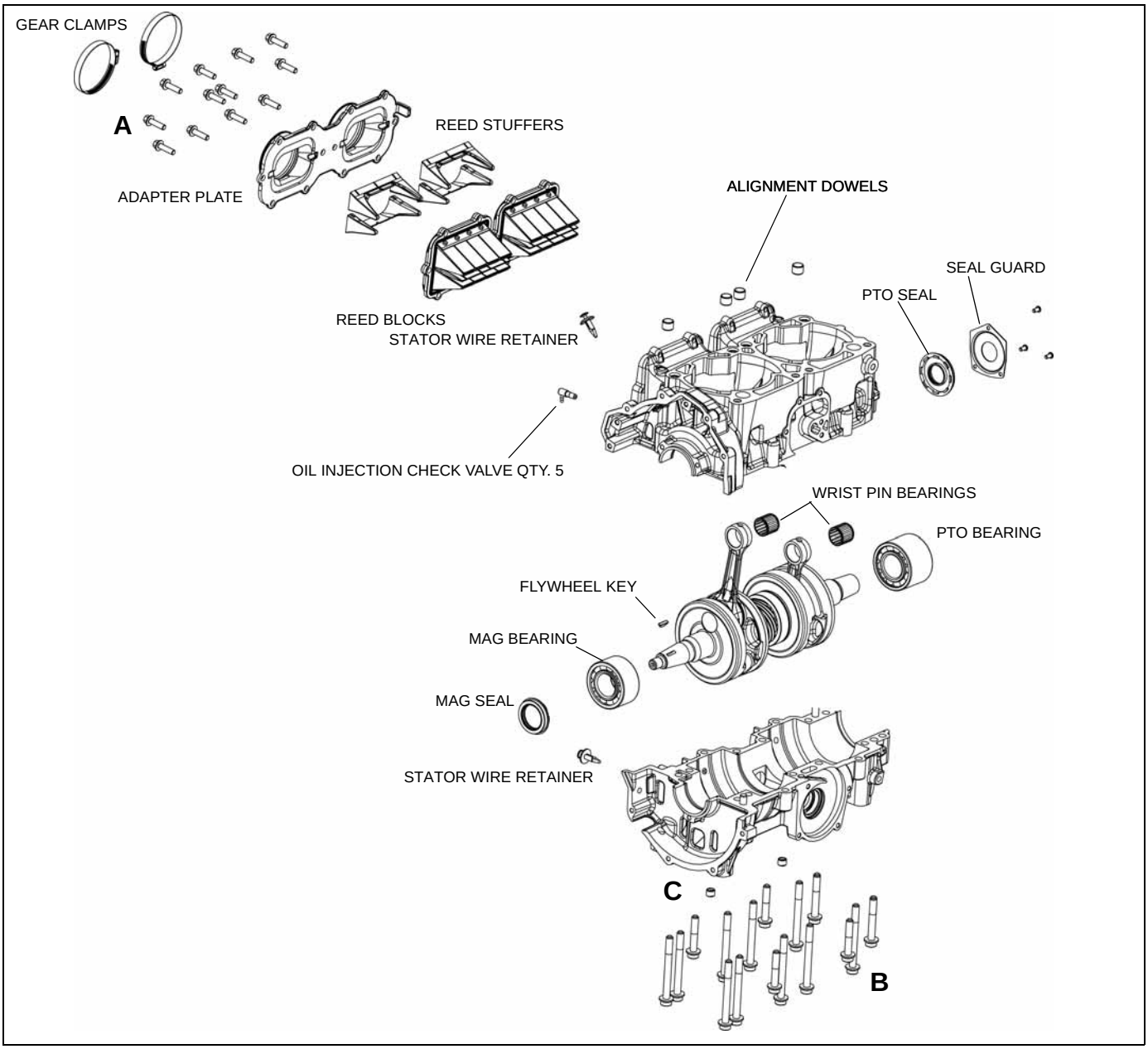
= T

A = 9 Ft.Lbs. (12 Nm)
B = 22 Ft.Lbs. (30 Nm)
C = 10 Ft.Lbs. (13 Nm) - Apply Pipe Sealant

Disassembly / Assembly Process

1. Remove the engine from the engine compartment.
2. Follow the process for removing the cylinder head, cylinders, pistons, flywheel / recoil housing, and the water / oil pump.
3. Remove the intake boots, reed stuffers, and reed assemblies from the intake tracks. Discard any seals or gaskets.
4. Remove the fasteners from the bottom of the crankcase. Carefully pry apart the crankcase halves. Discard the PTO and MAG crankshaft seals.
5. Remove the crankshaft. Inspect as required.
6. Thoroughly clean the two crankcase mating surfaces with carburetor cleaner and a gasket remover. Flush out the crankcase galleries.
7. Reinstall the crankshaft back into the lower crankcase using two new crankcase seals.
8. Apply a thin bead of Three Bond 1217H to the lower crankcase mating surface. Install the upper crankcase.
9. Loosely install the crankcase fasteners, then torque to the specifications at the beginning of the chapter. Use the correct torque sequence when tightening the screws.
10. Liberally coat the crankshaft bearings and components with Polaris two-stroke engine oil.

800 CFI Crankcase/Crankshaft

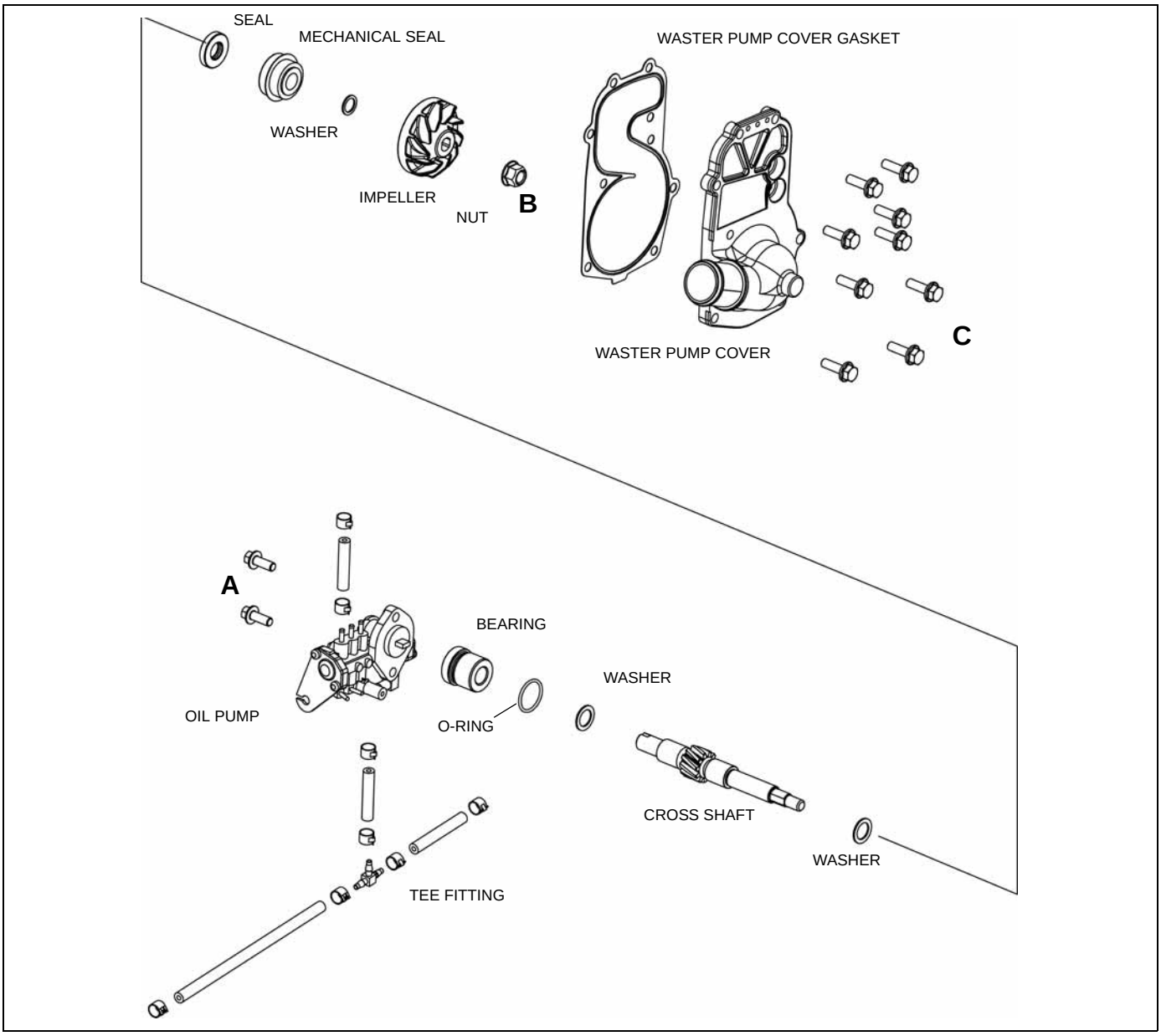


= T
A = 9 Ft.Lbs. (12 Nm) B = 22 Ft.Lbs. (30 Nm) - Apply Loctite 242 C = 10 Ft.Lbs. (13 Nm) - Apply Pipe Sealant

Disassembly / Assembly Process - 800 CFI Crankcase / Crankshaft

1. Remove the engine from the engine compartment.
2. Follow the process for removing the cylinder head, cylinders, pistons, flywheel / recoil housing, and the water / oil pump.
3. Remove the intake boots, reed stuffers, and reed assemblies from the intake tracks. Discard any seals or gaskets.
4. Remove the fasteners from the bottom of the crankcase. Carefully pry apart the crankcase halves. Discard the PTO and MAG crankshaft seals.
5. Remove the crankshaft. Inspect as required.
6. Thoroughly clean the two crankcase mating surfaces with carburetor cleaner and a gasket remover. Flush out the crankcase galleries.
7. Reinstall the crankshaft back into the lower crankcase using two new crankcase seals.
8. Apply a thin bead of Three Bond 1217H to the lower crankcase mating surface. Install the upper crankcase.
9. Loosely install the crankcase fasteners, then torque to the specifications at the beginning of the chapter. Use the correct torque sequence when tightening the screws.
10. Liberally coat the crankshaft bearings and components with Polaris two-stroke engine oil.

