

Quick Reference Guide

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Using the quick reference guide will assist you in quickly locating a desired topic or procedure contained within this shop manual. Bend the pages back until you match the desired section above with the black tab on the right hand side of the table of contents for that section. Refer to the table of contents for the exact page(s) to locate the specific topic or procedure required.



SPECIFICATIONS

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GENERAL SPECIFICATIONS MODELS SA340-A1 AND SA440-A1

GENERAL

Overall Length	102 inches (2.590 mm)
Overall Width	35-1/2 inches (902 mm)
Overall Height (No Windshield)	28 inches (711 mm)
Dry Weight (Approximate)	355 pounds (161 kg)

ENGINE

Models	Type 340TA, used on SA340-A1 Type 440TA, used on SA440-A1
Displacement	(SA340-A1) 20.7 C.I. (339cc) (SA440-A1) 26.6 C.I. (436 cc)
Bore x Stroke	(SA340-A1) 2.362 x 2.362 inches (60 x 60 mm) (SA440-A1) 2.677 x 2.362 inches (68 x 60 mm)
Number of Cylinders	2
Engine RPM at Full Throttle	(SA340-A1) 6,500 RPM (SA440-A1) 6,800 RPM
Engine RPM at Idle Speed	2,000 RPM
Starter	Manual rewind

IGNITION

Ignition System	Magneto - Breaker Point
Spark Plug	NGK BR-8ES

CARBURETOR

	MODEL	
	SA340-A1	SA440-A1
Carburetor Make	Mikuni	Mikuni
Carburetor Model	VM 34 Zinc	VM 34 Zinc
Setting No.	VM 34-130	VM 34-131
Type of Carburetor	Open Vent	Open Vent
Main Jet	260	310
Air Jet	None	None
Jet Needle	6DH3-3	6DH4-3
Needle Jet	P-6	P-6
Throttle Slide	2.5	2.5
Pilot Jet	25	25
By Pass	1.4 Dia.	1.4 Dia.
Pilot Outlet	0.8 Dia.	0.8 Dia.
Air Screw	1.5 Turns	1.5 Turns
Float Valve Seat	1.5 Dia.	1.5 Dia.
Starter Jet	2.0 Dia.	2.5 Dia.
Type of Float Chamber	Standard	Standard
Starter System	Cable	Cable

FUEL

Gasoline	Regular leaded (minimum pump posted octane number 89)
Oil	B.I.A. certified T.C.W.
Gasoline/Oil Ratio	(25 to 1) 1 quart (0.94 liters) of oil to 6.25 gallons (23.6 liters) of gasoline
Fuel Tank Capacity	6.25 gallons (23.6 liters)

DRIVE CONVERTER

	MODEL	
	SA340-A1	SA440-A1
Engagement Speed (approximate rpm)	3500	3500
Maximum Drive Converter rpm	6500	6800
Spring Part Number (standard)	050760	050760
Spring Part Number (optional)	050786	050786
Spring Color (standard)	Yellow	Yellow
Spring Color (optional)	Green	Green
Spring Length - New with no load*	4.35 ± 0.187	4.35 ± 0.187
Number of Spring Coils (standard)	5.35	5.35
Number of Spring Coils (optional)	5.0	5.0
Spring Wire Diameter	0.187 inch	0.187 inch
Spring Rate (standard)	45-53 lbs/in.	45-53 lbs/in.
Spring Rate (optional)	60-66 lbs/in.	60-66 lbs/in.
Spring Compression @ 1.25 Inches (standard)	145-165 lbs	145-165 lbs.
Spring compression @ 1.25 Inches (optional)	192-212 lbs.	192-212 lbs.
Weight Part Number (standard)	050835	050836
Weight Color (standard)	Black	Red
Weight Markings (standard)	0146-278	0146-286
Weight Thickness	0.250 inch	0.250 inch
Weight - Total gram weight (standard)	6.475	8.800
Ramp Part Number	050851	050851

Optional Weights			
Part Number	Color	Markings	Gram Weight
050845	Black	0146-279	5.457
050803	Green	0146-136	9.279
050777	White	0146-107	4.958
050778	Yellow	0146-123	6.992
050779	Black	0146-135	4.479
050776	Red	0146-106	5.958
050836	Red	0146-286	8.800

DRIVEN CONVERTER

Cam Angle	30°	30°
Spring Part Number	050774	050774
Spring Color	Black	Black
Spring Length - New with no load	4.60 inches	4.60 inches
Spring Diameter	2.880 inches	2.880 inches
Spring Wire Diameter	0.156 inches	0.156 inches
Spring Preload - Counterclockwise	2nd hole - 1/3 turn	2nd hole - 1/3 turn

BELT

Part Number	05065504	05065504
Outside Circumference	43.5 ± 0.25 inches	43.5 ± 0.25 inches
Width - Top surface	1-1/4 ± 1/32 inches	1-1/4 ± 1/32 inches
Thickness - Top of belt to bottom of lug	0.56 ± 0.03 inch	0.56 ± 0.03 inch
Belt Taper Angle	30°	30°

BRAKE

Minimum Brake Pad Thickness	1/16 inch	1/16 inch
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GEARING

Top Sprocket	18 teeth	19 teeth
Lower Sprocket	37 teeth	36 teeth
Sprocket Overall Ratio	2.05 to 1	1.87 to 1
Chain - Double row 35	90 pitch	90 pitch
Drive Chain Tension (free movement)	3/8 to 1/2 inch	3/8 to 1/2 inch

*After approximately 50 miles, the spring will take a "set" and lose 0.25 (1/4) of an inch of its total length. No significant loss of spring compression will occur because of the decreased spring length.

TRACK AND SUSPENSION

Track	Molded rubber with steel bars
Track Width	15 inches (381 mm)
Track Length	116 inches (2,946 mm)
Suspension	Slide rail

ELECTRICAL COMPONENTS

Type	12 volts - 100 watts
Headlight	Stanley A5988
Tail/Brake Light	G.E. No. 1035
Instrument Lights	G.E. No. 57

FRAME

Frame	Aluminum alloy and steel construction
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SERVICE SPECIFICATIONS

ENGINE

	MODEL	
	SA340-A1	SA440-A1
Effective Compression Ratio	6.6:1	6.6:1
Piston Ring Side Play (Top Ring)	0.004-0.006 in. (0.102-0.152 mm)	0.004-0.006 in. (0.102-0.152 mm)
Piston Ring Side Play (Bottom Ring)	0.002-0.004 in. (0.051-0.102 mm)	0.002-0.004 in. (0.051-0.102 mm)
Piston Ring End Gap	.006-0.014 in. (0.152-0.356 mm)	0.008-0.016 in. (0.020-0.406 mm)
Piston Skirt Clearance	0.0008-0.0022 in. (0.020-0.056 mm)	0.0008-0.0022 in. (0.020-0.056 mm)
Connecting Rod Radial Play	0.0008-0.0012 in. (0.020-0.030 mm)	0.0008-0.0012 in. (0.020-0.030 mm)
Connecting Rod Small End Diameter	0.7875-0.7880 in. (20.003-20.015 mm)	0.7875-0.7880 in. (20.003-20.015 mm)
Crankshaft End Play	0-0.030 in. (0.0-0.762 mm)	0-0.030 in. (0.0-0.762 mm)
Crankshaft Run Out	0.0012 in. (0.030 mm) (max)	0.0012 in. (0.030 mm) (max)

IGNITION

Spark Plug Gap	0.020-0.024 in. (0.5-0.6 mm)	0.020-0.024 in. (0.5-0.6 mm)
Ignition Timing	25° or 0.139 in.	25° or 0.139 in.
Magneto Leads		Resistance
Lighting Coil	Yellow-Brown	0.18 Ohm ± 10%
Exciter Coil	Red or White-Ground	1.13 Ohm ± 10%
Ignition Coil Leads		Resistance
Primary	Red or white to ground	1.61 Ohm ± 10%
†Secondary	High tension lead to ground	5165 Ohm ± 10%

†Remove spark plug caps.

NOTE: Defective coils cannot always be detected using this test alone. Use of a coil tester which simulates operating conditions is the recommended test method.

CARBURETOR

	MODEL	
	SA340-A1	SA440-A1
Air Screw Setting	1.5 turns off seat	1.5 turns off seat
Idle Screw Setting	3 turns open from coil bound initial (2,000 R.P.M. final)	3 turns open from coil bound initial (2,000 R.P.M. final)

CHASSIS

Converter Offset Distance	0.454 inches (11.5 mm)
Converter Center Distance	10.3 inches (262 mm)
Drive Chain Tension (free movement)	3/8 to 1/2 inch (9.5 to 12.7 mm)
Brake Lever Movement	3/4 inch (19 mm)
Track Tension	3/4 inch maximum deflection (5 to 8 lbs pull)
Steering Alignment	Skis parallel or 1/8 inch toe in
Tie Rod Adjusting Stud	1-1/4 inch (32 mm) maximum

GENERAL ENGINE TORQUE SPECIFICATIONS

Cylinder Head Bolts	16 ft/lb (2.213 kg-m)
Crankcase Bolts and Nuts	16 ft/lb (2.213 kg-m)
Flywheel Nut	60 ft/lb (8.3 kg-m)
Recoil Bolt	5 ft/lb (0.7 kg-m)
Spark Plug	20 ft/lb (2.7 kg-m)

TORQUE CHART AND LOC-TITE TABLE

Description	Quantity	Torque	Loc-Tite
ENGINE MOUNT & EXHAUST			
Engine rubber mount nuts	4	30 ft. lbs. (4.15 kg-m)	
Muffler mounting nuts	4	10 ft. lbs. (1.38 kg-m)	
Engine mounting screws	4	30 ft. lbs. (4.15 kg-m)	
ELECTRICAL SYSTEM			
Voltage regulator mounting nut	1	95 in. lbs. (1.09 kg-m)	
Brake and throttle lever lock screw	1	25 ft. lbs. (3.46 kg-m)	
Voltage regulator mounting screw (grounded to chassis)	1	95 in. lbs. (1.09 kg-m)	
Tail lamp lens mounting screws	2	50 in. lbs. (0.058 kg-m)	
Head lamp housing mounting screws	4	11 ft. lbs. (1.52 kg-m)	
Headlamp rim mounting screw	1	50 in. lbs. (0.58 kg-m)	
DRIVE CONVERTER			
Spider assy. - roller bearing mounting nuts	3	35-48 in. lbs. (0.40-0.55 kg-m)	
Spider assy - set screws	3	35-48 in. lbs. (0.40-0.55 kg-m)	
Spider assy. - set screw nuts	3	35-48 in. lbs. (0.40-0.55 kg-m)	
Ramp mounting screws	3	24-30 in. lbs. (0.28-0.35 kg-m)	
Movable sheave to bearing housing mounting socket screws	3	15-17 ft. lbs. (2.07-2.35 kg-m)	
Drive converter assembly to crankshaft bolt	1	55-60 ft. lbs. (7.61-8.30 kg-m)	

TORQUE CHART (CONTINUED)

TORQUE CHART (CONTINUED)			
Description	Quantity	Torque	Loc-Tite
DRIVEN CONVERTER & BRAKE			
Disc brake to stationary sheave mounting screw	3	95 in. lbs. (1.09 kg-m)	
Mounting screw - clevis retainer to cam	1	95 in. lbs. (1.09 kg-m)	
Nut - securing front caliper to brake support bracket	2	120 in. lbs. (1.38 kg-m)	
Nut - mounting screw - clevis retainer to cam	1	95 in. lbs. (1.09 kg-m)	
Nut - caliper to mounting bracket	1	19 ft. lbs. (2.63 kg-m)	
CHAIN CASE			
Chain case mounting nuts	4	17 ft. lbs. (2.35 kg-m)	242
Chain case cover mounting screws	2	20 ft. lbs. (2.77 kg-m)	
Top sprocket mounting screw	1	19 ft. lbs. (2.63 kg-m)	
Chain case cover plugs	2	20 in. lbs. (0.23 kg-m)	
Cap - speedometer drive adapter	1	Hand Tighten	
Top sprocket bearing retainer ring mounting screws	3	95 in. lbs. (1.09 kg-m)	
Bearing support assy to clevis mounting nut	1	95 in. lbs. (1.09 kg-m)	
Tensioner stopper mounting screw	1	95 in. lbs. (1.09 kg-m)	
Jam nuts - chain case set screws	2	17 in. lbs. (0.20 kg-m)	
Bottom sprocket mounting nut	1	55 ft. lbs. (7.61 kg-m)	
Tensioner stopper mounting nut	1	95 in. lbs. (1.09 kg-m)	
SUSPENSION			
Rear suspension bracket mounting nuts	4	17 ft. lbs. (2.35 kg-m)	242
Mounting screws - washer to limiters	2	95 in. lbs. (1.09 kg-m)	
Rear axle support brackets mounting screws	8	95 in. lbs. (1.09 kg-m)	
Axle bracket mounting screws	8	95 in. lbs. (1.09 kg-m)	
Mounting screws - limiters to front suspension arm	2	95 in. lbs. (1.09 kg-m)	
Mounting nut - idler shaft bolt	1	17 ft. lbs. (2.35 kg-m)	
Nut - shock absorber to rear suspension arm	1	30 ft. lbs. (4.15 kg-m)	
Nuts - eye bolts to suspension brackets	4	Adjust	
Attaching nuts - screws to limiters	2	95 in. lbs. (1.09 kg-m)	
Attaching nuts - support brackets	18	95 in. lbs. (1.09 kg-m)	
Wear strip attaching screws	9	60 in. lbs. (0.69 kg-m)	
Cross shaft mounting screws	4	30 ft. lbs. (4.15 kg-m)	
Mounting screws - upper idler shaft to chassis	2	15 ft. lbs. (2.07 kg-m)	
Mounting screws - suspension brackets - front and rear	8	25 ft. lbs. (3.46 kg-m)	
Mounting bolt - idler shaft	1	19 ft. lbs. (2.63 kg-m)	
DRIVE SHAFT			
Bearing housing mounting screws	3	95 in. lbs. (1.09 kg-m)	
Bearing housing grease fitting	1	40 in. lbs. (0.46 kg-m)	
Nuts - bearing housing mounting screws	3	95 in. lbs. (1.09 kg-m)	
SKI & SPINDLE			
Attaching nut - skeg (ski wear runner) to ski	4	15 ft. lbs. (2.07 kg-m)	
Attaching nuts - spring to ski	4	10 ft. lbs. (1.38 kg-m)	
Screw - spindle to spring saddle	2	40 ft. lbs. (5.53 kg-m)	
Nut - spindle to spring saddle	2	45 ft. lbs. (6.22 kg-m)	

TORQUE CHART (CONTINUED)

Description	Quantity	Torque	Loc-Tite
STEERING			
Nut - steering column to tie rod	1	35 ft. lbs. (4.84 kg-m)	242
Nuts - steering arms to tie rods	4	30 ft. lbs. (4.15 kg-m)	
Steering column mounting nuts, upper	2	17 ft. lbs. (2.35 kg-m)	
Steering column mounting screws, lower	2	13 ft. lbs. (1.80 kg-m)	
Tie rod jam nut - LH	2	35 ft. lbs. (4.84 kg-m)	
Tie rod jam nut - RH	2	35 ft. lbs. (4.84 kg-m)	
Nut - RH tie rod to steering column	1	30 ft. lbs. (4.15 kg-m)	
Handle bar to steering column mounting screws	4	95 in. lbs. (1.09 kg-m)	
CHASSIS			
Snow flap mounting screws	4	95 in. lbs. (1.09 kg-m)	
Hood guide and front bumper mounting screws	12	95 in. lbs. (1.09 kg-m)	
Hood guide, front bumper and hood hinge attaching nuts	18	95 in. lbs. (1.09 kg-m)	
Attaching nuts - rear bumper and snow flap	8	95 in. lbs. (1.09 kg-m)	
Passenger handles attaching nuts	4	60 in. lbs. (0.69 kg-m)	
Pan brace attaching screws	2	95 in. lbs. (1.09 kg-m)	
FUEL SYSTEM			
Fuel pump assy mounting screws	2	95 in. lbs. (1.09 kg-m)	
Air silencer support mounting screw	1	95 in. lbs. (1.09 kg-m)	
Attaching nuts - fuel pump assy and air silencer support	3	95 in. lbs. (1.09 kg-m)	
CABLES			
Brake cable jam nuts	2	12 ft. lbs. (1.66 kg-m)	
Choke cable assy	1	6 ft. lbs. (0.83 kg-m)	
Choke cable pal nut	1	Hand Tighten	
CRANK & PISTONS			
Flywheel nut	1	60 ft. lbs. (8.30 kg-m)	
CRANKCASE & CYLINDER			
Cylinder head nuts (long)	2	16-19-1/2 ft. lbs. (2.2-2.70 kg-m)	
Cylinder head nuts (short)	6	16-19-1/2 ft. lbs. (2.2-2.70 kg-m)	
Spark plug - NGK BR8ES	2	20 ft. lbs. (2.70 kg-m)	
Cylinder head bolt stud	8	16-19-1/2 ft. lbs. (2.2-2.70 kg-m)	
Crankcase bolt	1	16 ft. lbs. (2.21 kg-m)	
Crankcase nuts	10	16 ft. lbs. (2.21 kg-m)	
INTAKE & EXHAUST			
Mounting bolt - carburetor holder	2	40 in. lbs. (0.62 kg-m)	
Intake manifold bolts (long)	2	4-5 ft. lbs. (0.55-0.69 kg-m)	
Intake manifold bolts (short)	4	4-5 ft. lbs. (0.55-0.69 kg-m)	
Exhaust manifold nuts	4	10 ft. lbs. (1.38 kg-m)	

TORQUE CHART (CONTINUED)

Description	Quantity	Torque	Loc-Tite
FAN CASE & AIR SHROUD			
Fan assembly to pulley mounting nut	1	30 ft. lbs. (4.5 kg-m)	222
Air shroud mounting screws	11	Use impact driver	
Fan case to crankcase mounting nuts	4	10-12 ft. lbs. (1.4-1.7 kg-m)	
MAGNETO			
Breaker contact mounting screw	2	Use impact driver	
Stator plate mounting screws	3	5-6 ft. lbs. (0.69-0.83 kg-m)	
Exciting coil # 1, exciting coil # 2 and lighting coil to stator plate mounting screws	4	Use impact driver	
Condenser to stator plate mounting screw	2	Use impact driver	
ELECTRICAL			
Coil bracket mounting screws	2	5-6 ft. lbs. (0.69-0.83 kg-m)	
Ignition coil mounting screws	4	5-6 ft. lbs. (0.69-0.83 kg-m)	
RECOIL STARTER			
Drive plate mounting nut	1	8-10 ft. lbs. (1.11-1.38 kg-m)	
Starter pulley mounting bolts	3	5-6 ft. lbs. (0.69-0.83 kg-m)	
Starter mounting bolts	3	5-6 ft. lbs. (0.69-0.83 kg-m)	

NOTE: Loc-Tite formulas are selected on the basis of the diameter of the fastener, and the strength of the bond required. Generally, #222 is used on fasteners up to 5/16 inch (8 mm) diameter. If a particularly strong bond is required, or the fastener diameter is greater than 5/16 inch (8 mm), #242 is specified. Loc-Tite may significantly increase the torque necessary to remove a fastener. Be careful when applying extra force as this risks damaging the parts. Use only the specified formula on each fastener requiring Loc-Tite. Loc-Tite #222 and #242 are industrial designations. The consumer equivalent which may be substituted is Loc-Tite "Lock 'n Seal," product number 21, blue.

GEAR RATIO CHART

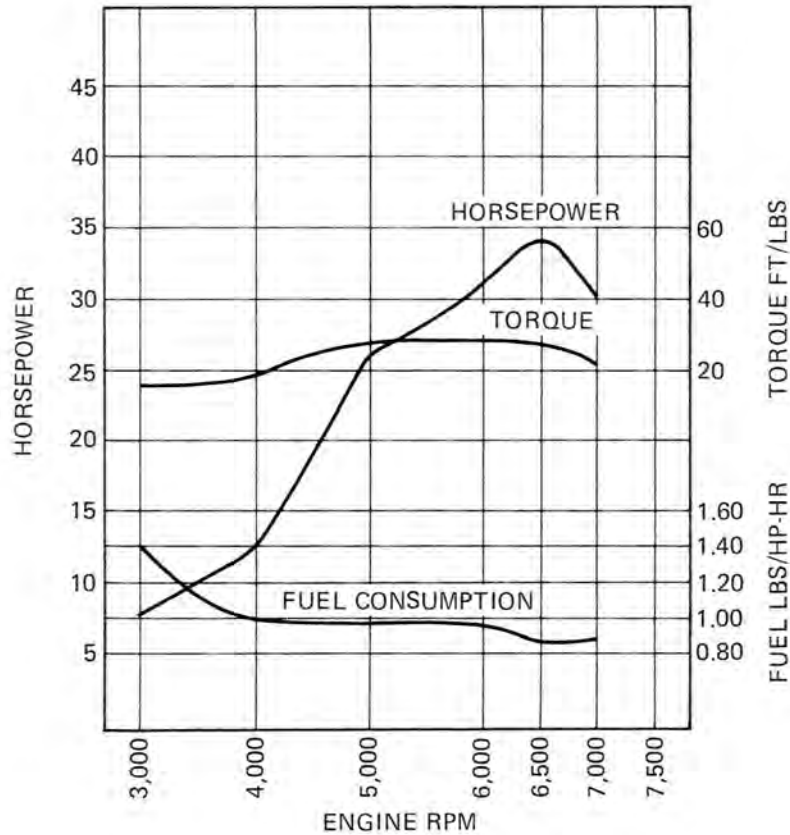
		DRIVE SPROCKET - NUMBER OF TEETH						
		15	16	17	18	19	20	21
DRIVEN SPROCKET - NUMBER OF TEETH	34			2.00:1 Gear Ratio *62 MPH 88 Chain Pitch				1.62:1 Gear Ratio *77 MPH 90 Chain Pitch
	35	2.33:1 Gear Ratio *53 MPH 88 Chain Pitch	2.19:1 Gear Ratio *57 MPH 88 Chain Pitch				1.75:1 Gear Ratio *71 MPH 90 Chain Pitch	
	36	2.40:1 Gear Ratio *52 MPH 88 Chain Pitch				1.90:1 Gear Ratio *65 MPH 90 Chain Pitch		
	37			2.18:1 Gear Ratio *57 MPH 90 Chain Pitch	2.06:1 Gear Ratio *60 MPH 90 Chain Pitch			

*Theoretical MPH @ 6500 RPM

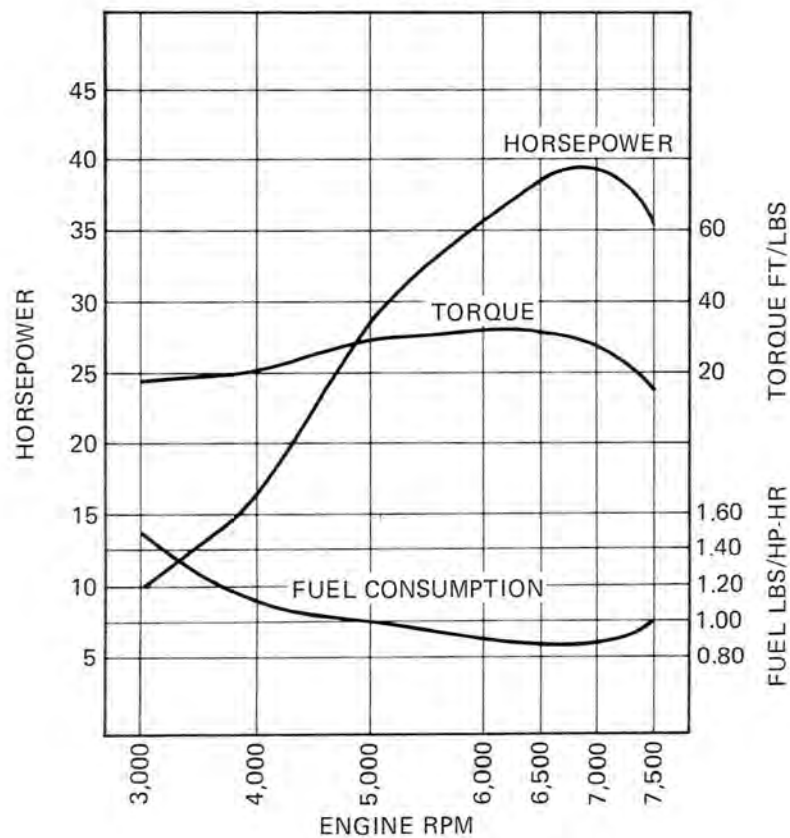
NOTE: All top speeds based on 1:1 clutch ratio and engine RPM at 6500.

ENGINE PERFORMANCE CURVES

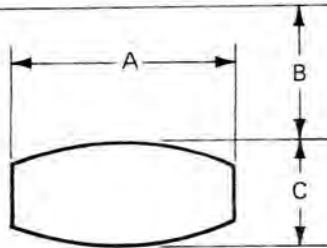
340 ASTRO



440 ASTRO

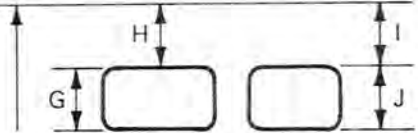
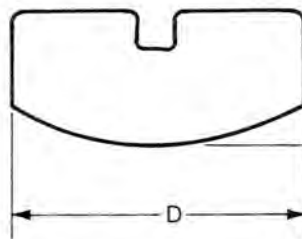


PORT DIMENSIONS



MODEL SA340-A1

A = 1.42 in. (36 mm)
 B = 1.48 in. (37.5 mm)
 C = 0.93 in. (23.5 mm)
 D = 1.61 in. (41 mm)
 E = 1.16 in. (29.5 mm)
 F = 3.76 in. (95.5 mm)
 G = 0.56 in. (14.1 mm)
 H = 1.93 in. (48.9 mm)
 I = 1.93 in. (48.9 mm)
 J = 0.56 in. (14.1 mm)



MODEL SA440-A1

A = 1.57 in. (40 mm)
 B = 1.52 in. (38.5 mm)
 C = 0.93 in. (23.5 mm)
 D = 1.81 in. (46 mm)
 E = 1.16 in. (29.5 mm)
 F = 3.76 in. (95.5 mm)
 G = 0.56 in. (14.1 mm)
 H = 1.93 in. (48.9 mm)
 I = 1.93 in. (48.9 mm)
 J = 0.56 in. (14.1 mm)

MAINTENANCE

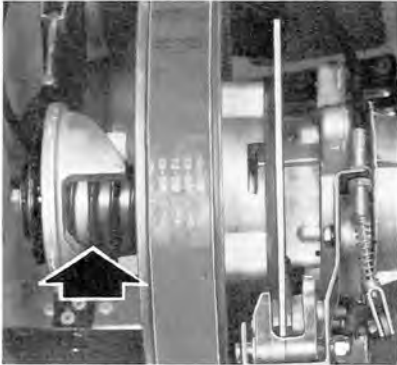
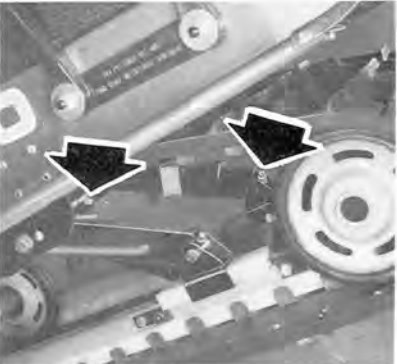
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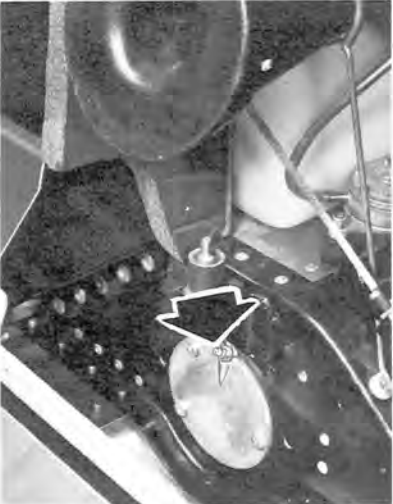
Maintenance Chart

Frequency Operation	Beginning of Each Season	First 50-100 Miles or 5-10 Hours Use	Every 300 Miles or 20 Hours Use	Every 600 Miles or 40 Hours Use	Every 900 Miles or 60 Hours Use	End of Each Season	Page Refer- ence
Install new spark plugs	x			x			
Check carburetor adjustment	x	x					
Check throttle cable adjustment	x	x			x		
Check enrichener cable adjustment	x	x			x		
Replace fuel filter					x		
De-carbon engine and exhaust						x	
Check breaker points			x				
Check ignition timing		x					
Replace drive belt (be sure converter pulleys are clean and dry)	x			x			
Check drive converter and driven converter alignment	x				x	x	
Check drive converter bushings for wear					x		
Clean and inspect drive and driven converters				x			
Check drive chain adjustment		x	x				
Adjust track tension and check alignment	x	x	x				
Check ski alignment	x			x			
Adjust brake		x	x				
Check fasteners for security (use torque chart as a guide)	x			x			
Inspect ski runners for wear	x		x				
Measure wear of slide rail wear strips	x		x				
Adjust headlight	x						

Lubrication Chart

Lubrication Point	Lubricant	Frequency	Illustration
CONTROL CABLES Inner cables	LPS, WD-40, Dri-Slide or similar low temperature lubricant.	Once a season and every 20 hours of operation.	
DRIVEN CONVERTER Ramp sliding surfaces	Low temperature grease.	Once a season and every 20 hours of operation.	
CHAIN CASE HOUSING	Sno Jet Chain Lubricant.	Check level every 20 hours of operation.	
SUSPENSION ARMS, Front and Rear	Low temperature E.P. (Extreme Pressure) Grease.	Once a season and every 40 hours of operation.	

LUBRICATION CHART (CONTINUED)

Lubrication Point	Lubricant	Frequency	Illustration
STEERING COLUMN	Low temperature E.P. Grease.	Once a season and every 40 hours.	
FRONT AXLE BEARING	Apply 3 pumps of grease with a hand-operated grease gun. CAUTION: The seal may be dislodged by the grease, check after greasing bearing.	Once each season.	

Theory of Operation for the Two-Stroke Engine

Introduction

All internal combustion engines are characterized by a four part cycle of operation. The four parts are: 1. Intake, 2. Compression, 3. Combustion, and 4. Exhaust.

A fuel/air mixture must be drawn into the engine, compressed, burned, and exhausted.

A two-stroke engine uses only two strokes to accomplish all four parts.

Each of the four parts can be easily understood by following the path of the fuel/air mixture through the engine (Figure 2-1).

1. Intake: On the downstroke of the piston a charge of fuel mixed with air is drawn into the engine through an open port in the cylinder.
2. Compression: Near the bottom of the downstroke, the intake port is closed, and the piston starts back up. This upstroke compresses the fuel/air mixture to a fraction of its former volume.

3. Combustion: When the mixture has been compressed, it is ignited and forces the piston down. This is called the power stroke.

4. Exhaust: After the power stroke, the piston rises again, pushing the burned gases out through the now open exhaust port, and the cycle is ready to start again.

The piston is carried through each step from one power stroke to the next by the rotating inertia of the crankshaft.

The intake of a two-stroke engine is perhaps the most complex part of the cycle. After the fuel and air have been mixed in the carburetor, it is drawn into the crankcase. As the piston rises, a hole in the cylinder wall (the intake port) is uncovered by the lower edge of the piston. The rising piston effectively increases the volume of the crankcase, drawing in the mixture. On its return trip, the piston blocks the intake port and lightly compresses the mixture in the crankcase. At about 55°-60° BBDC (before bottom dead center), the upper edge of the piston uncovers ports in the cylinder wall that are connected to the crankcase. The mixture in the crankcase, under pressure, rushes through these transfer ports into the cylinder.

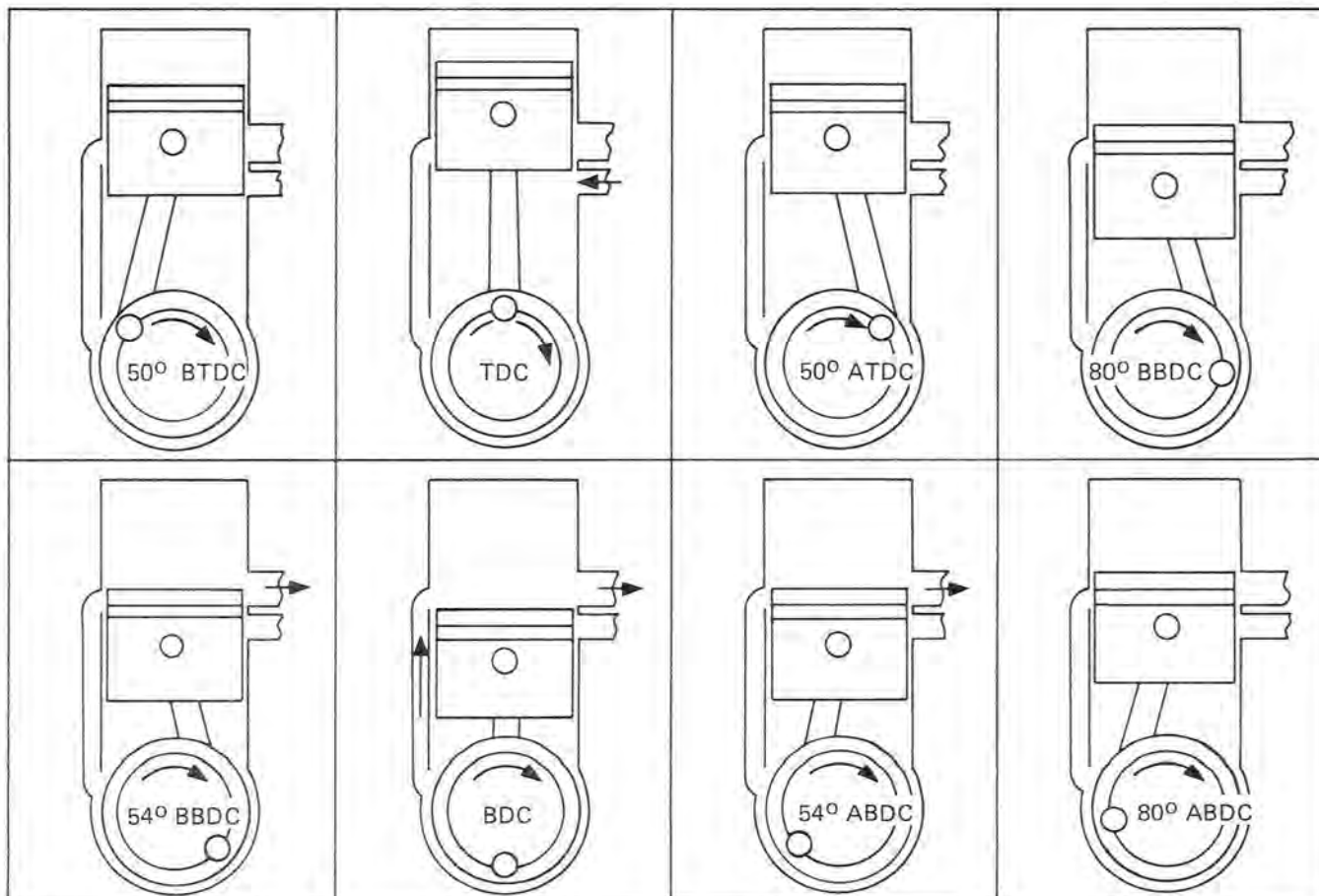


Figure 2-1

There are two separate intake actions: the first into the crankcase, and the second into the cylinder. In two-stroke terminology, only the first intake action is called the intake; the second is called the transfer or scavenging flow. The word "scavenge" is used because the new mixture flowing into the cylinder helps to clean the exhaust out of the combustion chamber. This is known as "scavenging" the exhaust.

After the piston passes BDC (bottom dead center) it rises, closing the transfer and exhaust ports, and opening the intake again. The mixture trapped above the piston is compressed as the piston nears TDC (top dead center), the spark plug is fired and the mixture starts burning.

The piston is driven downward by the combustion until the exhaust port is uncovered by the upper edge of the piston. The two-stroke engine goes through all four basic parts in just two strokes of the piston, and one complete rotation of the crankshaft.

Intake

A two-stroke engine's intake tract starts with the carburetor.

To get the mixture into the crankcase, there must be an opening to the carburetor. There is a valve in the opening or the piston on its downstroke will push the mixture back out through the carburetor. The intake timing is "symmetrical," it opens and closes the same number of degrees on either side of TDC (Figure 2-2).

The fuel/air mixture in the intake tract has inertia, and takes a certain amount of time to get into the

crankcase. The sooner the intake is opened, the more time there is to draw the mixture into the crankcase. If the intake is opened too soon, the crankcase pressure will be higher than atmospheric and the mixture will flow in the wrong direction. The transfers generally close at around 60° ABDC, which is the same as 120° BTDC. It would seem ideal to open the intake at about 115° BTDC, just after the transfer ports close. However, on a piston port engine this would require the intake to remain open until 115° ATDC as well, and all the crankcase pressure meant to transfer the mixture to the cylinder would be lost back out the open intake.

Transfer

Transfer ports are designed to move the fuel/air mixture from the crankcase to the cylinder, and to scavenge the exhaust from the cylinder. Because the exhaust port opens before the transfers do, the exhaust gases are already traveling in the right direction. As the pressure in the cylinder drops, the exhaust will no longer flow of its own accord. The transfer ports aim the incoming fuel/air mixture in such a way that it will sweep throughout the cylinder, pushing the exhaust gases toward the exhaust port.

The size and shape of the transfer ports are important for efficient scavenging. If they are too small, the transfer flow will be restricted. If the port is too large, the flow speed will drop. The lack of inertia of the gases will affect the direction of the flow after it leaves the port, resulting in poor scavenging. Recent studies indicate that transfer ports can be made almost as large as possible and still get good scavenging at low engine speeds by carefully controlling the angle at which the gases enter the cylinder. The transfer port passage is part of the crankcase volume. The larger the passage, the lower the crankcase pressure.

Timing of the transfer ports runs from about 60° BBDC to about 60° ABDC. The transfer ports cannot open until after the exhaust does or the exhaust would flow into the crankcase. This would mix the new charge and the exhaust, resulting in less power (or none at all). Transfer port timing is symmetrical about BDC. The closing point of the transfer port is important to good cylinder filling. If open too long, some of the mixture will flow back into the crankcase.

Compression

Compression occurs as the piston on its upstroke closes the intake and exhaust ports and compresses the fuel/air mixture in the cylinder to a fraction of its original volume. To achieve compression of any kind, the cylinder must be mechanically sealed.

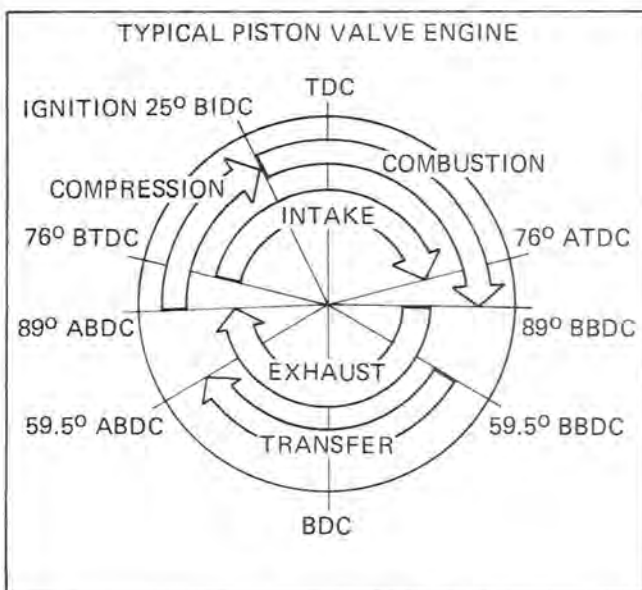


Figure 2-2

The cylinder head, in most engines, is separate from the cylinder itself. The joining surface between the head and the cylinder is sealed against both compression and combustion by the "head gasket." This gasket must be capable of withstanding high temperatures and pressures. Some head gaskets are simply a sheet of copper or aluminum. Others are a sandwich of copper and asbestos sheets. The head must be fastened tightly to the cylinder, squeezing the head gasket with just the right amount of force to keep it from leaking.

The piston is a close fit in the cylinder bore, but the final seal is made by piston rings. These are steel alloy rings which circle the piston in grooves and press outward against the cylinder wall to prevent leakage of compression or combustion past the piston. The piston rings must withstand high temperatures and pressures without deforming while rubbing constantly up and down on the cylinder wall.

Most engines have one or two compression sealing piston rings. Their job is to seal the gap between the piston and cylinder.

These rings are sometimes chrome plated to make them wear longer. Plain iron rings seal just as well but wear more quickly and for this reason they seal sooner when they are new. New piston rings must be "broken in." The new rings do not conform exactly to tiny irregularities of the cylinder wall, but they gradually wear to fit. This initial wear is the break-in period.

The cross-section of a ring is an important part of its design. Rings having a rectangular cross-section are called "flat" rings. The groove for this type of ring has parallel walls. Another type of ring has a wedge-shaped cross-section (see Figure 2-3). This type of ring is called a "key-stone" ring and its groove has non-parallel walls. The shape of the ring and its groove are designed to force the ring outward against the cylinder wall during the combustion stroke for better sealing. Key-stone rings should not be installed upside down. Flat rings sometimes also have a "top" and "bottom" and should always be installed carefully following the manufacturer's instructions.

A third type of ring is the "Dykes" pattern ring. This ring is usually used alone on a single-ring piston. It is placed at the upper edge of the piston, so that one side of the "L" shape protrudes above the edge slightly. The ring is forced against the cylinder wall during the upstroke by the drag of the cylinder wall twisting the ring outward. During the combustion stroke the gas pressure on the inside of the upper leg of the "L" forces it out against the cylinder wall for a good seal.

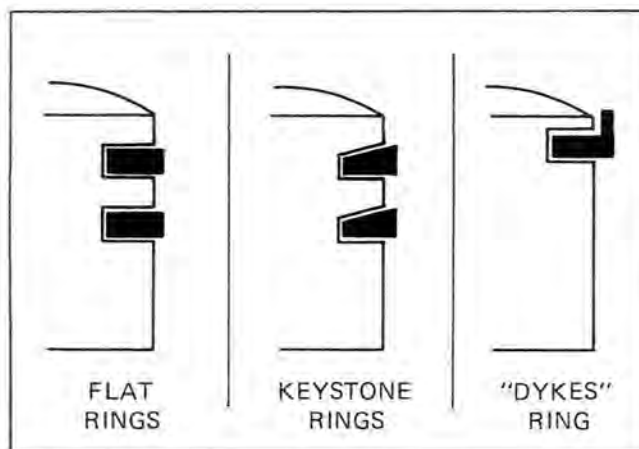


Figure 2-3

The compression ratio may be measured in two different ways. The entire cylinder displacement from BDC to TDC may be used, or just the displacement above the exhaust port. Kawasaki two-stroke engines are generally rated by the second method. As an example, imagine the engine in Figure 2-4 with a 60 mm stroke. Its displacement can be figured as shown.

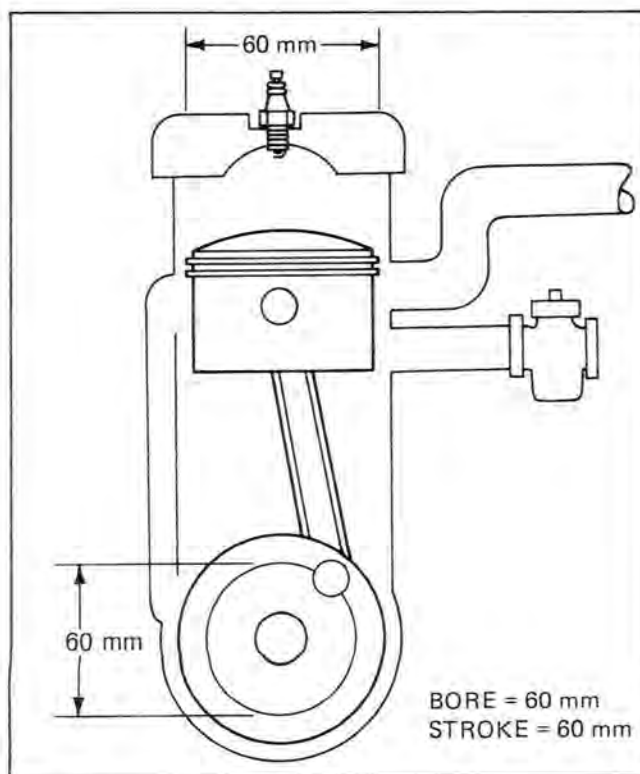


Figure 2-4

$$V = \pi r^2 h$$

WHERE:

V = displacement volume

r = 1/2 bore = 30 mm or 3 cm

h = stroke = 60 mm or 6 cm

$\pi = 3.1416$

$$V = (3.1416) (3)^2 (6)$$

$$V = 169.6 \text{ cc or approximately } 170 \text{ cc}$$

If the engine has a total combustion chamber volume of 20 cc at TDC, then the compression ratio can be figured.

$$R = \frac{V_1 - V_2}{V_2}$$

WHERE:

R = compression ratio

V = displacement volume - 170 cc

V = volume at TDC - 20 cc

$$R = \frac{170 + 20}{20}$$

$$R = 9.5$$

This is called the "theoretical" compression ratio. However, if we measure the total volume of the cylinder at the closing of the exhaust port instead of at BDC, the compression ratio calculations might look like these.

$$V = \pi r^2 h$$

WHERE:

V = displacement volume above exhaust port

r = 1/2 bore = 30 mm or 3 cm

h = distance from top of cylinder to
top of exhaust port = 40 mm or 4 cm

$\pi = 3.1416$

$$V = (3.1416) (3)^2 (4)$$

$$V = 113.1 \text{ cc or about } 113 \text{ cc}$$

$$R = \frac{V_1 + V_2}{V_2}$$

$$R = \frac{113 + 20}{20}$$

$$R = 6.7$$

This is usually called the "corrected" compression ratio, and is always lower than the theoretical compression ratio.

The compression ratio of an engine is one measure of the efficiency of the engine. The higher the compression ratio, the more efficiently the engine will use its fuel, up to a certain point. An engine with a high compression ratio will put out more horsepower for its size and go further on a gallon of gas than an otherwise identical engine with a lower compression ratio.

The further the mixture is compressed before it is burned, the hotter the combustion will be and the more heat will be produced. Greater heat means more expansion of the combustion products, and that means more horsepower for the amount of fuel used and the engine size.

Combustion

Combustion is started by a spark across the electrodes of a spark plug in the combustion chamber. The spark plug receives a timed surge of high-voltage electricity to ignite the mixture at the right instant. If the ignition comes too soon the engine will try to run backward; too late and part of the power stroke will be lost. The ignition is timed to ignite the mixture at 17° before top dead center (at 6000 revolutions per minute and up). The reason for this lead is to start the mixture burning in time so that peak cylinder pressures will occur just after TDC at high speeds.

When the spark plug fires, it ignites the mixture that is between its electrodes. That burning mixture ignites the mixture around it, and a "flame front" travels across the combustion chamber. The flame front moves across the combustion chamber, burning the mixture as it goes.

Normal combustion is a single flame front traveling across the combustion chamber at just the right speed. There are several types of abnormal combustions and all are undesirable. The most common is detonation. Detonation sounds like a hard, metallic, hammering from the engine. The flame front travels almost instantaneously through the mixture resulting in an explosion rather than an even burning of the mixture. Detonation is related to the octane of the gasoline used.

The "octane" of a gasoline is a number which defines that gasoline's burning speed under a standard set of laboratory conditions. The higher the octane, the more resistant the gasoline is to detonation. Octane ratings are assigned according to a laboratory procedure which compares a fuel's ability to resist detonation to that of a mixture of two petroleum distillate fuels. Oil companies produce gasoline to meet octane requirements by adding tetra-ethyl of lead or certain high-octane petroleum distillates. The "lead" in the gasoline makes it burn more slowly, thus avoiding detonation.

When the mixture burns, a chemical reaction takes place. The molecules of fuel combine with oxygen molecules of the air to produce carbon-monoxide, carbon-dioxide, water, traces of other various compounds, and heat. Heat is absorbed by the engine and combustion products. Heat absorbed by the engine is wasted, but heat that goes into the combustion products increases their pressure, forcing them to expand. This expansion is what produces the actual power in the engine.

The shape of the engine's combustion chamber is a factor in its ability to resist detonation. A smooth chamber with few projections and irregularities is more resistant to detonation. Chambers that induce mixture turbulence are more highly detonation resistant; and chambers with less surface area per unit of volume detonate less than others.

Smoothly surfaced combustion chambers are easily designed. Mixture turbulence can be induced by having a squish area: that is a part of the combustion chamber roof that comes very close to the top of the piston (at TDC), causing the mixture to squirt out from between the piston and the chamber roof as the piston nears TDC. The shape with the lowest surface area per unit of volume is the sphere. An ideal combustion chamber would be a smoothly finished, almost spherical chamber, with a squish area around the edge. This design allows a smooth scavenging flow across the chamber, especially when scavenging flow is lowest.

Compression ratio is important to combustion. A high compression ratio requires a high octane fuel to avoid detonation. A low compression engine can use a lower octane gasoline.

The compression pressure produced by an engine is a more accurate measure of its resistance to detonation than its compression ratio. Compression pressure is the pressure in the combustion chamber, before ignition, produced by the rising piston. An engine with a high compression ratio may leak, causing low compression pressure.

Another type of abnormal combustion is pre-ignition. If the combustion chamber becomes very hot, or a fleck of carbon on the chamber surface or on the head of the piston heats up, the mixture may be ignited before the plug fires. This starts a flame front traveling across the chamber. When the plug fires, its flame front meets the pre-ignition flame front with a small, sharp sound. The pre-ignition creates advanced timing, and the engine will soon overheat. Detonation and pre-ignition can lead to serious engine damage.

Another consideration in combustion chamber design is spark plug placement. The spark plug

should be placed near the center of the chamber so the flame front will have the shortest distance to travel to reach all points of the chamber. If the plug is on one edge of the chamber, the flame front has to travel all the way across. From the center, the flame front only has to travel half as far.

Part of the combustion chamber shape is determined by the top of the piston. It becomes the bottom of the chamber at TDC. The top of the piston is generally shaped in a gentle arc to strengthen its center. Some pistons have a raised center to take up space in the combustion chamber and raise the compression ratio.

As the piston is forced downward, the angularity of the connecting rod increases. The crankpin moves around its circle, away from the centerline of the cylinder and then back again. This results in the piston's being thrust against one side of the cylinder wall during combustion, and the other side during compression. The piston hole is slightly offset, in the direction opposite the direction of crankpin travel near TDC. This lessens the impact of the piston's sideways motion against the cylinder wall. The piston reaches TDC slightly before the crankpin does, and piston "slap" at the instant of combustion is minimized (Figure 2-5).

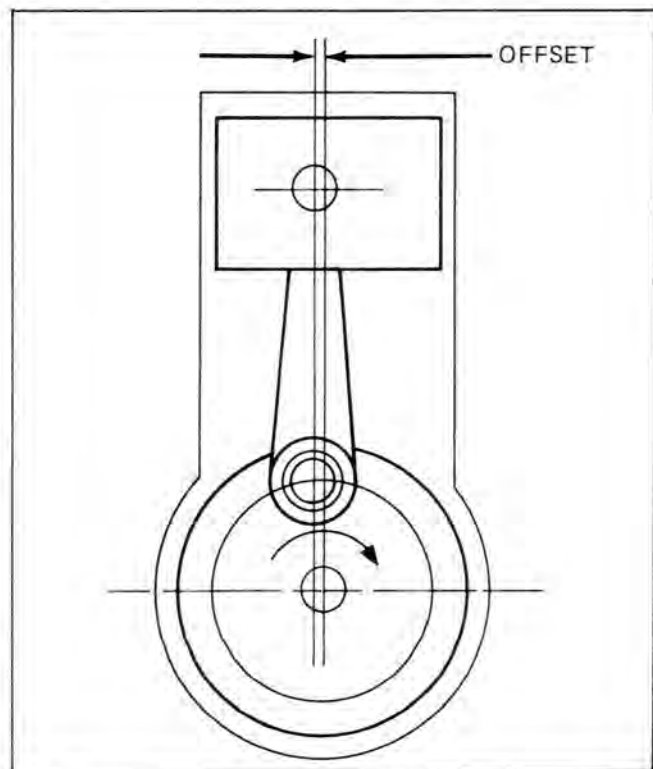


Figure 2-5

The piston cannot be made in a perfectly cylindrical shape or the piston would fit the cylinder only when the engine was cold, and not fit well when the engine was hot. A piston does not expand evenly as it heats up. Near the ring grooves and through the head (Figure 2-6), the piston walls are thicker for extra strength; the skirt is thin to save weight. The upper part of the piston will expand more than the skirt, and must be smaller. The wall thickness near the piston pin holes is greater to handle the stresses of the reciprocating motion of the piston. The piston will expand more across the piston pin bosses and must be made with an elliptical shape. As the piston heats up, it expands into a cylindrical shape and fits the cylinder.

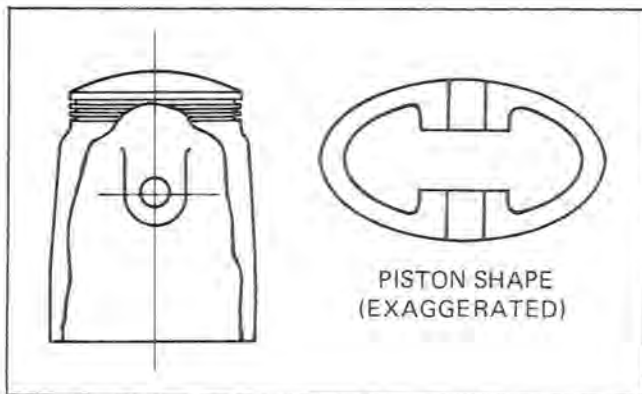


Figure 2-6

The rather odd shape of the piston when cold makes it important to know where to measure when checking piston to cylinder clearances. Usually the piston is measured with a micrometer across the skirt at 90° to the piston pin bosses, about 3/16 inches (5 mm) up from the bottom edge. The other half of piston clearance is the cylinder diameter. This is measured with a dial-bore gauge (if available) at four different positions, and in two directions at each position. The cylinder is measured not only for size, but for roundness and taper.

Exhaust

The design of the exhaust system and timing has a major effect on the characteristics of the engine. The speed range of the engine increases with the height of the exhaust port. Proportionately, the useful power range of the engine decreases. The exhaust port opens and closes at about 80° to 90° BBDC. The height of the port determines its timing. The higher the exhaust port, the wider the exhaust angle.

The last bit of pressure in the cylinder is released into the exhaust system with the opening of the

exhaust port. This forces the gases to move in the right direction. After bottom dead center, the rising piston forces the rest of the burned gases out through the exhaust port.

The exhaust system consists of a passage from the exhaust port through the cylinder head, an exhaust manifold, and a muffler. It removes the exhaust gases quickly and easily while reducing excessive noise.

Engine Design

Theory, function, and design of the upper portion of the engine are important, but not complete until the lower end (crankcase) functions are understood.

The crankcase contains the crankshaft, and supports the main bearings. Snowmobile engines use ball bearings for the main bearings.

These ball bearings are very strong and consist of two hardened steel races separated by a caged set of steel balls. The crankshaft is fitted to the inner race, and the crankcase carries the outer race. As the crank turns, the inner race rolls on the balls which roll on the outer race. The cage keeps the balls from rubbing against each other.

The crankcase is designed to totally enclose the crankshaft. In order to install and remove the crankshaft, the crankcase is split horizontally.

The crankcase must be airtight and oiltight. The mating surfaces of the crankcase halves must match perfectly. A sealing compound is used, rather than a gasket, to insure airtightness on Kawasaki two-stroke engines. The crankshaft oil seals and cylinder base baskets have to be airtight (Figure 2-7).

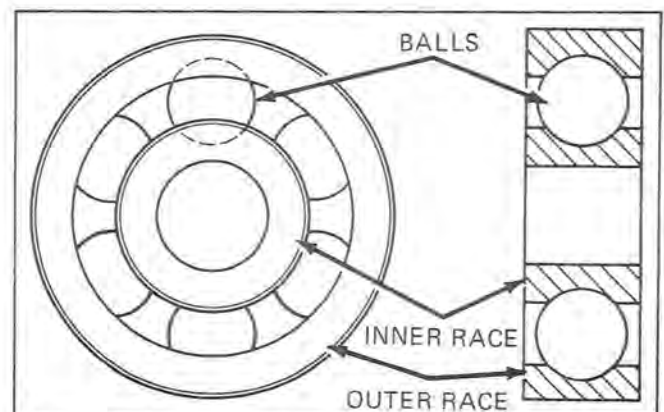


Figure 2-7

To achieve good crankcase compression, the crankwheels are designed to fill the crankcase as completely as possible. Between the crankwheels is the connecting rod. There is very little wasted space inside the crankcase.

The crankshaft is pressed together from separate parts. A caged needle bearing is used on the crankpin. The crankpin rolls on the needles, and the needles roll on the inside of the large end of the connecting rod. The connecting rod is located sideways, and held by two thrust washers, one on each side of the big end.

The crankshaft can twist or loosen and become misaligned because it consists of separate pieces pressed together. The crankwheels must be perfectly aligned on the crankpin (Figure 2-8). There is a specified side and radial clearance for the big end bearing (Figure 2-9).

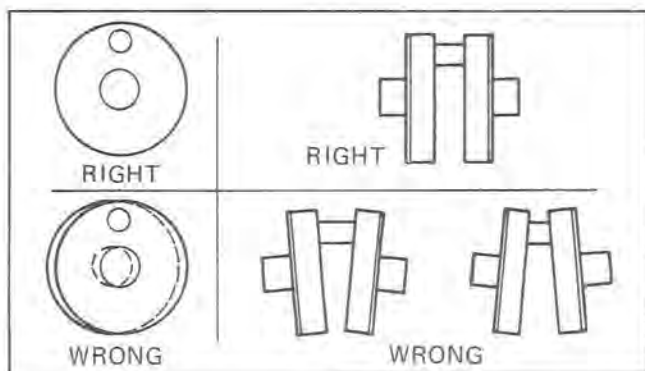


Figure 2-8

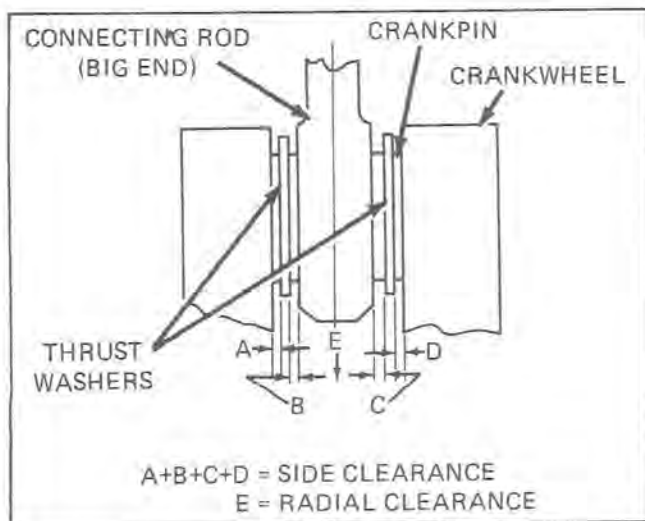


Figure 2-9

Lubrication

The lubricating oil for most snowmobile engines is carried entirely in the fuel. Petroil is a mixture of gasoline and oil used as a fuel in these two-stroke engines. The term "petroil" was probably termed by the British from the two words "petrol" for gasoline, and "oil."

Depending upon the manufacturer's recommendations, the ratio of gasoline to oil in a petroil mix can vary from 16 to 1, all the way to 50 to 1 (and some may be even higher).

Some snowmobile engines are automatically lubricated by a variable pump which may change the mixture from about 18 to 1 to about 50 to 1, depending on engine speed and throttle opening. When the engine needs less oil, as at an idle, it gets less oil.

Under full throttle, the engine will be fed more oil. Automatic oiling is economical because it gives the engine only as much oil as it needs. This also cuts down on visible exhaust emissions.

Cooling

All snowmobile engines need to be cooled. More heat is produced by combustion than the combustion products can absorb in horsepower. This extra heat is absorbed by the piston, cylinder walls, and cylinder head.

The piston is cooled by the new fuel/air mixture coming from the bottom, by the new mixture flowing across the top during the scavenging, and by contact with the cylinder walls. The piston is usually hotter than the cylinder walls or the cylinder head, and is the first component damaged by overheating.

The most common form of engine damage caused by overheating is piston seizure. This is caused by the overheated piston expanding and pressing against the cylinder wall. Friction adds heat to the piston until it begins to melt. Pieces are rubbed off onto the cylinder wall and welded there by extreme heat. A piston will seize first on the exhaust side because that side runs hotter. Incorrect piston clearances and uneven cylinder expansion can also cause seizure. A mild seizure feels like a sudden loss of power. If the damage is slight, the piston can be cleaned, and the cylinder bore honed. A more severe seizure may lock the engine solid. The damage from a severe seizure requires fitting a new piston and honing the bore. Sometimes the cylinder must be rebored to clean up scratches and gouges on the walls. A severe seizure can dam-

age the connecting rod and crankshaft. These components should always be examined for damage.

The cylinder and head may be cooled by air or water. At present Kawasaki is developing water cooled models. An air cooled engine has fins on the cylinder and head which increase the area exposed to air. The more area exposed, the more heat given up. If the cooling fins or fan intake system become clogged with foreign material, the engine may overheat.

The engine is cooled by the air flowing over it. A fan blows cooling air across the cylinders and heads and draws the heat out of the engine. The engine will not be cooled as effectively at an idle, and most snowmobile engines will gradually overheat if they are allowed to idle for an extended period of time.

