

CHAPTER 3

ENGINES

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1996 Models

Machine Model	Engine Model	Cyl. Disp. CC's	Bore MM	Bore Inches	Stroke MM	Stroke Inches	No. of Cyl.	Type of Cooling	Fuel Octane (Minimum)
Indy Lite/GT	EC34-2PM02	339	62.3	2.4528	55.6	2.1889	2	Fan	87*
Indy Lite Deluxe	EC34-2PME02	339	62.3	2.4528	55.6	2.1889	2	Fan	87*
Indy Sport/TranSport/ Sport Touring	EC44-3PM01	432	67.72	2.6661	60	2.3622	2	Fan	87*
Super Sport	EC44-3PM02	432	67.72	2.6661	60	2.3622	2	Fan	87*
Indy WideTrak GT	EC50PM03	488	72	2.8346	60	2.3622	2	Fan	87*
Indy Trail	EC50PM04	488	72	2.8346	60	2.3622	2	Fan	87*
Indy Trail Touring	EC50PME04	488	72	2.8346	60	2.3622	2	Fan	87*
Indy 440 LC	EC45PL06	432	67.72	2.6661	60	2.3622	2	Liquid	87*
Indy 440 XCR	EC45PL07	439	68.25	2.6870	60	2.3622	2	Liquid	91
Indy 440 XCR SP	EC45PL08	439	68.25	2.6870	60	2.3622	2	Liquid	91
Indy 500 Carb/SKS	EC50PL11	488	72	2.8346	60	2.3622	2	Liquid	87*
Indy Classic	EC50PLE11	488	72	2.8346	60	2.3622	2	Liquid	87*
Indy WideTrak LX	EC50PLE12	488	72	2.8346	60	2.3622	2	Liquid	87*
Indy 500 EFI/SKS/RMK	EC50PL13	488	72	2.8346	60	2.3622	2	Liquid	87*
Indy Classic Touring	EC50PL14	488	72	2.8346	60	2.3622	2	Liquid	87*
Indy 500 Carb RMK	EC50PL15	488	72	2.8346	60	2.3622	2	Liquid	87*
Indy 600 XCR/XLT SP	EC58PL02	597	65	2.5590	60	2.3622	3	Liquid	91
Indy XLT/SKS	EC58PL03	597	65	2.5590	60	2.3622	3	Liquid	87*
Indy XLT Touring	EC58PLE05	597	65	2.5590	60	2.3622	3	Liquid	87*
Indy XLT RMK	EC58PL07	597	65	2.5590	60	2.3622	3	Liquid	87*
Indy 600 XCR SP	EC59PL01	598	62.5	2.461	65	2.561	3	Liquid	91
Indy RXL	EC65PL05	648	67.72	2.6661	60	2.3622	3	Liquid	87*
Indy Ultra SP, SKS	EC68PL01	679	66.6	2.622	65	2.5591	3	Liquid	87*
Indy Ultra RMK	EC68PL04	679	66.6	2.622	65	2.5591	3	Liquid	87*
Indy Storm / RMK	EC80PL04	794	72	2.8346	65	2.5591	3	Liquid	91
Indy Storm/SKS	EC80PL05	794	72	2.8346	65	2.5591	3	Liquid	91

* Non-oxygenated. Minimum octane when using oxygenated fuel is 89 and re-jetting is required. See page 3.8 for fuel recommendation on 1996 models.

ENGINES

Engine Specifications

1996 Models

Engine Model	Cyl. Head CC's Uninstalled	Cyl. Head CC's Installed	Piston Rings	Piston/Cylinder Bore Clearance +.05 mm -.00 mm	Engine Operating RPM ± 200 RPM	Recommended Idle RPM
EC34-2PM02/E02	21.1	17.3	(2) 1.5 mm	.08-.14 (.0031-.0055")	7000	1600
EC44-3PM01	28.6	23.0	(2) 1.5 mm	.09-.14 (.0035-.0055")	7000	1600
EC44-3PM02	28.6	23.0	(2) 1.5 mm	.09-.14 (.0035-.0055")	6800	1600
EC50PM03	31.2	28.6	(2) 1.5 mm	.10-.16 (.0039-.0063")	6500	1600
EC50PM04/E04	26.7	24.1	(2) 1.5 mm	.10-.16 (.0039-.0063")	7000	1600
EC45PL06	25.8	21.1	(2) 1.2 mm	.09-.14 (.0035-.0055")	7750	1600
EC45PL07	20.0	19.0	(2) 1.2 mm	.06 (.0023")	8250	1800
EC45PL08	20.0	19.0	(2) 1.2 mm	.06 (.0023")	8250	2200
EC50PL11	23.6	23.6	(2) 1.2 mm	.09-.125 (.0035-.0049")	7800	1600
EC50PLE11	23.6	23.6	(2) 1.2 mm	.09-.125 (.0035-.0049")	7800	1900
EC50PLE12	23.6	23.6	(2) 1.2 mm	.06-.095 (.0023-.0037")	7000	1600
EC50PL13	23.6	23.6	(2) 1.2 mm	.09-.125 (.0035-.0049")	8000	1600
EC50PL14	23.6	23.6	(2) 1.2 mm	.06-.095 (.0023-.0037")	7800	1600
EC50PL15	23.6	23.6	(2) 1.2 mm	.09-.125 (.0035-.0049")	7800	1600
EC58PL02	19.8	17.1	(2) 1.2 mm	.09-.125 (.0035-.0049")	8500	2000
EC58PL03/E05/07	19.8	19.1	(2) 1.2 mm	.09-.125 (.0035-.0049")	8000	1700
EC59PL01	20.2	18.1	(2) 1.2 mm	.06-.095 (.0023-.0037")	8500	2000
EC65PL05	21.4	20.4	(2) 1.2 mm	.12-.170 (.0047-.0066")	8000	2200
EC68PL01	23.8	20.5	(2) 1.2 mm	.06-.095 (.0023-.0037")	8200	1800
EC68PL04	22.5	19.1	(2) 1.2 mm	.06-.095 (.0023-.0037")	8200	1800
EC80PL04	25.6	22.8	(2) 1.2 mm	.09-.125 (.0035-.0049")	8250	1600
EC80PL05	25.6	24.4	(2) 1.2 mm	.09-.125 (.0035-.0049")	8250	1600

Piston Ring End Gap (Installed)

Piston ring end gap all engines (except EC80PL04/05) .20 mm - .51 mm (.008" - .020")

Piston ring end gap EC80PL04/05 engines .30 mm - .45 mm (.012" - .018")

ENGINES **Engine Specifications**

1997 Models

Machine Model	Engine Model	Cyl. Disp. CC's	Bore MM	Bore Inches	Stroke MM	Stroke Inches	No. of Cyl.	Type of Cooling	Fuel Octane (Min)
Indy Lite	EC34-2PM02	339	62.3	2.4528	55.6	2.1889	2	Fan	87*
Indy Lite GT	EC34-2PM02	339	62.3	2.4528	55.6	2.1889	2	Fan	87*
Indy Lite Deluxe	EC34-2PME02	339	62.3	2.4528	55.6	2.1889	2	Fan	87*
Indy Sport	EC44-3PM02	432	67.72	2.6661	60	2.3622	2	Fan	87*
Indy TransPort	EC44-3PM02	432	67.72	2.6661	60	2.3622	2	Fan	87*
Sport Touring	EC44-3PM02	432	67.72	2.6661	60	2.3622	2	Fan	87*
Super Sport	EC50PM06	488	72	2.6661	60	2.3622	2	Fan	87*
Indy Trail	EC50PM04	488	72	2.8346	60	2.3622	2	Fan	87*
Indy Trail RMK	EC50PM05	488	72	2.8346	60	2.3622	2	Fan	87*
Indy Trail Touring	EC50PME04	488	72	2.8346	60	2.3622	2	Fan	87*
Indy XCF	EC44-3PM02	432	67.72	2.6661	60	2.3622	2	Fan	87*
Indy 440 LC	EC45PL09	432	67.72	2.6661	60	2.3622	2	Liquid	87*
Indy 440 XC	EC45PL08	438	68.19	2.6846	60	2.3622	2	Liquid	87*
Indy 500	EC50PL17	488	72	2.8346	60	2.3622	2	Liquid	87*
Indy 500 SKS	EC50PL17	488	72	2.8346	60	2.3622	2	Liquid	87*
Indy 500 RMK	EC50PL16	488	72	2.8346	60	2.3622	2	Liquid	87*
Indy 500 EFI	EC50PL18	488	72	2.8346	60	2.3622	2	Liquid	87*
Indy Classic	EC50PLE17	488	72	2.8346	60	2.3622	2	Liquid	87*
Indy Classic Touring	EC50PL19	488	72	2.8346	60	2.3622	2	Liquid	87*
Indy WideTrak GT	EC50PM03	488	72	2.8346	60	2.3622	2	Fan	87*
Indy WideTrak LX	EC50PLE20	488	72	2.8346	60	2.3622	2	Liquid	87*
Indy XLT	EC58PL03	597	65	2.5590	60	2.3622	3	Liquid	87*
Indy XLT SKS	EC58PL03	597	65	2.5590	60	2.3622	3	Liquid	87*
Indy XLT RMK	EC58PL07	597	65	2.5590	60	2.3622	3	Liquid	87*
Indy XLT Touring	EC58PLE09	597	65	2.5590	60	2.3622	3	Liquid	87*
Indy XLT SP	EC58PL12	597	65	2.5590	60	2.3622	3	Liquid	87*
Indy XLT LTD	EC58PLE09	597	65	2.5590	60	2.3622	3	Liquid	87*
Indy XLT LTD SP	EC58PL12	597	65	2.5590	60	2.3622	3	Liquid	87*
Indy 600 XC	EC58PL08	597	65	2.5590	60	2.3622	3	Liquid	87*
Indy 600 XCR	EC59PL01	598	62.51	2.4610	65	2.5591	3	Liquid	91
Indy 600 XCR (SE)	EC59PL01	598	62.51	2.4610	65	2.5591	3	Liquid	91
Indy RXL	EC65PL05	648	67.72	2.6661	60	2.3622	3	Liquid	87*
Indy Ultra	EC68PL01	679	66.6	2.6220	65	2.5591	3	Liquid	87*
Indy Ultra Touring	EC68PL01	679	66.6	2.6220	65	2.5591	3	Liquid	87*
Indy Ultra SP	EC68PL01	679	66.6	2.6220	65	2.5591	3	Liquid	87*
Indy Ultra SPX	EC68PL03	679	66.6	2.6220	65	2.5591	3	Liquid	91
Indy Ultra SPX SE	EC68PL03	679	66.6	2.6220	65	2.5591	3	Liquid	91
Indy 700 SKS	SN70LCDCSP-01	701	81	3.1889	68	2.6772	2	Liquid	87*
Indy 700 RMK	SN70LCDCSP-02	701	81	3.1889	68	2.6772	2	Liquid	87*
Indy Storm	EC80PL05	794	72	2.8346	65	2.5591	3	Liquid	91
Indy Storm SE	EC80PL05	794	72	2.8346	65	2.5591	3	Liquid	91
Indy Storm RMK	EC80PL04	794	72	2.8346	65	2.5591	3	Liquid	91

* Non-oxygenated. Use minimum 89 octane when using oxygenated fuel.

ENGINES

Engine Specifications

1997 Models

Engine Model	Cyl. Head CC's Uninstalled	Cyl. Head CC's Installed	Piston/Cylinder Bore Clearance +.05 mm -.00 mm	Piston Clearance Service Limit	Engine Operating RPM ± 200 RPM	Recommended Idle RPM
EC34-2PM02/E02	21.1	17.3	.08-.14 (.0031-.0055")	.2 (.0078)	7000	1600
EC44-3PM02	28.6	23.0	.09-.14 (.0035-.0055")	.2 (.0078)	6800	1600
EC50PM03	31.3	28.7	.10-.16 (.0039-.0063")	.2 (.0078)	6600	1600
EC50PM04/E04/05	26.7	24.1	.10-.16 (.0039-.0063")	.2 (.0078)	7000	1600
EC45PL08	20.0	19.0	.06-.095 (.0023-.0037")	.15 (.0059)	8250	1500
EC45PL09	25.8	21.1	.09-.140 (.0035-.0055")	.2 (.0078)	7750	1600
EC50PL16	28.0	22.0	.06-.095 (.0023-.0037")	.2 (.0078)	7750	1600
EC50PL17	23.6	23.6	.09-.125 (.0035-.0049")	.2 (.0078)	7750	1600
EC50PL18	23.6	23.6	.09-.125 (.0035-.0049")	.2 (.0078)	7750	1600
EC50PL19	23.6	23.6	.09-.125 (.0035-.0049")	.2 (.0078)	7750	1600
EC50PL20	23.6	23.6	.09-.125 (.0035-.0049")	.2 (.0078)	7750	1600
EC58PL03	19.8	19.1	.09-.125 (.0035-.0049")	.2 (.0078)	8250	1900
EC58PL07	19.8	19.1	.09-.125 (.0035-.0049")	.2 (.0078)	8250	1900
EC58PL08	19.8	17.1	.09-.125 (.0035-.0049")	.2 (.0078)	8500	1900
EC58PL09/E09	19.8	19.1	.09-.125 (.0035-.0049")	.2 (.0078)	8250	1900
EC58PL12	19.8	17.1	.09-.125 (.0035-.0049")	.2 (.0078)	8500	1900
EC59PL01	20.3	18.0	.07-.095 (.0028-.0037")	.15 (.0059)	8500	1500
EC65PL05	21.4	20.4	.12-.170 (.0047-.0066")	.2 (.0078)	8000	2200
EC68PL01	23.8	20.5	.07-.095 (.0028-.0037")	.15 (.0059)	8000	1500
EC68PL03	25.1	21.4	.06-.095 (.0023-.0037")	.15 (.0059)	8600	2200
SN70LCDCSP-01	41	32	.124 (.0048)	.2 (.0078)	8000	1500
SN70LCDCSP-02	41	32	.124 (.0048)	.2 (.0078)	8000	1500
EC80PL04	27.2	26.0	.09-.125 (.0035-.0049")	.2 (.0078)	8400	1600
EC80PL05	27.2	26.0	.09-.125 (.0035-.0049")	.2 (.0078)	8400	1600

Piston Ring End Gap (Installed)

Piston ring end gap all engines (except EC80PL04/05) .20 mm - .51 mm (.008" - .020")

Piston ring end gap EC80PL04/05 engines .30 mm - .45 mm (.012" - .018")

ENGINES

1998 Engine Specifications

1998 Models

Machine Model	Engine Model	Cyl. Disp. CC's	Bore MM	Bore Inches	Stroke MM	Stroke Inches	No. of Cyl.	Type of Cooling	Fuel Octane (Min)
Indy Lite / Dlx / Trg	EC34-2PM02A	339	62.3	2.4528	55.6	2.1889	2	Fan	87*
Indy Sport	EC44-3PM024	432	67.72	2.6661	60	2.3622	2	Fan	87*
Indy TransPort	EC44-3PM024	432	67.72	2.6661	60	2.3622	2	Fan	87*
Sport Touring	EC44-3PM024	432	67.72	2.6661	60	2.3622	2	Fan	87*
Indy XCF	EC44-3PM024	432	67.72	2.6661	60	2.3622	2	Fan	87*
Indy 440 LC	EC45PL091	432	67.72	2.6661	60	2.3622	2	Liquid	87*
Indy 440 XCR	SN44-44LCDCSP-01	438	66	2.5984	64	2.5197	2	Liquid	87*
Indy Trail	EC50PM043	488	72	2.8346	60	2.3622	2	Fan	87*
Indy Trail Touring	EC50PM043	488	72	2.8346	60	2.3622	2	Fan	87*
Indy Trail RMK	EC50PM051	488	72	2.8346	60	2.3622	2	Fan	87*
Super Sport	EC50PM061	488	72	2.6661	60	2.3622	2	Fan	87*
Indy WideTrak LX	EC50PL201	488	72	2.8346	60	2.3622	2	Liquid	87*
Indy 500	EC50PL171	488	72	2.8346	60	2.3622	2	Liquid	87*
Indy Classic	EC50PL171	488	72	2.8346	60	2.3622	2	Liquid	87*
Indy 500 RMK	EC50PL161	488	72	2.8346	60	2.3622	2	Liquid	87*
Indy Classic Trg	EC50PL191	488	72	2.8346	60	2.3622	2	Liquid	87*
Indy XLT LTD	EC58PL130	597	65	2.5590	60	2.3622	3	Liquid	87*
Indy XLT Touring	EC58PL130	597	65	2.5590	60	2.3622	3	Liquid	87*
Indy XLT SP	EC58PL140	597	65	2.5590	60	2.3622	3	Liquid	87*
Indy XLT Classic	EC58PL150	597	65	2.5590	60	2.3622	3	Liquid	87*
Indy 600 XC	SN60-70LCDCSP-01	593	74.5	2.9331	68	2.6772	2	Liquid	87*
Indy 600 RMK	SN60-70LCDCSP-02	593	74.5	2.9331	68	2.6772	2	Liquid	87*
Indy 600 XCR	EC59PL020	598	62.51	2.4610	65	2.5591	3	Liquid	91
Indy Ultra	EC68PL050	679	66.6	2.6220	65	2.5591	3	Liquid	87*
Indy Ultra Touring	EC68PL050	679	66.6	2.6220	65	2.5591	3	Liquid	87*
Indy 700 XC	SN70-70LCDCSP-02	701	81	3.1889	68	2.6772	2	Liquid	87*
Indy 700 RMK	SN70-70LCDCSP-01	701	81	3.1889	68	2.6772	2	Liquid	87*
Indy 700 XCR	EC68PL060	679	66.6	2.6220	65	2.5591	3	Liquid	91
Indy Storm	EC80PL052	794	72	2.8346	65	2.5591	3	Liquid	91

* Non-oxygenated. Use minimum 89 octane when using oxygenated fuel.

ENGINES **Engine Specifications**

1998 Models

Engine Model	Cyl. Head CC's Uninstalled (Bench)	Cyl. Head CC's Installed	Piston/Cylinder Bore Clearance (Target) +.05 mm -.00 mm	Piston Clearance Service Limit mm (inch)	Engine Operating RPM $\pm$ 200 RPM	Recommended Idle RPM
EC34-2PM02A	21.1	17.3	.08-.14 (.0031-.0055")	.2 (.0078)	7000	1600
EC44-3PM024	28.6	23.0	.09-.14 (.0035-.0055")	.2 (.0078)	6800	1600
SN44-44LDCDCSP-01	19.6	18.3	.09-.13 (.0035-.0051")	.19 (.0075)	8250	1600
EC45PL091	25.8	21.1	.09-.14 (.0035-.0055")	.2 (.0078)	7750	1600
EC50PM043	26.7	24.1	.10-.16 (.0039-.0063")	.2 (.0078)	7000	1600
EC50PM051	26.7	24.1	.10-.16 (.0039-.0063")	.2 (.0078)	7000	1600
EC50PM061	26.7	24.1	.10-.16 (.0039-.0063")	.2 (.0078)	7000	1600
EC50PL161	28.0	22.0	.06-.095 (.0023-.0037")	.2 (.0078)	7750	1600
EC50PL171	28.0	23.6	.09-.125 (.0035-.0049")	.2 (.0078)	7750	1600
EC50PL191	28.0	23.6	.06-.095 (.0023-.0037")	.2 (.0078)	7750	1600
EC50PL201	28.8	23.6	.06-.095 (.0023-.0037")	.2 (.0078)	7750	1600
EC58PL130	19.9	19.2	.09-.125 (.0035-.0049")	.2 (.0078)	8250	1900
EC58PL140	20.5	17.1	.09-.125 (.0035-.0049")	.2 (.0078)	8500	1900
EC58PL150	20.5	17.1	.09-.125 (.0035-.0049")	.2 (.0078)	8500	1900
EC59PL020	20.3	18.0	.07-.095 (.0028-.0037")	.15 (.0059)	8500	1500
EC68PL050	23.8	20.5	.07-.105 (.0028-.0041")	.15 (.0059)	8000	1500
EC68PL060	25.1	21.4	.06-.095 (.0023-.0037")	.15 (.0059)	8600	1800
SN60-70LDCDCSP-01	34.0		.11-.15 (.0043-.0059")	.2 (.0078)	8000	1500
SN60-70LDCDCSP-01	34.0		.11-.15 (.0043-.0059")	.2 (.0078)	8000	1500
SN70-70LDCDCSP-01	41	32	.11-.135 (.0043-.0053")	.2 (.0078)	8000	1500
SN70-70LDCDCSP-02	41	32	.11-.135 (.0043-.0053")	.2 (.0078)	8000	1500
EC80PL052	27.2	26.0	.09-.125 (.0035-.0049")	.2 (.0078)	8400	1600

Piston Ring End Gap (Installed)

Piston ring end gap (all engines except EC80PL04/05) .20 mm - .51 mm (.008" - .020")

Piston ring end gap EC80PL engines .30 mm - .45 mm (.012" - .018")

ENGINE Torque Specifications

When tightening bolts, nuts, or screws, a torque pattern should be followed to ensure uniform equal tension is applied to all fasteners. Proper torque application prevents fasteners from loosening or breaking in critical service. It also minimizes wear and eliminates premature or needless repair costs. Following uniform torque application sequence patterns ensures optimum performance from precision machined, close tolerance assemblies. On vital engine parts, torquing negligence is of the utmost importance.

Torque is a force which tends to produce rotation. The measurement of this force is expressed in units of force and length. There are at present two basic systems of units used to express torque, English and Metric. In the English system, the units of force are the pound or ounce, and the length is the foot or inch.

In the Metric system, the unit of force is expressed in grams (gm) or kilograms (kg), and length as centimeters (cm) or meters (m). The most common units of torque in the English system are ft. lb. and in. lb. In the Metric system, torque is commonly expressed in units of kg-m. Multiply foot pounds by .1383 to obtain kg-m.

Engine	Cylinder Head*		Cylinder Base Nuts	Crankcase 8 mm	Crankcase 10 mm	Flywheel
Fan Cooled Twin Cylinder	18-19 ft. lbs. (2.5-2.65 kgm)		24-28 ft. lbs. (3.3-3.9 kgm)	17-18 ft. lbs. (2.2-2.3 kgm)	23-25 ft. lbs. (3.2-3.5 kgm)	60-65 ft. lbs. (8.3-9.0 kgm)
EC45PL EC50PL EC58PL* EC59PL EC65PL EC68PL EC80PL	8 mm 17-20 ft. lbs. (2.4-2.8 kgm)	10 mm 24-26 ft. lbs. (3.3-3.6 kgm)	24-28 ft. lbs. (3.3-3.9 kgm)	17-18 ft. lbs. (2.2-2.3 kgm)	23-25 ft. lbs. (3.2-3.5 kgm)	60-65 ft. lbs. (8.3-9.0 kgm)
SN44	20-24 ft.lbs. (2.8 - 3.3 kgm)		30-34 ft.lbs (4.15-4.7 kgm)	20-24 ft.lbs. (2.8 - 3.3 kgm)		90 ft. lbs. (12.4 kgm)
SN60** SN70**	18 - 22 ft. lbs.** (2.3 - 3.04 kgm)		30-34 ft.lbs (4.15-4.7 kgm)	20-24 ft.lbs. (2.8 - 3.3 kgm)	26-30 Ft lbs (3.6-4.15 kgm)	55 ft. lbs. (7.4 kgm)

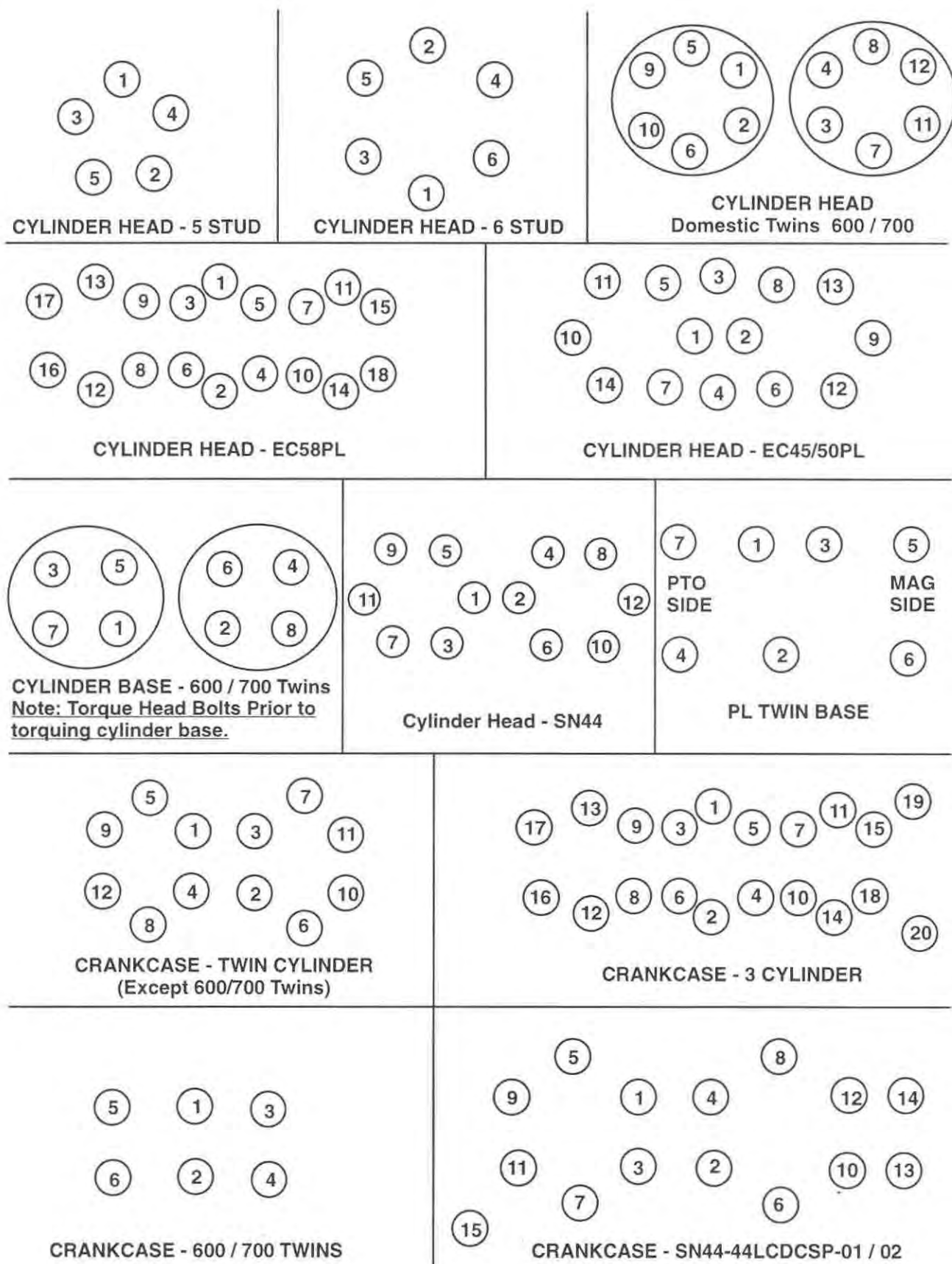
* Use high end of torque range

** Torque head bolts prior to torquing cylinder base nuts. Apply Loctite™ 242.

All 6mm Crankcase Bolts 108 in. lbs. (1.24 kg-m)

All 7/16-14 Engine Mount Strap Bolts 44-48 ft. lbs. (6.0-6.63 kg-m)

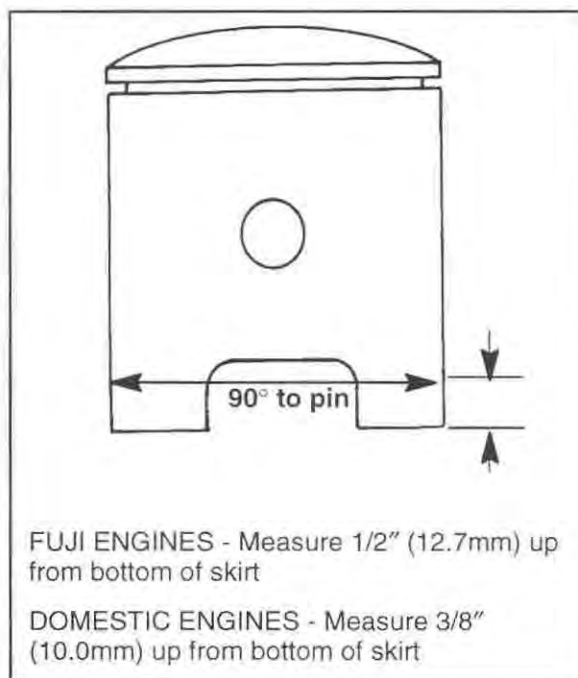
ENGINE Torque Patterns



Piston Measurement

Whenever cylinders are honed or bore clearance is checked, it is important to measure piston diameter properly to arrive at its major dimension. Measurements should be taken with piston at room temperature, and **at right angles to the pin** as shown. Determine the largest diameter within this area and refer to the chart below for clearance specifications.

Cylinder bore must be straight and concentric. Refer to honing information outlined in this section for specific procedures. Refer to the specification charts at the beginning of this chapter for *Target Clearance* when re-boring cylinder, or *Service Limit* specifications (to determine if piston requires replacement. Specifications are listed by engine model number.



Ni-Ca-Sil cylinders can be lightly honed if the proper stone is used. Ammco #3955 honing stones (for use with the Ammco 3950 cylinder hone) are suitable and can be ordered through most automotive supply stores or VST. See General Information chapter for tool ordering information.

To Determine Metric Displacement

mm Bore ÷ 2 =
x itself, or R squared =
x pi 3.1416 =
x mm stroke =
÷ 1000 = _____
displacement
of one cylinder
in cc

To Determine Compression Ratio

Compression Ratio =

Piston Displacement ÷
Installed Head Volume ÷

Installed Head Volume =

_____ : 1 Ratio

ENGINES

Fuel Recommendation

Oxygenated Fuel

Due to increased emphasis on reducing auto emissions, some areas are required to use oxygenated fuels. Oxygenated fuels are those which include oxygen in the molecule due to the addition of an ether or alcohol.

Polaris engines are designed for use with a specific fuel octane number. If fuels with a lower octane number than that specified are used, the engine may be severely damaged.

1997 - current models are calibrated for a minimum 87 octane (no lead regular) or 89 octane (oxygenated) fuel $[(R+M)/2]$. Some high performance models require a minimum of 91 octane. No change is required to 1997 models provided the minimum fuel octane requirement is met. Refer to the Specification Decal on the hood, Owner's Safety and Maintenance Manual, or Engine Chapter in this manual for minimum octane recommendation.

1996 Models-Oxygenated fuel can be used in all 1996 models of Polaris snowmobiles if these guidelines are followed:

NOTE: The use of fuel containing *methanol* is not recommended.

Carbureted Models: (see following page for EFI recommendations)

1. Use fuel with a minimum pump octane of 89 or higher $(R+M)/2$ method and jet carbs as outlined in step 2.
NOTE: Some models are calibrated to use a minimum of 91 octane fuel. On these models, only 91 octane or higher should be used. Refer to the Specification Decal, Owner's Safety and Maintenance Manual, or Engine Chapter in this manual for minimum octane recommendation.
2. When using 89 octane oxygenated fuel on 1996 models, install main jets that are one size larger than that listed on the jetting chart for a given altitude and temperature. For example, the minimum octane (non-oxygenated) fuel for the 1996 Indy Classic is 87. The main jet installed during production for use at altitudes of 0-3000 ft. and temperatures between -20 and +10°F is a 340. To use 89 octane *oxygenated* fuel, install 350 main jets.
3. Turn the pilot air screws in (clockwise) 3/8 turn from the standard setting. Example: if the production air screw setting is 1 turn out, the setting for 89 octane oxygenated fuel would be 5/8 turn out. This adjustment may vary according to model and type of fuel.

NOTE: The following 1996 Indy Classic charts are provided as an example only.

1996 Indy Classic

87 Octane
(Non-Oxygenated)

		AMBIENT TEMPERATURE			
		Below -20°F Below -29°C	-20° to +10°F -29° to -12°C	+10° to +40°F -12° to +5°C	Above +40°F Above +5°C
Altitude Meters (Feet)	0-900 (0-3000)	360	*340	320	300
	900-1800 (3000-6000)	320	300	280	260
	1800-2700 (6000-9000)	280	260	240	220
	2700-3700 (9000-12000)	240	230	210	200

 - Shaded zone should drop Jet Needle one position (raise E-Clip)

* Production Setting

1996 Indy Classic

89 Octane
(Oxygenated)

		AMBIENT TEMPERATURE			
		Below -20°F Below -29°C	-20° to +10°F -29° to -12°C	+10° to +40°F -12° to +5°C	Above +40°F Above +5°C
Altitude Meters (Feet)	0-900 (0-3000)	370	350	330	310
	900-1800 (3000-6000)	330	310	290	270
	1800-2700 (6000-9000)	290	270	250	230
	2700-3700 (9000-12000)	250	240	220	210

 - Shaded zone should drop Jet Needle one position (raise E-Clip)

Oxygenated Fuel - 1996 EFI Models

The fuel used in the Polaris engine is as important to engine life and performance as the lubricant used.

CAUTION:

Polaris engines are designed for use with a specific fuel octane number. If fuels with a lower octane number than that specified are used, the engine can become severely damaged.

Be certain the fuel used in the Polaris engine meets or exceeds the required minimum 87 octane (no lead regular) or 89 octane (oxygenated) fuel $[(R+M)/2]$.

NOTE: See oxygenated fuel recommendations below for 1996 EFI models. 1997 - current EFI models are calibrated for 89 octane oxygenated fuel or 87 octane non-oxygenated fuel, and do not require modifications below 5000 ft.

Refer to the Specification Decal, Owner's Safety and Maintenance Manual, or Engine Specifications in this manual for minimum octane recommendation.

Only winter gasoline should be used in Polaris snowmobiles. The gasoline sold at the pumps and used in the summer is different than gasoline sold in the winter. "Summer" fuels used in snowmobiles can cause hard starting.

To use 89 octane oxygenated fuel on 1996 EFI models:

1. At altitudes below 5000 ft., the compression ratio must be reduced by installing .020" head gasket shims between the cylinder head gasket and cylinder head. The part numbers are shown below. No change is required if machine is operated at altitudes above 5000 feet (1500 meters).

1996 EFI Cylinder Head Shims

Model	Shim Part Number
1996 500 EFI/SKS/RMK	(1) 5211416
1996 RXL	(3) 5211414

Fuel System Deicers

If non-oxygenated fuel is being used, Polaris recommends the regular use of Isopropyl base fuel system deicer (Polaris PN 2870505). Add 1 to 2 ounces per gallon (8-16 milliliters per liter) of gasoline to prevent engine damage resulting from fuel system icing and lean mixtures. Never use deicers or additives that contain *methanol*. Use *only* isopropyl fuel system deicers.

If using oxygenated fuel containing ethanol, additional alcohol deicers or water absorbing additives are not required and should not be used.

Whenever servicing the carburetor or fuel system, it is important to heed the warnings found on page 5.1.

ENGINES

Engine Removal

Engine Removal, Typical

1. Open hood and remove retention cable. Support hood securely.

2. Disconnect battery ground (–) from battery. Shut off fuel.

3. Remove airbox.

NOTE: On some models, fuel pump and/or CDI box must be removed from airbox before removing airbox.

4. Remove fuel pump from engine if applicable.

Engine Removal, Typical-Cont.

5. Free recoil rope from chassis.
6. Loosen clamps at carburetor mounting flange. Pull carbs from adaptors and secure out of the way. Note routing of all cables and hoses for reassembly.
7. Disconnect oil pump control cable.
8. Disconnect and plug oil supply line. A spare water trap plug can be used to plug the oil line from the oil reservoir.

ENGINES

Engine Removal

Engine Removal, Typical-Cont.

9. Remove drive belt and drive clutch.

10. Remove exhaust system.

NOTE: On triple pipe models, mark pipe location to simplify reassembly.

11. On liquid cooled models, drain coolant into suitable container.

12. Disconnect coolant supply hoses. (Liquid models)

Engine Removal, Typical-Cont.

13. Disconnect electrical connections from stator and starter motor (where applicable).
14. Remove two front and two rear engine mounting bolts securing engine mounting plate to chassis.
15. Remove engine from chassis.

ENGINES

Engine Installation

Engine Installation, Typical

1. Prepare chassis for engine installation by moving hoses and wiring out of the way.
2. With engine mounting plate connected to engine, set engine on rubber mounts and loosely install mounting bolts and nuts.
3. Install drive clutch and check clutch offset/alignment. See page 6.44. Adjust torque stop (where applicable) to .100" (2.5mm).
4. Tighten engine mounting bolts to specification.

Engine Mounting Bolt Torque-

Front - 28 Ft lbs (6.67 kgm)

Rear - 28 Ft lbs (6.67 kgm)

Engine Installation, Typical-Cont.

5. Connect all stator connections.
6. Connect oil supply line to oil pump. Bleed oil pump by opening bleed screw on top until oil flows steadily. Secure bleed screw. Install throttle cable to oil pump and check adjustment. Refer to page 3.89 for oil pump adjustment procedure.
7. Install carburetors and tighten clamps. Make sure hoses and cables are routed correctly.
8. Install airbox.

ENGINES

Engine Installation

Engine Installation, Typical-Cont.

9. Secure fuel pump and CDI box.
10. Install coolant hoses where applicable. Make sure hoses are routed properly and hose clamps are positioned and tightened securely.
11. Route and install recoil rope to chassis.
12. Install starter and starter cables (electric start models).

Engine Installation, Typical-Cont.