600/700/800 CFI Water-Oil Pump Assembly



= T
A = 7 Ft.Lbs. (9.5 Nm) B = 10 Ft.Lbs. (13 Nm) C = 9 Ft.Lbs. (12 Nm)

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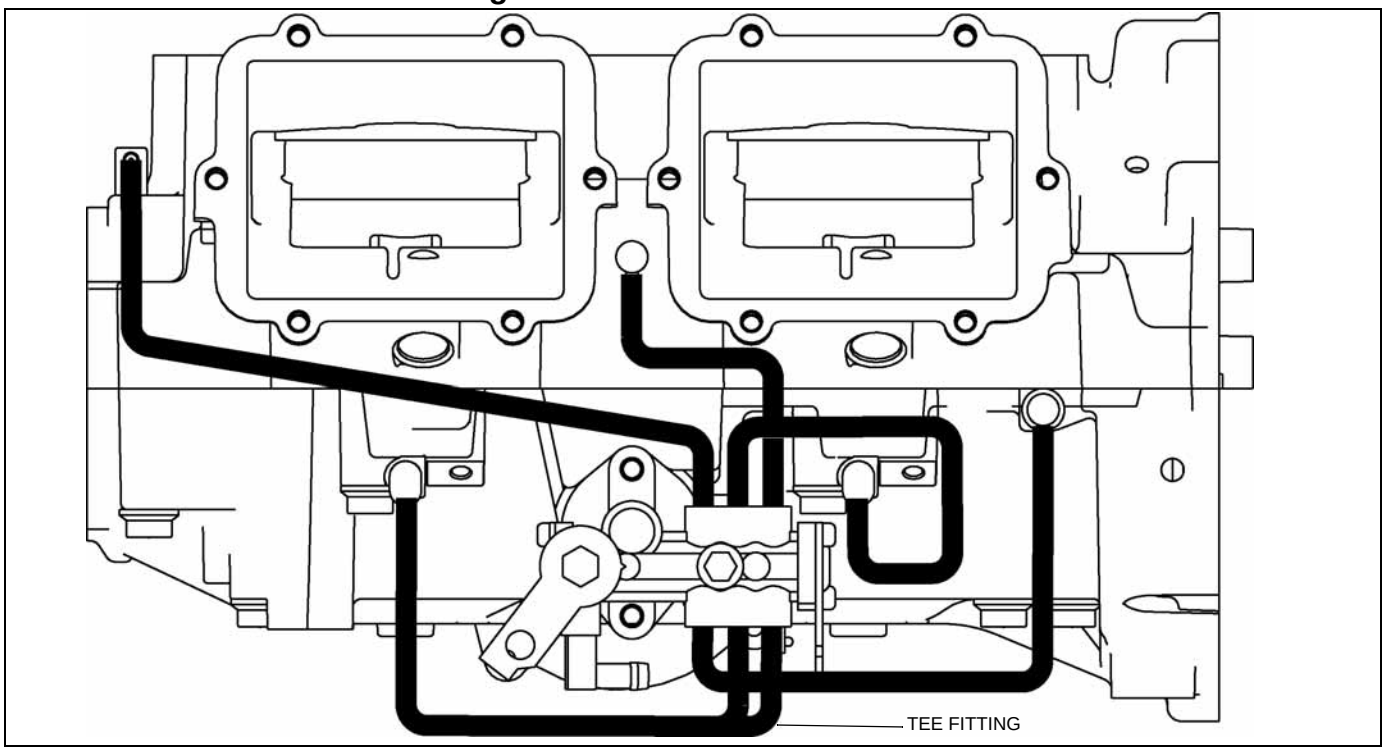
Disassembly / Assembly Process

IMPORTANT: Use the mechanical seal installation tool to install the water pump seal, PN: 2872010.

1. Remove the coolant from the engine using a siphon, wet/dry vac. or a drain pan.
2. Remove the airbox, exhaust pipe and resonator. Remove the hose connected to the water pump cover.
3. To access the impeller and mechanical seal, remove the water pump cover. Discard the water pump cover gasket.
4. Remove the impeller nut, impeller and washers from the cross shaft.
5. Carefully pry the mechanical seal and seal out of the crankcase.
6. Water pump assembly is the reverse of disassembly. Always use new seals and gaskets during assembly.
7. To remove the oil pump, remove the two fasteners then pull the pump / cover out of the crankcase bore. Discard the gasket.
8. To remove the oil pump / cover, remove the two fasteners then pull the pump / cover out of the crankcase bore. Discard the gasket.
9. The cross shaft can be extracted from the water pump side of the crankcase.
10. Assembly is the reverse of disassembly. Always use new o-rings, seals and gaskets during assembly.
11. Install a new seal onto the shaft from the water pump side.
12. To install a new water pump seal, use the seal installation tool, PN 2872010. Verify the seal lips are facing the cross shaft gear.

600/700/800 CFI Oil Hose Routing



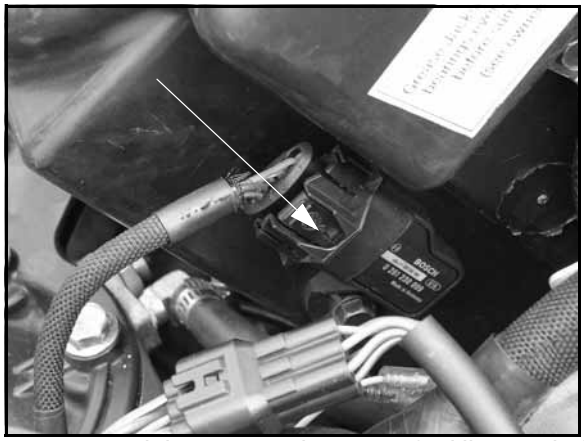
Engine Removal (Typical)

NOTE: Inspect all parts for wear or damage during disassembly. Replace all seals, o-rings, and gaskets with Genuine Pure Polaris parts during assembly.

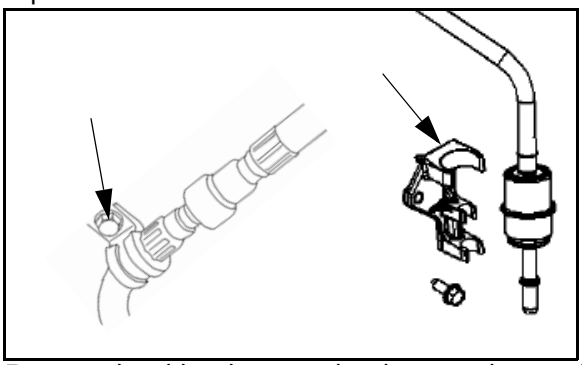
NOTE: The following removal and installation process involves a CFI engine. Carbureted engines do not use throttle bodies or the electrical components housed in the drive clutch cover electrical center.

1. Open the hood, and remove the side panels.
2. Disconnect the battery ground (-) cable from the battery if equipped.
3. If equipped, unplug exhaust temperature sensor and remove the exhaust system.
4. Remove the spark plug leads from the spark plugs.
5. If equipped, remove the belt cover/electrical center cover.

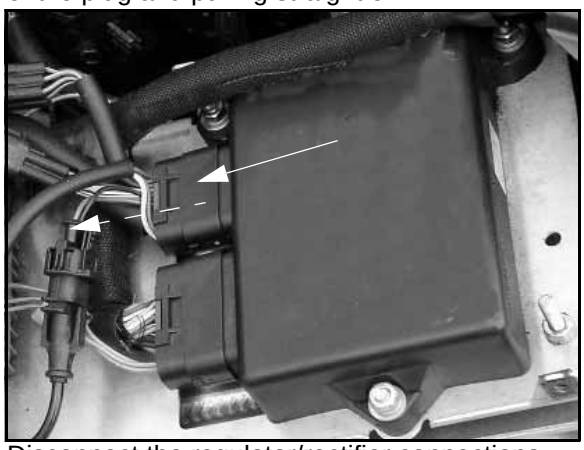
6. On CFI models, disconnect the intake air sensor located on the MAG side of the airbox.



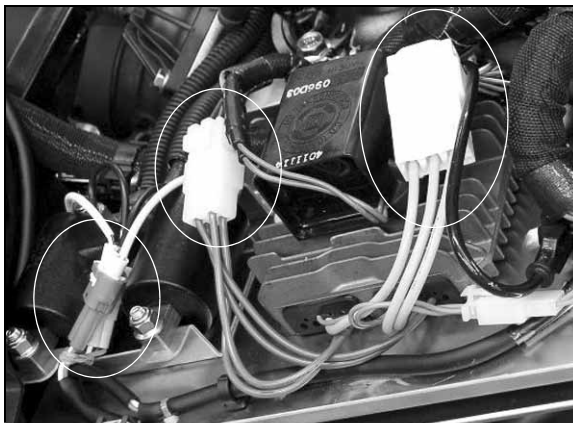
7. On CFI models, remove the return fuel line “P” holder located on the MAG side of the airbox.
8. On CFI models, separate the fuel filter from the filter clip that is on the MAG side of the airbox.



9. Remove the airbox by removing the gear clamps, then pulling the airbox assembly out of the engine compartment.
10. On CFI models, disconnect the main harness at the ECU. This is the smaller of the two plugs located on the ECU. Remove it by pressing up on the underside of the plug and pulling straight off.

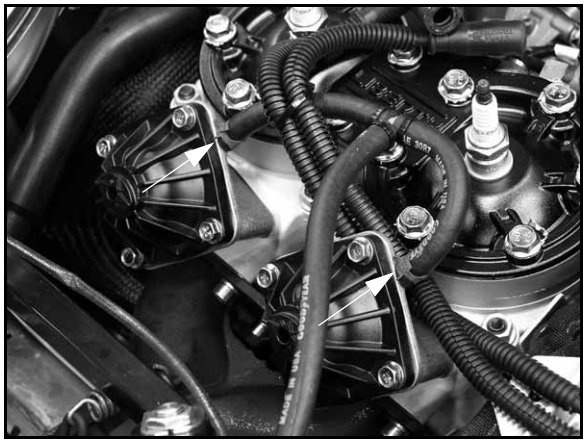


11. Disconnect the regulator/rectifier connections.
12. Disconnect the ignition coil connections and EV solenoid from the ECU harness on CFI models.



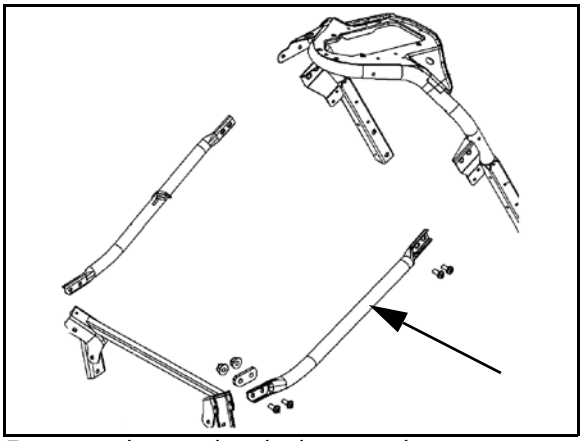
13. Disconnect the EV solenoid from the ECU harness.

14. Disconnect the EV vent lines from the EV base and secure the vent lines out of the way.

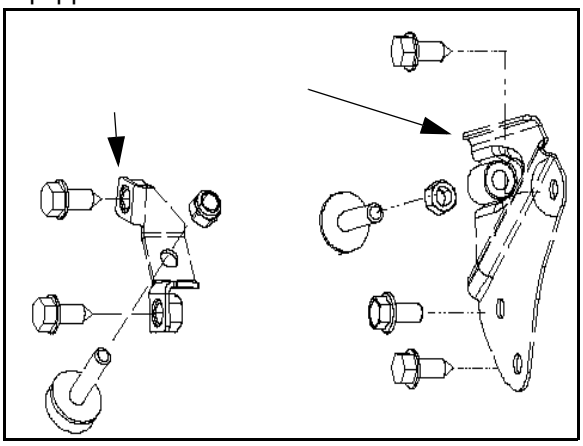


15. Remove the drive belt, driven and drive clutches. See Chapter 6.
16. Remove the recoil rope from the handle and route rope through the guide on the chassis brace and secure the recoil rope by tying a knot so that it does not go into the recoil housing.