The average snowmobile engine contains a high percentage of lightweight aluminum components. Aluminum conducts heat very quickly. An aluminum cylinder or head will run cooler than an identical iron one. The cylinder walls cannot be bare aluminum because they would be too soft and wear quickly. Some aluminum cylinders have a chrome plate lining to make them wear acceptably; others have a cast-in iron liner. To cool properly, the iron liner must be in contact with the aluminum of the cylinder over its entire surface. Small bubbles between the iron and the aluminum will insulate the liner, creating a hot-spot. Faulty cylinder castings create problems because of uneven heat transfer from the iron liner to the aluminum cylinder fins.

Carburetor

Introduction

The mixing of fuel and air in the amounts required for efficient combustion is the function of the carburetor.

A common method for referring to carburetors is the bore or venturi size. This method is used in snowmobiles. The measurement is the diameter of the smallest part of the venturi (Figure 2-10).

The carburetor is the rider's primary control over the movement of his machine. The carburetor chooses the engine speed that will propel the machine at the desired rate. With a squeeze of the control the rider can choose a speed anywhere from a virtual crawl to flat out. The rider expects that the engine will respond instantly, anywhere within its operating range.

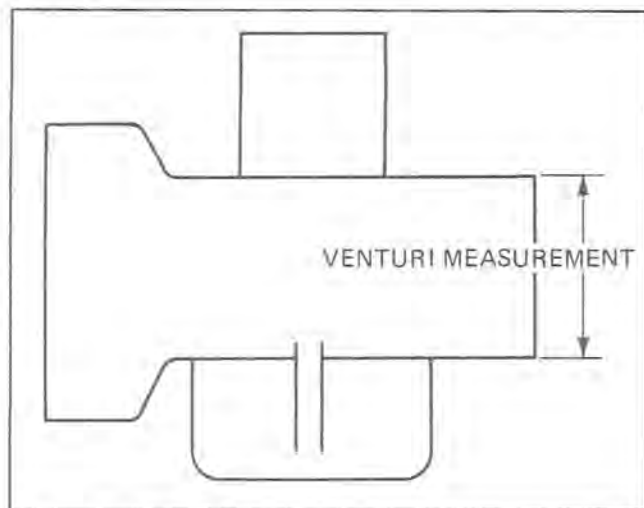


Figure 2-10

The carburetor receives the message from the rider in the form of a pull on a cable. This lifts a slide which uncovers the air passage to the engine. This slide, aided by numerous ports, passages, needles, and jets, regulates the flow of fuel and air into the engine. When the slide is lifted, a greater quantity of fuel/air mixture flows under the slide into the engine, causing it to produce more power. When the slide is lowered, less fuel/air mixture is admitted to the engine, causing it to reduce speed and power.

The carburetor controls the amount of fuel/air mixture which reaches the engine (Figure 2-11).

The fuel/air ratio must be adjusted to meet the changing needs of the engine for particular conditions of load and speed. The ideal burning ratio of fuel to air is about 1:15 or one gram of fuel to each 15 grams of air. This is an "ideal" or "theoretical" mixing ratio, and is only achieved for a fraction of the time that the engine is running. Due to incomplete vaporization of fuel at low speeds or additional fuel required at high speeds, the actual operational fuel/air ratio is usually richer.

Within the acceptable fuel/air ratios that can be burned in the engine, a balance between power and economy must be reached. The amount of air entering the engine for combustion is the limiting factor for maximum performance. To take advantage of the limited amount of air available for combustion, it is necessary to surround each air molecule with enough fuel molecules to insure that all of the air is utilized. Maximum power is obtained by gaining maximum burning efficiency of the available air. Maximum economy is gained by surrounding each molecule of fuel with several molecules of air to insure maximum use from a given quantity of fuel. Maximum economy is maximum burning efficiency of the available fuel.

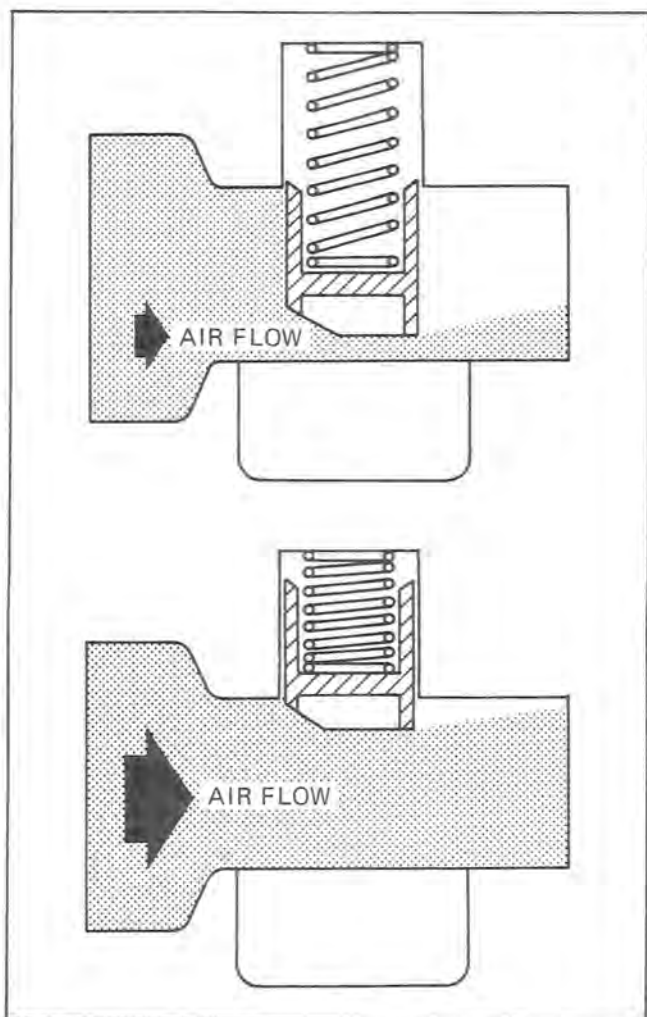


Figure 2-11

Somewhere between maximum power and maximum economy is where most snowmobiles are usually ridden. The range of fuel/air ratios that the engine receives at one time or another ranges from an extremely rich 1:6 to a very lean 1:17 (Figure 2-12). At very slow engine speeds the flow of air through the carburetor is slow and the fuel is broken up into small droplets. If the engine is cold,

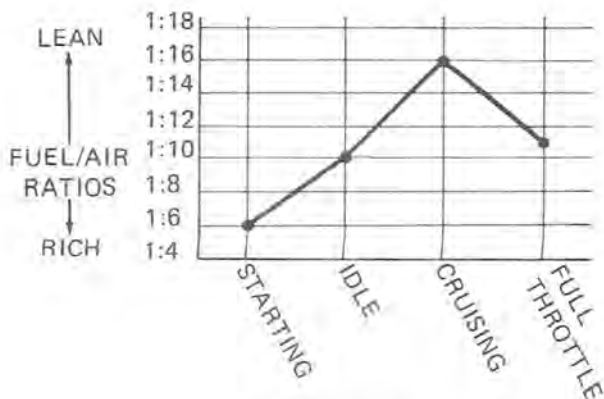


Figure 2-12

these droplets of fuel will not vaporize as they would in a warm engine. It is necessary to provide a very rich mixture to insure that some of the fuel will be burned.

When warmed up, the engine speed at idle is low, and air flow through the carburetor is so low that incomplete atomization of the fuel occurs. The mixture at idle is rich, about 1:10. Under hard acceleration, when maximum power is being developed, the mixture ratio might be around 1:12. The actual amounts of fuel and air are much greater for high power operation. This is why fuel economy drops rapidly when a snowmobile is ridden at full throttle much of the time. At cruising speeds, air flow through the carburetor is substantial, but the fuel is metered sparingly. This results in a slightly lean mixture.

The carburetor must have the ability to meter the fuel and air for extremes of power or economy and somewhere in between. The carburetor responds to the rider's needs by supplying fuel and air to the engine in the exact quantities demanded by speed and load.

Theory & Operation

Carburetor operation is based on the basic principles of fluid dynamics. These principles state that when a fluid (such as air) is flowing through a tube and encounters an area of smaller diameter (known as a venturi or constriction), the fluid will undergo an increase in velocity and a decrease in pressure as it passes through the venturi (Figure 2-13).

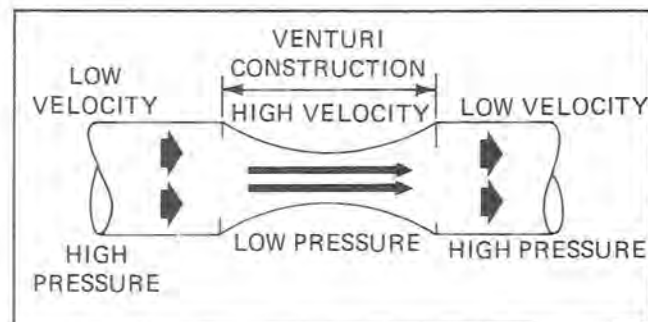


Figure 2-13

Air is drawn in from the air silencer into the engine. This air flows through the carburetor, both the large entry section and the smaller venturi section, with no loss. If 1000 cc of air flow past a point in the entry of the carburetor in one second, then the same amount of air (1000 cc) must flow past a point in the venturi in the same amount of time (one second). If only 900 cc could flow past the point in the venturi in one second, there would soon be a severe pressure build-up in front of the carburetor. To achieve the same flow volume, the

air must flow faster through the venturi. Exactly how much faster depends on how much smaller the constriction or venturi is than the rest of the tube. The smaller the venturi, the faster the air flow.

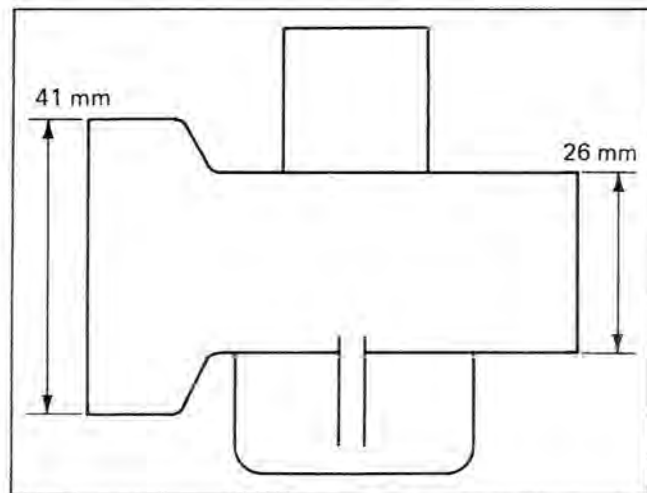


Figure 2-14

Figure 2-14 shows a carburetor with a maximum entry diameter of 41 mm and a venturi of 26 mm. The venturi dimension is the "size" of the carburetor.

The velocity of the air (or a single "particle" in the air) is inversely proportional to the cross-sectional area of the tube. To find the cross-sectional area of the entry and the venturi use the following equations:

$$A_1 = \pi r_1^2$$

$$A_2 = \pi r_2^2$$

Where:

A_1 is the area of the entry

A_2 is the area of the venturi

r_1 is the radius (1/2 of the diameter) of the entry

r_2 is the radius of the venturi

π is a constant, 3.14

express A_1 and A_2 in a ratio to find how much larger the entry is than the venturi.

The cross-sectional area of the entry is:

$$A_1 = 3.14 \times 20.5^2$$

$$A_1 = 3.14 \times 420.25$$

$$A_1 = 1319.585 \text{ mm}^2$$

The cross-sectional area of the venturi is:

$$A_2 = 3.14 \times 13^2$$

$$A_2 = 3.14 \times 169$$

$$A_2 = 520.66 \text{ mm}^2$$

The ratio of A_1 to A_2 is:

$$\frac{A_1}{A_2} = \frac{1319.585}{520.66} = \frac{2.53}{1} \text{ or } 2.53:1.$$

The area of the venturi is about 2-1/2 times less than the area of the entry. Since the velocity is inversely proportional to the area, the velocity through the venturi is about 2-1/2 times greater than through the entry tube.

Occurring along with the velocity increase is a drop in air pressure in the venturi region. This reduced pressure allows the air flowing through the carburetor to accelerate through the venturi section. Under average conditions, the pressure in the venturi will be approximately 60% of the pressure in the entry (which is approximately the same as atmospheric pressure).

Metering System

The carburetor consists of a number of separate systems to supply fuel and air as required. Fuel supply is handled by a fuel pump and float bowl. The main system, pilot system, and starter system mix fuel with air as it is needed by the engine (Figure 2-15).

The Float Bowl

The float bowl (or float chamber) is the source of fuel for the other systems which meter the fuel; the main and pilot systems; and the starter system. The float chamber is attached to the bottom of the carburetor. The upper portion of the chamber cavity is vented to the atmosphere, so air pressure inside the bowl is the same as pressure outside the bowl.

Fuel level in the float bowl is controlled by floats and a needle valve. The lower end of the needle valve rides on the float arm, and the upper end seals against the needle valve seat. When the level of fuel in the bowl drops, the floats drop slightly, and the needle valve moves down away from the seal. This allows fuel pumped from the tank by the fuel pump to flow into the bowl. As fuel enters the bowl, the floats rise, pushing the needle valve into contact with the valve seat, shutting off the flow of fuel.

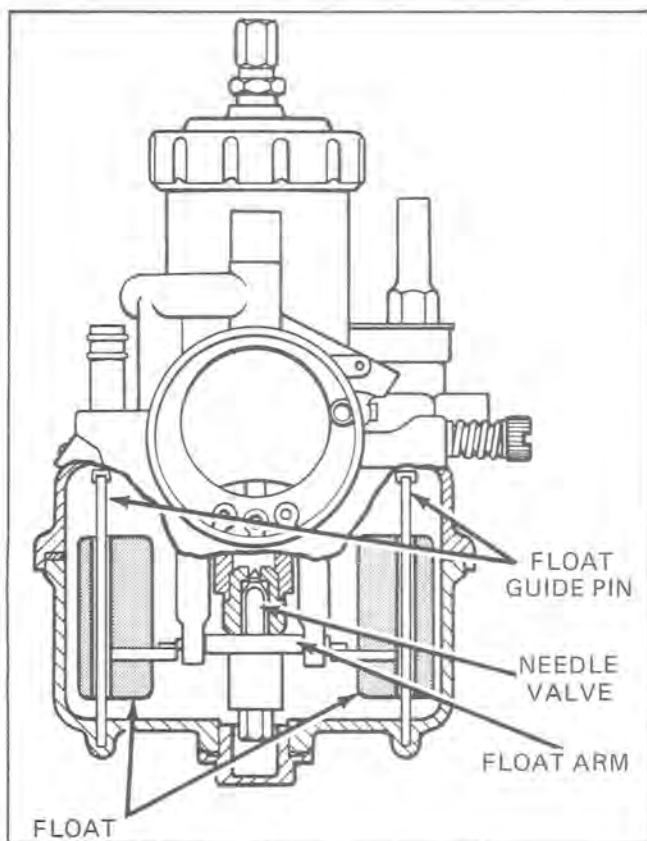


Figure 2-15

The fuel level affects how rich or lean the engine will run throughout its entire range. The reason for this is the drop in pressure that occurs in the venturi. The float bowl is vented to the atmosphere, so there is a pressure of 1.03 kg-cm² (14.7 psi) pushing down on the surface of the fuel in the float bowl. When the engine is stopped, this pressure is on the surface of all the fuel in the float bowl, including the fuel inside the "feed tubes" which lead into the venturi. When the engine is running, the pressure in the venturi is less, and the pressure in the feed tubes is also less. The atmospheric pressure acting on the surface of the fuel in the bowl is much greater than the pressure acting on the fuel in the feed tube. Therefore, the level of fuel in the feed tube rises, pushing the fuel in the feed tube up into the venturi where it is released into the air stream as tiny droplets (Figure 2-16).

The float level is important at low speeds. If too low, the decreased pressure in the venturi would not be able to pull enough fuel up out of the bowl and into the air stream. This would cause hard starting and lean mixture ratios. If the fuel level is too high, too much fuel is pulled into the venturi and the engine would run too rich. The float level is adjusted by bending the tab. Bending the tab towards the needle valve lowers the fuel level, and bending it away from the valve raises the level. Always set the fuel level at the correct level.

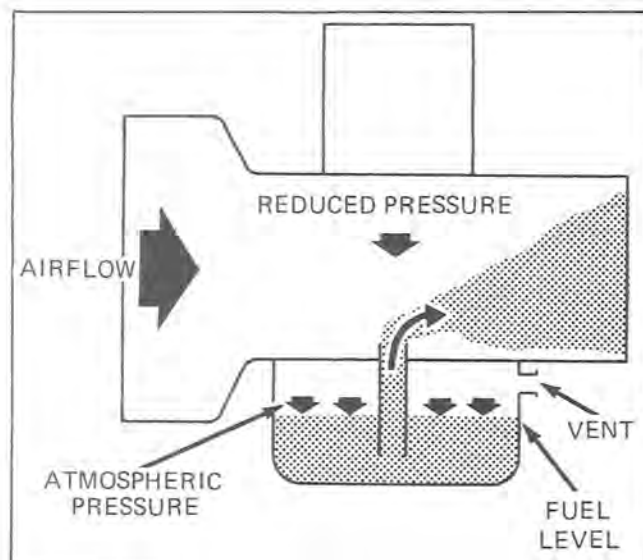


Figure 2-16

Metering the fuel and air in the proper amounts is performed by a number of separate systems. Each system has a range of throttle positions in which it is effective, but the division between where one system takes up and another leaves off is gradual. This "overlap" insures the transition from one system to another will be smooth. The metering components are the throttle slide, main fuel system, pilot system and starter system. Figure 2-17 illustrates the overlap between the components.

Throttle Slide

The amount of air entering the carburetor is determined by the throttle slide. The throttle slide rides in a closely fitting bore directly above the venturi in the carburetor body. The movement of the slide is controlled by a cable and spring. In the "fully closed" position, little or no space remains under the slide for the air to flow through the venturi. As the slide is raised higher, more air will flow through the venturi and into the engine. When the slide is in a lower position, it blocks part of the venturi, and the area under the slide becomes a venturi in a venturi. The size of the actual venturi or air passage changes with the position of the slide. This is known as a variable venturi type. It is the most common type found on snowmobiles and is used on all Kawasakis.

At lower throttle positions, the cutaway of the throttle slide affects mixture ratios. The effect of the cutaway is felt most from about 1/8 to 1/3 throttle. The higher the cutaway, the leaner the mixture will be at a constant throttle position. The higher cutaway offers less resistance to the incoming air. The fuel supply remains relatively constant at any constant throttle position, and the

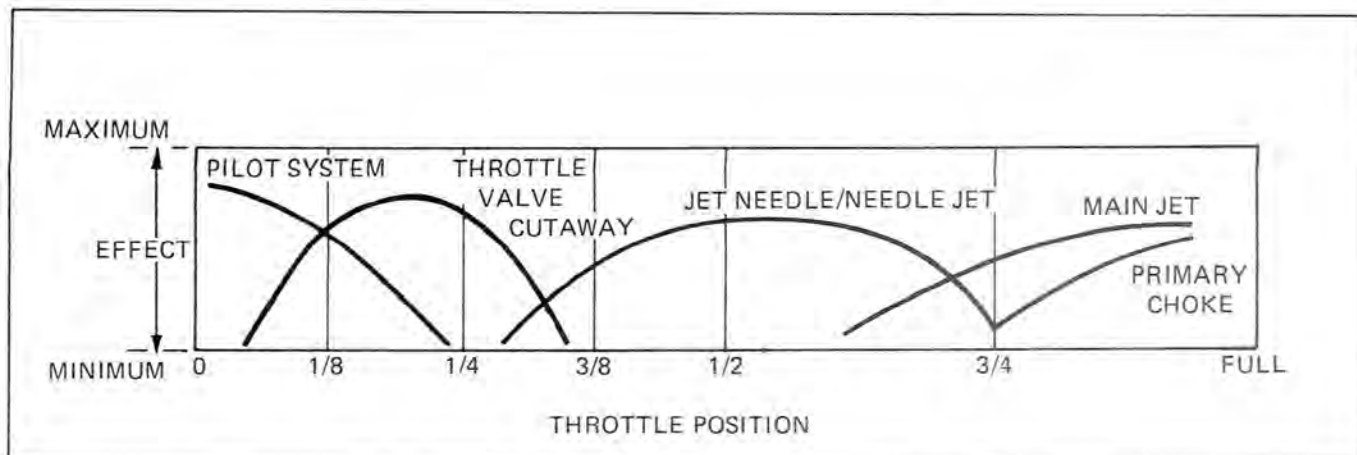


Figure 2-17

additional air results in a leaner mixture. The lower the cutaway, the greater air flow resistance, and a richer mixture. The slide cutaway provides for adjustment of the fuel/air ratio as the transition is made from idle to the full venturi action of the carburetor (Figure 2-18).

slide, jet needle, needle jet, and the main jet. As soon as there is enough air flow through the venturi to draw fuel up into the main jet/needle jet assembly, the main system takes effect. The main system components meter fuel from 1/8 throttle to full throttle. The throttle slide is part of the main system only in that it carries the jet needle.

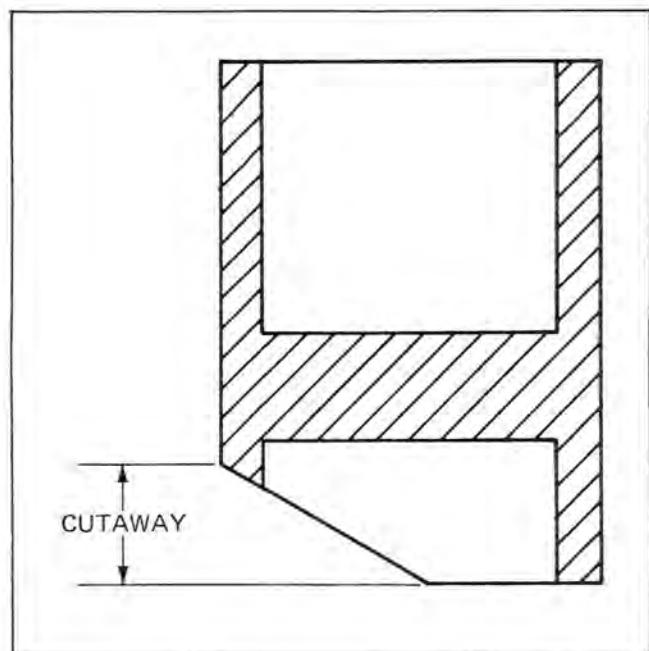


Figure 2-18

Main System

Four separate systems meter the fuel and mix it with the air: The main system for normal running, the pilot system for low speed running, and the starter system to assist starting with a cold engine.

The largest portion of the metering is performed by the main system. The components are: The throttle

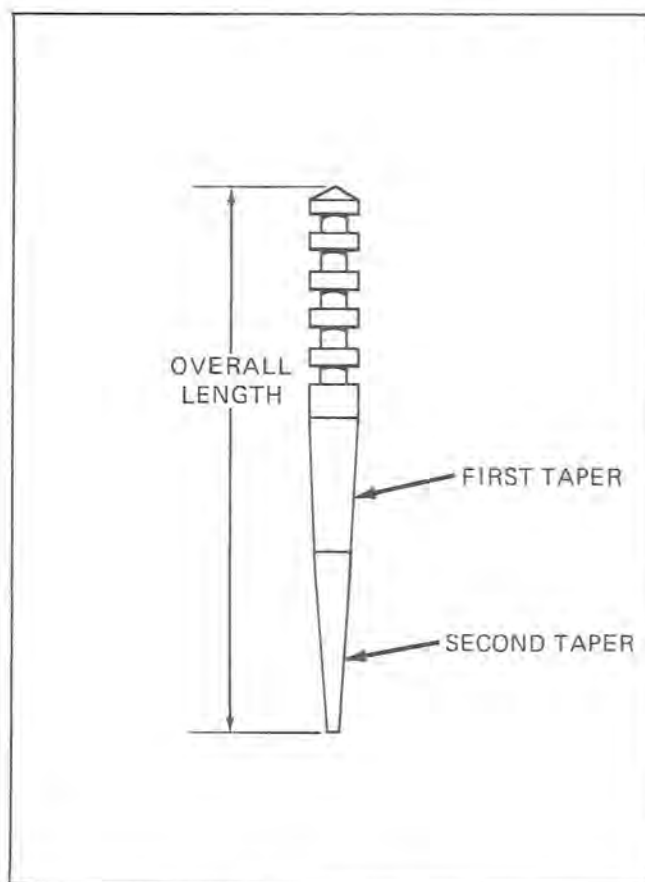


Figure 2-19

The jet needle rides in the throttle slide and moves up and down with the slide. The needle itself is

tapered at its lower end and has grooves at its top end. Figure 2-19 shows a typical double taper jet needle. The needle is tapered in two stages. This double taper needle is used in larger two-stroke engines. The markings on a needle indicate the length of the needle and the taper of both sections. The first number is the overall length of the needle, rounded off to the lowest 10 mm. Thus a 5 indicates that the needle is at least 50 mm but less than 60 mm in length. The letters on the needle indicate the taper of each section. The first letter stands for the taper of the top section (closest to the grooves), and the second letter stands for the bottom taper. The taper angles are graduated in 15' (15 minute) increments with a taper of 15' indicated by the letter A, a taper of 30' indicated by the letter B and so on. A needle marked 6DH3 would be between 60 and 70 mm with a top taper of 1° and a bottom taper of 2°. Refer to chart showing the taper angles of the double taper needles used by Kawasaki. Needles are sometimes referred to with another number which is not actually stamped on the needle. This number indicates the groove in which the clip belongs. A 6DH3-3 would refer to the needle described, as well as telling that the clip should be in the third groove from the top.

NEEDLE TAPER ANGLES

A	0° 15'	I	2° 15'
B	0° 30'	J	2° 30'
C	0° 45'	K	2° 45'
D	1° 0'	L	3° 0'
E	1° 15'	M	3° 15'
F	1° 30'	N	3° 30'
G	1° 45'	O	3° 45'
H	2° 0'	P	4° 0'

The top of the needle is fastened to the throttle slide, and the tapered end extends into the needle jet. The needle jet fits in the carburetor body in the center of the venturi. The lower end of the needle jet is fed fuel from the float chamber by the main jet. The inside diameter of the jet is greater than the non-tapered section of the needle. The inside diameter of the needle jet used is 2.680 mm and the outside diameter of the needle is 2.512 mm. Subtracting the diameter of the needle from the diameter of the jet gives the amount of clearance between them.

$$\begin{array}{r} 2.680 \text{ mm} \\ -2.512 \text{ mm} \\ \hline .168 \text{ mm} \end{array}$$

The clearance is 0.168 mm. As shown in Figure 2-20, the needle blocks the jet when the throttle slide is closed. When the slide is lifted, the needle rises out of the jet until the tapered section ar-

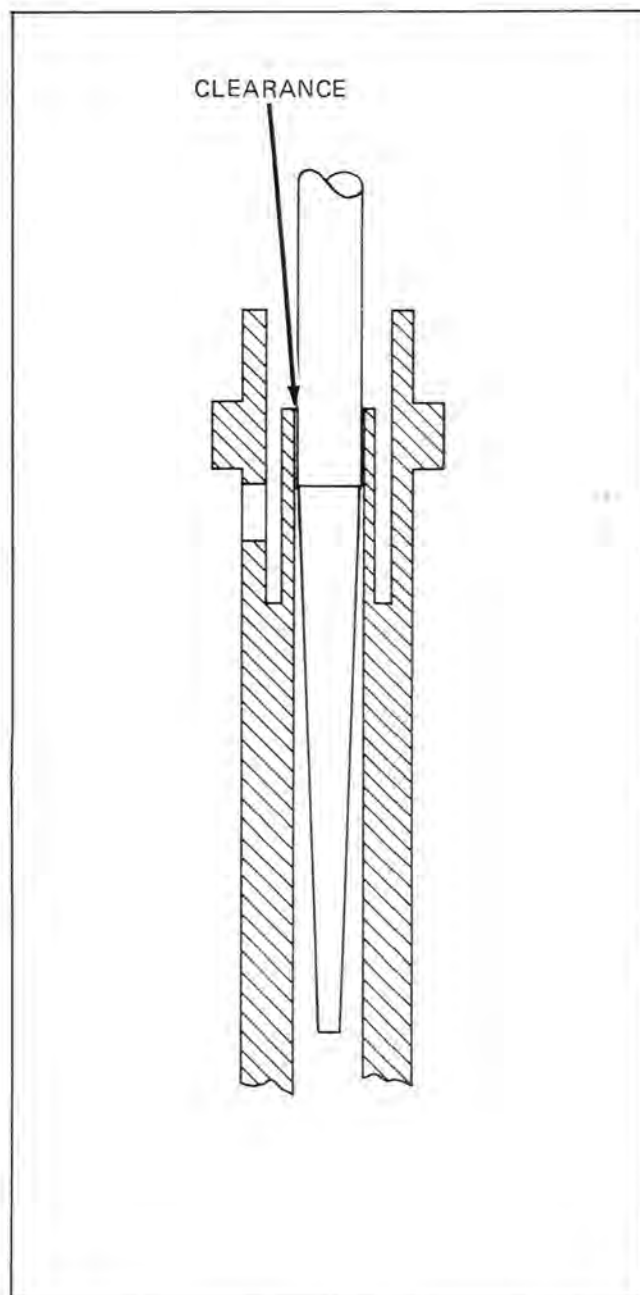


Figure 2-20

rises at the upper end of the jet. The effect of the taper is to increase the clearance between the jet and the needle as the needle is lifted.

With the throttle slide raised, fuel from the float bowl is drawn by reduced pressure, up into the jet and through the clearance area between the jet and the needle. The double taper of the needle serves to accelerate the flow rate of the fuel so the amount of fuel can keep up with increasing amount of air in higher throttle positions.

Changing the position of the needle changes the amount of available fuel. The needle is moved by

moving the clip up or down in the grooves on the needle. Moving the clip towards the top of the needle delays the fuel flow increase, leaning out the mixture. This is known as lowering the needle (because if the clip goes up, the needle sits lower). Raising the needle (lowering the clip) richens the mixture by advancing the fuel flow increase (Figure 2-21).

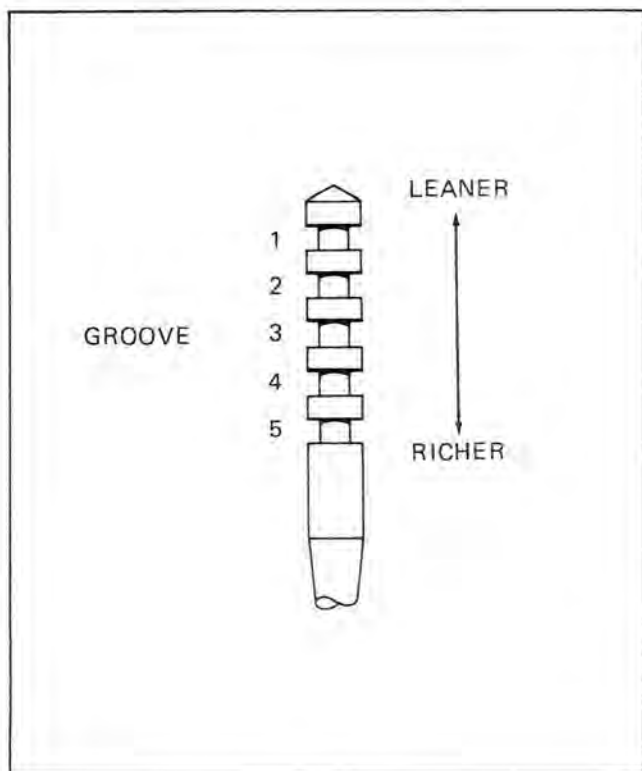


Figure 2-21

Around 3/4 throttle, the clearance between the needle and the jet becomes greater than the cross-sectional area of the main jet. At this point, the fuel flow is determined by the size of the main jet.

The needle jet pre-atomizes the fuel before it enters the venturi for final atomization into the engine. Fuel enters the venturi in a spray of tiny droplets rather than a flow or dribble. The atomized fuel spray is vaporized by the engine heat. The atomization of the fuel in the needle jet and venturi improves the burning efficiency of the engine.

Atomization of the fuel in a snowmobile carburetor is accomplished by use of a "primary type" needle jet. The primary type tends to flow more fuel, allowing richer mixtures, and is used mostly on larger two-stroke engines (Figure 2-22).

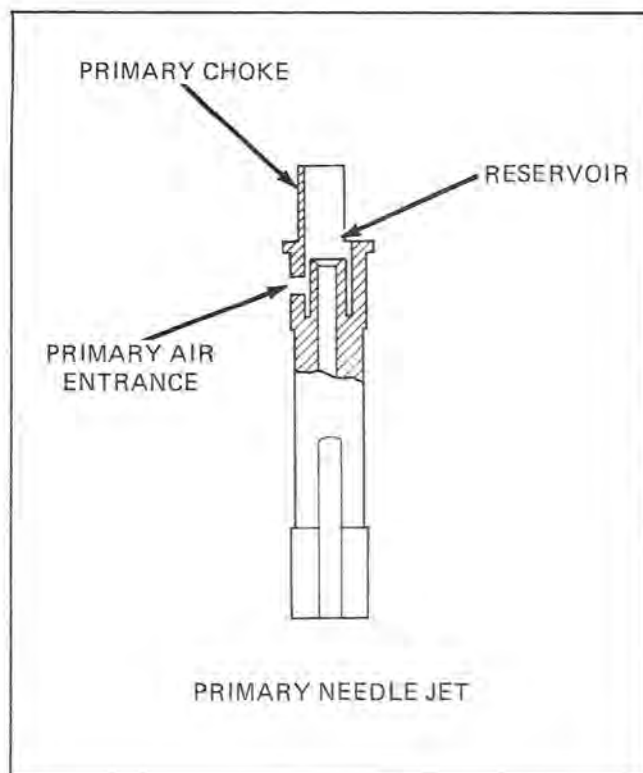


Figure 2-22

The primary type needle jet has a "reservoir" which surrounds the point at which the fuel exits past the needle. This reservoir is connected by passages in the carburetor body to a very small air jet in the front (away from the engine) end of the carburetor. Air flows in this jet, through the passages and into the reservoir where it mixes with the fuel and is drawn into the venturi. The entrance to this passage is out at a point of near atmospheric pressure and the exit is subject to venturi depression. Air flow is aided by pressure differential. The size of the jet is very small, so the air arrives at the reservoir with high velocity. At the reservoir, air helps break up the drops of fuel as they leave the center metering portion of the needle jet (Figure 2-23).

Surrounding two-thirds of the reservoir is a lip which extends up into the venturi in front of the needle. This lip generates turbulence which creates a greater vacuum behind the lip where the reservoir and needle are located. At high RPM, this extra vacuum effect helps pull more fuel up from the float bowl. The lip on the needle jet is known as a primary choke. The height of the primary choke determines the amount of turbulence, and the amount of extra depression at the venturi exit of the needle jet. A taller primary choke will create more turbulence and suction, leading to a richening of the mixture at higher RPM. Using a taller primary choke allows use of a smaller main jet to achieve approximately the same mixture ratio

at full throttle but a decrease in fuel consumption in the medium throttle position.

The needle jet is identified by its diameter. Figure 2-24 is a chart for identifying the size of needle jets of the primary type.

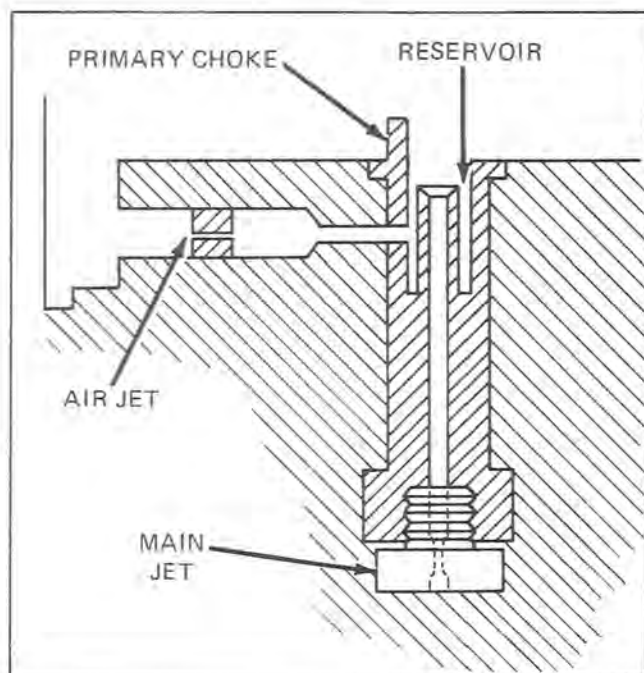


Figure 2-23

The last component of the main system is the main jet and the metering screw (not on all carburetors). The main jet is attached to the inside of the float bowl cover. An "O" ring is used to seal the bottom of the needle jet assembly to the float cover to insure that fuel can enter the needle jet only through the main jet. The main jet can be removed for cleaning or changing without removing the carburetor from the engine. The main jet meters all fuel to the main system except on carburetors equipped with an adjustable metering jet screw.

The adjustable metering screw is located on the outside of the float bowl. A plastic cap on the head of the screw indicates the adjustment setting which can be varied from closed to nearly one full turn open. The metering screw allows fuel to bleed into the main system which supplements the main jet metered fuel flow. A variable range of 100 points (10 jet size steps) can be obtained between the closed and one turn open position. In the closed position only the amount of fuel metered by the main jet can pass through the main system. As the metering screw is turned open fuel flow increases in the main system, making the fuel/air ratio richer.

When the main system begins to meter fuel, the throttle slide cutaway, needle, needle jet, and main jet determine the amount of fuel that should be delivered for the amount of air entering the engine. This working relationship continues until approximately 3/4 throttle. At this point, the cross-sectional area of the clearance between the needle and the needle jet becomes greater than the cross-sectional area of the main jet. When this occurs, there are no restrictions to fuel flow any greater than the restrictions of the main jet; and the size of the main jet determines how much fuel will be available.

Main jet size is indicated by the number stamped on the jet. There are different types of main jets, each with a different numbering system. Figure 2-25 shows each type of jet and Figure 2-26 compares their flow rates in cc per minute to the numbers stamped on the jets.

Use extreme care when changing main jets. Use a replacement of the same type. Matching only the numbers can result in total confusion as to why the engine will not run properly.

NEEDLE JET INSIDE DIAMETERS (MM)

	0	1	2	3	4	5	6	7	8	9
N	2.550	2.555	2.560	2.565	2.570	2.575	2.580	2.585	2.590	2.595
O	2.600	2.605	2.610	2.615	2.620	2.625	2.630	2.635	2.640	2.645
P	2.650	2.655	2.660	2.665	2.670	2.675	2.680	2.685	2.690	2.695
Q	2.700	2.705	2.710	2.715	2.720	2.725	2.730	2.735	2.740	2.745

Figure 2-24

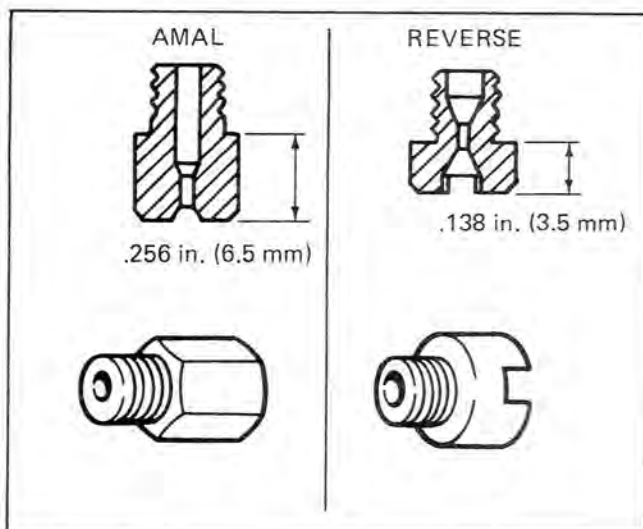


Figure 2-25

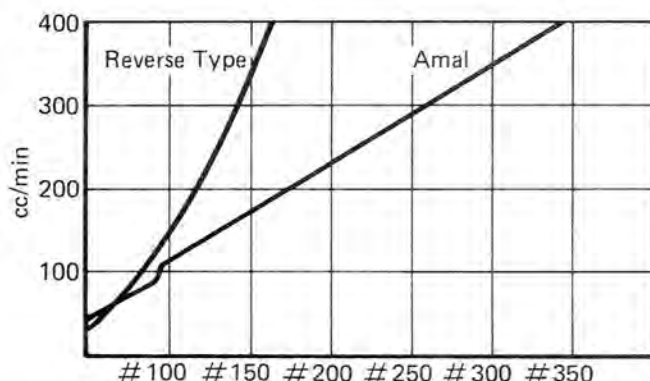


Figure 2-26

Pilot System (Figure 2-27)

Fuel and air supply at low speeds and small throttle openings is controlled by the pilot system, or slow system. The pilot system consists of a series of passageways in the carburetor body, a pilot jet to meter fuel, and a pilot air screw to meter air. At low engine speed and small throttle opening the main system can not provide the proper amount of fuel or air.

Fuel is drawn through the pilot jet which protrudes into the float chamber. The pilot jet has a series of holes drilled in its body at the point where the air is introduced from the passageways. These holes allow fuel to be mixed with air before it enters the venturi through the pilot outlet (Figure 2-28).

Air for the pilot system enters from the front of the carburetor and is metered by the pilot air screw. The pilot air screw is tapered to provide a gradual increase in air flow as the screw is backed out. The taper fits in the center of a passageway, and

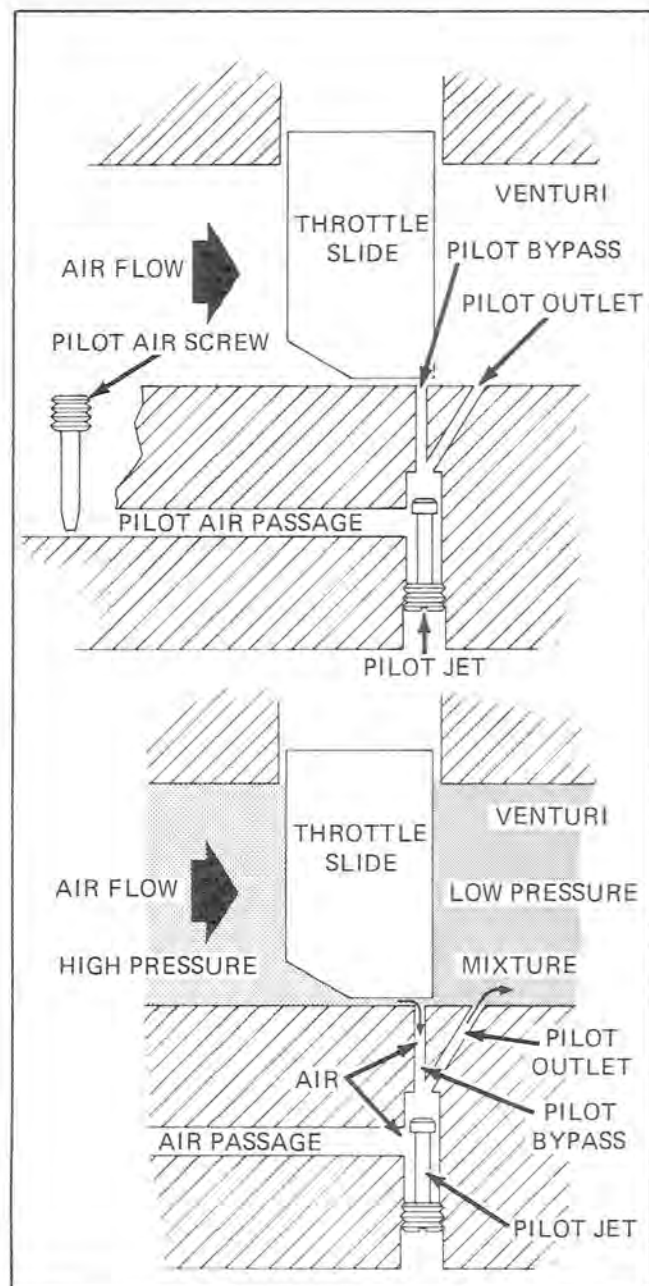


Figure 2-27

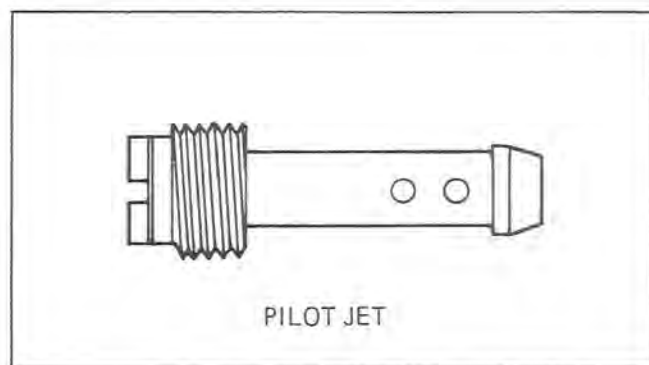


Figure 2-28

turning the screw all the way in closes the passageway. The normal air screw setting is from 1 to 1-3/4 turns out from a lightly seated position. If the pilot mixture appears too rich, backing the air screw out further will lean the mixture. Turning the air screw in farther will cut down the amount of air supplied, resulting in a richer mixture. Adjustment of pilot mixtures can also be effected by changing pilot jets.

At idle speeds (very low, "closed" throttle position) air from the air passage in the front of the carburetor is supplemented by air from the pilot bypass. At these almost closed throttle settings, air enters from the pilot air passage and the bypass. When the throttle is opened, air flow through the venturi increases, and fuel/air mixture now exits from both the outlet and the bypass, where it mixes with the air flowing through the venturi.

Fuel/air mixtures metered by the pilot system are somewhat richer than mid-range, partial throttle mixtures. Low engine speed at low throttle position does not promote good atomization of the fuel entering the engine.

Starter System

Starting a cold engine presents problems of low air flow and poor atomization that require a rich mixture. In a cold engine the engine parts are not hot enough to vaporize the droplets of fuel. To overcome these difficulties requires an even richer mixture than that provided by the pilot system. To provide these richer mixtures, a starter system is added to the carburetor. The starter system consists of a jet to meter the fuel, and a plunger which opens air passages from the front of the carburetor and into the venturi. The plunger is lifted by a cable. Lifting the plunger uncovers the air inlet passage and outlet to the venturi. If the throttle slide is closed, the air that goes to the engine must come through the starter passageways. This creates enough suction to draw fuel from the bowl into the chamber below the plunger. Here it is mixed with air from the front of the carburetor and drawn into the venturi and the engine. Atomization of fuel for starter mixtures is aided by an emulsion tube, a long tube which protrudes into the fuel and through which the fuel from the starter jet is drawn. This tube has holes drilled in it, similar to the pilot jet and air bleed needle jet. These holes allow a small amount of air from the float chamber to be mixed with the fuel before it enters the chamber below the starter plunger. The atomization of the fuel allows it to flow more easily through small passages (Figure 2-29).

Ignition System

The breaker point ignition system consists of a condenser (capacitor), breaker points, coils and spark plugs. See Figure 2-30.

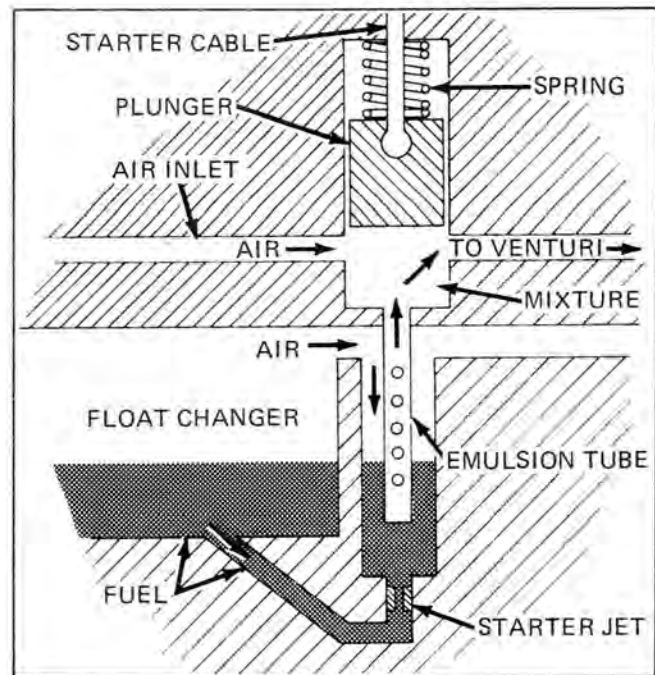


Figure 2-29

The rotor, (Figure 2-31), also called the flywheel, has four magnets evenly spaced about the circumference. As the crankshaft turns, the flywheel rotates around the coil, inducing an alternating current in the low tension coil.

The points and condenser act together to turn off the low tension coil voltage. The ignition points act as a switch to open and close the circuit to the ignition coil primary winding. The condenser prevents voltage from jumping the gap between the points as the points separate. Discharging the low tension coil induces a high voltage in the high tension coil which causes the spark plug to fire.

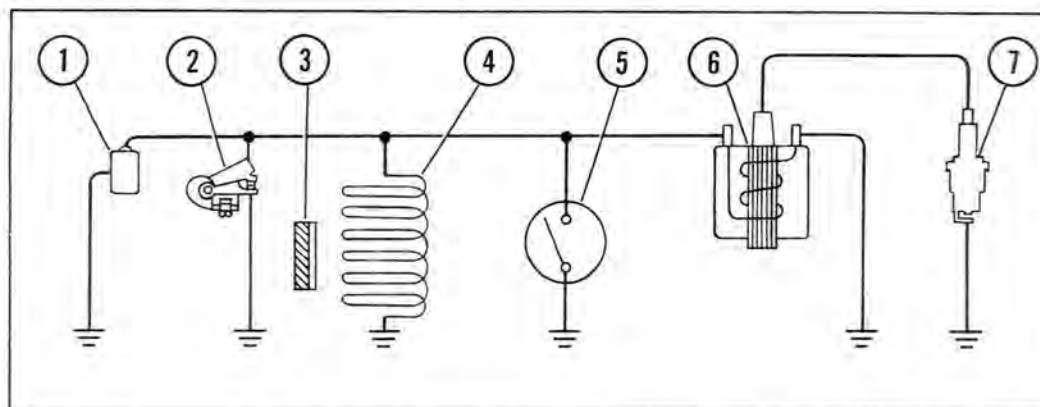
Electrical System

The snowmobile's electrical system consists of a tail/stop light, headlight, brake light switch, headlight beam switch, speedometer, tachometer, ignition switch, light regulator, and a printed circuit board. A schematic representation of the snowmobile electrical system is shown in Section 4.

Power to operate the electrical components is generated in the lighting coil on the engine flywheel.

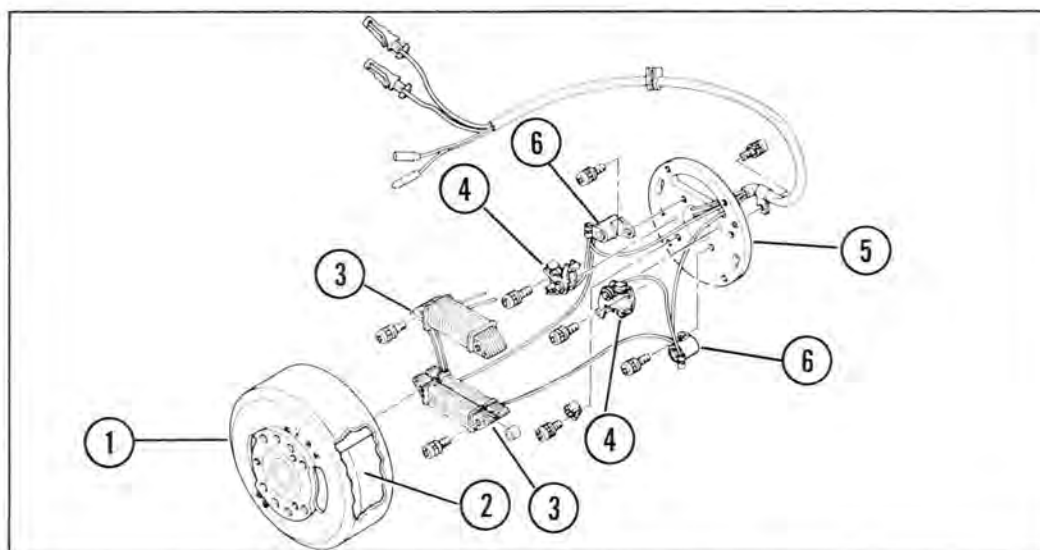
Torque Converter

A torque sensing, variable ratio, sheave-type torque converter is used to drive the snowmobile. This converter consists basically of a drive converter mounted to the power take-off of the en-



1. Condenser
2. Breaker Points
3. Permanent Magnets
4. Low Tension Coil (Primary)
5. Ignition Switch
6. High Tension Coil
7. Spark Plug

Figure 2-30



1. Rotor
2. Magnet
3. Coils
4. Breaker Points
5. Starter Plate
6. Condenser

Figure 2-31

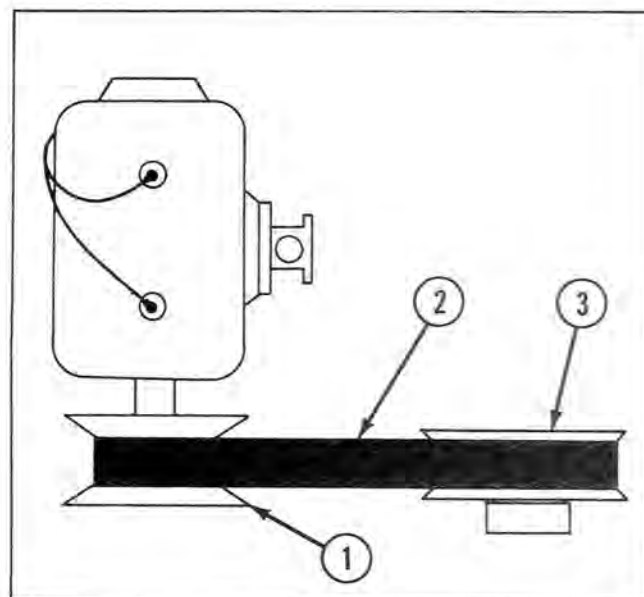
gine, a driven converter which drives the track through the chain case and gearing, and a V-belt which transmits rotary motion from the drive converter to the driven converter. See figure 2-32.

The method of transmitting power from the drive converter by means of a belt to the driven converter enables multiplication of engine torque as needed by the track to pull the snowmobile through varying snow depths, and up and down hills. The clutch automatically shifts to maintain maximum horsepower at all operating conditions.

Torque Converter System

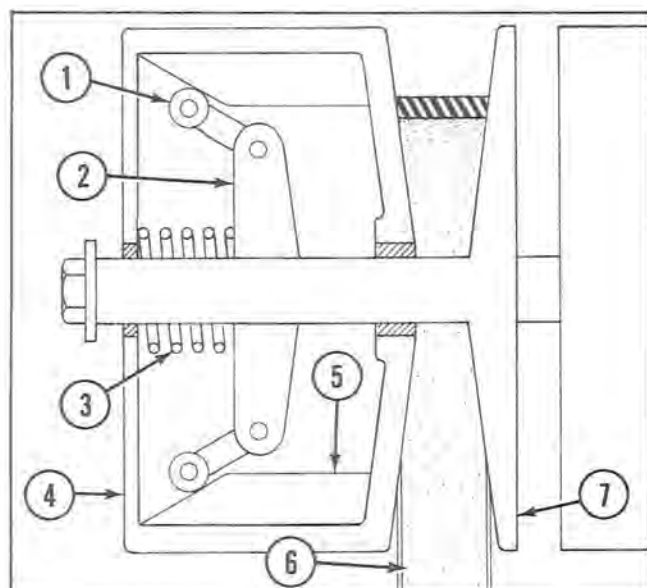
Drive Converter

The drive converter on the snowmobile is designed to provide maximum performance under all types of snow and load conditions (Figure 2-33).



1. Drive Converter
2. V-Belt
3. Driven Converter

Figure 2-32



1. Roller/Weights
2. Spider Assembly
3. Spring
4. Movable Sheave
5. Ramp
6. Drive Belt
7. Stationary Sheave

Figure 2-33

There are three variables that will change the performance characteristics of the drive converter. They are as follows:

1. Spring
2. Weights
3. Ramps

The primary function of the springs is to control the initial engagement between the movable drive sheave and T.C. belt. The spring also affects engine RPM throughout the drive converter shift pattern. A weak or light spring will decrease both engagement speed and maximum engine RPM, resulting in speeding up the shift pattern.

A heavy or strong spring will increase engagement speed and maximum engine RPM, but slows down the shift pattern. The drive spring will take a "set" after approximately 50 miles, and lose 1/4" of its total length. However, no significant loss of spring tension will occur due to the decreased spring length.

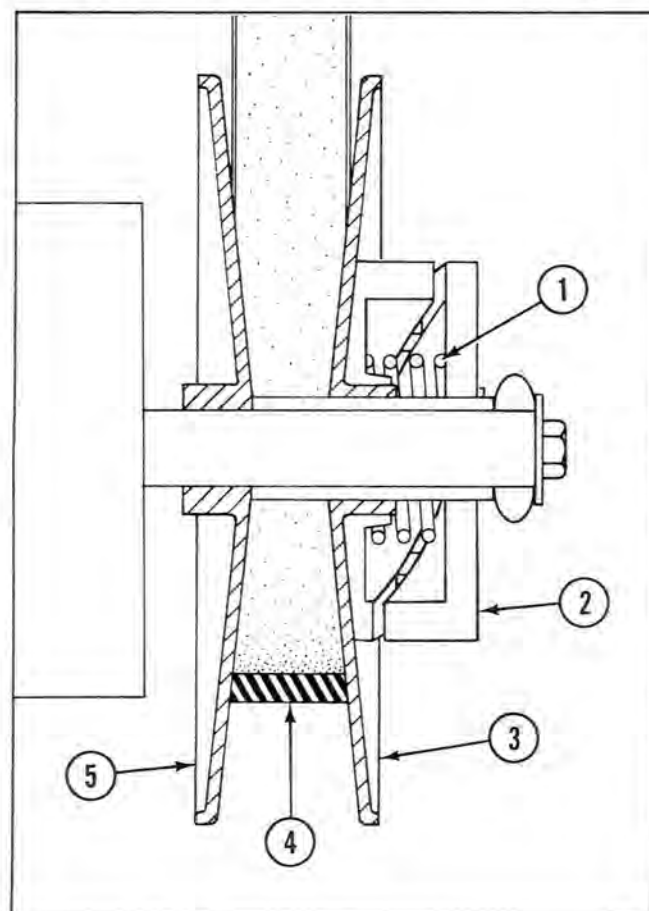
The drive converter contains six weights that control engine RPM. A lighter weight will increase engagement RPM, and maintain higher RPM throughout the total shift pattern. Care must be taken not to exceed specified engine RPM or engine damage will occur. By contrast, a heavy weight will decrease engagement RPM, and also lower engine RPM throughout the shift pattern.

However, the main function of the weights is to control the engine RPM through the shift pattern.

The ramp is designed so the shift pattern is within the peak torque curve of the engine. The ramp profile is the major factor in determining the characteristics of the shift pattern.

Driven Converter

The power that drives the track is transmitted from the drive converter through the T.C. belt to the driven converter. The driven converter is held closed by the driven torque converter spring. This positions the belt at idle, or with the engine off at the outside circumference of the driven flanges.



1. Spring
2. Torque Bracket Assembly
3. Movable Sheave
4. Drive Belt
5. Stationary Sheave

Figure 2-34

As the engine speed increases the driven flanges are spread apart allowing the belt to ride on a smaller diameter of the flanges. This change of flange diameter varies the drive ratio, automatically providing the most favorable ratio between the drive and driven converter for the

speed and load at which the machine is operating (Figure 2-34).

Chain Case and Gearing

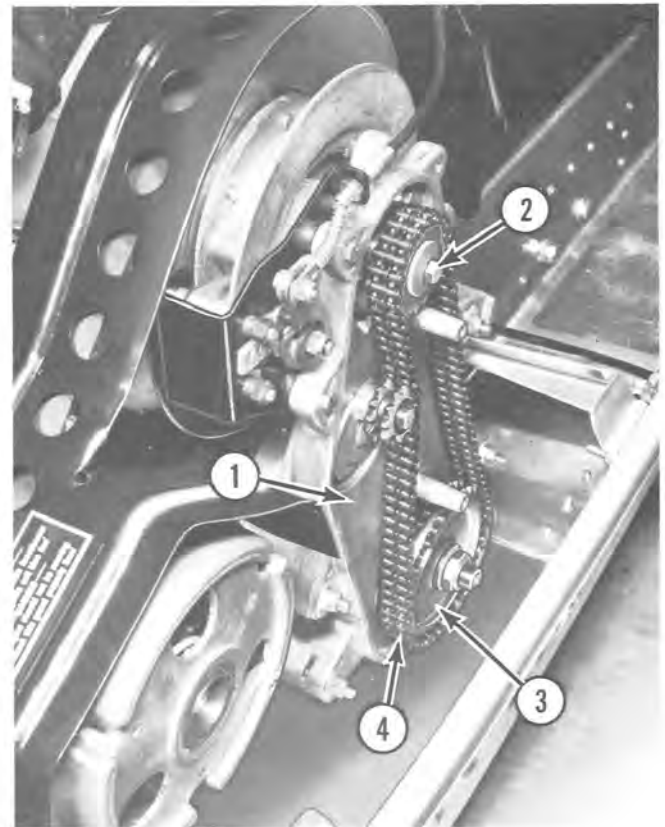
The chain case provides a mounting for the driven converter shaft and the front drive shaft. The drive sprocket, drive chain and driven sprocket are housed within the chain case. The chain case is a sealed housing which contains lubricant for the drive chain. See Figure 2-35.