13. Install exhaust system in reverse order of disassembly.

14. Secure hood cable.

15. Remove any coolant bleed screws or radiator caps and fill coolant system with coolant (liquid models).

Polaris Antifreeze
Quarts PN 2871534
Gallons PN 2871323

16. Add a full tank of premix fuel (40:1) to fuel tank.

ENGINES

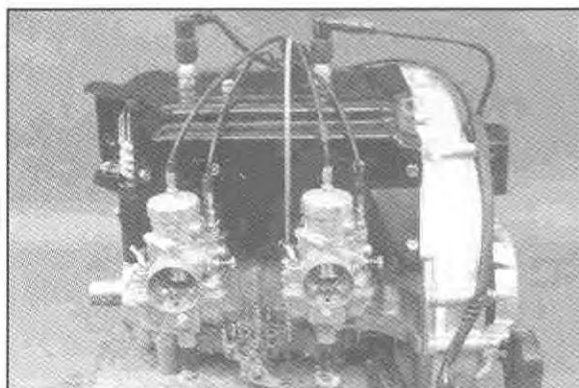
Engine Installation

Engine Installation, Typical-Cont.

17. Start engine and check operation. (Bleed cooling system on liquid models.)

Engine Disassembly

The photo at right shows a complete twin cylinder engine.



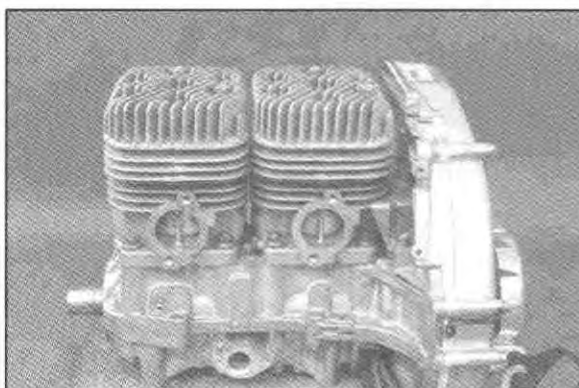
1. Remove carburetors.
2. Disconnect oil pump feed lines and remove oil pump.



3. Remove carburetor adaptors.



4. Remove air shrouds. **NOTE:** There are gaskets between shroud and cylinder.

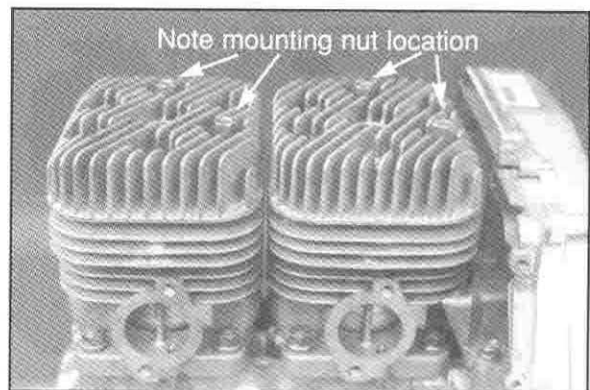


ENGINES

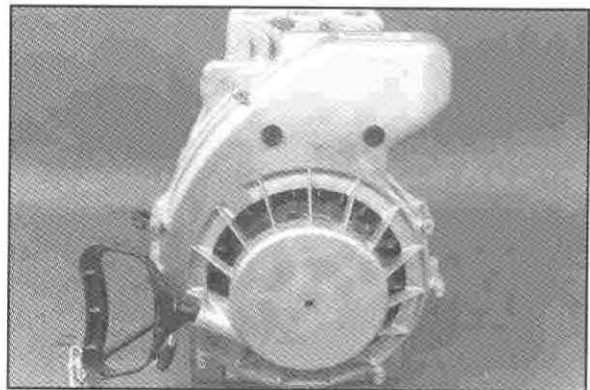
Fan Cooled Twin Cylinder

Engine Disassembly, Cont.

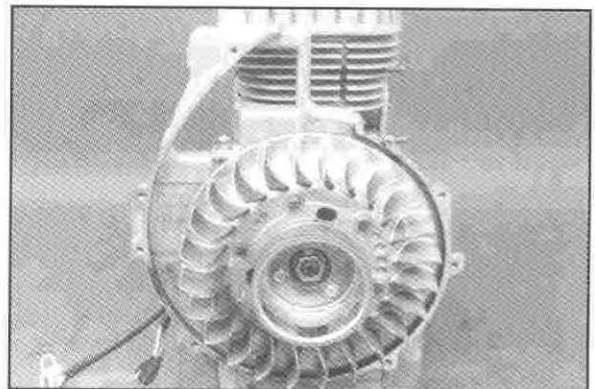
5. Note position of shroud retainer mounts on cylinder heads. These must be in the same position for reassembly.



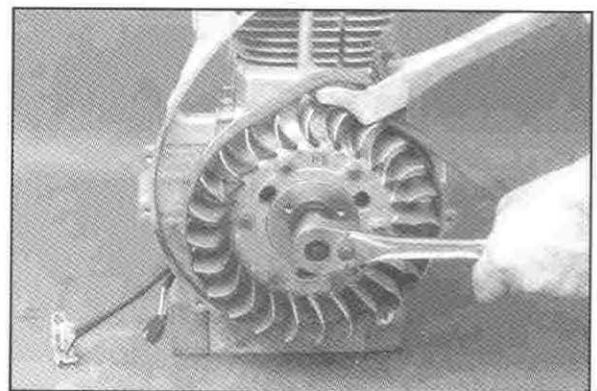
6. Remove recoil fan housing.



7. Remove recoil drive hub.



8. Remove flywheel retaining nut.



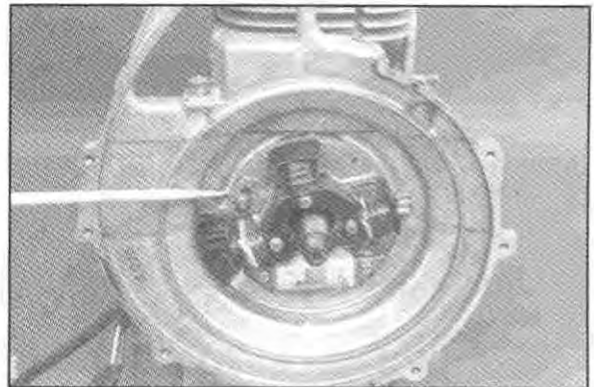
Engine Disassembly, Cont.

9. Using flywheel puller, remove flywheel.

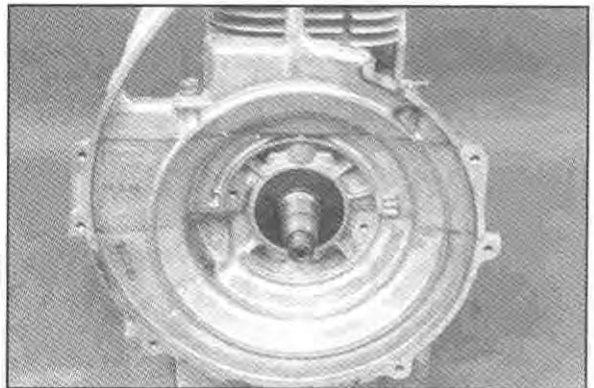
Flywheel Puller

PN 2871043

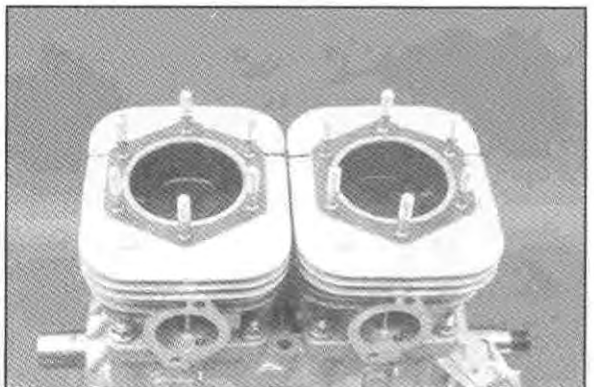
10. Mark stator plate and crankcase to ease reassembly. Remove stator plate.



11. Remove two bolts securing inner and upper shroud. Remove upper shroud.



12. Loosen and remove all bolts securing cylinder heads to cylinder. Remove heads.

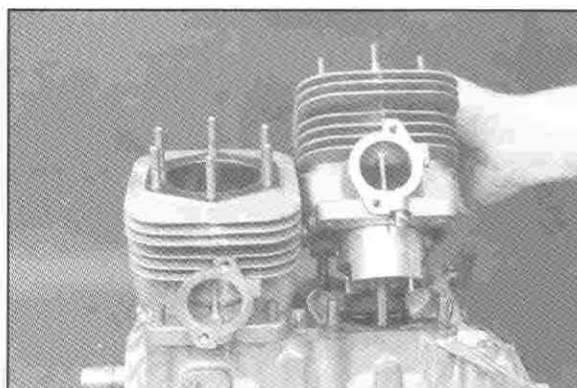


ENGINES

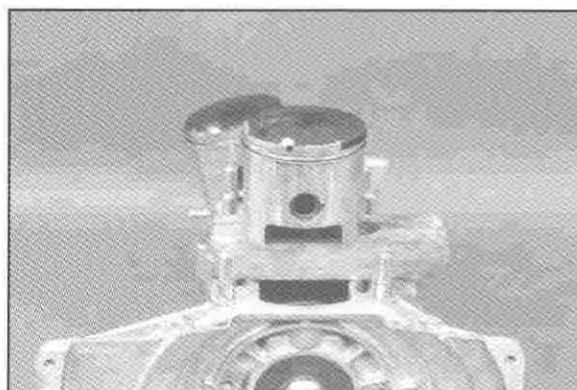
Fan Cooled Twin Cylinder

Engine Disassembly, Cont.

13. Remove cylinder base nuts and remove cylinders.
NOTE: Refer to cylinder inspection page 3.86.



14. Remove piston c-clip.



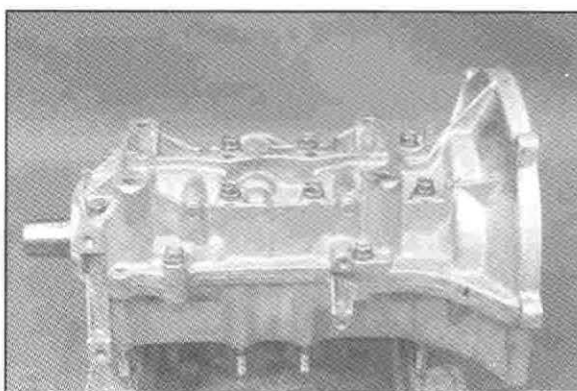
15. Remove piston pin and remove pistons. Refer to general inspection procedures page 3.80-3.87.

Piston Pin Puller

PN 2870386

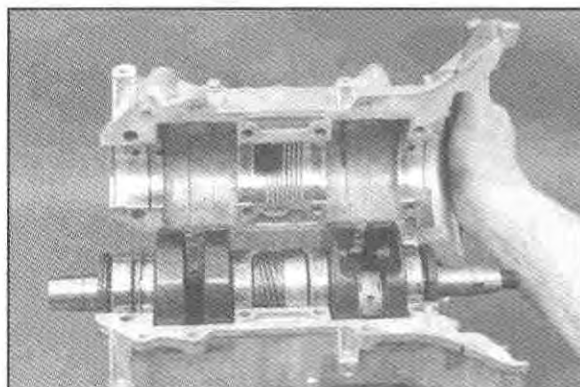


16. Remove all crankcase bolts.



Engine Disassembly, Cont.

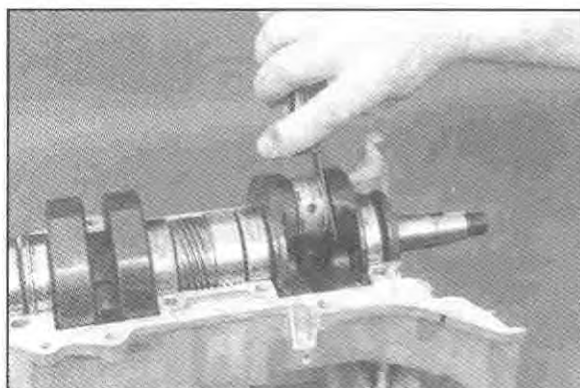
17. Separate crankcase halves.



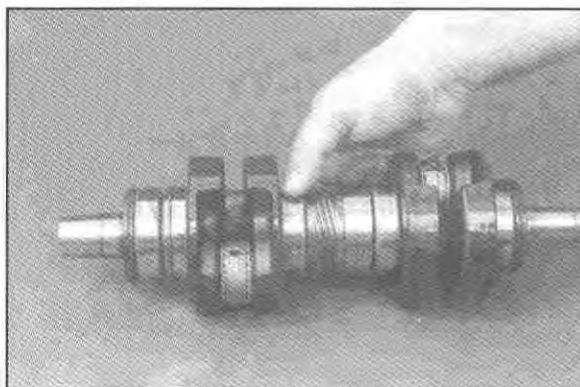
18. Measure connecting rod side clearance. See page 3.82 for measurement procedure.

Connecting Rod Side Clearance

.012" - .016 (.30 - .40 mm)



19. Refer to page 3.81 for crankshaft inspection procedure.



ENGINES

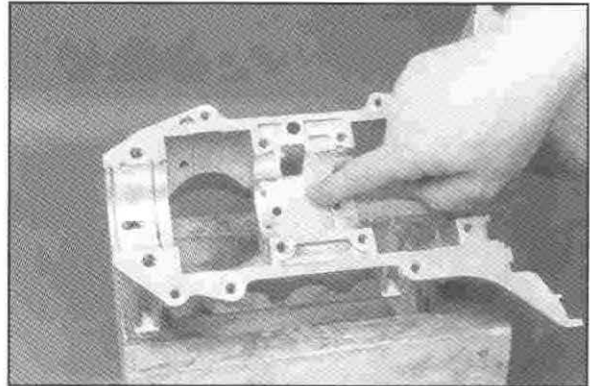
Fan Cooled Twin Cylinder

Engine Assembly

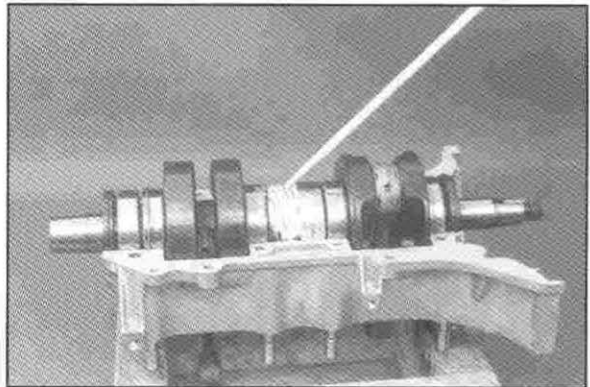
1. Clean all engine components thoroughly in a solvent tank. Remove all filings, excess sealer, and dust. Blow dry with compressed air.
2. Apply 3-Bond™ sealer to top half of crankcase and lubricate labyrinth seal and oil pump drive gear.

3-Bond™ 1215

PN 2871557 120 Gram Tube



3. Lightly grease seals and install on crankshaft on crankshaft with lip (spring) facing inward toward crankshaft. Place crankshaft in upper crankcase half. Make sure seal and PTO bearing retainer fit properly into grooves.

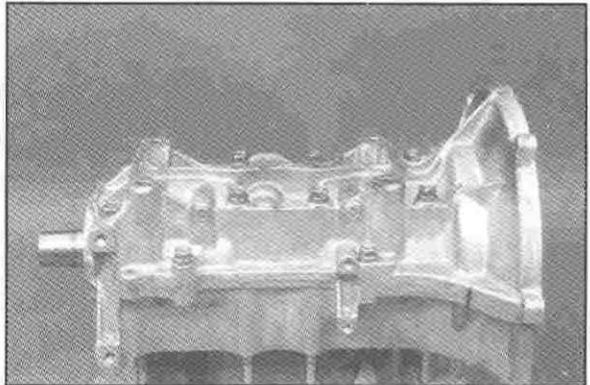


4. Install bottom crankcase half and insert crankcase bolts. Torque to specification in proper sequence shown on page 3.6.

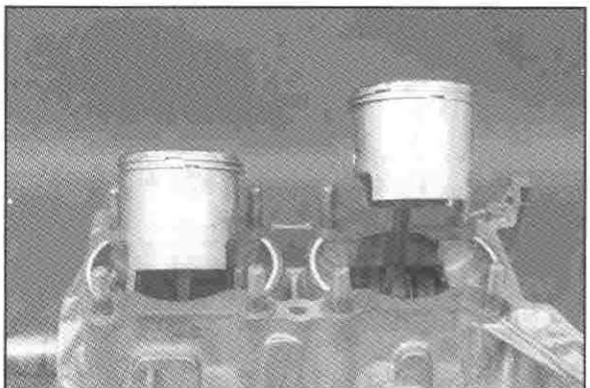
Crankcase Mounting Bolt Torque:

8mm - 18 ft. lbs. (2.48 kgm)

10mm - 26 ft. lbs. (3.59 kgm)



5. Install pistons with arrow (▶) on piston facing flywheel. Install C-clips securely in piston groove.
6. Lubricate rings and pistons with two stroke oil. Install rings with letter mark or beveled side facing upward.
7. Install base gasket with adhesive strip facing up.

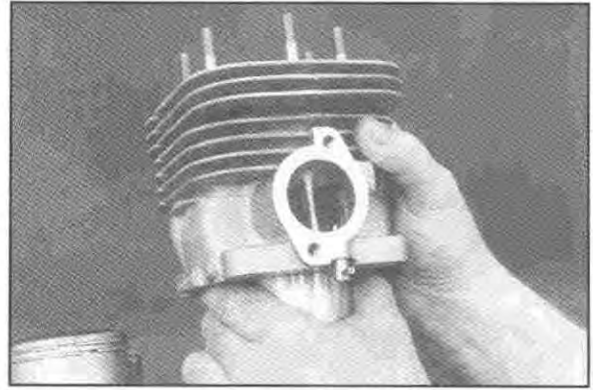


Engine Assembly, Cont.

8. Lubricate cylinder with two stroke oil and install onto piston while compressing piston rings by hand. Be sure ring end gap is centered over locating pin or ring damage may occur. **NOTE:** Use a piston support block to help hold piston and prevent piston damage during assembly.

Piston Support Block

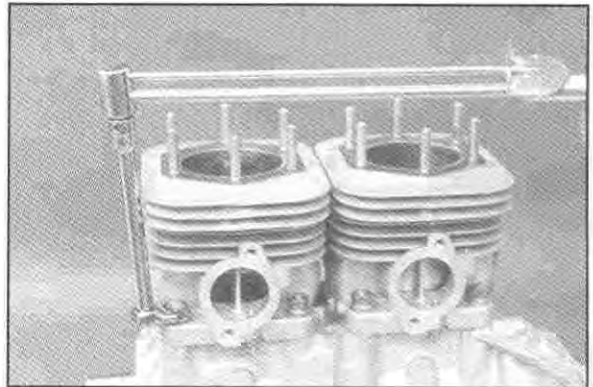
PN 2870390



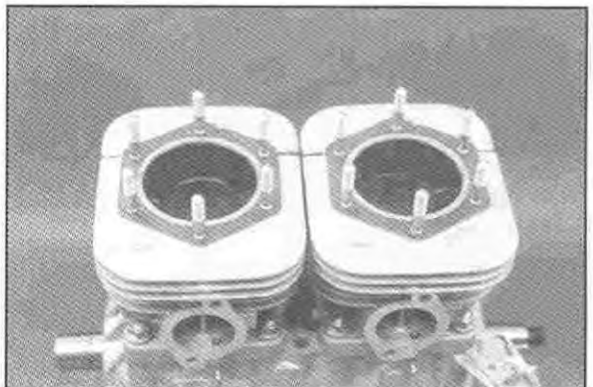
9. Torque cylinder base bolts to specification.

Cylinder Base Bolt Torque

24-28 Ft lbs (3.3-3.9 kgm)



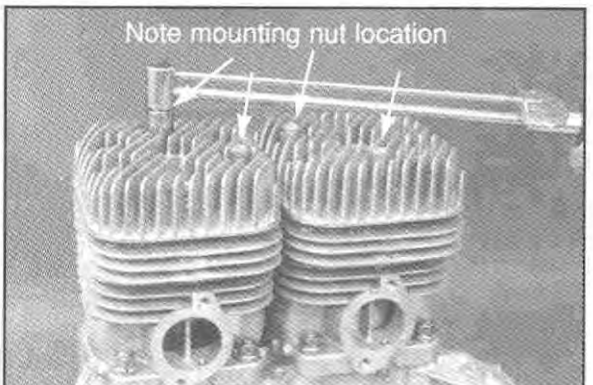
10. Install head gasket with wide side of fire ring facing down (narrow side up).



11. Install cylinder heads and torque head bolts to specification. **NOTE:** Make sure threaded head nuts are in the proper position for shroud mounting. See "x" in photo at right.

Head Bolt Torque-

19-18 Ft lbs (2.3-2.65 kgm)



ENGINES

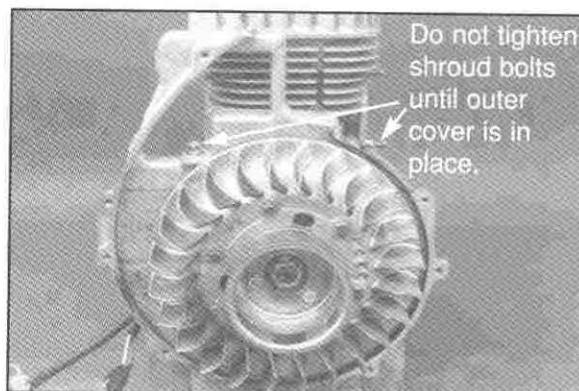
Fan Cooled Twin Cylinder

Engine Assembly, Cont.

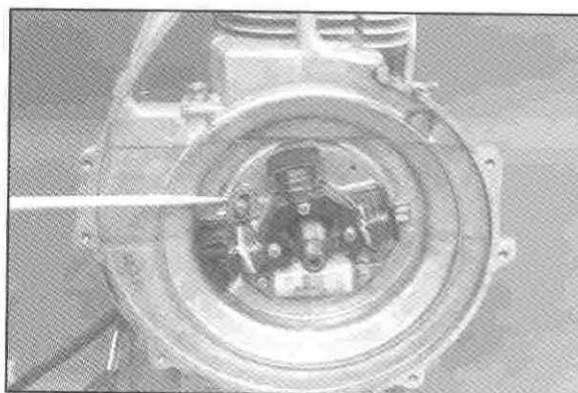
12. Install inner fan shroud.

CAUTION:

Do not tighten bolts until outer shroud is bolted in place. Outer shroud must determine placement of inner shroud, or damage may result.



13. Install stator plate aligning ignition timing mark as seen during disassembly. Tighten stator mounting bolts securely.

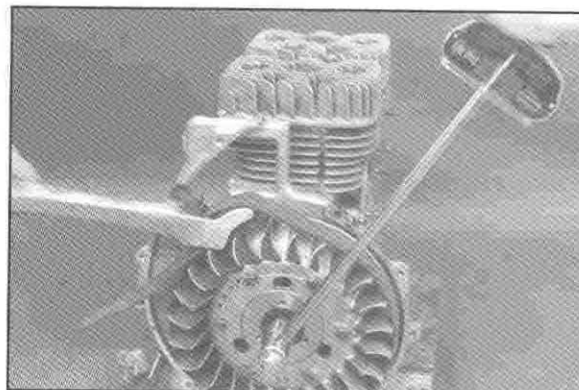


14. Make sure key is on crankshaft and install flywheel aligning keyway.

15. Install flywheel nut and torque to specification.

Flywheel Nut Torque-

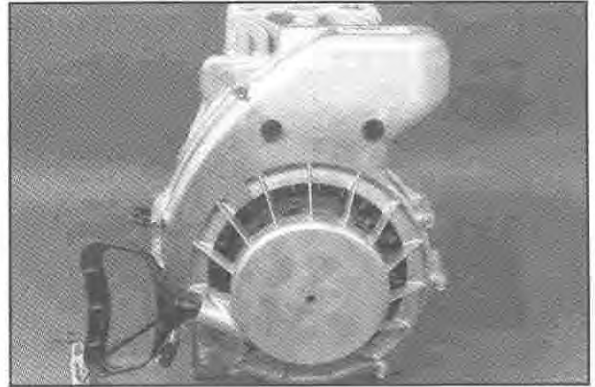
60-65 Ft lbs (8.3-9.0 kgm)



Engine Assembly, Cont.

16. Install recoil starter hub and recoil housing. **NOTE:** Tighten two inner shroud bolts.

Recoil Hub Bolt Torque:
8-10 ft. lbs. (1.11 - 1.38 kg-m)



17. Reassemble cooling shroud.



18. Install oil pump. If crankcase, oil pump, or pump drive components were replaced, refer to page 3.89 to inspect drive gear end play.

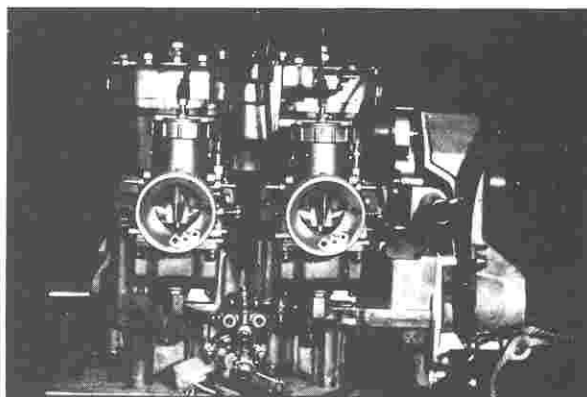
Oil Pump Mounting Screw Torque:
48 - 72 in. lbs. (.55 - .83 kg-m)

ENGINES

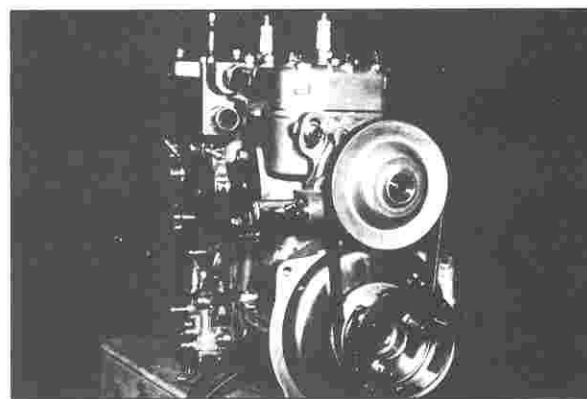
Liquid Twin Cylinder

Disassembly

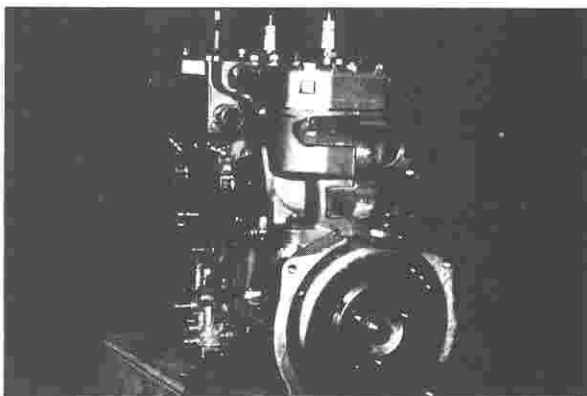
The photo at right shows a complete liquid twin cylinder engine.



1. Remove carburetors or throttle bodies.
2. Remove recoil housing and exhaust manifold.



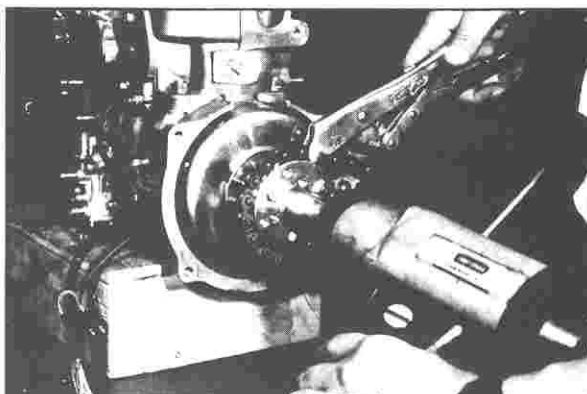
3. Remove water pump, starter recoil cup with water pump drive pulley and flywheel nut. Note position of shim washers for pulley alignment upon reassembly.



4. Install flywheel puller. Secure puller with a holding fixture tool, strap wrench, or chain wrench while pulling flywheel.

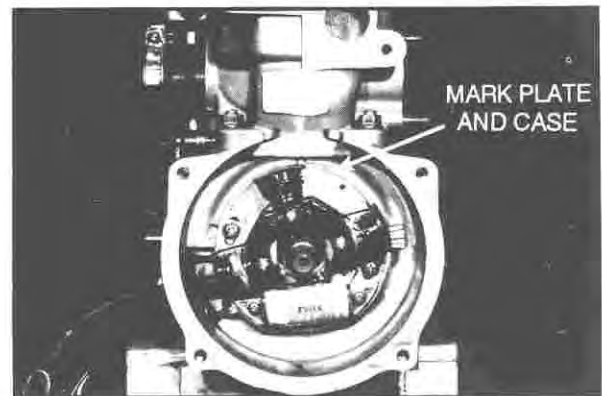
Flywheel Puller

PN 2871043

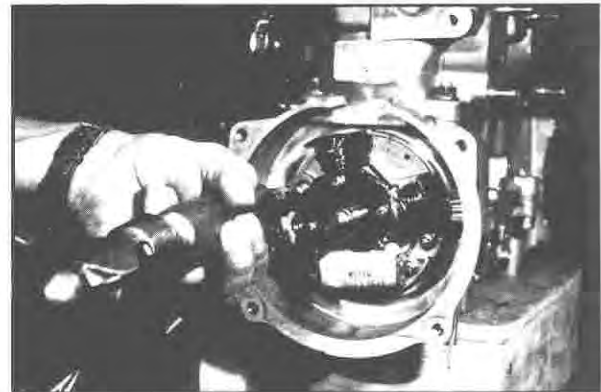


Disassembly, Cont.

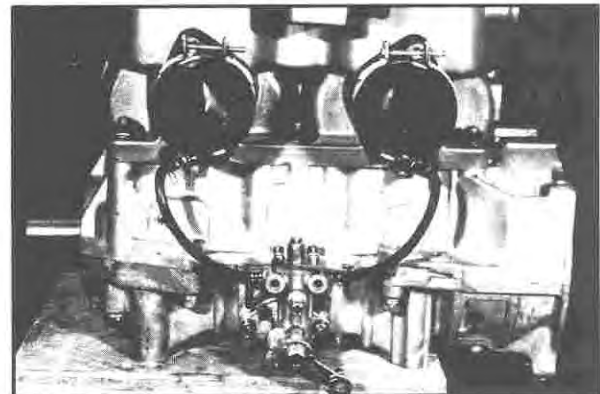
5. Mark stator plate and crankcase for reference when reassembling the engine.



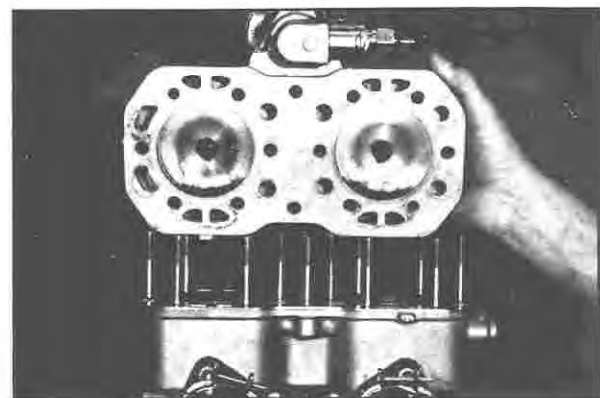
6. Using an impact screwdriver, remove stator screws.



7. Remove oil pump and oil pump feed lines from cylinder banjo bolts.



8. Remove cylinder head.

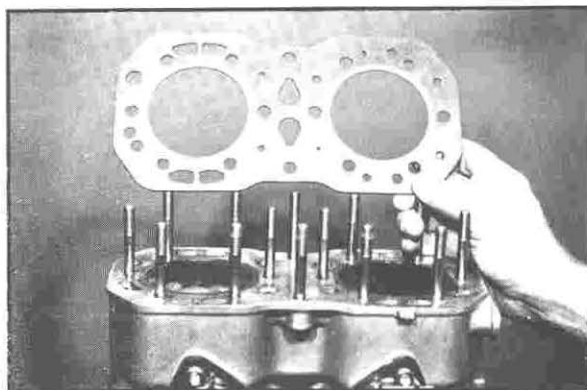


ENGINES

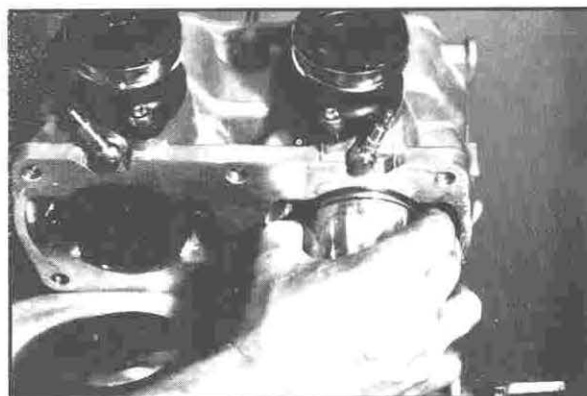
Liquid Twin Cylinder

Disassembly, Cont.

9. Remove head gasket. Note position of head gasket inlet and outlet hole sizes for reference during reassembly.



10. Remove cylinder.

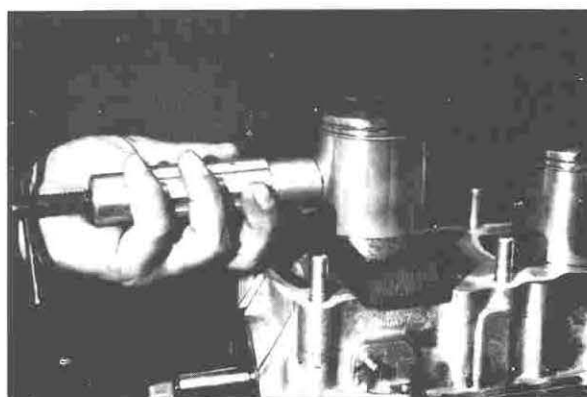


11. Remove C-clip retainer clips from piston as shown.



12. Using piston pin puller, remove piston pin from piston as shown.

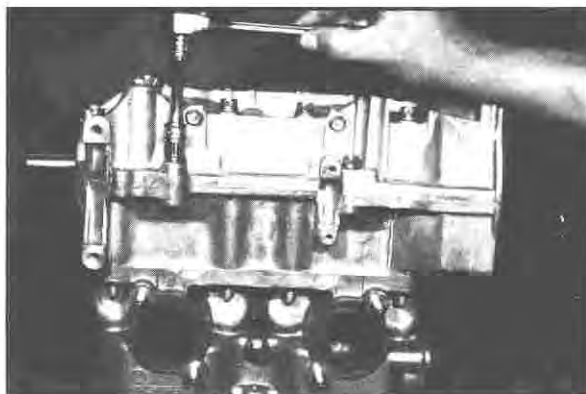
Piston Pin Puller
PN 2870386



Disassembly, Cont.

13. Remove crankcase bolts.

NOTE: Refer to general inspection procedures on pages 3.79-3.90 for engine component inspection (i.e. crankshaft and crankcase inspection, piston clearance, oil pump drive gear end play etc.).



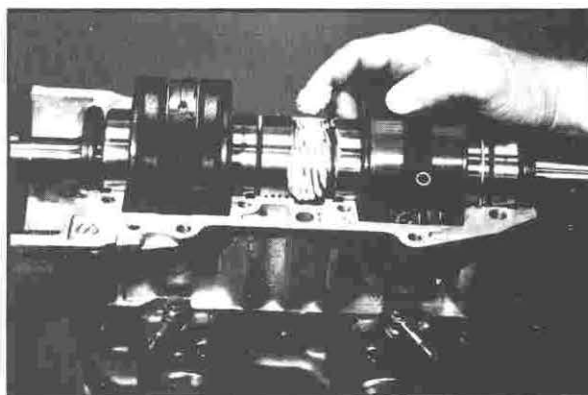
ENGINES

Liquid Twin Cylinder

Assembly

Prior to assembly, refer to page 3.87 and check ring end gap and piston to cylinder clearance.

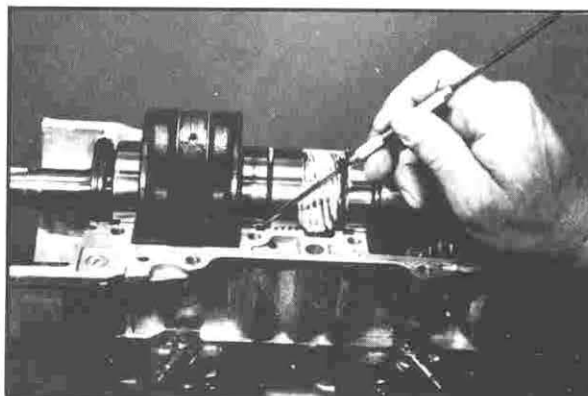
1. Grease crankshaft end seals, oil pump drive gear, and labyrinth seal area as shown. Seals should be installed with spring and lip facing inward toward crankshaft.