17. Drain the coolant from the engine into a suitable container.
18. Remove all coolant hoses from the coolant bottle and secure the loose hoses out of the way for engine removal.
19. Remove the four right hand chassis brace fasteners and remove the brace from the chassis.

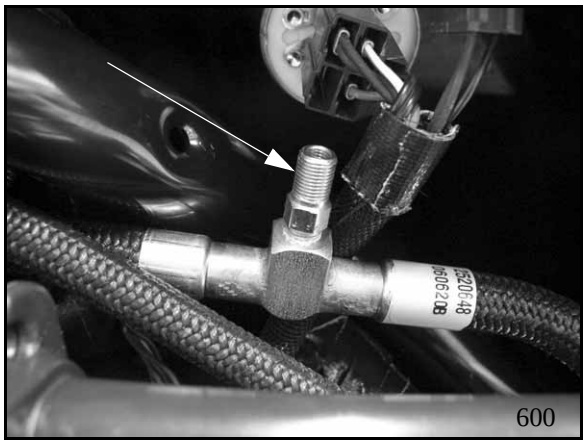


20. Remove the engine isolator and rear torque stop located on the left hand side of the engine where equipped.

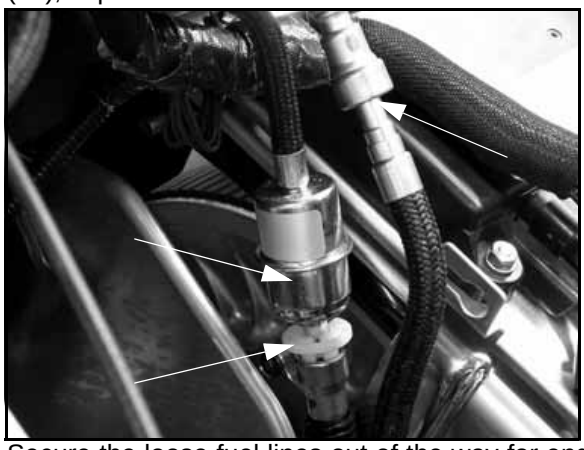


21. Remove the four engine mounting fasteners located on the engine straps.

22. On CFI models, remove the Schrader valve cover located under the steering hoop, and depressurize the fuel rail. See “Fuel Rail Bleeding / Pressure Testing” on page 4.37.



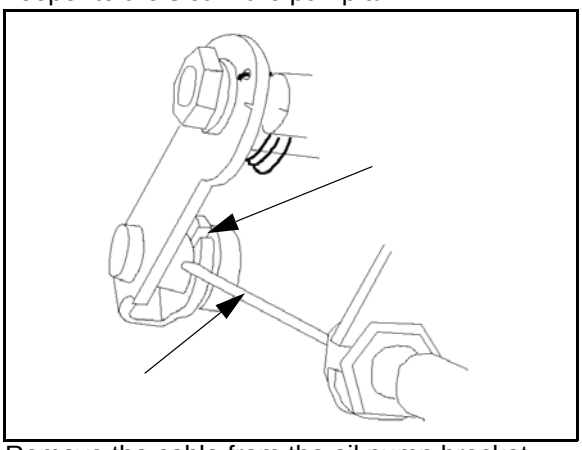
23. Using the fuel line disconnection tool (PN PS-47152) (20), separate the fuel filter and the fuel return line.



24. Secure the loose fuel lines out of the way for engine removal.

NOTE: An assistant will be needed for the following steps.

25. Lift engine out of chassis and carefully place engine on shock tower brace.
26. Remove the oil supply hose from the oil pump. Insert a screw or similar plug into the hose end and secure with clamp.
27. Remove the throttle body or carburetor rack.
28. Remove the oil cable lock nut from the threads on the cable housing.
29. Remove the throttle cable from the oil pump bracket.
30. Remove the oil cable from the oil pump lever by holding the pump open and rotating the cable and keeper to the slot in the pump arm.



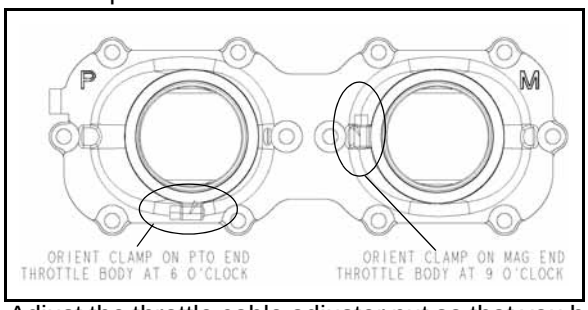
31. Remove the cable from the oil pump bracket.
32. Remove the engine from the chassis.
33. Inspect the motor mounts and replace if needed.

Engine Installation (Typical)

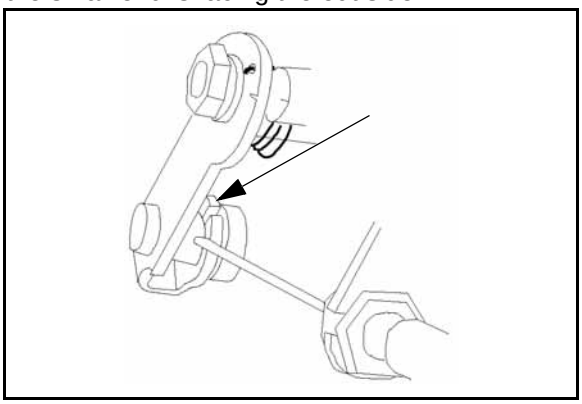
1. Make sure that you have the engine assembled in the state that it was when it was removed. This includes all the coolant hoses, oil lines, and electrical wires.
2. Fill oil lines with 2 stroke engine oil when assembling.
3. Clean the oil residue and debris out of the engine compartment.
4. To assure a smooth transition of the engine into the engine compartment, secure all loose hoses that are inside the engine compartment.

NOTE: You may need a helper with the installation of the throttle and oil cables.

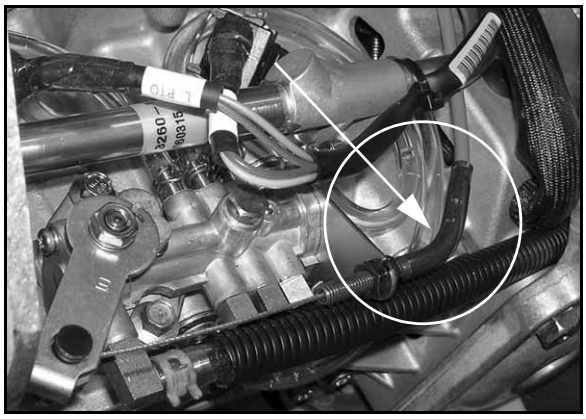
5. Place the engine on the shock tower brace.
6. With the throttle body or carburetor rack separated from the intake adapters, route the throttle cable behind the fuel rail, or under the carburetor rack and insert the throttle cable into the throttle pulley located in the center of the throttle bodies.
7. Insert the throttle body into the adapters and tighten the clamps in the orientation as shown below.



8. Adjust the throttle cable adjuster nut so that you have the correct throttle free play.
9. Place the oil cable into the oil pump arm. The oil pump arm has a slot in the back to slide the cable through for installation. The plastic end of the throttle cable is inserted so that the large flat is facing the engine and the small end is facing the out side.



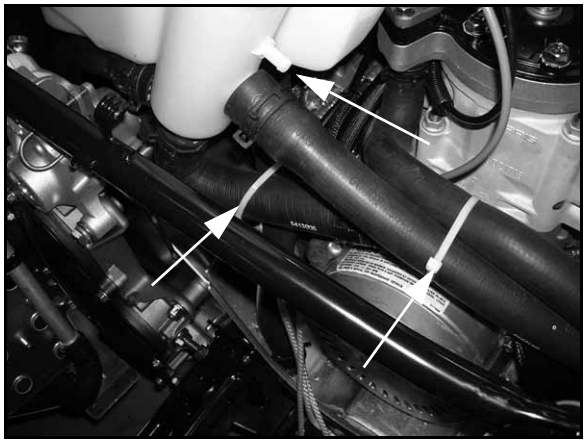
10. Using a 10mm open end wrench tighten the lock nut while holding the other nut with a 10mm open end wrench. Make sure that the oil cable angle is tilted slightly toward the engine.



11. Thread on the adjuster nut and adjust the oil pump and adjust the oil pump.
12. Reconnect the oil supply hose. Open the oil pump bleed screw to purge air from hose.
13. Carefully place the engine into the engine compartment and line up the engine mount studs with the engine straps on the engine.

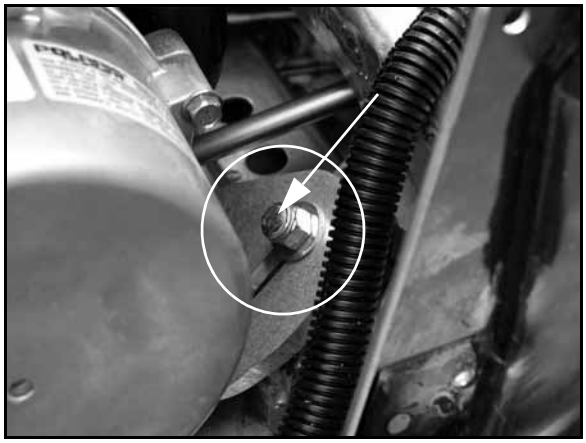
NOTE: Make sure that all hoses, lines and wires are not pinched or interfere with installation.

14. Connect all the coolant hoses.
15. Place panduit straps in the locations shown.
16. If applicable, place the coolant hose from the throttle bodies to the coolant bottle.



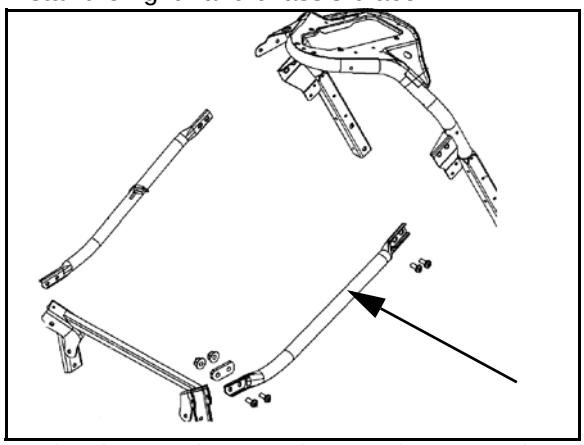
17. Secure the hose clamp over all coolant hose and fittings.