The top (drive) sprocket in the chain case is attached by splines to the driven converter. The bottom (driven) sprocket is attached to the track drive shaft by splines. The drive chain transfers power from the driven converter to the track drive shaft.

Track, Suspension, and Steering System

The suspension system consists of the track and slider and the skis. See Figure 2-36.

The track provides flotation and propels the snowmobile. Support for the track and suspension is provided by the sliders. Adjustable spring-loaded arms attached to the sliders allow suspension adjustment for the weight of the rider(s). Suspension can also be adjusted for snow conditions and steering control.



1. Chain Case
2. Drive Sprocket
3. Driven Sprocket
4. Drive Chain

Figure 2-35

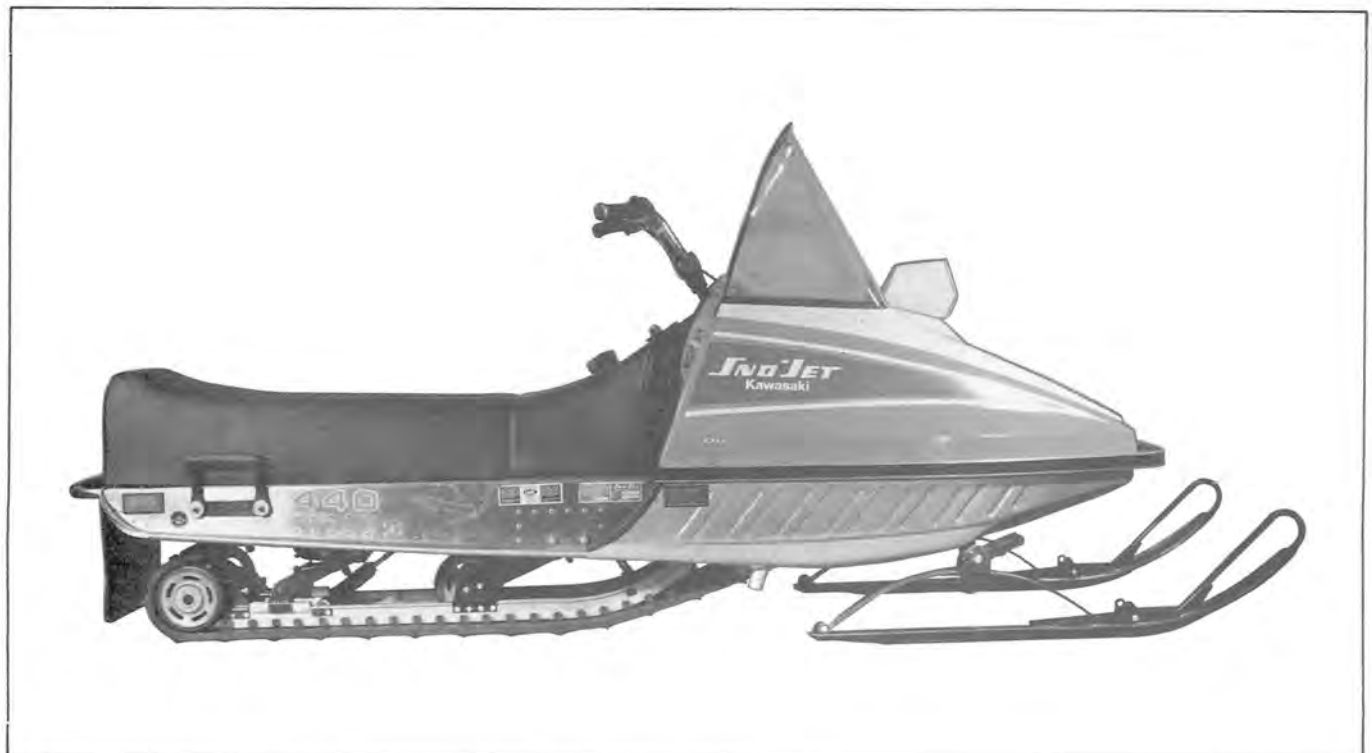


Figure 2-36

Two skis are attached to the front of the snowmobile for steering control and flotation. A wear bar at the bottom of the ski protects the ski from wear and aids in steering control. The steering system connected to the ski consists of a spindle, steering arm, tie rod and handlebars.

Maintenance

Two-Cycle Engine

Inspection

Inspect the engine and mating flanges for oil residue around flanges. Replace seals if leakage is evident.

Compression Check

A simple compression check is to pull the starter rope slowly. The starter rope should display noticeable resistance.

Use a compression gage for accurate measurement. A compression reading of 90 to 95 psi per cylinder is minimum. There should be no more than 10 percent difference between the two cylinders.

Fuel System

Carburetor

The pilot air screw should normally be positioned $1/2$ to 2 turns out from the seated position. An engine may idle smoothly out of these settings; however, problems may occur in the transition to mid range throttle operation. The pilot air screw should be adjusted for best idle within the correct adjustment range. See Figure 2-37.

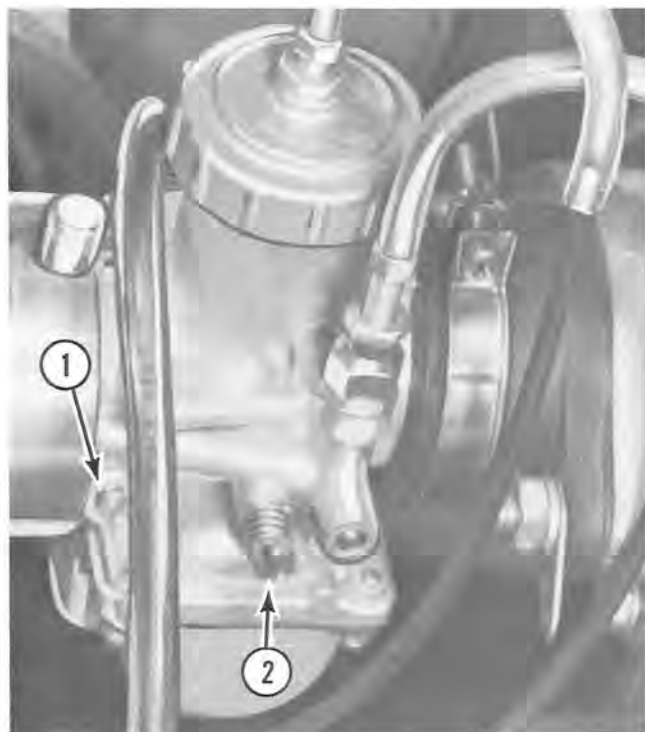
The idle speed screw should be adjusted from 3 to 6 turns out from the coil bound (screw turned in tight). Use a tachometer to measure engine speed and adjust the idle speed screw so that the engine idle speed is 2,000 RPM. See Figure 2-37.

Fuel Pump

Inspect the fuel pump and pulse line clamps for loose fit or leaks.

Fuel Filter

Inspect the fuel filter. If it is dirty or leaking, replace it.



1. Pilot Air Screw
2. Idle Speed Screw

Figure 2-37

Fuel Tank and Lines

Inspect the fuel tank for leaks. Also check all fuel lines and connections for leaks or kinks.

Throttle Control Cable

With the engine off and the air silencer removed from the carburetor, hold the throttle lever at the full throttle position and check that:

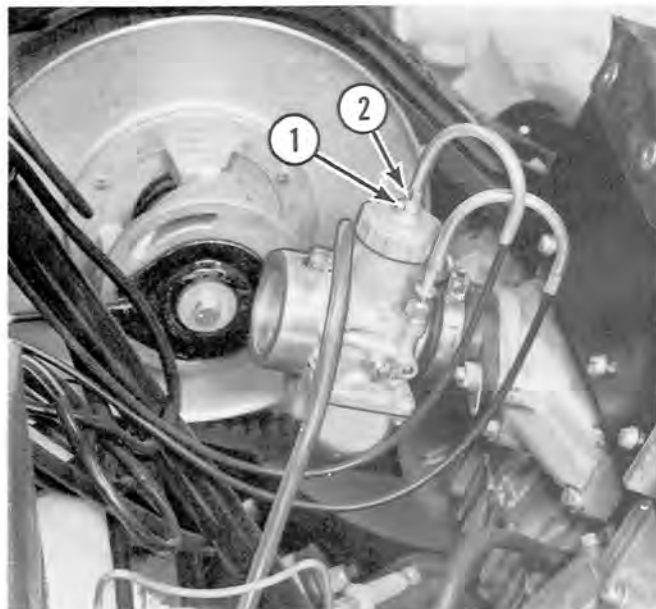
1. The throttle slide inside the carburetor bore opens fully.
2. The throttle lever is tight against handlebar grip. If adjustment of the throttle is required, loosen the locknut, and turn the adjusting screw on the throttle cable as required. See Figure 2-38.

Enrichener Control Cable

With the enrichener lever at off, the outer casting of the enrichener cable should have $1/16$ inch (1.5 mm) of free movement when raised. See Figure 2-39.

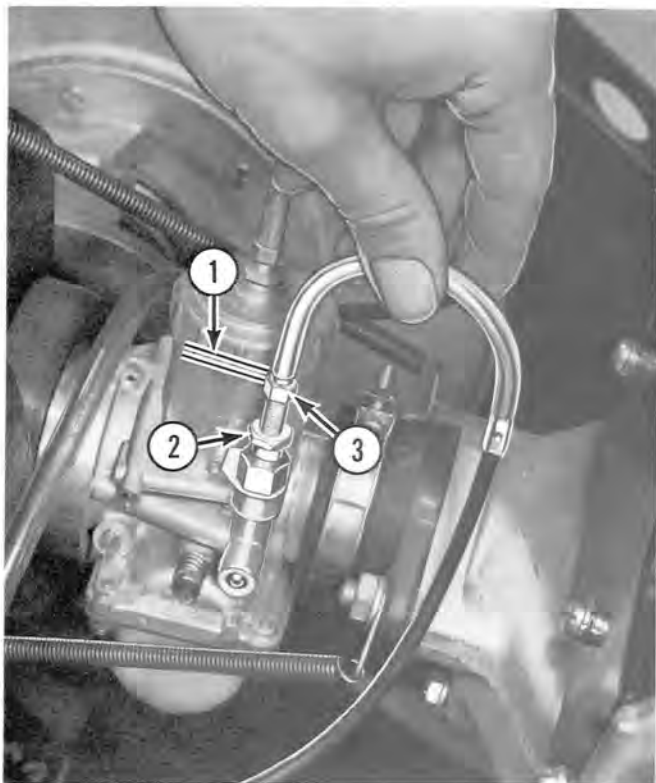
NOTE: Engine flooding may occur if the enrichener cable free movement is less than $1/16$ inch (1.5 mm).

If adjustment of the enricher cable is required, loosen the locknut and turn the adjusting screw to obtain the correct clearance.



1. Locknut
2. Adjusting Screw

Figure 2-38



1. 1/16 Inch (1.5 mm)
2. Locknut
3. Adjusting Screw

Figure 2-39

Ignition System

Ignition Coils

Ignition coils do not require regular service; however, they should be kept clean and the terminals checked for tightness.

Condenser

Make sure all connections are tight and clean, especially the condenser hold down screw.

Inspect the contacts for metal buildup. Buildup on the movable contact indicates weak condenser. Buildup on stationary contact indicates shorted condenser.

Points

Check the points every 100 to 150 hours of operation. Check for gap and condition. A gray color of the contacts is normal. Replace the points if they are severely pitted.

Ignition Timing Adjustment - Static

1. If the ignition timing requires adjustment, remove the muffler mounting nuts, and swing the muffler up to rest on top of the engine. Remove the manual starter and fan pulley.

NOTE: The cutout on the left side of the flywheel allows the adjustment of the points for the left cylinder. The points for the right cylinder can be adjusted through the cutout on the right side of the flywheel. If the points are out of tolerance, a weak spark may result. The advance mechanism levers are accessible through both cutouts in the flywheel. See Figure 2-40.

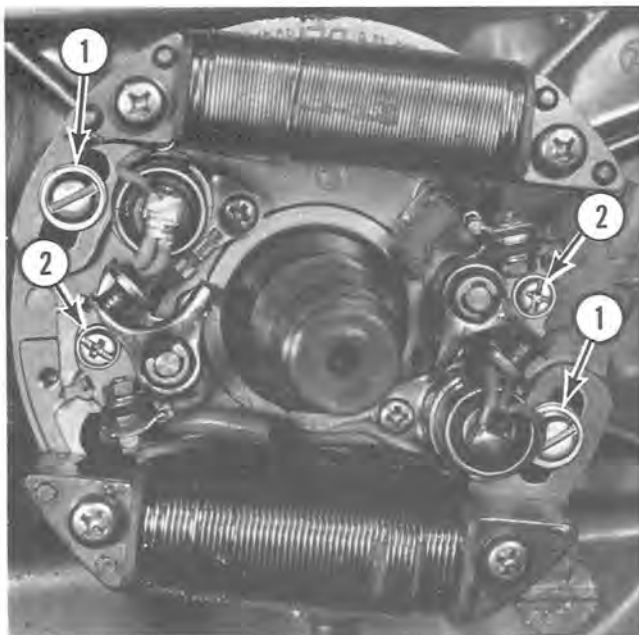
2. Adjust one set of points to 0.014 inch (0.35 mm). When properly adjusted, loosen the stator plate mounting screws. See Figure 2-41.
3. Turn the engine in the normal direction of rotation until the dial indicator is at 0.139 inch (3.5 mm) B.T.D.C. Move the advance levers to full advance (levers against the stop pins when rotated towards the outside diameter of the flywheel), and hold the flywheel and levers in this position to adjust the magneto base assembly.
4. Rotate the stator plate assembly until the points break (buzzer changes tone or the light dims slightly), and tighten the stator plate mounting screws. See Figure 2-41.
5. Re-check the timing to be sure it did not change after tightening the screws.

6. Install the dial indicator into the opposite spark plug hole and connect the timing buzzer or continuity light to the opposite ignition coil wire. Adjust the points to break when the dial indicator reads 0.139 inch (3.5 mm) B.T.D.C. and the advance levers are at full advance.



1. Cutout in Flywheel
2. Advance Lever

Figure 2-40



1. Stator Plate Mounting Screws
2. Breaker Point Mounting Screws

Figure 2-41

Ignition Timing Check-Dynamic

Dynamically timing a warm engine is the most accurate method of timing any engine. Remove one spark plug and find top dead center for that cylinder using a dial indicator. Make a fixed rigid pointer which will be used to check the timing marks. With the piston at top dead center, make a timing mark on the stationary sheave of the drive clutch aligned with the pointer. Now measure $1/16''$ (26.99 mm) for every degree of timing and make another mark on the stationary sheave of the drive clutch. Timing for the ASTRO is 25 degrees before top dead center, which would be $1-9/16''$ (39.69 mm) in the counterclockwise direction from the top dead center mark. Replace the spark plug and connect a timing light to the high tension wire. Remove the torque converter belt and secure the converter guard. Run the engine at 6000 RPM and aim the timing light at the pointer. If the timing is correct, the light will flash as the measured mark on the clutch and the pointer are aligned when engine speed is 6000 RPM.

WARNING

Do not exceed engine speed of 7000 RPM or serious engine damage will result.

Repeat the above procedure for the other cylinder. If the ignition timing is incorrect, make the necessary adjustments to obtain the correct timing.

WARNING

Do not start the engine without the drive converter guard in place.

Cleaning, Inspecting, and Gapping the Spark Plug

Normal plugs have brown to greyish-tan deposits and slight electrode wear. This indicates the correct spark plug heat range. See figure 2-42.



Figure 2-42



Figure 2-43

Carbon fouled plugs show dry, fluffy black deposits which may be caused by over-rich carburetion, overchoking, weak coil, or worn cables. See Figure 2-43.

Worn out, eroded electrodes and a pitted insulator are indications of long service. Replace old spark plugs for better fuel economy, quicker starting and smoother engine performance. See Figure 2-44.

Wet, oily deposits may be caused by the low speed carburetor adjustment being too rich, prolonged low speed operation, improper fuel-to-oil mixture, or worn breaker points. These plugs can usually be degreased and reinstalled. See Figure 2-45.



Figure 2-44



Figure 2-45

Burned or blistered insulator and badly eroded electrodes indicate overheating. Improper spark timing, low octane fuel or lean fuel/air mixtures can cause this condition. See Figure 2-46.



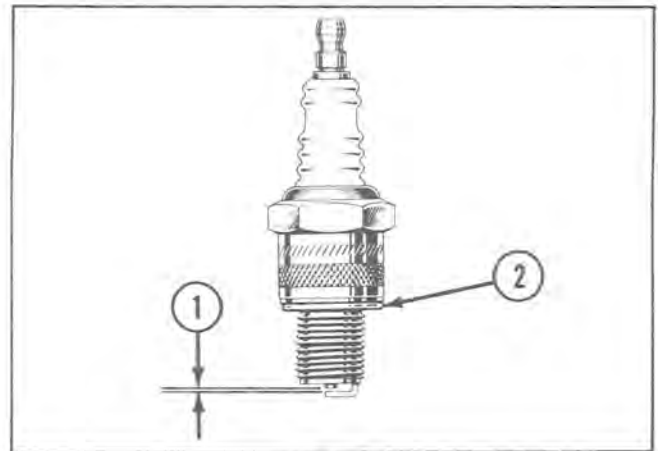
Figure 2-46

Inspect spark plugs for cracked porcelain and worn electrodes. Clean the electrodes with a point file. Adjust the gap to the specified 0.020 to 0.024 inch (0.5 to 0.6 mm). In regapping, adjust only the ground side electrode. Do not attempt to bend the center electrode; the insulation will crack. See Figure 2-47.

Before installing the spark plugs, be sure the washer is installed and the seat on the cylinder head is clean. Install the spark plug and tighten it to 18 to 20 ft. lbs. (2.5 to 2.7 kg-m).

CAUTION

Do not clean old spark plugs with a sandblaster. Grit may be released into the cylinder during engine operation causing severe damage.



- 1. Gap
- 2. Washer

Figure 2-47

Electrical System

Ignition Switch

The ignition switch should be lubricated with graphite once a year. The graphite will also prevent freezing of the ignition switch in extremely cold weather.

NOTE: Do not use an excessive amount of lubricant.

Headlight

Adjustment

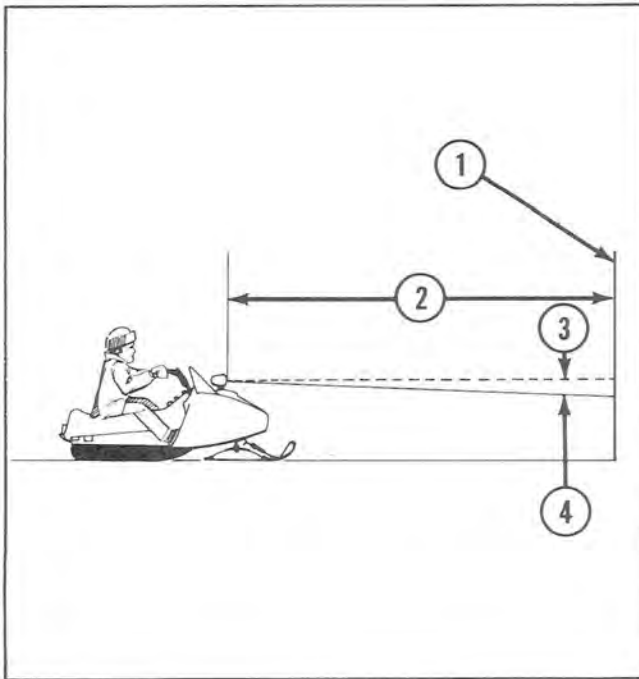
The headlight can be adjusted vertically or horizontally.

To check the aim of the headlight, position the front of the snowmobile 25 feet (7,260 mm) from a wall and illuminate the low beam of the headlight. See Figure 2-48.

The headlight beam should be directly in front of the snowmobile. If the aim of the headlight beam is off to the right or to the left, adjust the headlight using the horizontal adjusting screws. See Figure 2-49.

Measure the distance from the floor to the center of the headlight and mark the wall at the dimension measured (reference mark). See Figure 2-48.

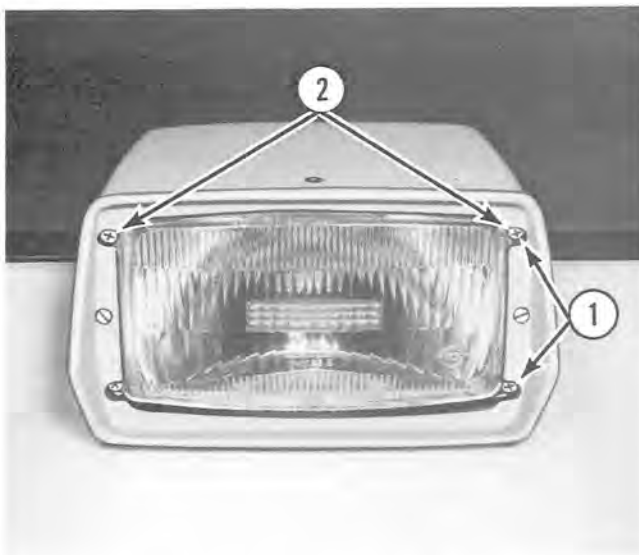
NOTE: Be sure an operator is seated on the snowmobile when the engine is running to prevent the vehicle from creeping ahead and to assure proper aiming.



1. Wall
2. 25 Feet (7,620 mm)
3. Reference Mark Center Of Headlight to Floor
4. 2 Inches (51 mm) Below Reference Mark

Figure 2-48

Illuminate the high beam. For proper headlight aim the high beam should be 2 inches (51 mm) below the reference mark. If adjustment is required, use the vertical adjusting screws. See Figure 2-49.



1. Horizontal Adjusting Screws
2. Vertical Adjusting Screws

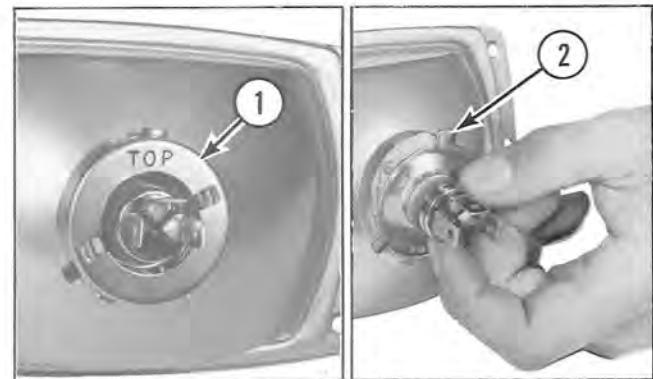
Figure 2-49

Replacement

Replace the headlight bulb from the rear of the headlight, through the access hole in the hood. Replacing the bulb from inside the hood does not disturb the headlight adjustments. Replace the headlight bulb as follows:

1. Remove the wire harness connector from the headlight.
2. Push down while turning the retaining ring counterclockwise. The retaining ring is marked "top" for proper indexing during installation. See Figure 2-50.
3. With the retaining ring removed, the bulb and socket can be pulled out of the headlight. Note that the socket is installed with the wide tab towards the top. See Figure 2-50.

Install the headlight bulb in the reverse order of removal.



1. Retaining Ring
2. Wide Tab On Socket

Figure 2-50

Tail/Brake Light

Replace the tail and brake light bulb by removing the lens, secured by 2 screws, and then removing the lamp from the socket. See Figure 2-51.

Speedometer

The speedometer cable should be lubricated once a year. Remove the cable from the rear of the speedometer and lubricate the cable with graphite.

Voltage Regulator

Check the connection on the circuit board from the voltage regulator. Make sure the connection is clean and tight.

CAUTION

If engine is run with voltage regulator disconnected, all the lights will burn out.

Circuit Board

Check the connectors on the circuit board to be sure they are clean and secure.

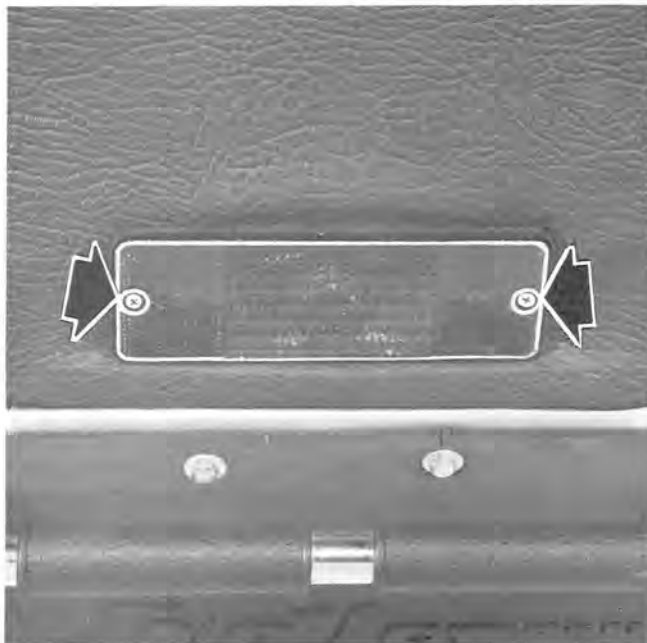


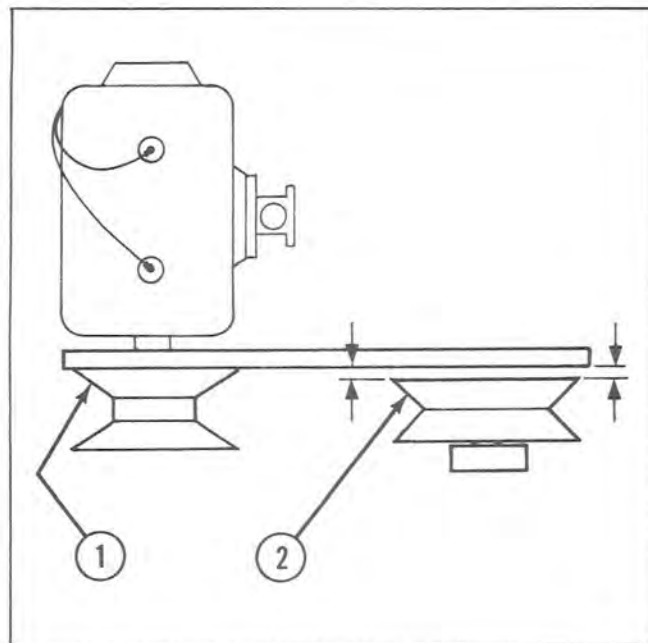
Figure 2-51

Converters

Drive Converter and Driven Converter Alignment

The converter alignment (offset) should be 0.454 (11.5 mm) as measured from the back face of the fixed sheave on the drive converter to the edge of the driven converter movable sheave (Figure 2-52).

If adjustment of the converter alignment is required, loosen the bolts securing the engine to the mounting frame, and slide the engine left or right as necessary to obtain the 0.454 inch (11.5 mm) offset. Tighten the engine mount bolts to 30 ft. lbs. (5.15 kg-m).



1. Fixed Sheave On Drive Converter
2. Movable Sheave On Driven Converter

Figure 2-52

Converter Center Distance Adjustment

The converter center distance should be 10.3 (262 mm). See Figure 2-53.

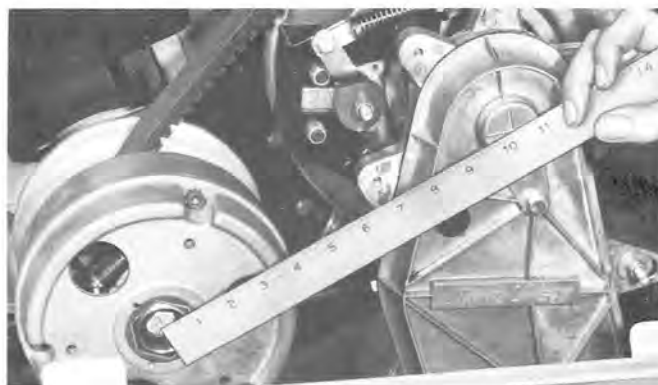
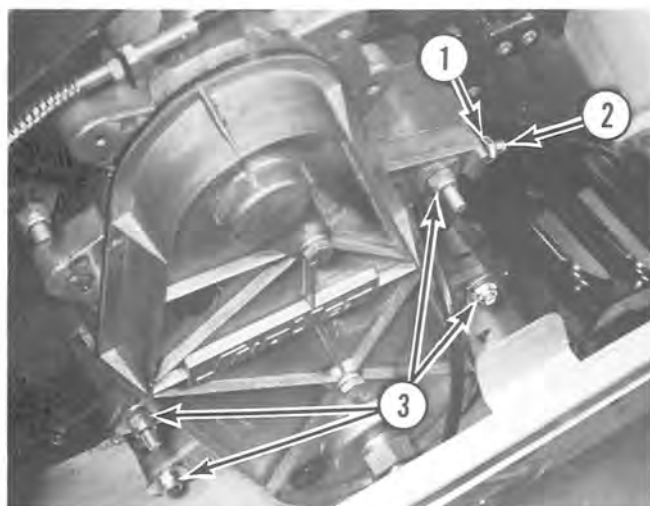


Figure 2-53

If adjustment of the converter center distance is required, loosen the four mounting nuts on the chain case and the locknut for the adjusting setscrew. The driven converter support arm must be disconnected from the chassis by removing the clevis pin from the yoke. While pushing forward on the chain case, turn the setscrew as required to obtain 10.3 inch (262 mm) center distance. Tighten the locknut and the chain case mounting nuts. See Figure 2-54. Install the driven converter support arm to the chassis and secure the clevis pin with safety clip.



1. Locknut
2. Setscrew
3. Mounting Nuts

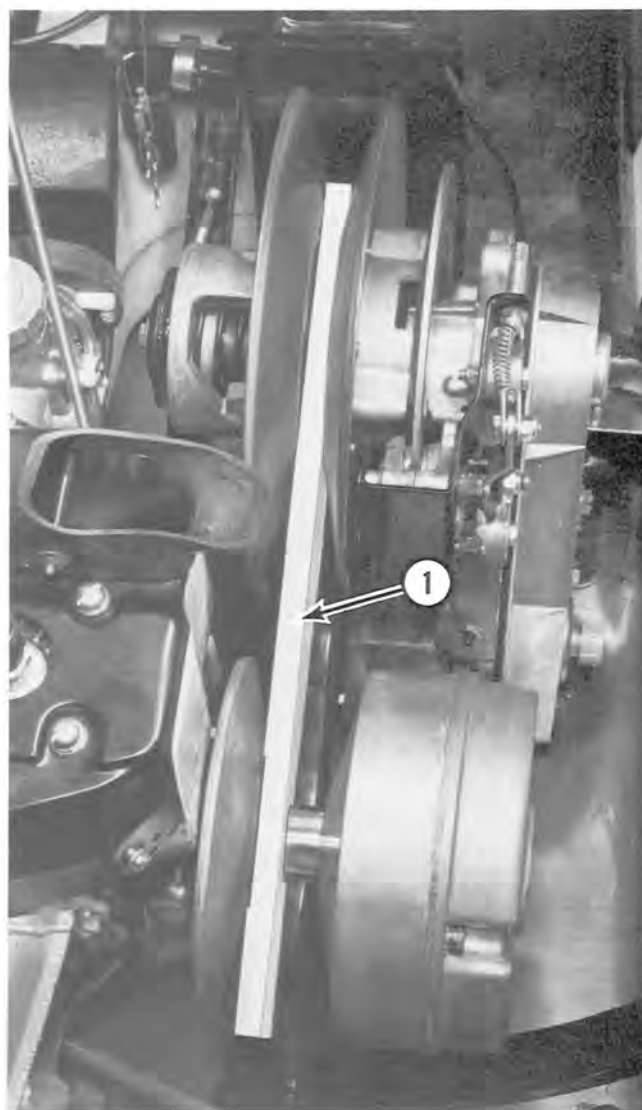
Figure 2-54

Drive Converter and Driven Converter Alignment Using Special Alignment Gauge P/N 205207

Correct converter center-to-center distance of 10.3 inches (262 mm), and converter offset distance 0.454 inches (11.5 mm) is obtained when alignment gauge P/N 205207 is correctly installed between drive and driven converter sheaves. (Figure 2-55.)

Center-To-Center Distance

1. Remove belt guard and remove drive belt.
2. Rotate driven converter moveable sheave assembly clockwise, and insert alignment gauge between sheaves. Carefully release moveable sheave assembly allowing spring tension to retain gauge in position between stationary and moveable sheave assemblies.
3. Rotate drive converter assembly until hex shaft is correctly positioned in the alignment gauge.
4. If adjustment of the converter center distance is required, loosen the four chain case mounting nuts and adjusting setscrew. The driven converter support bearing arm must be disconnected from the chassis by removing the clevis pin from the yoke. Position the chain case fore or aft as required. Tighten the chain case mounting nuts securely. Tighten setscrew and secure with jam nut. Adjust support bearing arm bolt to proper length, lock the jam nut, and connect to chassis with the clevis pin assembly.



1. Alignment Tool P/N 205207

Figure 2-55

Offset Distance

1. Correct off-set distance 0.454 inches (11.5 mm) is obtained when drive converter stationary sheave fits into recess of alignment gauge when gauge is positioned on hex shaft.
2. If adjustment is necessary, loosen four engine mounting bolts and two muffler mounting bolts. Slide engine back and forth until stationary sheave fits into recess in alignment gauge. Tighten all mounting bolts securely.

Parallelism

1. When checking the center-to-center and offset distances, parallelism must be checked by measuring dimensions A and B as shown in Figure 2-56A. Compare dimensions A and B against Notes I, II, and III.

NOTE I: Dimension A must be more than dimension B.

NOTE II: Dimension A must never exceed dimension B by more than 1/16 inch (1.6 mm).

NOTE III: If dimension A is more than dimension B, correct offset as described in Offset Distance.

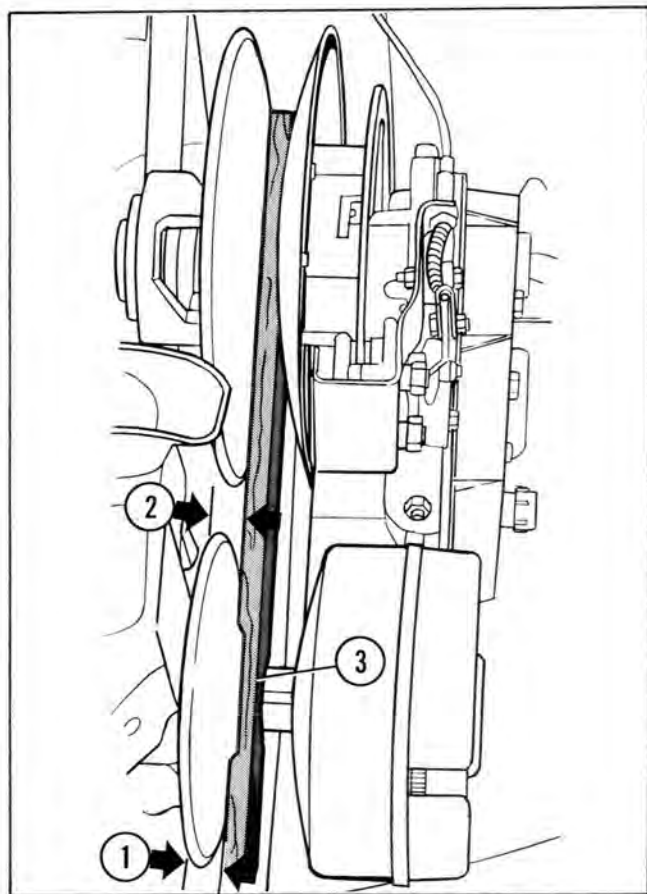
2. If dimension A is less than dimension B, parallelism between engine crankshaft and driven pulley is not correct. Parallelism must be adjusted as follows:

- a. Loosen engine and muffler mounting bolts and rotate the engine into the correct position.

Or

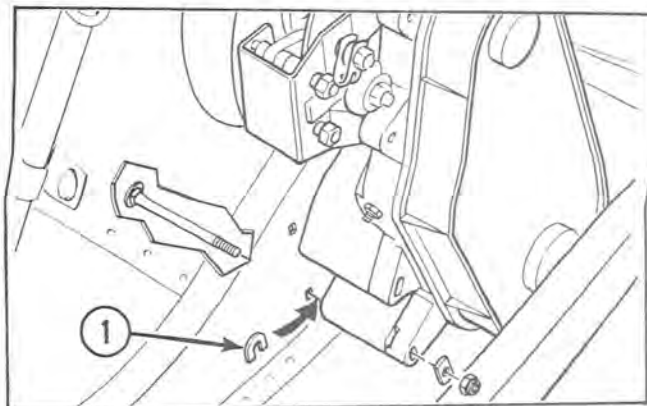
- b. Loosen chain case mounting bolts. Install alignment "U" washers as required between the chassis and chain case spacer to obtain correct position. See Figure 2-56B.

NOTE: Never use more than 2 alignment "U" washers per bolt.



1. Distance "A"
2. Distance "B"
3. Alignment Gauge P/N 205207

Figure 2-56A



1. Spacer

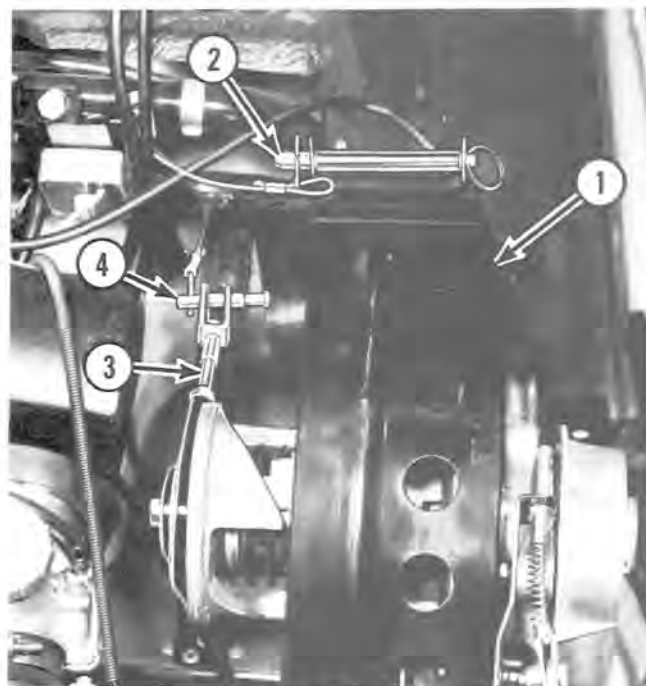
Figure 2-56B

Drive Belt

Inspect the drive belt for worn areas, cracks between the teeth, or ply separations.

To remove the drive belt:

1. Remove the safety pin which secures the belt guard at the top, and swing the belt guard forward. See Figure 2-57.



1. Belt Guard
2. Belt Guard Pin
3. Driven Converter Support Arm
4. Clevis Pin

Figure 2-57

2. Disconnect the driven converter support arm from the chassis by removing the clevis pin from the yoke.

3. Rotate the movable half of the driven sheave towards the rear of the vehicle while pushing it towards the steering post. Assistance may be required to apply the brake while rotating sheave. See Figure 2-58.

WARNING

Use caution when removing the drive belt from the driven converter sheave since it is under a heavy spring load. Keep fingers and hands clear when releasing sheave.

4. Roll the drive belt up and off the driven converter. Then release the movable sheave. See Figure 2-59.

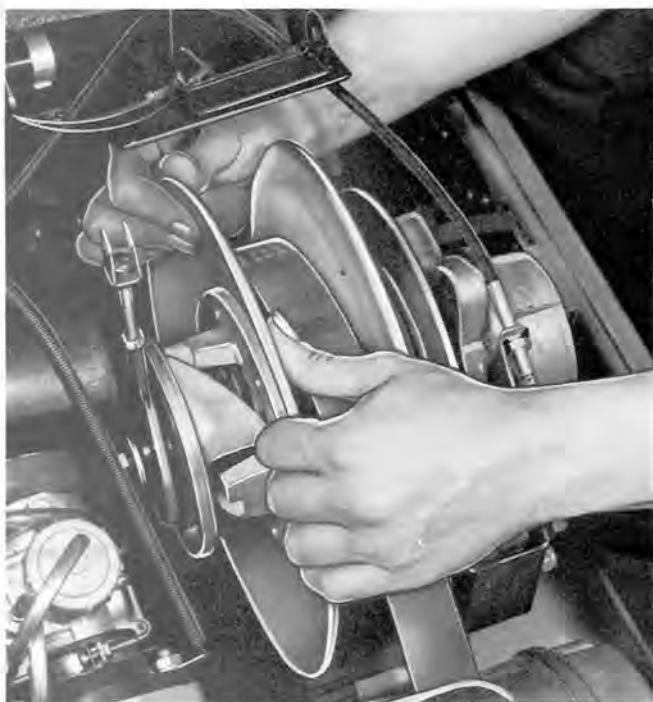
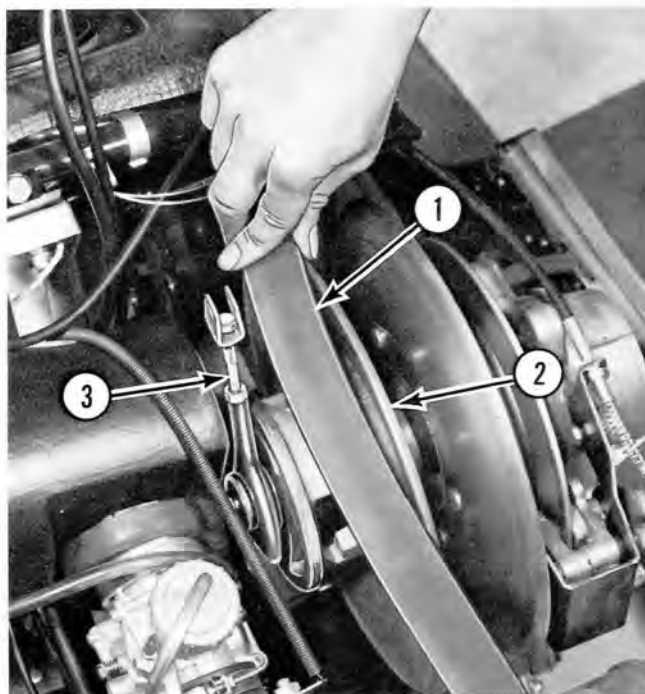


Figure 2-58

5. Work the drive belt past the carburetor and air silencer, then remove it from the drive converter.

To install the new belt:

1. With the drive belt in position around the drive converter, work the belt past the carburetor and around the driven converter support arm.
2. Open the driven converter movable sheave to ease installation of the drive belt.
3. Roll the drive belt over the top of the movable pulley, being careful not to pinch your fingers, and position in the driven converter.



1. Drive Belt
2. Driven Converter Movable Sheave
3. Driven Converter Support Arm

Figure 2-59

4. Install the driven converter support arm to the chassis, and secure the clevis pin with safety clip.
5. Position the clutch guard and secure it with the safety clip.
6. Close the hood and lock it into position with the hood latches.

NOTE: Always reinstall used belt so it will rotate in the same direction as it did originally.

Drive Converter

CAUTION

DO NOT LUBRICATE THE DRIVE CONVERTER. Any lubricant applied to the drive converter will drastically change the shifting characteristics, resulting in clutch failure and reduced drive belt life.

Clean the drive converter sheave surfaces once a year. Use a rag dipped in acetone liquid cleaner to remove water and oil. Remove rust or rubber with No. 260 and No. 320 emery cloth and polish with No. 400 emery cloth.

Driven Converter

Lubricate all ramp sliding surfaces with low temperature grease. Lubricate the movable sheave sliding surface with a graphite lubricant. Use a solvent to remove grease and rubber from the belt contact surfaces.

Brake Adjustment

Check the brake adjustment to be sure the driven converter can be moved back and forth with just a slight brake drag on the brake disc and that the brake lever movement is less than 3/4 inch (19 mm) when applying the brake. See Figure 2-60.

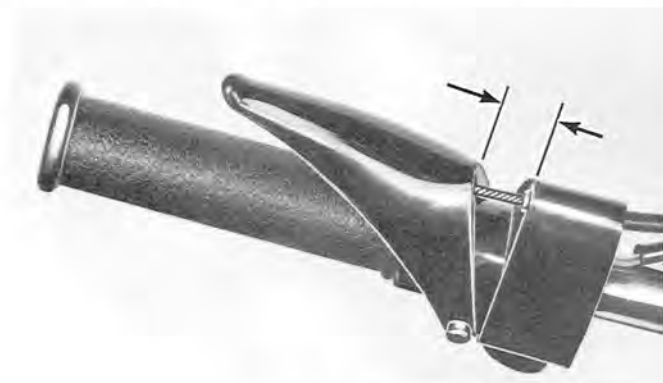


Figure 2-60

WARNING

DO NOT OVERTIGHTEN the brake. Component damage or personal injury could result.

If brake adjustment is required, turn the adjusting nut while simultaneously moving the driven converter back and forth until the brake pads just begin to move with the disc. See Figure 2-61.

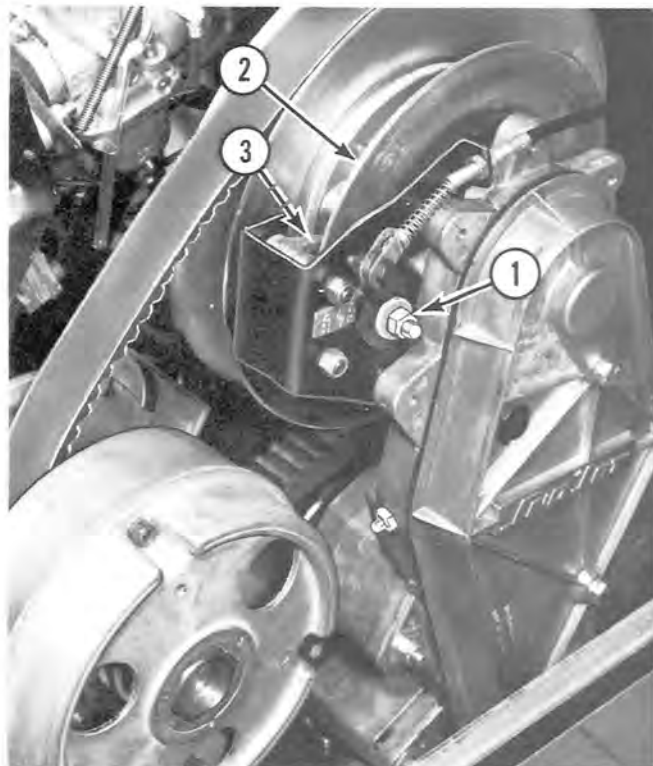
Chain Case And Gearing

Drive Chain Adjustment

Drive chain tension is correct when the driven converter sheave outer edge can be freely turned 3/8 to 1/2 inch (9.5 to 12.7 mm) (Figure 2-62). Hold track drive shaft sprocket with one hand so drive shaft does not rotate.

If adjustment of the chain tension is required, proceed as follows:

1. Loosen the locknut and setscrew, then rotate the driven converter sheave towards the front of the snowmobile to allow the chain to be properly tensioned.



1. Brake Adjusting Nut
2. Brake Disc
3. Brake Pads

Figure 2-61



1. 3/8 to 1/2 Inch (9.5 to 12.7 mm)

Figure 2-62

2. Turn the adjustment setscrew until it is tight and tighten the locknut.

Chain Case and Gearing Lubrication

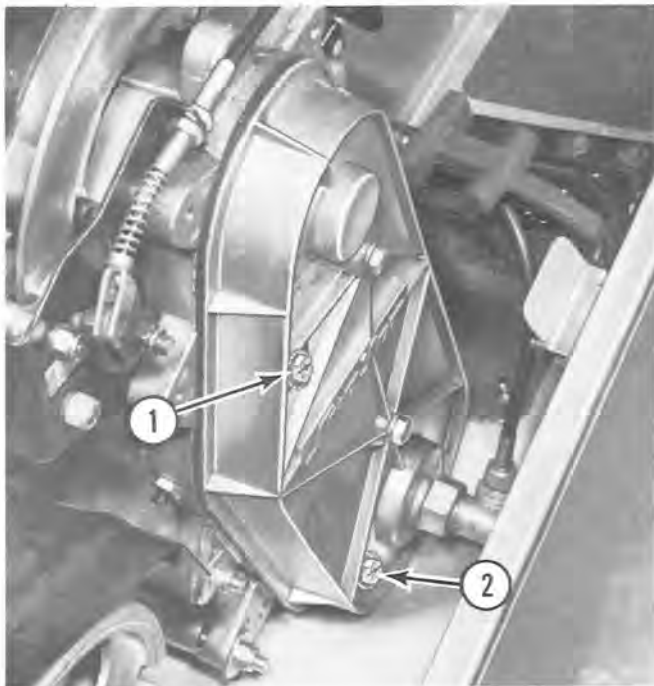
The drive chain operates in an enclosed chain case and is lubricated by a special chain oil. The oil level should be checked every 20 hours as described below. If filling is required, use only Sno Jet Chain Lubricant which is specially formulated for this application.

To fill the chain case:

Remove the plugs in the chain case cover, at the top (fill plug) and bottom (oil level plug). See Figure 2-63.

Pour Sno Jet Chain Lubricant into the chain case through the top hole until it is level with the bottom hole lower edge.

Install the upper and lower plugs into the chain case cover.



1. Fill Plug
2. Oil Level Plug

Figure 2-63

Track, Suspension, and Steering System

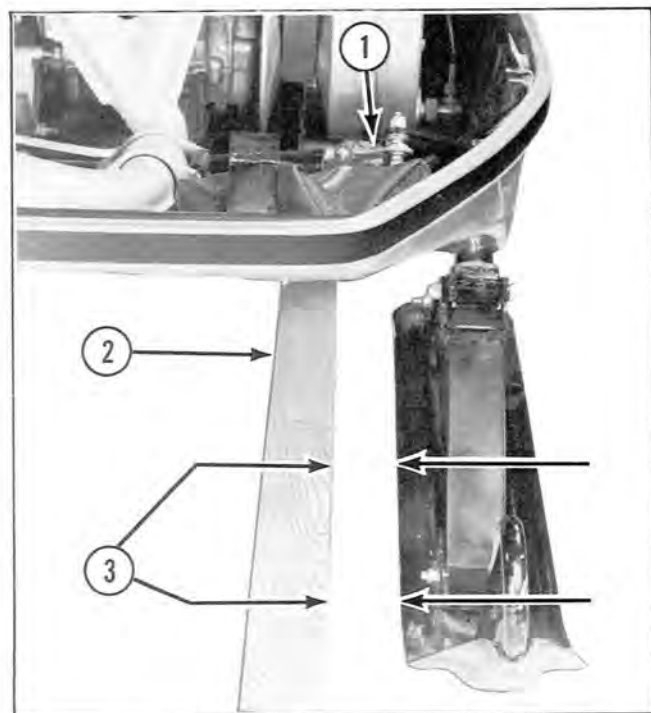
The steering system components should be checked periodically for excessive wear and se-

curity of fasteners (nuts, bolts, etc.). Proper ski alignment cannot be maintained with worn components.

Ski Alignment

Alignment should be checked at the beginning of each season, whenever the ski is subjected to a hard side impact, or when steering system components are replaced. Check the ski alignment as follows:

1. Place a long board (or suitable straightedge) against the edge of the track, and measure the clearance between the board and ski. Position the ski so that the clearance measured is the same at the front and rear of the ski. See Figure 2-64.

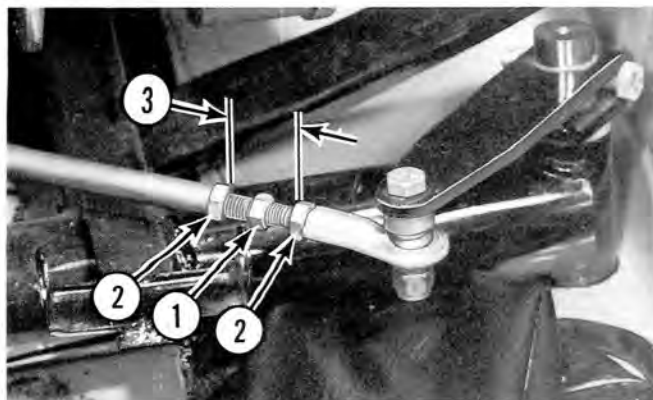


1. Tie Rod End
2. Straightedge Against Track
3. Measure Clearance Here

Figure 2-64

2. When the ski is parallel to the outside edge of the track, check the steering handlebar for centering.
3. If the handlebar requires centering, loosen the locknuts and turn the tie rod end adjusting bolt in the direction necessary to center the handlebar. See Figure 2-65.

NOTE: Be sure the ski remains parallel to the straightedge while turning the tie rod end adjusting bolt.



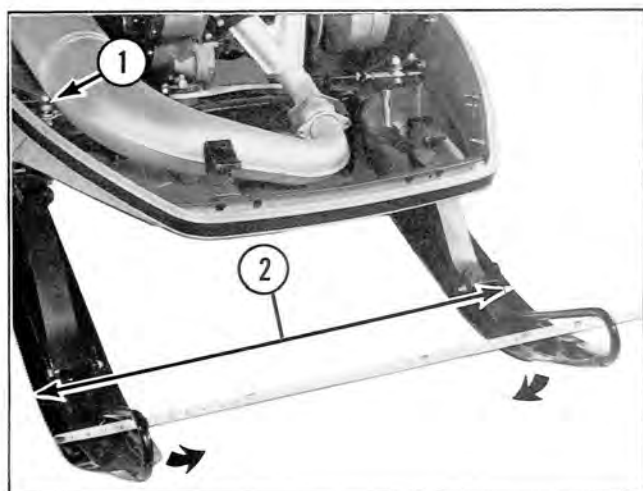
1. Tie Rod End Adjusting Bolt
2. Locknuts
3. 1-1/4 Inch (32 mm) Maximum

Figure 2-65

WARNING

If the dimension shown in Figure 2-65 exceeds 1-1/4 inch (32 mm), refer to Section 3 and check for damaged steering system components.

4. To align the other ski, move both ski tips towards the center of the snowmobile to remove the steering linkage play. Turn the tie rod end adjusting bolt (located below the muffler) to obtain an equal distance from ski to ski when measured at the front and rear of the skis. See Figure 2-66.



1. Tie Rod End Adjusting Bolt
2. Equal Distance Front And Rear

Figure 2-66

5. Tighten all the hardware (nuts, bolts, etc.) in the steering system.

Ski Runners

Excessively worn ski runners can greatly reduce the handling of your snowmobile. The runners on the bottom of each ski should be inspected often, since the wear rate depends on the surface the snowmobile is operated on. Replacement is recommended when the runners are more than 3/4 worn at any point. Refer to section 3 for ski runner replacement.

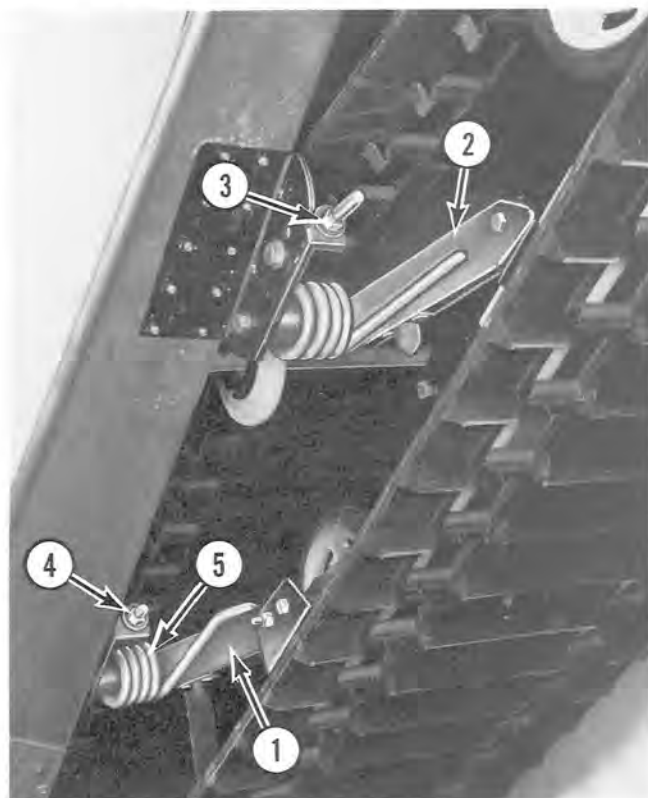
Suspension Adjustment

The slider suspension is fully adjustable for rider comfort.

The adjustments consist of changing the pre-load on the suspension springs. A suspension spring is on each side of the front and rear suspension arms.

Ride Adjustment

Ride adjustment is controlled by changing spring tension of the rear arm only. Tightening the adjustment nut will stiffen the ride and carry more driver or passenger weight. See Figure 2-67.



1. Front Suspension Arm
2. Rear Suspension Arm
3. Adjustment Nut (Ride)
4. Adjustment Nut (Handling)
5. Suspension Springs

Figure 2-67

CAUTION

Always adjust the pre-load (tension) of the springs on each side of the suspension arm equally. Excessive tension of one spring can cause spring breakage. See Figure 2-68.

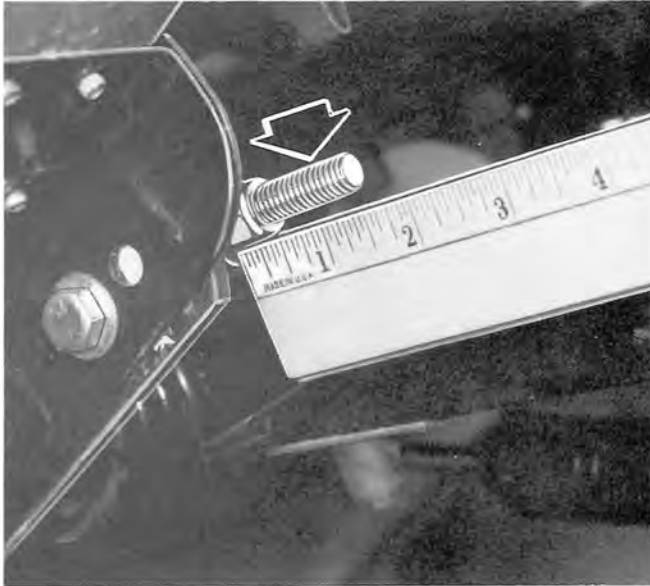


Figure 2-68

Handling Adjustment

The handling adjustment is controlled by changing the spring tension of the front arm only. See Figure 2-67.

Any changes to the adjusting nuts will change the snowmobile's handling characteristics. If the nuts are tightened, the front of the suspension presses harder on the ground and results in less ski pressure. Loosening the nuts causes the front of the suspension to have less pressure on the ground, causing the ski pressure to increase. A change in ski pressure will affect the vehicle steering response.

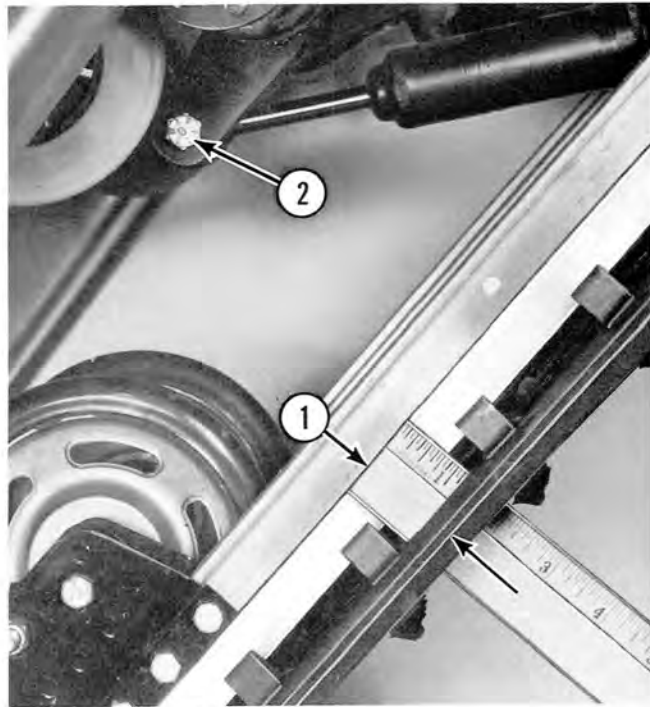
Track Tension Adjustment

WARNING

While raising the snowmobile off the ground, place the skis against a stationary object and secure the vehicle to prevent personal injury.

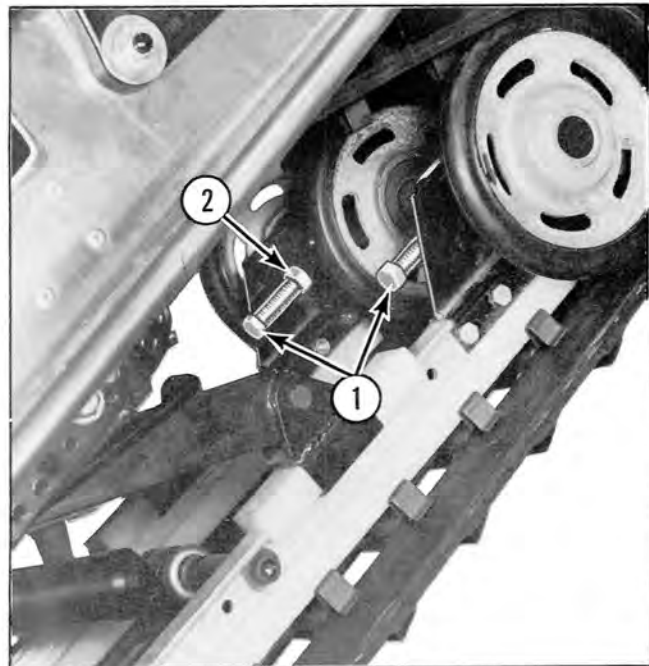
1. With the track completely off the ground, brace the snowmobile so it cannot fall, then hang a 8 to 10 pound (2.2 to 3.6 kg) weight from the mid point of the track.