2. Turn bearing so anti-rotation pins are in the proper groove.
3. Apply 3-Bond™ sealant to crankcase halves.

3-Bond™ 1215

PN 2871557 120 Gram Tube

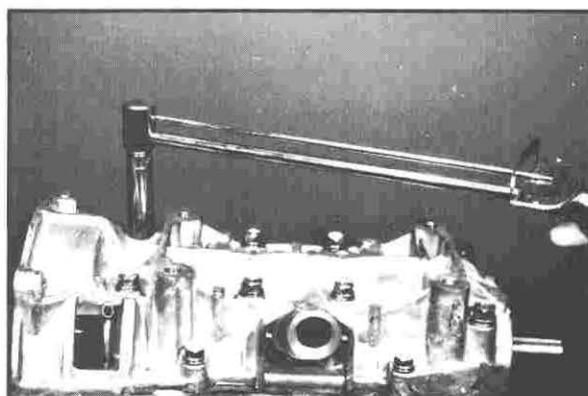


4. Torque crankcase following torquing specs and sequence outlined on pages 3.5 and 3.6. Lubricate crankshaft main bearings through access holes.

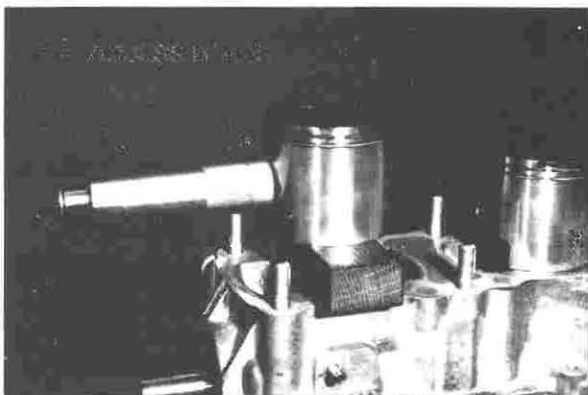
Crankcase Mounting Bolt Torque:

8mm - 18 ft. lbs. (2.48 kgm)

10mm - 26 ft. lbs. (3.59 kgm)

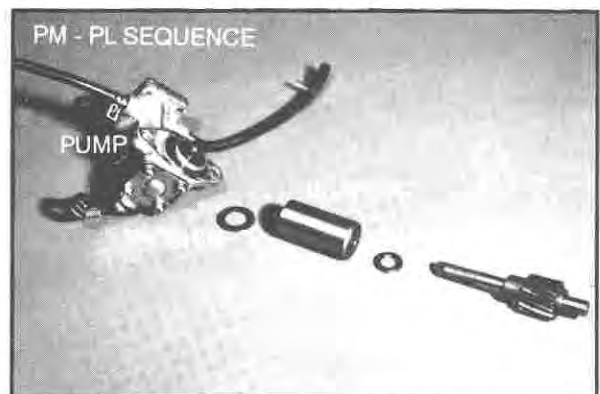
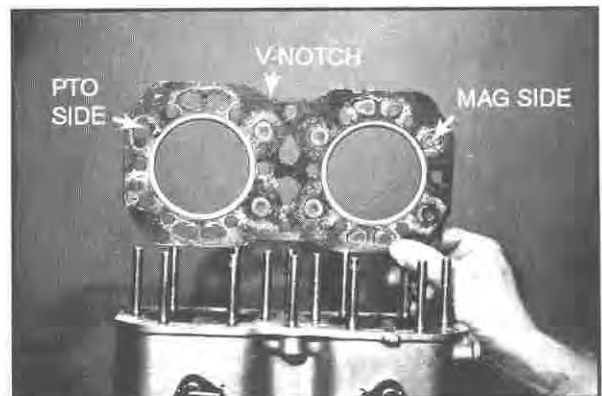


5. Install pistons with "F" mark or arrow (▲) toward flywheel.
6. Install C-clip using installation tool PN 2870773.
7. Install base gasket.
8. Lubricate rings and pistons with two stroke oil. Install rings with letter mark or beveled side facing upward. See page 3.87.



Assembly, Cont.

9. Lubricate rings and cylinder with Premium 2 Cycle Lubricant and compress rings with fingers, aligning end gaps with locating pins. Install cylinder with a gentle front-to-back rocking motion, being careful not to damage rings. Install cylinder base nuts and tighten to 24-28 ft. lbs. (3.3-3.9 kg-m) following the pattern shown on page 3.6.
10. Install head gasket. Note proper position of gasket, "V" notch forward, small intake hole on right (mag) side, large hole on left (PTO) side.
11. Install cylinder head and torque cylinder head nuts following torque specs and pattern sequence on pages 3.5 and 3.6.
12. Before installing oil pump drive gear, refer to end play adjustment, page 3.89.
13. Install oil pump in the sequence shown in photo at right.

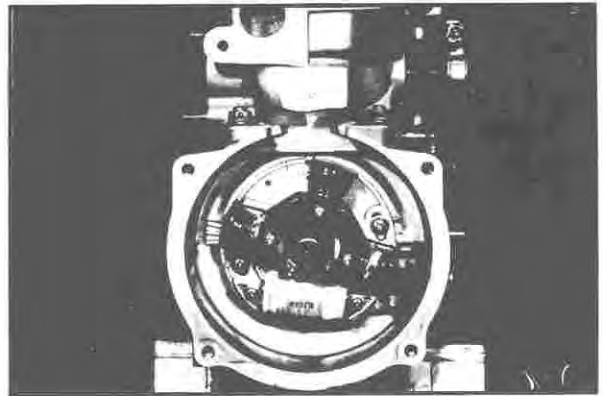


ENGINES

Liquid Twin Cylinder

Assembly, Cont.

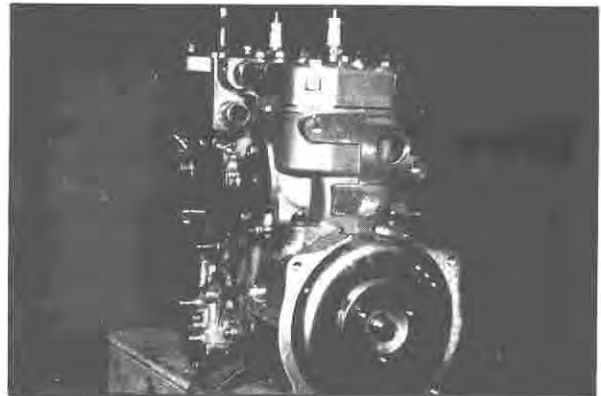
14. Connect oil feed lines to cylinder.
15. Align stator as previously marked on stator plate and secure with screws.



16. Install flywheel and torque flywheel nut to specifications.

Flywheel Nut Torque -

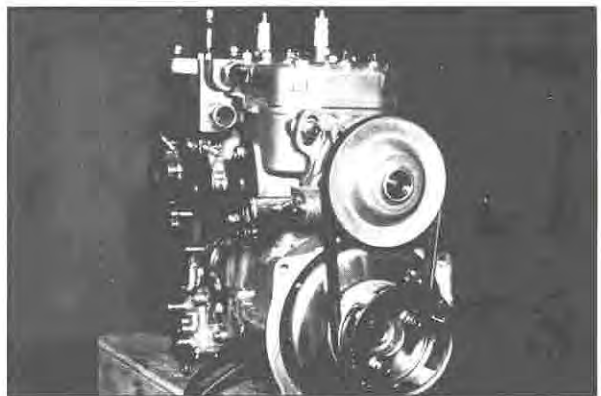
60 to 65 ft. lbs. (8.28 to 8.97 kgm)



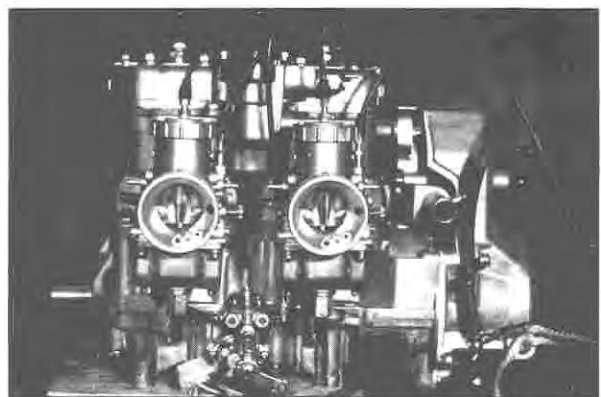
17. Install water pump and recoil starter cup.
18. Adjust tension on water pump belt by loosening mounting bolts, applying tension, and re-tightening bolts.

Water Pump Belt Deflection -

1/8 - 3/16" (.3 - .4 cm)

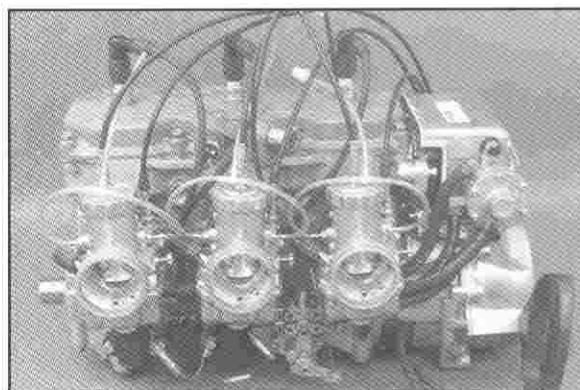


19. Install recoil housing, carburetors, and oil pump cable. Refer to oil pump bleeding in this section.
20. Connect CDI to stator plug connector.

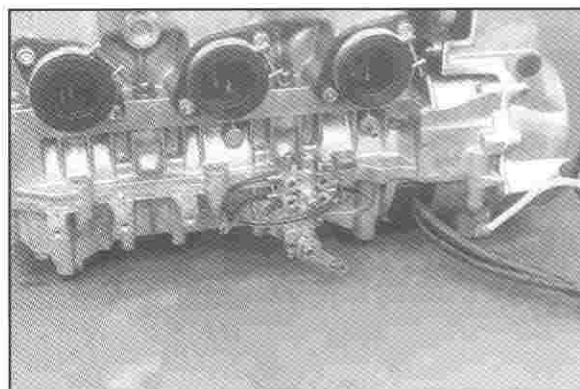


Disassembly

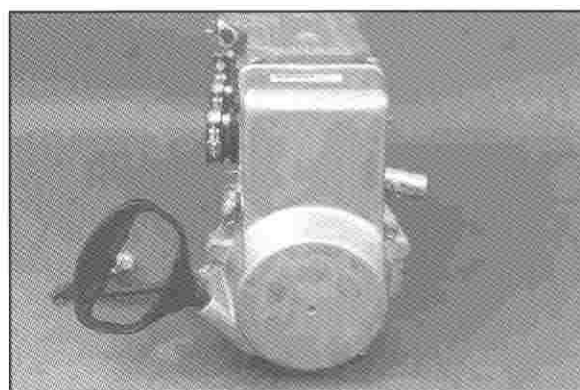
1. Remove carburetors and secondary coils.



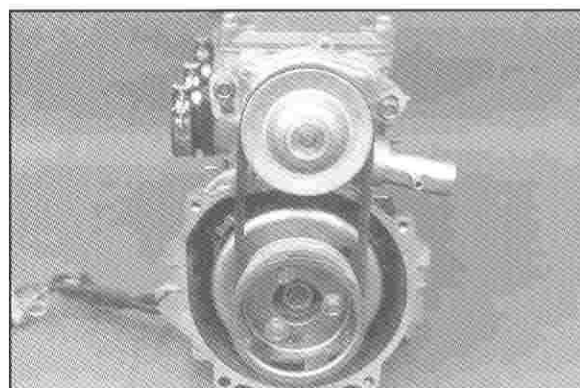
2. Remove oil pump.



3. Remove recoil housing.



4. Remove recoil hub.

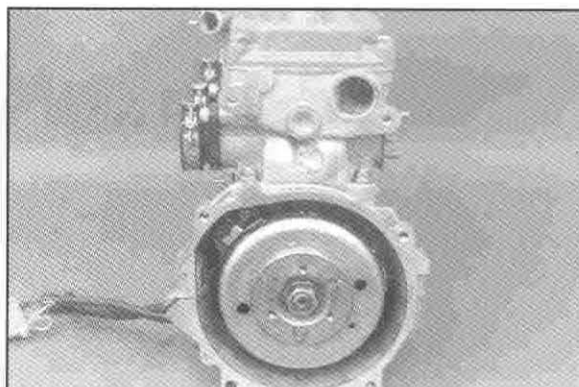


ENGINES

Three Cylinder Monoblock

Disassembly, Cont.

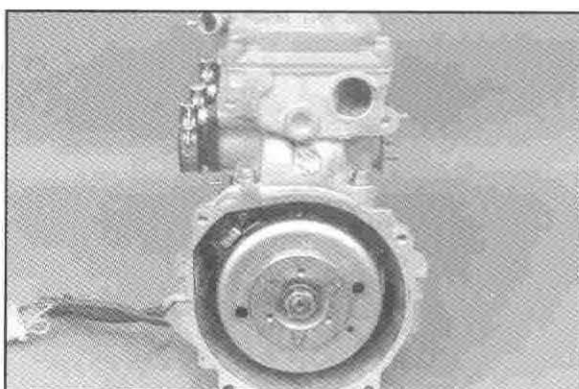
5. Remove water pump.



6. Remove flywheel retaining nut. Position flywheel holder as shown.

Flywheel Holder

PN 8700229



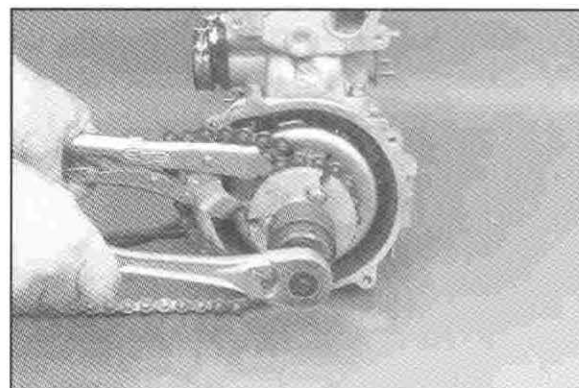
7. Install flywheel puller. Remove flywheel.

Flywheel Puller

PN 2871043

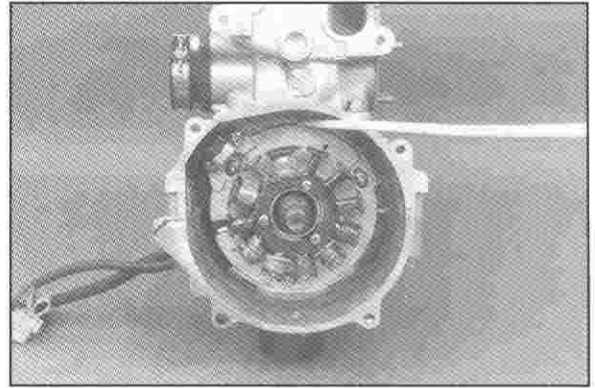
CAUTION:

Do not install puller bolts more than 5/16" (7.9 mm) or stator damage may result.

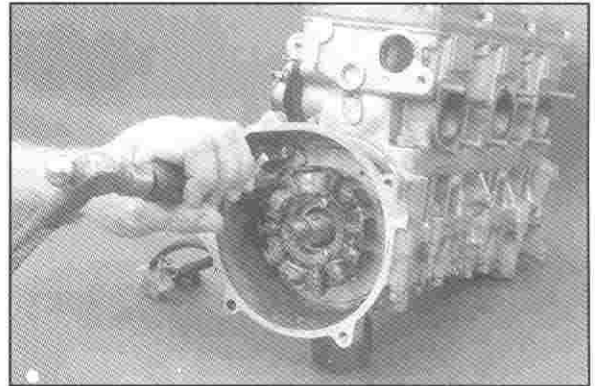


Disassembly, Cont.

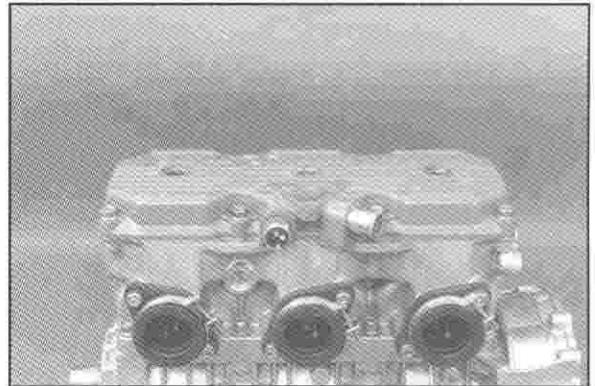
8. Note location of ignition timing marks.



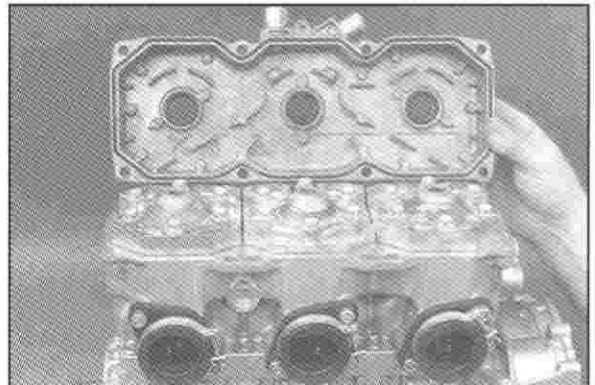
9. Remove stator. **NOTE:** Stator bolts may be loosened using an impact driver.



10. Remove cylinder head cover.



11. Note condition and location of spark plug seat O-rings in head cover. Also note the quantity and location of shim washers located beneath the O-rings.

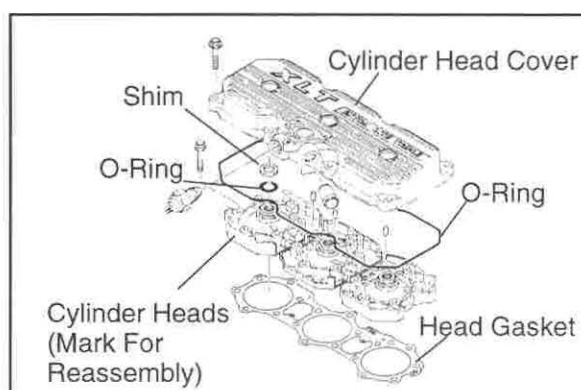


ENGINES

Three Cylinder Monoblock

Disassembly, Cont.

12. Remove cylinder heads. Mark PTO, Center, and Mag head to ensure correct reassembly.

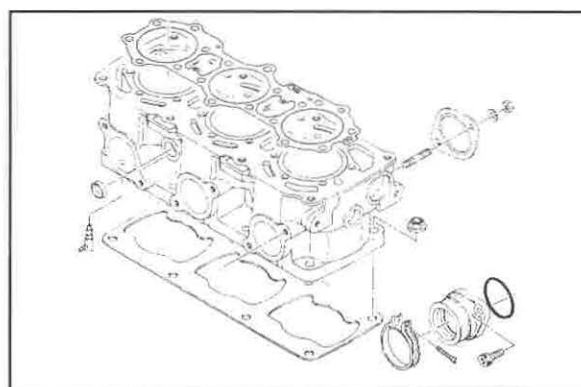


13. Remove cylinder and base gasket.

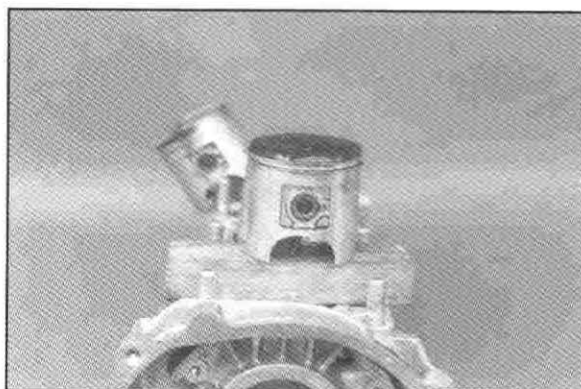
14. Refer to cylinder inspection procedure on page 3.86 to inspect cylinder.

CAUTION:

Use care to ensure pistons are not damaged as cylinder is removed.



15. Support pistons with piston support block and remove C-clips.

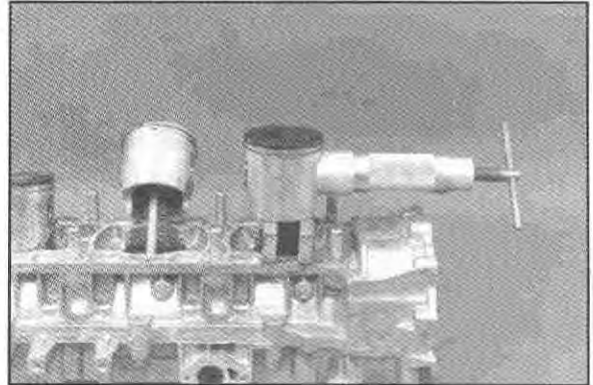


Disassembly, Cont.

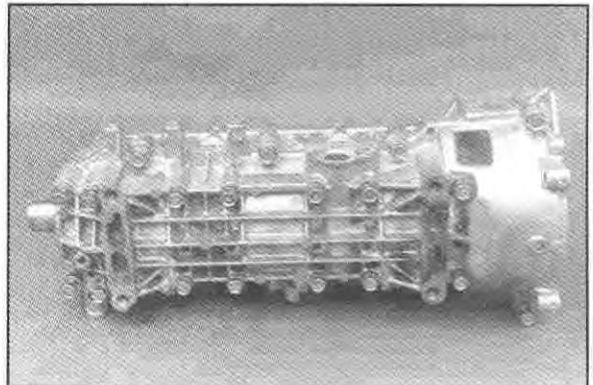
16. Remove piston pins using piston pin puller and adaptor as shown. Refer to pages 3.79 through 3.90 for general inspection procedures.

Piston Pin Puller PN 2870386

Adapter PN 5130971

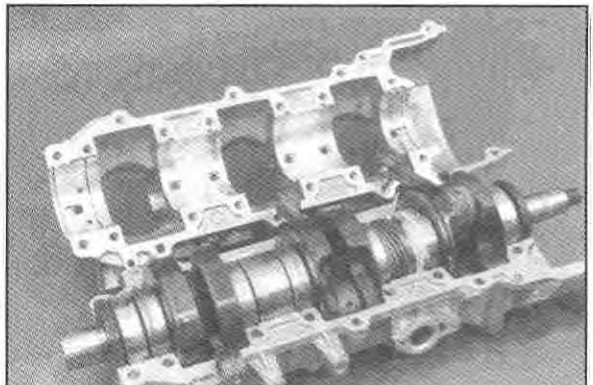


17. Remove all crankcase bolts.



18. Separate crankcase halves and remove crankshaft.

19. Follow procedure on page 3.81 for crankshaft inspection.



ENGINES

Three Cylinder Monoblock

Disassembly, Cont.

20. Clean all components in a solvent tank to remove any dust, dirt, debris, and excess sealant. Inspect mating surface of upper and lower crankcase for damage.

Assembly

1. Apply 3-Bond™ to upper crankcase half. Lubricate labyrinth seal and oil pump drive gear. Lightly grease seals and install on crankshaft with seal lip (spring) facing inward.

3-Bond™ 1215

PN 2871557 120 Gram Tube

2. Install crankshaft in upper crankcase.

NOTE: Make sure seals and all locating (anti-rotation) pins fit correctly in grooves.

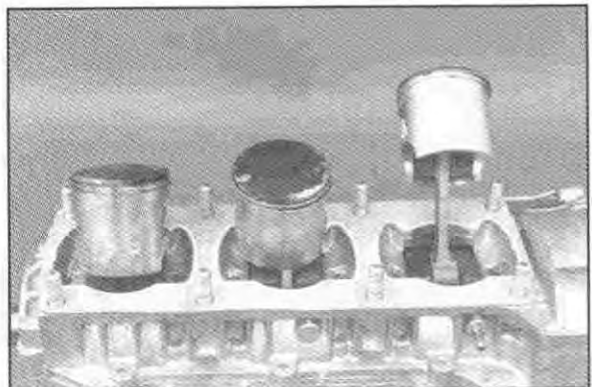
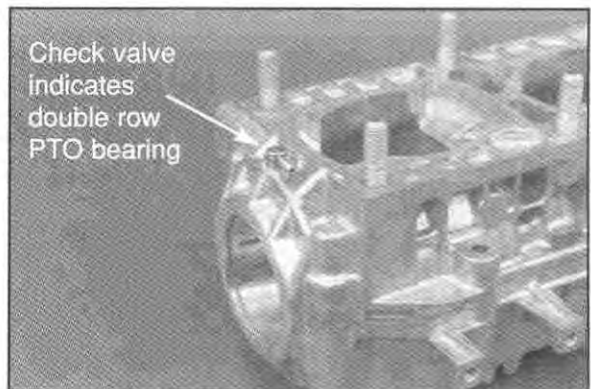
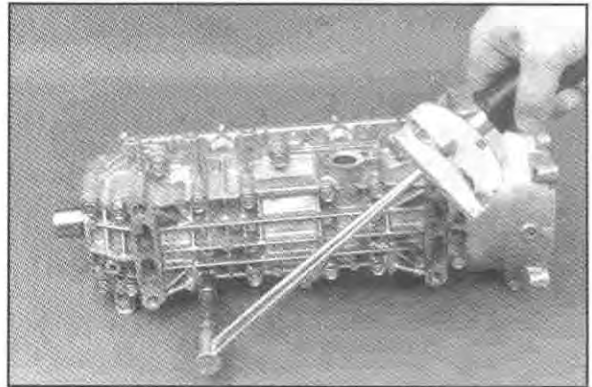
3. Some 1997 three cylinder monoblock engines have a double row PTO bearing. These models can be identified by the PTO oil check valve and wider housing. Make sure the crankshaft and crankcase mate properly.
4. Install bottom crankcase half. Make sure anti-rotation pins are aligned properly and torque bolts to specification.

Crankcase Bolt Torque:

8mm - 18 ft. lbs. (2.48 kgm)

10mm - 26 ft. lbs. (3.59 kgm)

5. Lubricate crankshaft main bearings through oil holes in upper crankcase. Lubricate connecting rod big end bearing.
6. Lubricate pistons, rings, connecting rod small end bearing and cylinder before assembly. Install pistons, piston pins, and C-clips with end gap up or down. **NOTE:** Marking on piston faces flywheel. Be sure "C" clips are fully seated in groove.
7. Apply a small amount of Loctite 515 gasket eliminator to base gasket ends and install gasket noting location of transfer port reliefs. **NOTE:** The sealant on base gasket faces up.



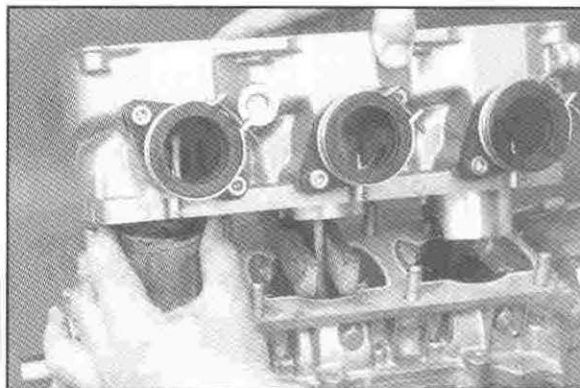
ENGINES

Three Cylinder Monoblock

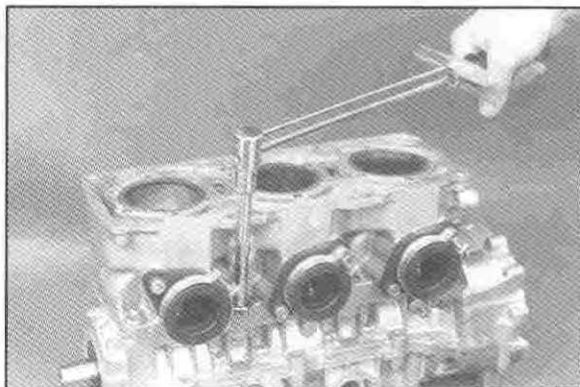
Assembly, Cont.

8. Before installing cylinder, refer to honing procedure on pages 3.79-3.80 of this section. Inspect piston to cylinder clearance and piston ring installed gap as shown on page 3.87. Install rings on pistons. Depress rings in alignment with locating pins on piston using either a ring compressor or your fingers. Carefully install the cylinder. Install pistons in the following order:

- Mag
- Center
- PTO

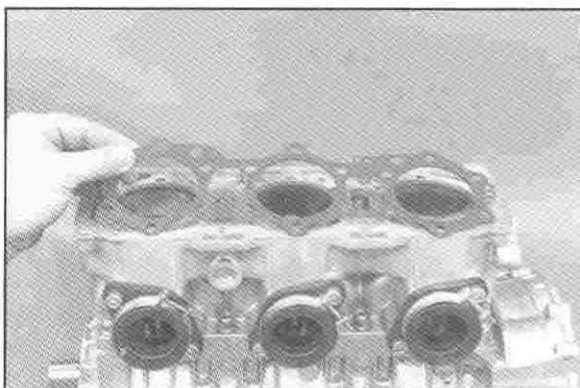


9. Torque base bolts, starting in the middle, alternate intake to exhaust side, moving toward PTO end and mag end. Refer to page 3.5 and 3.6 for torque patterns and specifications.

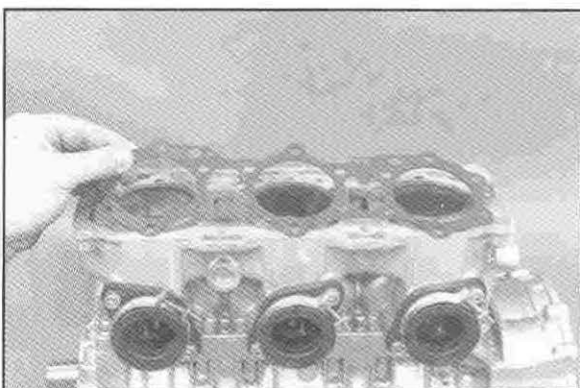


10. Install new head gasket. Be sure cylinder and cylinder head sealing surfaces are clean.

NOTE: EX stamping should be readable and facing exhaust side.



11. Install heads in the correct position and location as marked during disassembly. Torque head bolts to specification.

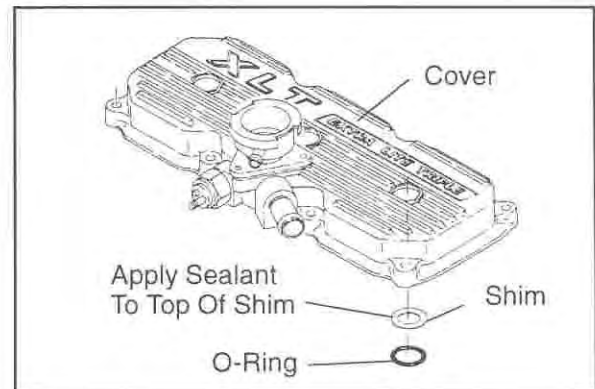


Head Bolt Torque

20 ft. lbs. (2.8 kgm)

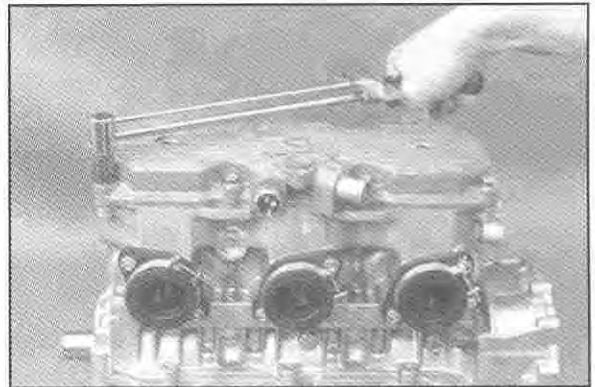
Assembly, Cont.

12. Replace outer O-ring on cover.
13. Apply Loctite 515 to cover as shown.
14. Position shim and O-Ring as shown.



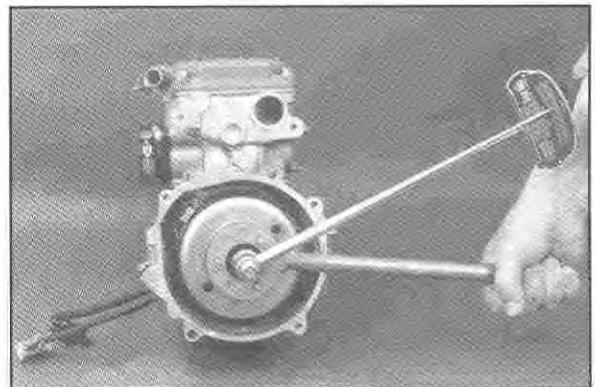
15. Install head cover.
16. Install and torque head cover mounting bolts to specification.

Head Cover Mounting Bolt Torque
17-20 Ft lbs (2.4-2.8 kgm)



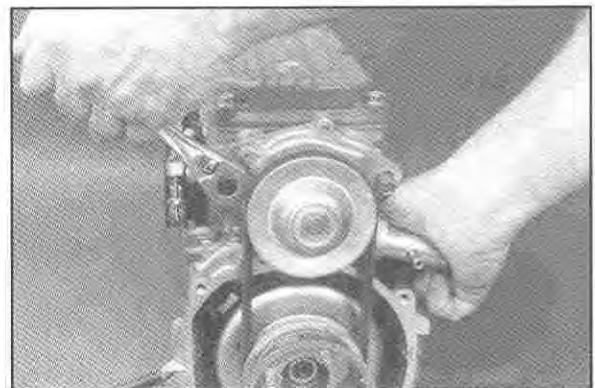
17. Install stator in the previously marked position and tighten screws securely.
18. Install and torque flywheel nut.

Flywheel Nut Torque -
60-65 ft. lbs. (8.28-8.97 kg-m)



19. Install water pump and belt. Apply proper tension to belt and tighten pump mounting bolts.

Water Pump Belt Tension
1/8" - 3/16" (3-4mm)



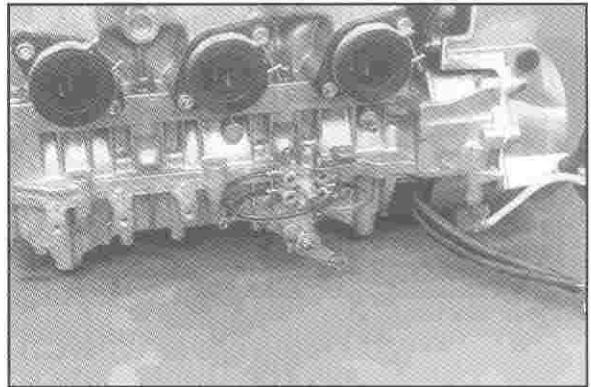
ENGINES

Three Cylinder Monoblock

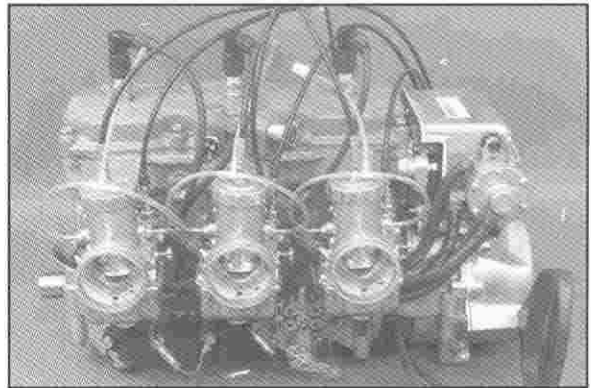
Assembly, Cont.

20. Install oil pump and connect feed lines to rubber mount. If crankcase, oil pump, or drive components were replaced, refer to oil pump drive gear end play adjustment on page 3.89.

21. Install recoil housing.

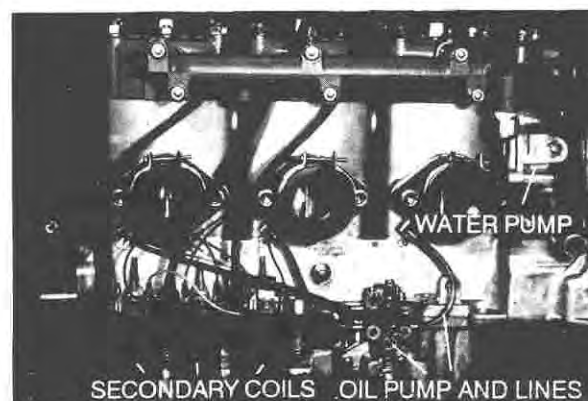
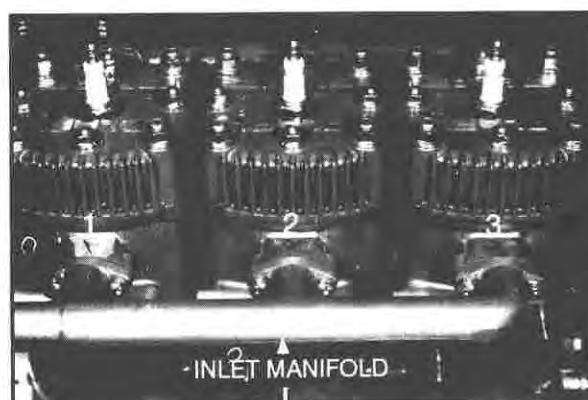


22. Install secondary coils and secure carburetors to rubber mounts.



Disassembly

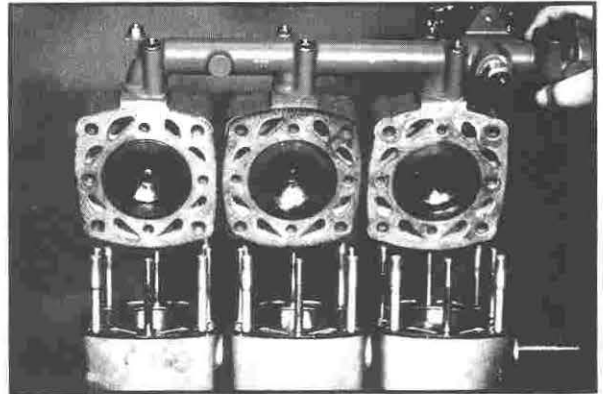
1. Remove water pump cover.
2. Mark cylinders #1 mag side, #2 center, #3 PTO side.
3. Remove inlet water manifold.
4. Remove oil pump lines and secondary coils.
5. Remove oil pump and drive gear.
6. Remove water pump.