18. Place the engine mount washers and fasteners (8) onto the engine mount studs. Torque to specification.

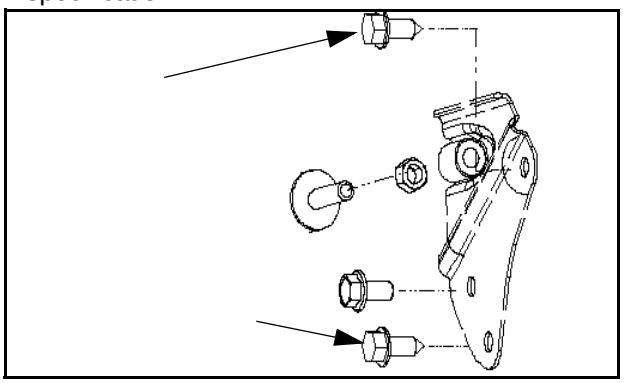


= T
Engine Mount Fasteners: 28 ft.lb (37.9 N-m)

19. Install the right hand chassis brace.



20. Apply Blue Loctite™ to the rear fasteners, install all the rear torque stop fasteners and torque to specification.



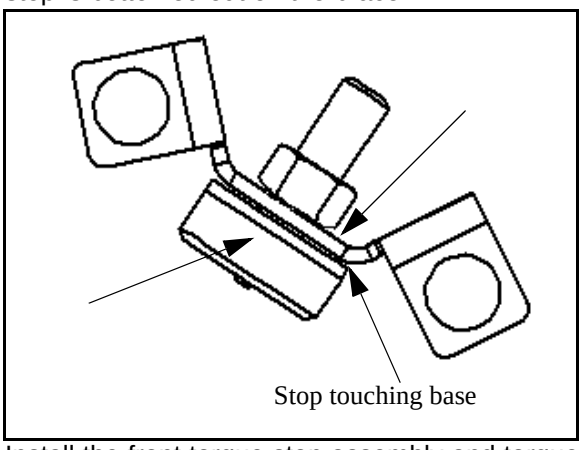
= T
Rear Torque Stop Fasteners: 28 ft.lb (37.9 N-m)

21. Adjust the rear torque stop so that you have a clearance of .010″-.030″ (.25-.75mm) from the face of the torque stop to the surface of the engine.

= In. / mm.
Rear Torque Stop Clearance: .010"-.030" (.25-.75mm)

NOTE: If a new torque stop is installed, install it so that the nub is touching the engine. This nub is .030" (.75mm) long.

22. Adjust the engine isolator limiter (if equipped) so the stop is bottomed out on the brace.



23. Install the front torque stop assembly and torque the plate fasteners to specification.

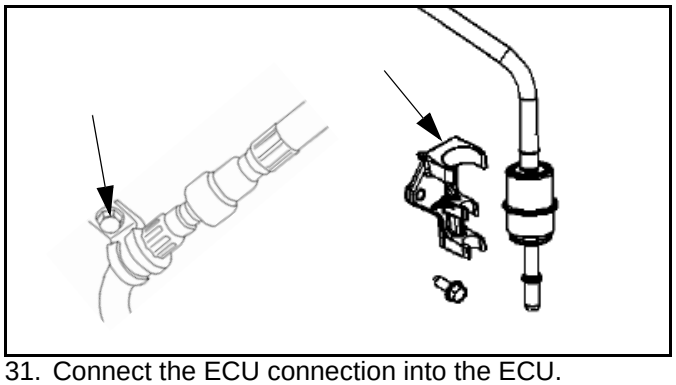
= T
Front Torque Stop Fasteners: 28 ft.lb (37.9 N-m)

24. Install the air box onto the carburetor rack. Make sure to line up the air box tabs with the air box plate.
25. Install the drive clutch. See “Drive Clutch Installation” on page 7.23.
26. Install the driven clutch. See “Driven Clutch Installation” on page 7.23.
27. Install the drive belt.
28. On CFI models, connect he fuel filter and fuel return line by pushing them together until you hear a audible “click”.

29. Secure the fuel return line “P” clamp onto the side of the airbox.

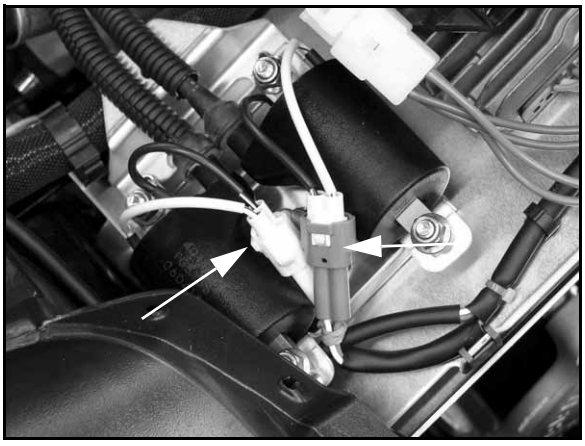
> **⚠ CAUTION**
>
> ALWAYS SECURE THE P-CLAMP AROUND THE HOSE WHERE THE HOSE MEETS THE METAL CONNECTOR.
> ALWAYS INSPECT FUEL SUPPLY AND RETURN HOSE ROUTINGS AND VERIFY THEY DO NOT MAKE CONTACT WITH EACH OTHER OR OTHER COMPONENTS.

30. Place the fuel filter back into the airbox-mounted holder.

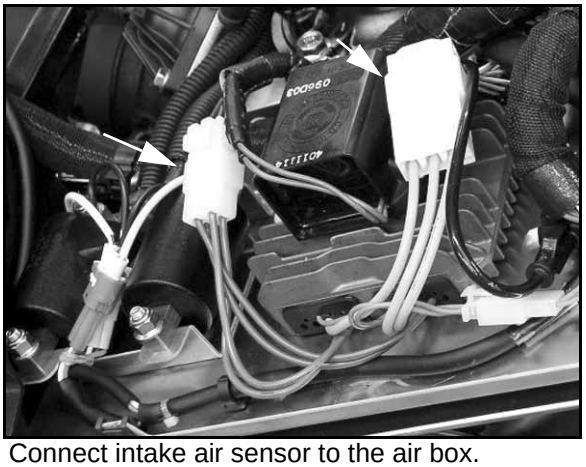


31. Connect the ECU connection into the ECU.
32. Connect the EV solenoid connection to the EV solenoid.
33. Connect the coil connections to the coils.

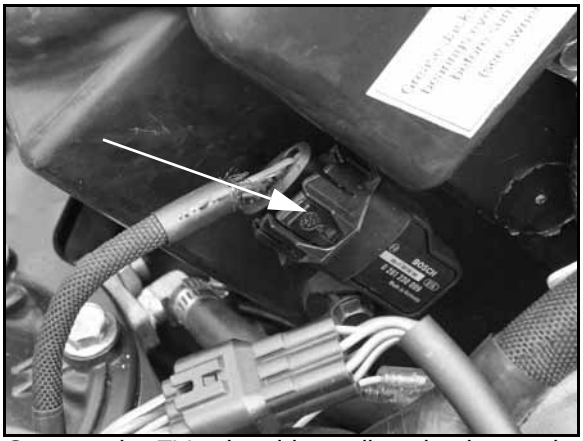
NOTE: The WHITE connector goes to the MAG coil (upper). The BLUE connector goes to the PTO coil (lower).



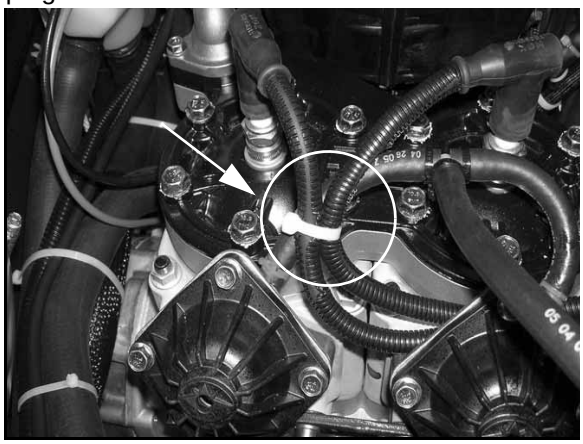
34. Connect the regulator rectifier connections.



35. Connect intake air sensor to the air box.



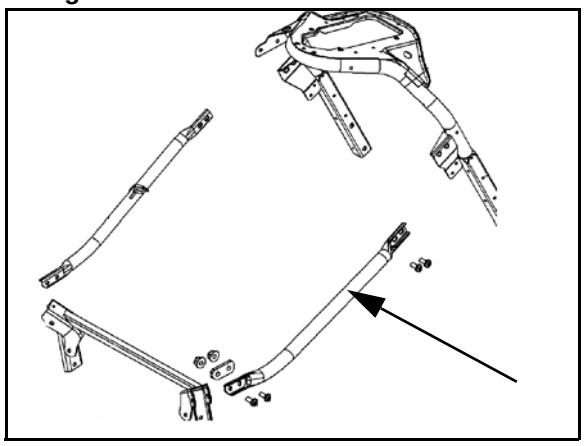
36. Connect the EV solenoid vent lines back onto the EV bases and install the panduit strap around the spark plug wires as shown.



37. Install the electrical center/belt holder over the electrical center by aligning the rear buttons to the rear of the clutch cover and installing the two fasteners.

38. Install the Nylock nuts and two T40 Torx bolts to the front and the two T40 to the rear of the LH and RH chassis brace and install the braces.

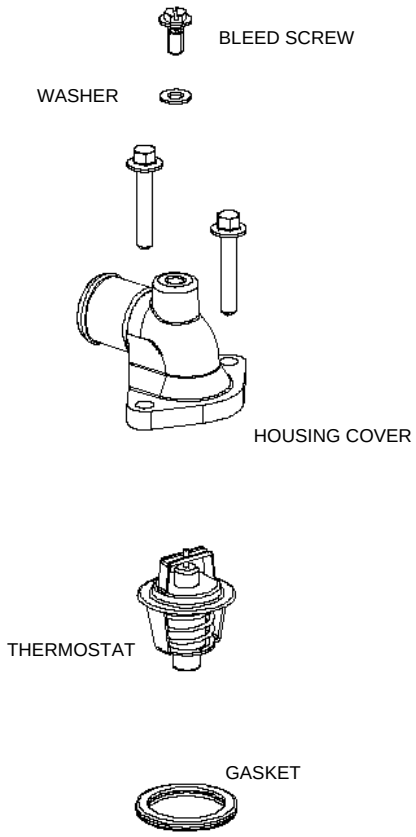
NOTE: Install the long bolts and the spacer on the front portion of the bar before inserting it into the mounting area.



39. Replace the nosepan plugs were removed to access the front chassis brace fasteners.
40. Route the recoil rope through the eyelet on the chassis brace and secure handle once past the console.
41. Install the exhaust system.
42. Add coolant and bleed system. See “Cooling System Bleeding” on page 3.9.
43. Premix the first tank of fuel. See “Fuel / Oil Premix Ratios” on page 2.12.
44. Test run the unit and clear any codes with Digital Wrench.
45. After test running check drive and driven clutch torque.