2. The clearance from the bottom of the wear strip to the top of the track should be $\frac{3}{4}$ inch (19 mm) when measured directly below the shock absorber upper mount bolt. See Figure 2-69.



1. $\frac{3}{4}$ Inch (19 mm)
2. Shock Absorber Upper Mount Bolt

Figure 2-69



1. Rear Axle Adjusting Bolts
2. Locknut

Figure 2-70

3. If necessary, turn the rear axle adjusting bolts as required to obtain the specified wear strip-to-track clearance. See Figure 2-70.
4. When the proper tension is attained, be sure both adjusting bolts are the same length when measured from the bolt head to the rear axle bracket. See Figure 2-70.

Track Alignment

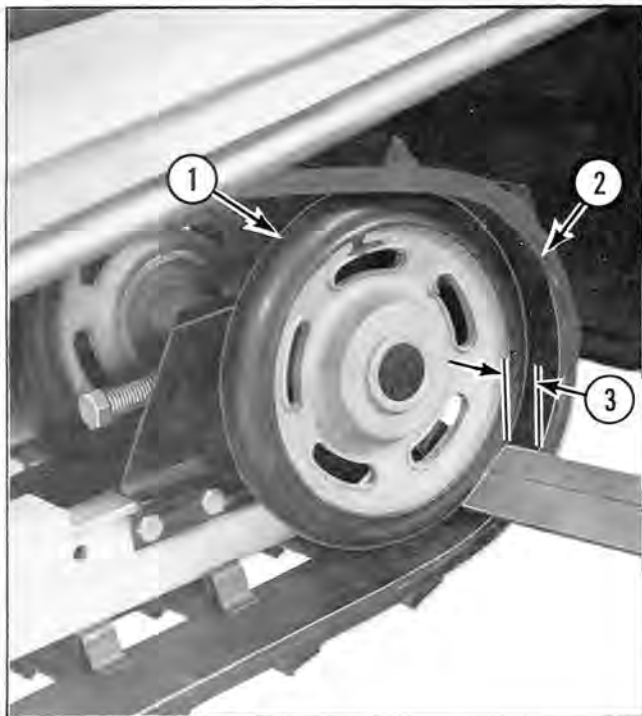
WARNING

To prevent injury, never measure track alignment while the engine is running.

Remove the weight from the track, start the engine and push the throttle only enough to turn the track slowly a few revolutions, then stop the engine and check the alignment.

The track is aligned when the distance between the rear idler wheel and edge of the track is equal on both sides. See Figure 2-71.

If the track runs to one side, tighten the rear axle adjusting bolt on the same side, approximately 1/2 turn, then restart the engine and recheck the alignment.



1. Idler Wheel
2. Edge of Track
3. Dimension Equal On Both Sides

Figure 2-71

Storage

Preparation for Storage

1. Wash the snowmobile. Thoroughly clean the snowmobile by hosing off all dirt and grime from the suspension.
2. Remove the air intake silencer from the carburetor and start the engine. With the engine running at idle speed, slowly inject B.I.A. certified T.C.W. oil into the carburetor. Stop the engine when excessive smoking from the muffler outlet pipe occurs. This procedure lubricates the internal engine components to prevent rust. Replace air intake silencer on the carburetor.
3. Siphon remaining fuel from the fuel tank.
4. Lubricate the suspension and steering column.
5. Plug the openings of the air intake silencer and muffler outlet with a rag or masking tape.
6. Replace the fuel filter.
7. Check the chain case lubricant level.
8. Remove the drive belt.

CAUTION

DO NOT LUBRICATE THE DRIVE CONVERTER.

9. Apply a light coat of oil to both driven converter sheaves to prevent rust.
10. Block the rear of the snowmobile off the ground to remove weight from the suspension and track.
11. Loosen the rear axle adjusting bolts to relieve the track tension.
12. Cover the snowmobile to protect it from dirt and dust.
13. Store the snowmobile in a dry, well ventilated area.

Removal From Storage

1. Fill the fuel tank with fresh fuel mixture.
2. Remove the plugs (masking tape or rags) from the air intake silencer and muffler outlet.

3. Remove the oil from the driven converter sheaves using a suitable solvent. The clutch pulleys must be clean and dry.
4. Install a new drive belt.
5. Adjust the track tension.
6. With the rear of the snowmobile off the ground start the engine. Rotate the track several re-

volutions at low speed and check the track alignment.

7. Check brake and throttle control adjustments.
8. Replace the spark plugs after the first 1/2 hour of operation. This will allow the oil used to lubricate the engine during storage to collect on the old spark plugs.

REPAIR

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Troubleshooting

Isolating a malfunction is as important as correcting the trouble. Use a good systematic approach to locate the problem in the minimum amount of time. All service operations can be solved by following these three steps:

1. Identify the problem
2. Determine cause of the problem
3. Correct the problem

Obtain from the owner an accurate description of the trouble, operating conditions, and maintenance history. In many cases, these will help to isolate the trouble. Sometimes solving the problem is not enough, and the cause has created other undetected problems. Use the Troubleshooting Charts as a guide in solving the problem. If additional interrelated problems exist, refer to appropriate portion of Section 3 for major repair procedures.

Problem	Condition	Remedy
Engine does not start - no spark.	ENGINE	
	1. Key switch not ON or malfunctioning.	1. Turn switch ON or replace.
	2. Emergency stop switch in OFF position or malfunctioning.	2. Move switch to ON or replace stop switch.
	3. Spark plug(s) fouled, oiled or damaged.	3. Replace spark plug(s).
	4. Plug cap(s) damaged, leaking or shorted.	4. Replace plug cap(s).
	5. High tension wire(s) loose, grounded or shorted.	5. Service high tension wire(s)/coil(s).
	6. Defective breaker points.	6. Replace breaker points.
	7. Defective exciter coil.	7. Replace exciting coil.
	8. Defective condenser(s).	8. Replace condenser(s).
	9. Defective ignition coil.	9. Replace ignition coil.
	10. Improper breaker point gap.	10. Adjust breaker points.
	11. Weak flywheel magnets.	11. Replace the flywheel.
Engine will not start - does not get fuel.	1. Fuel tank empty.	1. Fill fuel tank with fuel.
	2. Cracked, broken or pinched fuel line.	2. Replace the fuel line.
	3. Obstructed or damaged in-line filter.	3. Replace in-line filter.
	4. Carburetor or fuel pump malfunctioning.	4. Service the carburetor or the fuel pump.
	5. Impulse line is cracked, broken or pinched.	5. Replace the impulse line.

TROUBLESHOOTING (CONTINUED)

Problem	Condition	Remedy
Engine will not start - does not get fuel. (cont)	6. Carburetor adjusted incorrectly.	6. Adjust the carburetor.
Engine will not start - fuel will not ignite.	1. Air leak between carburetor, silencer seal or intake manifold. 2. Carburetor adjusted incorrectly. 3. Water in carburetor. 4. Engine is flooded. 5. No compression (worn or broken rings, scored piston, hole in piston or damaged cylinder). 6. Blown head gasket.	1. Tighten mounting bolt and nuts. 2. Adjust the carburetor. 3. Disassemble and clean carburetor. 4. Turn key switch OFF, remove spark plug and dry it - crank engine over 5-10 times. Install spark plug and start engine. If engine continues to flood, check carburetor. 5. Check compression, replace worn or damaged parts. 6. Replace head gasket.
Engine does not idle or idle rpm fluctuates.	1. Air screw adjusted incorrectly. 2. Idle screw adjusted incorrectly. 3. Defective fuel pump (check valve). 4. Idle screw broken and embedded in main carburetor body casting. 5. Impulse line cracked, kinked or broken. 6. Enrichener cable adjusted incorrectly. 7. Oil seals leaking. 8. Air leak (pressure check engine).	1. Adjust air screw. 2. Adjust idle screw. 3. Service the fuel pump (check valve). 4. Replace the idle screw and the main carburetor body casting. 5. Replace or repair impulse line. 6. Adjust enrichener cable. 7. Replace oil seals. 8. Disassemble and replace worn, defective, or damaged parts.

Problem	Condition	Remedy
Engine develops power loss or runs on one cylinder.	1. Fouled or defective spark plug(s). 2. Obstruction inside of muffler. 3. In-line filter obstructed. 4. Excessive carbon buildup in exhaust port(s). 5. Damaged or worn rings. 6. Low crankcase pressure. 7. Damaged piston. 8. Damaged head gasket. 9. Broken (shorted) high tension leads. 10. Defective plug cap(s).	1. Replace the spark plug(s). 2. Remove obstruction or replace muffler. 3. Replace in-line filter. 4. Clean exhaust port(s). 5. Replace the rings. 6. Check crankcase for leaks; replace oil seal or gasket. 7. Replace piston and related component(s). 8. Replace gasket. 9. Replace complete ignition coil. 10. Replace cap(s).
Engine overheats.	1. Incorrect spark plug(s). 2. Cooling fins obstructed. 3. Air leak between carburetor, intake manifold or cylinders. 4. Carburetor adjusted incorrectly. 5. Excessive carbon deposits in combustion chamber, exhaust port or muffler. 6. Damaged rings caused by excessive carbon buildup.	1. Install correct spark plug(s). 2. Clean cooling fins. 3. Replace gaskets, tighten mounting hardware. 4. Adjust carburetor 5. Clean affected components. 6. Clean or replace rings.
Engine backfires; has irregular running condition. Note: Engine may eventually overheat.	1. High tension lead wire shorting out. 2. Fouled or incorrect spark plug (heat range too hot). 3. Air leak between carburetor and intake manifold. 4. Air leak between intake manifold and cylinders.	1. Replace complete ignition coil. 2. Replace spark plug or install spark plug having colder heat range. 3. Check carburetor holder to make sure it is not warped. 4. Install new intake manifold gaskets.

TROUBLESHOOTING (CONTINUED)

Problem	Condition	Remedy
Engine four-cycles.	1. Carburetor incorrectly adjusted. 2. Dirt between needle valve and valve seat.	1. Adjust carburetor. 2. Service carburetor.
Engine stops (suddenly) after running.	1. Defective ignition coil. 2. Obstruction in fuel tank or fuel filter. 3. Fuel line obstructed or pinched. 4. Spark plug bridged. 5. Seized piston(s). 6. Seized crankshaft. 7. Defective exciter coil.	1. Replace ignition coil. 2. Clean or replace filter. 3. Remove obstruction, remove pinched area from fuel line. 4. Replace spark plug. 5. Replace piston and any affected components. 6. Replace crankshaft and any affected components. 7. Replace exciter coil.
Engine stops (gradually) after running.	1. Obstruction in fuel tank or fuel filter. 2. Fuel line obstructed or pinched. 3. Damaged head gasket(s). 4. Loose cylinder head. 5. Loose spark plug(s).	1. Clean or replace filter. 2. Remove obstruction, remove pinched area from fuel line. 3. Replace head gasket(s). 4. Tighten cylinder head nuts to correct torque. 5. Tighten spark plug(s) to correct torque.
	DRIVE CONVERTER	
Drive converter engages before specified rpm.	1. Incorrect spring. 2. Weak or damaged spring. 3. Incorrect weights.	1. Install correct spring. 2. Replace spring 3. Install correct weights.
Drive converter engages after specified rpm.	1. Incorrect spring. 2. Incorrect weights. 3. Dirty movable sheave.	1. Install correct spring. 2. Install correct weights. 3. Clean movable sheave.

Problem	Condition	Remedy
Drive converter engages after specified rpm.	4. Worn (flat spots) rollers and ramps. 5. Bushing in housing worn excessively on inside diameter.	4. Replace rollers and ramps. 5. Replace components as required.
Maximum drive converter rpm too high.	1. Incorrect weights. 2. Incorrect ramps (ramp angle too steep at top). 3. Short belt or incorrect center to center distance.	1. Install correct weights. 2. Install correct ramps. 3. Install new belt and establish correct offset and center to center distance.
Maximum drive converter rpm too low.	1. Incorrect weights (too heavy). 2. Incorrect ramps (ramp angle too flat at top). 3. Long belt or incorrect center to center distance.	1. Install correct weights. 2. Install correct ramps. 3. Install new belt and establish correct offset and center to center distance.
Shifting too quickly.	1. Incorrect weights (too heavy). 2. Incorrect ramps (ramp angle too flat). 3. Weak drive spring. 4. Driven spring preload incorrect (too loose).	1. Install correct weights. 2. Install correct ramps. 3. Replace spring. 4. Correct spring preload.
Shifting too slowly.	1. Incorrect weights (too light). 2. Incorrect ramps (ramp angle too steep). 3. Spring too strong. 4. Driven spring preload too tight.	1. Install correct weights. 2. Correct ramps. 3. Replace spring. 4. Decrease spring preload.
Belt deposits on stationary sheave and moveable sheave.	1. Wrong offset and center to center distance.	1. Remove belt deposits and establish correct offset and center to center distance.
Drive converter will not disengage at idle - engine starts hard and stalls because of belt drag.	1. Loose moveable sheave bushing setscrews. 2. Drive belt outside circumference below specifications. 3. Thickness of belt on inside diameter exceeds specifications.	1. Stake movable sheave set screws. 2. Replace drive belt 3. Check drive belt specifications (belt thickness on inside diameter).

TROUBLESHOOTING (CONTINUED)

Problem	Condition	Remedy
	DRIVE BELT	
Side of belt glazed or baked - not normal, caused by excessive heat buildup.	1. Incorrect belt - excessive slippage. 2. Too much throttle applied under heavy load - excessive slippage. 3. Weak drive converter spring. 4. Drive converter engagement rpm too low. 5. Improper drive converter operation (sticking, etc.). 6. Drive converter and driven converter "offset/center to center" is incorrect. 7. Oil or grease on drive converter or driven converter sheave surface.	1. Install correct drive belt. 2. Tell driver to decrease throttle under heavy load condition; install new belt. 3. Perform spring pressure test; install new spring if spring is weak. 4. Adjust engagement rpm - see specifications. 5. Remove and repair drive converter; install new belt if one is needed. 6. Check and adjust, install new belt if one is needed. 7. Clean sheaves; install new belt if one is needed.
Lugs worn off inside of belt.	1. Drive converter engages suddenly (engagement speed too high). 2. Center to center distance too far apart or belt too short.	1. Remove and repair drive converter; install new belt, if one is needed. 2. Alter center to center distance or install longer belt.
Belt worn in one spot.	1. Track frozen to skid frame, front drive or ground. 2. Incorrect track tension. 3. Idle speed too high. 4. Improper operation of drive converter.	1. Free track and install new belt. 2. Adjust track tension and install new belt. 3. Reduce idle rpm and install new belt. 4. Repair or replace drive converter and install new belt.
Cracks at base of belt lug.	Continuous over revving when snowmobile is operated.	Decrease rpm and install new belt.
	CHAIN CASE	
Rattle in chain case.	1. Incorrect chain tension. 2. Chain stretched beyond adjustable limit.	1. Adjust chain tension. 2. Install new chain and sprockets.

Problem	Condition	Remedy
Chain slippage.	1. Incorrect chain tension. 2. Chain stretched beyond adjustable limit. 3. Sprocket teeth worn.	1. Adjust chain tension. 2. Install new chain and sprockets. 3. Install new sprockets and chain.
Chain slips off sprockets.	1. Incorrect chain tension. 2. Sprocket teeth worn. 3. Sprockets misaligned.	1. Adjust chain tension. 2. Install new sprockets and chain. 3. Align top sprocket with bottom sprocket.
TRACK		
Edge of track is frayed.	1. Track is misaligned. 2. Track strikes rivets in tunnel, yet alignment is correct.	1. Set track tension and alignment. 2. Remove rivets and install correct type rivet.
Track is grooved (worn) or burnt on inside surface.	1. Track tension is too tight. 2. Rear idler wheels do not turn or otherwise damaged.	1. Set track tension and alignment. 2. Install new rear idler wheels and set track tension and alignment.
Track ratchets or hits on body tunnel (top).	Track tension is too loose.	Set track tension and alignment.
Accelerated rail strip wear.	1. Slide rail(s) bent. 2. Badly worn clip that contacts slide rail. 3. Track is misaligned.	1. Straighten slide rail(s) or install new rails. 2. Install new rail strip and/or clip. 3. Set track tension and alignment.
DRIVEN CONVERTER		
Low engine rpm yet belt shifts completely through driven converter operating range (1 to 1 ratio).	Weak spring or broken spring.	Rotate end of spring clockwise on driven converter to increase spring tension or install new spring.
High engine rpm yet belt takes too long to shift through driven converter range (1 to 1 ratio).	1. Incorrect spring - too heavy. 2. Dirt on moveable or stationary sheave. 3. Excessively worn moveable or stationary sheave.	1. Install correct spring. 2. Clean sheaves. 3. Install new components.

Electrical Troubleshooting Using An Ohmmeter

GENERAL DESCRIPTION

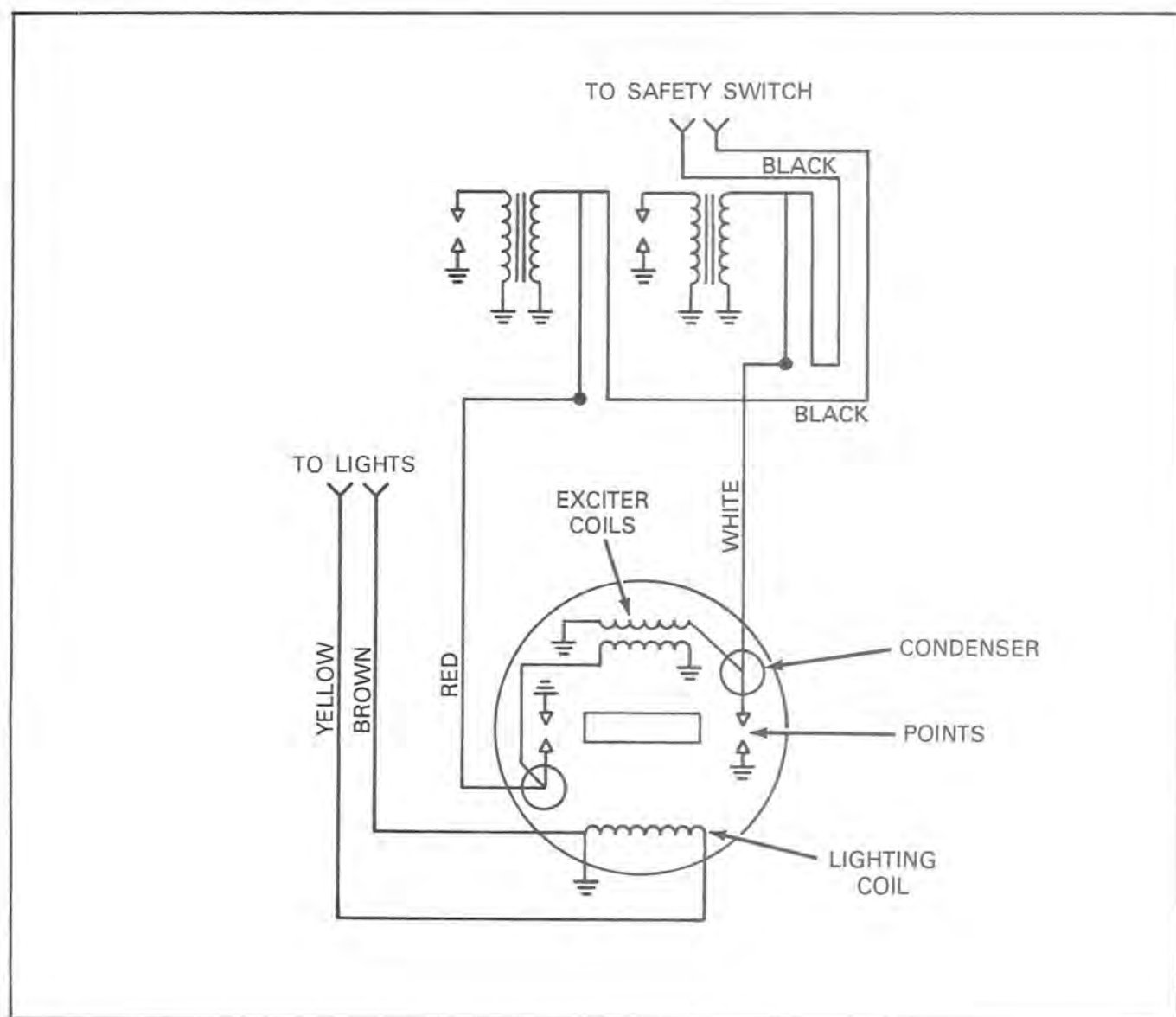
The following test procedures are designed for locating ignition system malfunctions using an ohmmeter.

1. CHECKING MAGNETO WIRING CONNECTIONS

a. The wiring between the magneto and ignition coil uses couplers to prevent any wrong connection. All wiring connections must be done accurately. Only wires of like colors should be connected together by the couplers.

b. Use the rotor puller (a special tool) to remove the flywheel. Do not use a hammer, or the flywheel may be damaged.

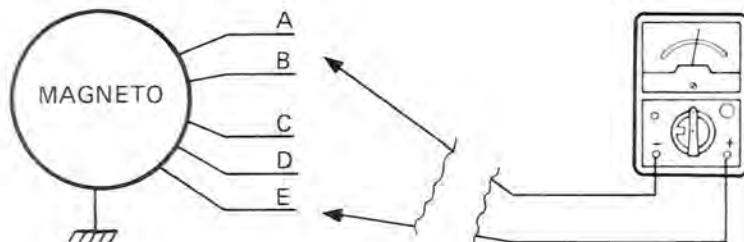
MAGNETO WIRING CONNECTIONS



2. Checking The Magneto And Ignition Coils

Do not use an improper tester (insulation resistance testers or other testers with a battery of large capacity).

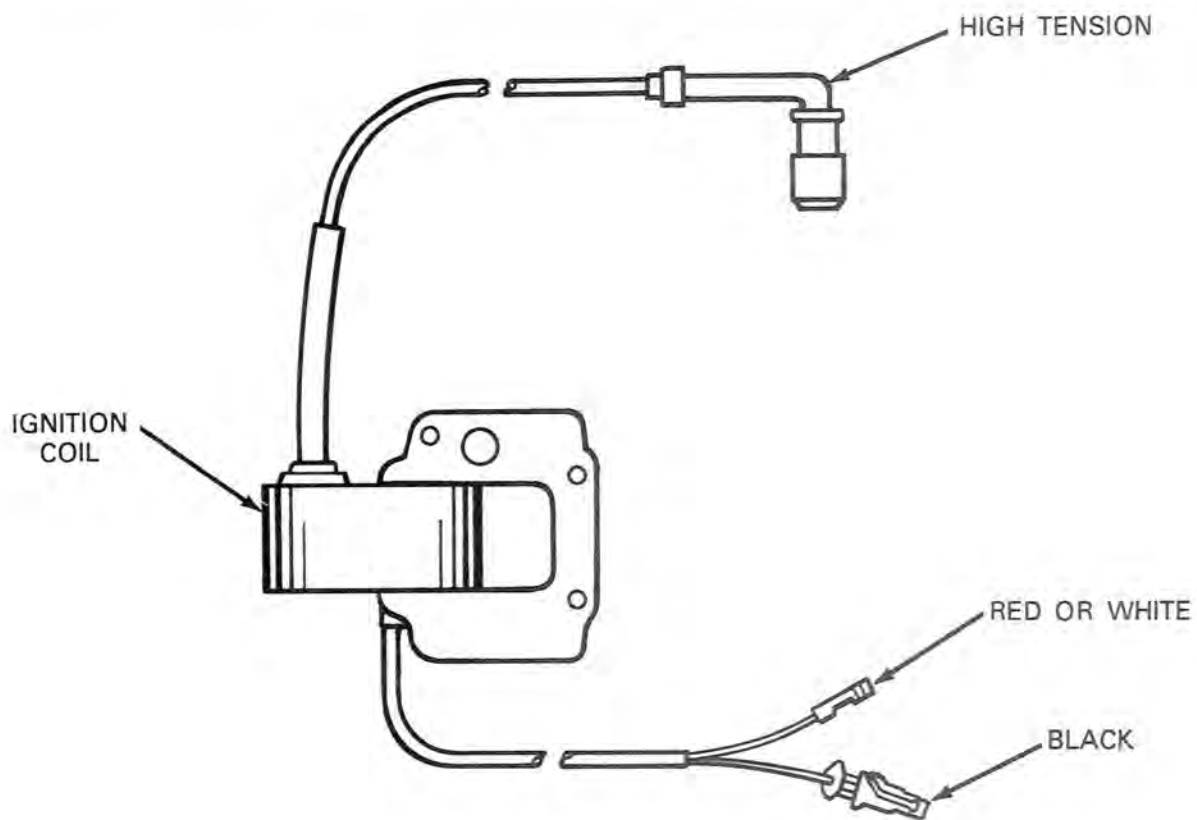
To locate the cause of trouble (broken coil, short circuit, etc.) measure the resistance of each winding.



PART TO BE MEASURED	EXCITER COIL (1)	EXCITER COIL (2)	LIGHTING COIL
MEASURED FROM	RED TO GROUND	WHITE TO GROUND	YELLOW TO BROWN
RESISTANCE *	$1.1 \pm .1 \Omega$	$1.1 \pm .1 \Omega$	$.2 \pm .02 \Omega$

* Resistance measurements on the exciter coils must be made with the points open, otherwise the reading will be zero ohms. Points may be opened by rotating the engine.

3. Checking The Ignition Coils



VALUE TO BE MEASURED	PRIMARY WINDING RED OR WHITE TO GROUND	SECONDARY WINDING HIGH TENSION TO GROUND
RESISTANCE *	$1.2 \pm .1\Omega$	$5200 \pm 500\Omega$

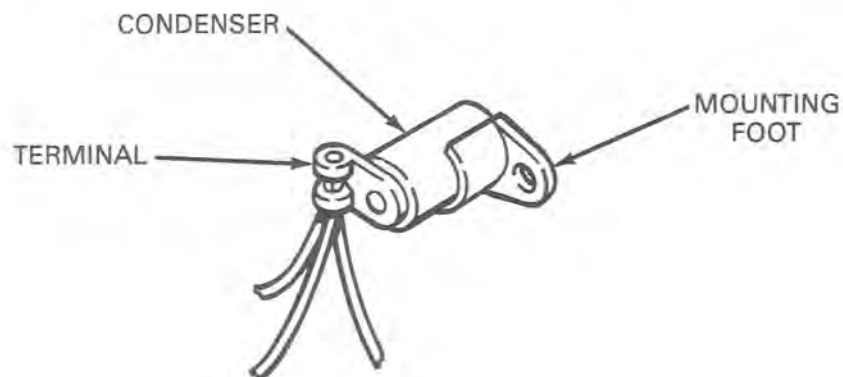
* Remove spark plug caps from high tension wires and disconnect red, white and black wires at their connectors to make resistance measurements.

** Defective coils cannot always be detected using this test alone. Use of coil tester which simulates operating condition is the most reliable test method.

4. Checking The Condensers

A good condenser should read open when checked with an ohmmeter. A shorted condenser will not

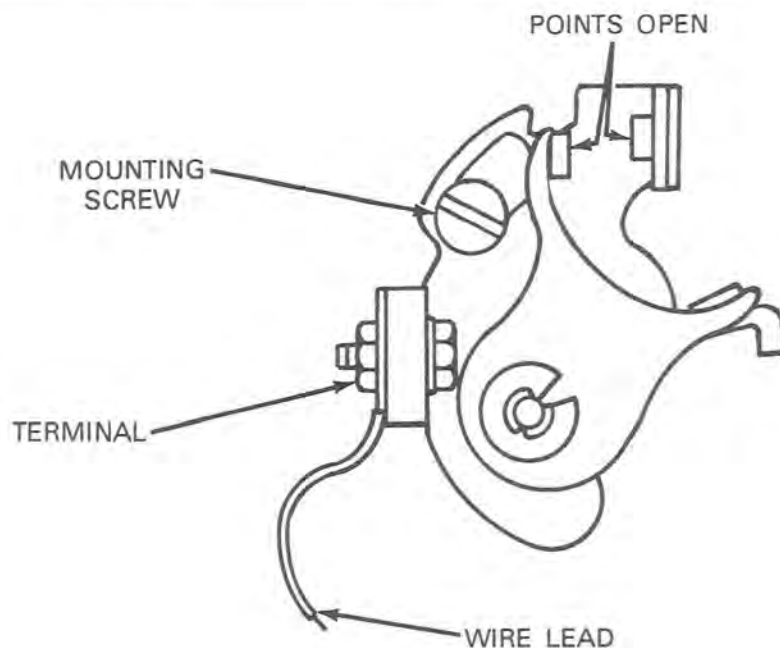
allow any spark to be produced. Disconnect the condenser from its mounting base by removing the screw attaching it before measuring resistance.



ITEM TO BE CHECKED	CONDENSER TERMINAL TO MOUNTING FOOT
RESISTANCE *	INFINITE (OPEN)

* The condition of a condenser cannot be checked using a resistance measurement alone. To check condenser performance, a condenser tester must be used.

5. Checking The Breaker Points



ITEM MEASURED	BREAKER POINTS MOUNTING SCREW TO TERMINAL
RESISTANCE*	INFINITE

* Resistance measurement must be made with points open and with wire lead removed from the breaker arm.

6. TROUBLESHOOTING - USING OHMMETER

Observe the following notes when performing the troubleshooting procedures.

NOTE: Connections must be correct. To avoid connection errors, couplers are used for connections of the flywheel magneto, and ignition coil. All wires are color coded.

NOTE: Magnet removal; use the flywheel magnet puller (special tool) to remove the magnets from

the flywheel magneto. Never attempt to remove using a hammer. The magneto or crankshaft will be damaged.

The troubleshooting table lists ignition problems and possible conditions which would cause them. To determine whether the magneto or ignition coils are defective, check the resistance readings values listed on the previous page. If the resistance readings obtained are not within the range given in the previous tables, the component is defective and must be replaced.

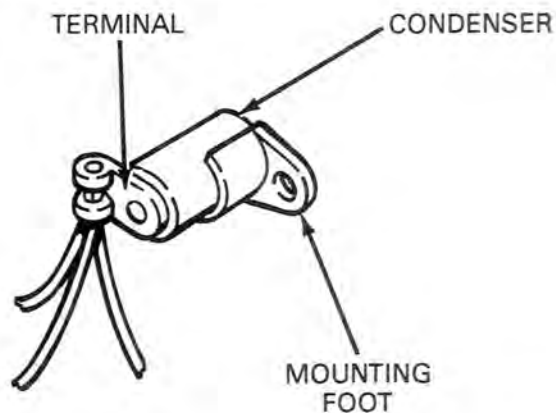
ELECTRICAL TROUBLESHOOTING

Problem	Condition	Remedy
No spark is produced	1. Defective magneto exciter coil (1) 2. Defective magneto exciter coil (2) 3. Defective ignition coil primary winding 4. Defective ignition coil secondary winding 5. Shorted points 6. Spark plug is shorted - resistance between electrodes should be 1 M Ω or more 7. Wrong wire connections 8. Shorted condenser	1. Replace coil (1) 2. Replace coil (2) 3. Replace ignition coil 4. Replace ignition coil 5. Replace points 6. Replace spark plug 7. Connect wires correctly 8. Replace condenser
The engine starts but will not pick up speed	1. Defective magneto exciter coil (1) 2. Defective magneto exciter coil (2) 3. Improper timing 4. Wrong point gap 5. Shorted spark plugs. Resistance between electrodes should read 1 M Ω or more 6. Worn points	1. Replace coil (1) 2. Replace coil (2) 3. Adjust timing to idle at 1500 rpm to 2000 rpm 4. Adjust point gap 5. Replace spark plugs 6. Replace points
The engine is cranked again but will not start	1. Defective magneto exciter coil (1) 2. Defective magneto exciter coil (2)	1. Replace coil (1) 2. Replace coil (2)
The engine tends to kick back	1. Improper timing	1. Adjust idle speed for 1500 rpm to 2000 rpm

7. Electrical Troubleshooting - Using A Condenser Tester

1. Remove the condenser from its mounting plate by removing the screw attaching it.

2. Check the capacitance of the condenser by measuring between its mounting foot and terminal using a suitable condenser tester.



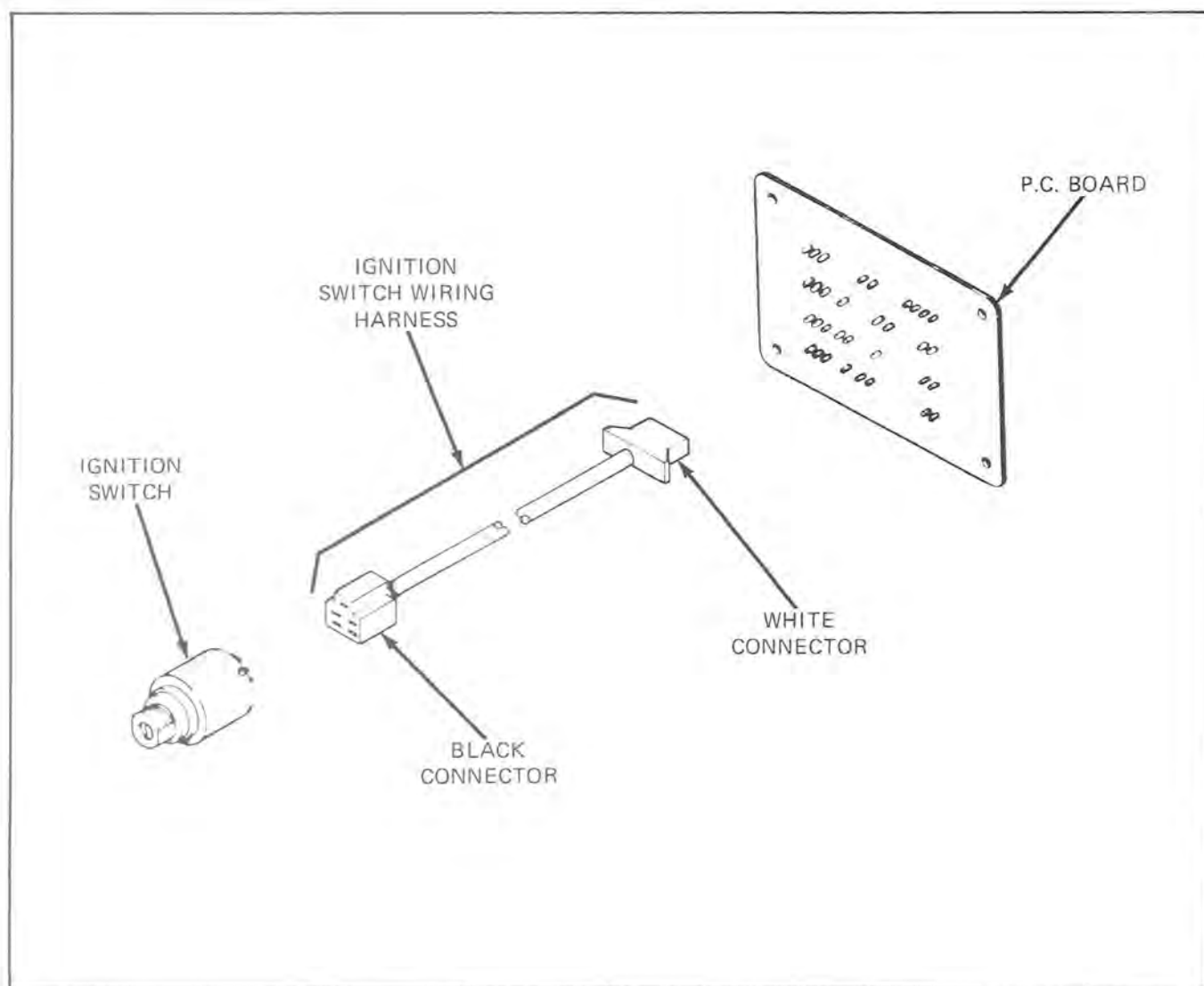
ITEM TO BE MEASURED	CONDENSER TERMINAL TO MOUNTING FOOT
CAPACITANCE	.18 uf

Ignition Switch and Emergency Stop Switch Test, Including Associated Circuits

1. Disconnect the black plug from engine to P.C. board.
2. Turn the ignition and emergency stop switches on.
3. Connect ohmmeter leads to the two pins on P.C. board that engine connector was plugged into (ohms X 1 scale).
4. If the ohmmeter registers infinity, there is an open circuit and the switches should be good. (To verify, activate ignition switch, meter should read 0. Turn on ignition switch and activate emergency stop switch, meter should read 0.)

Be sure to turn both switches on before proceeding.

5. If the reading is 0 or very low, keep ohmmeter connected to P.C. board and proceed to steps 6 and 7 below.
6. Disconnect emergency stop switch connector from P.C. board. If ohmmeter reads infinity, replace emergency stop switch, if not plug connector back into P.C. board and proceed to step 7.
7. Disconnect ignition switch connector (white) from P.C. board. If ohmmeter reads 0, replace P.C. board. If ohmmeter reads infinity, plug connector back into P.C. board and disconnect black connector from back of ignition switch. If ohmmeter reads infinity, replace ignition switch. If ohmmeter reads 0, replace wiring from P.C. board to ignition switch.



Magneto Alternator and Light Regulator Tests

These tests should be conducted if bulbs burn out consistently or all the lights are extremely dim. (Filaments barely light.) Bulbs which fail due to overvoltage usually have melted filaments rather than broken ones.

1. Raise the rear of the snowmobile. Make sure the track is free to rotate.

WARNING

While raising the snowmobile off the ground, place the skis against a stationary object, and be sure the vehicle is properly secured, to prevent personal injury.

2. Connect multimeter leads at engine (white) connector on P.C. board. DO NOT DISCONNECT FROM P.C. BOARD. Hook one lead to the yellow wire and the other to the black or brown wire.
3. Set multimeter at 25 volts AC.
4. Set ignition switch in "ON" position (lights off). Do not activate brake light during test.

CAUTION

Excessive voltage may exist during test 4 & 5 which may burn out bulbs if lights are turned on.

5. Start the engine. DO NOT RUN OVER 2000 RPM. The voltmeter should read 8-11 volts AC. If the voltage reads 8-11 volts, the magneto and voltage regulator are probably OK. If it reads less than 8-11 volts, proceed to No. 6. If it reads higher, the voltage regulator is probably open and is not working. To be sure, increase RPM slowly. DO NOT EXCEED 3000 RPM. If the voltage reading did not stabilize or exceeded 22 V, the regulator should be replaced. (Before replacing make sure connections on regulator is in good condition and case is properly grounded to chassis.)
6. With engine still running disconnect voltage regulator from P.C. board (single yellow wire). When voltage regulator is disconnected the voltage reading should increase to 14-20 volts. DO NOT RUN OVER 2000 RPM. If it does not, the problem is in the magneto lighting coil or wiring to lighting coil from P.C. board. If voltage does increase the regulator is most likely shorted and should be replaced.

Headlight and Headlight Circuit Test

Before proceeding with these tests, be sure magneto alternator and voltage regulator are working properly.

1. Check to see if headlight bulb filaments are good.
 - a. Disconnect headlight connector.
 - b. Connect one lead of the ohmmeter to the ground terminal of the headlight.
 - c. Connect the other ohmmeter lead to the high beam terminal.
 - d. Set ohmmeter scale to ohms X 1.
 - e. If ohmmeter reads infinity or more than 2 ohms the filament is faulty.
 - f. Test the low beam in the same way by moving the ohmmeter lead from the high beam filament to the low beam.
 - g. If headlight malfunction still exists, proceed.
2. Check to see if voltage is present at headlight connector.
 - a. Raise the rear of the snowmobile. Make sure the track is free to rotate.

WARNING

While raising the snowmobile off the ground, place the skis against a stationary object, and be sure the vehicle is properly secured, to prevent personal injury.

- b. Run engine at 2000 RPM.
- c. Set voltmeter to 25 volts AC.
- d. Check for voltage between black and brown wire (low beam) and black and green wire (high beam). Be sure light switch is turned on and beam switch is set to proper beam, either high or low.
- e. If voltage is not present at either high or low beam, check headlight harness for good connection to P.C. board, and check for burned or shorted wires in headlight harness. If harness is good, proceed to tests for the beam switch and light switch. If taillights, etc. work proceed to the beam switch test before the light switch test.

Light Switch Test

1. Disconnect white ignition switch connector from P.C. board.
2. Connect ohmmeter between red and blue leads using ohms X 1 scale.
3. Turn key switch on.
4. Ohmmeter should read 0. If it reads infinity key switch or wiring from P.C. board to key switch could be faulty.
5. Disconnect wiring from key switch.
6. Connect ohmmeter between B and L terminals.
7. Turn key switch on.
8. Ohmmeter should read 0. If it does not key switch is faulty. If it reads 0 and the reading in step 4 was infinity, the problem is in the wiring from the P.C. board to the key switch.
9. If 0 was obtained in steps 4 and 8 above and the output from the magneto alternator and voltage regulator is OK, and there are no lights, (headlights, tail, brake, etc) the problem is in the P.C. board circuitry. The board should be removed and inspected or replaced.

Beam Switch Test

1. Disconnect black beam switch connector from P.C. board.
2. Connect ohmmeter to brown and orange wires to beam switch (ohms X 1.)
3. Turn beam switch to low, meter should read 0.
4. Turn beam switch to high, meter should read infinity.
5. Connect ohmmeter to brown and green wires to beam switch.
6. Turn beam switch to high, meter should read 0.
7. Turn beam switch to low, meter should read infinity.
8. If any of the tests in steps 3, 4, 6, or 7 were faulty, replace the beam switch.
9. If all above tests were OK and there is no headlight power, and the headlight circuit, magneto alternator, voltage regulator, and key switch tests were OK the problem is in the P.C. board. The board should be removed and inspected or replaced.

Stop and Tail Light

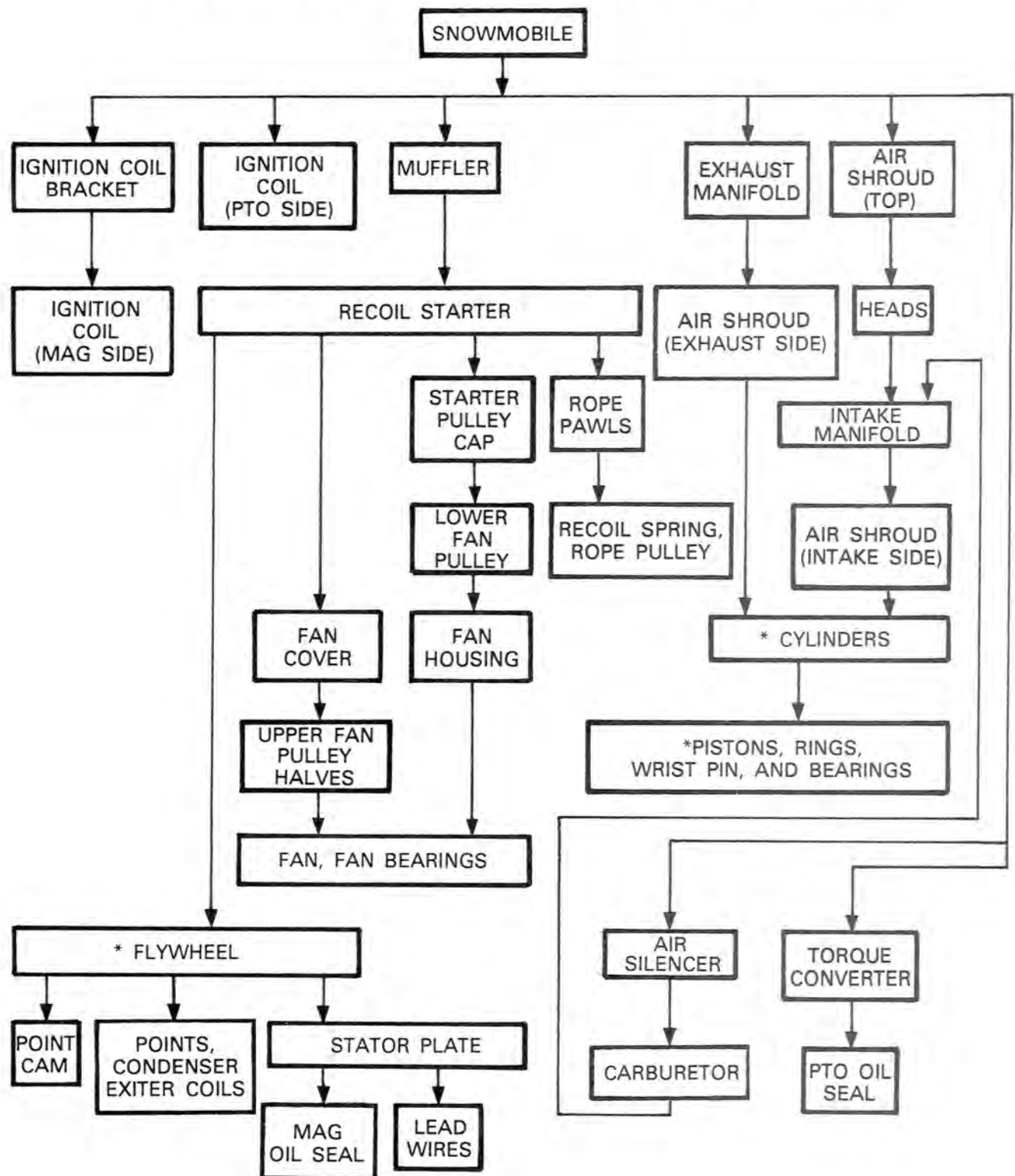
1. Check stop taillight bulb before testing and make sure it is making a good connection in socket housing.
2. Disconnect tail lamp (green) connector from P.C. board.
3. To check wiring to taillight connect ohmmeter between the brown lead and black lead (ohms X 1). Ohmmeter should read 2 - 3 ohms.
4. To check wiring to stop light, connect ohmmeter between the green and black wires in the connector (ohms X 1 scale). Ohmmeter should read 1 - 2 ohms.
5. If the readings in steps 3 and 4 read higher than specified or read infinity the problem is in the wiring to the tail stop light. Remove seat and inspect wiring to taillight. (Check bulb contacts again.)
6. If reading in step 3 was OK and the taillight, headlight, and instrument lights do not function proceed to the tests for the magneto alternator voltage regulator and key switch tests. If only the taillight does not function the problem is in the P.C. board. Remove and inspect P.C. board or replace.
7. If reading in step 4 was OK proceed to the test for the brake light switch.
8. If the brake light switch tests OK and the other lights function OK the problem is in the P.C. board. Remove and inspect P.C. board or replace.

Brake Switch Test

Before proceeding with this test make sure brake lever is adjusted so it makes good contact with brake switch.

1. Disconnect orange brake switch connector from the P.C. board.
2. Connect ohmmeter between the yellow and blue wires to the brake light switch (ohms X 1 scale).
3. The ohmmeter should read infinity (open).
4. Squeeze the brake lever. The ohmmeter should read 0.
5. If the readings in steps 3 and 4 are not obtained, replace the brake light switch.

FLOW CHART DISASSEMBLY - ENGINE INSTALLED

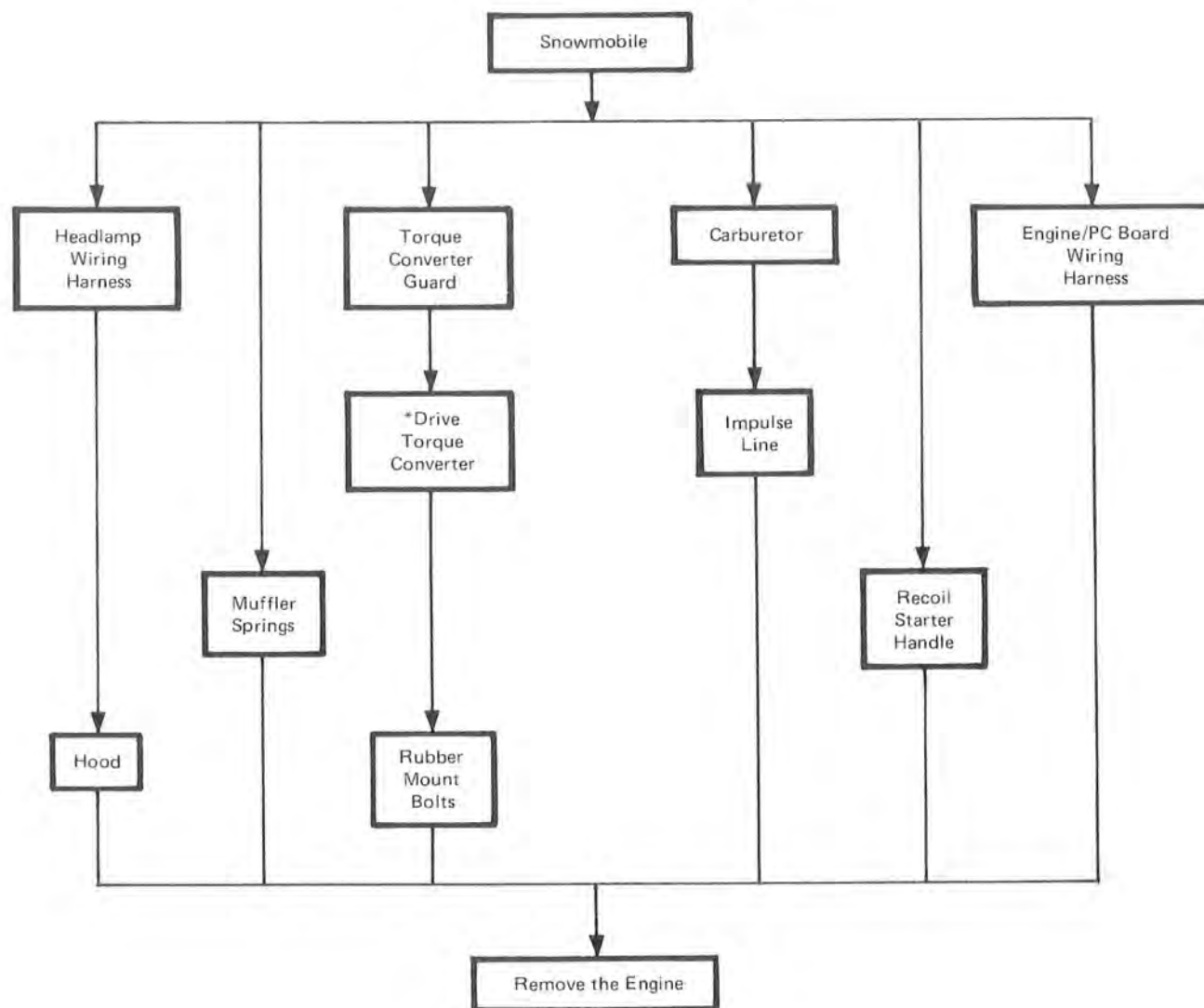


* Removal, installation, disassembly, or assembly requires use of special tool(s).

NOTE:

This chart is designed to aid in determining proper removal sequence. Select the component you wish to remove and follow the arrows leading to that point on the chart.

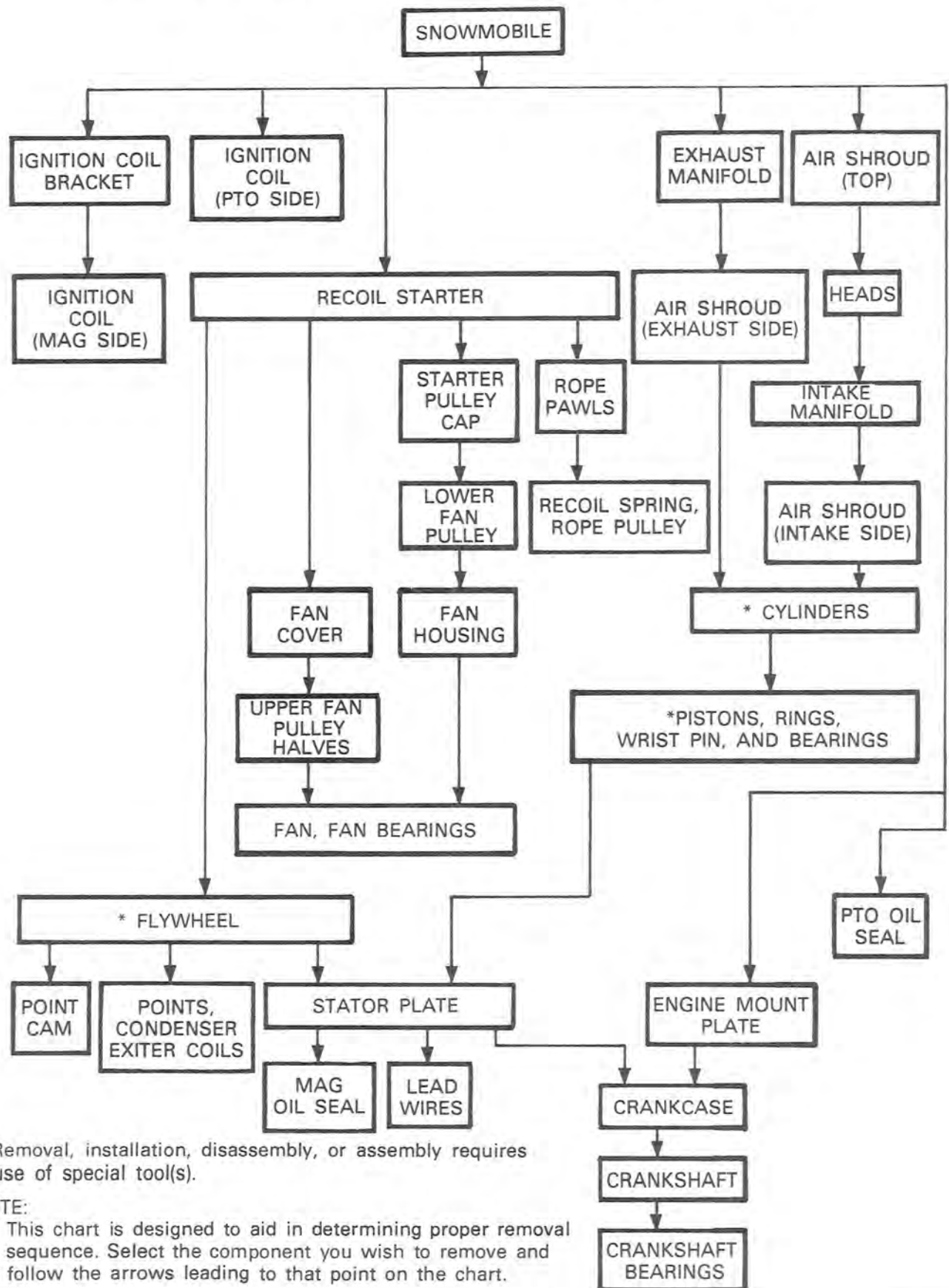
Flow Chart Engine Removal



*Removal, installation, disassembly, or assembly requires use of special tool(s).

NOTE: This chart is designed to aid in determining proper removal sequence. Select the component you wish to remove and follow the arrows leading to that point on the chart.

FLOW CHART DISASSEMBLY - ENGINE REMOVED



* Removal, installation, disassembly, or assembly requires use of special tool(s).

NOTE:

This chart is designed to aid in determining proper removal sequence. Select the component you wish to remove and follow the arrows leading to that point on the chart.

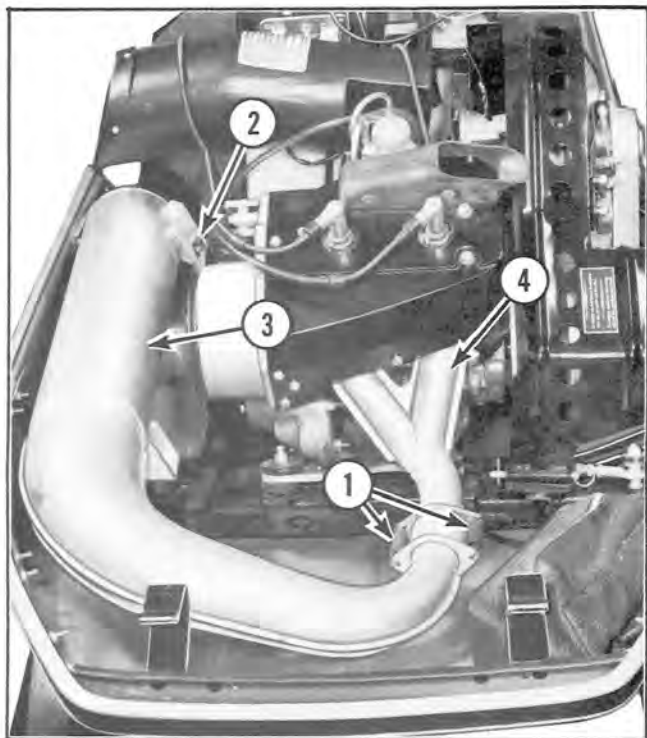
Muffler

Removal

1. Remove the air intake silencer.
2. Remove two springs (1, Figure 3-1) which secure the muffler to the exhaust manifold.
3. Remove two nuts and washers (2) which secure the muffler to the mounting brackets.
4. Remove the muffler from the snowmobile, carefully separating from the exhaust manifold flange.

Installation

Install the muffler by reversing the removal procedure. Make sure the muffler is properly seated on the rubber mounts.



1. Spring
2. Nut and Washer
3. Muffler
4. Exhaust Manifold

Figure 3-1

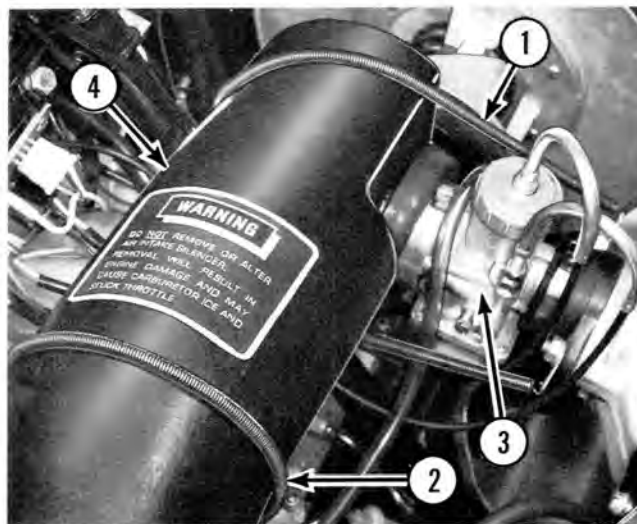
Air Intake Silencer

Removal

Disconnect the spring extensions (1 and 2, Figure 3-2). Remove the carburetor from the air intake silencer by pulling the carburetor and seal from the flange. Remove the air intake silencer from the snowmobile.

Installation

Install the air intake silencer by reversing the removal procedure.



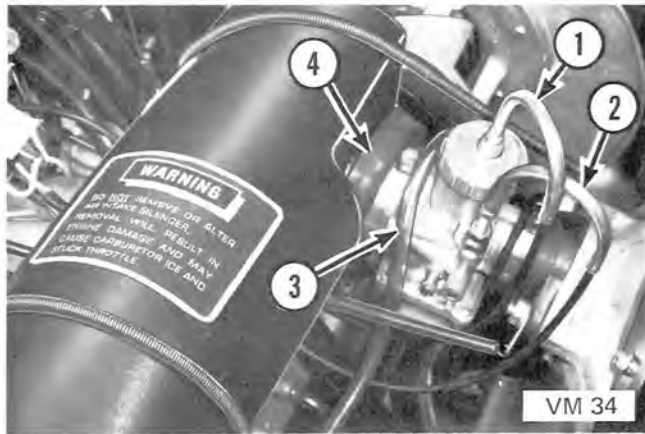
1. Spring Extension
2. Spring Extension
3. Carburetor
4. Air Intake Silencer

Figure 3-2

Carburetor

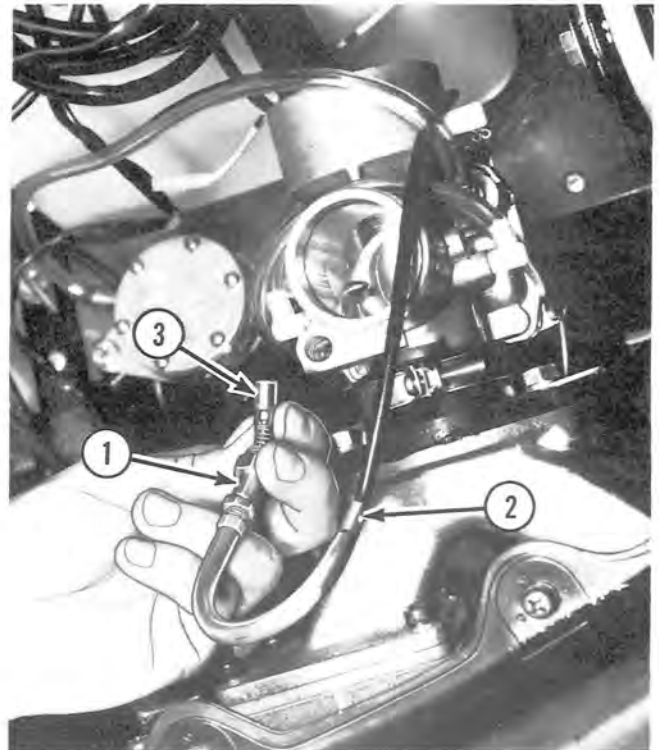
Removal

1. Remove the carburetor fuel supply line. Plug the fuel line opening. See Figure 3-3.
2. Unscrew the mixing body top assembly and pull out the throttle valve. See Figure 3-4.
3. Compress the throttle spring and pull the spring from its seat. Slip the throttle cable through the slot in the piston valve plate. Remove the spring, piston valve plate, and jet needle from the valve.