ENGINES RXL

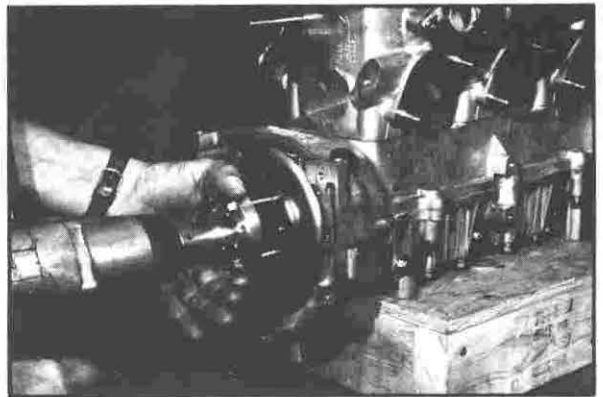
Disassembly, Cont.

7. Remove outlet manifold.
8. Remove heads either as a unit or individually.

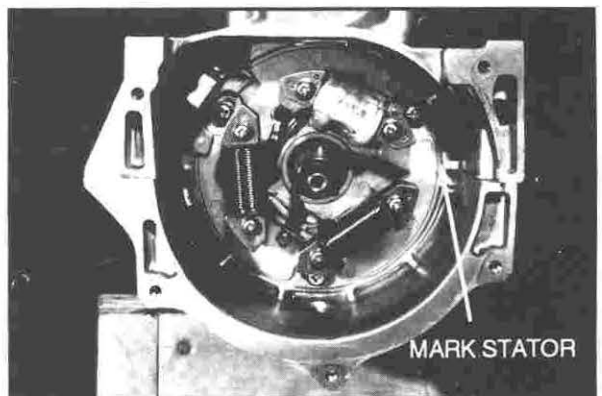


9. Remove recoil starter cup and flywheel nut.
10. Using flywheel puller, remove flywheel.

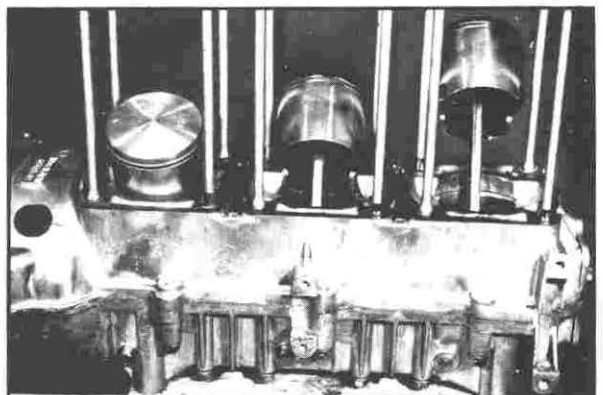
Flywheel Puller PN 2871043



11. Mark stator plate and case. Remove attaching screws.



12. Mark cylinders - mag, center, PTO.



Disassembly, Cont.

13. Remove piston C-clips as shown.

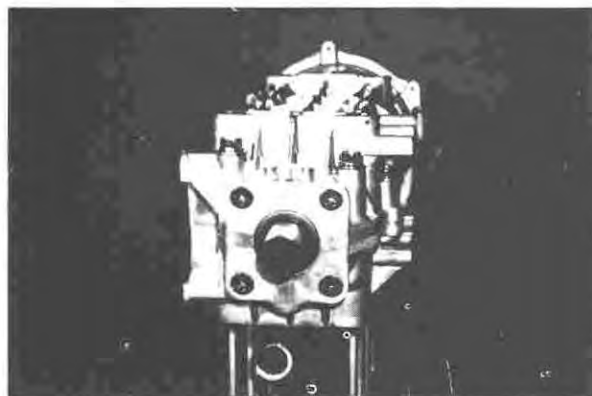


14. Using piston pin puller, remove piston pin and mark pistons mag, center and PTO. Refer to pages 3.86 - 3.87 for cylinder and piston inspection. Refer to pages 3.79 - 3.80 for cylinder honing information.

Piston Pin Puller PN 2870386

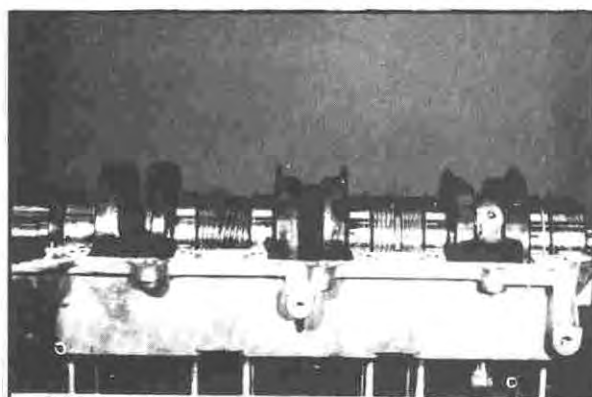


15. Remove seal plate and crankcase bolts.



16. Remove crankshaft from case. Refer to pages 3.81-3.85 for crankcase and crankshaft inspection procedures.

17. Clean all parts.

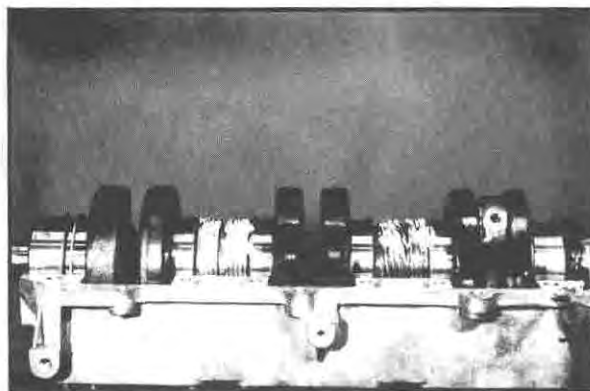


ENGINES

RXL

Assembly

1. Remove old crankcase sealer from case halves.
2. Grease mag end seal lip, oil pump drive gear, and labyrinth seal area.
3. Make sure all bearing anti-rotation pins are aligned with reliefs in crankcase.



4. Apply 3-Bond™ sealer to the bottom crankcase half.

3-Bond™ 1215

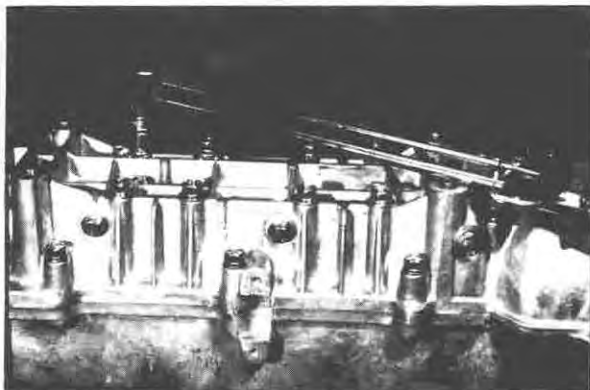
PN 2871557 120 Gram Tube

5. Torque crankcase bolts as shown. Refer to torquing pattern and specifications page 3.5 - 3.6.

Crankcase Mounting Bolt Torque:

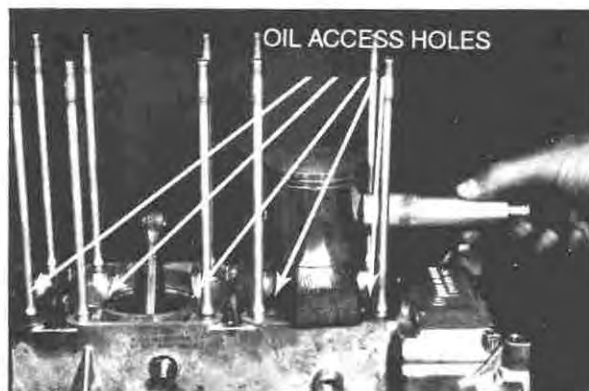
8mm - 18 ft. lbs. (2.48 kgm)

10mm - 26 ft. lbs. (3.59 kgm)



6. Install pistons with arrow toward flywheel side of crankcase.
7. Install piston C-clips with C-clip installation tool.

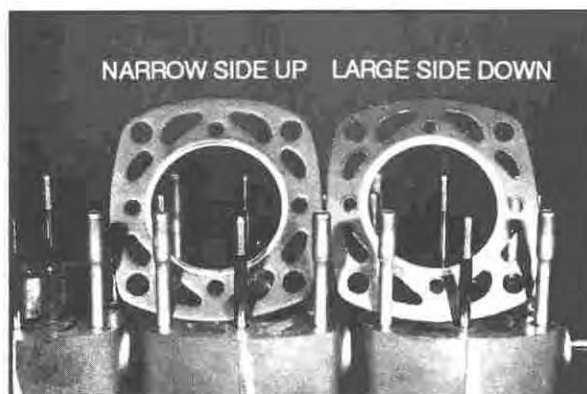
C Clip Installation Tool PN 2870773



8. Lubricate crankshaft bearings through access holes in the case.
9. Install keystone rings onto piston with beveled side up and flat side of ring down.

Assembly, Cont.

10. Before installing cylinder, refer to honing procedure on pages 3.79-3.80 and piston/cylinder inspection on pages 3.86-3.87 of this section. Lubricate all parts with Premium 2 Cycle Lubricant.
11. Depress rings in alignment with locating pins on piston using either a ring compressor or your fingers. Carefully install the cylinder.
12. Install new head gasket with large diameter side of fire ring toward cylinder.
13. Install cylinder heads onto cylinder either as a unit or individually.



Cylinder Head Nut Torque:

10mm - 24-26 ft. lbs. (3.3-3.59 kgm)
8mm - 17-18 ft. lbs. (2.35-2.48 kgm)

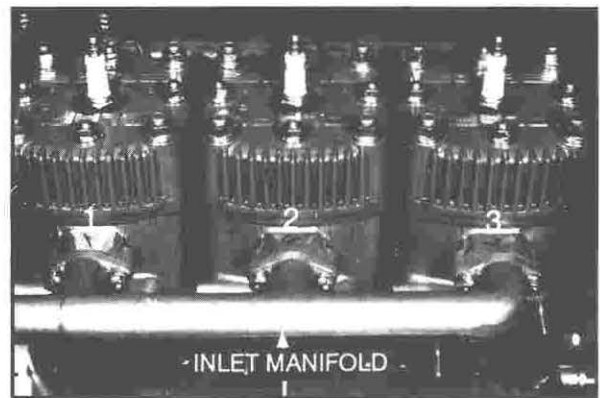
ENGINES RXL

Assembly, Cont.

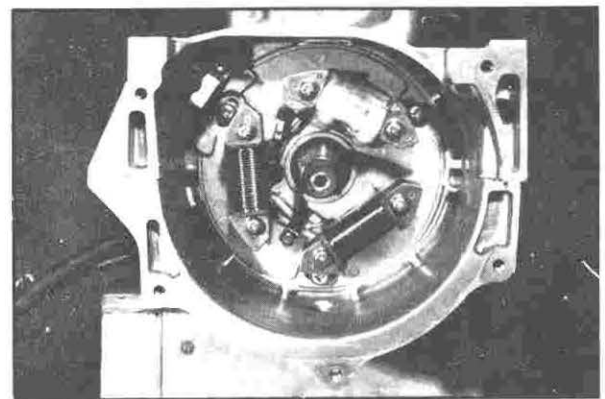
14. Install exhaust manifold gaskets and water manifold. Torque nuts to specification. Use caution when torquing nuts to avoid gasket damage.

Exhaust Manifold Nut Torque:

6 ft. lbs. (2.28 kgm)



15. Install and align stator plate with previous marks.

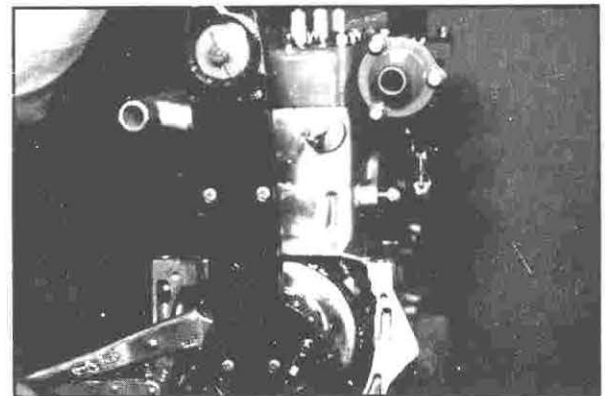


16. Install flywheel and flywheel nut. Using flywheel holder to hold flywheel, torque nut to specification.

Flywheel Nut Torque:

60 ft. lbs. (8.28 kgm)

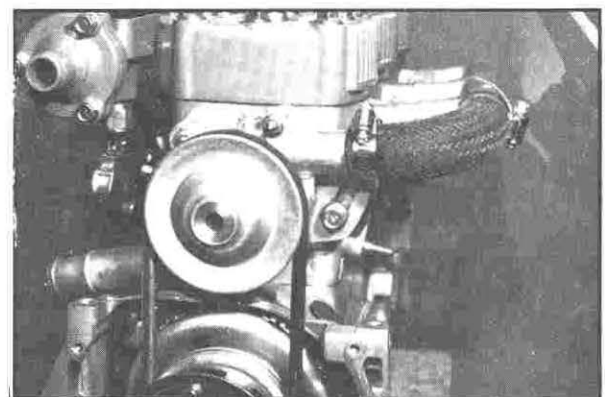
Flywheel Holder PN 8700229



17. Install water pump and pump belt. Adjust belt tension.

Water Pump Belt Deflection -

1/8 - 3/16" (.3 - .4 cm)



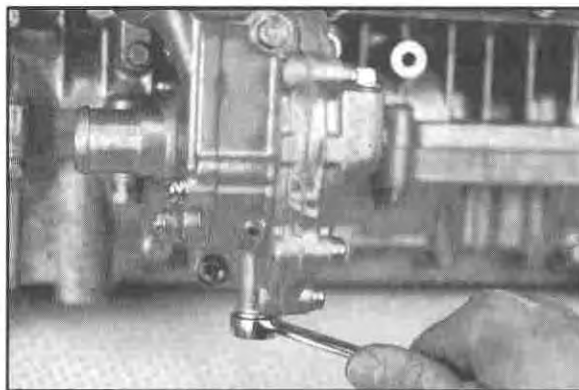
Assembly, Cont.

18. Install oil pump and connect feed lines to cylinder.
19. Install secondary coils.
20. Install carburetors, recoil housing and water pump belt guard.
21. Install exhaust manifold gaskets and exhaust manifold.
22. Refer to oil pump drive gear end play adjustment, page 3.89.

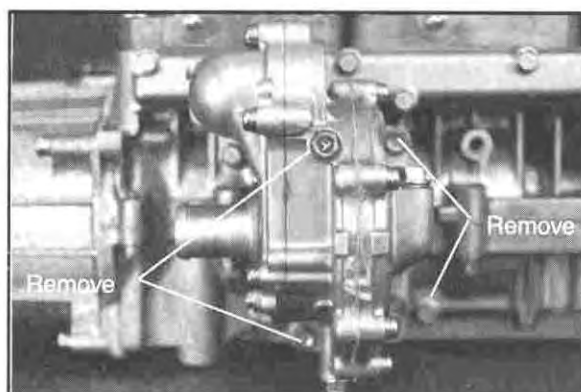
ENGINES EC59PL/EC68PL

Disassembly

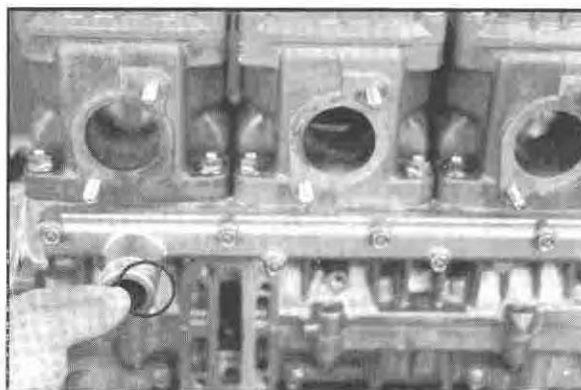
1. Drain lubricant from water pump drive gear case (1996 models).



2. Remove four bolts and pull water pump straight outward.

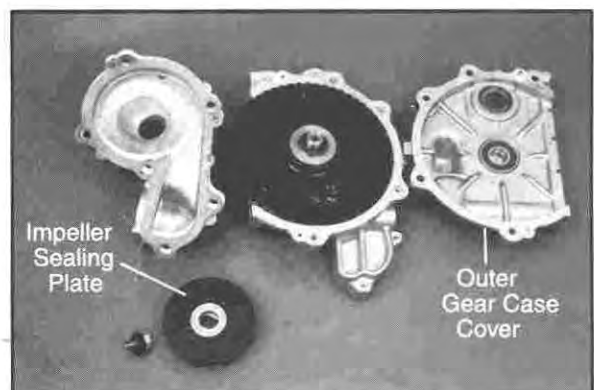
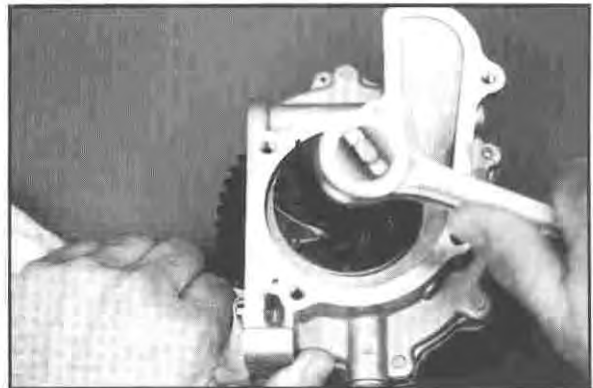
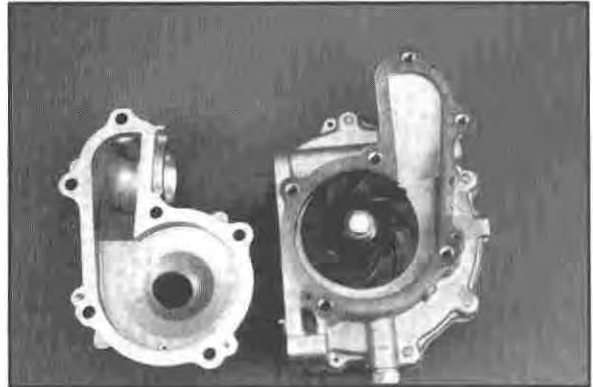


3. Inspect sealing O-ring on water pump manifold. Replace if worn or damaged.



Water Pump Disassembly/Inspection

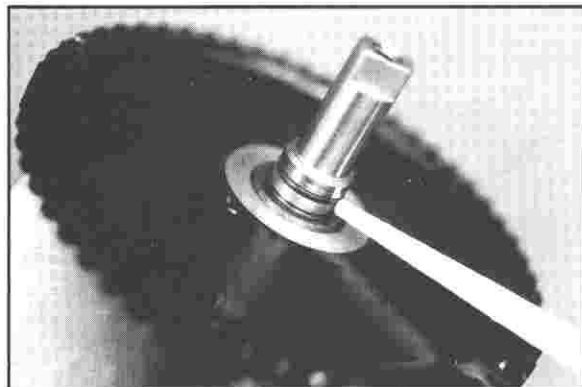
1. Remove (6) impeller housing cover bolts. Replace gasket and thoroughly clean surfaces prior to reassembly.
2. Remove impeller bolt and impeller.
3. Remove outer gear case cover. Remove impeller sealing plate from impeller. Inspect plate and rubber seal for corrosion or damage.
4. Use a soft faced hammer to drive gear and pump shaft assembly from pump housing.



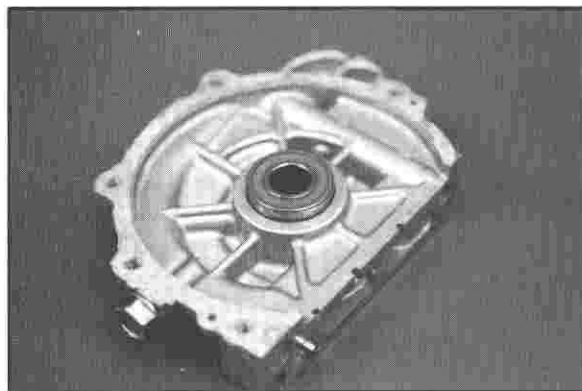
ENGINES EC59PL/EC68PL

Water Pump Disassembly/Inspection, Cont.

5. Replace O-ring on pump shaft upon reassembly. Drive or press mechanical seal assembly from case. Always replace the seal if removed. If coolant is evident in gearcase oil, replace mechanical seal.

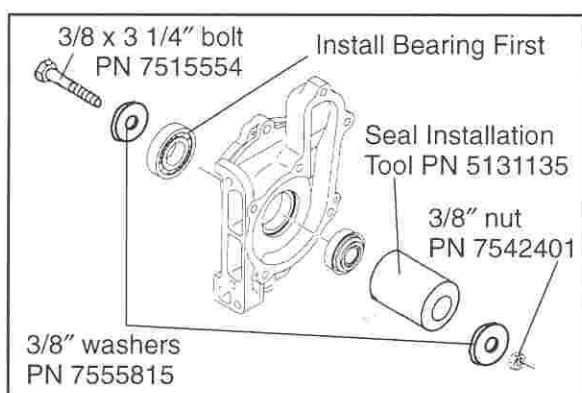


6. Inspect bearings in cover and pump housing, replace if worn. The bearing seal on gear case must be in good condition to prevent oil leaks. Replace the sealed bearing if oil leakage is evident at water pump weep hole.



7. Grease O-ring on pump shaft and install shaft in pump housing. Install new mechanical seal using seal installation tool kit PN 5131135 and parts hardware shown below.

Seal Installation Tool PN 5131135



Water Pump Disassembly/Inspection Cont.

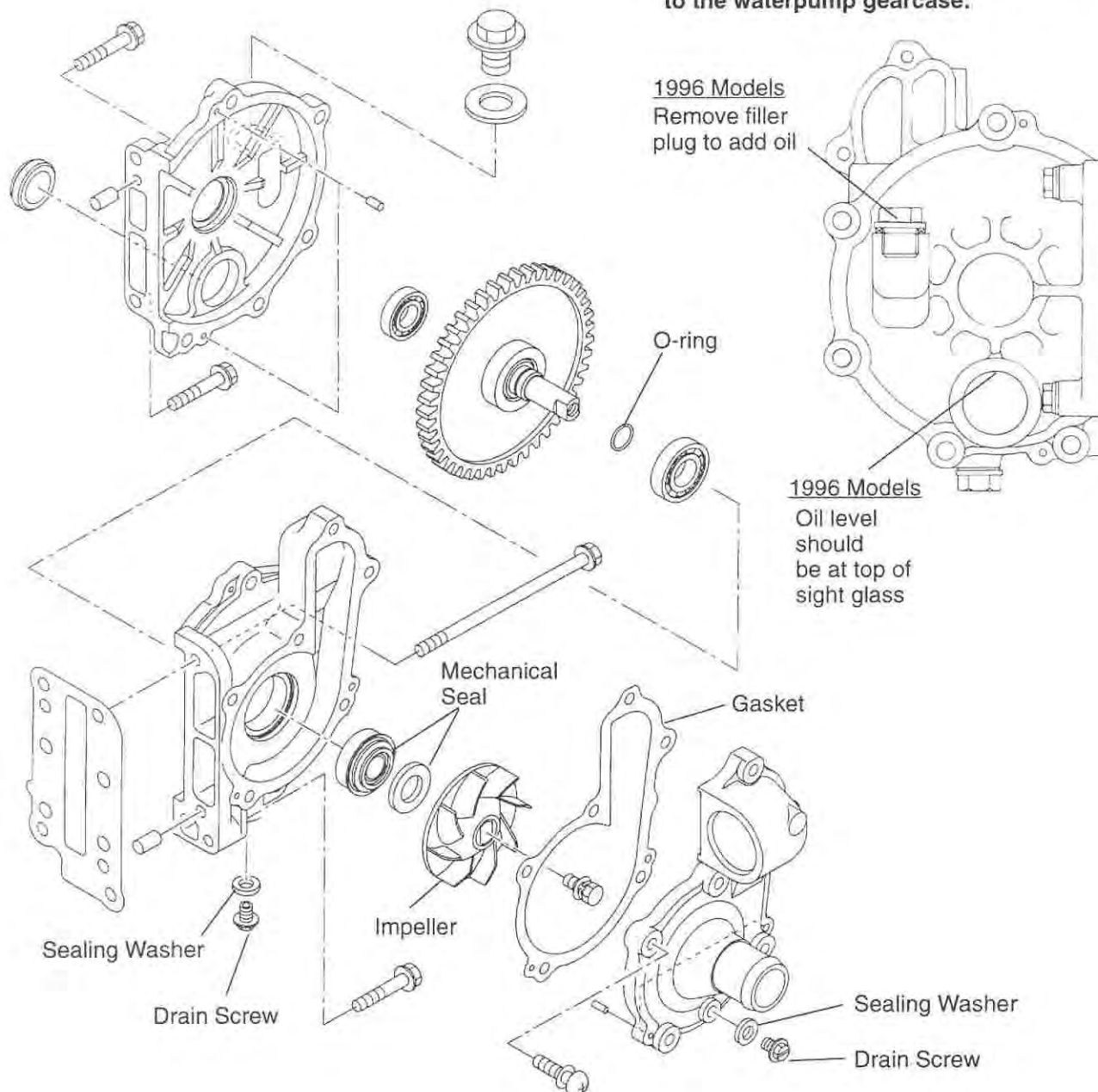
8. Install impeller, apply Loctite 242™ to bolt and torque to 72 in. lbs. (.83 kg-m).
9. Install impeller cover with new gasket and torque bolts to 72 in. lbs. (.83 kg-m).
10. Apply 3-Bond™ 1215 or Loctite 518 to sealing surfaces and install gearcase cover. Torque bolts to 72 in. lbs. (.83 kg-m).

Water Pump Gearcase Lubricant: (96 only)

Capacity: Approximately 50cc*
Type: Polaris All Season 0W40
Synthetic PN 2871281

*Fill to top of sight glass with engine installed.

Note: 97 models - do not add lubricant to the waterpump gearcase.

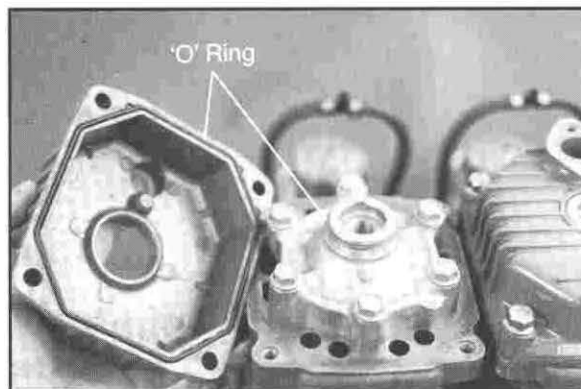


ENGINES
EC59PL/EC68PL
Disassembly, Cont.

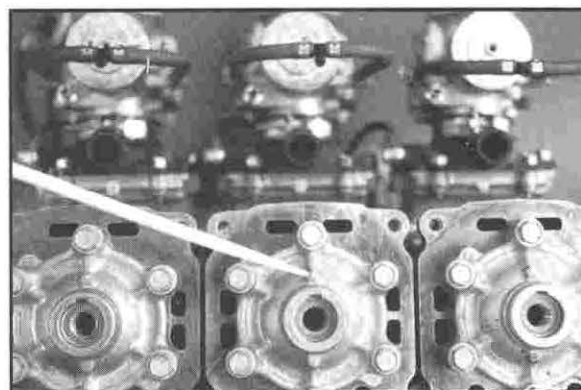
1. Remove water manifold and cylinder head covers.



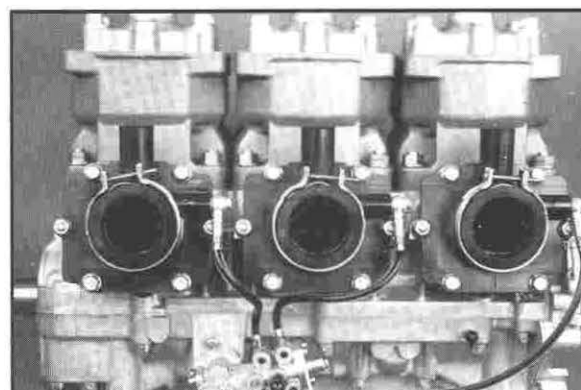
2. Inspect cylinder head cover O-rings.



3. Arrow on cylinder head points to intake.



4. Remove carburetor adaptors, reed valves, and disconnect oil lines. Refer to page 3.77 for reed valve inspection.



Disassembly, Cont.

5. Remove flywheel nut and washer. Install puller and remove flywheel. Align mark on stator plate with crankcase projection upon reassembly. Remove stator plate screws (3) with a hand impact driver.

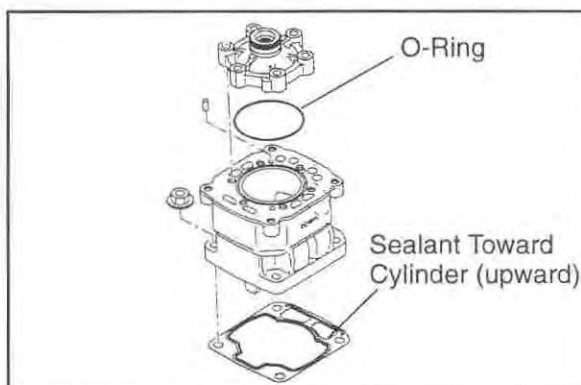
Flywheel Puller PN 2871043

Flywheel Holder PN 8700229



6. Remove cylinder heads, cylinder base nuts, and cylinders. Mark cylinders mag, center, PTO for reference. Replace O-rings and base gaskets. Install new base gaskets with sealant toward the cylinder.

NOTE: Refer to pages 3.79-3.90 for general inspection procedures.

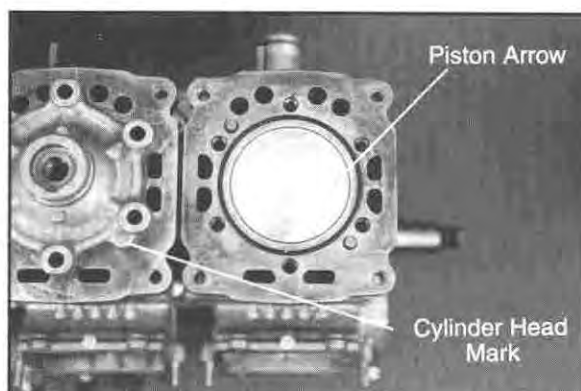


7. Identify pistons mag, center, and PTO. The arrow must point to Mag end of engine upon reassembly.

Cylinder Head Marking (EC68PL Engines)

EC68PL01 "C" Marked On Head

EC68PL04 "G" Marked On Head



8. Remove piston C-clips.

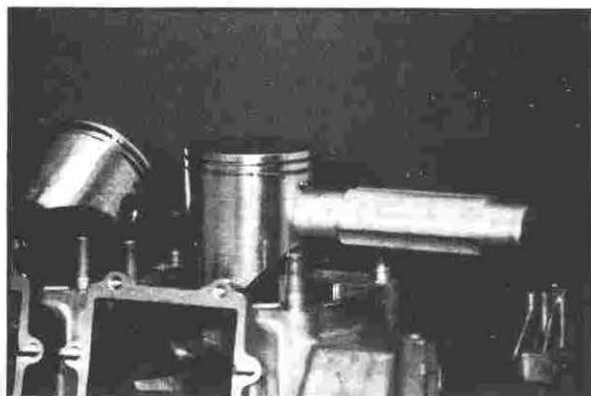


ENGINES EC59PL/EC68PL

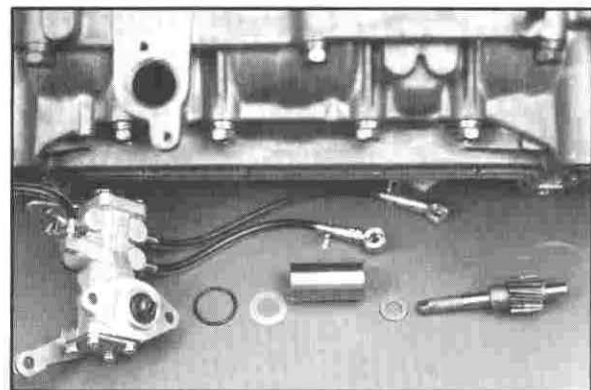
Disassembly, Cont.

9. Remove pistons using piston pin puller.

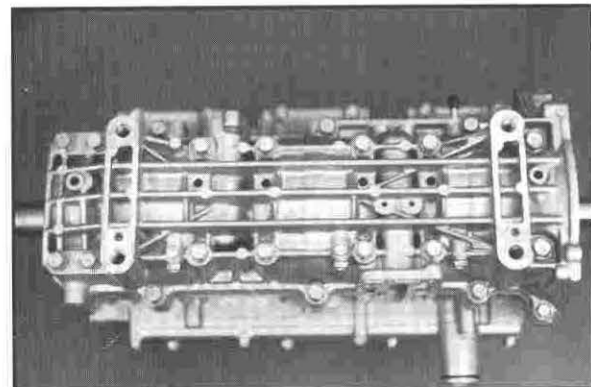
Piston Pin Puller PN 2870386



10. Remove oil pump. Note position of shim(s), spacer, and thrust washer for reassembly. Refer to page 3.88 for oil pump drive gear end play adjustment procedure.

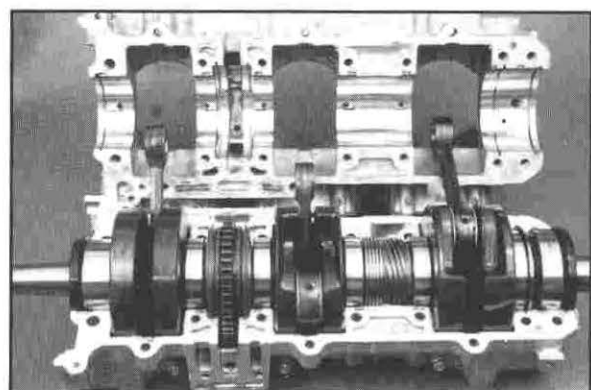


11. Remove crankcase bolts.



12. Tap crankcase lightly with a soft faced hammer to separate. Remove crankshaft from case.

NOTE: Refer to pages 3.79-3.90 for general inspection procedures.



Assembly

1. Replace crankshaft end seals.
2. Clean crankcase surfaces and apply a thin even layer of 3-Bond™ 1215 sealer to both halves.

3-Bond™ 1215

PN 2871557 120 Gram Tube

3. Align crankshaft bearing anti-rotation pins with relief in bottom case half.
4. Torque crankcase bolts to specification following pattern on page 3.6.

Crankcase Mounting Bolt Torque:

8mm - 18 ft. lbs. (2.48 kgm)

10mm - 26 ft. lbs. (3.59 kgm)

5. Measure piston to cylinder clearance and piston ring installed gap before cylinder installation.
6. Install pistons with arrow to mag (flywheel) end. Be sure "C" clips are fully seated with gap up or down.
7. Install keystone rings on pistons with beveled side up and flat side down. See page 3.87. Lubricate all top end components with Polaris Premium 2 Cycle Lubricant during assembly.
8. Install cylinder heads with new O-rings and arrows pointing to intake.
9. Install water pump on crankcase.

Water Pump Bolt Torque:

8-10 ft. lbs. (1.11-1.38 kgm)

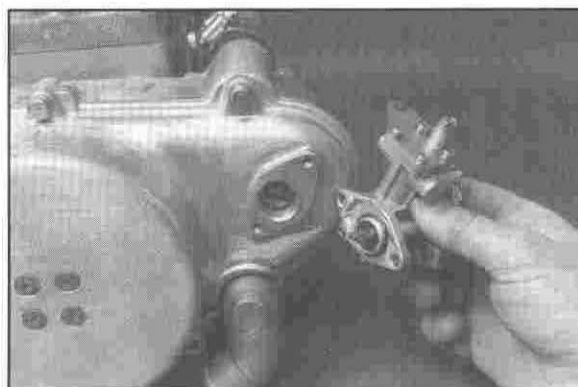
10. Align mark on stator plate with crankcase projection. Apply Loctite™ 242 to stator plate screws and tighten securely.
11. Apply Loctite™ 242 to flywheel nut threads. Torque nut to **60-65 ft. lbs. (8.30 - 8.99 kg-m)**.
12. Install recoil hub and torque bolts to **8-10 ft. lbs. (1.11 - 1.38 kg-m)**.
13. Install oil pump and torque screws to **4-6 ft. lbs. (.55 - .83 kg-m)**.
14. Bleed oil pump and cooling system as outlined in Maintenance section after engine installation.
15. Fill and bleed cooling system as outlined on page 3.91.
16. Inspect ignition timing.

ENGINES

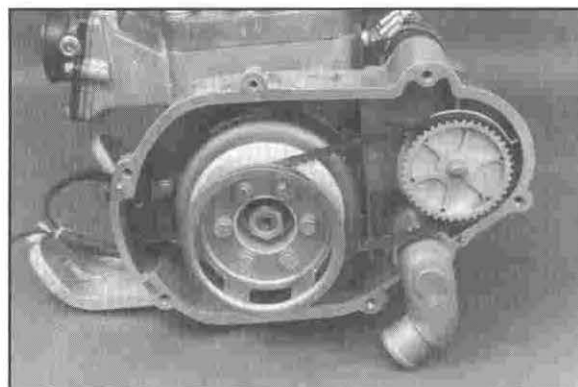
700 Case Reed

Disassembly

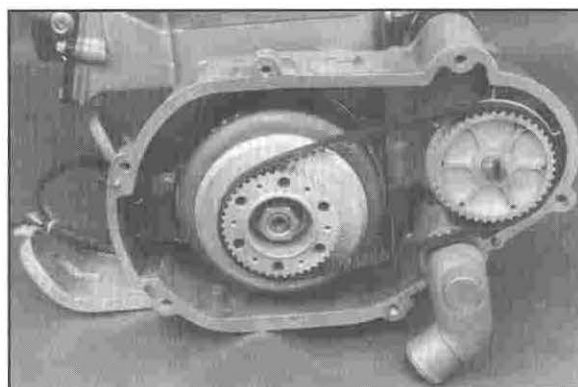
1. Remove oil pump.