COOLING SYSTEMS

Thermostat Replacement



⚠ CAUTION

Allow engine to cool completely before working with the engine cooling system.
Engine coolant can be under pressure and hot. Escaping steam and/or coolant may cause severe burns to exposed skin.

1. Remove the housing cover, by removing the cover bolts.
2. Check the gasket condition and replace if damaged.
3. Replace the thermostat. Make sure that the spring side is facing downward or toward the engine.
4. Replace cover. Torque the cover fasteners to specification.

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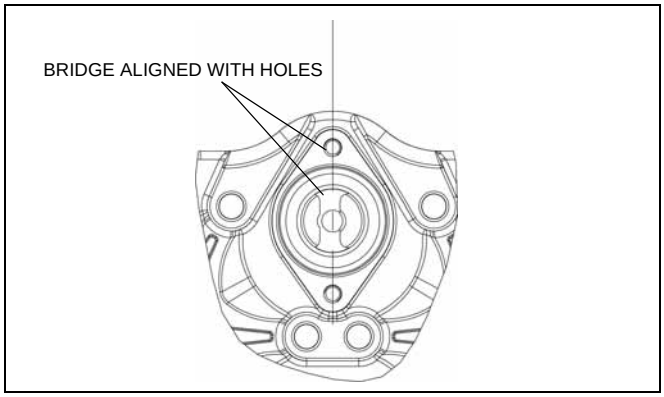
Cover Fasteners: 9 Ft.Lbs. (12 Nm)

5. Verify the bleed screw and washer are installed.

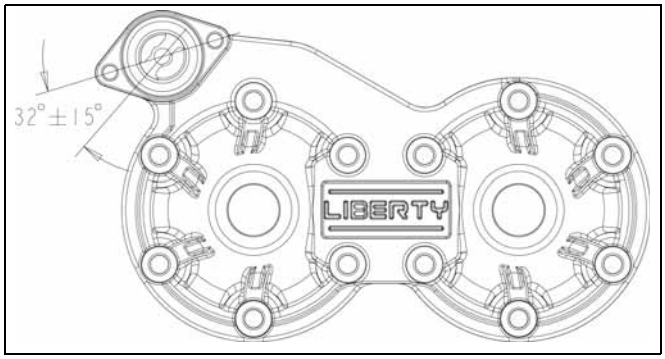
Thermostat Orientation

The thermostat must be installed in the cylinder head has shown in the illustrations.

Center Thermostat Location



Offset Thermostat Location



800 CFI Thermostats

There are two different thermostats used depending on if the engine is installed in a vehicle with or without a front tunnel bypass cooler.

Cooling System Type	Thermostat PN	Bleed Hole ID
Bypass FRT Cooler	7052433	2 mm
No FRT Cooler	7052452	3.5 mm

The larger bleed hole thermostat is designed for cooling systems that do not feature a bypass circuit in the cooling system. Both thermostats are full open at 120°F (49°C).

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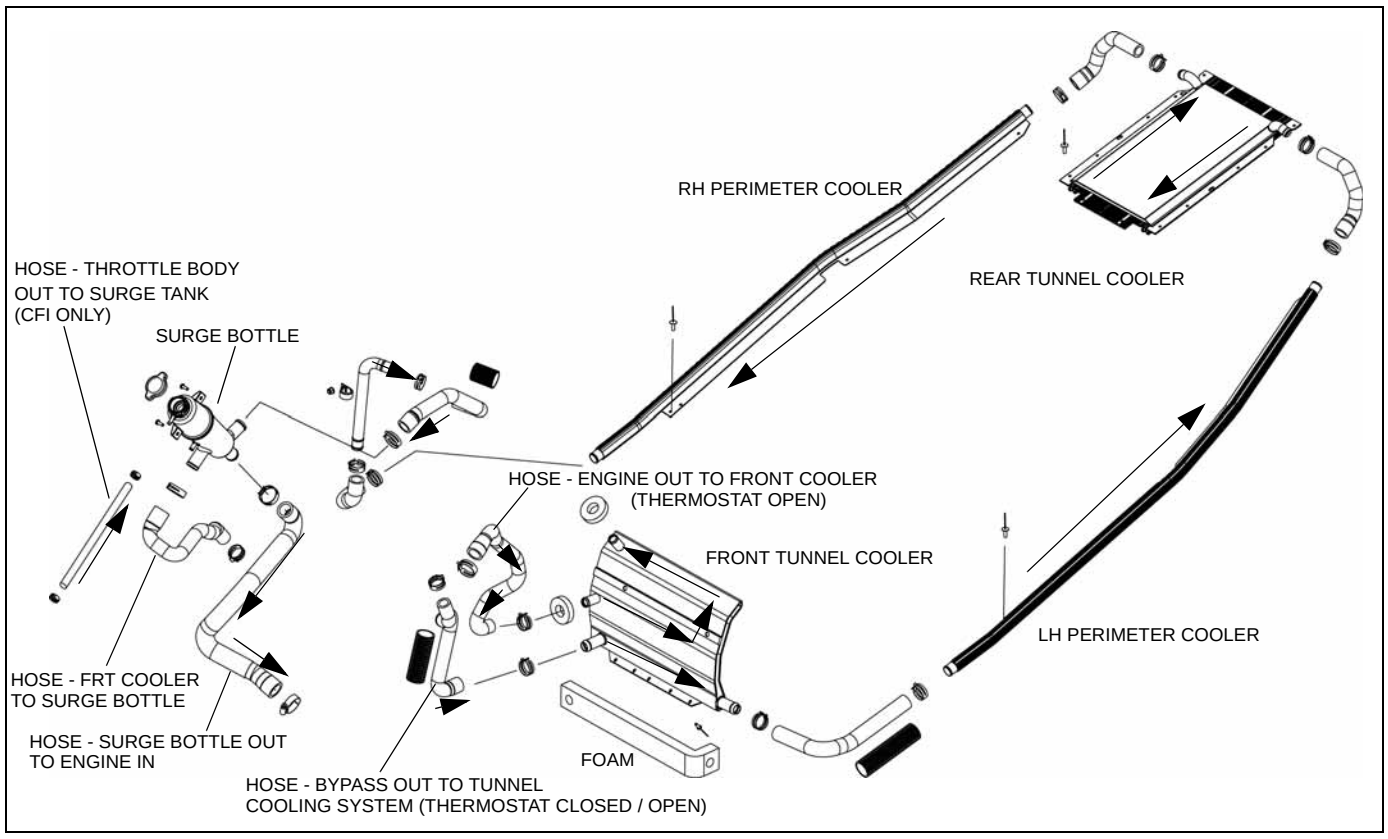
2007 700 Dragon IQ Cooling System



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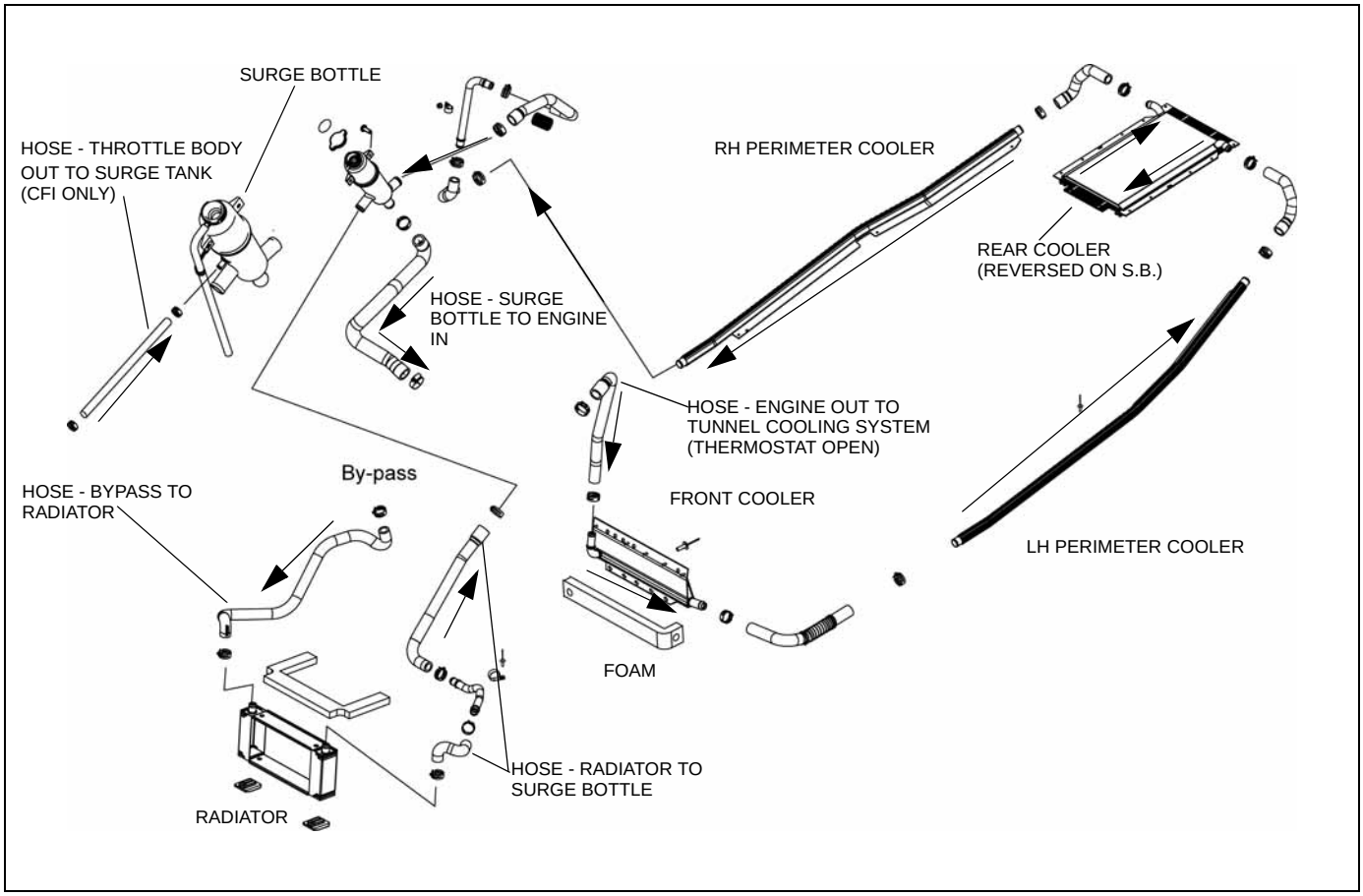
2007 600 IQ 121/Switchback/LX-2008 CFI LX Cooling System