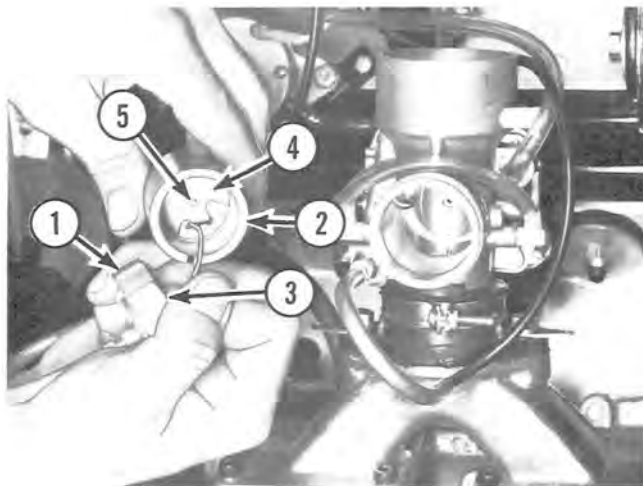
1. Throttle Cable
2. Enrichener Cable
3. Fuel Supply Line
4. Silencer/Carburetor Seal

Figure 3-3



1. Starter Plunger Cap
2. Enrichener Cable
3. Starter Plunger

Figure 3-5



1. Mixing Body Top Assembly
2. Throttle Valve
3. Throttle Spring
4. Piston Valve Plate
5. Jet Needle

Figure 3-4

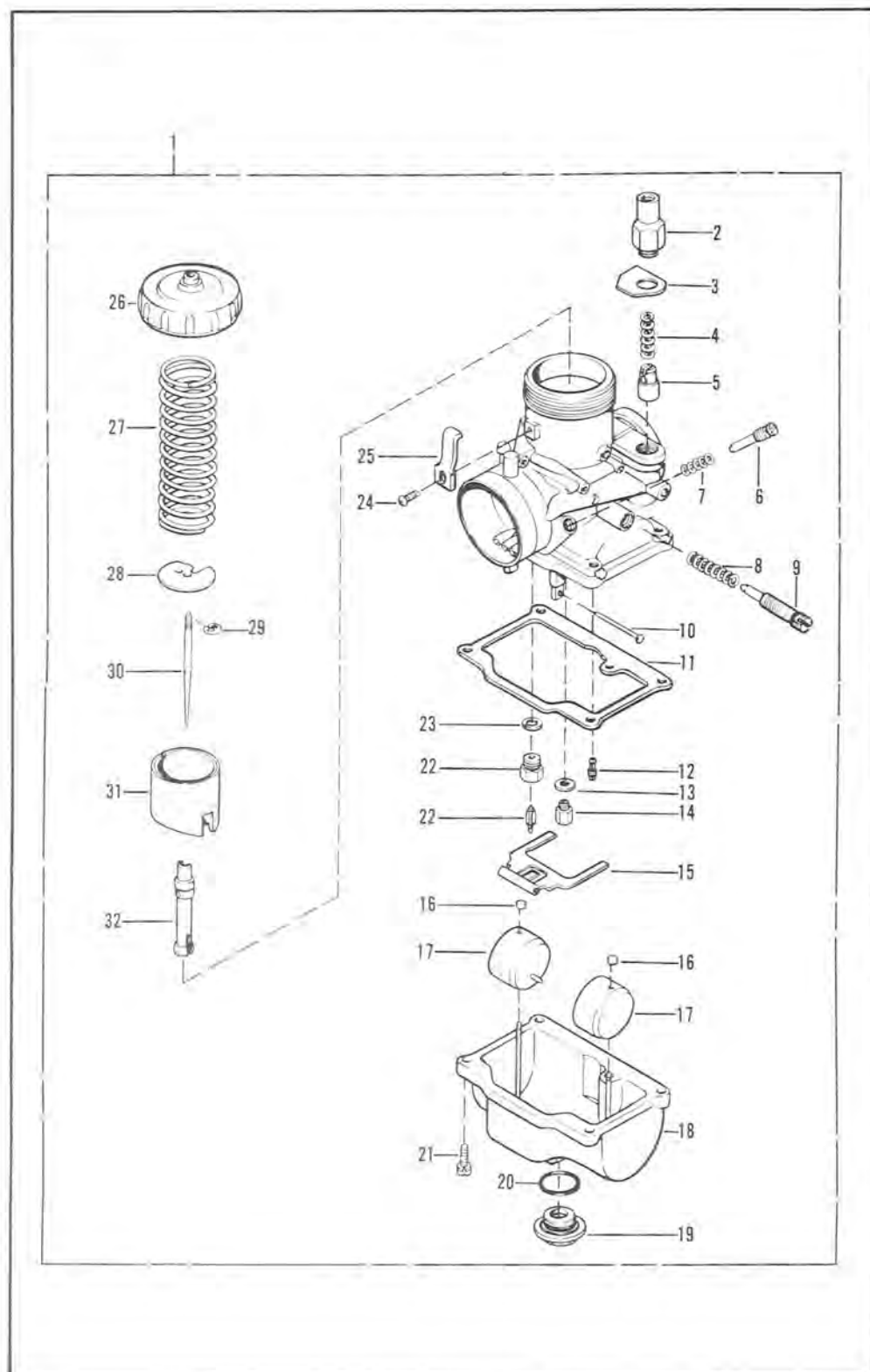
4. Unscrew the starter plunger cap and remove the starter plunger to release the enrichener cable. Unscrew the fitting and disconnect the enrichener cable. See Figure 3-5.
5. Pull the carburetor from the intake silencer. Remove the silencer/carburetor seal from the carburetor flange. See Figure 3-3.

Disassembly of Carburetor

1. Select a clean work area for disassembling the carburetor. Most carburetor problems are caused by dirt in the system.
2. Clean the carburetor with fuel and blow dry with compressed air before disassembling. Do not blow high pressure air through the carburetor until it is disassembled.
3. Remove four screws with washers (21, Figure 3-6) and separate the float chamber body (18) from the upper carburetor body. Remove the gasket (11).
4. To remove the main jet (14), unscrew from the upper carburetor body. Remove jet washer (13).
5. Push out the float arm pin (10) and remove the float arm (15). Remove the float valve assembly (22) and place in a secure location to prevent damage.
6. To remove the needle jet (32), use a soft rod (such as a pencil) to push the needle jet up through its bore.

7. Remove the pilot jet (12) by unscrewing with a thin-bladed screwdriver.

8. Remove the throttle stop screw (9) and spring (8) and pilot air adjusting screw (6) and spring (7).



1. Carburetor Assembly
2. Starter Plunger Cap
3. Washer
4. Spring
5. Starter Plunger
6. Pilot Air Adjusting
Screw
7. Spring
8. Spring
9. Throttle Stop Screw
10. Pin
11. Gasket
12. Pilot Jet
13. Washer
14. Main Jet
15. Float Arm
16. Cap
17. Float
18. Float Chamber Body
19. Drain Screw
20. O-Ring
21. Screw
22. Float Valve Assembly
23. Washer
24. Screw
25. Plate
26. Cap
27. Spring
28. Plate
29. Clip
30. Needle Jet
31. Throttle Valve
32. Needle Jet

Figure 3-6

VM 34 CARBURETOR

Cleaning Carburetor

Thoroughly clean all parts with a mild solvent or fuel/oil mixture. Inspect all drilled holes, openings and fuel passages in the body. Blow compressed air through the passages. Remove any sediment from the fuel bowl.

Reassembly of Carburetor

1. Place the spring (8, Figure 3-6) on the throttle stop screw (9) and install in the carburetor body. Turn in the screw about 10 turns.
2. Insert the spring (7) and pilot air adjusting screw (6) in the carburetor body. Turn the screw all the way in then turn out 1-3/4 turns for initial adjustment.
3. Install the float valve assembly (22) and tighten to 25 to 30 inch-pounds.
4. Install the float arm (15) and secure with float arm pin (10). Be sure the pin is securely seated.
5. Invert the carburetor and check the alignment between the float arm and the base of the carburetor. The float arm must be parallel to the base.
6. Install the needle jet (32) down through the top of the carburetor. Hold the needle jet in place while installing the jet washer (13) and main jet (14).
7. Install the pilot jet (12). Do not overtighten.
8. Position the floats (17) on float chamber pins. Install the floats with the brass pins at the bottom.
9. Position a new gasket (11) on the carburetor body. Place the carburetor body on the float chamber body (18). Hold the carburetor body and float bowl together and invert the carburetor. Check for proper alignment of the two castings. Secure with the four screws with washers (21).
4. Hold the throttle cable and mixing body top assembly in one hand. Place the spring in the top and compress the spring so the throttle cable extends beyond the spring.
5. Guide the throttle valve over the throttle cable. Insert the end of the cable through the hole in the throttle valve slot.
6. While keeping the spring compressed, release the throttle valve and install the piston valve plate. Then release the spring.
7. Install the throttle valve into the carburetor so the slot in the throttle valve mates with the locating pin inside the throttle valve bore. Install the mixing body top assembly and tighten finger tight. Tighten the throttle cable locknut.
8. Slide the starter plunger cap, washer and spring over the end of the enrichener cable. See Figure 3-5.
9. Place the hole in the starter plunger over the cable end and spring. Insert the plunger into the carburetor body and tighten the starter plunger cap. Bend washer plate against cap.
10. Connect the fuel supply line and the carburetor vent hose. See Figure 3-3.
11. Raise the rear of the snowmobile off the ground. Start the engine and perform the carburetor adjustments in Section 2 of this manual.

Installation Of Carburetor

1. Install the silencer/carburetor seal to the carburetor flange and install the carburetor on the air intake silencer.
2. Screw the mixing body top assembly (Figure 3-4) to the throttle cable.
3. Insert the jet needle into the throttle valve.

Troubleshooting

Carburetor related malfunctions can be identified as too rich or too lean a fuel mixture. Symptoms are as follows:

When the fuel/air mixture is too rich:

1. Engine noise is dull and intermittent.
2. The condition grows worse when the engine is hot.
3. The condition grows worse when the starter (choke) is opened.
4. The condition may improve slightly when the air silencer is removed.
5. Exhaust gases are heavy.
6. Spark plugs become fouled.

When fuel/air mixture is too lean,

1. The engine becomes overheated.

2. The condition improves when the starter is opened.
3. Acceleration is poor.
4. Spark plugs burn.
5. The revolutions of the engine fluctuate and lack of power is noticed.

If a carburetor is experiencing too rich or too lean fuel mixture problems, first check to see that the throttle is working properly. Then disassemble and clean the carburetor. A rich or lean fuel mixture is usually caused by a clogged air or fuel passage. If cleaning does not improve carburetor performance, carburetor tuning may be necessary.

Tuning

Different fuel metering components function according to the throttle setting:

1. Pilot Air Screw - from closed throttle to one eighth ($1/8$) throttle opening.
2. Throttle Valve Cutaway - one eighth ($1/8$) to one fourth ($1/4$) throttle opening.
3. Jet Needle and Needle Jet - one fourth ($1/4$) to three fourths ($3/4$) throttle opening.
4. Main Jet - three fourth ($3/4$) to full throttle opening.

Tuning enables adjustment of the fuel/air mixture at any throttle setting by replacing the standard fuel metering devices with parts designed to meter more or less fuel than standard. Because a change in one fuel metering system can affect the performance of other systems, all systems should be checked whenever a change is made to one fuel metering system.

The pilot air screw regulates air that mixes with fuel from the pilot jet. Turning the pilot air screw in richens the fuel/air mixture. Turning out leans the mixture. The pilot air screw should be normally positioned $1/2$ to 2 turns from full in. Less than $1/2$ turn indicates the pilot jet is too small. More than two turns out indicates the pilot jet is too large.

The jet needle system can be tuned by changing the position of the clip on the jet needle. There are five grooves at the top of the needle. The grooves are numbered 1 through 5 from top to bottom. The clip is normally installed in the No. 3 groove. Moving the clip to a higher position on the needle leans out the fuel/air mixture. Moving the clip to a lower position richens the fuel/air mixture.

Fuel Pump Removal

1. Remove air intake silencer from carburetor.
2. Remove fuel inlet line from fuel pump. Plug end of fuel line. See Figure 3-7.
3. Remove fuel outlet line and impulse line from fuel pump.
4. Remove two fuel pump mounting bolts.

Disassembly

1. Remove six retainer screws (1, Figure 3-8).
2. Lift off body cover (A), gasket (2) and diaphragm (5). Note the position of gasket (2) in relation to body cover (A).
3. Grommets (3) cannot be reinstalled. Be sure to have replacements before removing them. Remove grommets (3) and check valves (4) from main body (B).

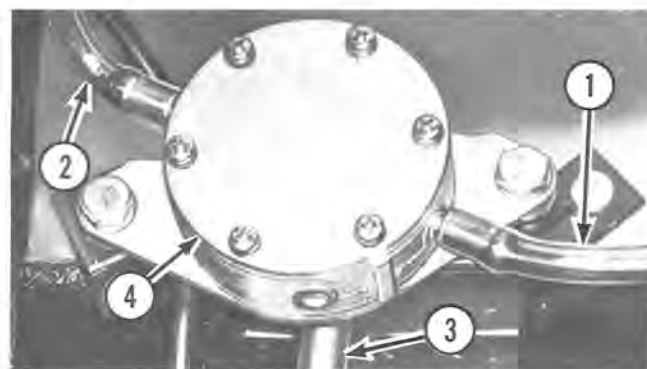
Cleaning

Clean body castings (A, B, C) with a mild solvent.

CAUTION:

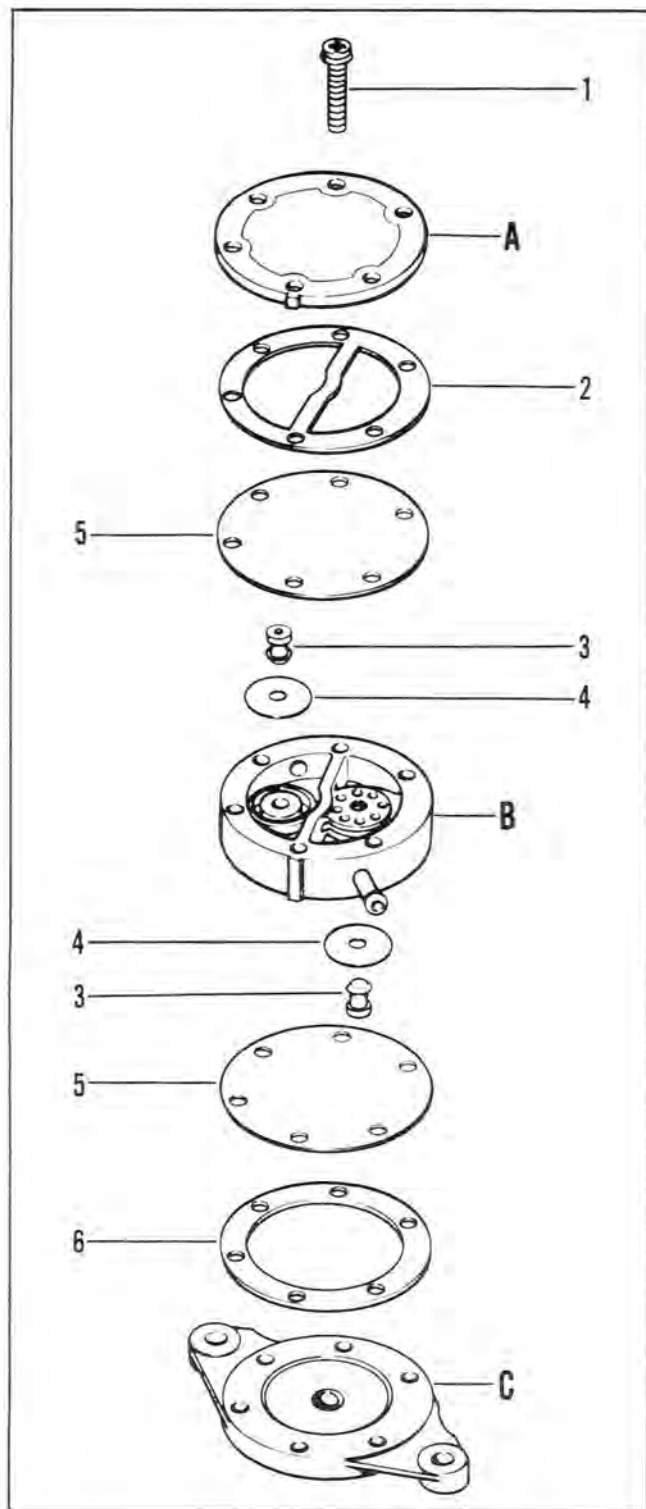
Do not clean rubber diaphragms with solvent. Damage to diaphragms will occur.

Be sure fuel line and impulse line fittings are clear of any obstructions.



1. Fuel Inlet Line
2. Fuel Outlet Line
3. Impulse Line
4. Fuel Pump

Figure 3-7



A. Body Cover
B. Main Body
C. Pump Casting

1. Screw
2. Gasket
3. Grommet
4. Valve
5. Diaphragm
6. Gasket

Figure 3-8

FUEL PUMP

Reassembly

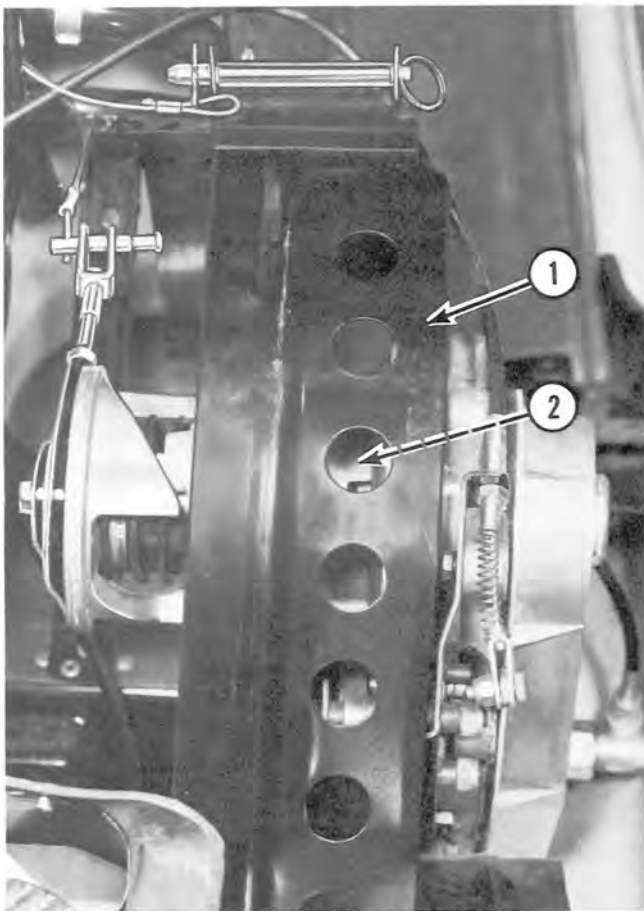
1. Install lower gasket (6, Figure 3-8) and diaphragm (5) on pump casting (C).
2. Install check valves (4) using new grommets (3) in main body (B). Position main body (B) on pump casting (C).
3. Install diaphragms (5) and upper gasket (2). Be sure to align tabs on gasket (2) and main body (B).
4. Install body cover (A). Be sure tab on body cover (A) aligns with gasket (2) and main body (B).
5. Install six retaining screws (1) and tighten in a crisscross pattern.

Installation

1. Connect impulse line to bottom fitting.
2. Install fuel inlet line and fuel outlet lines. Arrows on top of body cover (A, Figure 3-8) indicate direction of fuel flow.
3. Install two fuel pump mounting bolts.
4. Replace air intake silencer to carburetor.

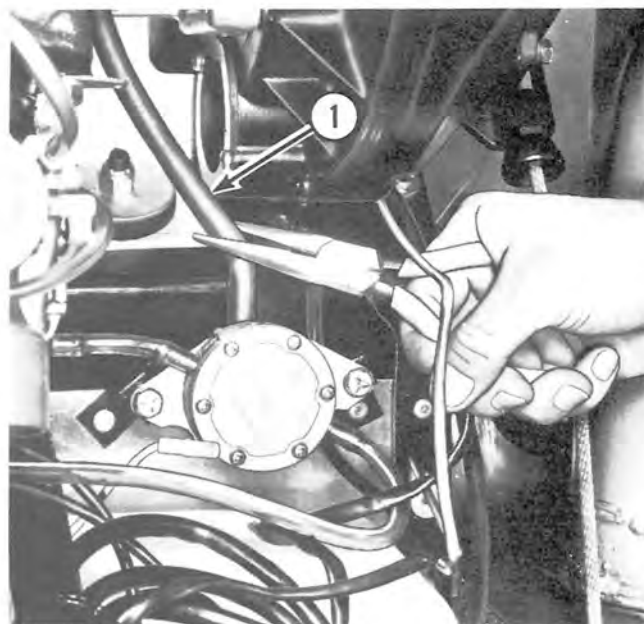
Engine Removal

1. Remove the hood.
2. Remove the retainer pins and remove the drive belt guard (Figure 3-9). Remove the drive belt.
3. Disconnect the wiring harness from the engine or circuit board as required.
4. Remove starter handle and tie a knot in the rope.
5. Disconnect the fuel impulse line from the engine as shown in Figure 3-10.
6. Remove the carburetor from the engine mount by loosening clamp screw and pulling from the engine. If carburetor is to be removed, refer to the carburetor repair instructions.
7. Use a spring puller tool or a long wire hook to disconnect the two exhaust springs.
8. Remove the four engine mounting bolts, nuts and spacers. Use a socket wrench to hold bolts while removing nuts.
9. Remove the engine from the snowmobile.



1. Drive Belt Guard
2. Drive Belt

Figure 3-9

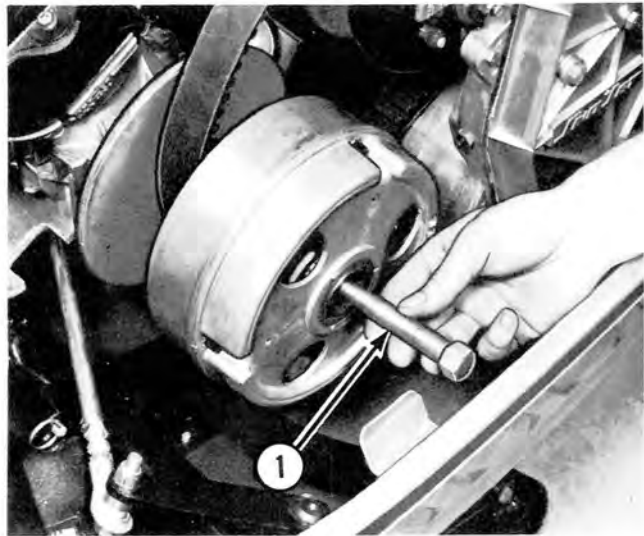


1. Impulse Line

Figure 3-10

Removing External Components

1. Remove the drive converter mounting bolt and lockwasher. Install the drive converter puller bolt (tool no. 205196) and screw in to remove the drive converter. See Figure 3-11.



1. Drive Converter Puller Bolt

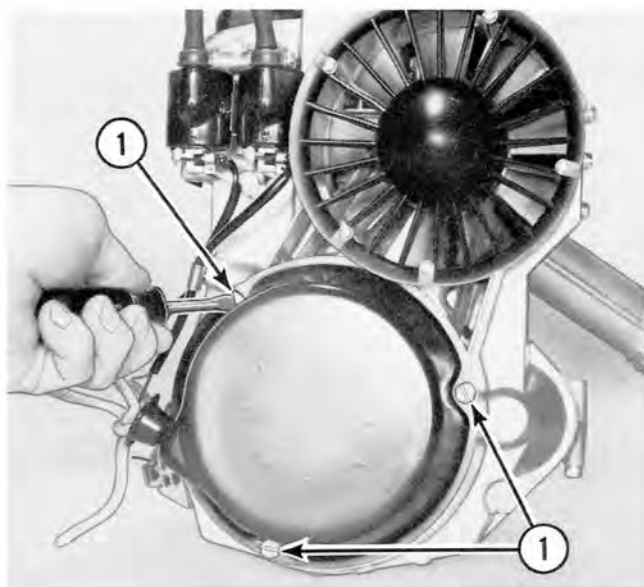
Figure 3-11

2. Remove the exhaust manifold.
3. Remove the spark plugs.
4. Remove the engine mounting plate.

Recoil Starter

Removal

1. Remove starter handle and tie knot in starter rope to prevent rope from suddenly retracting into the recoil case.
2. Remove three slotted hex head bolts securing starter assembly to engine and remove starter assembly. (Figure 3-12)

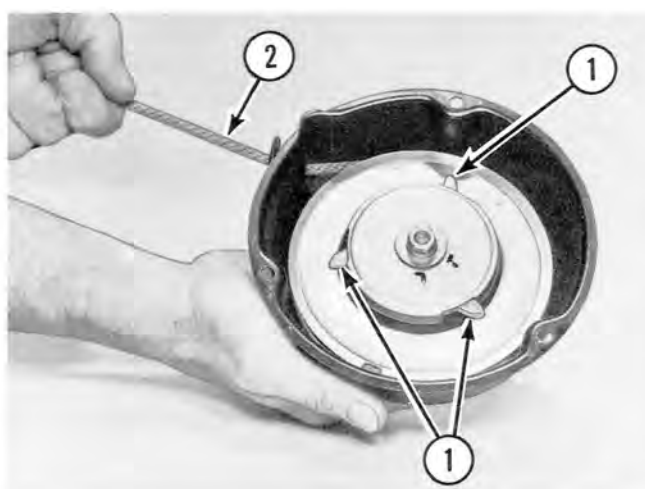


1. Slotted Hex Head Bolts (3)

Figure 3-12

Inspection

1. Pull the starter rope out 3-5 inches (76.2-127.0 mm) and examine the starter pawls for chips or excessive wear. See Figure 3-13. Listen for any grinding noise which might indicate a broken or worn starter spring. Examine the starter rope for excessive wear or frayed condition.

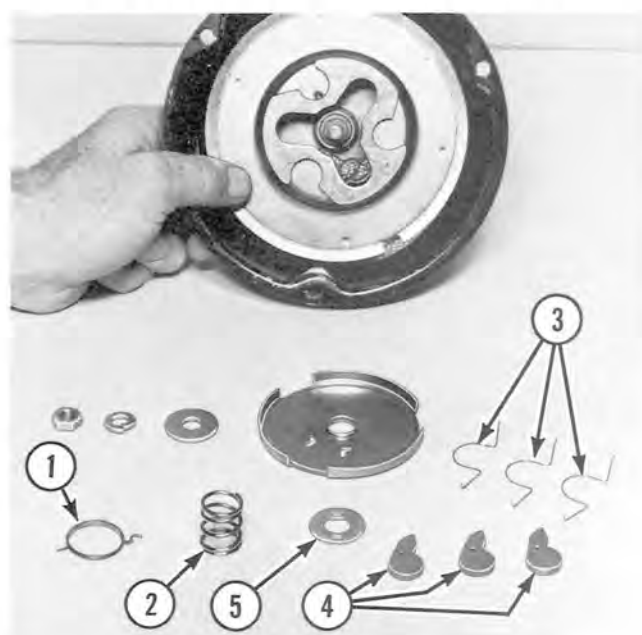


1. Starter Pawls
2. Starter Rope

Figure 3-13

Disassembly

1. Release recoil spring tension by removing handle from starter rope and allowing recoil reel to spin slowly.
2. Remove the nut and washers securing the retaining cover to the starter assembly. Exert slight downward pressure on cover to remove spring tension from retaining cover and slowly remove cover.
3. Remove the return spring, pressure spring, starter pawl springs, pawls and washer from starter assembly. Figure 3-14. Check the return spring and pressure spring for breaks, rust, distorted or weakened condition.



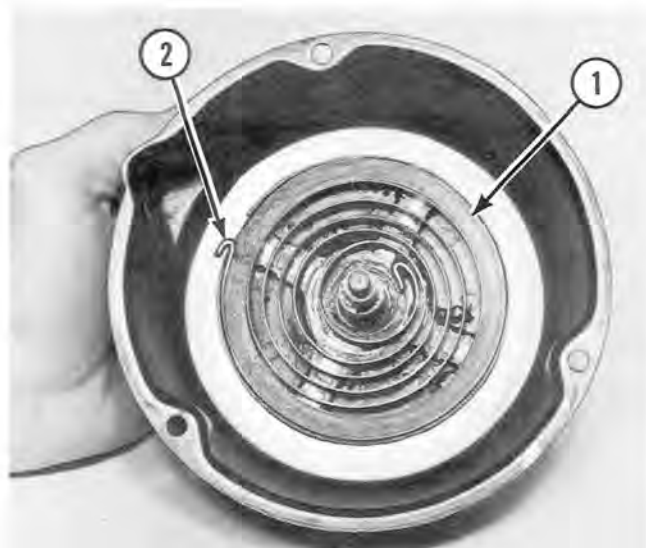
1. Return Spring
2. Pressure Spring
3. Starter Pawl Springs
4. Pawls
5. Washer

Figure 3-14

4. To replace starter rope, remove recoil reel from starter assembly. Untie knot and remove starter rope. Install new starter rope and tie a securing knot as shown in Figure 3-13.

WARNING

Exercise care when removing recoil reel from starter assembly. All spring tension should be released to prevent spring from accidentally disengaging and causing injury. Wear safety glasses when repairing starter assembly components.



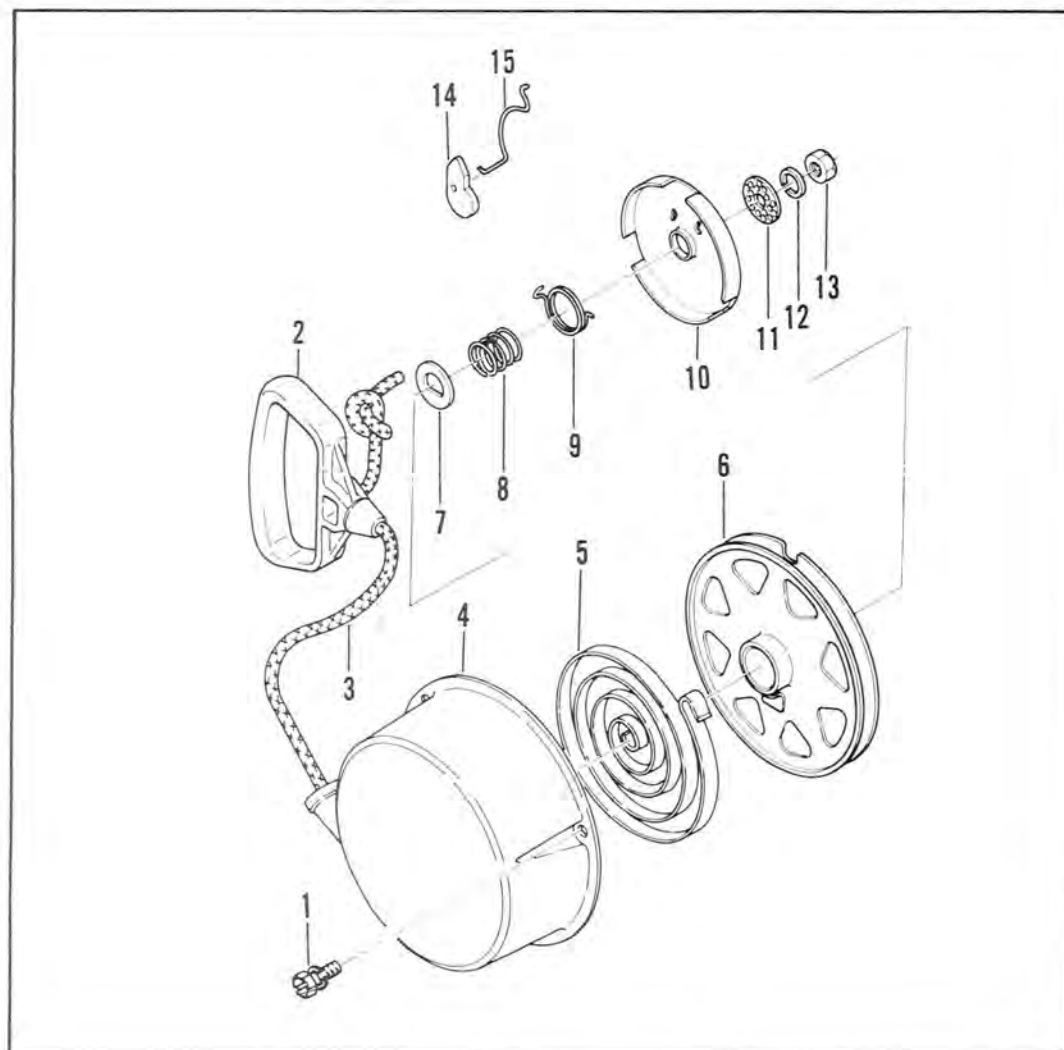
1. Recoil Spring
2. Spring Hook

Figure 3-15

5. With recoil reel removed, as shown in Figure 3-15, examine recoil spring for cracks, crystallization or abnormal bends. Exercise care when handling recoil case to prevent recoil spring from accidentally disengaging. Spring should remain in the recoil case. When installing a new recoil spring, attach hook in recoil spring to recoil case.

Reassembly

1. Thoroughly clean all parts removed prior to reassembling starter. Reassemble components as shown in Figure 3-6. Apply a light coat of low-temperature grease (Texaco 2346EP or equivalent) on recoil reel and recoil spring.
2. Apply correct recoil spring tension by placing rope in notch of recoil reel and rotate reel COUNTERCLOCKWISE four turns. Release rope from notch and allow rope to rewind.



1. Hex Head Bolt
2. Starter Handle
3. Starter Rope
4. Recoil Case
5. Recoil Spring
6. Recoil Reel
7. Washer
8. Spring
9. Return Spring
10. Retainer Cover
11. Washer
12. Lockwasher
13. Nut
14. Starter Pawl
15. Pawl Spring

Figure 3-16

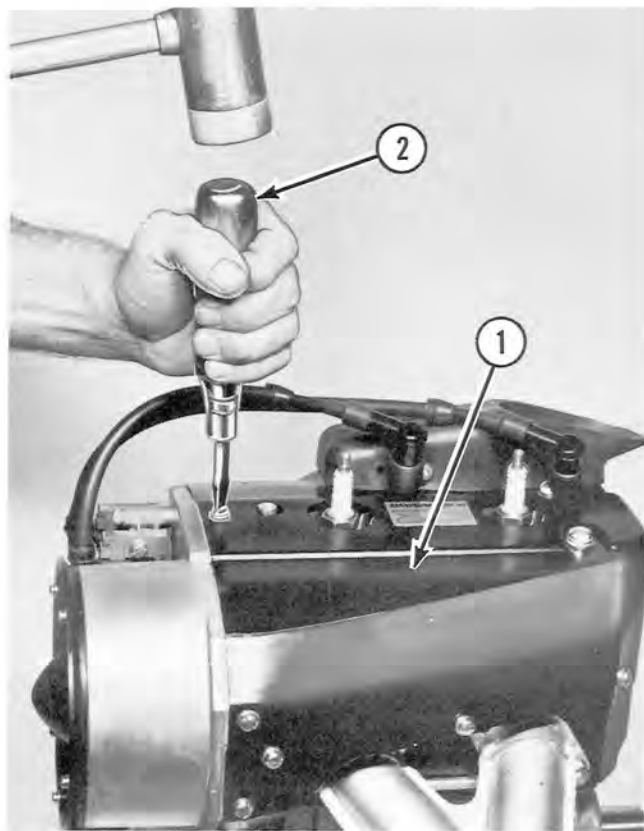
- Secure starter assembly to engine using three hex head bolts. Insert starter rope through guide in chassis and attach starter handle to starter rope. Pull starter a few times and observe starter operation.

NOTE: Before bolts are tightened pull slightly on starter rope to engage pawls, then tighten bolts securely.

Air Shrouds

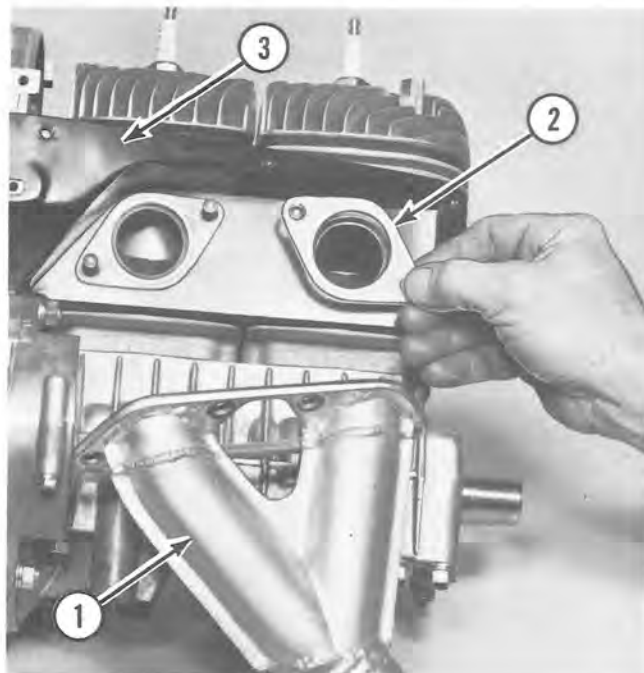
Removal

- Using an impact driver, remove eleven screws, lockwashers and washers securing main shroud to engine. (Figure 3-17) Impact driver must be used to prevent stripping the screw heads because LOCTITE was applied to screws during assembly.
- Remove four nuts and lockwashers securing exhaust manifold, gaskets and exhaust air shroud to engine. (Figure 3-18) Discard gaskets.



- Main Engine Shroud
- Impact Driver

Figure 3-17



- Exhaust Manifold
- Gaskets
- Exhaust Air Shroud

Figure 3-18

- Remove six bolts, lockwashers and flat washers securing intake manifold, gaskets and intake air shroud to engine. Discard gaskets.

Inspection

- Thoroughly clean air shrouds in a solvent and blow dry using compressed air.
- Inspect air shrouds for cracks, distortion or rust.
- Check intake and exhaust manifolds for cracks. Check gasket surfaces and clean using a scraper.

Reassembly

- Reassemble air shrouds, intake and exhaust manifolds to engine. Using new gaskets, assemble (2 each per cylinder) one on each side of exhaust and intake air shrouds. Secure using hardware previously removed. Torque brass exhaust manifold mounting nuts to 10 ft. lbs. (1.38 kg-m) and intake manifold bolts to 4-5 ft. lbs. (0.55-0.69 kg-m).

CAUTION

If cylinders or cylinder heads have been removed intake manifold bolts must be secured before torquing nuts securing heads and cylinders.

NOTE: Apply LOCTITE to main air shroud screws. Use an impact driver to assure main air shroud screws are tight.

2. Always use new gaskets during reassembly to ensure proper connections.
3. Install rubber damper to intake air shroud to prevent unnecessary engine noise.

Flywheel Magneto and Fan Housing

REMOVAL

FLYWHEEL MAGNETO

1. Remove flywheel retaining nut using a 18 mm socket. Insert a long rod or large screwdriver through slots in starter pulley to prevent crankshaft from rotating (Figure 3-19).

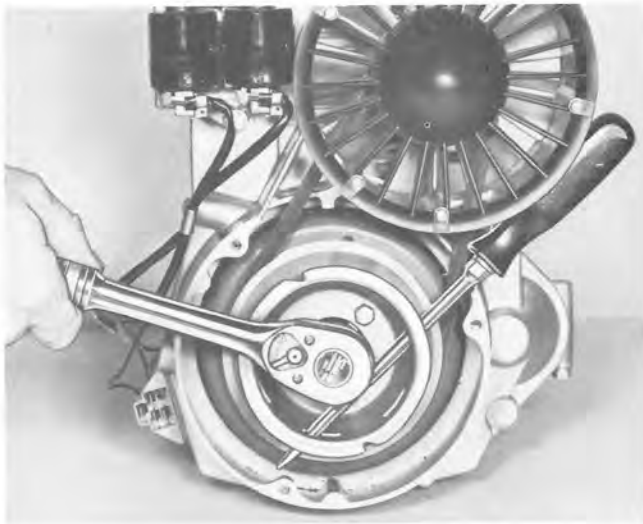
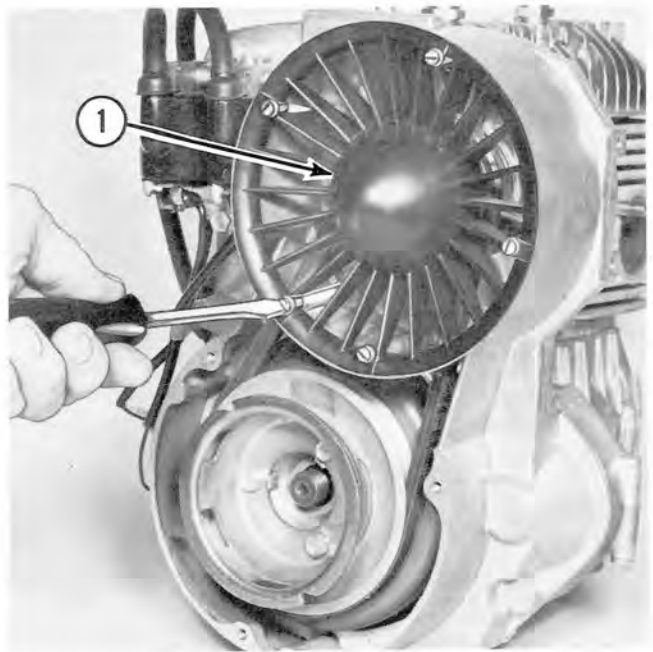
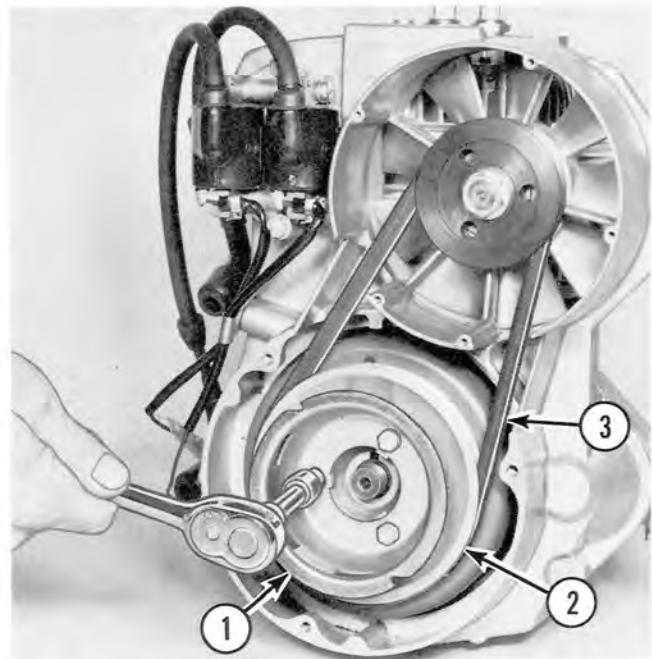


Figure 3-19



1. Fan Cover

Figure 3-20

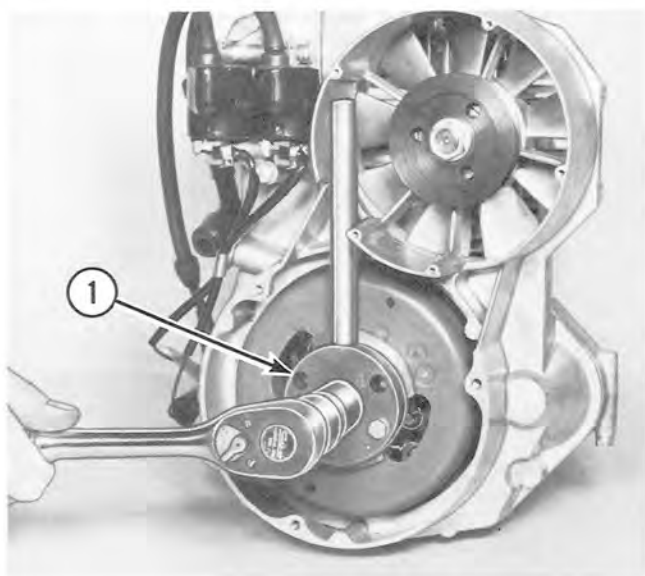


1. Starter Pulley
2. Fan Drive Pulley
3. Fan Belt

Figure 3-21

2. Remove five screws securing plastic fan cover to fan housing (Figure 3-20).
3. Remove three bolts and washers securing starter pulley and fan drive pulley to flywheel. Remove fan belt from fan pulley. (Figure 3-21)
4. Install flywheel puller tool no. T56019-011 and remove flywheel. Use side cutters or small drift to remove flywheel key. (Figure 3-22)

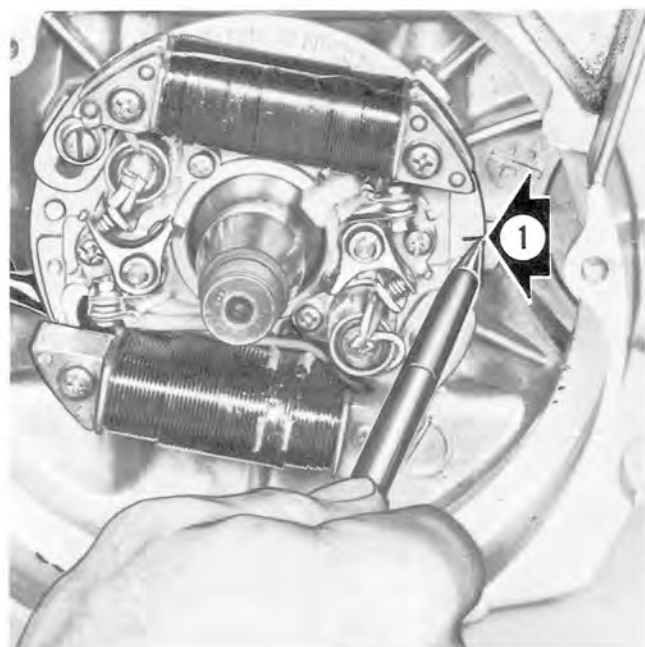
NOTE: Place flywheel on a non-magnetic area to prevent rotor magnets from attracting metal filings or particles.



1. Flywheel Puller

Figure 3-22

5. Prior to removing starter assembly scribe an aligning mark from stator plate to crankcase. When reassembling timing can be set at original position. (Figure 3-23).
6. Using needle nose pliers remove electrical leads from cord connector.



1. Scribe Mark

Figure 3-23

7. Remove two screws and four washers securing stator assembly to crankcase. Remove stator assembly and slide electrical leads through rubber grommet. (Figure 3-24)

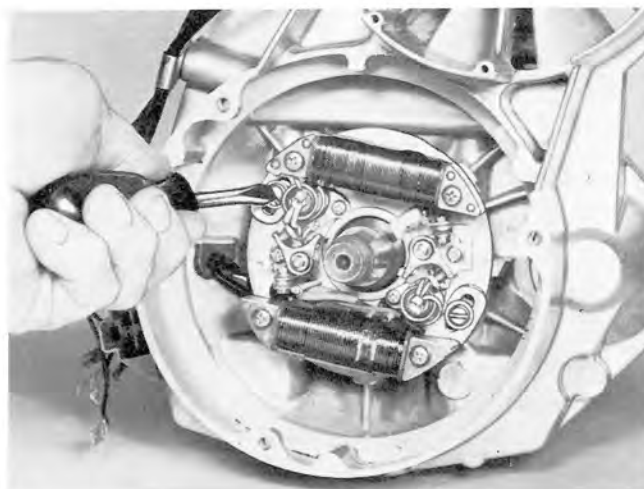
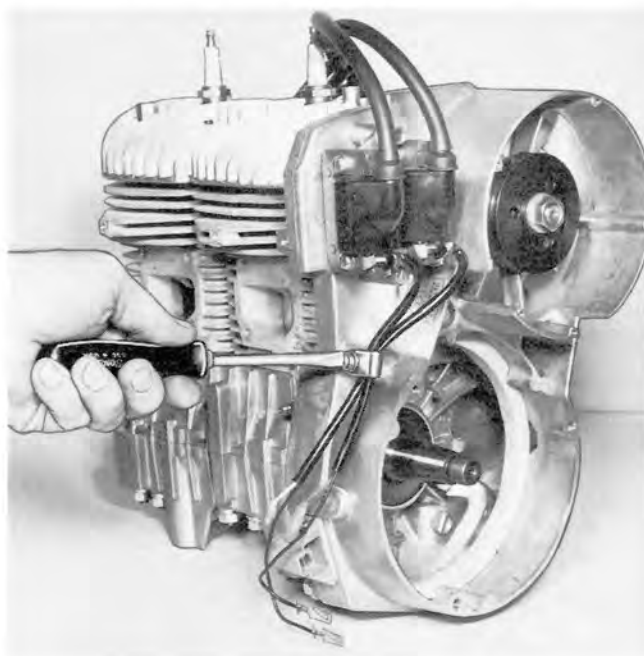


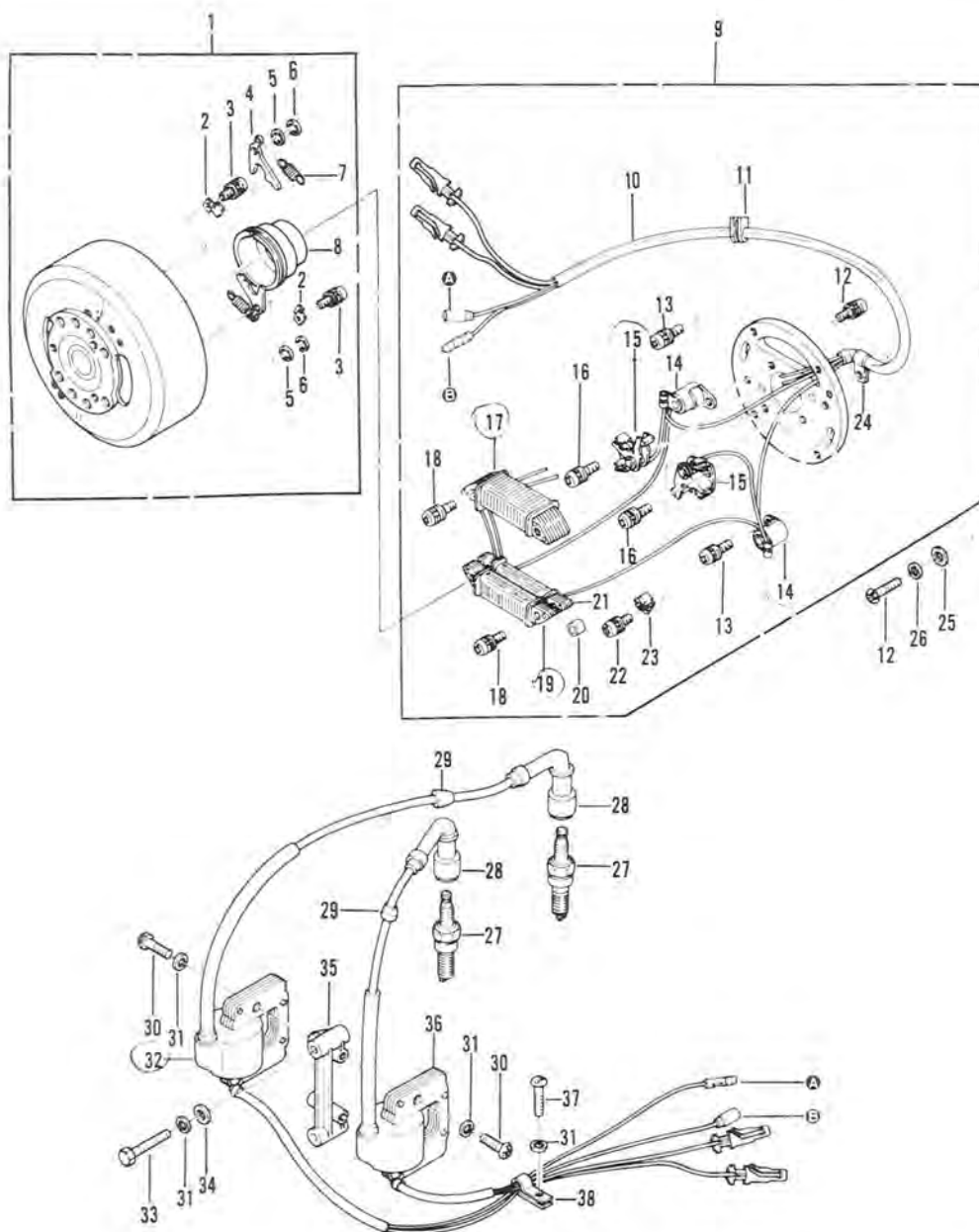
Figure 3-24

8. Refer to Figure 3-25 for disassembly sequence of magneto components.
9. Remove ignition coil leads from cord connector. Remove clamp securing leads to fan housing. Remove two screws securing coil bracket to fan housing and remove ignition coils. (Figures 3-26, 3-27)



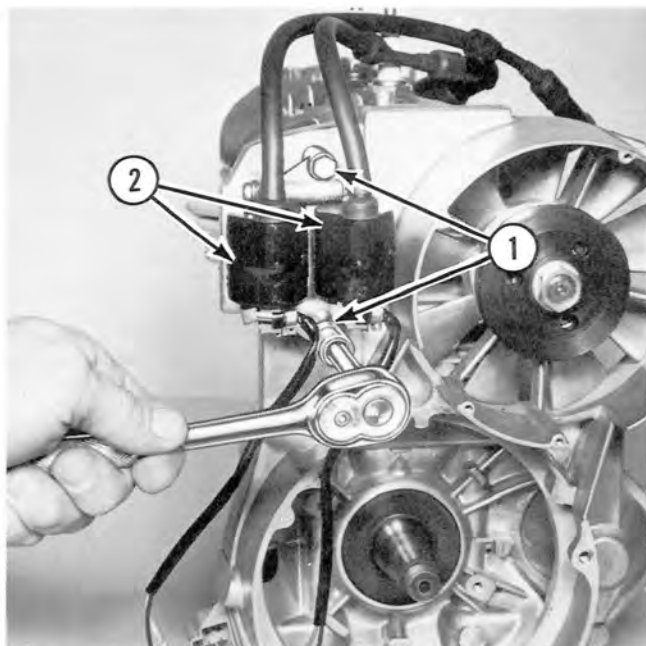
1. Clamp

Figure 3-26



- | | | |
|----------------------|---------------------------|---------------------------|
| 1. Flywheel Assembly | 14. Condenser | 27. Spark Plug |
| 2. Cam Holder | 15. Breaker Contact | 28. Cap |
| 3. Screw | 16. Screw | 29. Grommet |
| 4. Advance Weight | 17. Lighting Coil | 30. Screw |
| 5. Washer | 18. Screw | 31. Washer |
| 6. "E" Ring | 19. Exciting Coil (no. 1) | 32. Ignition Coil (no. 1) |
| 7. Advance Spring | 20. Collar | 33. Bolt |
| 8. Cam | 21. Exciting Coil (no. 2) | 34. Washer |
| 9. Stator Assembly | 22. Screw | 35. Bracket |
| 10. Wiring Harness | 23. Cam Felt | 36. Ignition Coil (no. 2) |
| 11. Grommet | 24. Clamp | 37. Screw |
| 12. Screw | 25. Washer | 38. Clamp |
| 13. Screw | 26. Washer | |

Figure 3-25



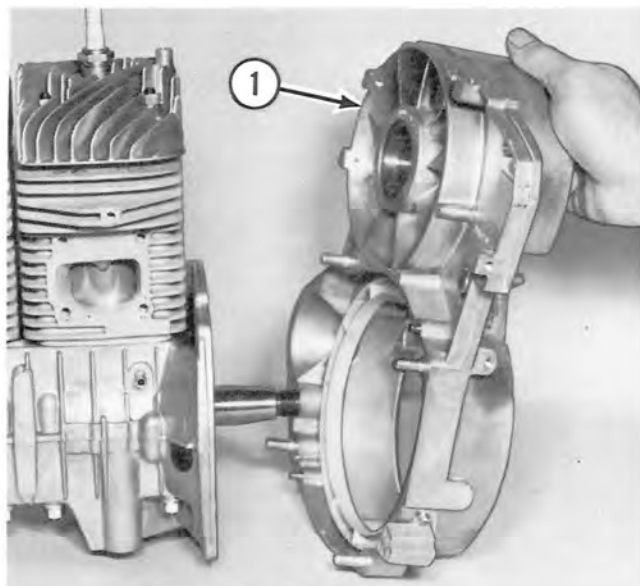
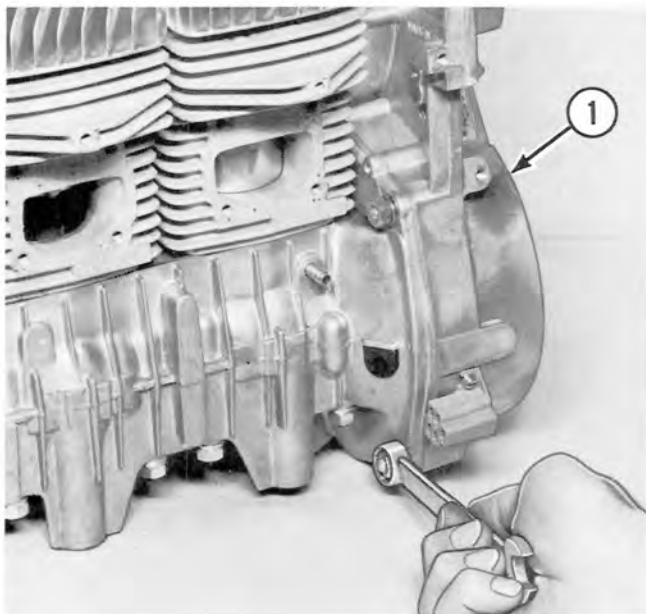
1. Mounting Bracket Screws
2. Ignition Coils

Figure 3-27

Removal

FAN HOUSING

1. Remove four nuts and washers securing fan housing to crankcase and remove fan housing. (Figure 3-28)
2. Using fan pulley holder tool no. 205208 remove nut and washer securing fan assembly to fan housing.

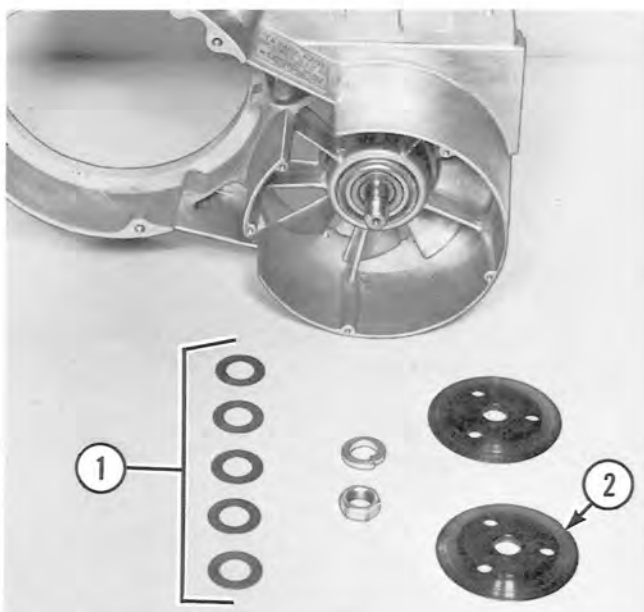


1. Fan Housing

Figure 3-28

3. Remove fan pulley halves and spacers from fan shaft. (Figure 3-29)

NOTE: Spacers are used between the fan pulley halves to adjust fan belt tension. Using fewer spacers increases fan belt tension. During reassembly place half of the spacers removed behind the inside pulley half and the balance outboard of the outside pulley half to maintain proper belt alignment.



1. Spacers
2. Pulley Halves

Figure 3-29

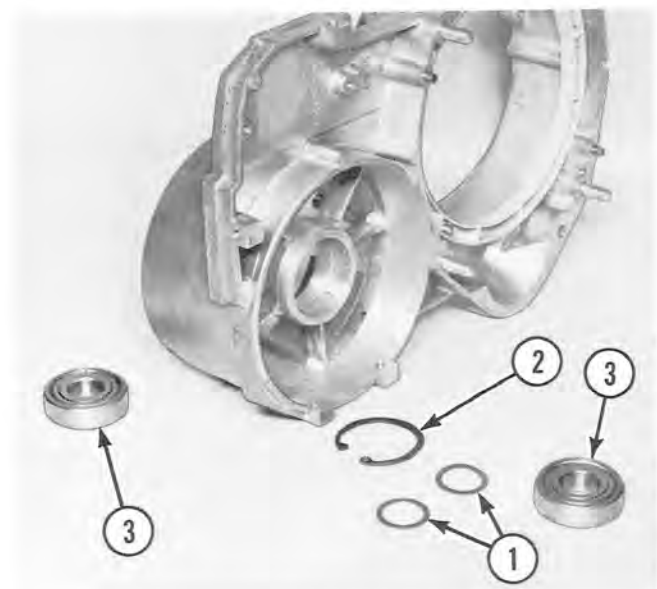
- Using a heat gun or propane torch, heat aluminum fan case allowing bearings to be removed from fan case.

WARNING

Do not contact heated fan housing with bare hands or severe burn could result.

- Using Tru-Arc or circlip pliers remove circlip and two spacers from fan housing. (Figure 3-30)

NOTE: Circlip is used to correctly position bearings. Spacers are installed between bearings to eliminate side loads when shaft nut is tightened.



- Spacers (2)
- Circlip
- Bearings

Figure 3-30

Inspection

- Check breaker points for pitting or excessive wear. Clean point contacts using bias tape.
- Inspect all lead wires for cracks or frayed condition.
- Check magnets in rotor assembly. Thoroughly clean magnet area to remove any metal filings or particles that magnets may have attracted.
- Check woodruff key and keyway for damage.
- Inspect fan housings for cracks or distortion.
- Check bearings for discoloration and wear.