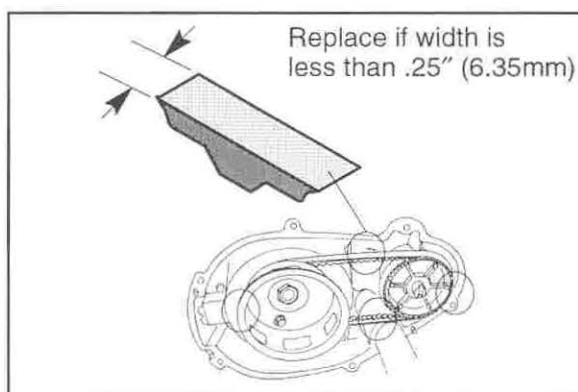
2. Remove recoil housing.



3. Remove recoil hub. Inspect waterpump drive belt for missing, cracked, or broken drive cogs. Replace if worn.



Measure the belt at 4 different points as shown. Replace if width is less than .25" (6.35mm). Nominal new width is .345" (8.75mm). Refer to engine assembly for installation tips.



Disassembly, Cont.

4. Remove drive gears and belt.
5. Remove flywheel nut using flywheel holder.

Flywheel Holder

PN 8700229

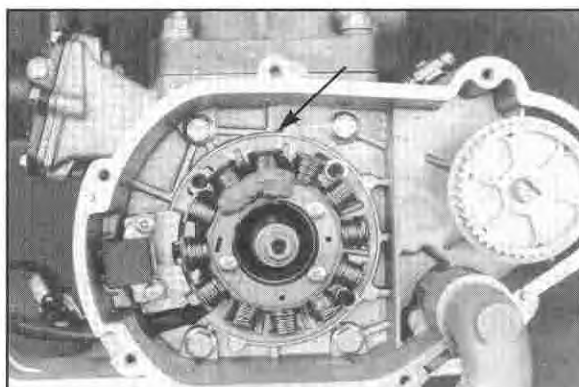
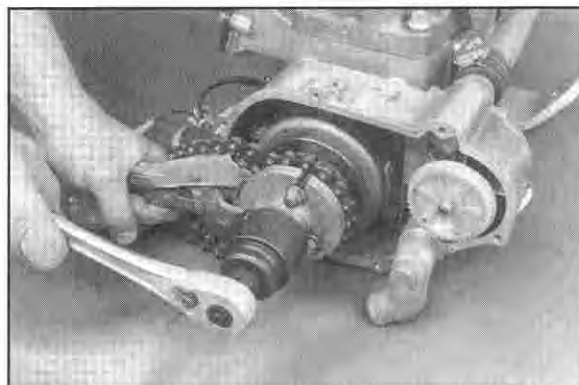
6. Remove flywheel using flywheel puller.

Flywheel Puller

PN 2871043

7. Note the ignition timing strip on the flywheel.

8. Before removing stator plate, note where ignition timing marks are located.

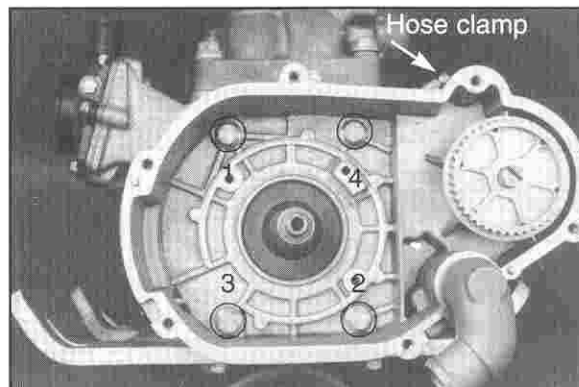


ENGINES

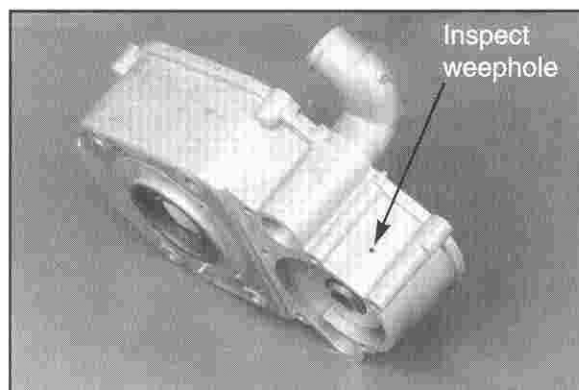
700 Case Reed

Disassembly, Cont.

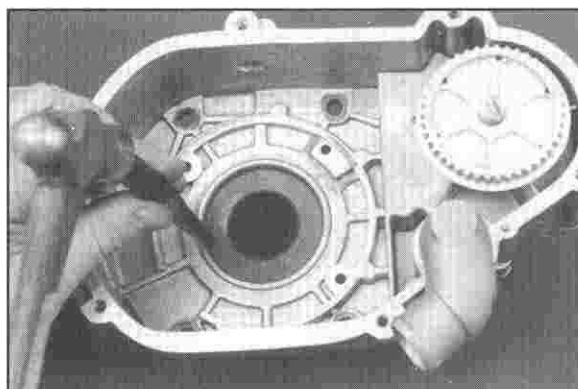
9. Remove four bolts holding water pump housing to crankcase. Loosen hose clamp and remove housing.



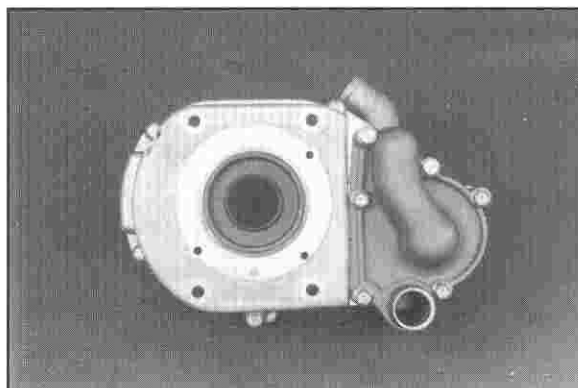
10. Inspect water pump weep hole for signs of leakage or blockage.



11. Inspect crankshaft seal and replace if necessary. Remove seal by driving from outside toward engine. Replace seal if removed.

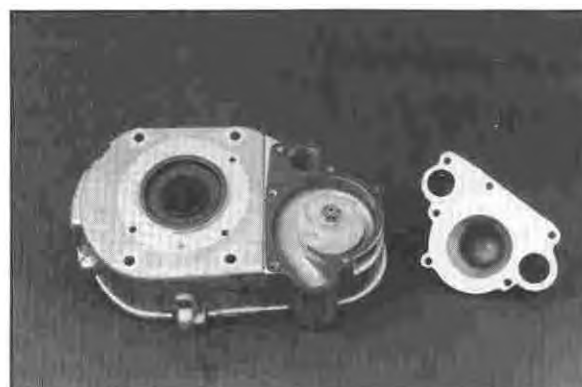


12. Remove water pump cover bolts.



Disassembly, Cont.

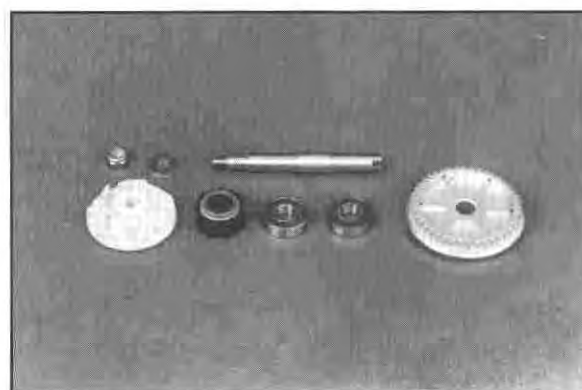
13. Remove impeller retaining nut, washer, impeller, and 10x14mm washer.



14. Slide shaft assembly out of cover.



15. Inspect bearings. Replace if necessary. Replace mechanical seal using the special tools listed below. Use the seal press to install a new mechanical seal in cover with spring sleeve toward impeller housing. Install seal guide over end of shaft and apply a light film of grease to seal guide. Carefully install shaft and bearings in cover. Assemble 10x14mm washer, impeller, washer, and nut. Torque impeller nut to specification.



Seal Guide 2871846

Seal Press 2871847

Impeller Nut Torque

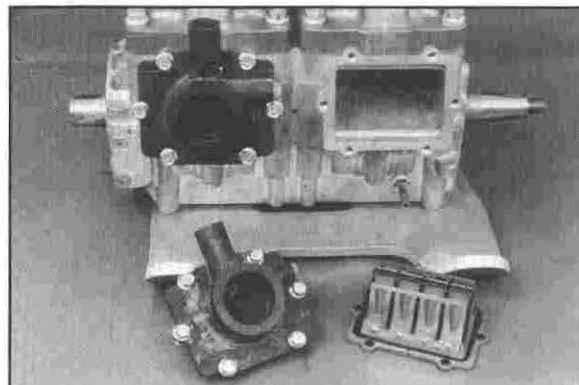
10 ft. lbs. (1.38 kg-m)

ENGINES

700 Case Reed

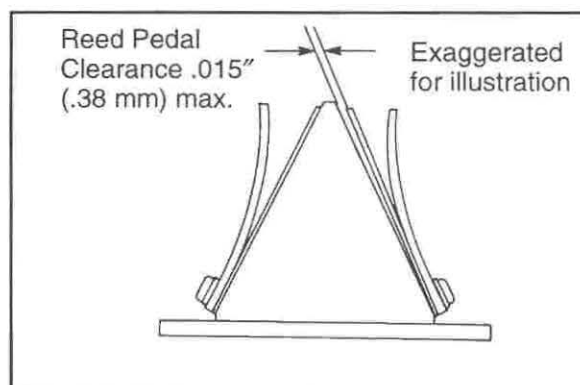
Disassembly, Cont.

16. Remove reed cover, reed stuffers, and reeds.

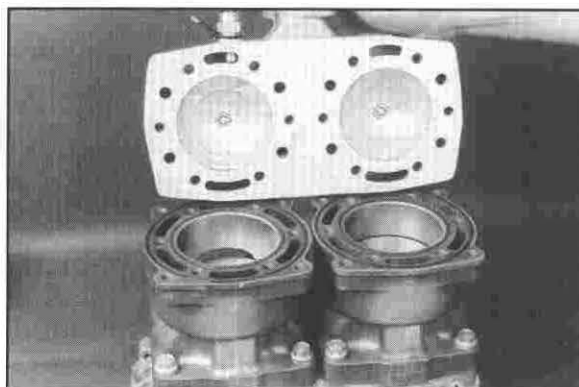


Reed Valve Inspection

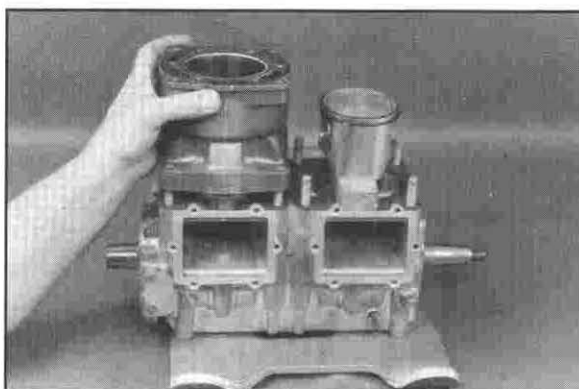
17. Measure air gap between fiber reed and reed block as shown. The air gap should not exceed .015" (.4 mm). If clearance is excessive DO NOT attempt to reverse the reeds to reduce the air gap. *Always replace them if damaged.* Check each fiber reed for white stress marks or missing material. Replace if necessary.



18. Remove cylinder head. Note condition and placement of both cylinder head O-rings. Refer to pages 3.80-3.85 for general inspection procedures.

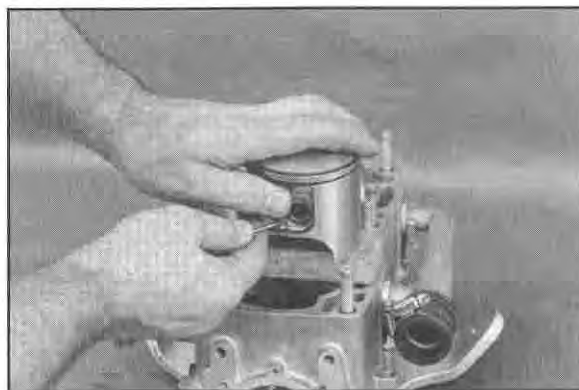


19. Loosen cylinder base nuts and remove cylinders.



Disassembly, Cont.

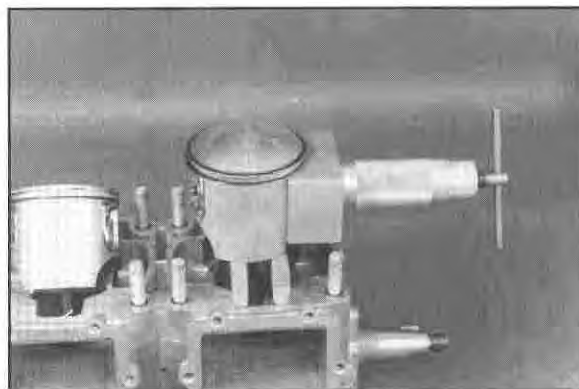
20. Carefully remove C-clip holding piston pin in place.



21. Remove piston pin using piston pin puller and adaptor.

Piston Pin Puller PN 2870386

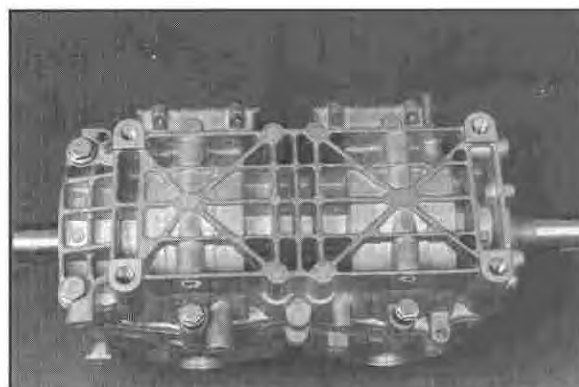
Adaptor PN 2871445



22. Remove water manifold by removing both retainer brackets.



23. Remove bottom crankcase bolts and separate crankcase halves.

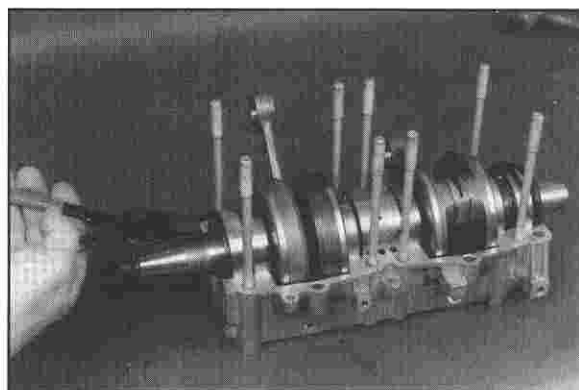


ENGINES

700 Case Reed

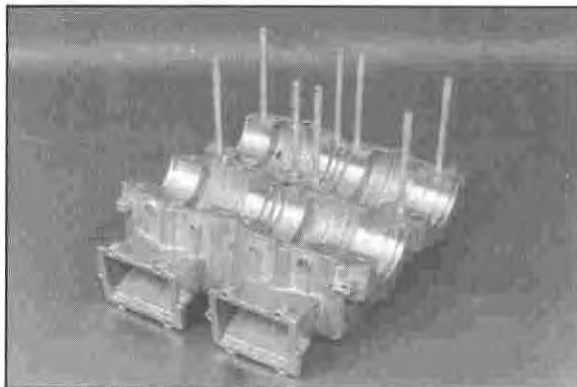
Disassembly, Cont.

24. Remove snap rings and crankshaft seals. For crankshaft/crankcase inspection procedure, refer to pages 3.81-3.85.
25. Clean thoroughly to remove all grease, oil, dirt, and old sealant.



Assembly

1. Clean all parts with solvent.

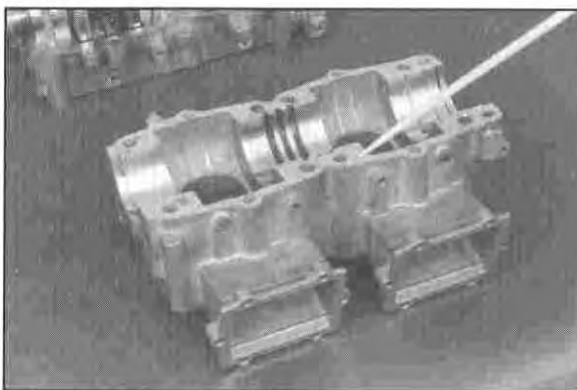


2. Apply 3-Bond™ 1215 sealant to upper crankcase half.

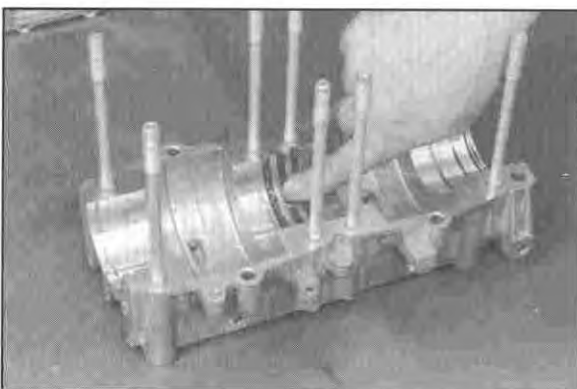
NOTE: Use only 3-Bond™ 1215 sealant. Curing time and film thickness are critical for proper bearing clearance.

3-Bond™ 1215

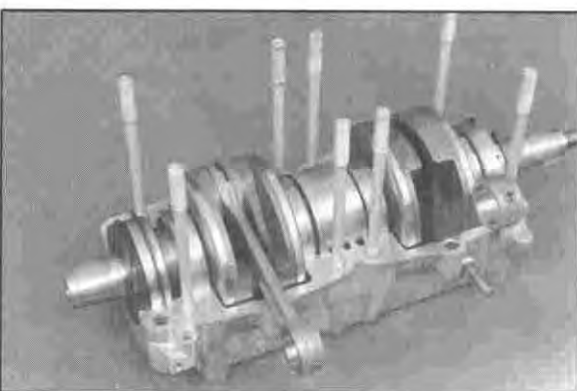
PN 2871557 120 Gram Tube



3. Grease labyrinth seal.



4. Set crankshaft in lower crankcase. Lubricate seal lips with Premium All Season Grease. Make sure seals are positioned properly with lip and spring facing inward toward crankshaft. Install snap rings with gap facing upward toward upper case half.



ENGINES

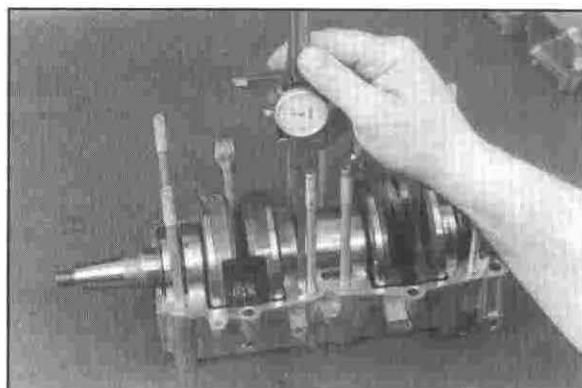
700 Case Reed

Assembly, Cont.

5. If studs were removed or new crankcase installed, apply Loctite™ 242 to threads of studs and screw in until bottomed. Tighten securely.
6. Measure installed length of stud bolt. This is the length necessary to allow cylinder installation.

Lower Crankcase Stud Height

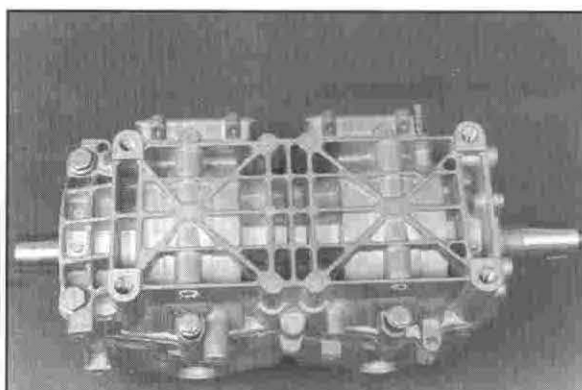
121-124 mm (4.76-4.88") from crankshaft parting line.



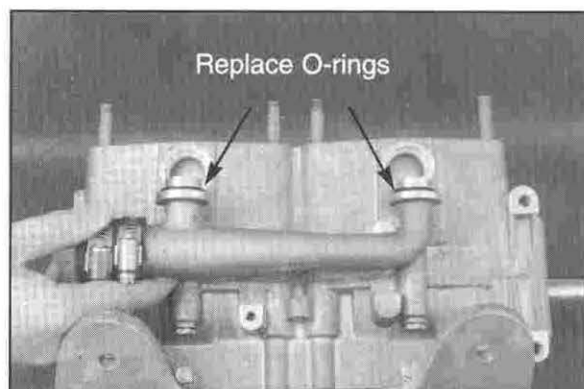
7. Install crankcase halves together. Torque bottom crankcase bolt to specification in the proper sequence.

Crankcase Mounting Bolt Torque:

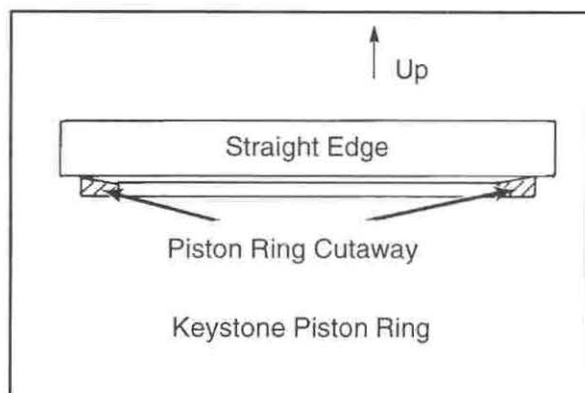
8mm - 18 ft. lbs. (2.48 kgm)
10mm - 26 ft. lbs. (3.59 kgm)



8. Install new O-rings on water manifold. Grease O-rings and install manifold.

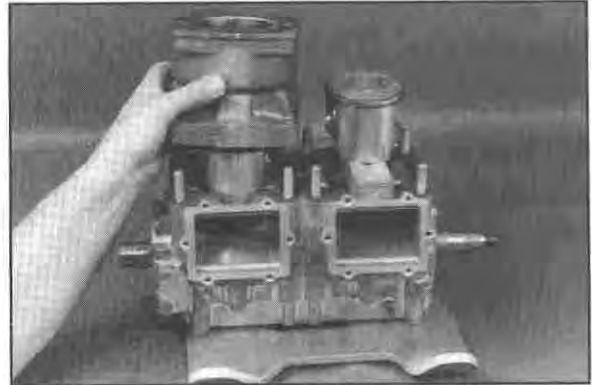


9. Install pistons and rings. Make sure C-clips are firmly seated in grooves. **NOTE:** Keystone ring bevel must be up. Marking near ring end gap faces upward.



Assembly, Cont.

10. Lubricate pistons, rings, upper rod bearing, and cylinders with two stroke oil and install cylinders. Loosely install cylinder nuts.



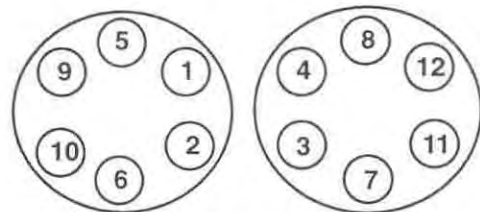
11. Install new cylinder head O-ring and install cylinder head. Make sure O-ring is properly seated in groove. Apply Loctite 242 to threads of head bolts and install.

NOTE: Torque cylinder head bolts prior to torquing cylinder base nuts.



12. Torque head bolts in proper sequence.

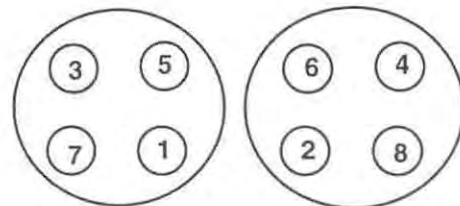
Head Bolt Torque
24 Ft lbs (3.3 kgm)



600 / 700 Cylinder Head

13. Torque cylinder base nuts in proper sequence.

Cylinder Base Nut Torque
30 - 34 Ft lbs (4.15 - 4.70 kgm)



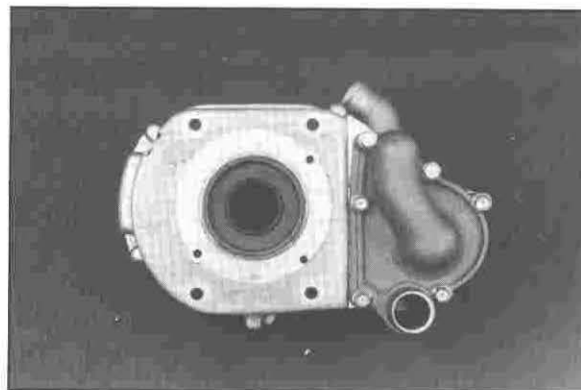
600 / 700 Cylinder Base

ENGINES

700 Case Reed

Assembly, Cont.

14. Reassemble water pump carefully installing seal.

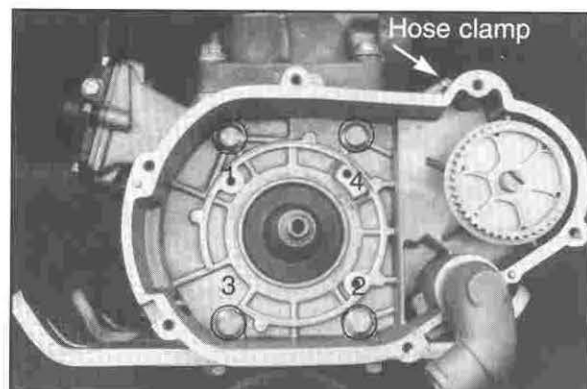


15. Install crankcase seal to ignition/water pump housing from inside toward outside. Spring and seal lip must face inward toward crankshaft. Seal lip bottoms on housing.

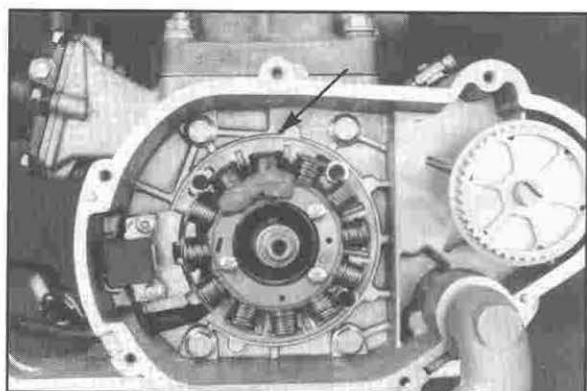


16. Apply 3 Bond™ sealant to pump housing crankcase mating surface and carefully install onto crankcase. Tighten water pump to engine hose clamp and torque bolts to specification.

Ignition/Water Pump Housing Torque
22 Ft. lbs (3.04kgm)



17. Align timing marks and install stator.



Assembly, Cont.

18. Apply Loctite™ 262 evenly to flywheel taper. Install flywheel key and flywheel. Apply Loctite™ 242 to crankshaft threads. Torque nut to specification.

Flywheel Nut Torque -

60-65 ft. lbs. (8.28-8.97 kg-m)

Flywheel Holder

PN 8700229

19. Install water pump belt and recoil hub.

Recoil Hub Bolt Torque -

96-108 in. lbs. (1.11 - 1.25 kg-m)

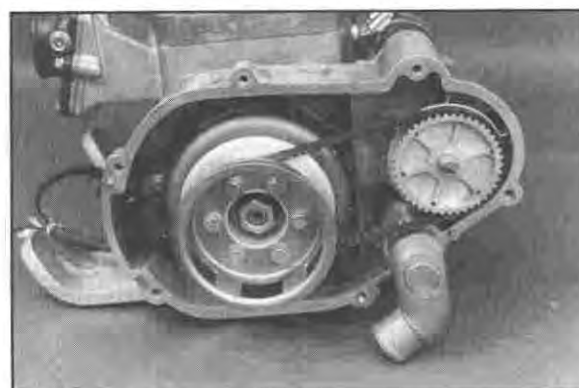
20. To verify concentricity of the drive hub, rotate the flywheel 1/8 turn at a time while checking belt deflection. Tension should be even at all points without any tight spots. If a tight spot is found, place four 1/2" (12.7mm) lengths of 1/2" wide masking tape on outer circumference of the flywheel hub as shown at right. This will center the drive pulley on the flywheel hub and ensure even tension on the belt in all crankshaft positions.

Water Pump Belt Width Service Limit

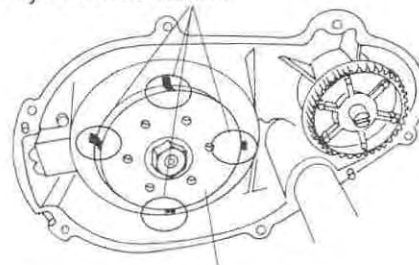
1/4" (6.35 mm) Minimum Width

21. Install recoil cover and oil pump. Make sure oil pump drive slot mates properly with water pump shaft. Torque oil pump mounting bolts to specification.

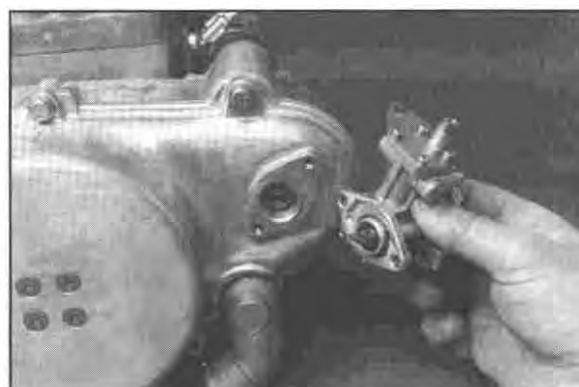
22. Install reed valve, reed stuffer, and reed cover.



Place tape every 90° over edge of hub and onto flywheel as shown



Do not apply tape to face of hub.

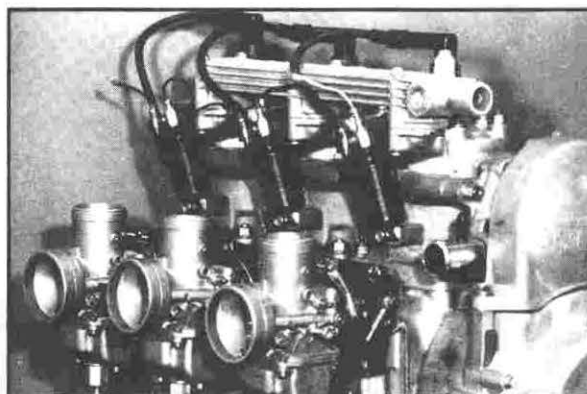


ENGINES

800 Case Reed

Disassembly

1. Remove carburetors, water outlet manifold, secondary coils, oil pump and reed valve cage assemblies. **NOTE:** Mark each components mag, center, and PTO so they will be in the correct location when reassembling.

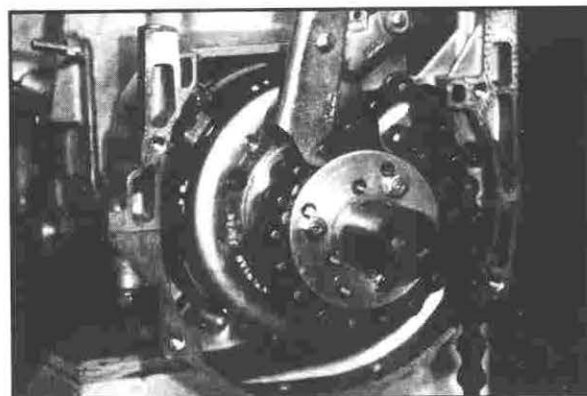


2. Remove recoil housing, water pump belt guard, water pump and flywheel nut.

Flywheel Holder PN 8700229

3. Install flywheel puller and remove flywheel.

**Flywheel Puller
PN 2871043**



CAUTION:

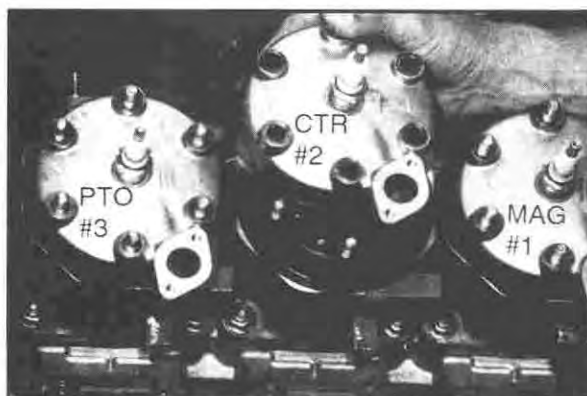
Do not thread puller bolts more than 3/8" (0.5 mm) into flywheel or coil damage may occur.

Disassembly, Cont.

4. Mark stator plate at case parting line and remove plate.



5. Remove remainder of head nuts and cylinder base nuts.
6. Carefully remove cylinders. Measure piston to cylinder clearance and piston ring installed gap. Refer to pages 3.80-3.85 for general inspection procedures.



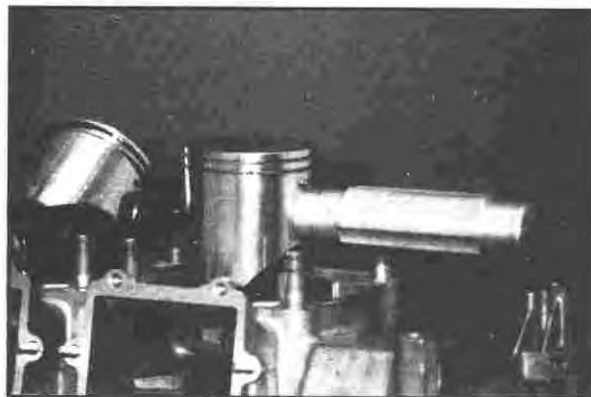
7. Remove C-clip retainers.



8. Use piston pin puller to remove piston pins.

Piston Pin Puller

PN 2870386

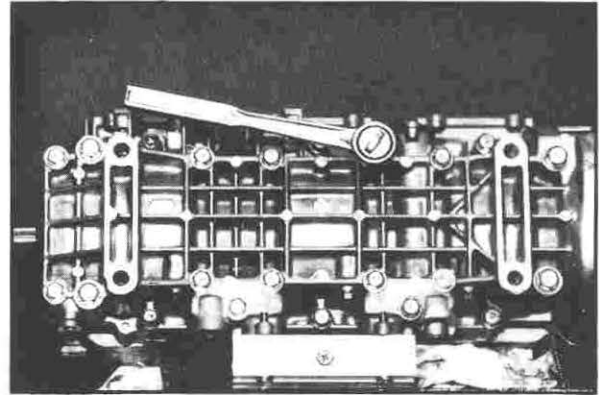


ENGINES

800 Case Reed

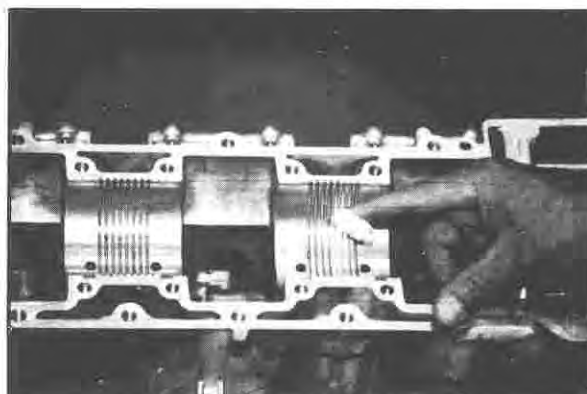
Disassembly, Cont.

9. Remove crankcase bolts and separate crankcase halves.
10. Inspect crankcase and crankshaft as outlined on pages 3.81-3.85.
11. Clean crankcase thoroughly to remove all grease, oil, dirt, and old sealant.

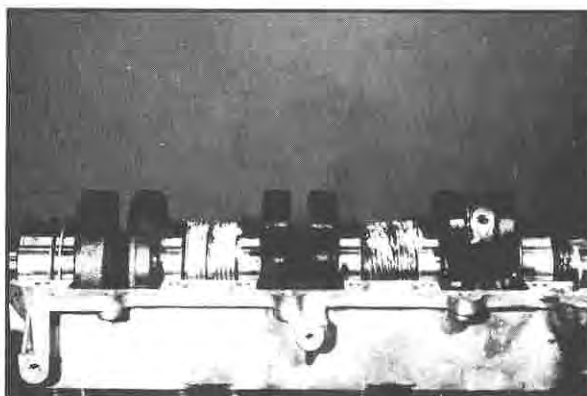


Assembly

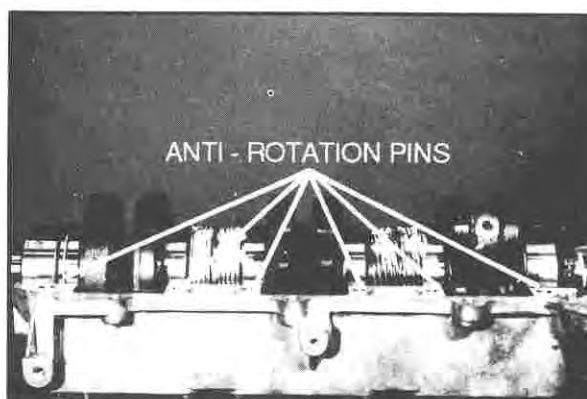
1. Grease oil pump drive gear and labyrinth seal area.