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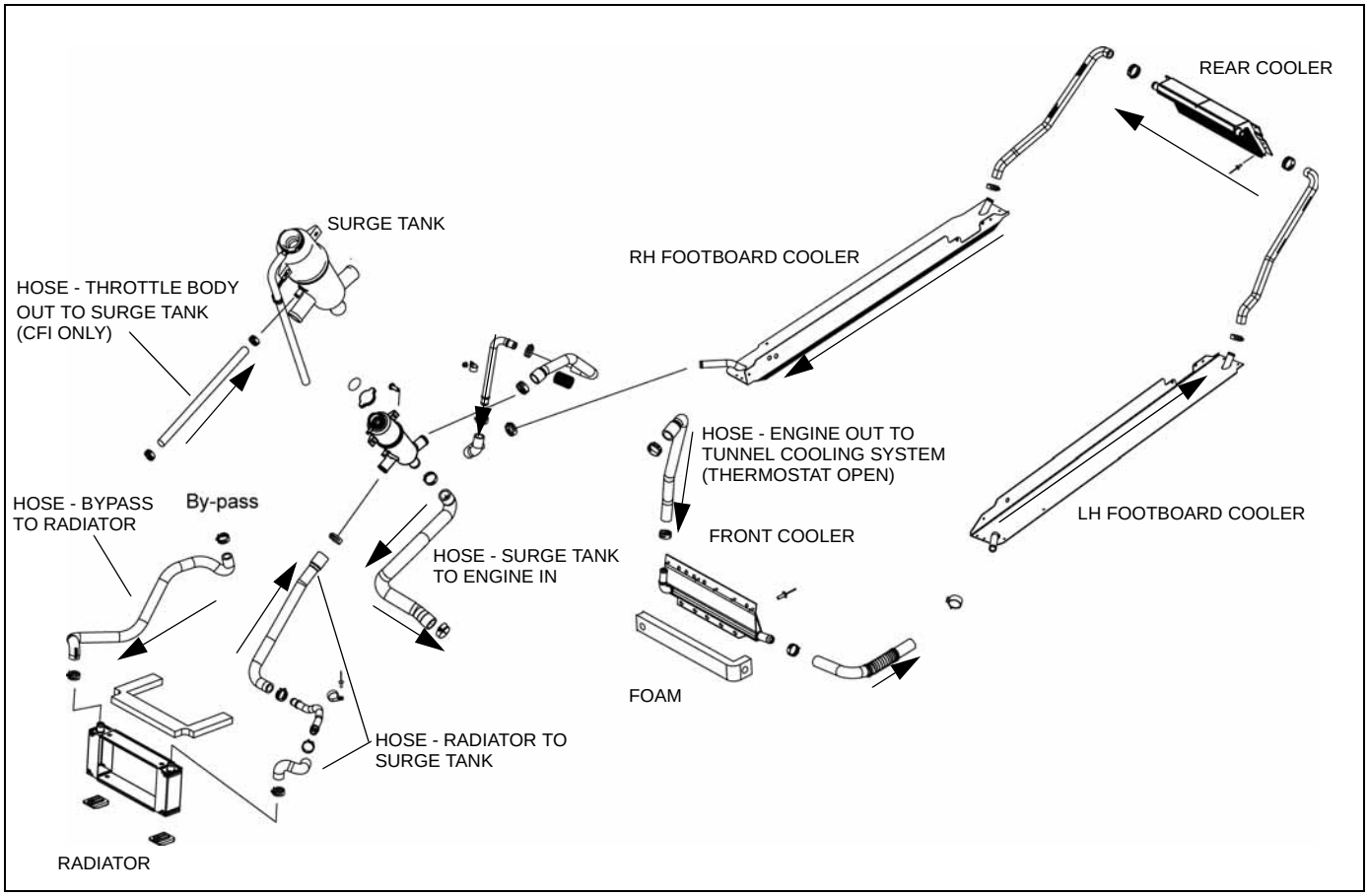
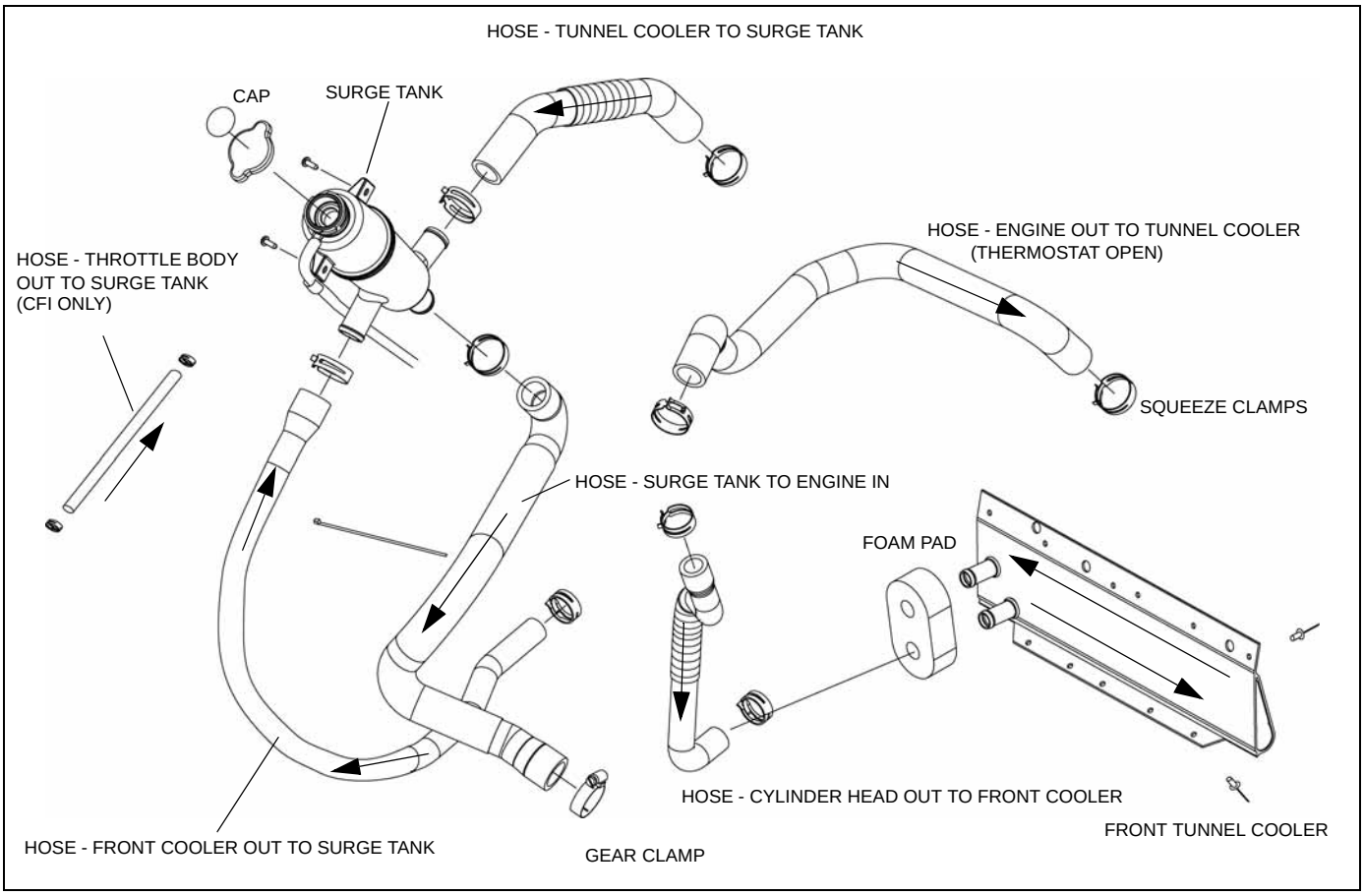
2007-2011 IQ Touring Cooling System