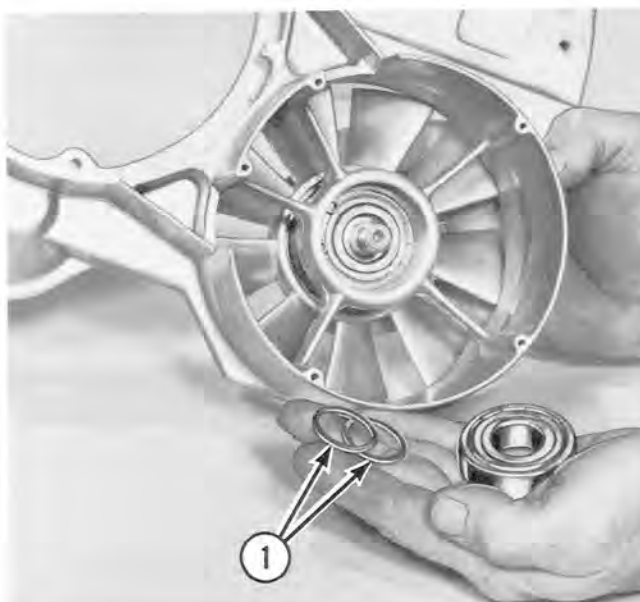
- Check fan belt for excessive wear.
- Check cooling fan assembly for missing or damaged fins.
- Check threads on all mounting studs for damage.

Reassembly

FAN HOUSING

- Install circlip in fan housing.
- Using a heat gun or propane torch heat aluminum fan case housing and insert bearings.

NOTE: Insert two spacer washers between bearings to eliminate side loads when shaft nut is tightened. (Figure 3-31)



- Spacers

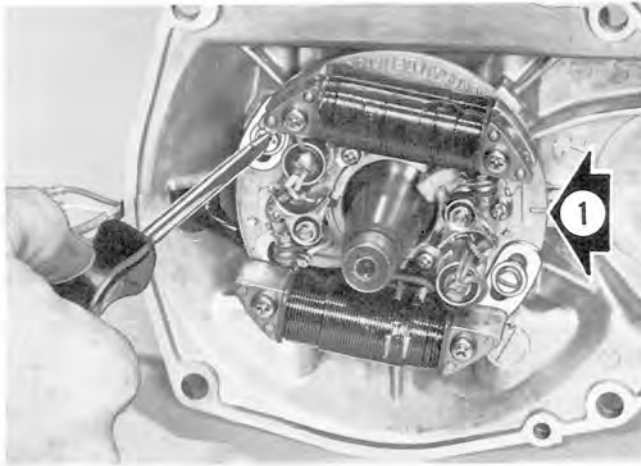
Figure 3-31

- Install fan assembly through bearings and attach pulley half to shaft. Assemble same number of pulley spacer washers to shaft as previously removed and attach remaining pulley half to shaft. Secure pulley halves to shaft using washer and nut. Tighten securely.

Magneto

- Reassemble all components to stator assembly.

2. Insert electrical leads through grommet in crankcase and reinstall stator assembly to crankcase. Align timing mark made during disassembly. Secure stator assembly using two screws and washers previously removed. (Figure 3-32).



1. Timing Mark

Figure 3-32

3. Install fan housing to crankcase. Secure using four nuts and eight washers previously removed. Tighten nuts securely. Attach stator electrical leads to cord connector. (Figure 3-33).
4. Secure ignition coils to fan housing using two bolts and four washers. Tighten securely. If leads were removed from cable clamp insert leads into clamp and secure clamp to fan housing. Insert black leads into cord connector and attach red and white leads to stator leads. (Figure 3-34).

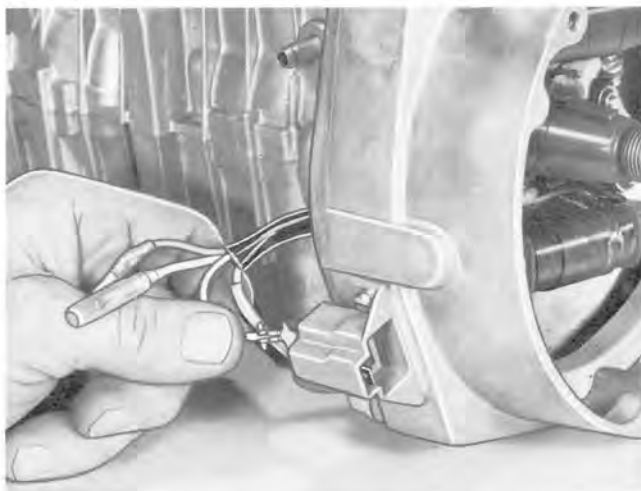
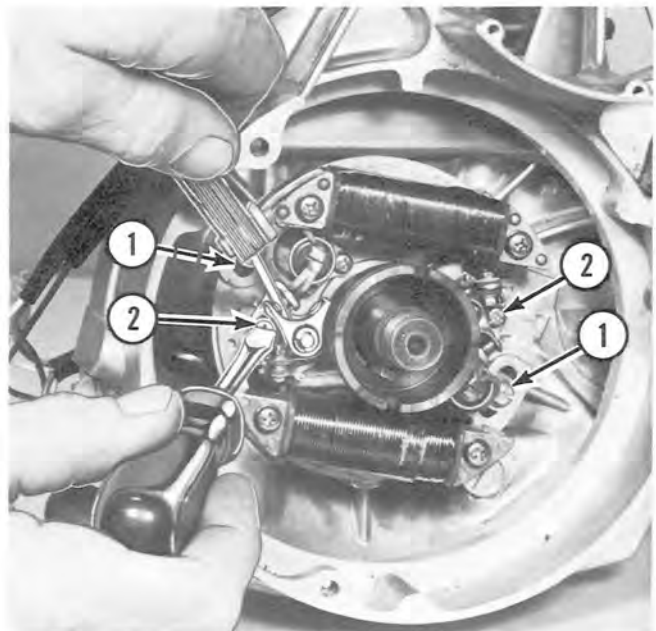


Figure 3-33



Figure 3-34

5. Rotate crankshaft until number one points are fully opened. Insert feeler gauge to check correct point setting. Adjust point setting until 0.014 inch (0.35 mm) is obtained. Tighten breaker point mounting screw securely. Re-check point setting after mounting screw is secure to insure proper point gap. (Figure 3-35).



1. Stator plate mounting screws
2. Breaker point mounting screws

Figure 3-35

6. Install dial indicator in number one cylinder and locate correct timing position (0.006 inch 0.145 mm B.T.D.C.) using a buzz box or continuity light connected to red magneto wire lead. Timing can be checked in retard or advanced position by swinging advance arm.

NOTE: If timing on number one cylinder is not correct loosen stator plate mounting screws and rotate stator plate until correct timing is obtained. (Figure 3-36). Rotating stator plate opposite engine rotation advances timing.

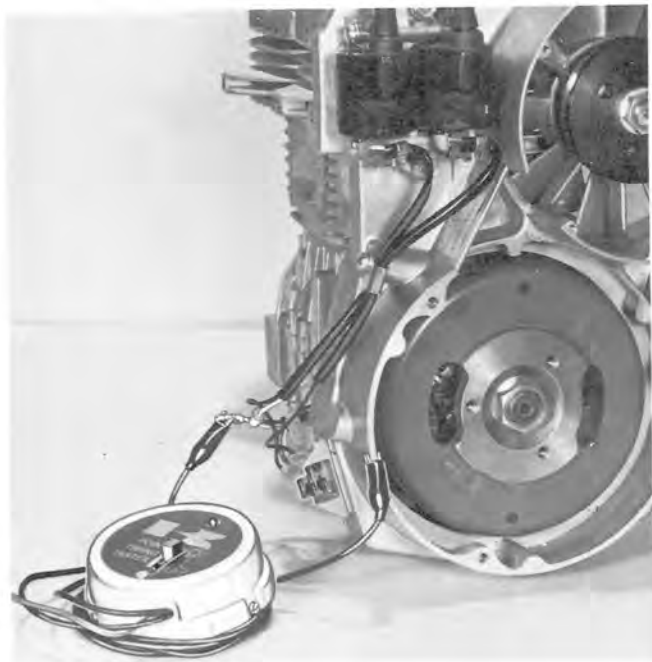


Figure 3-36

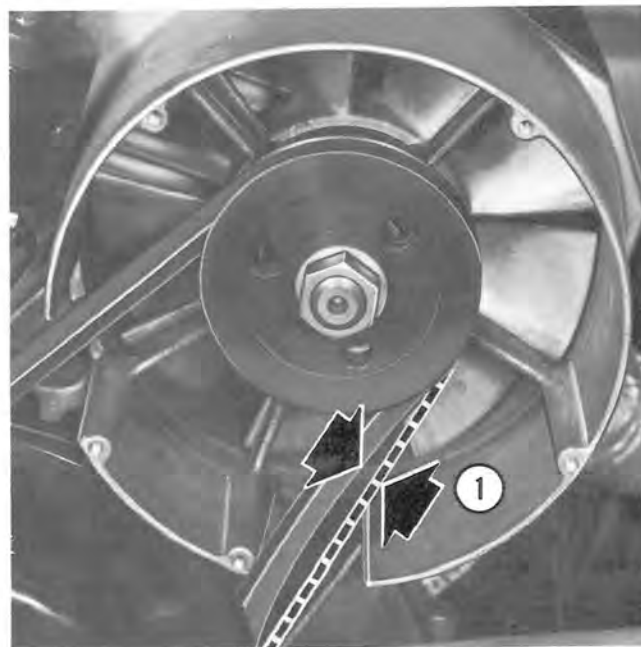
7. Install dial indicator in number two cylinder and connect buzz box or continuity light to white magneto wire lead and check timing. Timing should be within 0.005 inch (0.127 mm) of number one cylinder. If adjustment is required, readjust the point gap on number two points only. Tighten breaker point mounting screw securely. Recheck timing after mounting screws are secured.
8. Install woodruff key to crankshaft. Reassemble flywheel to crankshaft and secure with washer and flywheel nut. Torque flywheel nut to 60 ft. lbs. (8.3 kg-m).
9. Install fan belt, fan drive pulley and starter pulley to flywheel. Secure using three bolts and lockwashers. Tighten bolts evenly to prevent distortion of pulleys. (Figure 3-37).

NOTE: Install fan drive pulley with machined shoulder toward flywheel.



Figure 3-37

10. Check fan belt tension by measuring belt deflection with ten pounds (5 kg) force applied to belt. Correct belt deflection should be 5/32 inch (3.5 to 4.5 mm). (Figure 3-38) If adjustment is required remove or add spacers between fan pulley halves until correct measurement is obtained. Removing spacers will increase belt tension.



1. 5/32 inch (3.5 to 4.5 mm deflection)

Figure 3-38

11. Secure plastic fan cover to fan housing. Tighten five screws evenly to prevent damaging the fan cover.

Cylinder Heads, Cylinders And Pistons

Cylinder Heads

REMOVAL

1. Remove spark plugs.
2. Remove eight nuts, lockwashers and washers securing cylinder heads to cylinders, using a 8 mm socket and 3 inch extension. Carefully remove cylinder heads and gaskets. Discard gaskets. (Figure 3-39).

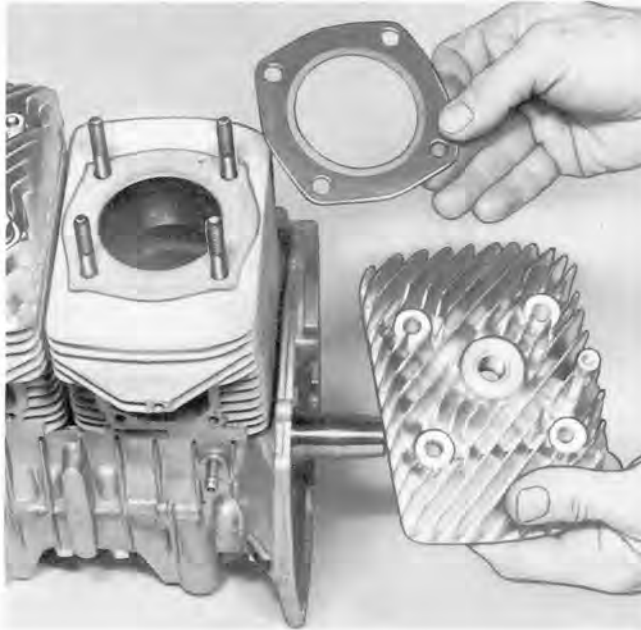


Figure 3-39

INSPECTION

1. Remove excessive carbon from inside cylinder head using a nonferrous carbon scraper.
2. Inspect cooling fins for damage.
3. Wash cylinder head in solvent and blow dry using compressed air.
4. Place a straight edge across the gasket surface of the head to detect any warpage. Measure in several spots. If slight distortion is present it can be corrected by using no. 400 sandpaper on a surface plate and rubbing head in a circular motion to remove high spots.

NOTE: Dying the gasket surface before you begin will indicate high spots after some sanding.

Cylinders

REMOVAL

1. Gently tap cylinder with a soft mallet to release seal.
2. Carefully remove cylinders from crankcase studs. Hold piston during cylinder removal to prevent piston from suddenly contacting studs or crankcase. (Figure 3-40)



Figure 3-40

3. Remove and discard cylinder base gaskets.

INSPECTION

1. Check the cylinder for damaged or broken fins.
2. Thoroughly clean all carbon deposits from exhaust ports and cylinder walls.
3. Check cylinder wall for excessive scoring.
4. Using an inside micrometer check cylinder bore for "out of round" or "taper" condition. (Figure 3-41).

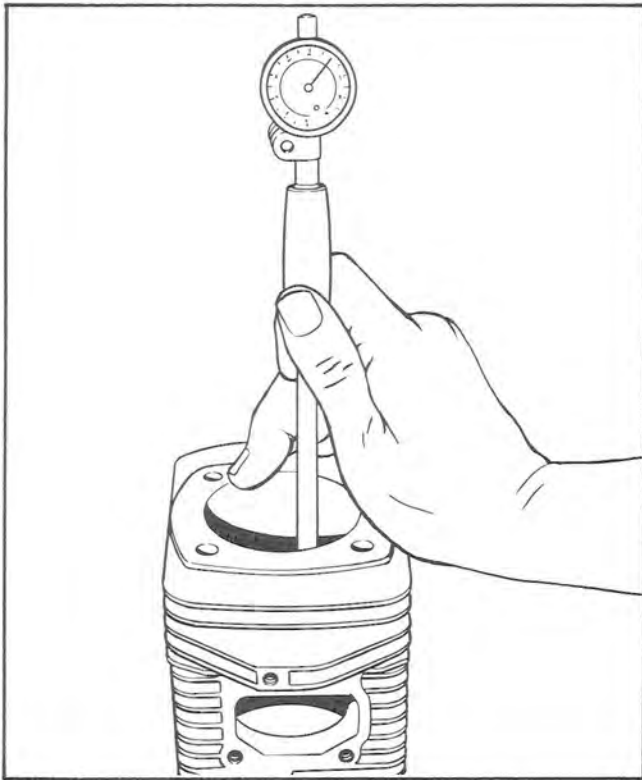


Figure 3-41

NOTE: To check for out of round of the cylinder bore move the micrometer in a circular direction, 90° at a time. The difference in measurements obtained should not exceed 0.002 inches (0.05 mm).

NOTE: To check for taper of the cylinder bore, move the micrometer from the top to the bottom of the cylinder. The difference in the measurements obtained (between top and bottom) should not exceed 0.002 inches (0.05 mm).

5. Hone or rebores the cylinder as required if measurements obtained in step 4 exceed 0.002 inches (0.05 mm).
6. Wash cylinder with solvent or soap and water to insure all honed material has been removed. Failure to do so may result in premature wearing or scoring of the cylinder and piston.

Pistons

REMOVAL

1. Seal crankcase with clean shop rag and using a sharp steel pointer remove piston circlips. Discard circlips. (Figure 3-42)

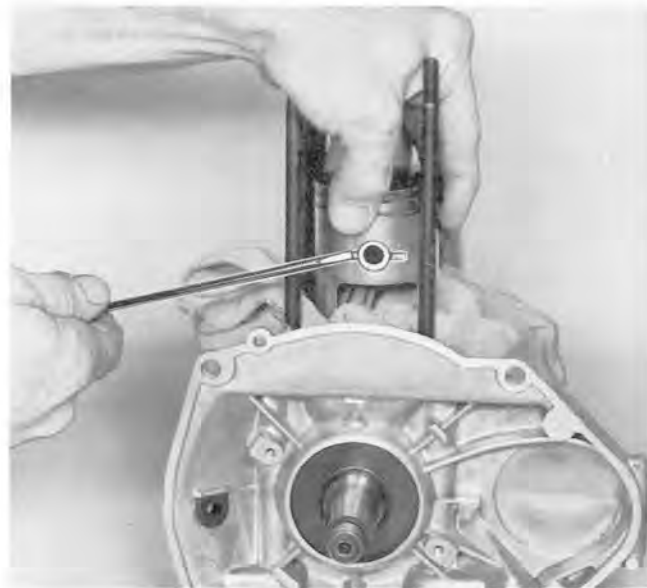
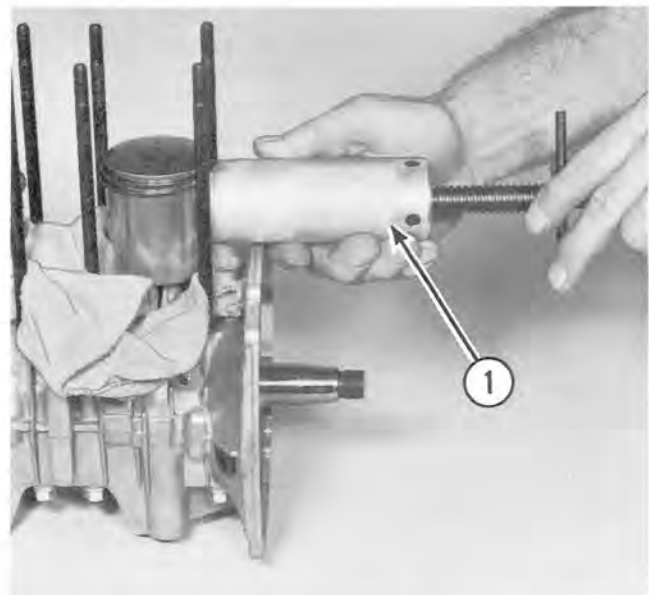


Figure 3-42

2. Using piston pin puller tool no. 57001-910 remove piston pins from pistons and remove piston from connecting rod (Figure 3-43).

NOTE: Keep piston pin bearings together as a set and mark pistons left and right to assure correct reassembly.

3. Using a ring expander tool remove rings from piston. Rings have identification markings and are numbered one or two. Number one is the top ring.



1. Piston pin puller tool no. 57001-910

Figure 3-43

NOTE: Do not interchange rings between pistons. A ring expander spring is installed inside bottom ring, remove ring expander spring carefully to prevent damage.

INSPECTION

1. Remove all carbon from piston dome, ring grooves and piston skirt.

NOTE: If piston dome or skirt is scored or damaged, replace piston and piston rings.

2. Check piston-to-cylinder wall clearance. Measure smallest inside diameter of the cylinder bore. Micrometer reading must be 2.3622-2.3681 inches (60.001-60.089 mm) for the 340cc engine and 2.6772-2.6831 inches (68.0-68.15 mm) for the 440cc engine. The two measurements must not vary by more than 0.0020 of an inch (0.05 mm). If the measurements vary by more than 0.0020 of an inch (0.05 mm) the cylinder must be replaced. Using a micrometer measure the outside diameter of each piston at right angle to piston pin hole and 3/16 inch (4.76 mm) from bottom.

Subtract the piston skirt measurement from the cylinder bore measurement. The difference between the two measurements must be between 0.0008-0.0020 inch (0.02-0.05 mm). If measurement exceeds 0.0020 inch (0.05 mm) replacement of piston and piston rings is required.

3. Check piston pin for wear or damage. Using a one inch outside micrometer measure piston pin diameter.

Measurement obtained must be 0.6297-0.6299 inch (15.994-15.999 mm). If measurement exceeds limit replace piston pin and needle bearing set.

4. Check piston pin hole diameter by inserting an inside snap gauge approximately 1/4 inch (6.35 mm) into piston pin hole. Remove snap gauge and measure it using a one inch outside micrometer. Piston pin hole diameter must be 0.6298-0.6301 inch (15.99-16.0 mm). If measurement obtained is not within specified limits, replace piston, piston pin and needle bearing.

5. Check needle bearings and needle bearing cage for wear or overheating.

6. Check piston ring gap by inserting piston ring into cylinder near the bottom where no ports exist. Insert feeler gauge between opening in the ends of the piston ring. (Figure 3-44) Maximum ring gap should not exceed 1/64 inch (0.7 mm).



Figure 3-44

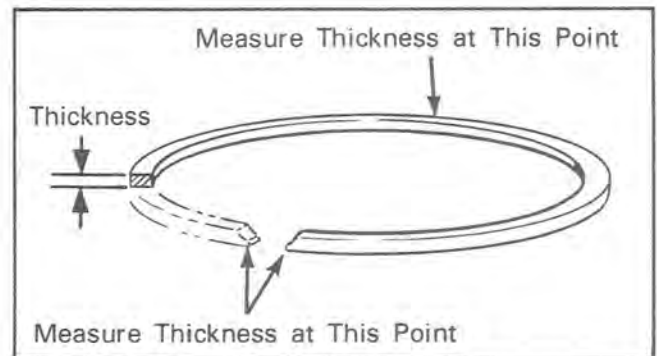


Figure 3-45

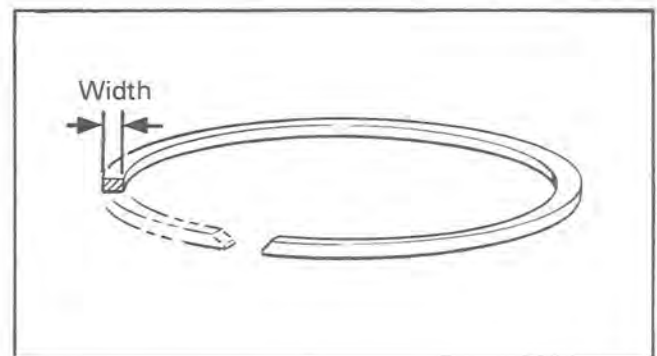


Figure 3-46

7. Check top and bottom piston ring thickness. Using a micrometer measure the thickness of the top and bottom rings at the ends and center arc of both rings. (Figure 3-45) Measurement obtained for the top and bottom rings should be 0.0775-0.0787 inch (1.95-1.99 mm). If measurement exceeds limits replace rings.

8. Check top and bottom piston ring width: Model SA340-A1: Using a micrometer measure the width of the top and bottom rings at the ends and center arc. Width of the top ring should be 0.097-0.105 inch (2.46-2.67 mm). Width of the bottom ring should be 0.082-0.090 inch (2.08-2.28 mm). If the width of the rings is not within the specified measurements replace the rings.

Model SA440-A1: Using a micrometer measure the width of the top and bottom rings at the ends and center arc. (Figure 3-46) Width of the top ring should be 0.1107-0.1187 inch (2.81-3.01 mm). Width of the bottom ring should be 0.1037-0.1117 inch (2.63-2.83 mm). If the width of the rings is not within the specified limits replace the rings.

9. Install rings in ring grooves of piston and check ring groove clearance.

NOTE: The rings are stamped number 1 and 2; 1 is the top ring. Ring expander is inserted inside bottom ring.

Place a straight edge along the side of the piston and push the rings into the piston ring grooves. Using a feeler gauge measure the clearance between the rings and ring grooves. If measurements obtained exceeds limits specified in Table 3-1 replace piston, rings and piston pin as a set.

TABLE 3-1. RING/GROOVE CLEARANCE

STANDARD	SERVICE LIMIT
TOP RING 0.004-0.006 inch (0.10 - 0.15 mm)	Must not exceed 0.006 inch (0.15 mm)
BOTTOM RING 0.002 - 0.004 inch (0.05 - 0.10 mm)	Must not exceed 0.004 inch (0.10 mm)

CAUTION

New circlips must be used to prevent serious engine damage.

REASSEMBLY

1. Install new cylinder base gaskets on crankcase.
2. Apply light coat of oil to piston pin needle bearings and insert needle bearings into upper connecting rod.
3. Install piston to connecting rod with arrow pointing toward exhaust side. (Figure 3-47) Insert piston pin and using piston pin puller tool no. 57001-910 draw piston pin carefully into piston. Secure piston pin using new circlips.



Figure 3-47



Figure 3-48

4. Apply a light coat of oil to the inside of cylinders and outside of pistons. Align piston rings with locating pins on piston and using ring compressor tool no. T57001-130 compress the rings and install cylinders over pistons. (Figure 3-48)

CAUTION

Make sure piston rings are in correct position to prevent breakage.

5. Install new head gaskets to cylinders with wide metal section of gasket facing cylinders.
6. Set cylinder heads in place on correct cylinders and loosely install the eight nuts, washers and lockwashers. Do not tighten cylinder nuts until intake manifold is installed. Refer to Section 2 for correct torque.

NOTE: The long nuts are installed on the outside studs of the PTO side cylinder head.

7. Install spark plugs and torque to 20 ft. lbs. (2.77 kg-m).

Crankcase Assembly

REMOVAL

1. Remove ten nuts, lockwashers, washers and one bolt, lockwasher and washer securing crankcase halves. (Figure 3-49)

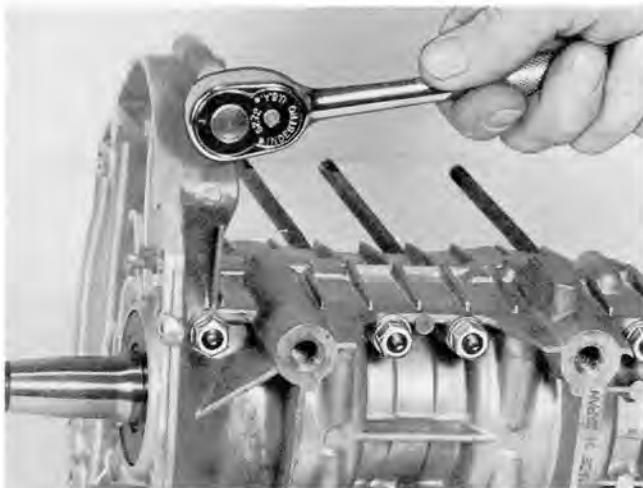


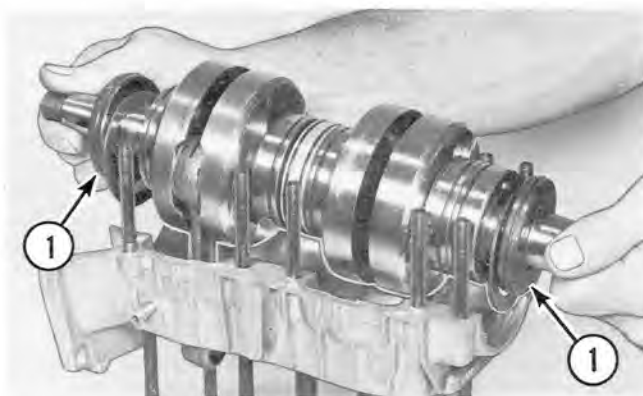
Figure 3-49

2. Using a soft mallet gently tap crankcase studs to break seal and remove lower crankcase half.

CAUTION

Never pry crankcase halves apart with screwdriver or similar tool. Sealing surfaces will be damaged making crankcase unusable.

3. Carefully remove crankshaft from crankcase. Remove oil seals and washers from crankshaft. (Figure 3-50)



1. Oil Seals

Figure 3-50

INSPECTION

1. Wash crankcase halves in cleaning solvent, dry using compressed air.
2. Inspect crankcase halves for scoring, pitting, scuffing or any imperfection in the castings that may cause a crankcase leak.
3. Check oil seals for wear, cracks or deterioration. Replace seal if damage is suspected. Check washers for damage.
4. Clean crankshaft in cleaning solvent, dry using compressed air.
5. Check keyway for damage. Inspect magneto external threaded end for damaged threads. Check PTO internal threads for damage. Check taper on both ends of crankshaft for scratches, scoring or signs of excessive wear.
6. Check rubber "O" rings for damage.
7. Check crankshaft main outer bearings for discoloration, wear, or skuffing. After oiling bearings should rotate freely on crankshaft with no binding or grinding noise evident. Replace bearings if damage is suspected.

If bearings require replacement, use puller tool no. 57001-158 to remove bearings. (Figure 3-51)

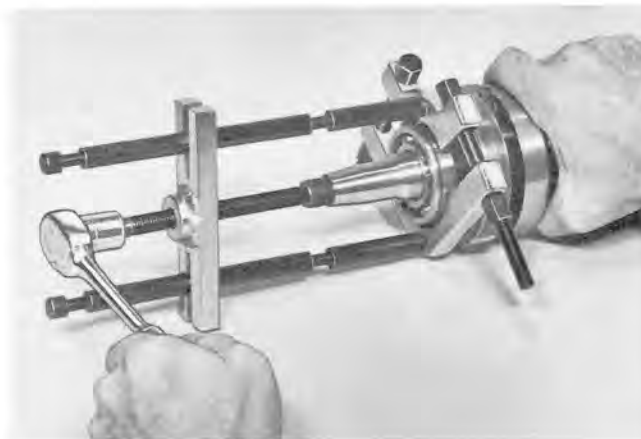


Figure 3-51

8. If bearings are replaced you must measure crankshaft and shim as required to assure correct end play exists when crankshaft is installed in crankcase. Measure distance "A" across the outside surfaces of each crankshaft flyweight. Add shims as required per shim chart and install bearings one and two to crankshaft. Refer to Figure 3-52 for correct measurement areas. Add shims as required and install bearings one and two.

9. New bearings are easily installed on crankshaft after heating inside bearing race with a heat gun or propane torch. After bearing is heated properly, slide bearing into correct position on crankshaft.

NOTE: Be sure rubber "O" rings are removed from bearings when heating. Do not hammer bearings onto crankshaft.

SHIM CHART - DISTANCE "A"

DISTANCE "A"	SHIMS REQUIRED
1.9551-1.0634 inch (49.66-49.87 mm)	None
1.9469-1.9547 inch (49.45-49.65 mm)	2
1.9373-1.9465 inch (49.22-49.44 mm)	4

Measure distance "B" from outside surface of bearing one to outside surface of unmounted bearing three. (Figure 3-52) Refer to the following shim chart and place the necessary shims between bearing two and three and install bearing three to crankshaft.

SHIM CHART - DISTANCE "B"

DISTANCE "B"	SHIMS REQUIRED
8.0158-8.0256 inch (203.61-203.85 mm)	None
8.0119-8.0157 inch (203.51-203.60 mm)	1
8.0080-8.0118 inch (203.41-203.50 mm)	2
8.0040-8.0079 inch (203.31-203.40 mm)	3
8.0001-8.0039 inch (203.21-203.30 mm)	4
7.9962-8.000 inch (203.11-203.20 mm)	5
7.9922-7.9961 inch (203.01-203.10 mm)	6
7.9898-7.9921 inch (202.94-203.00 mm)	6+1, 5+2, 4+3

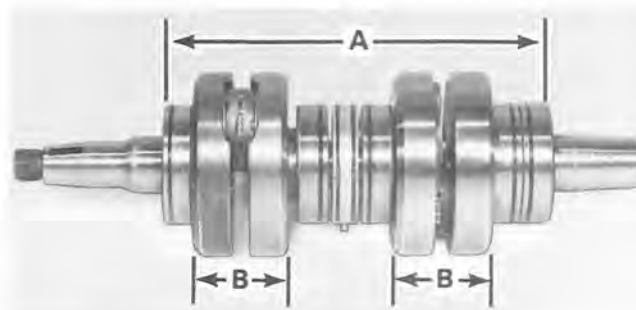


Figure 3-52

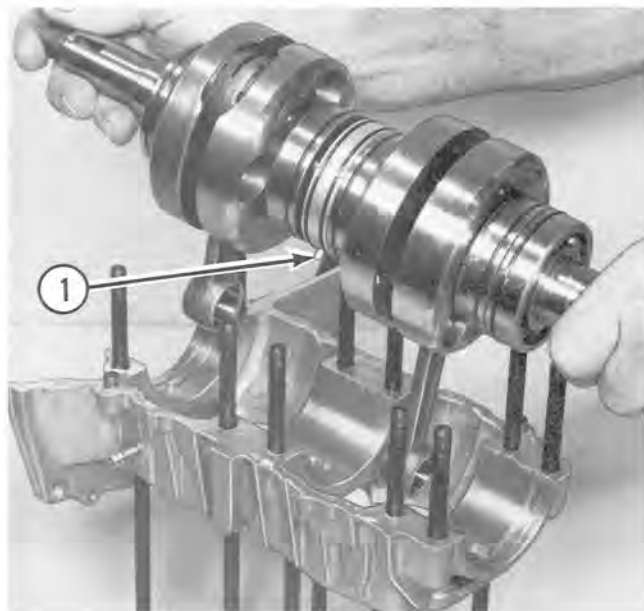
10. Check connecting rod side play by inserting a feeler gauge between connecting rod big end and crankshaft flyweight. (Figure 3-53) Correct side clearance is 0.016-0.020 inch (0.41-0.51 mm).
11. Check for excessive radial clearance of connecting rod big end by measuring the distance the connecting rod big end is moved up and down. Radial play should not exceed 0.0008-0.0012 inches (0.020-0.030 mm).
12. Place crankshaft in a flywheel alignment jig, and place a dial guage against each bearing. Rotate the crankshaft slowly. The maximum difference in gauge readings for each bearing is the crankshaft runout at that point. If measurements obtained exceeds 0.003 inch (0.08 mm) the crankshaft must be replaced.



Figure 3-53

INSTALLATION

1. Install "O" rings to crankshaft bearings.
2. Oil all bearings.
3. Align crankshaft labyrinth seal aligning pin with recess in upper crankcase half and carefully insert crankshaft into crankcase. (Figure 3-54)



1. Aligning Pin

Figure 3-54

4. Install washers in crankcase grooves. Apply a coat of grease to inner section of oil seal and install oil seals to crankshaft.

CAUTION

When replacing bearings, crankshaft surface that oil seal contacts may be scratched which will cause excessive seal wear. Always remove any irregularities on the shaft surface using number 400 emery cloth before installing new oil seals.

5. Apply crankcase sealer to lower crankcase half and carefully attach crankcase halves.
6. Secure crankcase halves using ten nuts, lock-washer washers and one bolt, lockwasher and washer. Tighten hardware evenly and in the sequence shown in Figure 3-55. Torque to 16 ft. lbs. (2.21 kg-m).

NOTE: Apply torque in one third increments to prevent distortion of crankcase halves.

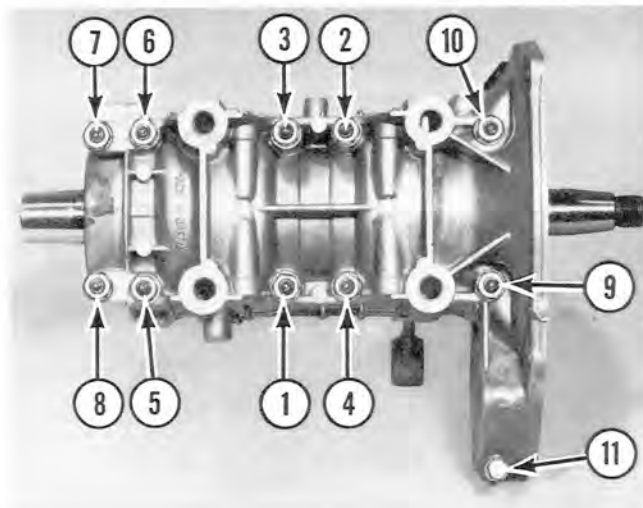


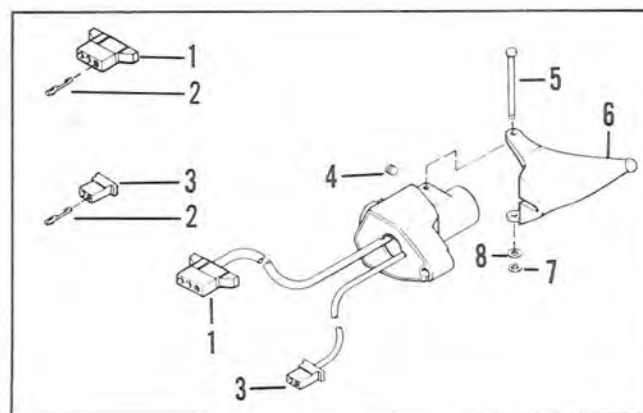
Figure 3-55

Brake Light Switch, Dimmer Light Switch, or Brake Lever Assembly

Removal

NOTE: Entire brake lever assembly must be replaced to replace brake light switch or dimmer light switch.

1. Remove brake cable from brake lever assembly.



1. Socket Housing, 3 Position
2. Socket Connector
3. Socket Housing, 2 Position
4. Lock Screw
5. Lever Pivot Pin
6. Brake Lever
7. E Clip
8. Washer

Figure 3-56

2. Insert a screwdriver between handle grip and handlebar to loosen the grip from the bar, and pull handle grip from handlebar.
3. Remove brake socket housings from printed circuit board.
4. Loosen lock screw and slide brake lever assembly from handlebar (Figure 3-56).

Installation

1. Install brake lever assembly on the handlebar in reverse order of removal. Tighten lock screw to 25 ft. lbs. (3.36 kgm).
2. Check brake lever adjustment as described in Section 2.

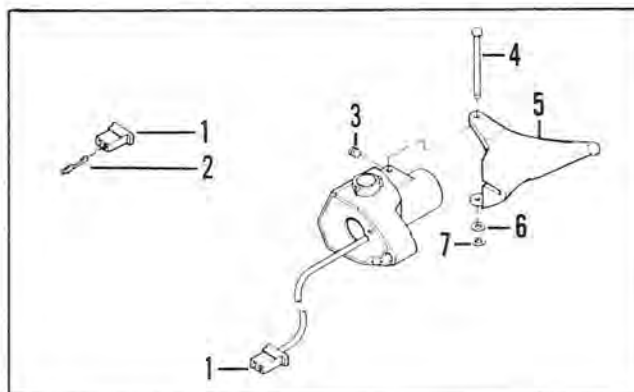
Emergency Stop Switch or Throttle Lever Assembly

Removal

NOTE: Entire throttle lever assembly must be replaced to replace emergency stop switch.

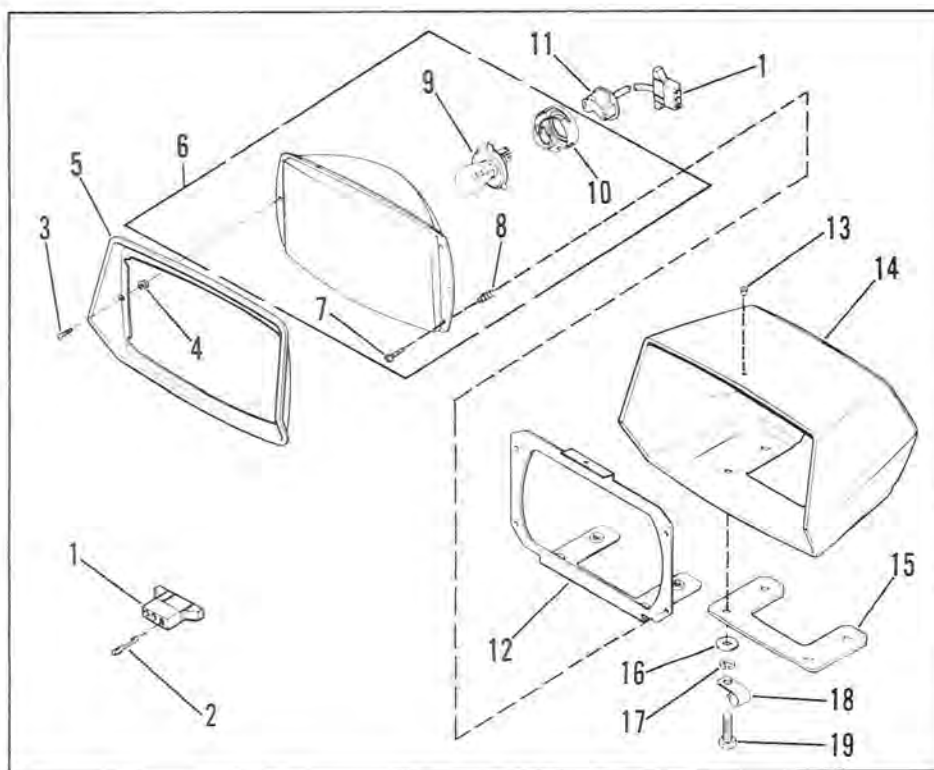
1. Remove throttle cable from throttle lever assembly.

2. Insert a screwdriver between handlegrip and handlebar to loosen the grip from the bar, and pull handlegrip from handlebar.
3. Remove the throttle socket housing from printed circuit board. (Note where it is located.)
4. Loosen lock screw (Figure 3-57), and slide throttle lever assembly from the handlebar.



1. Socket Housing, 2 Position
2. Socket Connector
3. Lock Screw
4. Lever Pin
5. Throttle Lever
6. Washer
7. E Clip

Figure 3-57



1. Socket Housing
2. Socket Connector
3. Machine Screw
4. Rubber Spacer
5. Headlamp Housing Rim
6. Lamp and Lens Assembly
7. Machine Screw
8. Adjusting Spring
9. Bulb
10. Bulb Retainer
11. Wiring Harness Assembly
12. Bracket Assembly
13. Rivet
14. Housing
15. Gasket
16. Washer
17. Lockwasher
18. J-Clip
19. Capscrew

Figure 3-58

Installation

1. Install throttle lever assembly on the handlebar in the reverse order of removal. Tighten lock screw to 25 ft. lbs. (3.36 kgm).
2. Check throttle lever adjustment as described in Section 2.

Headlamp

Removal

1. Remove wire harness assembly from bulb and remove capscrews, lockwashers, washers, and J-clip which secure headlamp housing to hood.
2. Remove headlamp gasket.
3. Disassemble headlamp as illustrated in Figure 3-58.

Installation

1. Reassemble headlamp in reverse order of removal. Tighten capscrews, lockwashers, washers, and J-clip.
2. Adjust headlamp in accordance with Section 2.

Ignition Switch

Removal

1. Remove the face nut and wiring harness from the ignition switch and remove ignition switch from the console (Figure 3-59).

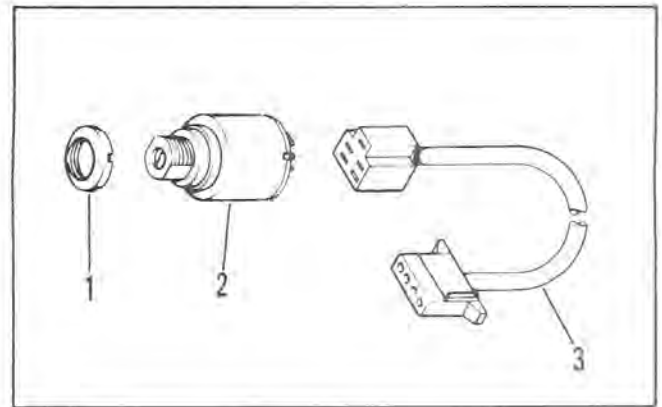
Installation

1. Install ignition switch in the reverse order of removal. Hand-tighten the face nut.

Tachometer

Removal

1. Drill out rivets which secure the bulkhead to the console, and remove the fuel cap from the fuel tank.
2. Remove screws securing console to the chassis, and pull out the console for access to the tachometer.
3. Remove the light bulb assembly from the tachometer, and disconnect wires from the tachometer.



1. Face Nut
2. Ignition Switch
3. Wiring Harness

Figure 3-59

4. Remove the tachometer bracket and remove the tachometer from the console.

Installation

1. Install the tachometer in reverse order of removal. Secure the bulkhead with self-tapping screws or pop rivets.

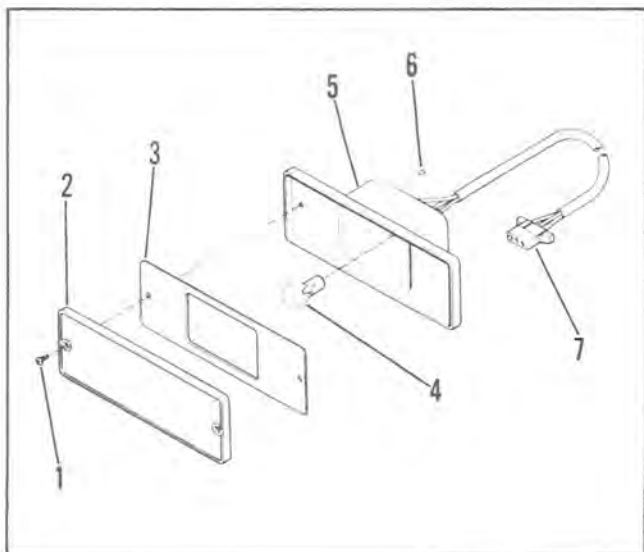
Printed Circuit Board Replacement

1. Disconnect all socket housings from printed circuit board. Remove rivets securing printed circuit board to the chassis.
2. Remove the printed circuit board and plate.
3. Install printed circuit board and plate in reverse order of removal.

Tail Lamp

Removal

1. Disconnect tail lamp socket housing from printed circuit board.
2. Remove the seat, sliding the tail lamp wiring harness through the console and seat cover. If necessary, clip the socket housing from the tail lamp wiring harness.
3. Remove the tail lamp lens and gasket. Figure 3-60.



1. Screw
2. Lens
3. Gasket
4. Bulb
5. Back Assembly
6. Rivet
7. Socket Housing

Figure 3-60

4. Drill out the rivets securing tail lamp to the seat, and remove the tail lamp.

Installation

1. Install tail lamp assembly in the reverse order of removal. Secure tail lamp to seat with self-tapping screws.
2. Secure bulkhead to chassis with self-tapping screws or pop rivets. Tighten seat assembly cap screws to 15 ft. lbs (2.07 kgm) and console screws to 95 in. lbs. (1.09 kgm).

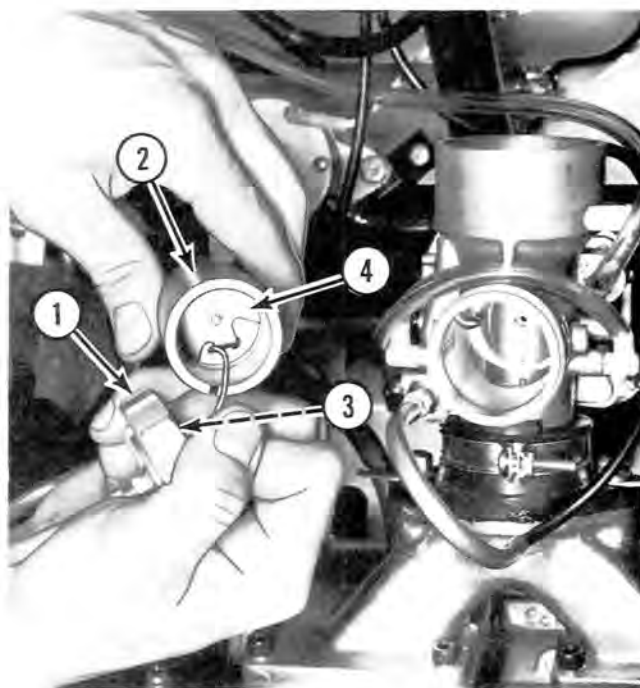
Light Regulator Replacement

1. Disconnect light regulator socket housing from the printed circuit board.
2. Remove machine screw, lockwasher and locknut, and remove the light regulator.
3. Install light regulator in the reverse order of removal. Tighten machine screw to 95 in. lbs. (1.09 kgm).

Throttle Cable

Removal

1. Unscrew the mixing body top assembly (1, Figure 3-61), and pull out the throttle valve assembly (2).
2. Compress the throttle spring (3) and remove the throttle valve plate (4).
3. Slide the throttle cable tip to the larger hole in the base of the throttle valve and separate the throttle cable from the throttle valve.
4. Loosen the throttle cable locknut and unscrew the throttle cable from the mixing body top assembly. See Figure 3-61.
5. Remove snap ring and disconnect the throttle cable end from the throttle lever. See Figure 3-62.

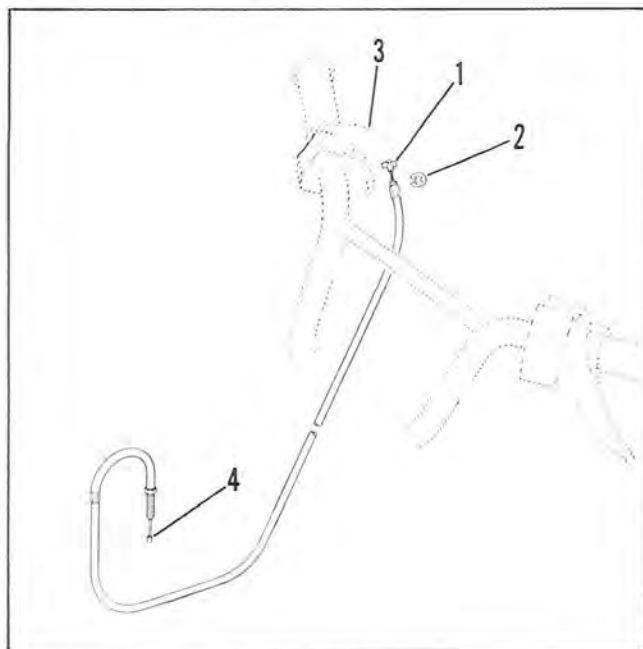


1. Mixing Body Top Assembly
2. Throttle Valve Assembly
3. Spring
4. Throttle Valve Plate

Figure 3-61

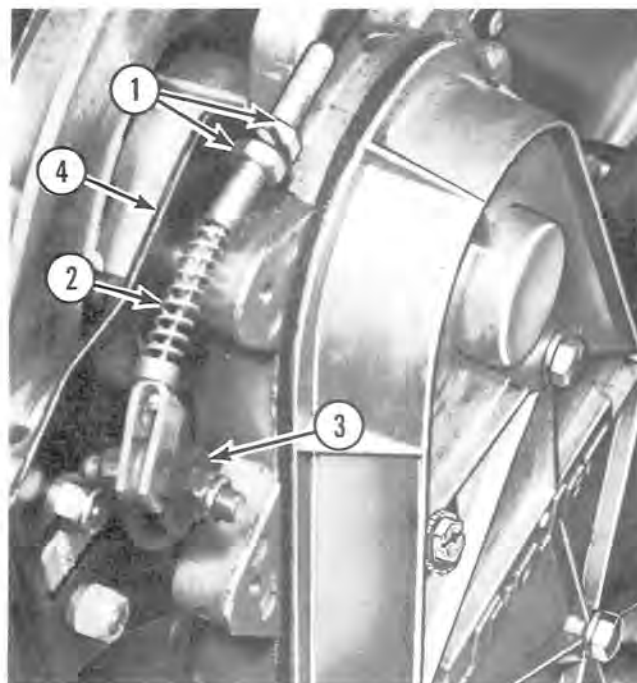
Installation

1. Slide the throttle cable through the throttle lever assembly and install the snap ring. Figure 3-62.



1. Throttle Cable End
2. Snap Ring
3. Throttle Lever
4. Throttle Cable Tip

Figure 3-62

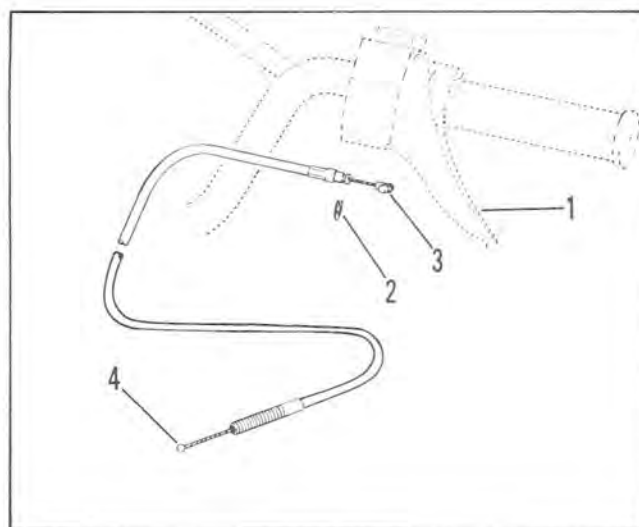


1. Locknuts
2. Return Spring
3. Retainer
4. Brake Support Bracket

Figure 3-63

2. Connect the throttle cable end to the throttle lever.
3. Screw the mixing body top assembly (1, Figure 3-61) to the throttle cable.
4. Hold the throttle cable and mixing body top assembly in one hand. Place the spring (3) in the top and compress the spring so the throttle cable extends beyond the spring.
5. Guide the throttle valve (2) over the throttle cable. Insert the end of the cable through the hole in the throttle valve slot.
6. While keeping the spring compressed, release the throttle valve and install the throttle valve plate (4). Then release the spring.
7. Install the throttle valve into the carburetor so the slot in the throttle valve mates with the locating pin in the throttle valve bore. Install the mixing body top assembly (1) and tighten finger tight. Tighten the throttle cable locknut.

2. Remove the locknuts (1) from the brake cable.
3. Remove the snap ring (2, Figure 3-64) and disconnect the brake cable end (3) from the brake lever (1).



1. Brake Lever
2. Snap Ring
3. Brake Cable End
4. Brake Cable Tip

Figure 3-64

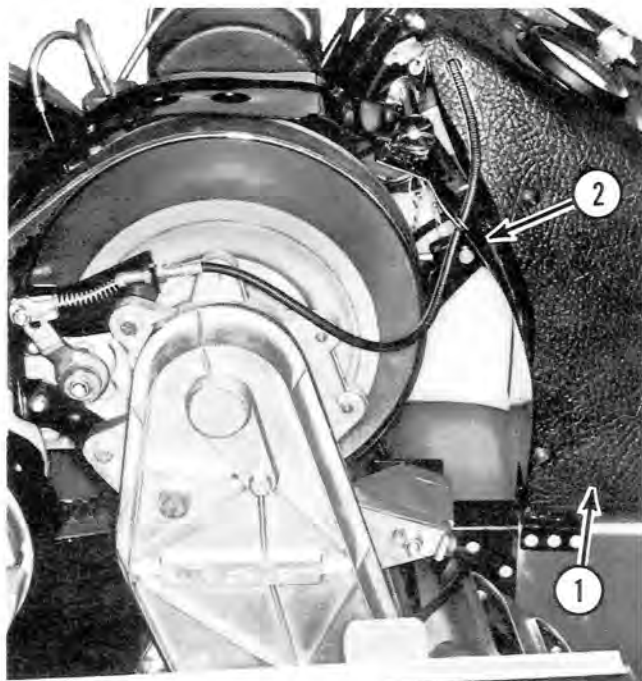
Brake Cable

Removal

1. Compress the return spring (2, Figure 3-63) and disconnect the brake cable tip from the retainer (3).

Installation

1. Place the end of the brake cable through the brake lever assembly and install the snap ring (2, Figure 3-64).
2. Connect the brake cable end (3) to the brake lever (1).
3. Slide the other end of the brake cable through the hole in the fuel tank cover and the converter guard assembly. See Figure 3-65.
4. Install one locknut (1, Figure 3-63) on the end of the brake cable and place it through the brake support bracket (4).
5. Install the second locknut and return spring (2) on the end of the brake cable. Compress the spring and connect the brake cable tip to the retainer (3). For brake cable adjustment see Section 2.



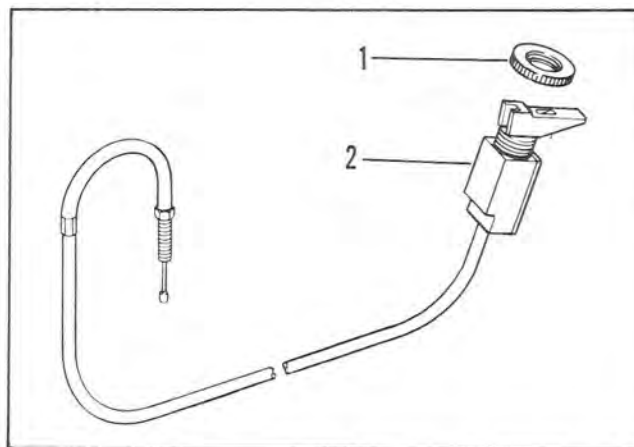
1. Fuel Tank Cover
2. Converter Guard Assembly

Figure 3-65

Enrichener Cable

Removal

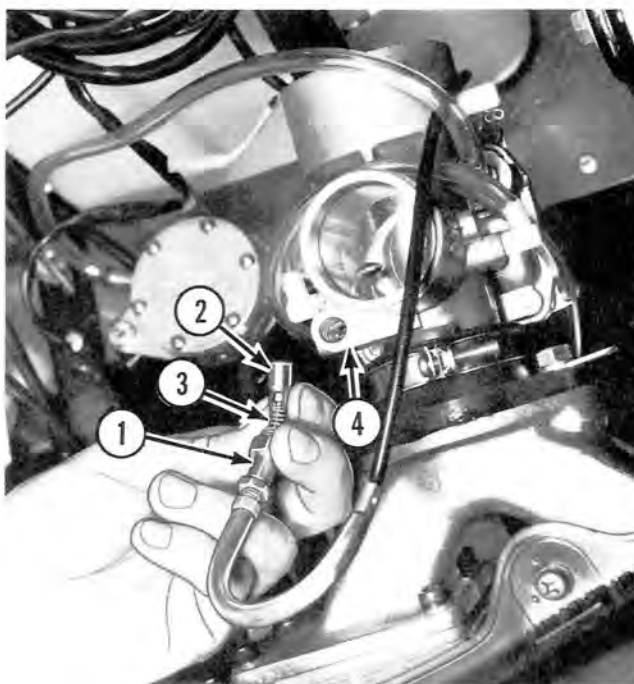
1. Unscrew the enrichener switch nut (1, Figure 3-66) and separate the enrichener switch (2) from the fuel tank cover.



1. Enrichener Switch Nut
2. Enrichener Switch

Figure 3-66

2. Unscrew the starter plunger cap (1, Figure 3-67). Remove the starter plunger assembly (2) from the carburetor.



1. Starter Plunger Cap
2. Starter Plunger
3. Spring
4. Washer

Figure 3-67

3. Unscrew the fitting, compress the starter plunger spring (3) and disconnect the enrichener cable from the starter plunger assembly.

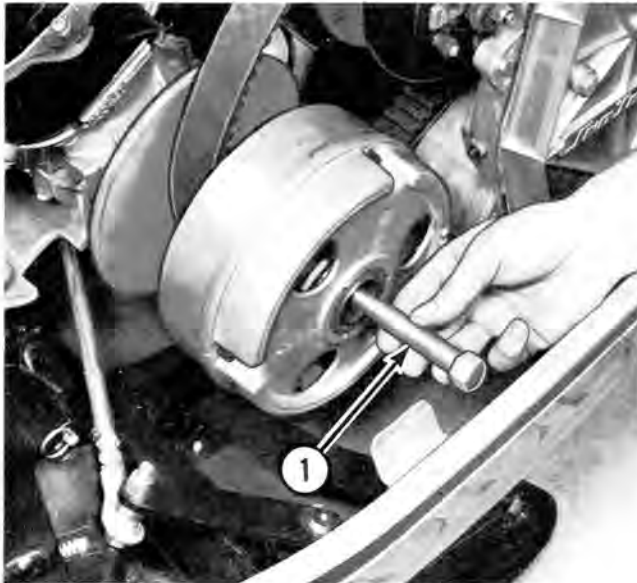
Installation

1. Slide the enricher switch (2, Figure 3-66) through the hole in the fuel tank cover, and install the enricher switch nut (1).
2. Slide the starter plunger cap (1, Figure 3-67), washer (4) and spring (3) over the end of the enricher cable.
3. Place the hole in the starter plunger (2) over the cable end and spring. Insert the plunger into the carburetor body and tighten the starter plunger cap (1). Bend washer against cap.

Drive Converter

Removal

1. Remove the drive belt.
2. Remove the drive converter mounting bolt and lockwasher.
3. Install the drive converter puller bolt (tool No. 205196) and screw in to remove the drive converter. Figure 3-68.



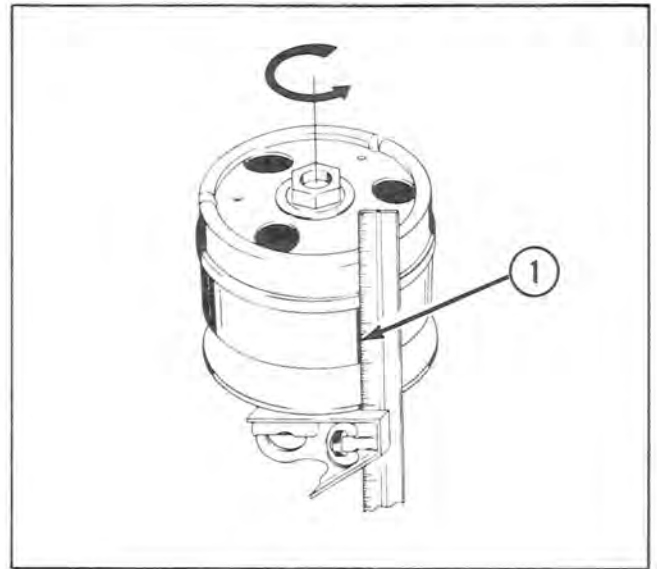
1. Drive Converter Puller Bolt

Figure 3-68

Checking Drive Converter Wear

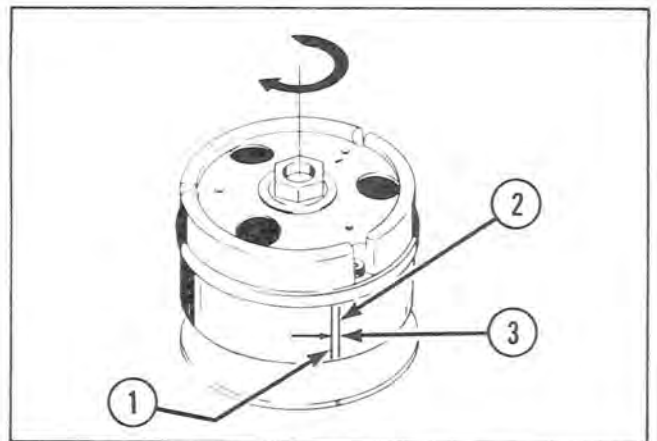
1. With the drive converter removed from the engine, remove the spring as described in steps 1 and 2 of the following disassembly procedure. Then reinstall the housing and bearing assembly.