2. Grease end seals and oil pump drive gear.



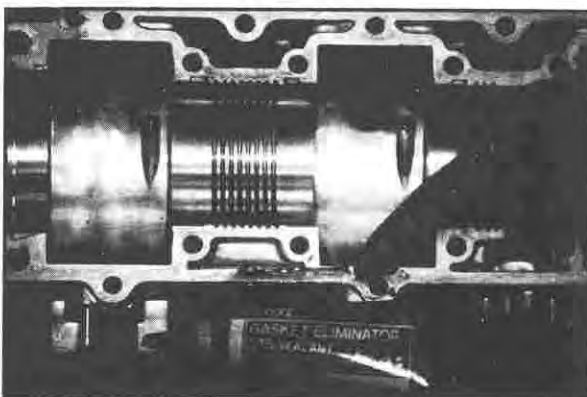
3. Position anti-rotation pins with relief in case.



4. Apply a light film of 3 Bond™ 1215 to crankcase and reassemble halves.

3-Bond™ 1215

PN 2871557 120 Gram Tube



ENGINES

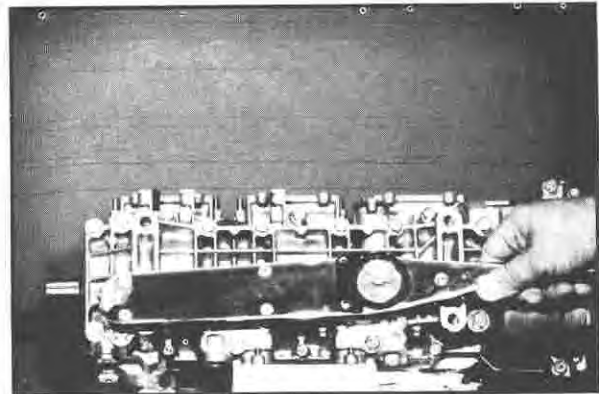
800 Case Reed

Assembly, Cont.

5. Install bolts and torque to specifications and pattern found on page 3.5 and 3.6.

Crankcase Mounting Bolt Torque:

8mm - 18 ft. lbs. (2.48 kgm)
10mm - 26 ft. lbs. (3.59 kgm)



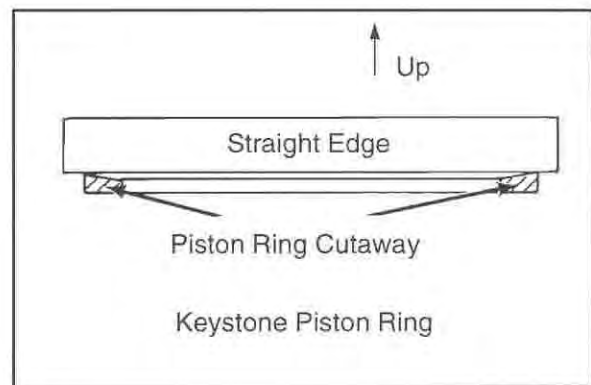
6. Install piston pin bearings.
7. Install piston with arrow (▶) toward flywheel.
8. Install C-clip retainers using tool. **NOTE:** The C-clip opening should be in the up or down position.

C-Clip Retainer Installation Tool

PN 2870773



9. Lightly oil rings and cylinder. **NOTE:** Keystone ring bevel must be up. Marking near ring end gap faces upward.



10. Carefully compress rings and install cylinder over piston. Torque cylinder base nuts to specification.

Cylinder Base Nut Torque:

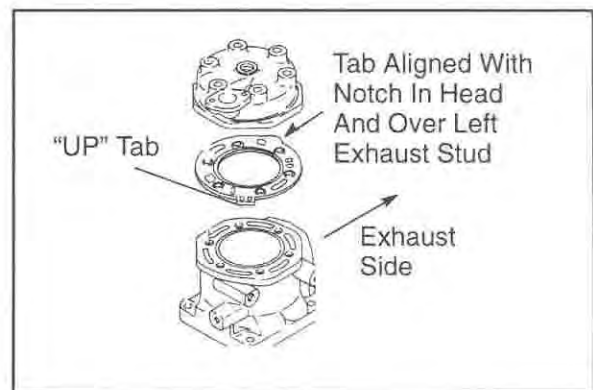
28 ft. lbs. (3.86 kgm)



Assembly, Cont.

11. Install new head gasket with the rounded tab positioned directly over the left exhaust flange stud and the "UP" tab under the water outlet of head. When properly installed on the cylinder the word "UP" and "80" should be readable. All head gaskets are the same thickness.

Head Gasket Thickness .8mm

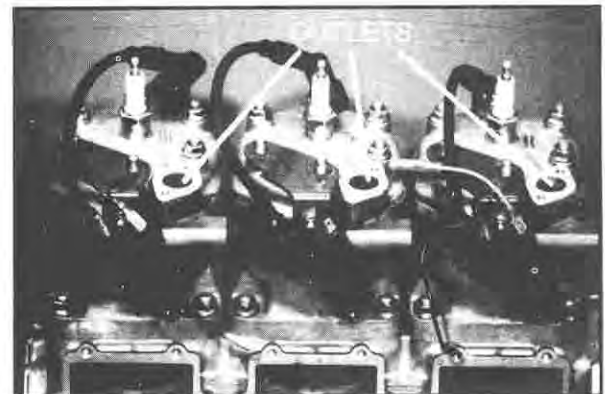


12. Install heads, positioning outlets as shown. Make sure coils are in correct position and torque head nuts to specification.
 - Storm coolant outlet restrictor plates must be positioned as follows for proper cooling:

PTO 11 mm
Center 12 mm
Mag 13 mm

Cylinder Head Nut Torque:

18 ft. lbs. (2.48 kgm)

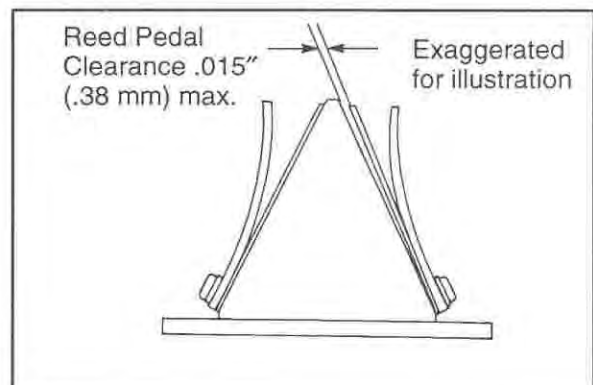


Reed Valve Inspection

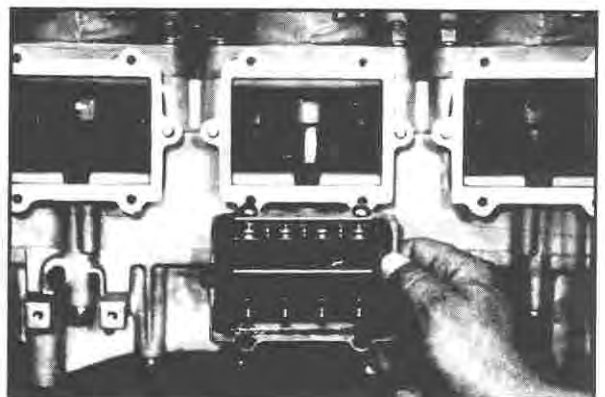
13. Measure air gap between fiber reed and reed block as shown. The air gap should not exceed .015" (.4 mm). If clearance is excessive DO NOT attempt to reverse the reeds to reduce the air gap. *Always replace them if damaged.* Check each fiber reed for white stress marks or missing material. Replace if necessary.

Reed Air Gap - Maximum

.015" (.4 mm)



14. Install reed cages.



ENGINES

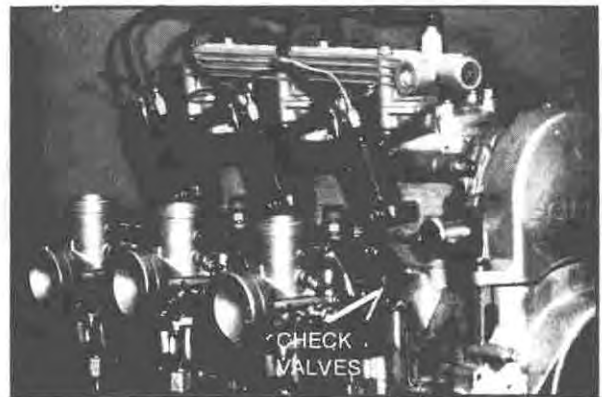
800 Case Reed

Assembly, Cont.

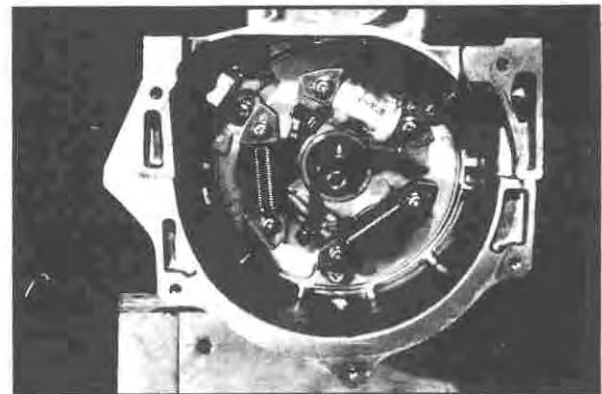
15. Install carburetor mounting flanges.

CAUTION:

Position oil check valve as shown.



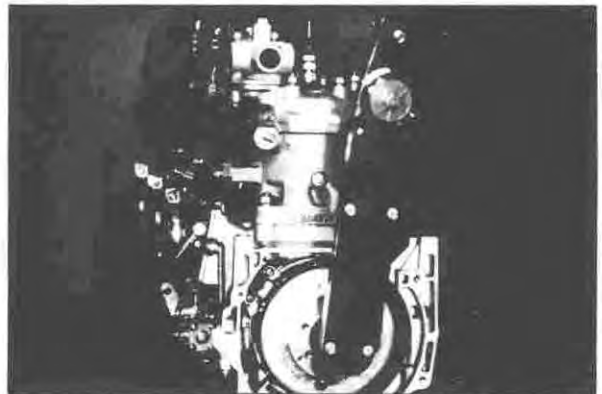
16. Install oil pump drive gear in correct sequence.
17. Check oil pump drive gear end play. See adjustment on page 3.89.
18. Install oil pump.
19. Position stator plate at previously marked position and secure in place.



20. Torque flywheel nut to specification. Install new O-ring on water pump and grease lightly. Install pump, recoil cup, and belt.

Flywheel Nut Torque:

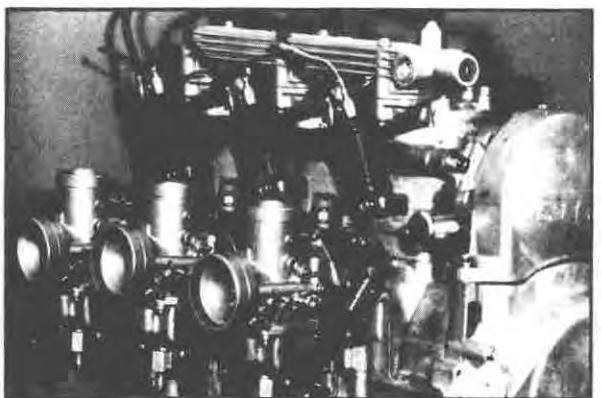
65 ft. lbs. (8.97 kgm)



21. Adjust tension on water pump belt by loosening mounting bolts, applying tension, and re-tightening bolts. Install recoil housing and belt guard.

Water Pump Belt Deflection -

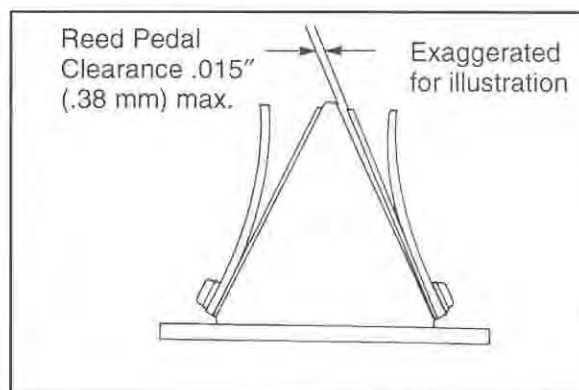
1/8 - 3/16" (.3 - .4 cm)



Disassembly

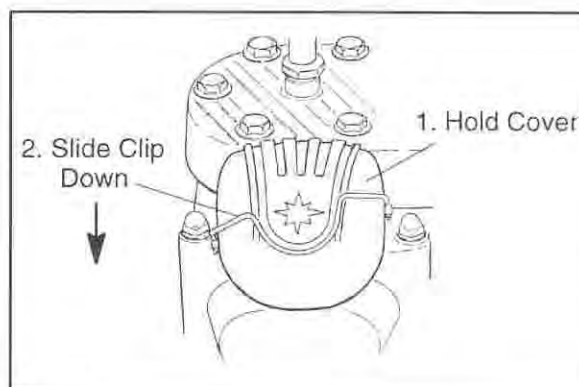
1. Remove carburetor mount adaptors, reed cages, stuffers, and oil pump. Note position of stator wire guide.

Measure air gap between fiber reed and reed block as shown. The air gap should not exceed .015" (.4 mm). If clearance is excessive DO NOT attempt to reverse the reeds to reduce the air gap. *Always replace them if damaged.* Check each fiber reed for white stress marks or missing material. Replace if necessary.



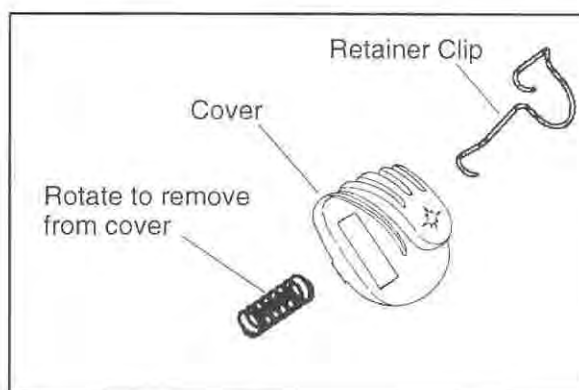
V.E.S. Removal

2. Pull back cover retainer clip while holding the cover in place.
3. Remove cover and return spring.



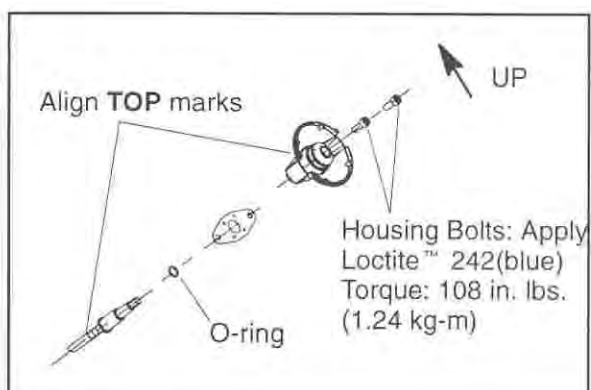
4. If the spring stays in the cover, hold the cover with spring facing toward you. Rotate spring in a counterclockwise direction while pulling outward on the spring. Do not distort the spring upon removal.

CAUTION: Do not attempt to remove the plastic valve piston at this time. The bellows must first be removed from the piston or damage may occur to the bellows or piston.



5. Remove two (5mm) hex screws from valve housing.
6. Note location of "TOP" marks on housing and exhaust valve. Lift entire valve assembly from cylinder along with gasket.

NOTE: Refer to Maintenance Chapter page 2.28a - 2.28e for cleaning and inspection procedure.

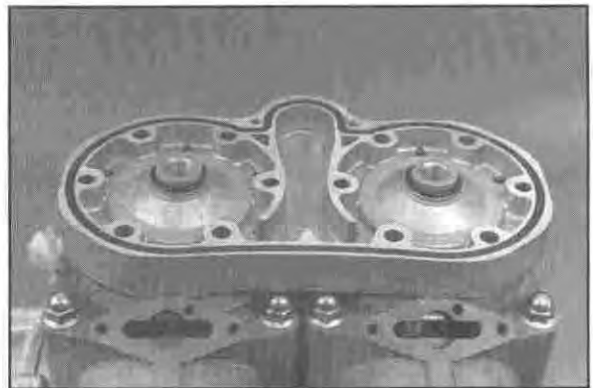


ENGINES

SN44 Case Reed

Disassembly, Cont.

7. Remove cylinder head cover and inspect O-rings (A, B) and sealing surfaces for damage.



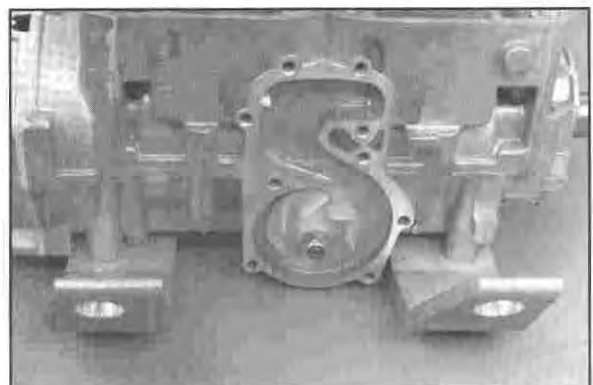
8. Remove cylinder head and inspect all O-ring sealing surfaces and grooves for damage or debris. Use new O-rings upon reassembly.
9. Remove cylinder base nuts. Note location of acorn nuts on exhaust side (where applicable).
10. Carefully remove cylinders while supporting pistons and connecting rods to prevent piston damage. Refer to pages 3.80-3.85 for general inspection procedures.
11. Remove outer piston pin C-clips using a scribe through access slot in piston.
12. Place support block under piston and remove piston pins using pin puller.



Piston Pin Puller	PN 2870386
Support Block	PN 2870390

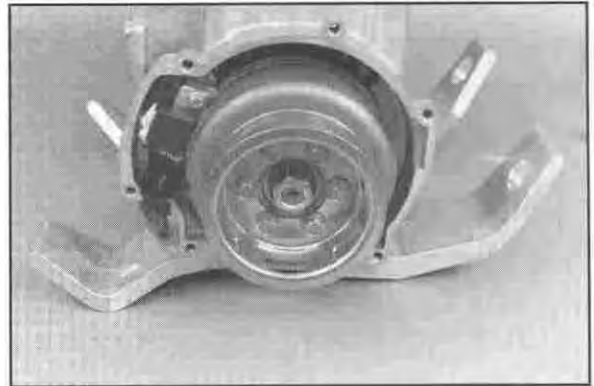


13. Remove water pump cover from front of engine.



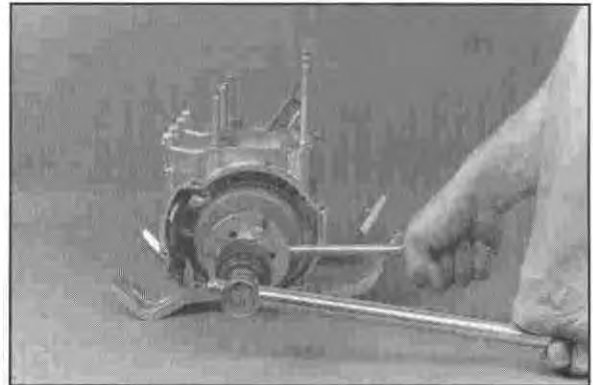
Disassembly, Cont.

14. Remove recoil housing and drive hub.

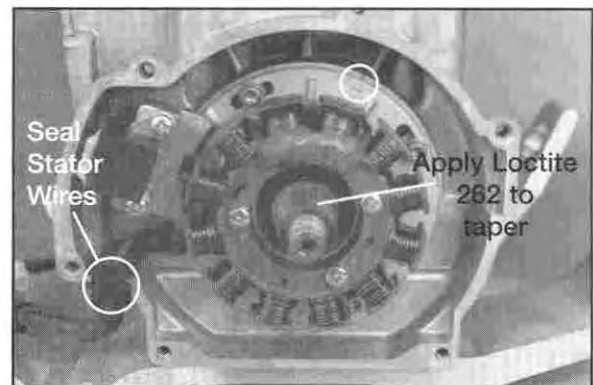


15. Remove flywheel using heavy-duty flywheel puller.
Use drive clutch puller T-handle to hold puller.

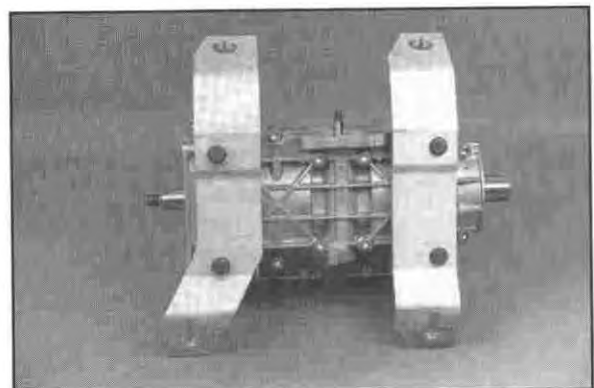
Flywheel Puller	PN 2871043
T-Handle	PN 5020326



16. Before removing stator plate, note where ignition timing marks are located, or scribe additional marks for reference upon reassembly.



17. Mark or note location of engine mount straps and remove.

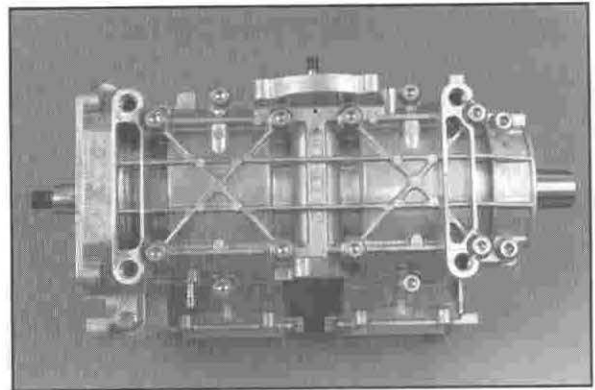


ENGINES

SN44 Case Reed

Disassembly, Cont.

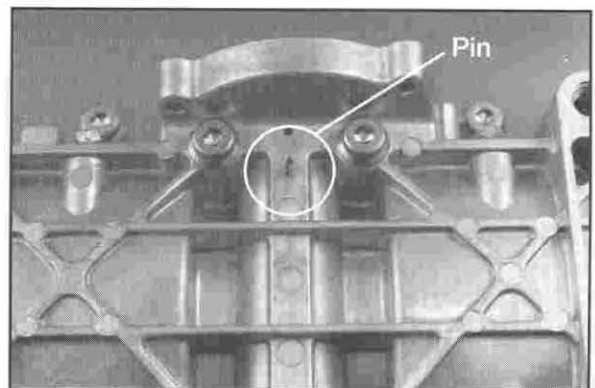
18. Remove bolts and separate case halves. Keep bolts in order for assembly.



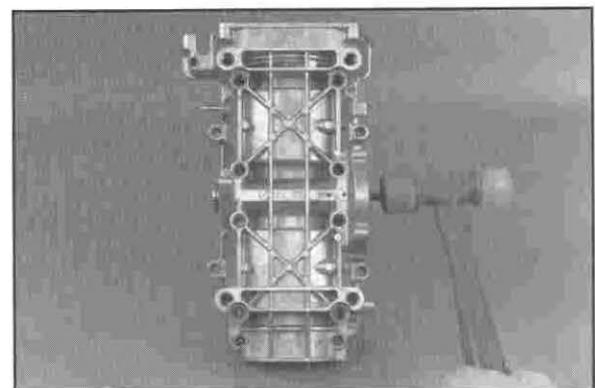
19. To prevent damage to snap-ring grooves, lift crankshaft straight upward and out of lower case.



20. If pump shaft removal is necessary, remove retaining pin from crankcase using a diagonal cutter or similar tool.

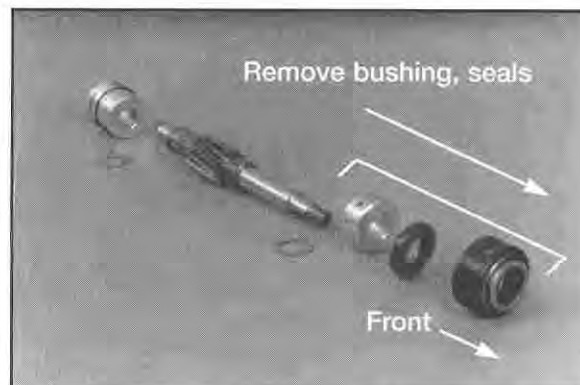


21. Using a soft faced hammer, tap pump shaft out of lower case half from front (water pump side) to rear (oil pump side). Note location washers on the shaft.



Disassembly, Cont.

22. Press front bushing, oil seal and mechanical seal out of lower crankcase using a suitable (soft) drift from the oil pump (rear) side. Be careful not to damage bushing.

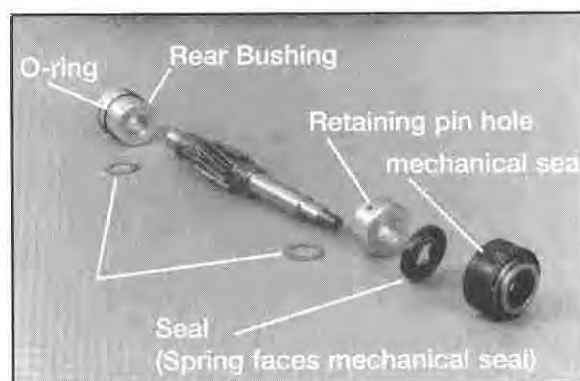
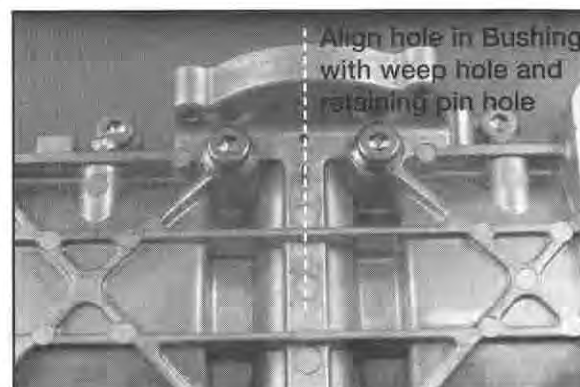


Assembly

1. Insert bushing into case on water pump side using weep hole to align hole for retaining pin. Press in until firmly seated in case. Install retaining pin. Tap in until seated in bushing

NOTE: If front bushing is replaced it may be necessary to drill a retaining pin hole in the new bushing. If there is no hole in the bushing:

- Install bushing in crankcase as described above.
 - Remove the retaining pin from lower crankcase.
 - Using the retaining pin hole as a guide, carefully drill a hole in the new bushing to the same depth and diameter as the hole in the old bushing. Be careful not to enlarge the retaining pin hole.
 - Install new retaining pin.
2. Install oil seal with spring facing outside of crankcase (toward you) until seated against bushing.
 3. Lubricate and install washer on pump shaft (water pump end). Install shaft with washer through bushing and oil seal from the oil pump side of case. Be sure spring stays in position on seal lip.
 4. Install remaining washer on shaft.
 5. Lubricate and install rear bushing with new O-ring until seated against shaft.
 6. Install oil pump, being careful to engage pump shaft in drive shaft.



Oil Pump Mounting Screw Torque:

60 in. lbs. (.70 kg-m)

ENGINES SN44 Case Reed

Assembly, Cont.

7. Install mechanical seal guide (special tool) on end of pump shaft.

Mechanical Seal Guide

Tool: PN 2871846

Mechanical Seal Press

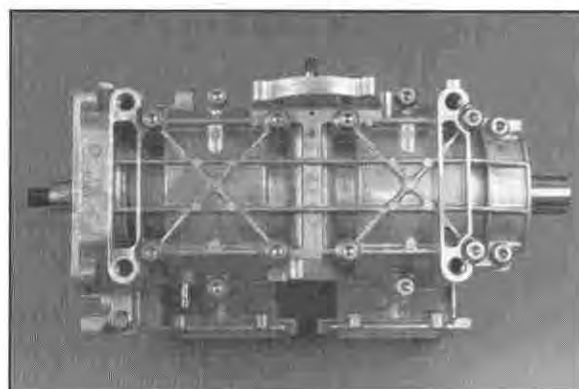
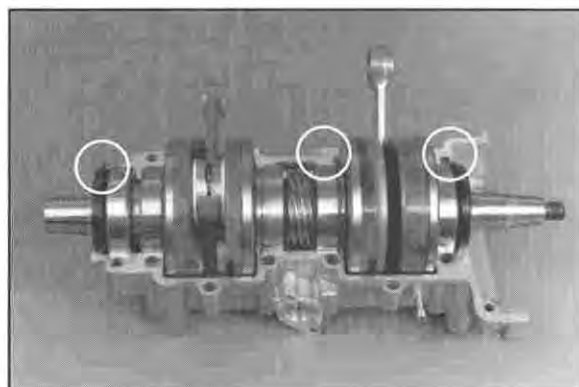
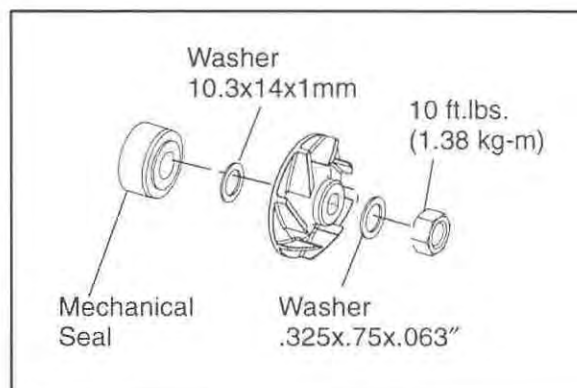
Tool: PN 2871846

8. Lubricate seal guide and drive or press a new mechanical seal into case until fully seated using the seal press tool.
9. Lubricate all crankshaft bearings with Premium 2-Cycle or Premium Gold Engine Lubricant.
10. Lightly grease pump shaft drive gear and sealing lip of crankshaft seals.
11. Install seals on crankshaft with spring facing inward (toward crankshaft).
12. Clean and de-grease lower crankcase and install crankshaft assembly, aligning seals and snap ring with grooves in case.
13. Apply a thin coating of 3-Bond 1215 sealant to lower crankcase mating surface.
14. Install upper crankcase on lower crankcase.
15. Apply Loctite 242 to threads of bolts and install. Torque bolts in three steps to specified torque following the sequence shown at right

Crankcase Bolt Torque:

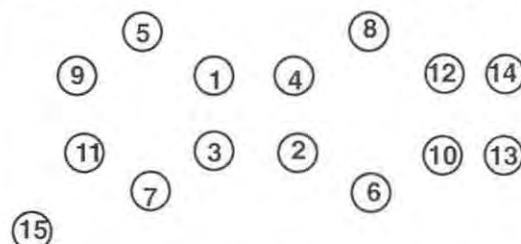
8mm 20-24 ft.lbs. (2.8 - 3.3 kgm)

6mm 108 in. lbs. (1.24 kg-m)



MAG End

PTO End



CRANKCASE - SN44-44LCDCSP-01 / 02

Assembly, Cont.

16. Assemble engine mount straps to crankcase.

Engine Mount Strap Torque:

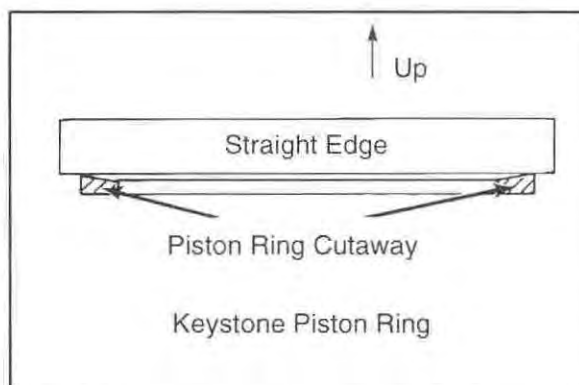
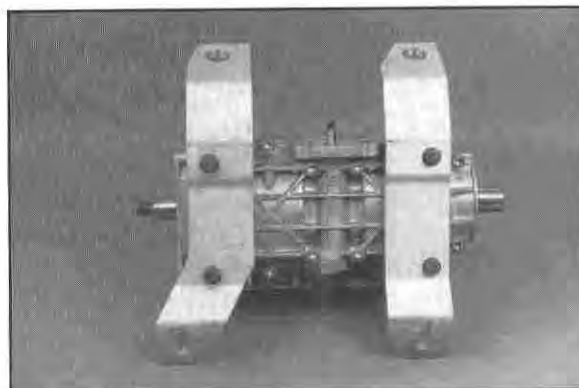
44-48 ft. lbs. (6.0-6.6 kg-m)

17. Lubricate main bearing oil holes with Polaris Premium 2 Cycle or Premium Gold engine oil and rotate crankshaft to distribute oil evenly.
18. Install a new C-clip in both pistons (inside) with gap facing down. Be sure clip is fully seated in groove.
19. Lubricate and install new connecting rod small end bearing in rod.
20. Install piston with arrow facing exhaust (ring locating pins should be facing intake). Warming the piston may help to ease installation of pin.
21. Install remaining C-clip with gap down. Be sure both clips are fully seated on the groove.
22. Install new base gasket. Be sure gasket surface is clean and free of nicks, burrs, or scratches.
23. Lubricate and install piston rings on piston with mark on end of ring facing upward.
24. Place piston support under skirt and lubricate pistons and cylinders thoroughly.
25. Align ring end gaps with locating pins and compress rings. Install cylinder carefully with a gentle front to rear rocking motion. Install cylinder base nuts loosely. Do not tighten them at this time. Repeat Steps 22-25 for other cylinder.

CAUTION:

Do not twist or force cylinder during installation.

26. Install new cylinder head O-rings and install cylinder head. Make sure O-rings are properly seated in grooves. Apply a light film of grease to hold O-rings in place if necessary.



ENGINES

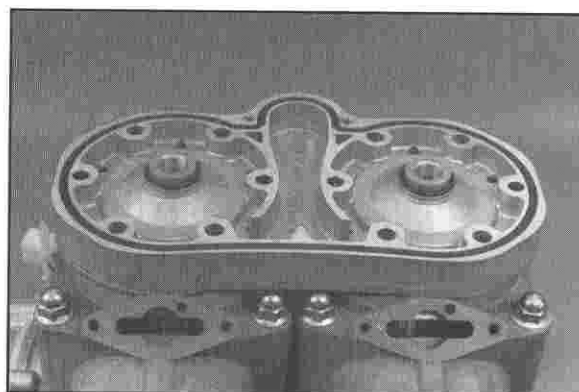
SN44 Case Reed

Assembly, Cont.

27. Install new cylinder head cover O-rings and install cylinder head cover. Make sure O-rings are properly seated in grooves. Apply a light film of grease to hold O-rings in place if necessary.

28. Loctite 242 to threads of head bolts and install.

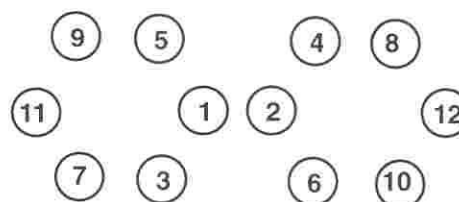
NOTE: Torque cylinder head bolts prior to torquing cylinder base nuts.



29. Torque head bolts in proper sequence.

Head Bolt Torque:

20-24 Ft lbs (2.77 - 3.3 kgm)

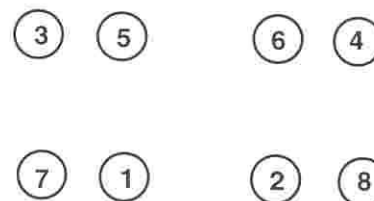


Cylinder Head

30. Torque cylinder base nuts in proper sequence.

Cylinder Base Nut Torque:

30 - 34 Ft lbs (4.15 - 4.70 kgm)

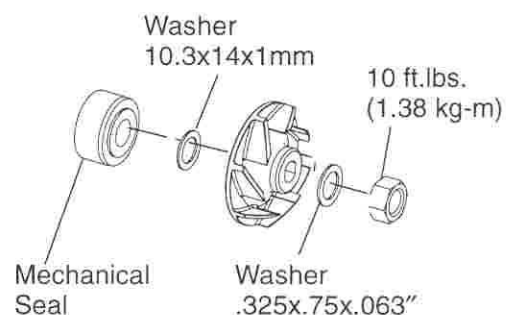


Cylinder Base

31. Install washers and water pump impeller as shown and torque nut to 10 ft. lbs. (1.38 kg-m).

Impeller Nut Torque:

10 Ft lbs (1.38 kgm)

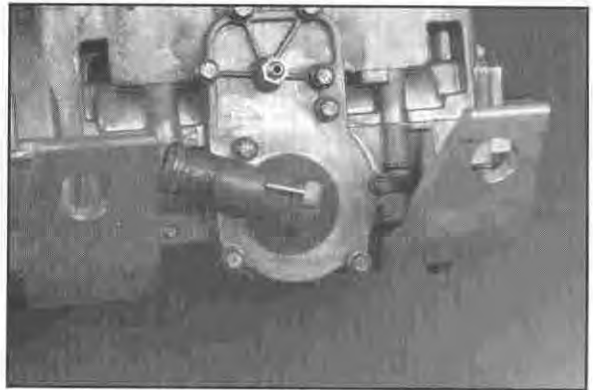


Assembly, Cont.