2007-2010 IQ 600 RMK/700 RMK Cooling System



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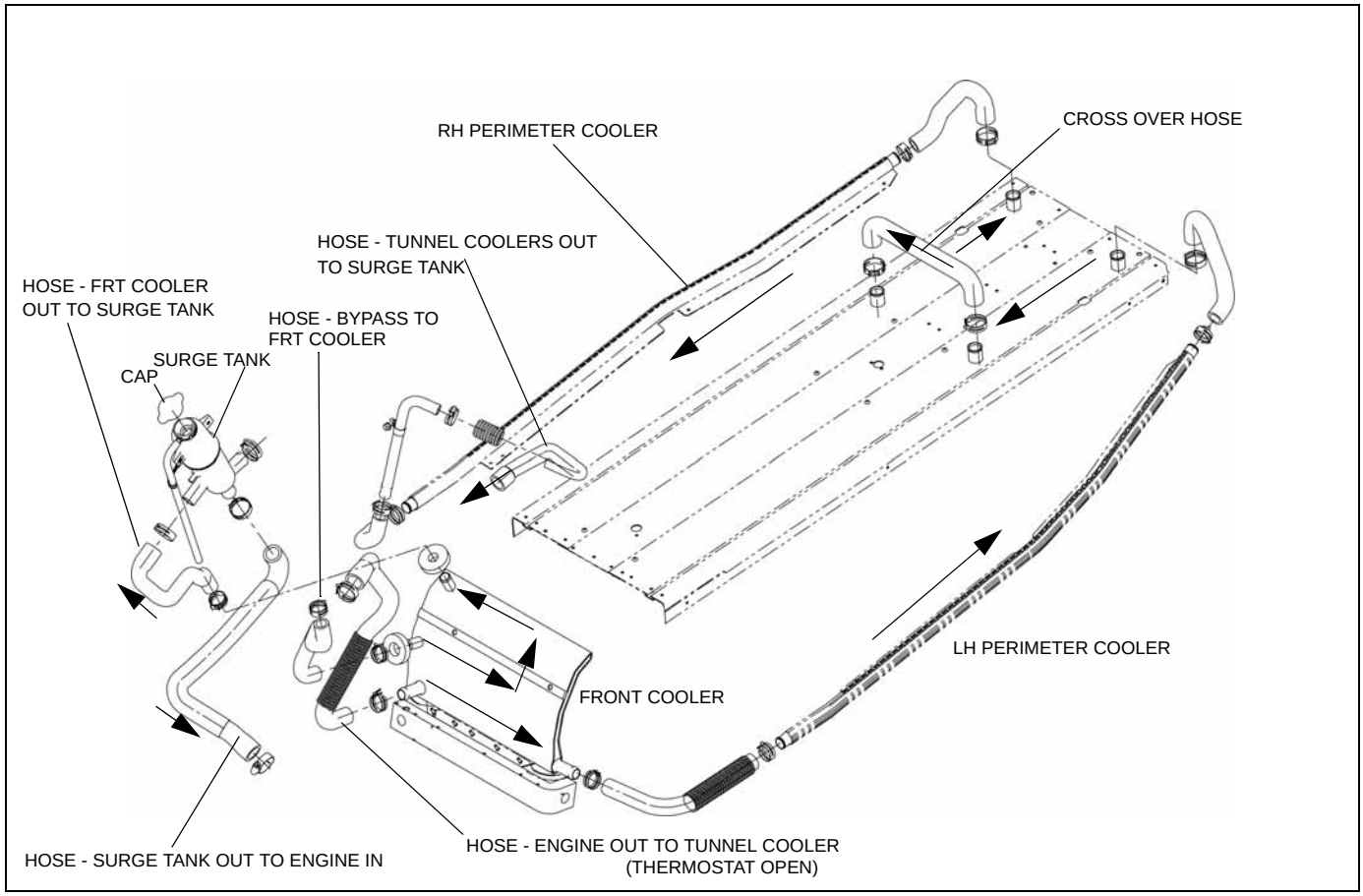
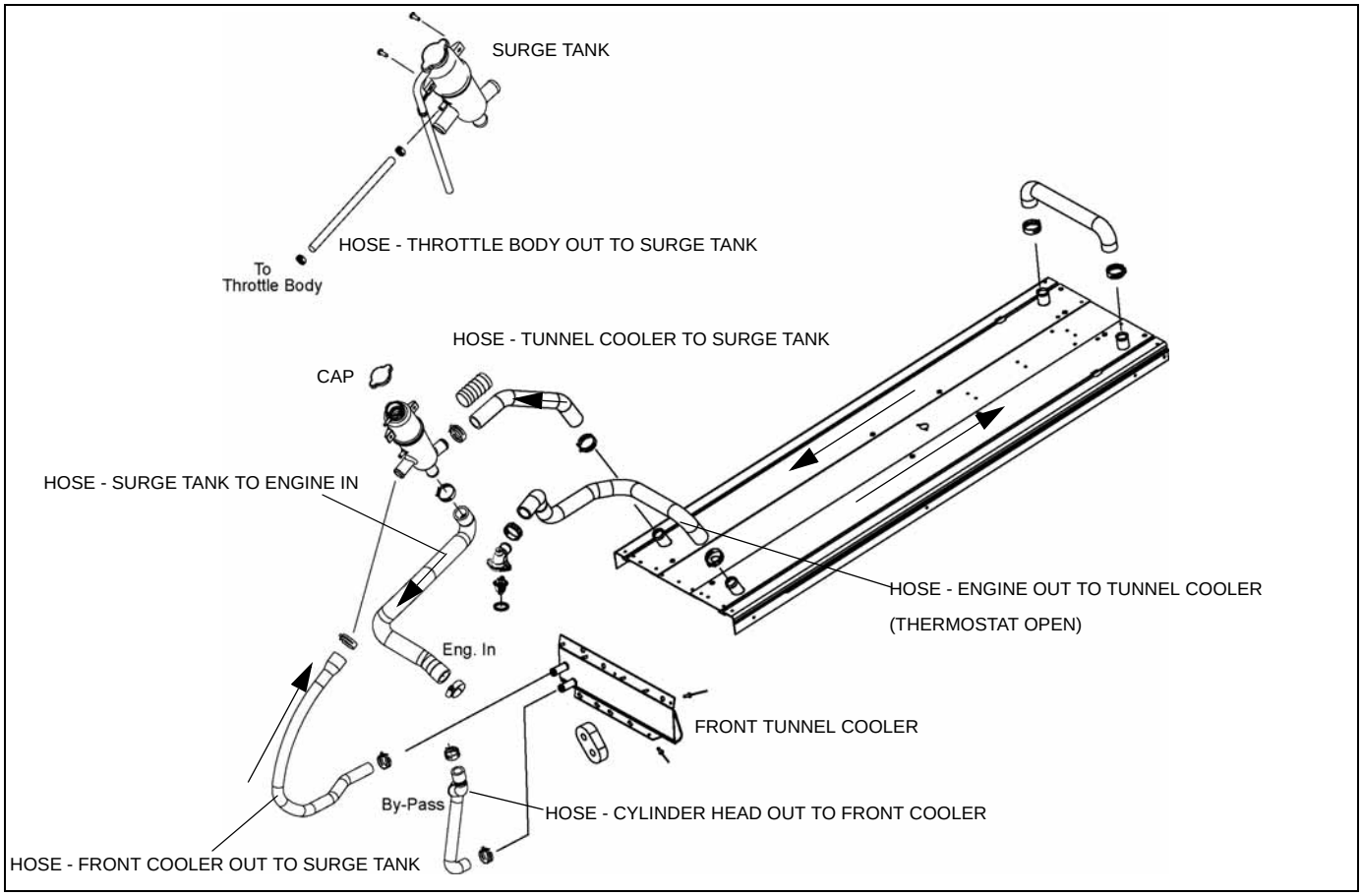
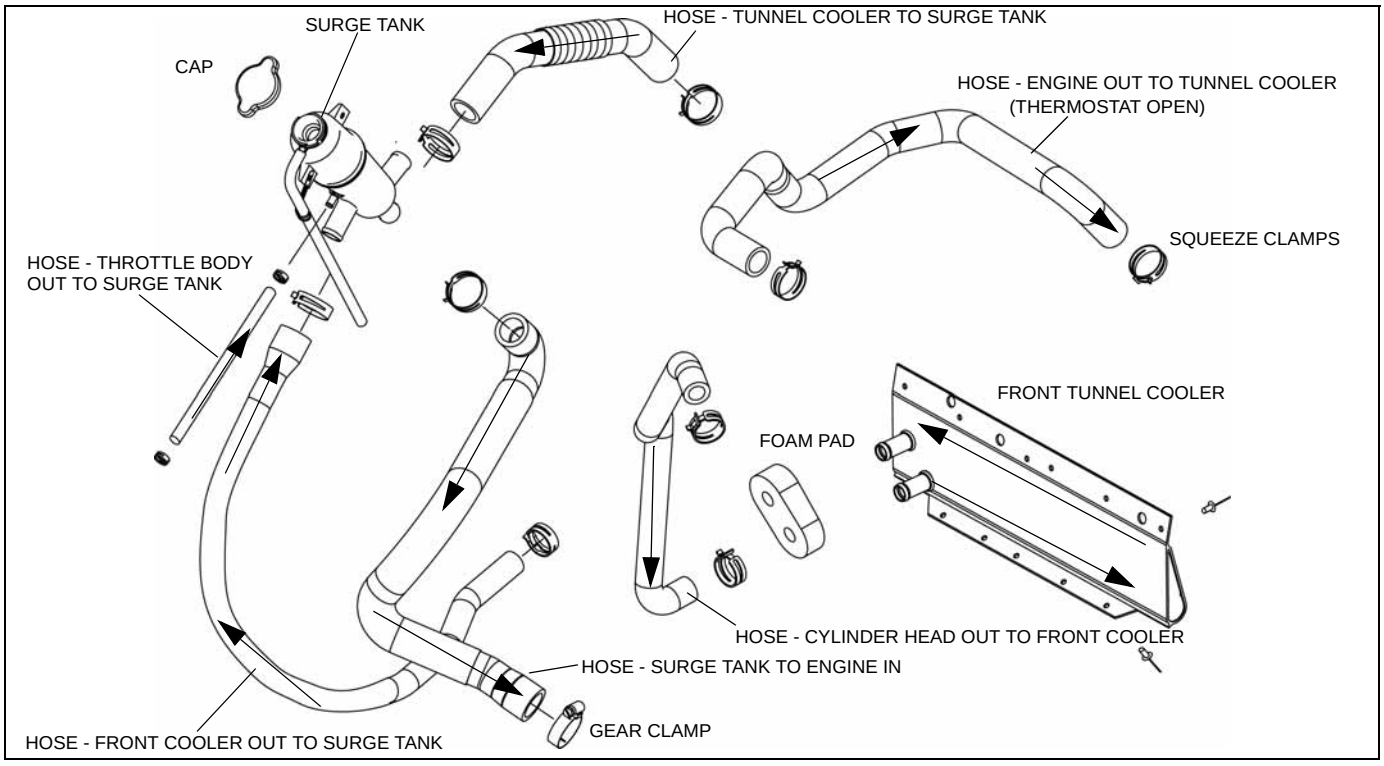
2008 IQ 121/Switchback Cooling System



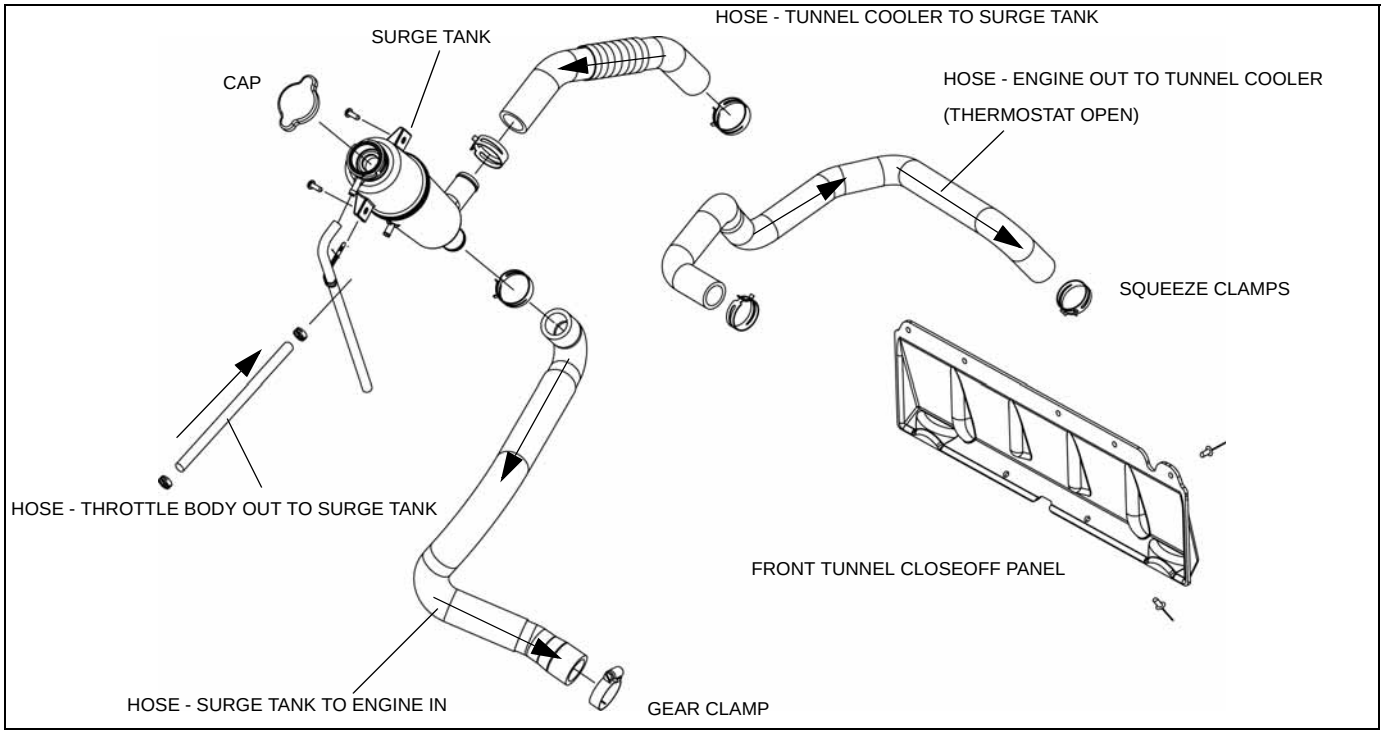
2009-2011 IQ 121/Switchback Cooling System