2. Hold the stationary sheave securely and rotate the movable sheave counterclockwise as far as it will go. Scribe a line on the stationary and movable sheaves using a combination square as a guide as shown in Figure 3-69. Mark this line "A."
3. Now rotate the movable sheave all the way clockwise. Scribe a second line on the movable sheave in line with line "A" on the stationary sheave (Figure 3-70).
4. Measure the distance between the two lines on the movable sheave. If the difference is 0.156 inch or more, the drive converter is worn out of tolerance and must be replaced.



1. Line "A"

Figure 3-69



1. Line "A"
2. Line "B"
3. Dimension "X"

Figure 3-70

Disassembly

1. Loosen the three capscrews (9, Figure 3-71) securing the housing and bearing assembly (7). Mark the housing and bearing assembly and the movable sheave (3) for proper alignment. Carefully remove the capscrews while releasing spring tension on the housing and bearing assembly. Remove the housing and bearing assembly from the movable sheave (3).

CAUTION:

Bearing and housing may be damaged if not carefully disassembled. Even minor damage to this bearing can make it unuseable.

2. Slide the spring (10) and cup washer (11) from the shaft.
3. Loosen three locknuts (17) on the spider assembly (13). Back off the screws (18) until the spider is free in the hex shaft.
4. Push the spider down against the movable sheave. If the spider does not slide easily, force down with a slight amount of pressure.
5. Remove the split ring (12) from the hex shaft.
6. Mark the spider for correct alignment with the hex shaft and remove the spider.
7. Mark the movable sheave for correct alignment with the stationary sheave and remove the movable sheave (3).
8. To service the spider roller arm assembly, remove the capscrew (14) and nut (16) securing the roller arm weights (15) and the roller (1). Remove the capscrew (6) and ramp (4) from the movable face.

Cleaning

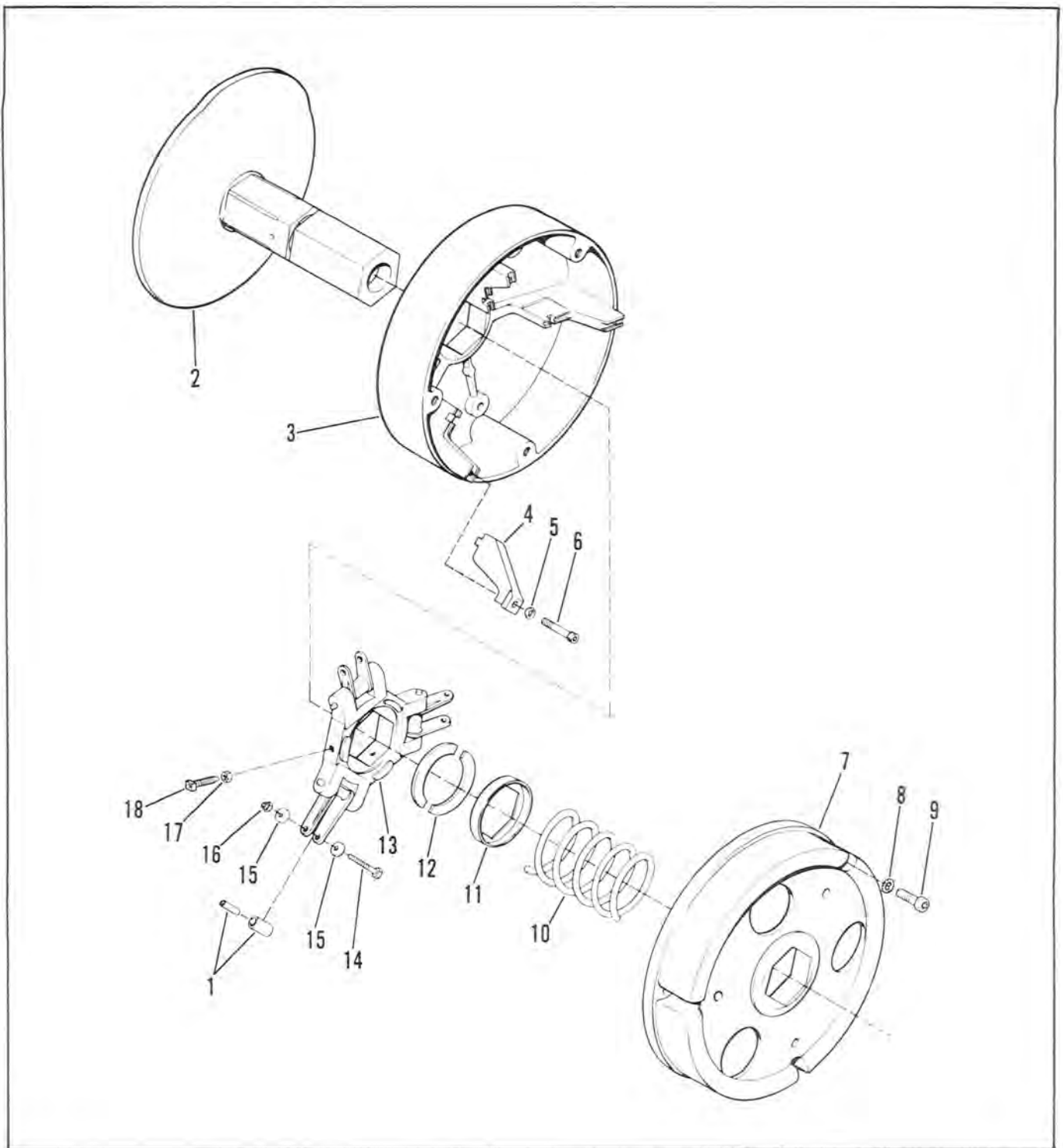
1. Remove all grease and dirt by placing components in cleaning solvent. Dry parts with compressed air or a clean cloth.
2. Remove drive belt accumulations from the stationary sheave, movable sheave and hex bearing with cleaning solvent. Do not use steel wool or a wire brush on the hex bearing.
3. Remove rust and drive belt accumulations from the steel shaft of the stationary sheave with cleaning solvent or a fine grade of steel wool.

Reassembly

1. Position the ramp (4, Figure 3-71) in the movable sheave (3). Secure with the capscrew (6) and tighten capscrew to 24 to 30 in. lbs. (0.28 to 0.35 kg-m).
2. Place the movable sheave on the hub of the stationary sheave (2), matching alignment marks on the movable sheave and stationary sheave.
3. If the spider roller arm assembly was serviced, align the slot in the bushing with the ears on the roller arm. Place the roller and bushing into the roller arm. Slide the weight (15) onto the capscrew (14) and start the capscrew into the roller arm. Slide the remaining roller arm weight on the capscrew and secure with the nut (16). Tighten the nut to 35 to 48 in. lbs. (0.40 to 0.55 kg-m).
4. Match the alignment marks on the spider assembly (13) and hex shaft and slide the spider assembly onto the shaft.
5. Place split rings (12) on the hex shaft.
6. Position the spider against the split rings. Tighten the three setscrews (18) on the spider assembly to 36 to 48 in. lbs. (0.41 to 0.55 kg-m). Tighten the locknuts (17) securely.
7. Place the cup washer (11) and spring (10) over the hex shaft.
8. Match alignment marks and place the housing and bearing assembly (7) over the spring. Press down on the housing and bearing assembly to compress the spring. Hold in position while lifting up on the movable sheave. Secure the housing and bearing assembly to the movable sheave with three capscrews (9) and tighten to 15 to 17 ft. lbs. (2.07 to 2.35 kg-m).

Installation

Install the drive converter on the crankshaft and secure with a bolt and lockwasher. Tighten the bolt to 75 ft. lbs. (10.37 kg-m). Install the drive belt.



- | | |
|--|---------------------|
| 1. Roller-Bearing | 10. Spring |
| 2. Stationary Sheave | 11. Washer |
| 3. Movable Sheave and Bearing Assembly | 12. Split Ring |
| 4. Ramp | 13. Spider Assembly |
| 5. Washer | 14. Screw |
| 6. Screw | 15. Weight |
| 7. Housing and Bearing Assembly | 16. Nut |
| 8. Washer | 17. Nut |
| 9. Screw | 18. Screw |

Figure 3-71

Driven Converter

NOTE: When repair of the driven converter is required, remove the chain case and driven converter from the snowmobile as an assembly. See "Chain Case Removal." Then disassemble the driven converter as follows.

Disassembly

1. Remove the screw (5, Figure 3-72), lock-washer (6) and flat washer (7).
2. Use a puller to remove the bearing support assembly (8). Remove the spacer (9).
3. Hold the stationary sheave (18) and turn the movable sheave (15) so the shoe ramps (14) do not contact the cam or torque bracket (12).
4. Force the torque bracket down on the shaft until it bottoms.

WARNING

Keep a downward pressure on the torque bracket and release spring tension slowly.

5. Remove the retaining ring (10), the torque bracket assembly (12), and driven spring (13).
6. Slide movable sheave (15) from stationary sheave shaft (18). Remove the key (21) and bushing (16).
7. Pull the shoe ramps (14) from the hub of the movable sheave (18).
8. Remove three capscrews (20) and separate the brake disc from the stationary sheave.

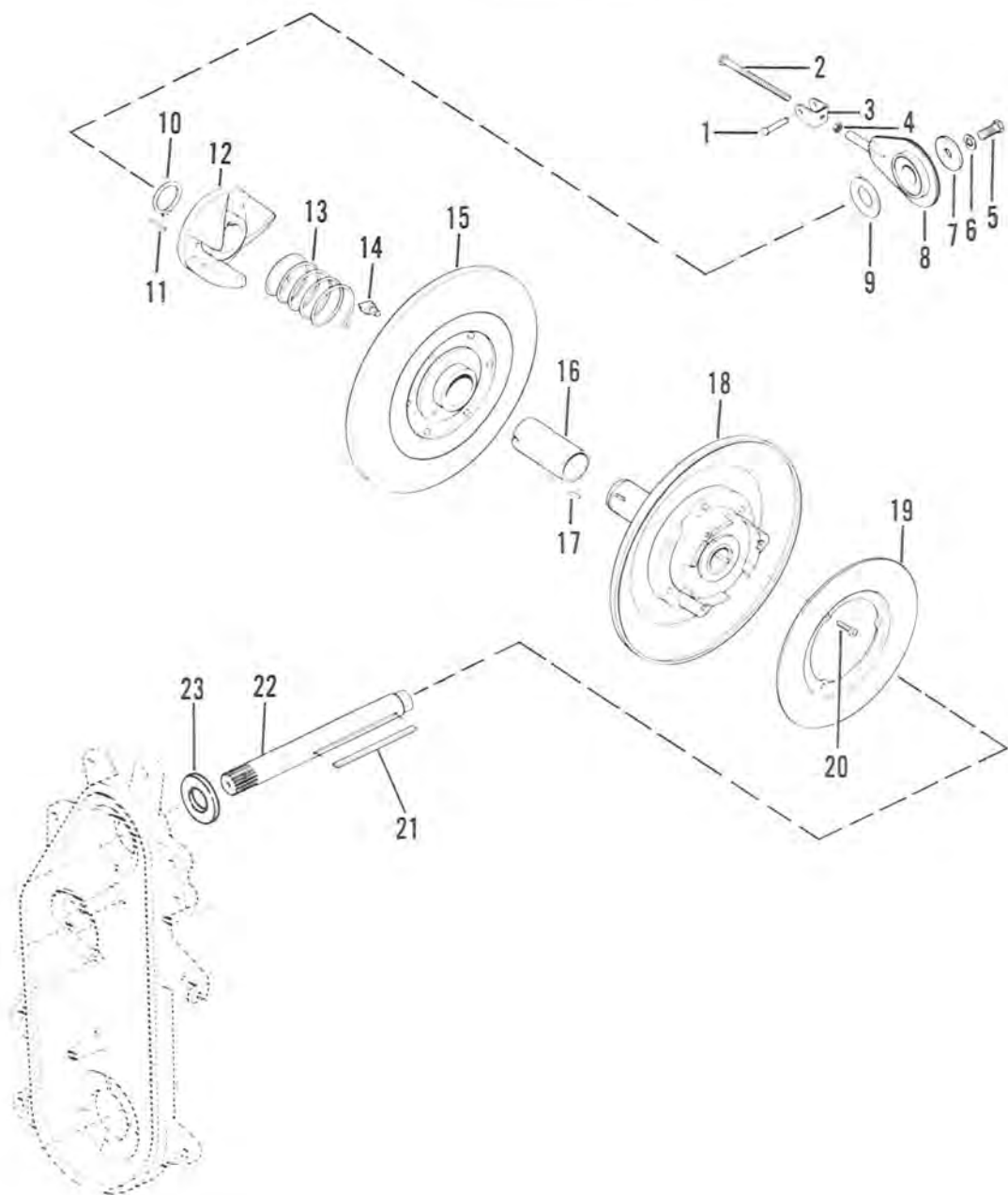
Cleaning and Inspection

1. Remove all foreign matter from the shoe ramps with a clean cloth and inspect for wear.
2. Place remaining components in cleaning solvent and remove all grease and dirt. Dry components with compressed air or a clean cloth.
3. Inspect sliding surfaces for wear and damage.
4. Inspect the fixed and movable faces for broken or loose rivets.

5. Check the torque bracket for cracks, wear and other damage.

Reassembly

1. Position the shoe ramps (14, Figure 3-72) on the movable face and tap into place using a rubber mallet.
2. Position the stationary sheave (18), bearing (16) and movable sheave (15). Install key (17) and slide parts together.
3. Position the driven spring (13) over the stationary sheave and hook the turned down end into the hole in the movable face.
4. Position the torque bracket (12) over the spring and hook the turned up end into the second hole of the torque bracket for standard spring tension.
5. Align the keyway in the torque bracket with the key (17). Push the torque bracket onto the shaft just far enough to contact the key. Hold the torque bracket in position. Turn the movable face counterclockwise until there is slight spring tension. Then turn the movable face an additional 120 degrees.
6. Push the torque bracket down on the shaft until it bottoms. Hold the torque bracket in position and install the retaining ring (10).
7. Release the torque bracket against the retaining ring.
8. Install the brake disc (19) and secure with three cap screws (20). Use Loc-Tite on screws and torque to 95 in. lbs. (1.09 kg-m).
9. Position the spacer (23) key (21) on the converter shaft (22). Install the assembled converter.
10. Position the spacer (9) and press on the bearing support assembly (8).
11. Install flat washer (7), lockwasher (6) and screw (5).
12. Install the chain case in the snowmobile.



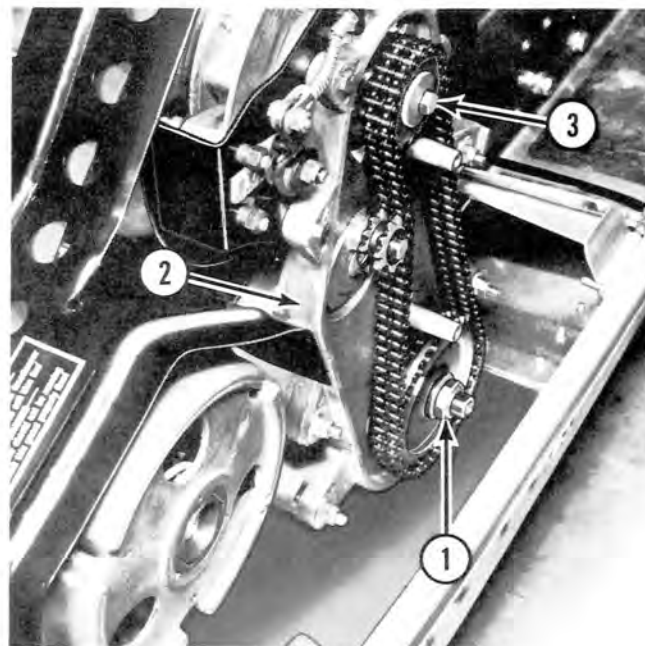
- | | |
|-----------------------------|-----------------------|
| 1. Pin | 13. Spring |
| 2. Adjusting Screw | 14. Shoe Ramp |
| 3. Clevis | 15. Movable Sheave |
| 4. Locknut | 16. Bearing |
| 5. Screw | 17. Key |
| 6. Lockwasher | 18. Stationary Sheave |
| 7. Flat Washer | 19. Brake Disc |
| 8. Bearing Support Assembly | 20. Capscrew |
| 9. Thin Spacer | 21. Key |
| 10. Retaining Ring | 22. Converter Shaft |
| 11. Pin | 23. Thick Spacer |
| 12. Torque Bracket Assembly | |

Figure 3-72

Chain Case

Removal

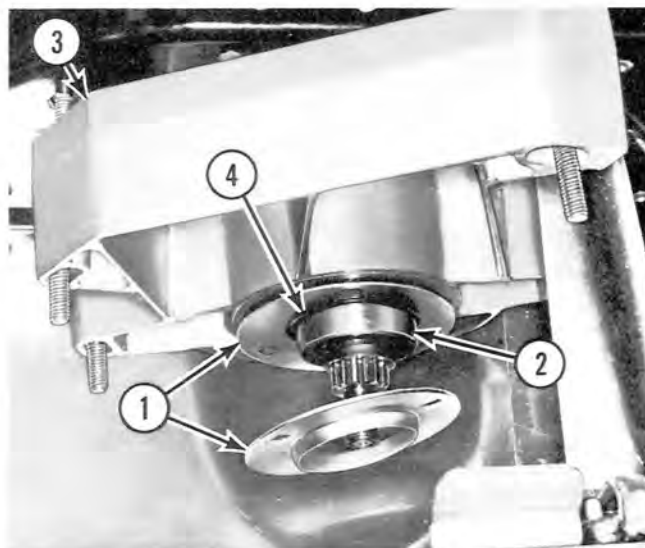
1. Remove the drive belt.
2. Remove the nose pan plug for access to the speedometer drive adapter. Remove the speedometer drive adapter (Figure 3-73).
3. Remove the two bolts and nuts that secure the brake support bracket to the chain case (Figure 3-73).
4. Remove brake caliper support bracket assembly.
5. Disconnect the converter shaft bearing support bracket by removing clevis pin.



1. Lower Sprocket Retaining Nut
2. Chain Adjuster Set Screw
3. Top Sprocket Retaining Screw

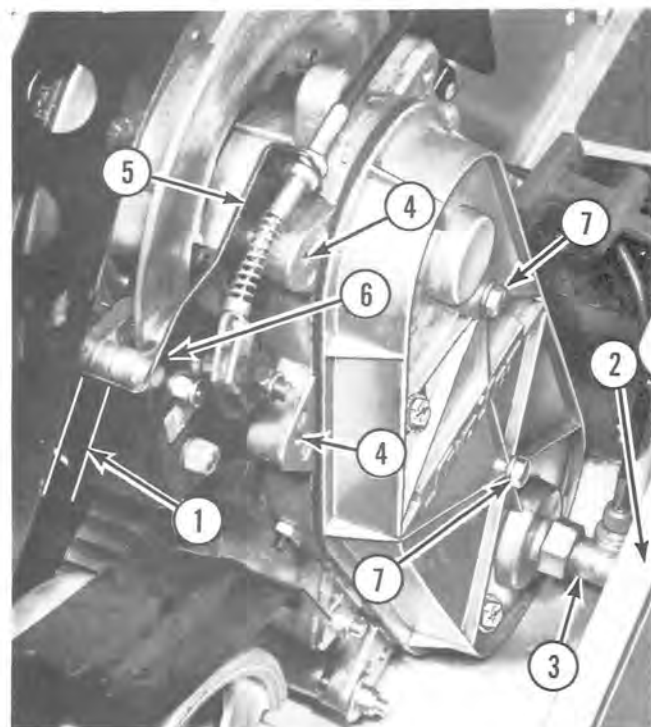
Figure 3-74

7. Loosen chain adjuster set screw and jam nut.
8. Remove lower sprocket retaining nut, upper sprocket retaining screw and remove sprockets and chain.



1. Bearing Flange Plate
2. Bearing
3. Chain Case Spacer
4. O-Ring

Figure 3-75



1. Drive Belt
2. Nose Pan Plug
3. Speedometer Drive Adapter
4. Bolts and Nuts
5. Brake Support Bracket
6. Brake Caliper Assembly
7. Cover Screws

Figure 3-73

6. Siphon oil from chain case or use a suitable container to collect the chain case lubricant. Remove two chain case cover screws and remove chain case cover (Figure 3-73).

9. Remove four locknuts and washers. Pull the chain case assembly and driven converter outward to disengage from the track drive shaft, and remove from the snowmobile.
10. Remove the bearing flange plates and bearing from the drive axle shaft. Then remove the chain case spacer (Figure 3-75).

Disassembly of the Chain Case

1. Remove the capscrew (4, Figure 3-76), lockwasher (5), flat washer (6), and upper sprocket (55).
2. Remove the capscrews (7), washers (8), and lift off the bearing retaining ring (9). Remove the sprocket spacer (56).
3. To remove the converter shaft (45), first remove the driven converter. See "Disassembly of the Driven Converter." Then drive the converter shaft with spacer (12) and bearing (47) from the chain case base (29) using a soft mallet. Bearing (47) must be removed from the torque converter end of the shaft with the puller.
4. Remove the bearing assembly (10), circlip (11) and o-ring (26).
5. Remove the snap ring (18) and washer (15). Lift off the tensioner sprocket (17) and washer (15).
6. Remove the capscrew (35), nut (40), and tensioner stopper (36) and allow chain tensioner (14) to unwind.
7. Remove the capscrew (7) and washer (54). Remove the chain tensioner and spring (13).

Cleaning and Inspection

1. Clean metal parts in solvent and dry all parts except bearings with compressed air. Allow bearings to air dry.
2. Inspect bearings for scoring and wear.
3. Inspect sprocket and splined shafts for chipped, broken or missing teeth or splines.

Reassembly

1. If removed, reinstall the converter shaft (45, Figure 3-76) and driven converter.
2. Install the spring (13) with one end inserted in the hole in the chain case base (29) and one end in the hole in the chain tensioner (14). The chain tensioner must be adjusted after the chain case is installed in the snowmobile.
3. Install capscrew (7 apply Loc-Tite), washer (54). Wind spring one quarter turn and install capscrew (35), tensioner stopper (36) and nut (40).
4. Oil tensioner bearing and install tensioner sprocket (17) with one washer (15) on each side. Secure with snap ring (18).
5. Install bearing spacer (12), and press on bearing assembly (10) and circlip (11).
6. Install bearing retaining ring (9). Secure with three capscrews (7) and washers (8).

Figure 3-76

- | | | |
|---------------------------|--------------------------|-------------------------------|
| 1. Cover | 20. Clevis | 39. Adjuster Sleeve |
| 2. Gasket | 21. Nut | 40. Nut |
| 3. Chain | 22. Spacer | 41. Key |
| 4. Capscrew | 23. Bolt | 42. Spacer |
| 5. Lockwasher | 24. Washer | 43. Bearing Support Assembly |
| 6. Flat Washer | 25. Bearing Flange Plate | 44. Pin |
| 7. Capscrew | 26. O-Ring | 45. Converter Shaft |
| 8. Lockwasher | 27. Bearing | 46. Spacer |
| 9. Bearing Retaining Ring | 28. O-Ring | 47. Bearing |
| 10. Bearing Assembly | 29. Chain Case Base | 48. Gasket |
| 11. Circlip | 30. Washer | 49. Cap |
| 12. Spacer | 31. Nut | 50. Speedometer Drive Adapter |
| 13. Spring | 32. Sprocket | 51. Plug |
| 14. Chain Tensioner | 33. Washer | 52. Capscrew |
| 15. Washer | 34. Nut | 53. O-Ring |
| 16. Bearing | 35. Screw | 54. Washer |
| 17. Sprocket | 36. Tensioner Stopper | 55. Sprocket |
| 18. Snap Ring | 37. Nut | 56. Spacer |
| 19. Capscrew | 38. Screw | |

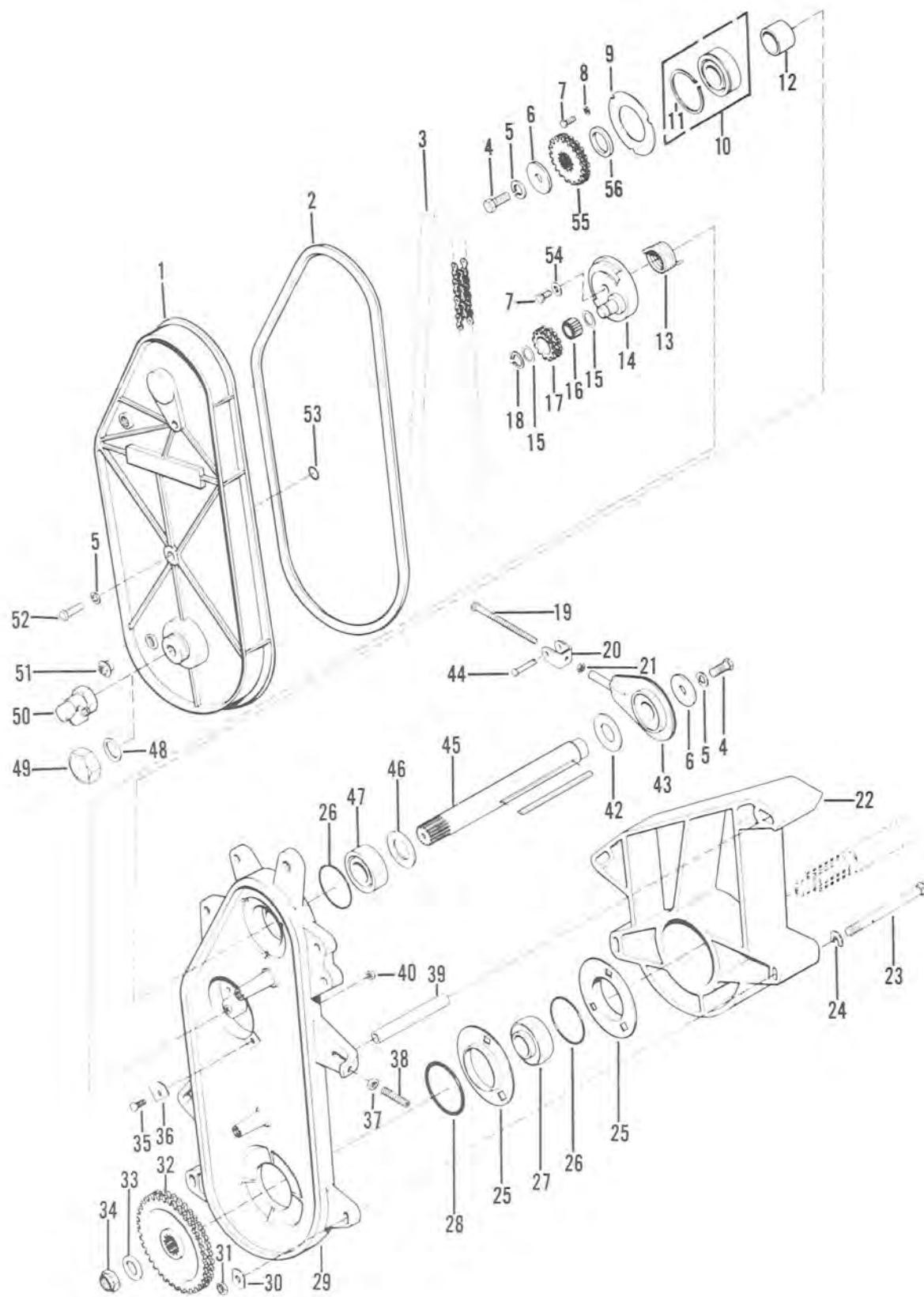
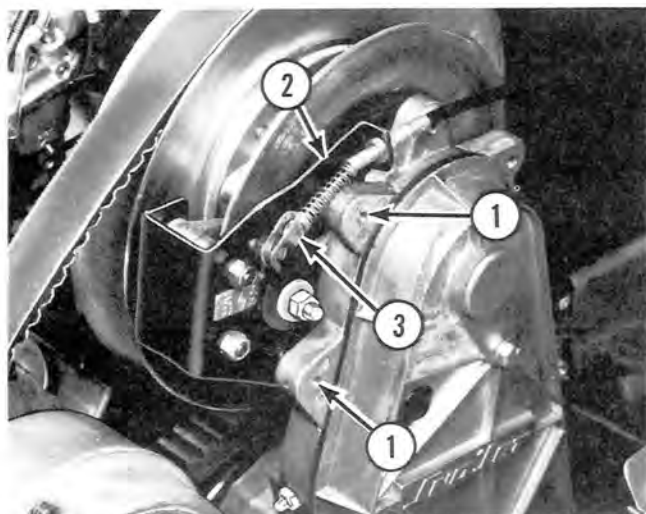


Figure 3-76

Installation

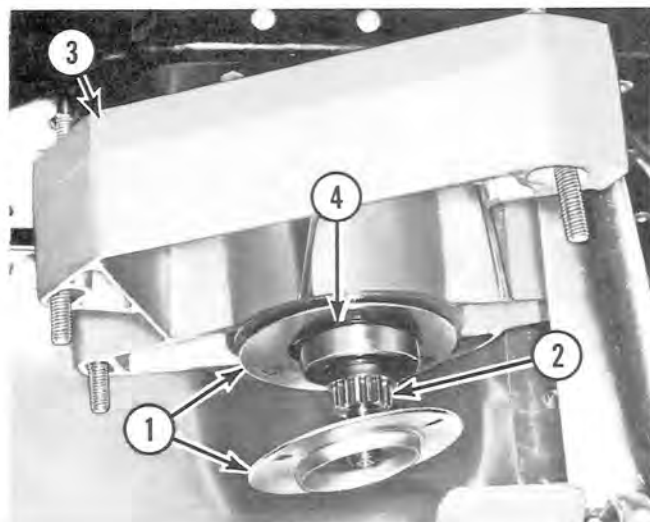
1. Install the brake caliper to the chain case, and secure with two screws and nuts (Figure 3-77).
2. Install the chain case spacer, bearing flange plates, bearing and o-ring (Figure 3-78).



1. Screws and Nuts
2. Brake Support Bracket
3. Brake Clevis

Figure 3-77

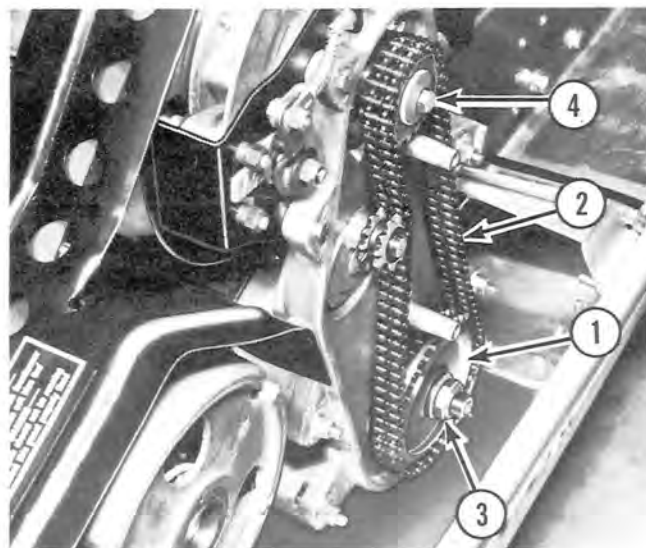
3. Align indexing holes in bearing flange plates to tabs on chain case assembly and position chain case over the drive shaft. Secure with four locknuts and washers.



1. Bearing Flange Plate
2. Bearing
3. Chain Case Spacer
4. O-Ring

Figure 3-78

4. Install upper sprocket spacer on converter shaft.
5. Install the upper sprocket, lower sprocket and the chain as a unit. Install the lower sprocket retaining nut. (Figure 3-79). Torque nut 55 ft. lbs. (7.61 kg-m). Apply Loc-Tite to upper sprocket retaining screw. Install large washer and lockwasher. Torque sprocket retaining screw to 19 ft. lbs. (2.63 kg-m).



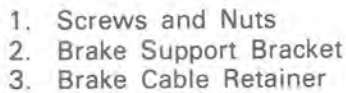
1. Lower Sprocket
2. Chain
3. Lower Sprocket Retaining Nut
4. Upper Sprocket Retaining Screw

Figure 3-79

6. Install the drive belt.
7. Install the chain case cover and add chain oil to the lower edge of the level hole.
8. Install the speedometer drive adapter and nose pan plug.
9. Refer to Section 2 and adjust the drive belt, drive chain, and the converter alignment.

Brake Caliper Removal

1. Release the brake cable at the cable retainer and remove the spring. See Figure 3-80.



2. Remove two screws and nuts securing the brake caliper assembly to the chain case casting.

1. Remove the nut (14, Figure 3-81) and washer (15) and lift off the cam (13) and spring (17).
2. Remove two nuts (18), screws (1), washers (2) and bushings (19). Remove the brake support bracket (20).
3. Separate caliper B (3) from caliper A (7), and remove pad A (5) and backup washer (6).



3-60 BRAKE CALIPER COMPONENTS

Repair

Inspect the brake pads for wear. If pad A is worn so only 1/32 inch (0.79 mm) protrudes from the caliper, replace pad A. Use contact cement to secure the new pad. If pad B is worn to 1/8 inch (3.18 mm), replace pad B.

Clean all parts in solvent. Be sure to keep oil and grease from the pads. Braking action will be impaired by oily or greasy pads.

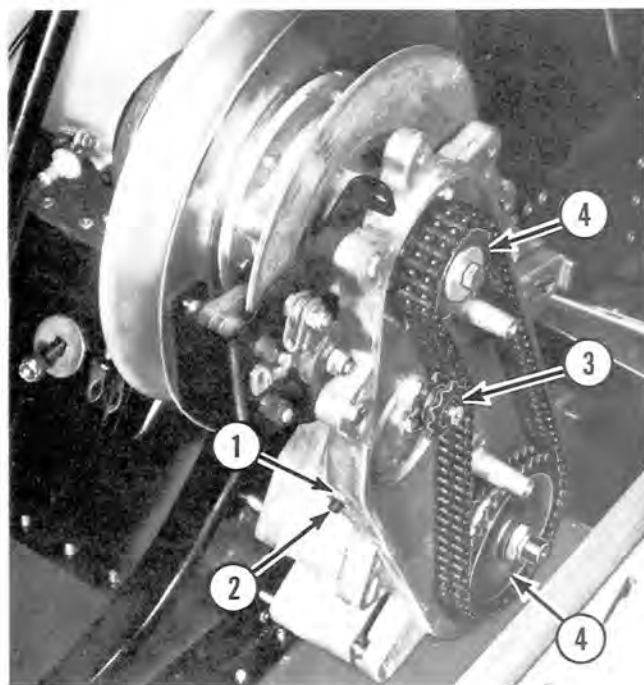
Assembly

Apply coating of Never-Seez to push pins. Assemble and install brake caliper in the reverse order of removal and disassembly. Then adjust brake as instructed in Section 2 of this manual.

Drive Chain Replacement

Removal

1. Siphon oil from chain case or use a suitable container to collect the chain case lubricant. Remove two chain case cover screws and remove chain case cover.
2. Loosen chain adjuster set screw and jam nut.
3. Remove lower sprocket retaining nut, upper sprocket retaining screw and remove sprockets and chain. (Figure 3-82).



1. Locknut
2. Setscrew
3. Chain Tensioner
4. Sprockets

Figure 3-82

Installation

1. Install the upper sprocket, lower sprocket and the chain as a unit. Install the lower sprocket retaining nut. Torque nut 55 ft. lbs. (7.61 kg-m). Apply Loc-Tite to upper sprocket retaining screw. Install large washer and lockwasher. Torque sprocket retaining screw to 19 ft. lbs. (2.63 kg-m) (Figure 3-82).
2. Install the chain case cover and add chain oil to the lower edge of the level hole.
3. Install the speedometer drive adapter and nose pan plug.
4. Adjust the drive chain as described in Section 2.

Slide Rail Suspension Removal

1. Position the snowmobile on its right side, and loosen rear axle adjusting bolts to relieve track tension (Figure 3-83).

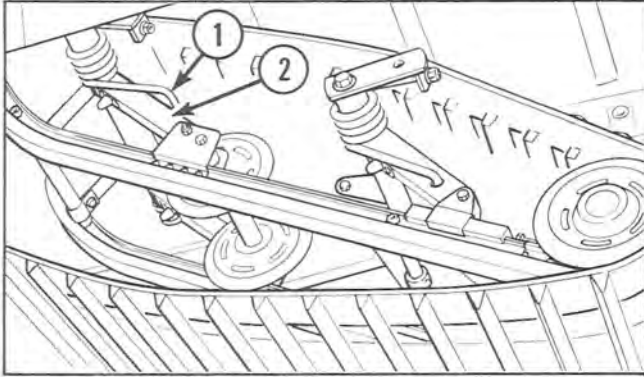


1. Rear Axle Adjusting Bolts

Figure 3-83

2. Remove middle idler shaft, spacers, and wheels (Figure 3-84).
3. Relieve tension on rear suspension springs and remove capscrews and nuts which secure the brackets and pivot shaft to the chassis (Figure 3-85).

4. Relieve tension on the front suspension arm springs by swinging suspension out of chassis. (Figure 3-84).



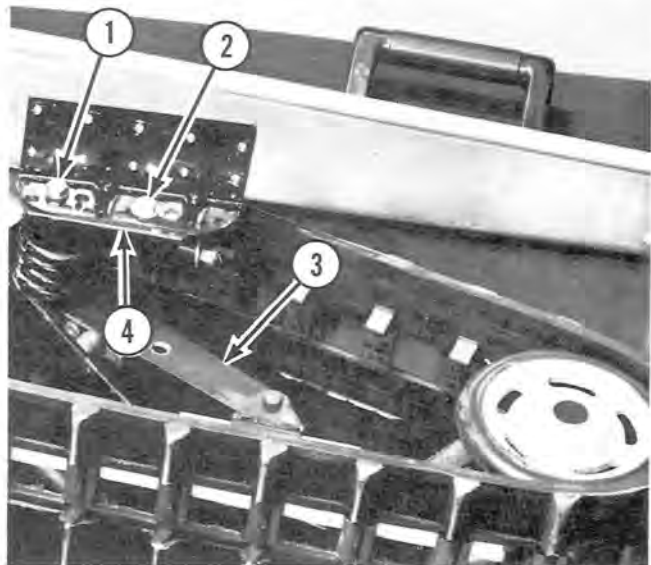
1. Front Spring
2. Front Suspension Arm

Figure 3-84

WARNING

The springs are held under high tension. To prevent injury, keep hands away from springs when releasing tension.

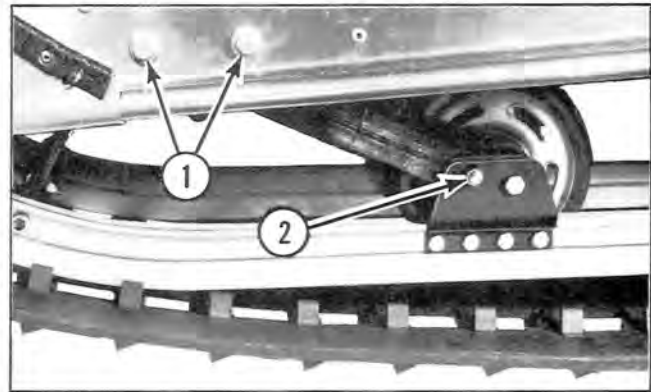
5. Remove capscrews and nuts from front suspension brackets and pivot shaft (Figure 3-86).



1. Pivot Shaft Screw
2. Bracket Screw and Nut
3. Rear Suspension Arm
4. Rear Suspension Bracket

Figure 3-85

6. Remove slide rail suspension from track assembly.



1. Bracket Screw and Nut
2. Pivot Shaft Screw

Figure 3-86

Inspection

Move slide rail suspension back and forth on a level surface to check for binding (Figure 3-87).

If the suspension binds, locate the problem and refer to the appropriate repair procedure, below. Refer to Figure 3-88 for parts location and identification when repairing the suspension.

NOTE: The following repairs are performed with the slide rail suspension removed from the snowmobile.

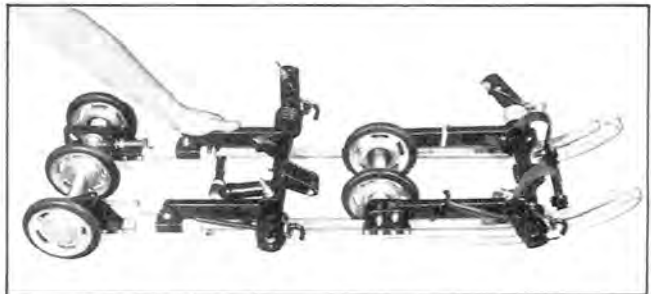


Figure 3-87

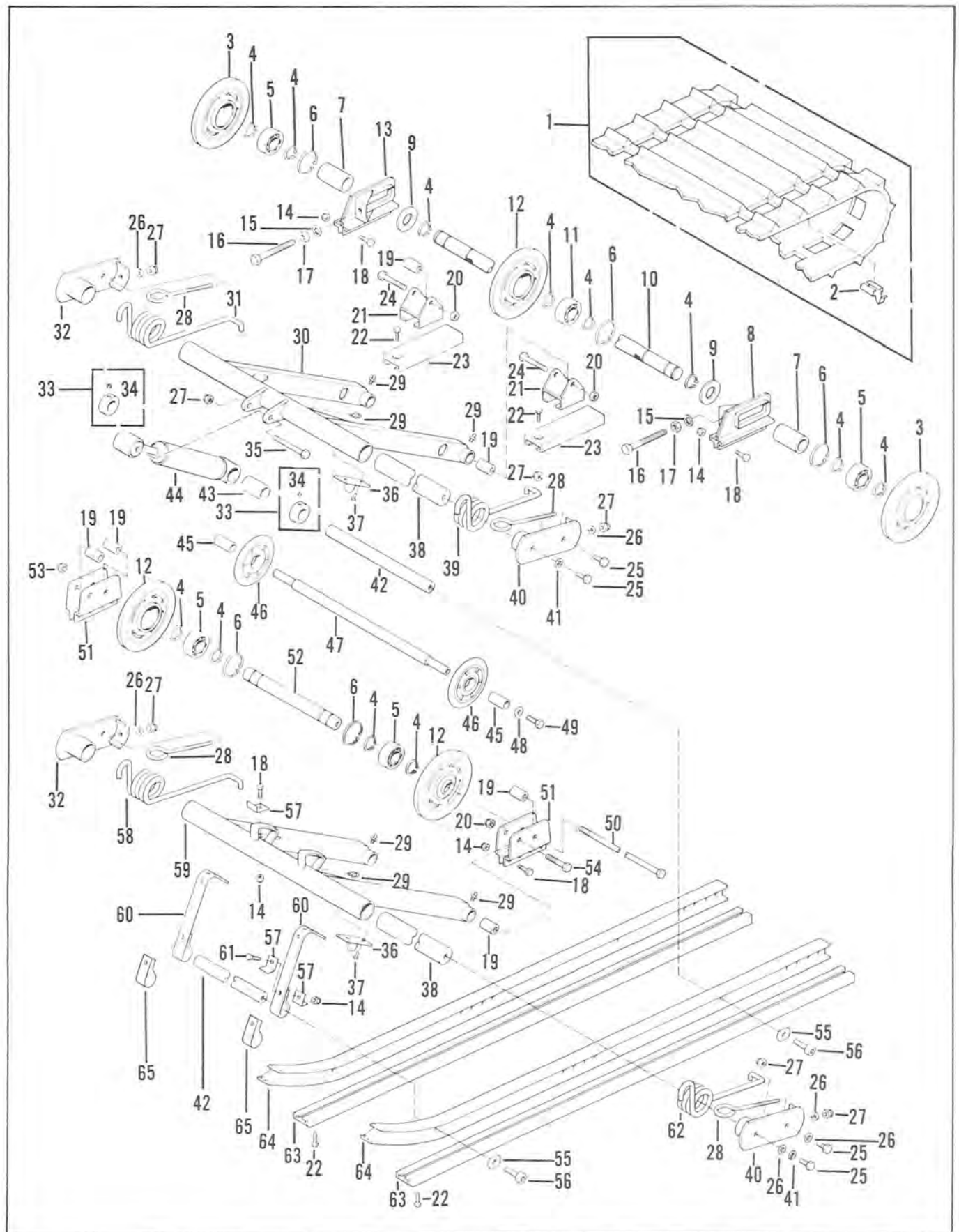


Figure 3-88

Front Idler Shaft and Wheels

Inspection

1. Replace front idler shaft wheel if rubber is excessively worn.
2. Spin wheels on the shaft and check for noise or binding. Replace bearings if necessary.
3. Inspect the shaft for damage.

Removal

Remove front idler shaft and wheels from the suspension by removing bolts and suspension bushings from the axle brackets (Figure 3-89).

Disassembly

1. To remove idler wheel, remove snap ring and tap wheel from the bearing.
2. To remove bearings, remove outside snap ring which secures it to the idler shaft, and pull bearing from the shaft with a puller.

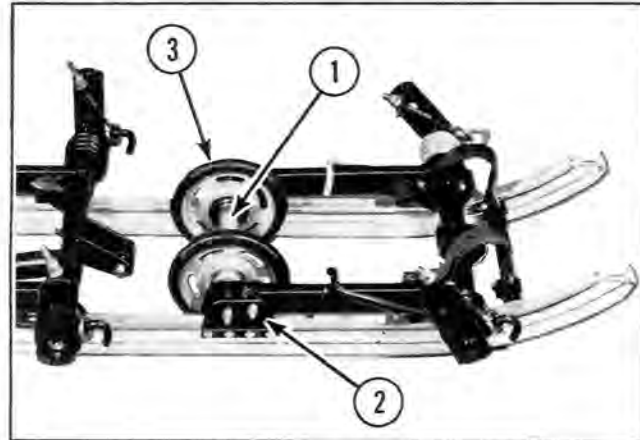
NOTE: To protect against wear, DO NOT allow dirt to enter bearings.

Reassembly and Installation

1. Reassemble bearings and wheels to idler shaft.

NOTE: To prevent bearing damage, press bearings onto the idler shaft - DO NOT tap them on.

2. Secure the idler shaft assembly and bracket bushings to axle brackets with long bolt and nut, tighten to 17 ft. lbs. (2.35 kg-m).



1. Front Idler Shaft
2. Axle Bracket
3. Idler Wheel

Figure 3-89

Figure 3-88

- | | | |
|-------------------------------|-------------------------|--------------------------|
| 1. Track Assy | 23. Wear Strip | 45. Spacer |
| 2. Track Clip | 24. Capscrew | 46. Idler Wheel |
| 3. Rear Idler Wheel | 25. Capscrew | 47. Middle Idler Shaft |
| 4. Snap Ring | 26. Washer | 48. Washer |
| 5. Bearing | 27. Locknut | 49. Capscrew |
| 6. Snap Ring | 28. Eye Bolt | 50. Bolt |
| 7. Bushing | 29. Grease Fitting | 51. Axle Bracket |
| 8. Rear Axle Support Bracket | 30. Rear Suspension Arm | 52. Front Idler Shaft |
| 9. Washer | 31. Spring | 53. Nut |
| 10. Rear Axle | 32. Suspension Bracket | 54. Capscrew |
| 11. Bearing | 33. Collar | 55. Washer |
| 12. Idler Wheel | 34. Set Screw | 56. Cap Screw |
| 13. Rear Axle Support Bracket | 35. Capscrew | 57. Washer |
| 14. Locknut | 36. Bumper | 58. Spring |
| 15. Star Washer | 37. Pop Rivet | 59. Front Suspension Arm |
| 16. Bolt | 38. Pivot Shaft | 60. Limiter |
| 17. Nut | 39. Spring | 61. Capscrew |
| 18. Capscrew | 40. Suspension Bracket | 62. Spring |
| 19. Bushing | 41. Lockwasher | 63. Rail Wear Strip |
| 20. Nut | 42. Shaft | 64. Suspension Rail |
| 21. Bracket | 43. Bushing | 65. Shield |
| 22. Screw | 44. Shock Absorber | |

Middle Idler Shaft and Wheels

1. Replace a cracked or excessively worn middle idler wheel.
2. Inspect the shaft for damage.
3. Inspect idler shaft spacers for damage and replace as required.

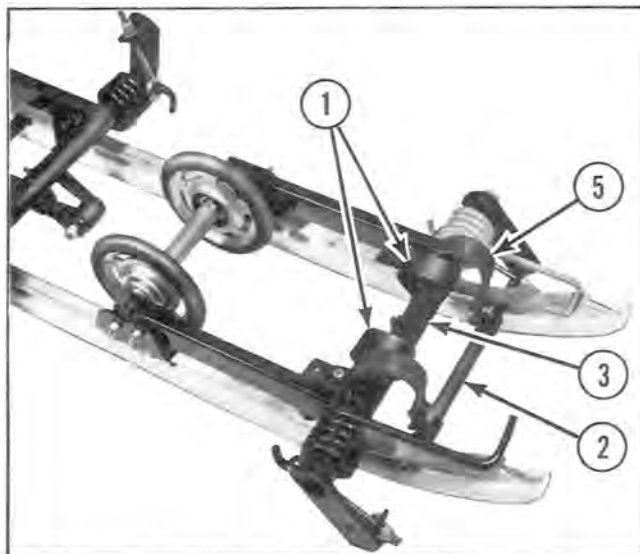
Limiters

Inspection

1. Inspect limiters for deterioration and damage. Replace as required.
2. Check the limiter cross shaft for distortion.

Removal and Disassembly

1. To remove limiter, remove capscrews, washers, and nuts which secure it to the suspension arm and cross shaft (Figure 3-90).



1. Limiters
2. Cross Shaft
3. Suspension Arm
4. Suspension Rail
5. Limiter Shield

Figure 3-90

2. Remove capscrews and washers which attach the limiter cross shaft to the suspension rails.
3. Slide limiter strap shields and limiter from the cross shaft.

Reassembly

1. Attach limiter to the front suspension arm with capscrews and washers using hole farthest from end of strap. Tighten capscrews to 95 in. lbs. (1.09 kg-m).
2. Secure limiter shield to limiter with a washer, capscrew, and locknut. Do not tighten capscrews completely.
3. Slide limiter cross shaft through the shields and limiter, and secure it to the suspension rail with washers and capscrews. Use Loc-Tite and tighten capscrews to 30 ft. lbs. (4.15 kg-m).
4. Tighten remaining limiter shield capscrews to 95 in. lbs. (1.09 kg-m).

Rail Wear Strips

Inspection

1. Check rail wear strips for cracks, distortion, and alignment with rail suspension.
2. Measure wear strip thickness. If rail strip is worn to 3/8 inch (9.5 mm) or less at any point, it must be replaced.

Removal

1. Turn slide rail suspension upside down, and brace it to prevent shifting.
2. Remove self-tapping screw from the top of the rail wear strip.
3. Tap the back of the wear strip with a block of wood and hammer as illustrated in Figure 3-91 to remove it from the suspension rail.



Figure 3-91

Installation

Install new rail wear strip by sliding it into position on the suspension rail. Secure with a self-tapping screw and tighten to 60 in. lbs. (0.69 kg-m).

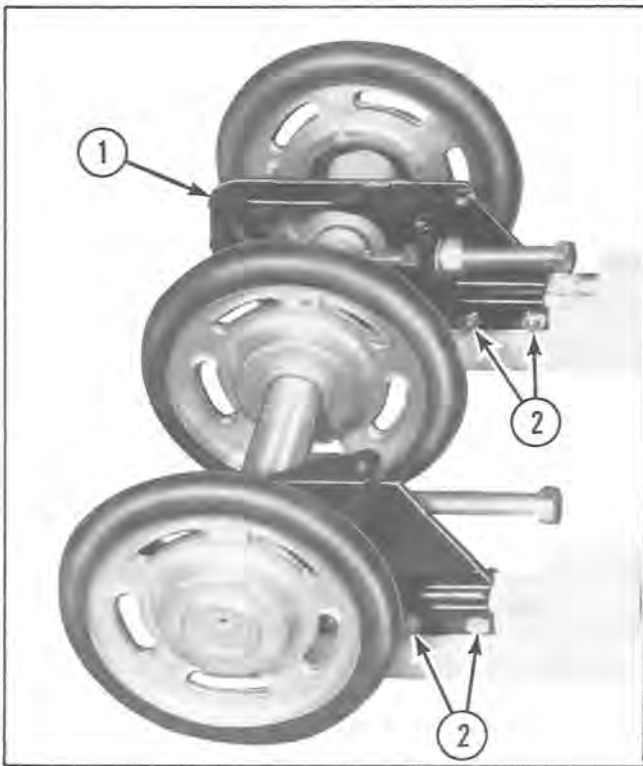
Rear Axle and Wheels

Inspection

1. Replace rear idler wheel if rubber is excessively worn.
2. Spin rear idler wheels on the shaft, and check for noise or binding. Replace bearings if necessary.
3. Inspect the shaft for damage.

Removal and Disassembly

1. Remove eight capscrews and nuts from rear axle support brackets (Figure 3-92).



1. Rear Axle Support Bracket
2. Capscrews and Nuts.

Figure 3-92

2. Slide the brackets from suspension rail.

3. Using 90° circlips, remove snap rings which secure outside wheels, and tap the wheels from the bearings.

NOTE: To protect against excessive wear, DO NOT allow dirt to enter bearings.

4. Remove snap rings which position the bearing on the rear axle, and remove the bearing with a bearing puller.
5. Remove snap rings, rear axle support bracket, washer, and middle wheel from rear axle.
6. Remove snap ring and middle bearing from the machined end.

Reassembly and Installation

1. Reassemble rear axle and wheels in the reverse order of removal. Press bearings into position.
2. Secure rear axle support brackets to the suspension rails with capscrews and locknuts. Tighten the capscrews to 95 in. lbs. (1.09 kg-m).

Shock Absorber

Inspection

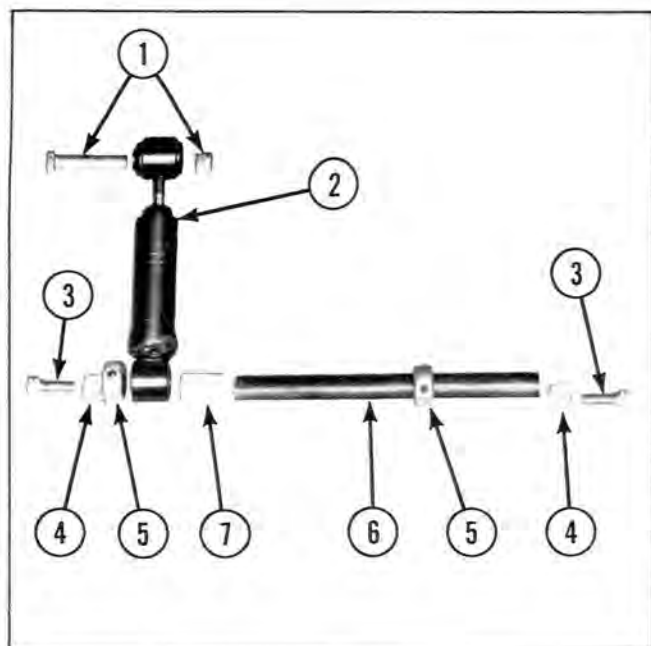
1. Examine shock absorber shaft for warpage.
2. Examine shock absorber for leakage and cracked or worn rubber.

Removal and Disassembly

1. Remove the capscrew and nut which secure the shock absorber top to the suspension arm. Loosen only one collar (Figure 3-93).
2. Remove shock absorber shaft by removing capscrews and washers from the suspension rails.
3. Remove collar, shock absorber, and bushing from the shaft.

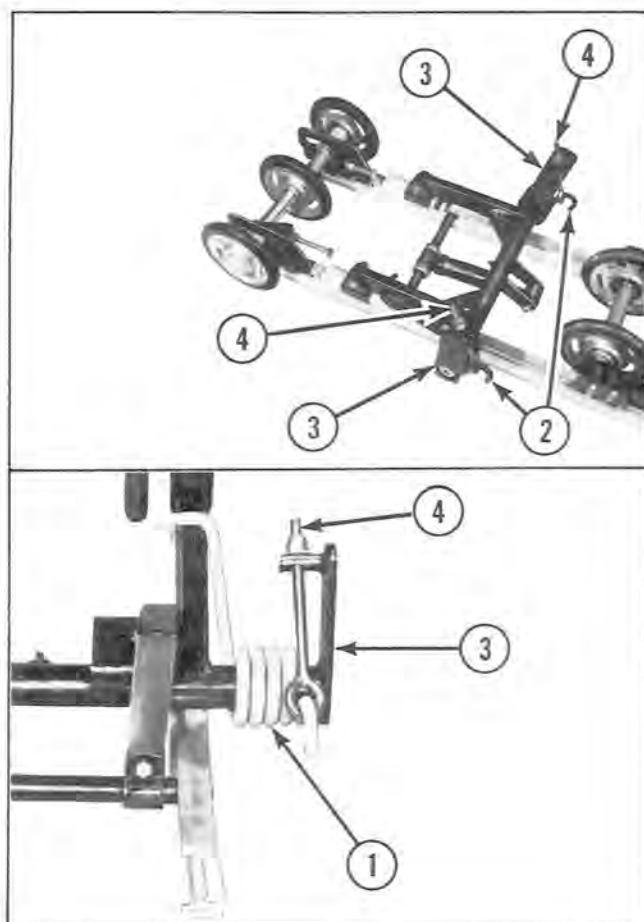
Reassembly and Installation

1. Reassemble shock absorber to shaft and to the chassis in the reverse order of removal. Place Loc-Tite on all capscrews.
2. Tighten capscrew and nut which secure shock absorber to the suspension arm to 30 ft. lbs. (4.15 kg-m), and tighten capscrews and washers which secure the shaft to the suspension rail to 30 ft. lbs. (4.15 kg-m).



1. Capscrew and Nut
2. Shock Absorber
3. Capscrew
4. Washer
5. Collar
6. Shaft
7. Bushing

Figure 3-93



1. Front Spring
2. Rear Spring
3. Suspension Bracket
4. Eye Bolt

Figure 3-94

Front and Rear Springs

Inspection

1. Check eye bolts (Figure 3-94) for distortion or wear.
2. Replace a distorted spring or spring arm.
3. Examine suspension brackets for bends. Straighten or replace if necessary.

Removal

Remove the suspension brackets, eye bolts, and springs by sliding from the pivot shafts (Figure 3-94).

Installation

Install the suspension brackets, eye bolts, and springs in the reverse order of removal.

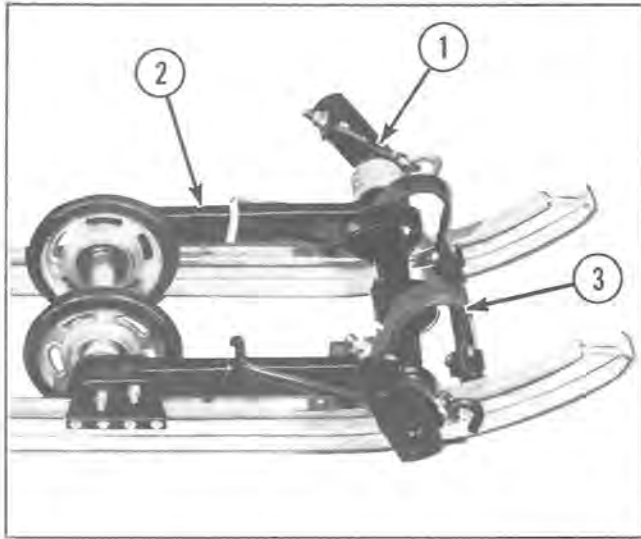
Front and Rear Suspension Arms

Inspection

1. Examine suspension arms for bends. Replace if necessary.
2. Rotate the pivot shaft. If there is binding of the shaft, lubricate it with three grease gun pumps of low temperature, extreme pressure (E. P.) grease. Replace suspension arm and pivot shaft if binding persists.
3. Replace worn bumpers.

Front Suspension Arm Removal

1. Remove springs, eye bolts, and suspension brackets from suspension arm and remove all capscrews, nuts, and washers which secure the arm to the suspension rails and limiters (Figure 3-95).



1. Spring, Eyebolt, and Suspension Bracket
2. Suspension Arm
3. Limiter

Figure 3-95

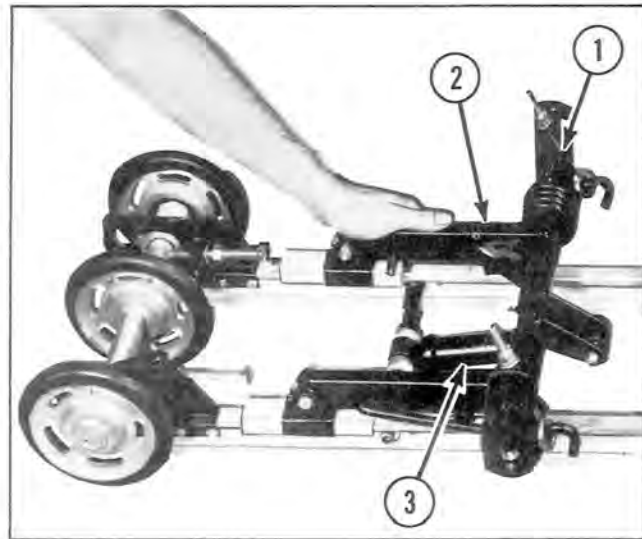
2. Remove the limiters.
3. Remove suspension arm.