32. Install water pump cover with new gasket.

Water Pump Cover Bolt Torque:

9 Ft lbs (1.25 kgm)



33. Install new exhaust manifold gaskets and manifold.

Exhaust Manifold Bolt Torque:

16 Ft lbs (2.21 kgm)

34. Assemble V.E.S. valve as outlined in Maintenance section page 2.28a-e.

35. Install reed valves, stuffers, and carburetor adaptors. Place stator wire guide on Mag side carburetor adaptor bolt.

36. Install stator assembly, aligning timing marks or marks made upon disassembly. Seal stator wires with high temperature silicone sealant. Install and tighten stator screws to specification.

37. Measure trigger (pulse) coil gap and compare to specification.

Stator Screw Torque

60 in. lbs. (.69 kg-m)



Trigger (Pulse) Coil Gap

Minimum: .020" (.5mm)

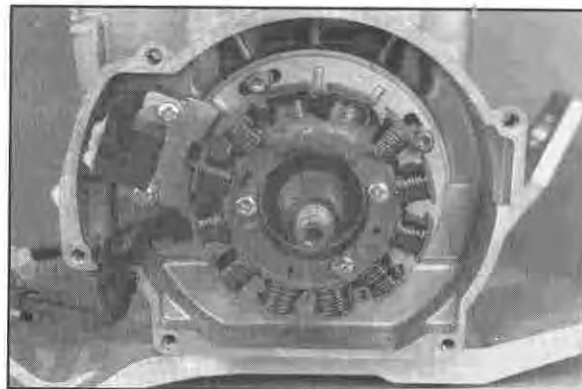
Maximum: .040" (1.0mm)

ENGINES

SN44 Case Reed

Assembly, Cont.

38. Apply Loctite™ 262 evenly to the flywheel mounting taper on crankshaft. Install woodruff key.
39. Install flywheel. Apply Loctite™ 242 to crankshaft threads. Install washer and nut.
40. Use flywheel holder to hold flywheel and torque nut to specification.



Flywheel Holder: PN 8700229

Flywheel Nut Torque:

90 ft. lbs. (12.45 kg-m)

41. Install recoil hub and recoil housing. Torque bolts to specification.

**Recoil Hub and Housing Bolt
Torque:**

108 in. lbs. (1.25 kg-m)



42. Install engine in chassis and align clutches.
43. Refer to Maintenance Chapter to fill and bleed cooling system and oil pump.

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 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.

* Except Nicasil

Cylinder Hone Selection

Selecting a hone which will straighten as well as remove material from the cylinder is very important. Honing a cylinder with a spring loaded glaze breaker is never advised. Polaris recommends using a rigid type hone which also has the capability of oversizing. These hones are manufactured by such companies as Sunnen Products Company of St. Louis, Missouri; and Ammco Tools, Inc., of North Chicago, Illinois.

Shown at right is the Ammco No. 3950 hone. This hone has roughing and finishing stone sets available to service engines with cylinder bores up to 75mm in diameter.



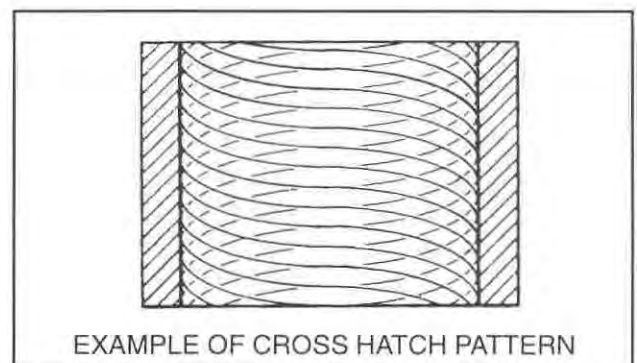
De-glazing

If cylinder wear or damage is minimal, hone the cylinder lightly with finish stones following the procedure outlined on page 3.80

Honing To Oversize

If cylinder wear or damage is excessive, it will be necessary to oversize the cylinder using a new oversize piston and rings. This may be accomplished by either boring the cylinder and then finish honing to the final bore size, or by rough honing followed by finish honing.

For oversize honing always wet hone using honing oil and a coarse roughing stone. Measure the piston (see piston measurement) and rough hone to the size of the piston or slightly larger. Always leave .002 - .003" (.05 - .07 mm) for finish honing. Refer to pages 3.3-3.4 for piston to cylinder specifications before honing. Complete the sizing with fine grit stones to provide the proper cross-hatch finish and required piston clearance. See procedure on page 3.80.

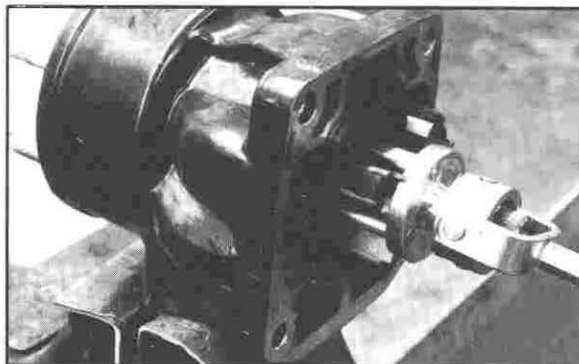


ENGINES

General Inspection Procedures

Honing Procedure

1. Wash cylinder with solvent. Clamp cylinder securely in a soft jawed vise by the exhaust port studs.
2. Place hone in cylinder and tighten stone adjusting knob until stone contacts the cylinder walls (DO NOT OVERTIGHTEN). Cylinders may be wet or dry honed depending on the hone manufacturer's recommendations. Wet honing removes more material faster and leaves a more distinct pattern in the bore. 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" (1.3 cm) beyond the bore at the end of each stroke. Release the hone at regular intervals to inspect bore size and finish. Do not "drag" the hone out of the bore.



Port Chamfering

Remove the sharp edges at the bottom and top of each port whenever boring or honing is performed. Make sure there are no sharp edges.

IMPORTANT:

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.

Crankcase Inspection / Bearing Fit

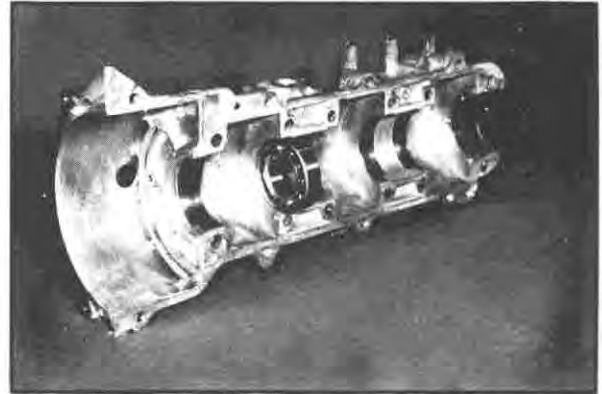
Any time crankshaft bearing failure occurs and the case is to be reused, Polaris recommends checking the bearing fit into the case halves using the following procedure.

1. With case halves cleaned, press a replacement bearing into each of the main bearing journals to determine a basic amount of press fit. **NOTE:** Do a comparison check of all journals by manually forcing the bearing into the bearing seats noting if any are noticeably loose or tight. Normal hand installation will be an indication of the recommended interference fit. If the bearing falls out of the case when the case is inverted, the case should be replaced.

Crankcase Bearing Interference Fit:

C-3 - .0006" (.015mm) - Crush

C-4 - .001" (.025mm) - Crush



Crankshaft Main Bearing Inspection

1. Clean crankshaft thoroughly and oil main and connecting rod bearings with Polaris Premium 2 engine oil. Carefully check each main bearing on the shaft.

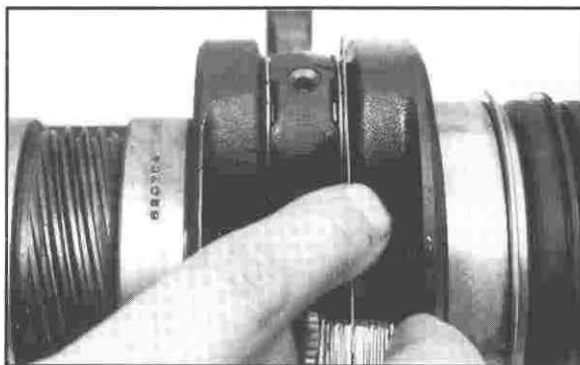
NOTE: Due to extremely close tolerances, the bearings must be inspected visually, and by feel. Look for signs of discoloration, scoring or galling. Turn the outer race of each bearing. The bearings should turn smoothly and quietly. The inner race of each bearing should fit tightly on the crankshaft. 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.

ENGINES

General Inspection Procedures

Connecting Rod (Big End) Bearing Inspection

1. Measure connecting rod big end side clearance with a feeler gauge. Clearance should be equal on all rods (within .002"). Rotate rod on crankshaft and check for 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.

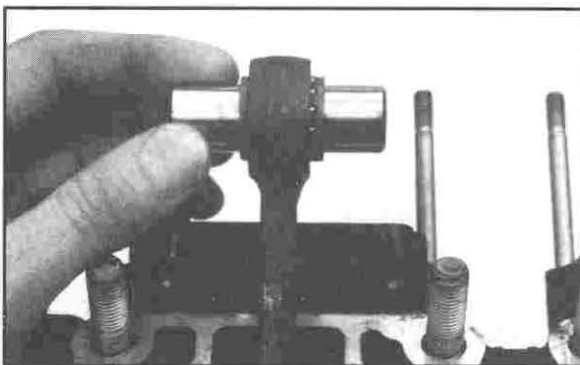


NOTE: Specialized equipment and a sound knowledge of crankshaft repair and straightening is required to perform crankshaft work safely and correctly. Crankshaft repair should be performed by trained Polaris service technicians in a properly equipped shop.



Connecting Rod Small End Inspection

1. Clean small end of connecting rod and inspect inner bore with a magnifying glass. Look for any surface irregularities including pitting, wear, or dents.
2. Run your 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. Rotate pin slowly and check for rough spots or any resistance to movement. Slide pin back and forth through bearing while rotating and check for rough spots.
4. With pin and bearing centered in rod, twist ends back and forth in all directions to check for excessive axial play. Pull up and down evenly on both ends of pin to check for radial play. 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.



Piston Pin / Needle Bearing Inspection

1. Clean needle bearing in solvent and dry with compressed air.
2. Inspect needle cage carefully for cracks or shiny spots which indicate wear. Replace needle bearings if worn or cracked, and always replace them if piston damage has occurred.
3. Visually inspect piston pin for damage, discoloration, or wear. Run your fingernail along the length of the pin and replace it if any rough spots, galling or wear is detected.



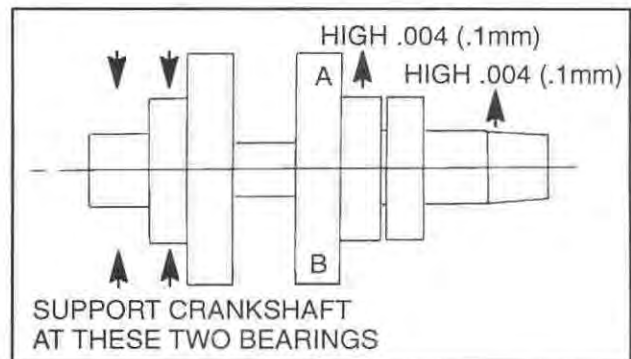
Crankshaft Straightening

Lubricate the bearings and clamp the crankshaft securely in the holding fixture. On three cylinder crankshafts, straighten one of the ends (Magnetor or PTO) and then straighten the center section. Place the center section in the holding fixture and then straighten the remaining end. 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.



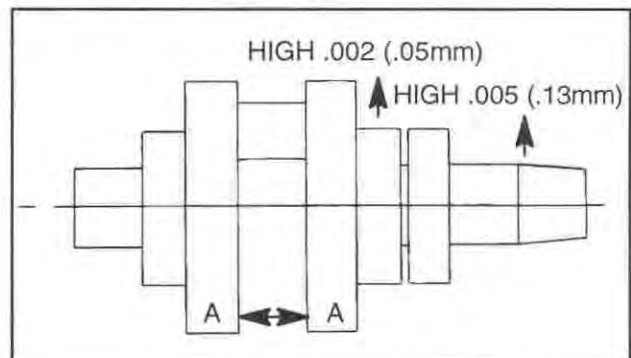
NOTE: The rod pin position in relation to the dial indicator position tells you what action is required to straighten the shaft.

4. To correct a situation like the one shown in the illustration at right, strike the shaft at point A with a brass hammer.



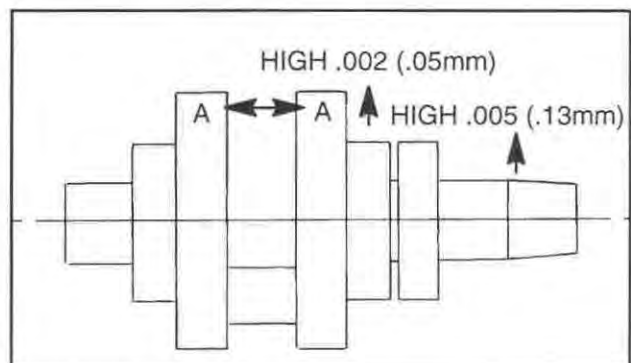
NOTE: The rod pin position in relation to the dial indicator position tells you what action is required to straighten the shaft.

5. To correct a situation like the one shown in the illustration at right, squeeze the crankshaft at point A. (Use tool from alignment kit).



6. If the crank rod pin location is 180° from the dial indicator (opposite that shown above), it will be necessary to spread the crankshaft at the A position as shown in the illustration at right. When rebuilding and straightening a crankshaft, straightness is of utmost importance. Runout must be as close to zero as possible.

NOTE: Maximum allowable runout is .004" (.1 mm).



ENGINES

General Inspection Procedures

Crankshaft Indexing

Polaris crankshafts are pressed together or "indexed" so the connecting rod journal center lines are 180° (twins) or 120° (triples) 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 or cylinders. Causes for out-of-index crankshafts include but are not limited to:

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

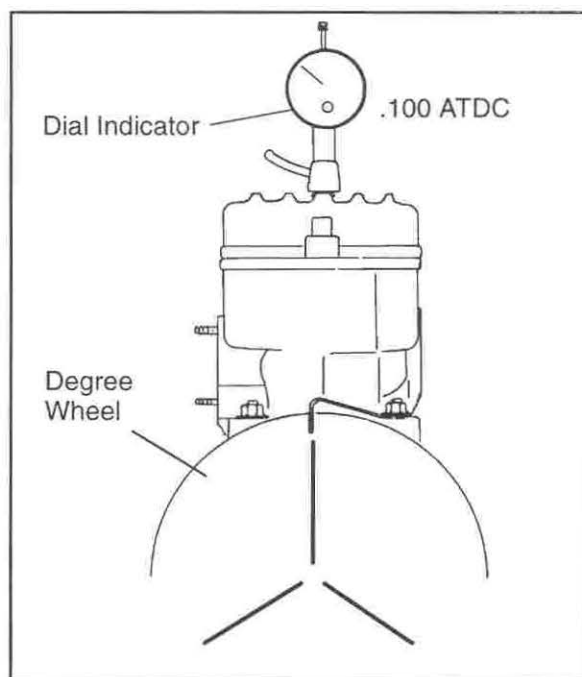
Following is a method of checking:

CAUTION:

Disconnect battery ground cable and **all** spark plug high tension leads; ground high tension leads to engine. Disconnect lanyard from engine stop switch before proceeding with the following steps.

1. Securely fasten a degree wheel on the flywheel or PTO end of crankshaft. Use a large degree wheel for more accuracy, and make sure it is mounted concentrically with the crankshaft center line.
2. Sharpen a coat hanger or section of welding rod and anchor it to a convenient spot. Point the sharpened end at the outer perimeter of the degree wheel.
3. Install a dial indicator into the magneto end cylinder spark plug hole (front) (#1). (The ignition timing is referenced by the magneto end.)
4. Rotate the engine to bring the piston to top dead center (TDC) on the cylinder with the indicator installed.
5. Locate TDC as accurately as possible by finding the center of the point where there is no piston movement. "Zero" the dial indicator at this point. Continue to rotate the crankshaft in the normal direction of rotation until the dial indicator reads .100" (2.54mm) after top dead center (ATDC).

IMPORTANT: Do not allow the crankshaft to move from this position.



Crankshaft Indexing (Continued)

6. Bend the pointer or move the degree wheel until the pointer aligns with the 180 or 120° mark on the degree wheel.
7. 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 by repeating steps 4. and 5. . The pointer should align with the 180 or 120° mark when the dial indicator reads .100" (2.54mm) ATDC.

IMPORTANT: *Do not* move the degree wheel or pointer after the initial setting on the mag end cylinder - simply read the wheel and dial indicator.

8. Remove the dial indicator and install in cylinder #2 or center cylinder. Repeat steps 4. and 5. Note the degree wheel indication when the dial indicator reads .100" ATDC. It should be 180 or 120° ($\pm 2^\circ$) from cylinder #1. Repeat procedure on PTO cylinder (#3) where applicable. Cylinder #3 should also be 120° ($\pm 2^\circ$) from cylinder #1.

Symptoms of an out of index crankshaft can include:

- 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, piston holing);
- Excessive vibration of engine, backfiring, etc.;
- Rough idle, poor top speed.

ENGINES

General Inspection Procedures

Cylinder Head Inspection

1. Inspect each cylinder head for warping. Replace cylinder head if warp exceeds service limit.

Cylinder Head Warp

Service Limit: .003" (.08mm)



Cylinder Measurement

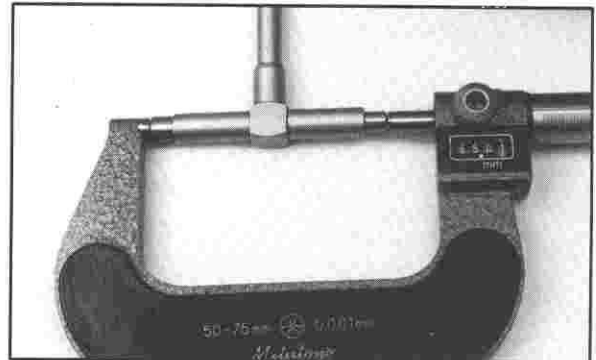
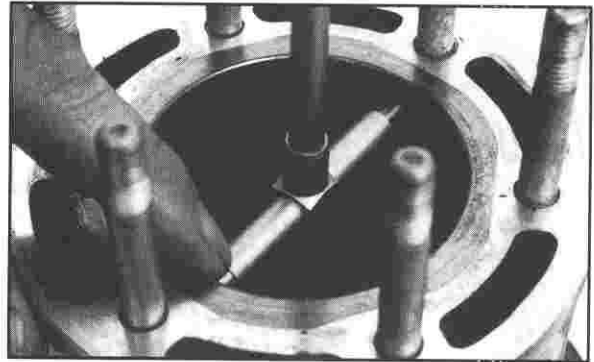
2. Inspect each cylinder for wear, scratches, or damage. If no damage is evident, measure the cylinder for taper and out of round with a telescoping gauge or a dial bore gauge. Measure the bore 1/2" from the top of the cylinder; in line with the piston pin and 90° to the pin to determine if the bore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

Cylinder Taper

Limit: .002 Max.

Cylinder Out of Round

Limit: .002 Max.



Piston Inspection/Measurement

1. 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.
2. Measure piston outside diameter at a point 10 mm (3/8") up from the bottom of the skirt at a 90° angle to the direction of the piston pin. Record the measurement for each piston.

NOTE: The piston must be measured at this point to provide accurate piston-to-cylinder clearance measurement.

3. Subtract this measurement from the minimum cylinder measurement recorded previously. If clearance exceeds the service limit, the cylinder should be re-bored and new pistons and rings installed. Refer to specifications on pages 3.3-3.4 for specifications.

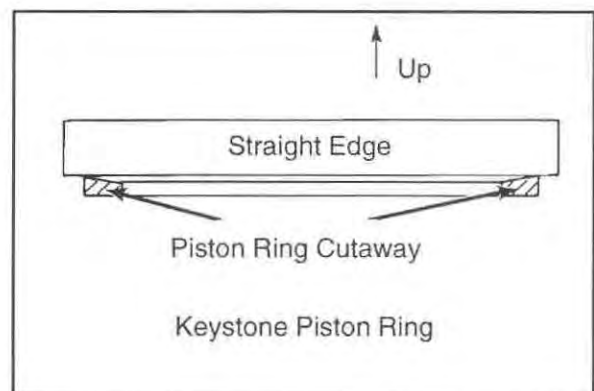


Piston Ring Installed Gap

1. Position 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.

NOTE: Always check piston ring installed gap after re-boring a cylinder or when installing new rings.



ENGINES

General Inspection Procedures

Oil Pump Operation and Troubleshooting

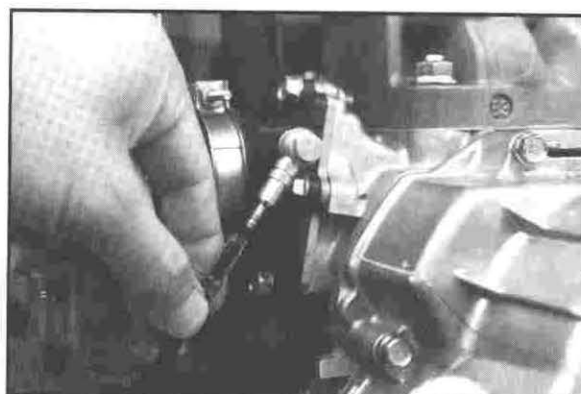
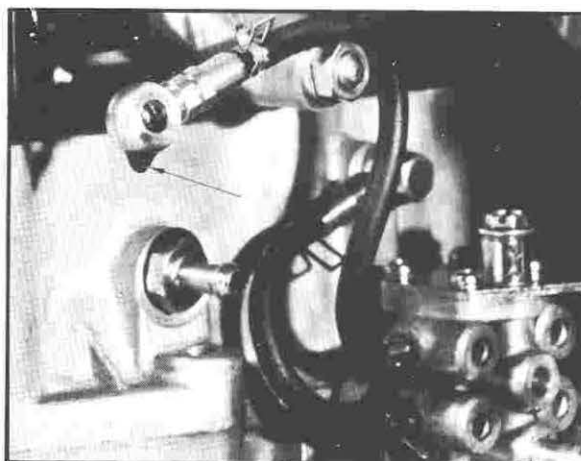
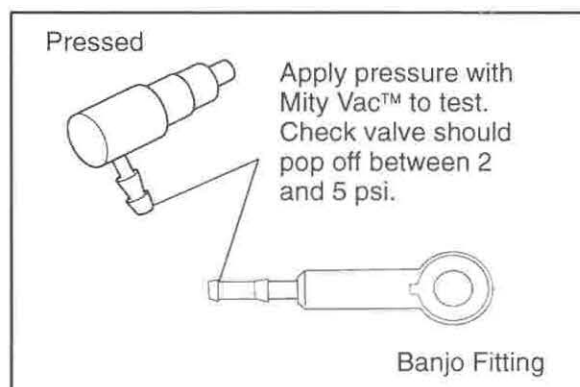
Any time the engine is disassembled or repaired, it is important that the oil supply from the pump to the engine be checked.

NOTE: Banjo type or pressed in valves should open with 2 to 5 lbs. of pressure.

CAUTION:

Use 40:1 premix in tank when troubleshooting oil delivery problems.

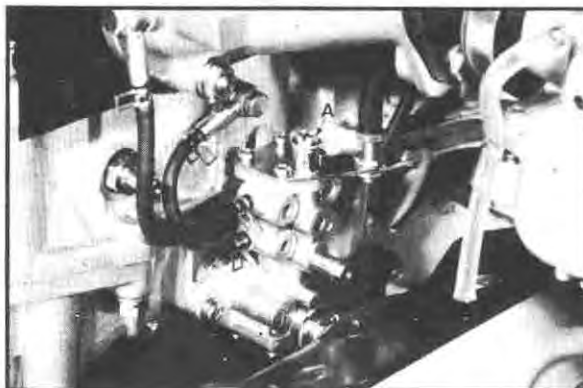
1. With engine in chassis, oil reservoir full, and pump bled, remove two oil feed line banjo bolts from their location on the manifold or carburetors. **NOTE:** Use care not to lose the two washers on either side of the banjo check valve. Some oil fittings are pressed into the carburetor mounting flange. Check valve is inline on 700 models.
2. Inspect each banjo bolt to make sure it is not plugged or restricted.
3. Loosely thread only the banjo bolts back into the manifold or carburetors.
4. Place oil feed lines with their check valves away from the clutch area. Start the engine and let it idle at normal idle RPM.
5. Lift oil pump control lever up to its maximum flow position.
6. Drops of oil should be visible from the banjo check valves after the engine is idled one to two minutes, with a drop occurring approximately every few seconds.
7. If oil does not flow from one of the check valves, remove oil line from check valve and again idle engine. If oil then flows, the check valve is defective and must be replaced.
8. If oil does not flow with check valves removed from their feed lines, the malfunction is one of the following:
 - Inline filter or feed lines blocked;
 - Kinked or restricted oil tank vent line;
 - Feed lines leaking;
 - Defective pump.



Oil Pump Bleeding

The oil pump must always be bled following any service to the injector system or engine which allows the loss of oil and subsequent entrapped air during reassembly.

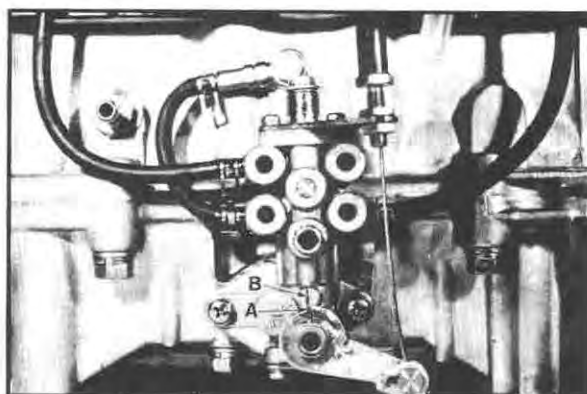
1. Fill oil reservoir with Polaris injector oil.
2. Loosen brass hex head screw (A). After a short time oil should flow from beneath the screw head to indicate the pump is free of air.
3. Tighten bleed screw.



Oil Pump Adjustment - All Models

After the engine RPM and carburetor adjustments have been made, the oil pump must also be adjusted.

1. With engine shut off and throttle in its idle position, the pump lever index mark (A) must align with the pump housing boss index mark (B).
2. Loosen lock nuts on cable housing sleeve and vary cable housing length as required. **NOTE:** Verify that pump lever is actuated upon initial throttle opening.



Oil Pump Drive Gear End Play Adjustment

If the oil pump, crankcase, or any other oil pump drive component is replaced, inspect the drive gear end play using the following procedure:

1. Measure distance from oil pump mounting surface to bushing. Call this measurement "A".

NOTE: Make sure the bushing is fully seated in the crankcase.



ENGINES

General Inspection Procedures

Oil Pump Drive Gear End Play Adjustment

2. Measure distance from oil pump mounting flange surface to end of seal flange as shown. Call this measurement "B".
3. Subtract measurement "B" from "A" to determine total bushing end play.
4. Measure thickness of existing shims and subtract from total bushing end play determined in step 3.
5. Add or subtract shims as required to provide specified end play.
6. Lightly grease a new O-ring and install it on the pump. Install pump, engaging slot in shaft with drive gear. Apply Loctite™ 242 to bolts and torque evenly to 78 in. lbs. (.9 kg-m).



Oil Pump Mounting Bolt Torque (242 Blue)

78 in. lbs (.9 kg-m)

Optional Shims:

PN 3083671 = .006" (.15mm)
PN 3083672 = .012" (.3mm)
PN 3083673 = .024" (.6mm)

End Play

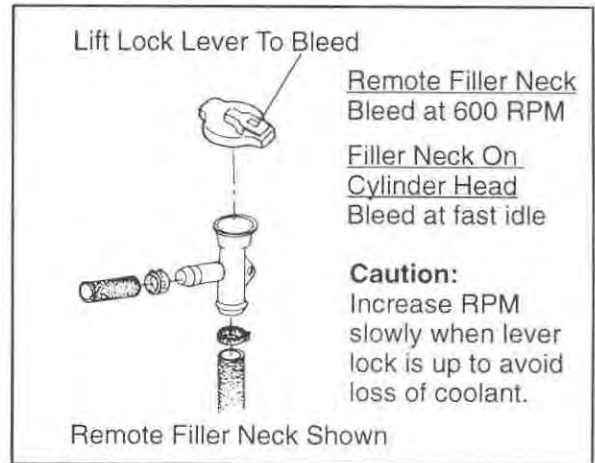
.008 - .016" (.203 - .406 mm)

Cooling System - EC45/50PL With Positive Bleed Recovery System

Filling and Bleeding Procedure

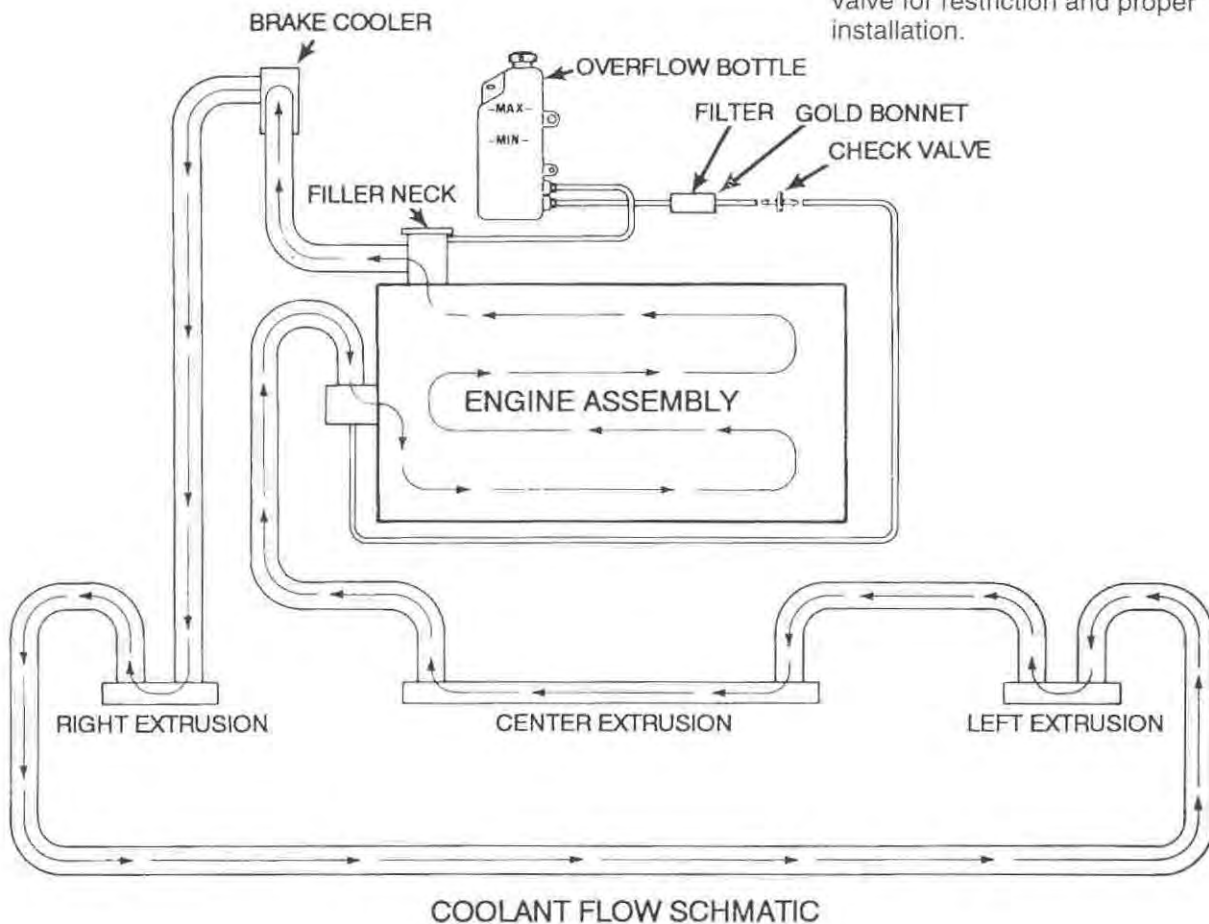
If the cooling system should become low in the tank and/or filler neck, the system should be bled of any trapped air using the following procedure:

1. Elevate front end of machine approximately 10" (25 cm).
 2. Fill coolant expansion reservoir to indicated maximum level line.
 3. Remove pressure cap and slowly pour coolant into engine until the coolant level is at the pressure cap fitting neck. Install pressure cap and lift lever.
 4. Install the pressure cap with the lever lock up in its release position and run the engine at fast idle for two to three minutes. This will purge the system of trapped air. Close the lever lock and check recovery tank fluid level.
- CAUTION:** On models equipped with remote filler neck, low idle RPM must be used for bleeding (600 RPM $\pm$ 100) to allow all air to purge and prevent trapped air which can lead to overheating and engine damage. Reset idle to specs after bleeding. System is properly bled when no air bubbles are visible in overflow line when RPM is increased slightly.



EC45/50PL ENGINES

NOTE: If system is difficult to bleed, inspect coolant filter and check valve for restriction and proper installation.

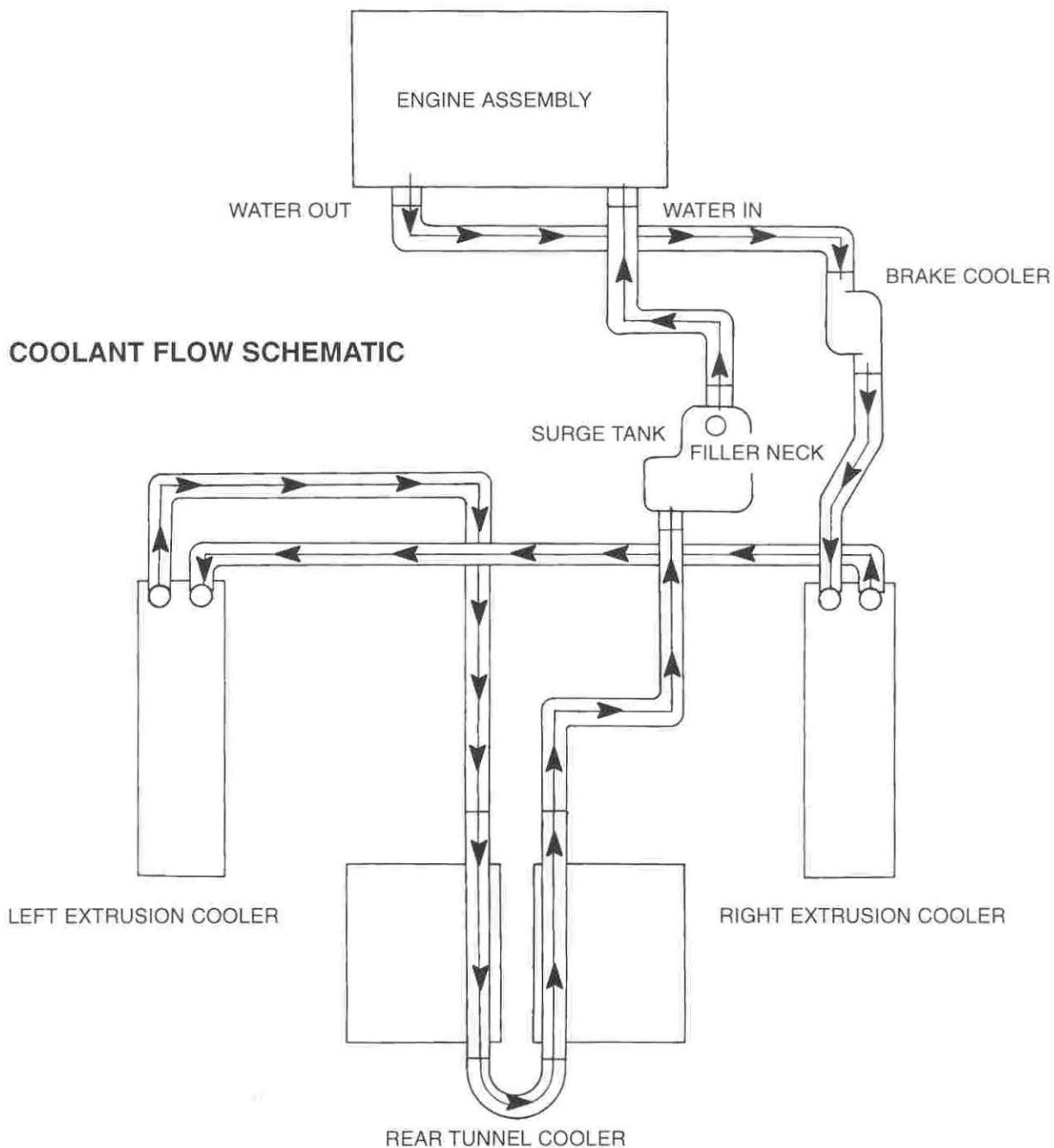


COOLING SYSTEM

Cooling System - EC65PL05

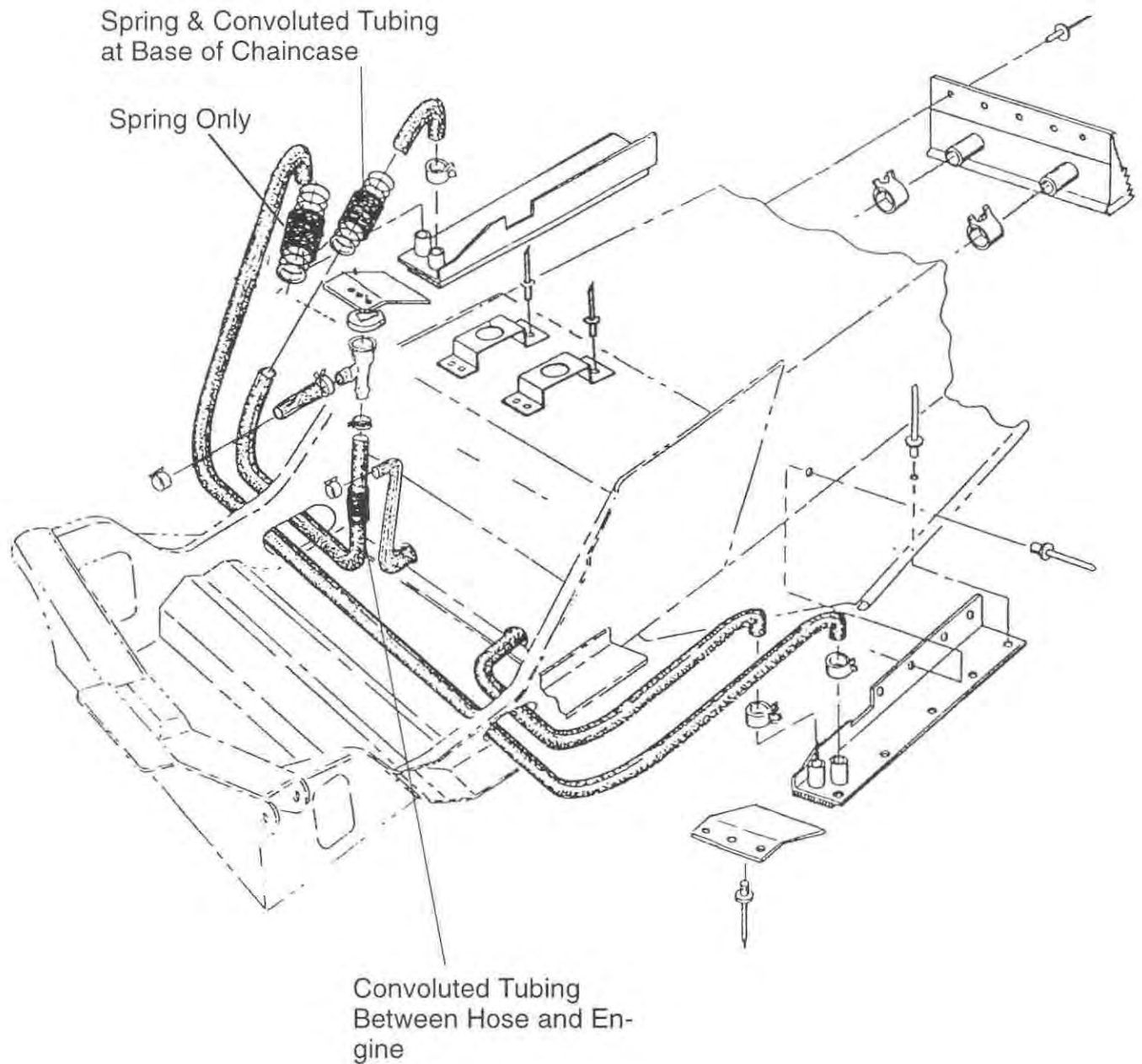
Filling and Bleeding Procedure

1. Fill system with a 50/50 mixture of antifreeze and water.
2. With engine running, crack bleed screws on water pump and head.
3. Continue adding antifreeze mixture until system is purged of air.
4. Close bleed screws.
5. Add antifreeze mixture up to fill line.