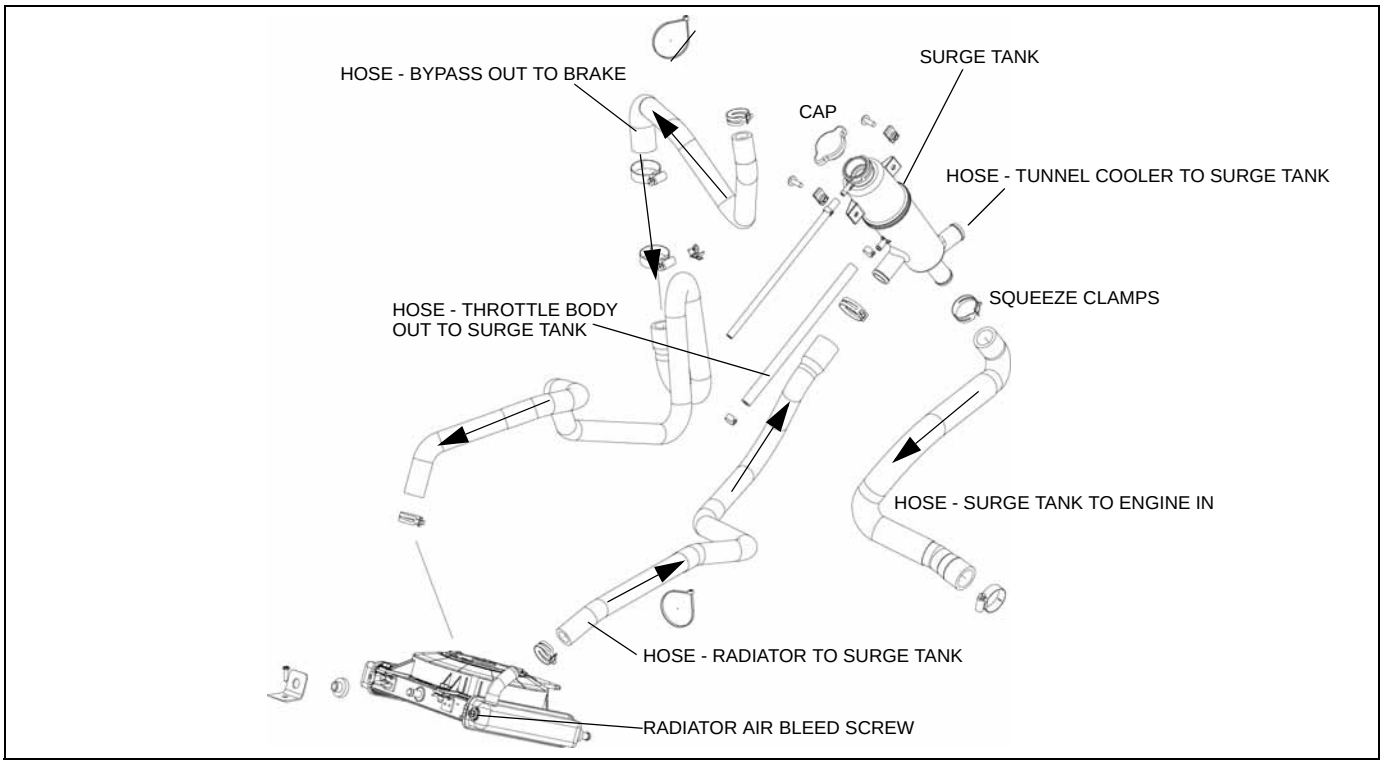
800 RMK (With Bulkhead Cooler)



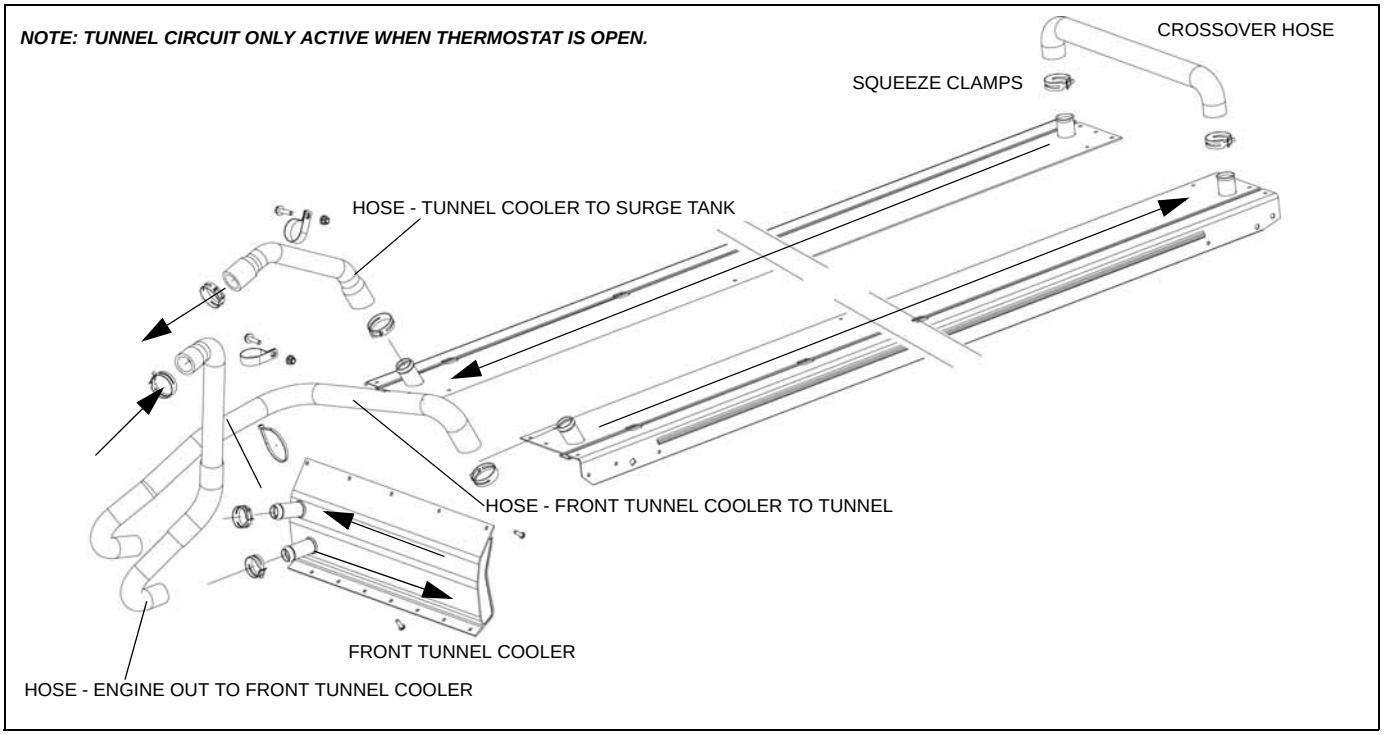
800 RMK / Assault (Without Bulkhead Cooler)



600 Widetrak Bypass Circuit



600 Widetrak Tunnel Circuit



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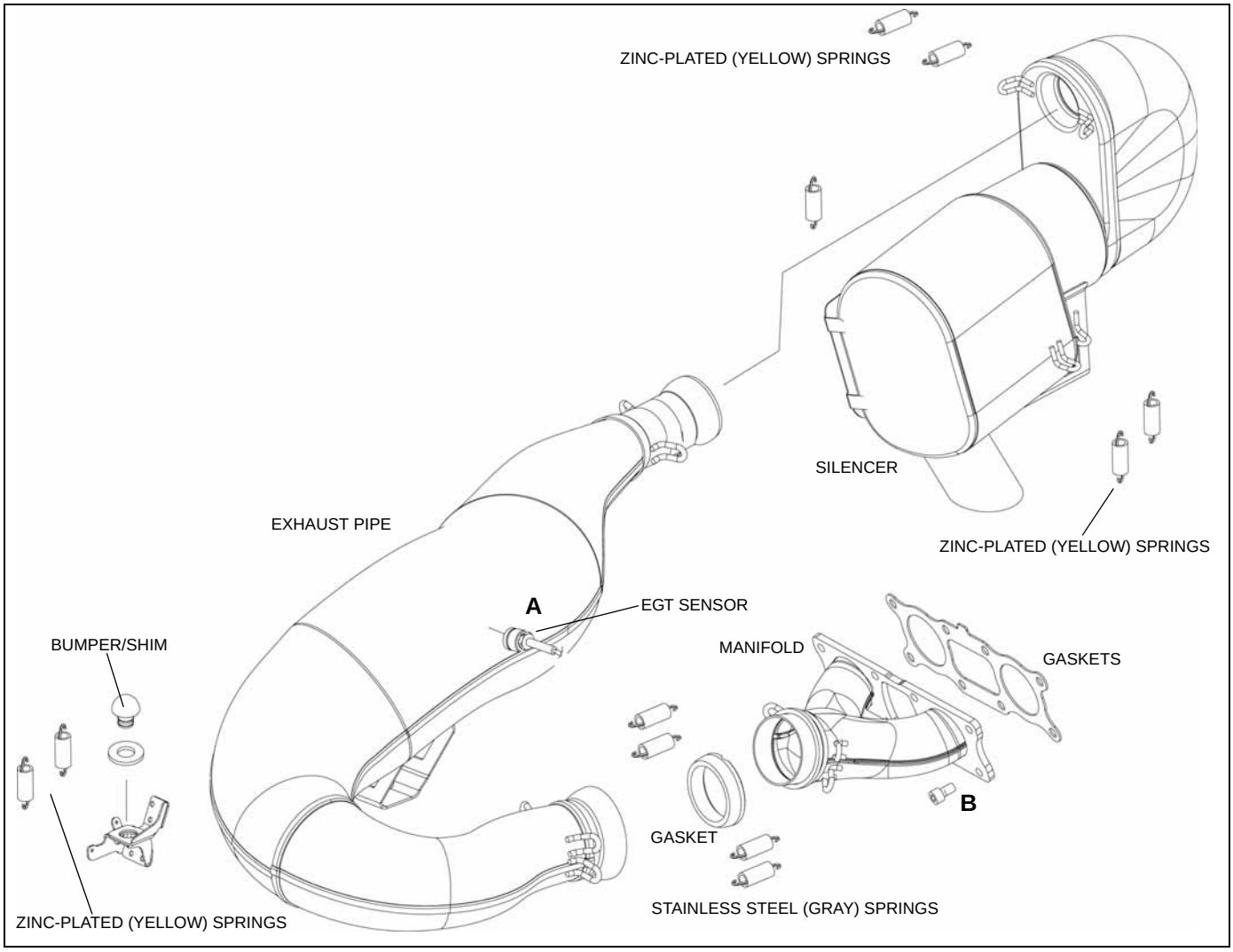
EXHAUST SYSTEMS

Assembly View (Typical)



= T
A = EGT Sensor: 32 Ft.Lbs. (44 Nm) B = Exhaust Manifold Fasteners: 22 Ft. Lbs. (30 Nm)

NOTE: Always use the stainless steel (gray) springs to connect the exhaust pipe to the exhaust manifold.

NOTES