COOLING SYSTEM
Typical 440 Indy / 500 Indy / 500 Classic / 500 RMK /
Classic Touring / WideTrak LX

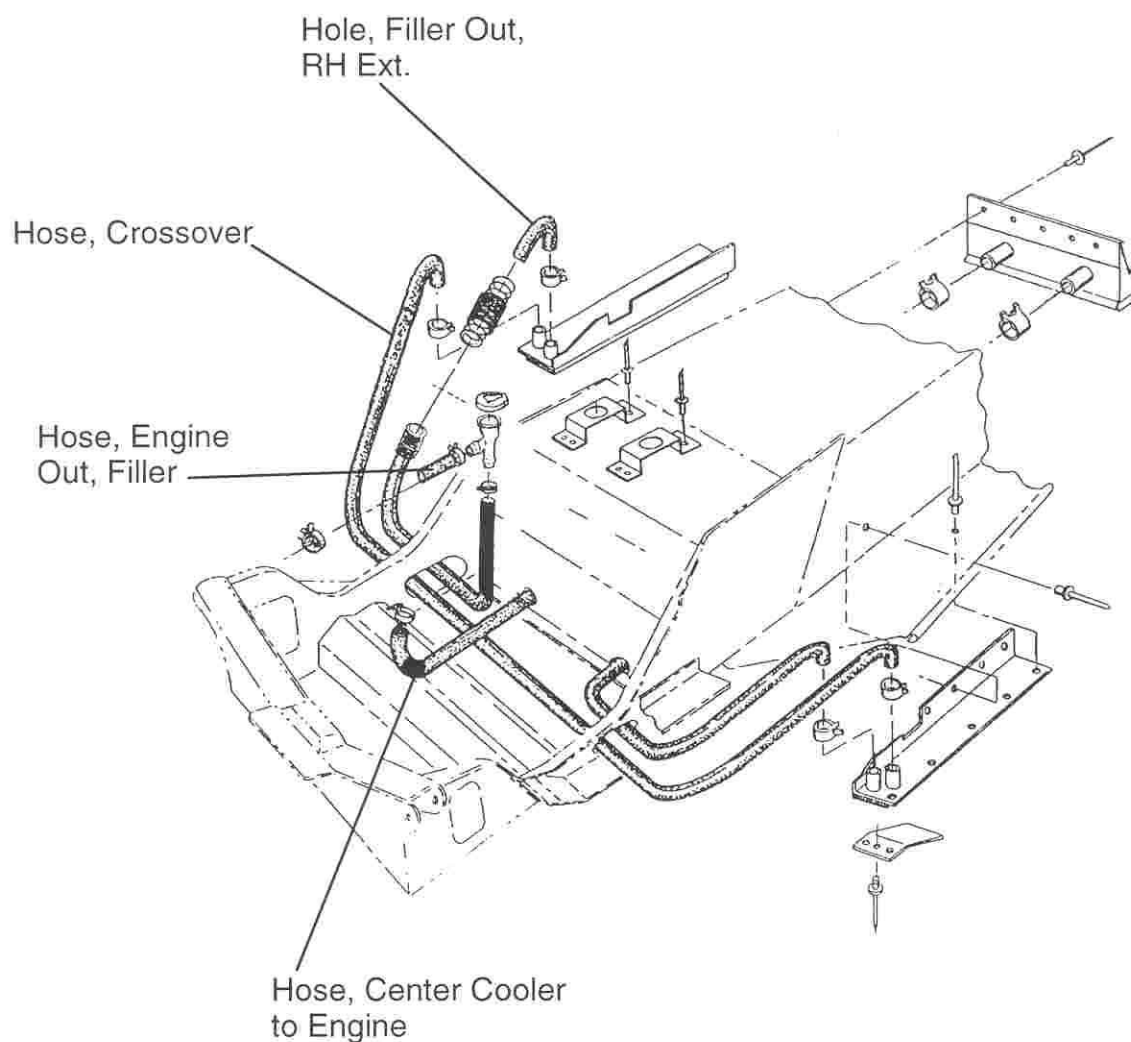
NOTE: When leak testing cooling system, system pressure should not exceed 2 lbs. less than cap pressure. Refer to filling and bleeding procedure on page 3.91.



COOLING SYSTEM

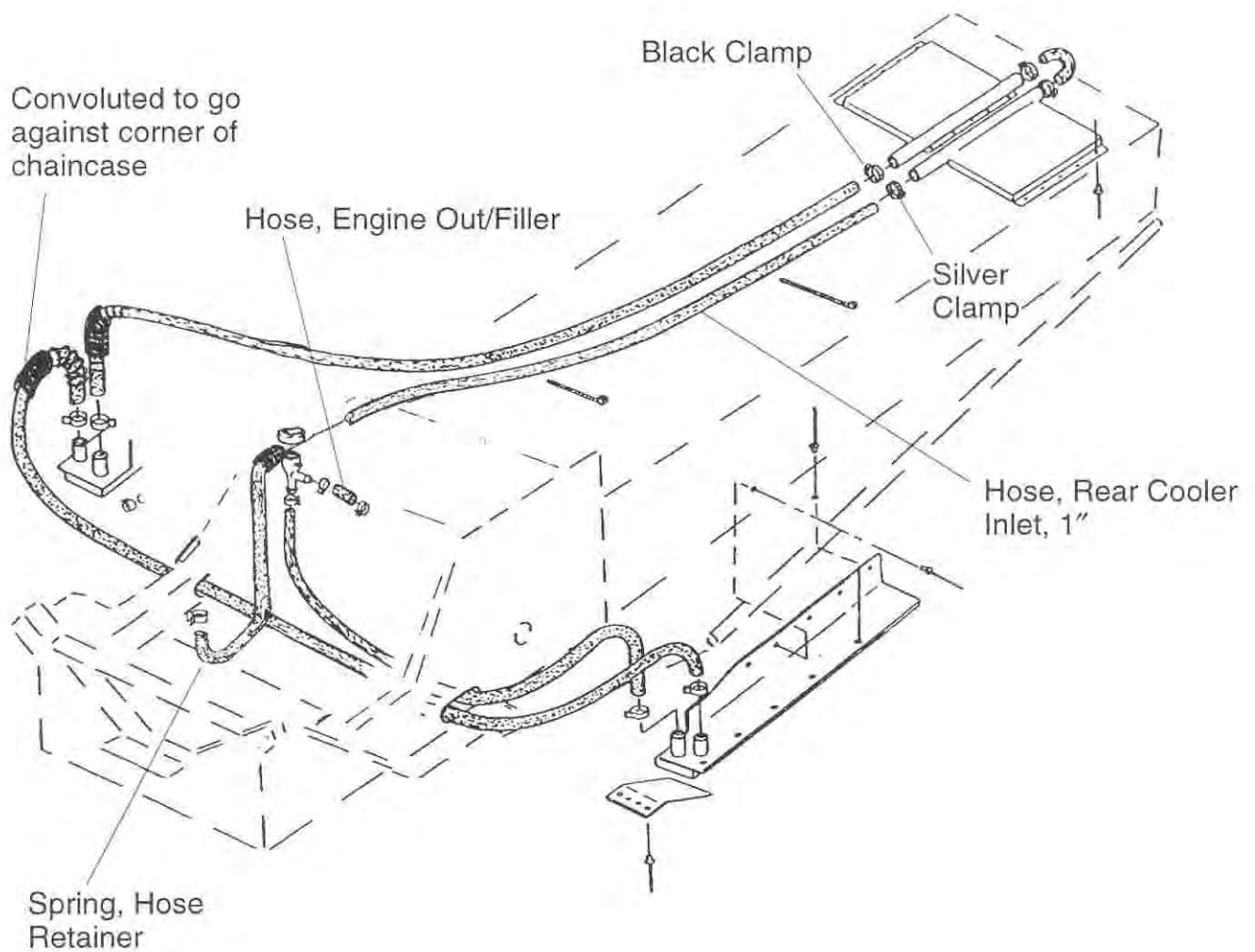
EC58 Style With Center Cooler - XLT LTD / XLT Classic / XLT SP

NOTE: When leak testing cooling system, system pressure should not exceed 2 lbs. less than cap pressure. Refer to filling and bleeding procedure on page 3.91.



COOLING SYSTEM EC58 Style Without Center Cooler - XLT Touring

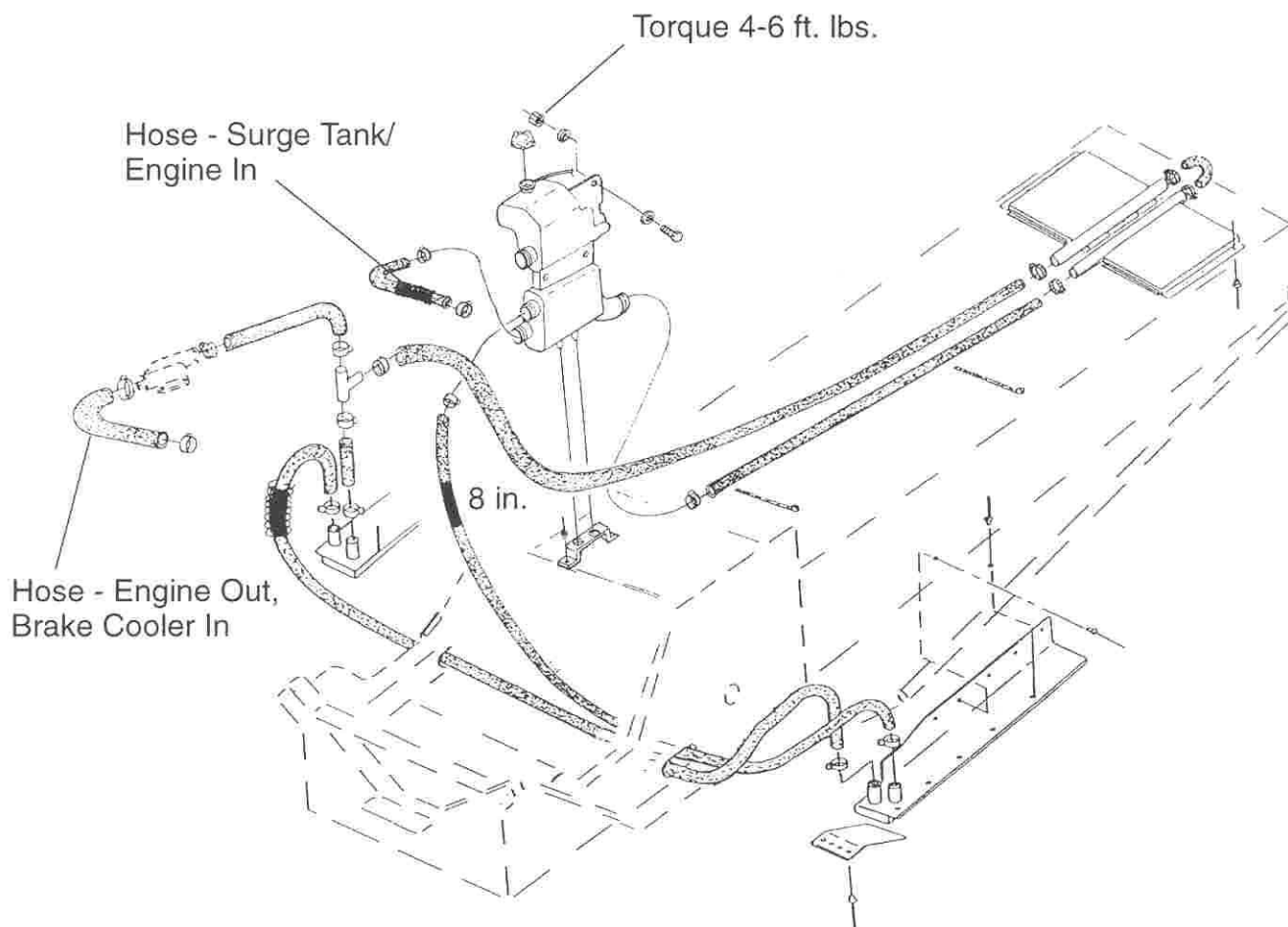
NOTE: When leak testing cooling system, system pressure should not exceed 2 lbs. less than cap pressure. Refer to filling and bleeding procedure on page 3.91.



COOLING SYSTEM

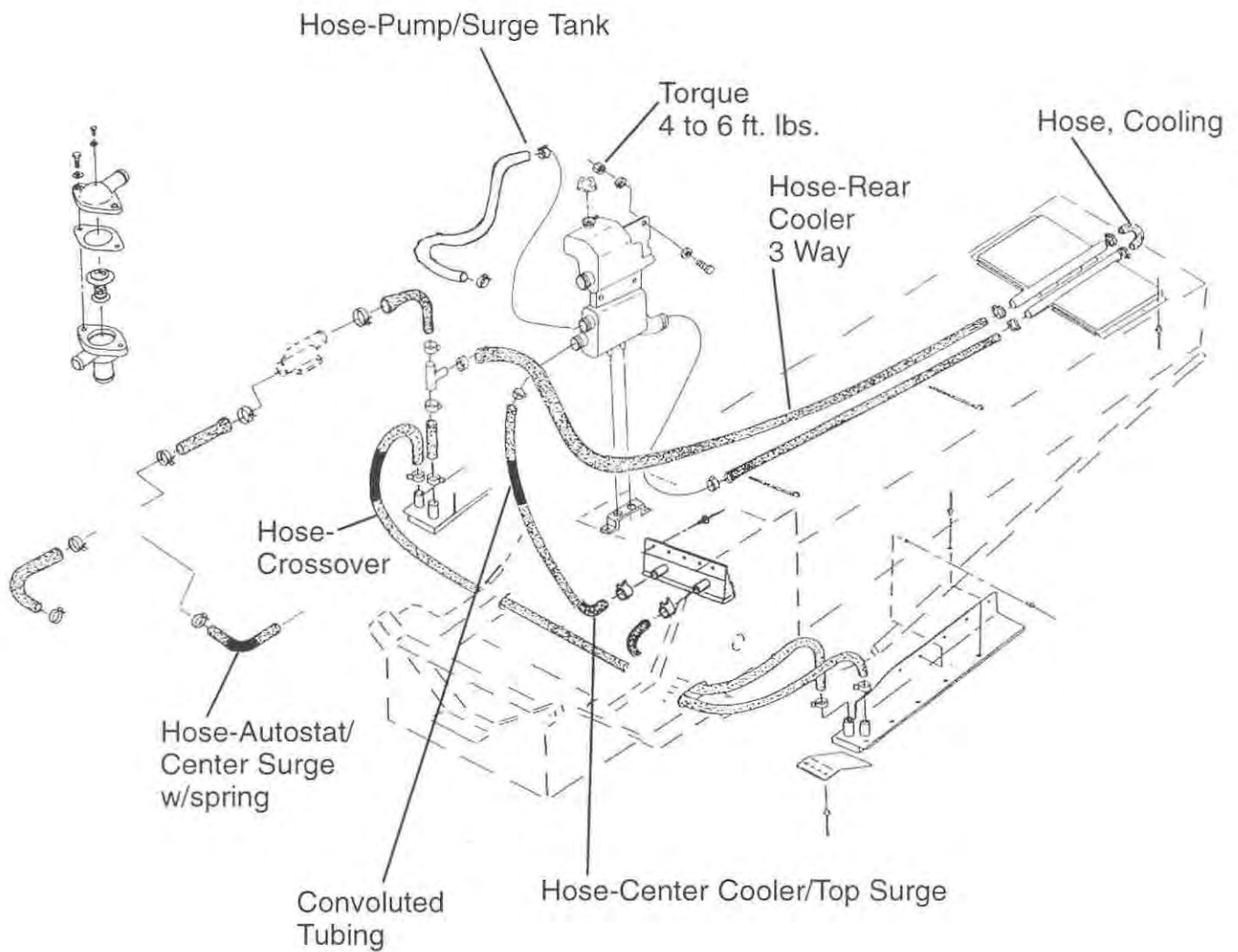
EC59/68 Style Without Center Cooler - Ultra / Ultra Touring

NOTE: When leak testing cooling system, system pressure should not exceed 2 lbs. less than cap pressure. Refer to filling and bleeding procedure on page 3.91.



COOLING SYSTEM
EC59/68 Style With Center Cooler -700 XCR / 600 XCR

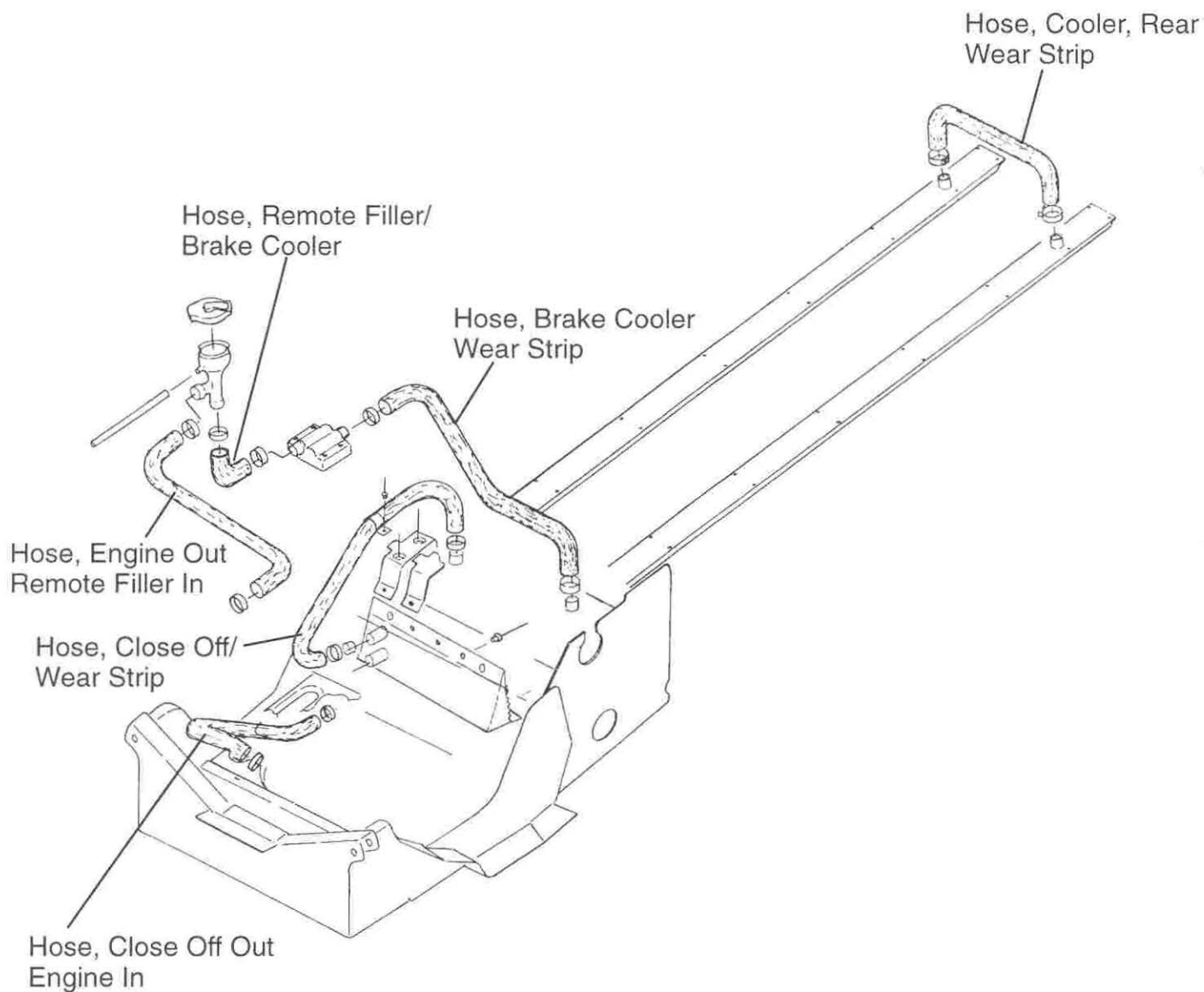
NOTE: When leak testing cooling system, system pressure should not exceed 2 lbs. less than cap pressure. Refer to filling and bleeding procedure on page 3.91.



COOLING SYSTEM

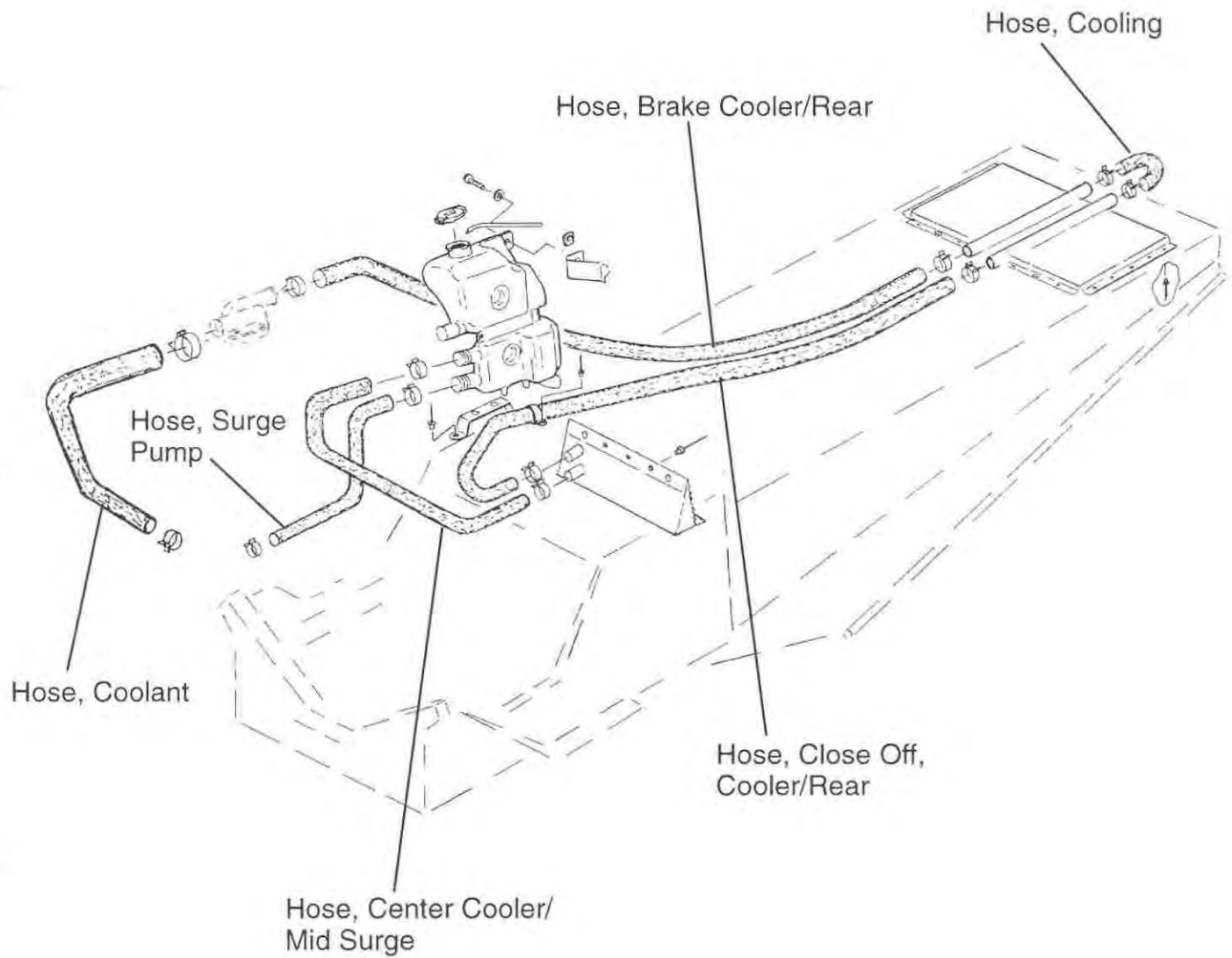
Domestic Twins With Wear Strip Coolers - 600 XC / 700 XC

NOTE: When leak testing cooling system, system pressure should not exceed 2 lbs. less than cap pressure. Refer to filling and bleeding procedure on page 3.91.



COOLING SYSTEM Domestic Twins With Center Coolers - 600 RMK / 700 RMK

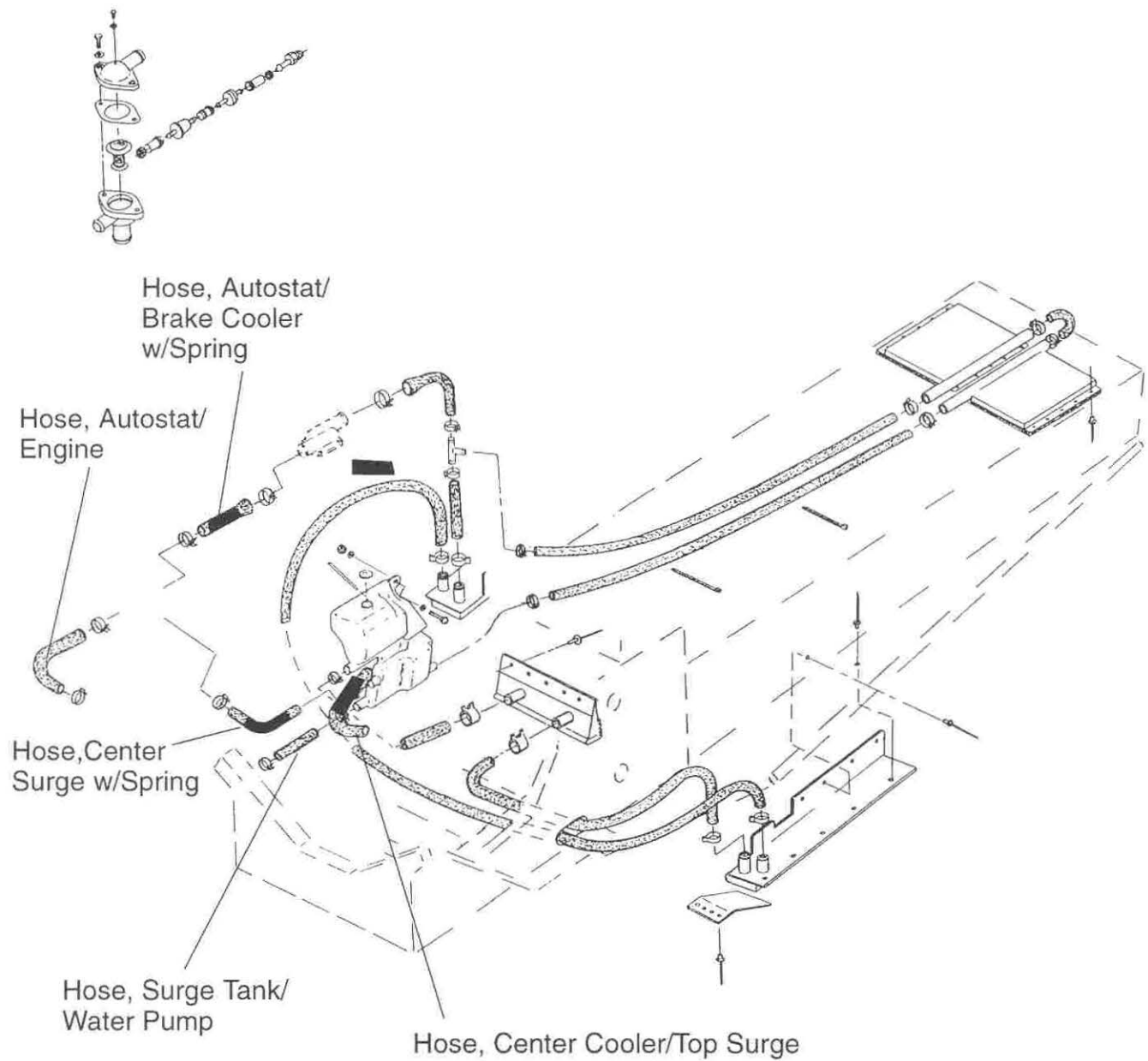
NOTE: When leak testing cooling system, system pressure should not exceed 2 lbs. less than cap pressure. Refer to filling and bleeding procedure on page 3.91.



COOLING SYSTEM

Storm 0985782

NOTE: When leak testing cooling system, system pressure should not exceed 2 lbs. less than cap pressure. Refer to filling and bleeding procedure on page 3.91.



ENGINES

Recoil Starter Spring Replacement

Disassembly

1. Remove recoil handle and allow rope to retract and spring to totally unwind.
2. Remove retaining nut, ratchet friction plate and ratchet pawl from reel face.
3. Lift reel assembly straight up, out of housing. **NOTE:** If the spring tension is relieved and the reel is lifted straight out, the spring will remain in the housing.

Assembly

1. If the spring was removed, reinstall it by spiraling counterclockwise toward the center.
2. Lubricate center shaft and spring with grease.

Premium All Season Grease

PN 2871423 (14 oz.)

3. Wind rope in a counterclockwise direction around outside of reel, as viewed from ratchet side of reel.
4. Pass end of rope through rope guide and slide reel down onto shaft and spring. **NOTE:** Make sure reel tab engages hook on end of spring.

Assembly, Cont.

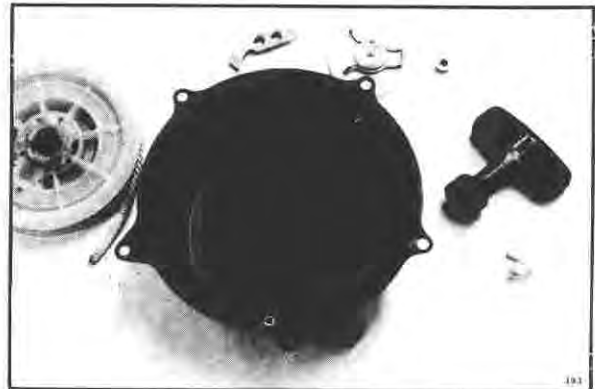
5. Install rope handle.
6. Reinstall ratchet pawl onto reel face. **NOTE:** Ratchet spring holds ratchet in.
7. Reinstall friction plate with one end of friction spring in hole on end of ratchet pawl.
8. Reinstall flange nut and torque to specification.

Flange Nut Torque-

5 ft. lbs. (.69 kg-m)

Assembly, Cont.

9. Pull recoil rope to full extension and align notch on outside edge of reel with housing rope guide hole.
10. Using a needle nose pliers or hooked wire, pull a loop of rope through the notch into center of housing.
11. Holding side of rope loop attached to reel, wind reel counterclockwise until coil bind is felt. Then unwind reel between one and two turns.
12. Pull loop to outside of housing by pulling on rope handle.
13. Allow rope to fully retract and check for normal recoil and ratchet operation.



ENGINES Troubleshooting

PROBLEM	PROBABLE CAUSE
Will not start/ hard starting	-Check ignition switch for run position, moisture contamination -Check auxiliary shut-off switch operation -Low compression -Out of fuel/fuel restriction -No spark -Spark plug(s) fouled -Disconnect engine connector to eliminate any shorts that might be in the system -If starter won't work (electric models), check wires from starter solenoid and battery or check battery and battery cables -Open or broken reed valves
Low compression	-Sheared flywheel key -Broken piston skirt -Excessive piston ring end gap -Improper piston clearance -Head gasket faulty -Poor ring sealing, piston damage, cylinder scored
No spark	-Spark plug fouled -Secondary coil faulty or wires disconnected -Primary coil shorted or open -Exciter coil faulty -CDI faulty -Trigger coil faulty -Ignition switch shorted, contaminated with moisture -Auxiliary switch shorted or contaminated with moisture
Engine idles but no acceleration	-Restricted fuel flow/air flow -Restricted or plugged main jet -Incorrect ignition timing -Clutching incorrect
Engine runs but fails to reach maximum RPM	-Restricted or plugged fuel filter -Fuel tank inlet screen restricted or plugged -Fuel pump not operational -Impulse line restricted or plugged -Incorrect track tension -Incorrect main jet -Throttle slides not fully open -Drive chain too tight -Incorrect clutching, worn clutch components -Exhaust restriction -Excessive driveline friction (HiFax overheating)
Engine runs but fails to idle	-Incorrect air mixture setting -Throttle stop screw incorrectly adjusted -Pilot jet restricted or plugged -Fuel pump lacks fuel to impulse line -Air leak at carb adaptor -Incorrect carburetor synchronization -Low compression -Tight belt -Piston damage -Choke plungers not seating properly -Throttle cable incorrectly adjusted
Engine runs, but overloads with fuel	-Chokes are not seating -Fuel pump diaphragm is ruptured (can be caused by engine backfiring) -Carburetor slides are not synchronized -Too large main jet -Needle and seat not seating properly -Incorrect float level -Poor reed valve condition -Restricted air intake or exhaust outlet
Carburetion and plug fouling	-If a lot of riding is on trails, and plugs foul and get black when doing so, verify <i>all</i> tune up adjustments: carb sync, oil pump adjustment, pilot screw setting, spark plug type and gap, venting for carbs, proper jetting for altitude and temperature, belt tension, clutch operation. If tune up items are correct, check: float level, jet needle position, jet needle wear, inlet needle and seat wear, exhaust outlet clear, etc.

ENGINES

Troubleshooting

PROBLEM	PROBABLE CAUSE
Engine runs but overheats	-Coolant level -Incorrect main jet -Incorrect timing -Incorrect spark plug -Water pump belt loose or broken -Cooling restriction -Air in cooling system (bleed properly) -Inadequate snow for cooling (ice and/or marginal conditions)
Battery will not charge (battery equipped models only)	-Faulty connections -Insufficient alternator output -Faulty diodes (rectifier) -Sulfated battery -Battery electrolyte overfilled or low -Faulty cell in battery -Amp draw with key off -Excessive load on alternator
Lights don't work	-Engine not running -Check wiring harness connector - color matching -Check for burned out bulbs -Check wiring for shorts or loose connections -Disconnect taillight wiring harness- if headlight works, short is in taillight wiring or taillight
Unit fails to propel itself	-Check belt (center distance) -Check clutch -Check chain -Check drive sprocket assembly -Track frozen or stuck -Check tune up items
Track wears unevenly	-Check tension -Check for proper alignment -Check for loose, bent, or broken suspension parts -Riding in marginal or no snow conditions
Chaincase gets hot	-Check oil level -Check chain tension -Check track assembly -Check jackshaft and drive shaft bearings -Check brake operation
Unit hard to steer (heavy steering)	-Check lubrication on spindles -Check ski alignment -Check spindle bushings -Check steering post bushings -Check carbide skags -Front limiter strap too short (if steering is heavy) -Torsion springs set too heavy