Rear Suspension Arm Removal

1. Remove springs, eye bolts, and suspension brackets from suspension arm (Figure 3-96).
2. Remove shock absorber.
3. Remove all capscrews, nuts, and washers which secure the arm to the suspension rails.
4. Remove suspension arm.

Installation

1. Install the front and rear suspension arms in the reverse order of removal. Tighten capscrews and nuts which attach the arms and suspension brackets to 17 ft. lbs. (2.35 kg-m).
2. Install shock absorber.
3. Install limiters.



1. Spring, Eyebolt, and Suspension Bracket
2. Suspension Arm
3. Shock Absorber

Figure 3-96

Suspension Rails

Inspection

Inspect suspension rails for distortion and damage.

Removal

1. Remove rail wear strips.
2. Remove all capscrews, nuts, screws, and washers which secure suspension rails to the suspension, and slide out the rails from the suspension.

Installation

1. Reassemble suspension rails in the opposite order of removal. Tighten capscrews which attach rails to the limiter cross shaft to 30 ft. lbs. (4.15 kg-m). Apply Loc-Tite to cross shaft capscrews. Tighten capscrews and nuts which attach rails to the axle brackets and rear axle support brackets to 95 in. lbs. (1.09 kg-m).
2. Install rail wear strips. Tighten screw to 60 in. lbs. (0.69 kg-m).

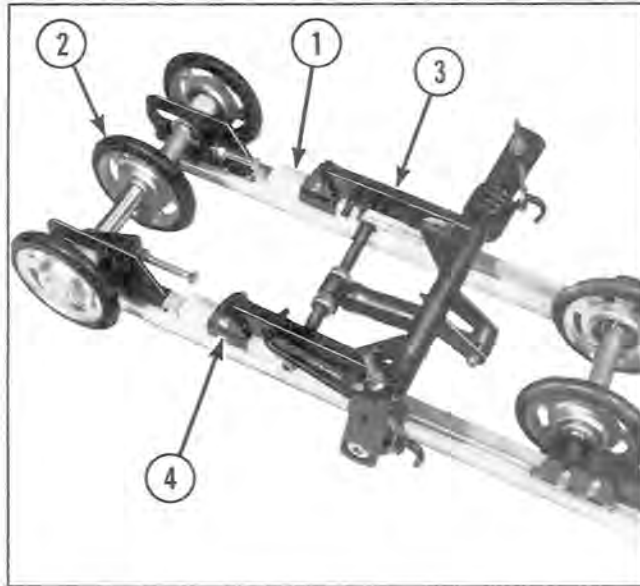
Wear Strips

Inspection

Replace wear strip if damaged.

Removal

1. Remove capscrews and nuts which secure rear axle support brackets to suspension rail, and slide off rear axle assembly (Figure 3-97).



1. Wear Strip
2. Rear Axle Assembly
3. Rear Suspension Arm
4. Rear Suspension Bracket

Figure 3-97

2. Remove screws attaching wear strips to rail suspension.
3. Remove rear suspension arms from rear suspension brackets.
4. Slide wear strips from rail suspension.

Reassembly

Reassemble the wear strips in reverse order of removal. Tighten the capscrews which secure rear axle brackets to 95 in. lbs. (1.09 kg-m), capscrews and nuts which support the suspension arm to rear suspension brackets to 15 ft. lbs. (2.07 kg-m), and the wear strip screws to 60 in. lbs. (0.69 kg-m).

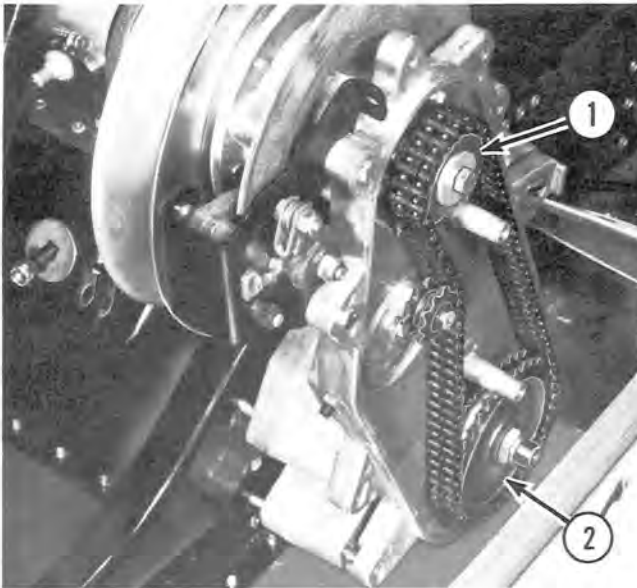
Installation of Slide Rail Suspension

1. On front suspension arm, position spring arms toward suspension rail. Secure suspension brackets, eye bolts, and springs to suspension arms with large rubber bands.

2. With the snowmobile on its right side, insert middle idler shaft, spacer, and wheels between track. Secure shaft to chassis with flat washers and capscrews, and tighten to 15 ft. lbs. (2.07 kg-m).
3. Slide suspension between the track, and align pivot shafts with the chassis and suspension bracket. Secure pivot shafts with flat washers, lockwashers, and capscrews. Remove rubber bands. Do not tighten screws completely.
4. Align both front suspension brackets with the front chassis. Secure bracket to chassis with flat washers, locknuts, and capscrews. Tighten screws to 25 ft. lbs. (3.46 kg-m).
5. Brace each rear suspension bracket, and align it with chassis rear suspension bracket. Secure bracket to chassis with capscrews and locknuts. Tighten these screws and pivot shaft screws to 25 ft. lbs. (3.46 kg-m).
6. Adjust the track and suspension in accordance with Section 2.

Drive Shaft and Track Removal

1. Remove slide rail suspension.
2. Remove the drive belt.
3. Remove nose pan plug from the chassis and speedometer drive adapter from the chain case. Also remove the speedometer key if snowmobile is so equipped.
4. Use a suitable container to collect chain case lubricant.
5. Secure upper sprocket capscrew, and remove jam nut from lower sprocket. Also remove washer, chain, and sprocket (Figure 3-98).
6. Remove track assembly from drive shaft. While protecting drive shaft, lift shaft, bearing, and oil seal from the bearing housing.
7. Reach between the track and remove the drive shaft from the chassis.
8. Remove track.

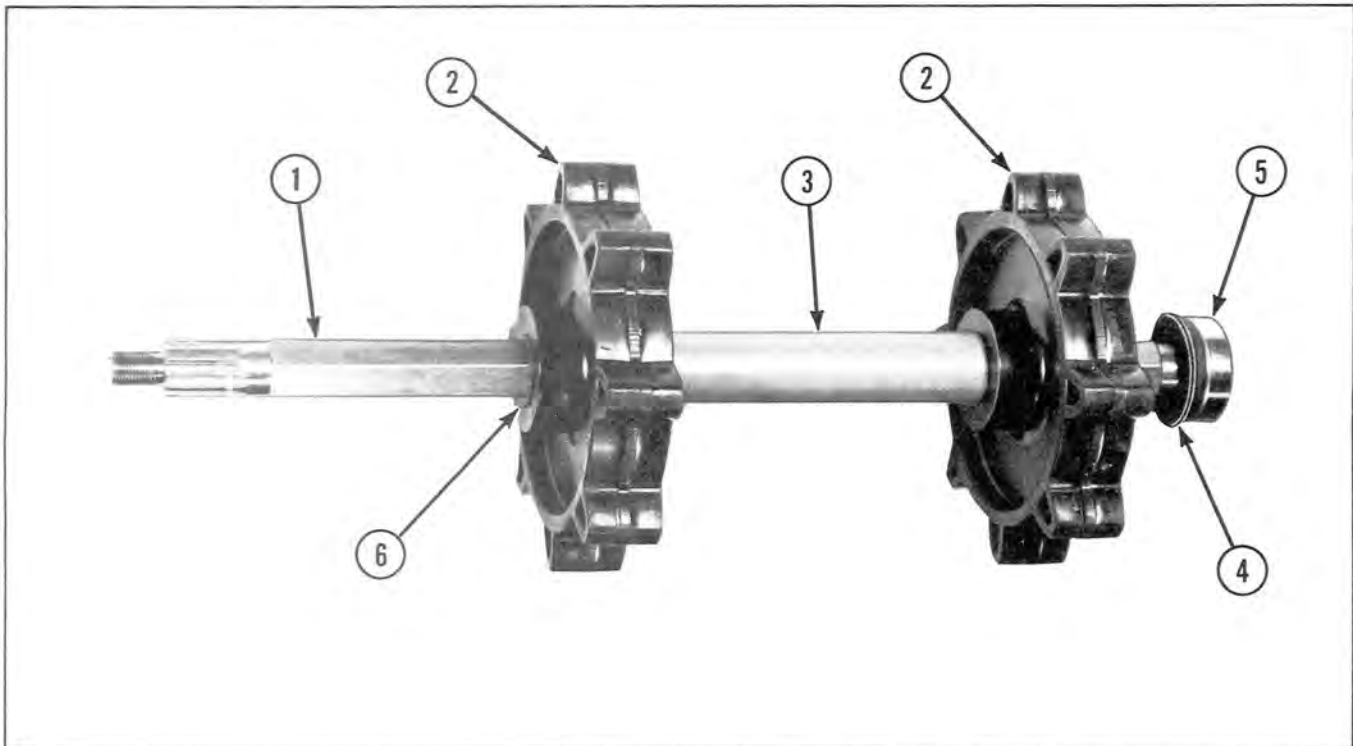


1. Upper Sprocket
2. Lower Sprocket

Figure 3-98

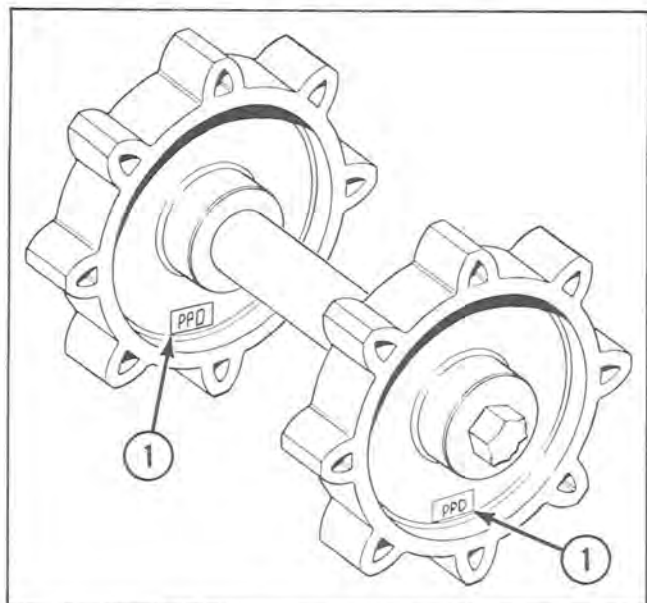
Repair of Drive Shaft

1. Turn the bearing by hand. If the bearing binds, has excessive end play or is rough, it must be replaced. Remove the snap ring (Figure 3-99). Use a puller to remove the bearing. Be careful not to damage the oil seal.
2. Check the drive shaft for distortion. Check the splined end for chipped, nicked or broken splines.
3. Check the drive sprockets for excessive wear. To remove drive sprockets, position the drive shaft vertically on a wood block to protect the drive shaft. Lightly tap off the sprockets with a rubber mallet. When reassembling the drive sprockets, make sure the index marks (ppd) are aligned as shown in Figure 3-100.



1. Drive Shaft
2. Drive Sprocket
3. Spacer
4. Oil Seal
5. Bearing
6. Snap Ring

Figure 3-99

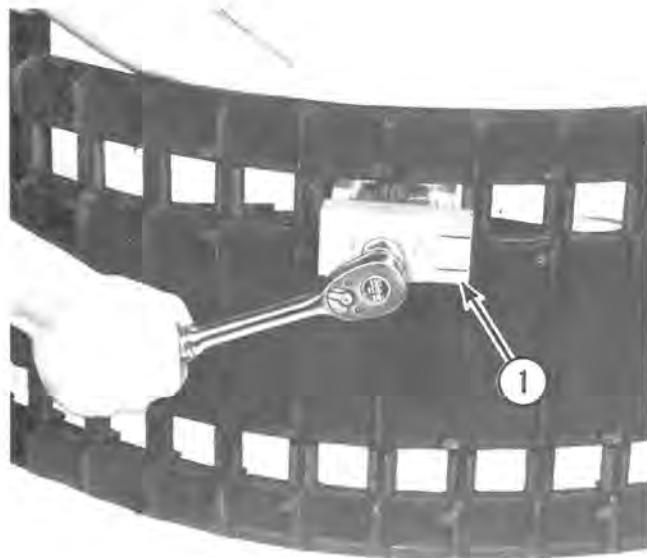


1. Alignment Marks (ppd)

Figure 3-100

Repair of the Track

1. Check track for cracks, tears and gouges.
2. Check for broken, worn or missing clips. Remove old clips.



1. Track Clip Tool Assembly

Figure 3-101

To install new clip, position it on track and compress with track clip tool assembly (tool no. 205088) as shown in Figure 3-101.

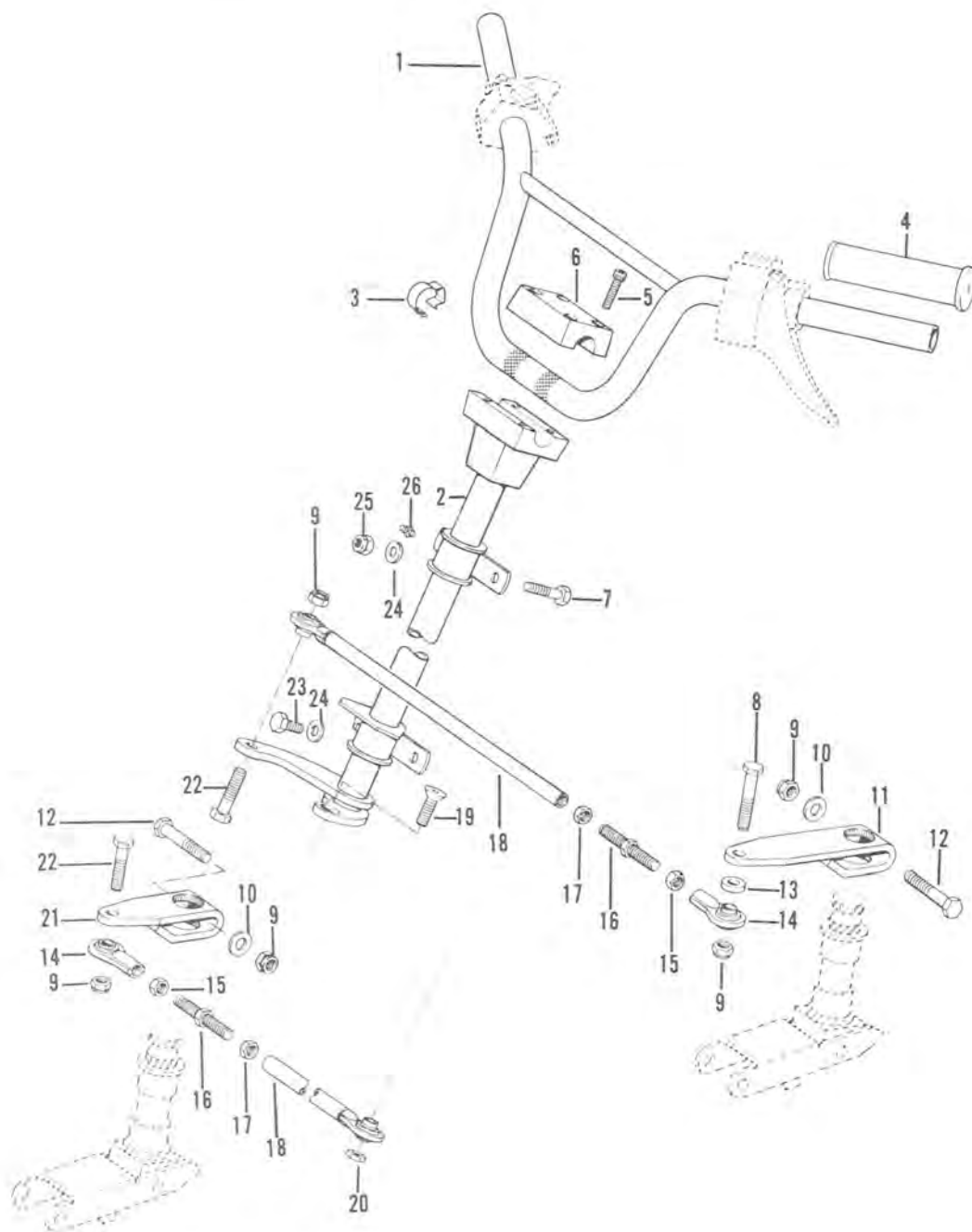
Drive Shaft and Track Installation

1. Insert track onto chassis tunnel.
2. Protect drive shaft splines and insert splined end of drive shaft through the chain case hole, and insert bearing and oil seal into the bearing housing.
3. Place sprocket, chain, and washer on the drive shaft, and secure with jam nut. Tighten nut to 55 ft. lbs. (7.61 kg-m).
4. Clean chain case gasket surfaces, and install new O-rings and gasket.
5. Secure chain case cover to chain case, and tighten capscrews and washers to 20 ft. lbs. (2.77 kg-m).
6. Insert speedometer key into chain case if the snowmobile is so equipped. Hand tighten speedometer drive adapter, and insert nose pan plug into position.
7. Lubricate chain case and bearing as specified in Section 2.
8. Adjust drive chain tension as described in Section 2.
9. Install the drive belt.
10. Adjust the track as described in Section 2.

Steering and Skis

Handlebars and Column Removal

1. Disconnect electrical connectors from the circuit board so handlebars can be removed.
2. Disconnect the control cables from the handles.
3. Remove four mounting screws (5, Figure 3-102) from the handle holder (6). The handlebars can now be removed.

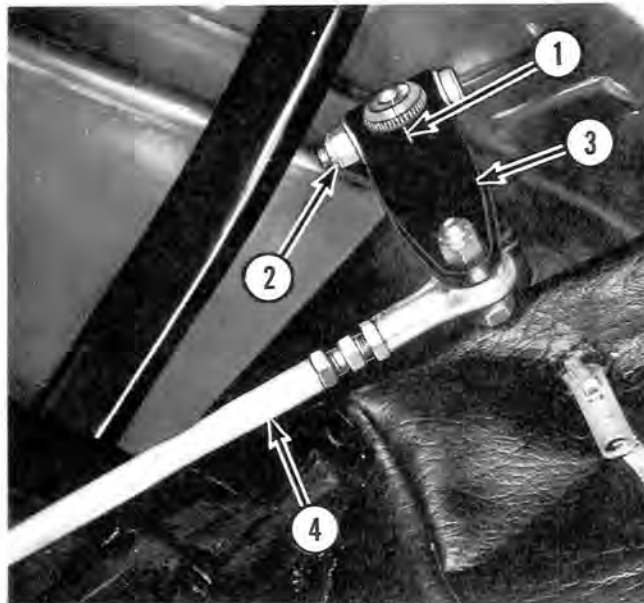


- | | | |
|------------------|------------------------|-------------------------|
| 1. Handlebar | 11. Steering Arm, Long | 21. Steering Arm, Short |
| 2. Handle Pole | 12. Screw | 22. Screw |
| 3. Wire Clamp | 13. Spacer | 23. Screw |
| 4. Handle Grip | 14. Tie Rod End | 24. Washer |
| 5. Screw | 15. Jam Nut | 25. Nut |
| 6. Handle Holder | 16. Stud | 26. Grease Fitting |
| 7. Screw | 17. Jam Nut | |
| 8. Screw | 18. Rod | |
| 9. Nut | 19. Screw | |
| 10. Washer | 20. Nut | |

Figure 3-102

Steering Arms and Skis Removal

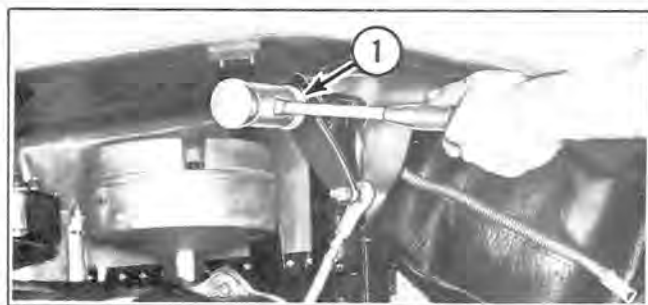
1. Scribe an alignment mark on the steering arm and spindle to aid in installation. (Figure 3-103).



1. Alignment Mark
2. Nut
3. Steering Arm
4. Steering Rod

Figure 3-103

2. Remove the nuts from the steering arm retaining bolts. Do not remove the bolts until the steering rods are removed.
3. Remove the steering rod bolts and note the numbers and positions of spacers (13, Figure 3-102). Rotate the spindle until the steering arm bolt can be removed.
4. Position the snowmobile on its side. Force the spindle from the steering arm by tapping with a soft mallet. (Figure 3-104).



1. Spindle

Figure 3-104

5. Remove one ski spindle bushing from top of snowmobile chassis and one bushing from underneath chassis
6. Remove the steering rod bolts from the steering arms. Remove the steering arms.

Steering Rods and Steering Column Removal

NOTE: Engine is removed for access.

1. To remove the steering rods, remove screws and nuts which secure the steering rods to the steering column flange.
2. To remove the steering column, remove two bolts which secure it to the weld assembly and two bolts and locknuts which secure it to the steering support assembly.

Repair

1. Clean all steering components thoroughly.
2. Inspect parts for wear and damage. Refer to Figure 3-102 for parts location and identification. Replace parts as required.

Installation

1. Install the steering rods to the steering column and secure with screws and nuts. Tighten nuts to 35 ft. lbs. (4.74 kgm).
2. Slide the steering column into position. Apply Loctite to screws and secure the lower steering column bracket with two screws and washers. Tighten screws to 35 ft. lbs. (4.74 kgm). Secure the upper steering column bracket with two screws, washers and nuts. Tighten screws to 10 ft. lbs. (1.38 kgm).
3. Install the steering arms and secure the steering rods to the steering arms.
4. Position one bushing on the ski spindle and install the spindle in position on the steering arm. Install the remaining bushing. Match alignment marks made on the ski spindle during disassembly.
5. Install handlebars and secure with four mounting screws.
6. Attach electrical connectors.
7. Align the skis as described in Section 2. After alignment, check mounting hardware for proper torque.

Repair of the Skis

1. Clean the skis thoroughly to remove dirt and grease. Paint as required to prevent rust.
2. Inspect skis for wear and damage. See Figure 3-105 for parts location and identification.

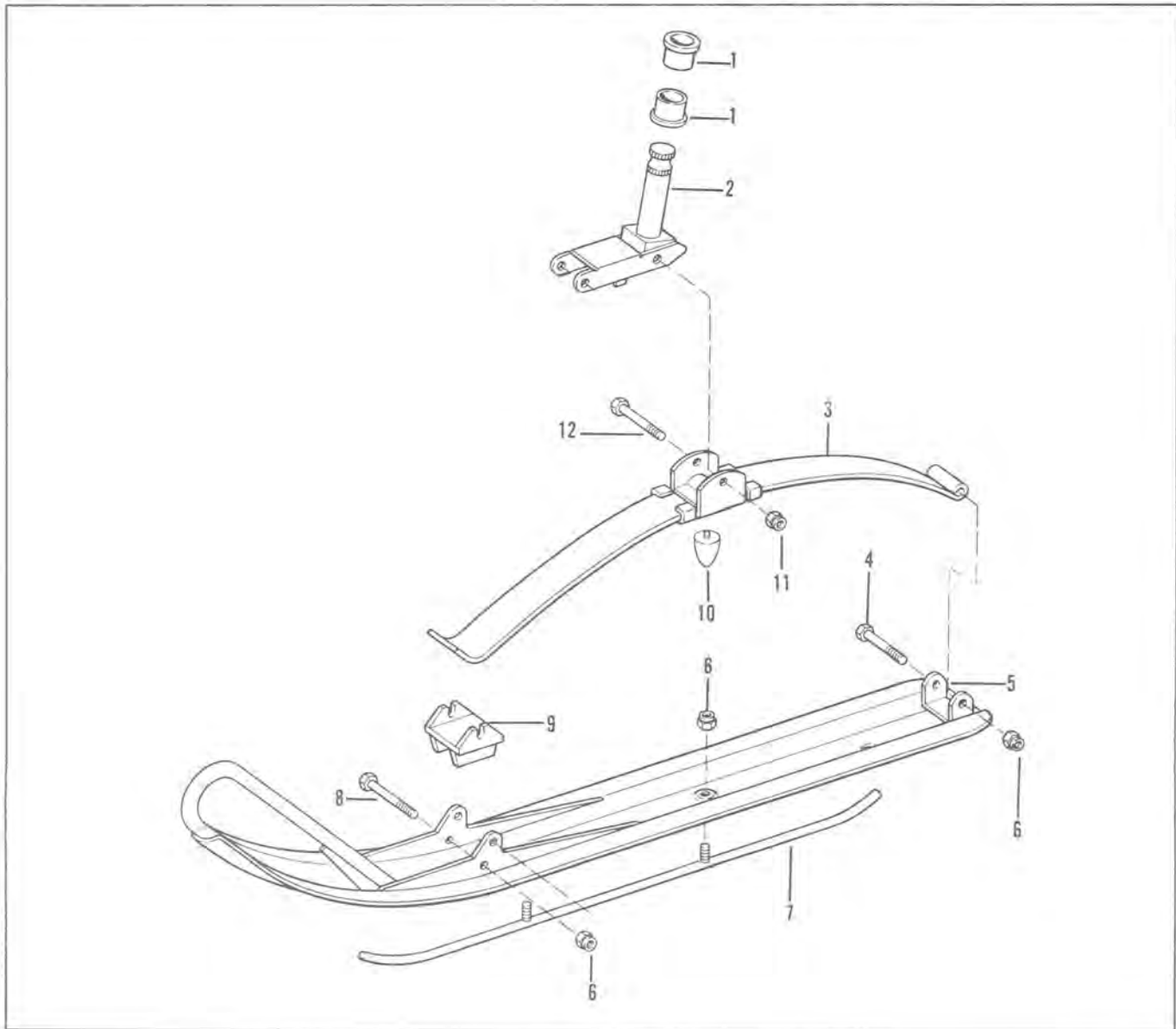
Skeg Replacement

1. Remove nuts (6, Figure 3-105) securing skeg to ski and remove skeg.

2. To install skeg, grasp ends of skeg and bend skeg until the two studs on skeg are aligned with holes in ski. Insert skeg studs through holes in ski, and secure skeg to ski using two nuts (6, Figure 3-105). Tighten nuts to 15 ft. lbs. (2,07 kgm).

Ski Spindle Replacement

1. Remove the nut (11) and screw (12) which secure the spindle to the ski saddle. The nut must be removed first because the ski saddle is threaded. (Figure 3-105).



- | | |
|------------|--------------|
| 1. Bushing | 7. Skeg |
| 2. Spindle | 8. Screw |
| 3. Spring | 9. Rub Strip |
| 4. Screw | 10. Bumper |
| 5. Ski | 11. Nut |
| 6. Nut | 12. Screw |

Figure 3-105

2. Lift the spindle from the ski saddle.
3. To install, apply low-temperature grease to the unthreaded portion of the screw (12). Position the spindle on the ski saddle and secure with screw. Tighten screw to 30 ft. lbs. (4.15 kgm).

Make sure the head of the capscrew is on the outside of the machine.

NOTE: On some replacement spindles, the spindle may be too wide for the ski saddle. Grind the spindle if necessary for a proper fit.

4. Install the nut (11) and tighten to 30 ft. lbs. (4.15 kgm).

Ski Spring Replacement

1. Remove the spindle from the ski saddle.
2. Place the ski in a vise and compress spring about one inch. Remove the screw (8) and nut (6) which secure the front of the spring. Slowly release vise pressure.

CAUTION:

When tightening the vise, be sure ski is securely positioned in vise. Spring pressure will tend to force ski to rotate resulting in possible damage.

3. Remove the screw (4) and nut (6), and remove the spring.
4. To install the spring, position the end of the spring in the rear ski mounting bracket. Secure with screw (4) and nut (6) and tighten the nut to 20 ft. lbs. (2.76 kgm).

NOTE: Install nut (6) on inside of ski.

5. Position the rub strip (9) and front of spring on the front ski mounting bracket.
6. Place the ski in a vise and compress the spring until the screw (8) and nut (6) can be installed. Tighten nut to 35 ft. lbs. (4.74 kgm). Remove from vise.

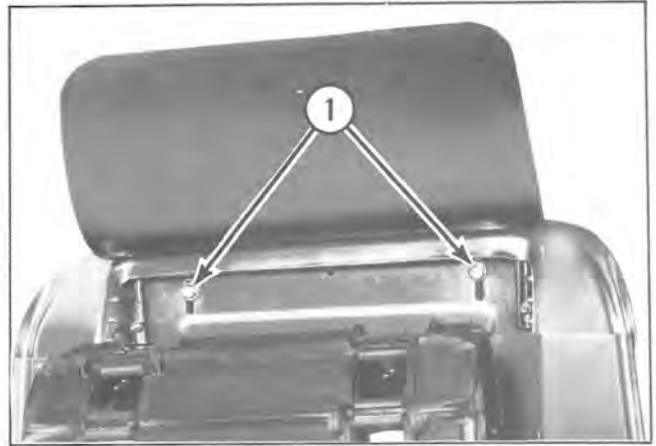
NOTE: Install nut (6) on inside of ski.

7. Install the spindle.

Seat

Removal

1. Remove the two seat mounting bolts (Figure 3-106).



1. Seat Mounting Bolts

Figure 3-106

2. Unplug the tail and brake light wiring harness from the circuit board (Figure 3-107).
3. Lift the seat from the snowmobile.



1. Tail and Brake Light Connector

Figure 3-107

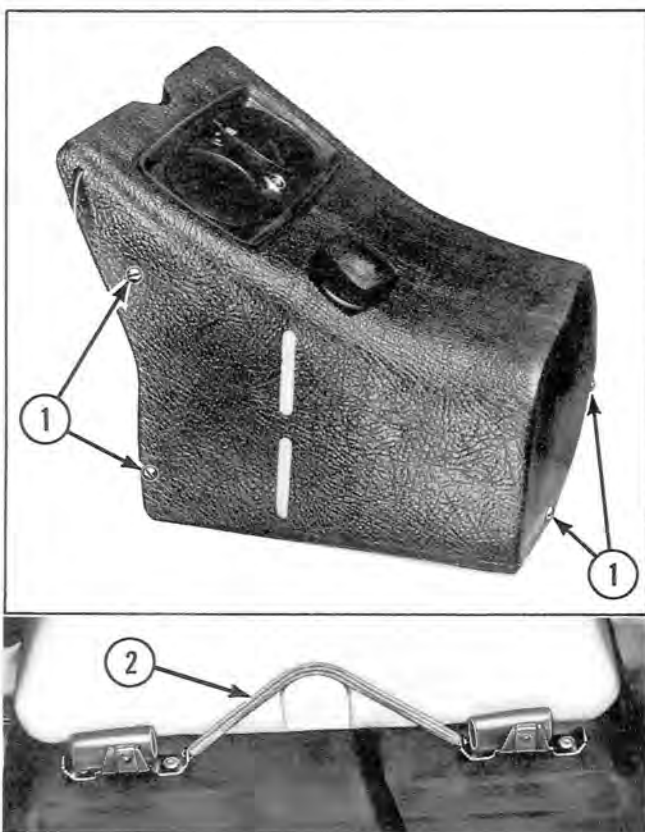
Installation

1. Position the seat on the snowmobile.
2. Connect the seat brackets and secure with two seat mounting bolts.
3. Connect the tail and brake light wiring harness to the circuit board.

Fuel Tank

Removal

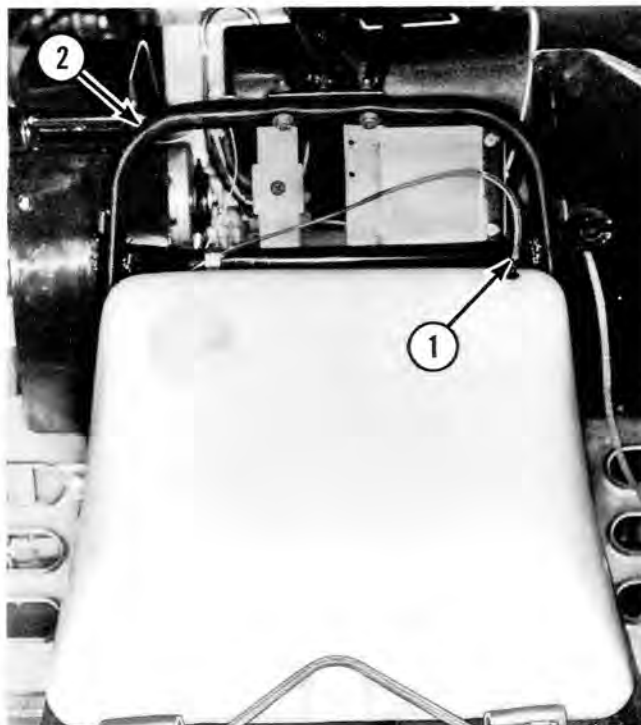
1. Disconnect speedometer cable from gauge.
2. Unplug speedometer, tachometer and ignition switch.
3. Remove the seat and fuel cap.



1. Console Holddown Screw
2. Holddown Spring

Figure 3-108

4. Remove six console holddown screws, console, and release the fuel tank holddown spring. (Figure 3-108).



1. Vent Tube
2. Upper Steering Mount

Figure 3-109

5. Disconnect the fuel line and free the vent tube from the upper steering mount. (Figure 3-109).
6. Remove the fuel tank from the snowmobile.

Installation

1. Position the fuel tank in the snowmobile.
2. Connect the fuel line and secure the vent tube in the upper steering mount.
3. Secure the fuel tank holddown spring and install the console with the six console holddown screws.
4. Plug in speedometer, tachometer and ignition switch.
5. Connect speedometer cable.
6. Install the fuel cap and seat.

APPENDIX

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Fuel and Oil Recommendations

WARNING

Gasoline is extremely flammable and highly explosive under certain conditions. Insure adequate ventilation when fueling the snowmobile and never smoke or allow sparks or open flame near fuel system.

Your Kawasaki Snowmobile uses a two cycle engine which means oil must be mixed with the gasoline to provide proper internal engine lubrication and cooling.

Oil

We recommend using B.I.A. certified T.C.W. (Two Cycle) oil. These oils are specially formulated to give minimum piston ring varnish and combustion chamber deposits along with excellent lubrication qualities (Figure 4-1).



Figure 4-1

The use of fuel additives such as "tune-up tonics" and "super oils" are NOT RECOMMENDED.

Fuel

Use regular leaded gasoline with a minimum PUMP POST OCTANE NUMBER of 89.

Fuel/Oil Mixture (Ratio)

The fuel-to-oil ratio required is 25 to 1 (25 parts gasoline to 1 part oil). Or, simply stated, 1 quart oil (0.94 liters) to 6.25 gallons gasoline (23.6 liters).

WARNING

Gasoline fumes are heavier than air and can become explosive if exposed to a pilot light from a furnace, hot water heater, etc. Mix fuel or fill the fuel tank only in an area that is well ventilated and free from pilot lights and sparks.

Mixing Fuel/Oil

Always use a clean separate container to mix fuel. Put 2.5 to 3 gallons (11 liters) of gasoline into container. Add 1 quart (0.94 liters) oil and shake the container from side to side. Add the remainder of the gasoline to the container and shake well (Figure 4-2).

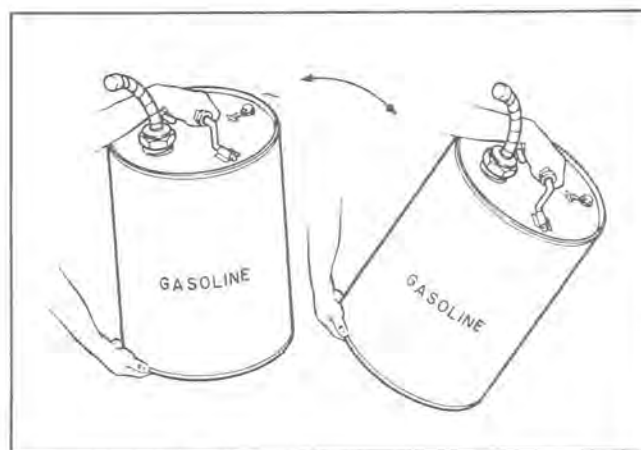


Figure 4-2

CAUTION

Fuel and oil MUST be PROPERLY MIXED or damage to the engine will result.

Before removing filler cap from the fuel tank, remove any ice, snow, or water from around the fuel tank opening to prevent contamination of fresh fuel mixture.

Fill the fuel tank slowly and pour the fuel into the tank using a funnel with a fine mesh screen.

Break-in Procedure

During the first 10 hours of operation, Do not subject the snowmobile engine to continued full speed, do not ride with passengers in deep snow, and do not break trail.

For proper engine break-in, run machine on hard packed snow at approximately 1/2 to 3/4 throttle, with occasional bursts to full speed. Limit the full speed operation to 1-1/2 to 2 minutes then return to cruising speed for 10 to 15 minute interval. After 10 hours of operation, or 2 tanks of gasoline are used, break-in is complete.

CONVERSION CHART/Fraction Inch to Decimal Inch to mm

Frac. Inch	Dec. Inch	mm.	Frac. Inch	Dec. Inch	mm.	Frac. Inch	Dec. Inch	mm.	Frac. Inch	Dec. Inch	mm.
	.000400	.0100	13/32	.406250	10.3187		.984259	25.0000		1.800000	45.7196
	.000800	.0200	27/64	.421875	10.7156	63/64	.984375	25.0031		1.811037	46.0000
	.001200	.0300		.433074	11.0000	1	1.000000	25.4001	1-13/16	1.812500	46.0376
	.001600	.0400	7/16	.437500	11.1125		1.023629	26.0000	1-27/32	1.843750	46.8313
	.002000	.0500		.450000	11.4300	1-1/32	1.031250	26.1938		1.850000	46.9896
	.002400	.0600	29/64	.453125	11.5094		1.050000	26.6699		1.850407	47.0000
	.002800	.0700	15/32	.468750	11.9062	1-1/16	1.062500	26.9876	1-7/8	1.875000	47.6251
	.003100	.0800		.472444	12.0000		1.062999	27.0000		1.889777	48.0000
	.003500	.0900	31/64	.484375	12.3031	1-3/32	1.093750	27.7813		1.900000	48.2596
	.003900	.1000	1/2	.500000	12.7000		1.100000	27.9397	1-29/32	1.906250	48.4188
1/128	.007900	.2000		.511814	13.0000		1.102369	28.0000		1.929147	49.0000
	.011800	.3000	33/64	.515625	13.0969	1-1/8	1.125000	28.5751	1-15/16	1.937500	49.2126
1/64	.015625	.3969	17/32	.531250	13.4937		1.141739	29.0000		1.950000	49.5296
	.015700	.4000	35/64	.546875	13.8906		1.150000	29.2097		1.968522	50.0000
	.019700	.5000		.550000	13.9700	1-5/32	1.156250	29.3688	1-31/32	1.968750	50.0063
	.023600	.6000		.551184	14.0000		1.181113	30.0000	2	2.000000	50.8001
	.027600	.7000	9/16	.562500	14.2875	1-3/16	1.187500	30.1626		2.007892	51.0000
1/32	.031250	.7937	37/64	.578125	14.6844		1.200000	30.4797	2-1/32	2.031250	51.5939
	.031500	.8000		.590554	15.0000	1-7/32	1.218750	30.9563		2.047262	52.0000
	.035400	.9000	19/32	.593750	15.0812		1.220483	31.0000		2.050000	52.0695
	.039370	1.0000		.600000	15.2400	1-1/4	1.250000	31.7501	2-1/16	2.062500	52.3876
3/64	.046875	1.1906	39/64	.609375	15.4781		1.259853	32.0000		2.086632	53.0000
	.050000	1.2700	5/8	.625000	15.8750	1-9/32	1.281250	32.5438	2-3/32	2.093750	53.1814
1/16	.062500	1.5875		.629924	16.0000		1.299223	33.0000		2.100000	53.3395
5/64	.078125	1.9844	41/64	.640625	16.2719		1.300000	33.0197	2-1/8	2.125000	53.9751
	.078740	2.0000		.650000	16.5100	1-5/16	1.312500	33.3376		2.126002	54.0000
3/32	.093750	2.3812	21/32	.656250	16.6687		1.338593	34.0000		2.150000	54.6095
	.100000	2.5400		.669294	17.0000	1-11/32	1.343750	34.1313	2-5/32	2.156250	54.7688
7/64	.109375	2.7781	43/64	.671875	17.0656		1.350000	39.2897		2.165372	55.0000
	.118110	3.0000	11/64	.687500	17.4625	1-3/8	1.375000	34.9251	2-3/16	2.187500	55.5626
1/8	.125000	3.1750		.700000	17.7800		1.377963	35.0000		2.200000	55.8795
9/64	.140625	3.5719	45/64	.703125	17.8594		1.400000	35.5597		2.204712	56.0000
	.150000	3.8100		.708664	18.0000	1-13/32	1.406250	35.7188	2-7/32	2.218750	56.3564
5/32	.156250	3.9687	23/32	.718750	18.2562		1.417333	36.0000		2.244112	57.0000
	.157418	4.0000	47/64	.734375	18.6531	1-7/16	1.437500	36.5126	2-1/4	2.250000	57.1501
11/64	.171875	4.3656		.748034	19.0000		1.450000	36.8297	2-9/32	2.281250	57.9439
3/16	.187500	4.7625	3/4	.750000	19.0500		1.456703	37.0000		2.283482	58.0000
	.196850	5.0000	49/64	.765625	19.4469	1-15/32	1.468750	37.3063		2.300000	58.4195
	.200000	5.0800	25/32	.781250	19.8437		1.496073	38.0000	2-5/16	2.312500	58.7376
13/64	.203125	5.1594		.787409	20.0000	1-1/2	1.500000	38.1001		2.322852	59.0000
7/32	.218750	5.5562	51/64	.796875	20.2406	1-17/32	1.531250	38.8938	2-11/32	2.343750	59.5314
15/64	.234375	5.9531		.800000	20.3200		1.535443	39.0000		2.350000	59.6895
	.236220	6.0000	13/16	.812500	20.6375		1.550000	39.3696		2.362226	60.0000
1/4	.250000	6.3500		.826779	21.0000	1-9/16	1.562500	39.6876	2-3/8	2.375000	60.3251
17/64	.265625	6.7469	53/64	.828125	21.0344		1.574817	40.0000		2.400000	60.9594
	.275590	7.0000	27/32	.843750	21.4312	1-19/32	1.593750	40.4813		2.401596	61.0000
9/32	.281250	7.1437		.850000	21.5900		1.600000	40.6396	2-13/32	2.406250	61.1189
19/64	.296875	7.5406	55/64	.859375	21.8281		1.614187	41.0000	2-7/16	2.437500	61.9126
	.300000	7.6200		.866149	22.0000	1-5/8	1.625000	41.2751		2.440966	62.0000
5/16	.312500	7.9375	7/8	.875000	22.2250		1.650000	41.9096		2.450000	62.2294
	.314960	8.0000	57/64	.890625	22.6219		1.653557	42.0000	2-15/32	2.468750	62.7064
21/64	.328125	8.3344		.900000	22.8600	1-21/32	1.656250	42.0688		2.480336	63.0000
11/32	.343750	8.7312		.905519	23.0000	1-11/16	1.687500	42.8626	2-1/2	2.500000	63.5001
	.350000	8.8900	29/32	.906250	23.0187		1.692927	43.0000		2.519706	64.0000
	.354330	9.0000	59/64	.921875	23.4156		1.700000	43.1796	2-17/32	2.531250	64.2939
23/64	.359375	9.1281	15/16	.937500	23.8125	1-23/32	1.718750	43.6563		2.550000	64.7694
3/8	.375000	9.5250		.944889	24.0000		1.732297	44.0000		2.559076	65.0000
25/64	.390625	9.9219		.950000	24.1300	1-3/4	1.750000	44.4501	2-9/16	2.562500	65.0876
	.393704	10.0000	61/64	.953125	24.2094		1.771667	45.0000	2-19/32	2.593750	65.8814
	.400000	10.1600	31/32	.968750	24.6062	1-25/32	1.781250	45.2438		2.598446	66.0000

CONVERSION CHART/Fraction Inch to Decimal Inch to mm cont.

Frac. Inch	Dec. Inch	mm.	Frac. Inch	Dec. Inch	mm.	Frac. Inch	Dec. Inch	mm.	Frac. Inch	Dec. Inch	mm.
2-5/8	2.600000	66.0394	2-31/32	2.952780	75.0000	3-5/16	3.312500	84.1377	3-11/16	3.661449	93.0000
	2.625000	66.6751		2.968750	75.4064	3-11/32	3.343750	84.9314		3.687500	93.6627
	2.637816	67.0000		2.992150	76.0000		3.346485	85.0000		3.700000	93.9792
	2.650000	67.3094	3	3.000000	76.2002		3.350000	85.0892		3.700819	94.0000
2-21/32	2.656250	67.4689	3-1/32	3.031250	76.9939	3-3/8	3.375000	85.7252	3-23/32	3.718750	94.4564
	2.677186	68.0000		3.031520	77.0000		3.385855	86.0000		3.740189	95.0000
2-11/16	2.687500	68.2626		3.050000	77.4693		3.400000	86.3592	3-3/4	3.750000	95.2502
	2.700000	68.5794	3-1/16	3.062500	77.7877	3-13/32	3.406250	86.5189		3.779559	96.0000
	2.716556	69.0000		3.070890	78.0000		3.425225	87.0000	3-25/32	3.781250	96.0439
2-23/32	2.718750	69.0564	3-3/32	3.093750	78.5814	3-7/16	3.437500	87.3127		3.800000	96.5192
2-3/4	2.750000	69.8501		3.100000	78.7393		3.450000	87.6292	3-13/16	3.812500	96.8377
	2.755930	70.0000		3.110260	79.0000		3.464595	88.0000		3.818929	97.0000
2-25/32	2.781250	70.6439	3-1/8	3.125000	79.3752	3-15/32	3.468750	88.1064	3-27/32	3.843750	97.6314
	2.795300	71.0000		3.149635	80.0000	3-1/2	3.500000	88.9002		3.850000	97.7891
	2.800000	71.1194		3.150000	80.0093		3.503965	89.0000		3.858299	98.0000
2-13/16	2.812500	71.4376	3-5/32	3.156250	80.1689	3-17/32	3.531250	89.6939	3-7/8	3.875000	98.4252
	2.834670	72.0000	3-3/16	3.187500	80.9627		3.543339	90.0000		3.897669	99.0000
2-27/32	2.843750	72.2314		3.189005	81.0000		3.550000	90.1691		3.900000	99.0591
	2.850000	72.3893		3.200000	81.2793	3-9/16	3.562500	90.4877	3-29/32	3.906250	99.2189
	2.874040	73.0000	3-7/32	3.218750	81.7564		3.582709	91.0000		3.937043	100.0000
2-7/8	2.875000	73.0251		3.228375	82.0000	3-19/32	3.593750	91.2814	3-15/16	3.937500	100.0130
	2.900000	73.6593	3-1/4	3.250000	82.5502		3.600000	91.4392		3.950000	100.3291
2-29/32	2.906250	73.8189		3.267745	83.0000		3.622079	92.0000	3-31/32	3.968750	100.8060
	2.913410	74.0000	3-9/32	3.281250	83.3439	3-5/8	3.625000	92.0752		3.976413	101.0000
2-15/16	2.937500	74.6126		3.300000	83.8192		3.650000	92.7092	4	4.000000	101.6000
	2.950000	74.9293		3.307115	84.0000	3-21/32	3.656250	92.8639			

DRILL SIZES

Inch Decimal Equivalent

80	.0135	61	.039	42	.0935	23	.154	4	.209		
79	.0145	60	.040	41	.096	22	.157	3	.213		
78	.016	59	.041	40	.098	21	.159	2	.221		
77	.018	58	.042	39	.0995	20	.161	1	.228	O	.316
76	.020	57	.043	38	.1015	19	.166			P	.323
75	.021	56	.0465	37	.104	18	.1695	A	.234	Q	.332
74	.0225	55	.052	36	.1065	17	.173	B	.238	R	.339
73	.024	54	.055	35	.110	16	.177	C	.242	S	.348
72	.025	53	.0595	34	.111	15	.180	D	.246	T	.358
71	.026	52	.0635	33	.113	14	.182	E	.250	U	.368
70	.028	51	.067	32	.116	13	.185	F	.257	V	.377
69	.02925	50	.070	31	.120	12	.189	G	.261	W	.386
68	.031	49	.073	30	.1285	11	.191	H	.266	X	.397
67	.032	48	.076	29	.136	10	.1935	I	.272	Y	.404
66	.033	47	.0785	28	.1405	9	.196	J	.277	Z	.413
65	.035	46	.081	27	.144	8	.199	K	.281		
64	.036	45	.082	26	.147	7	.201	L	.290		
63	.037	44	.086	25	.1495	6	.204	M	.295		
62	.038	43	.089	24	.152	5	.2055	N	.302		

English to Metric Conversions

METRIC EQUIVALENTS

m indicates one meter
 cm indicates one hundredth of a meter
 mm indicates one thousandth of a meter
 km indicates one thousand meters

LENGTH

1 mm. - 0.03937 In.
 Cm. - 0.3937 In.
 Meter - 3.28 Ft.
 Meter - 1.094 Yd. (39.37 In.)
 Kilom. - 0.621 Mile

In. - 2.54 Cm.
 Ft. - 0.3048 Meter
 Yd. - 0.9144 Meter
 Mile - 1.61 Kilom.

AREA

Sq. Cm. - 0.1550 Sq. In.
 Sq. M. - 10.76 Sq. Ft.

Sq. In. - 6.45 Sq. Cm.
 Sq. Ft. - 0.0929 Sq. M.

VOLUME

Cu. Cm. - 0.061 Cu. In.
 Cu. M. - 35.315 Cu. Ft.

Cu. In. - 16.38 Cu. Cm.
 Cu. Ft. - 0.028 Cu. M.

CAPACITY

Liter - 0.0353 Cu. Ft.
 Liter - 0.2642 Gallons (U.S.)
 Liter - 61.023 Cu. In.
 Liter - 2.202 lb. of fresh water at 62°F.

Cu. Ft. - 28.32 Liters
 Gal. - 3.785 Liters
 Cu. In. - 0.0164 Liter

CONVERSION FACTORS

Inches to centimeters (cm) Multiply by 2.54
 Meters (m) to yards Multiply by 70 and divide by 64
 Kilometers (km) to miles Multiply by 5 and divide by 8
 Cubic inches to cubic centimeters Multiply by 16.39
 Grams to ounces Multiply by 567 and divide by 20
 Liters to U.S. pints Multiply by 95 and divide by 20
 Degrees Centigrade to degrees Fahrenheit Multiply by 9, divide by 5 and add 32
 Degrees Fahrenheit to degrees Centigrade Subtract 32, multiply by 5 and divide by 9

WEIGHT

Gram - 15.432 Grains
 Gram - 0.0353 Oz.
 Kilogram - 2.2046 lbs.
 Kilogram - 0.0011 Ton (Sht)
 Met. Ton - 1.1025 Ton (Sht)
 Grain - 0.0648 Gram

Oz. - 28.35 Gram
 Lb. - 0.454 Kilgm.
 Ton (Sht) - 907.18 Kilgm.
 Ton (Sht) - 0.907 Metric Ton
 Ton (Sht) - 2000 lb.

PRESSURE

1 Kilogram per Sq. Cm. - 14.2233 Lbs. per Sq. In.
 1 Lb. per Sq. In. - 0.070307 Kilgms. per Sq. Cm.
 1 Kilogram per Sq. Meter - 0.20482 Lbs. per Sq. Ft.
 1 Lb. per Sq. Ft. - 4.8824 Kilgms. per Sq. Meter
 1 Kilgm. per Sq. Cm. - 0.96784 Standard Atmosphere
 1 Standard Atmosphere - 1.033228 Kilgm. per Sq. Cm.
 1 Metric Atmosphere - 1.033228 Kilgm. per Sq. Cm.
 1 Std. Atmosphere - 4.6959 Lbs. per Sq. In.

CONVERSION TABLE/GALLON to QUART to PINT to LITER

GALLON	QUART	PINT	LITER
1	= 4	= 8	= 3.785
1/4	= 1	= 2	= 0.946
1/8	= 1/2	= 1	= 0.473
.264	= 1.056	= 2.113	= 1

One Imperial Gallon - 1.2 US gallons or 4.537 liters or 277.3 C.I. One liter - 1000 cc

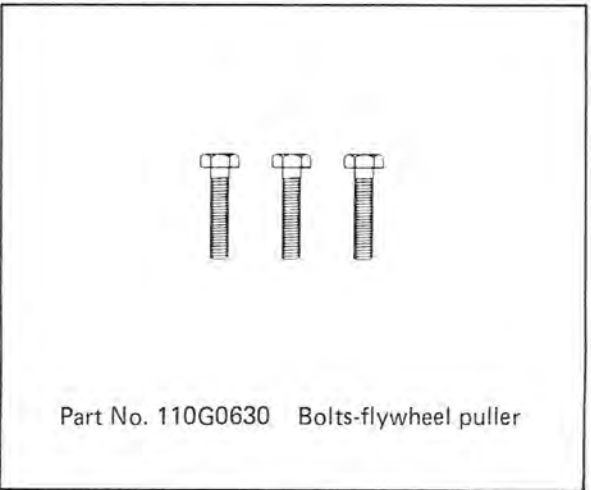
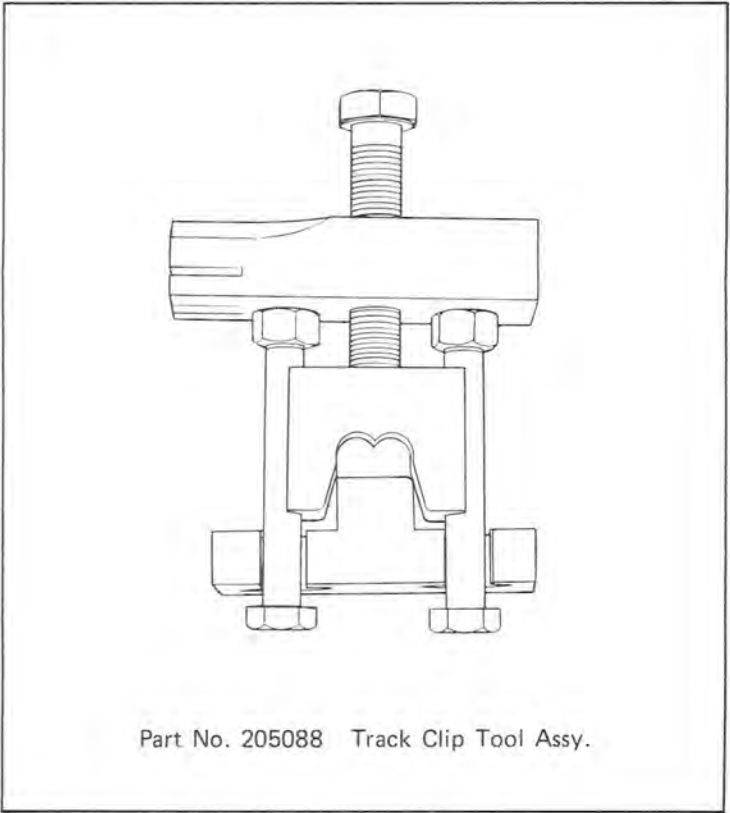
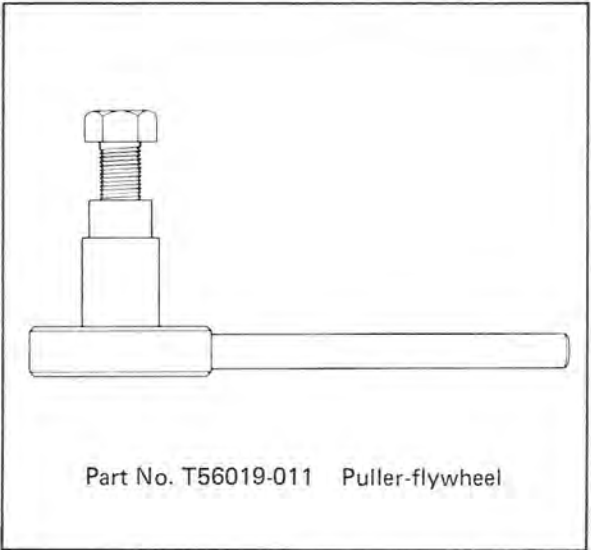
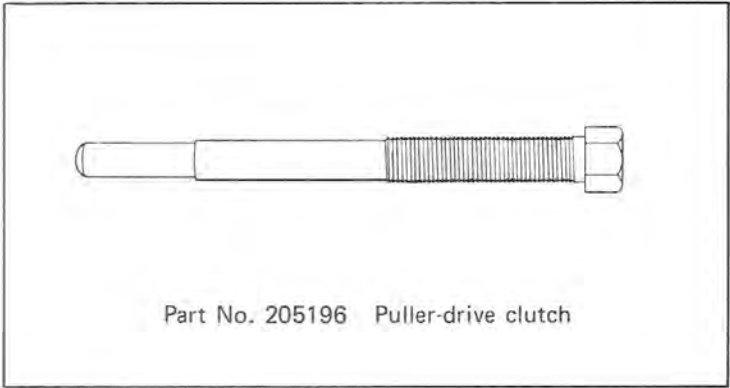
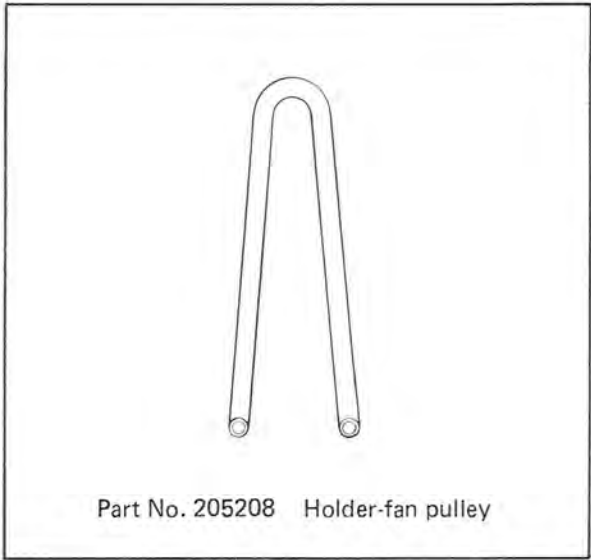
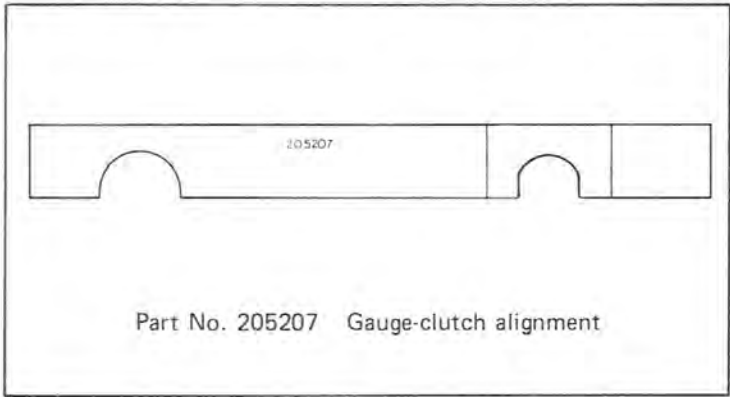
UNIT CONVERSION TABLE

cc	x	.0610	=	cu.in.
cc	x	.02816	=	fl.oz. (imp.)
cc	x	.03381	=	fl.oz. (U.S.)
cu. in.	x	16.39	=	cc
fl. oz.(imp.)	x	35.51	=	cc
fl. oz.(U.S.)	x	29.57	=	cc
ft-lbs	x	12	=	in-lbs
ft-lbs	x	.1383	=	kg-m
gal. (imp.)	x	4.546	=	liters
gal. (imp.)	x	1.201	=	gal. (U.S.)
gal. (U.S.)	x	3.7853	=	liters
gal. (U.S.)	x	.8326	=	gal. (imp.)
grams	x	.03527	=	oz.
in.	x	25.40	=	mm
in-lbs	x	.0833	=	ft-lbs
in-lbs	x	.0115	=	kg-m
kg	x	2.2046	=	lb.
kg	x	35.274	=	oz.
kg-m	x	7.233	=	ft-lbs
kg-m	x	86.796	=	in-lbs
kg/cm ²	x	14.22	=	lbs/sq.in.
km	x	.6214	=	miles
lb.	x	.4536	=	kg
lb/sq. in.	x	.0703	=	kg/cm ²
liter	x	28.16	=	fl.oz. (imp.)
liter	x	33.81	=	fl.oz. (U.S.)
liter	x	.8799	=	qt. (imp.)
liter	x	1.0567	=	qt. (U.S.)
meter	x	3.281	=	ft.
mile	x	1.6093	=	km
mm	x	.03937	=	in.
oz.	x	28.35	=	grams
qt. (imp.)	x	1.1365	=	liters
qt. (imp.)	x	1.201	=	qt. (U.S.)
qt. (U.S.)	x	.9463	=	liters
qt. (U.S.)	x	.8326	=	qt. (imp.)
°C → °F:	$\frac{9(^{\circ}\text{C} + 40)}{5} - 40 = ^{\circ}\text{F}$			
°F → °C:	$\frac{5(^{\circ}\text{F} + 40)}{9} - 40 = ^{\circ}\text{C}$			

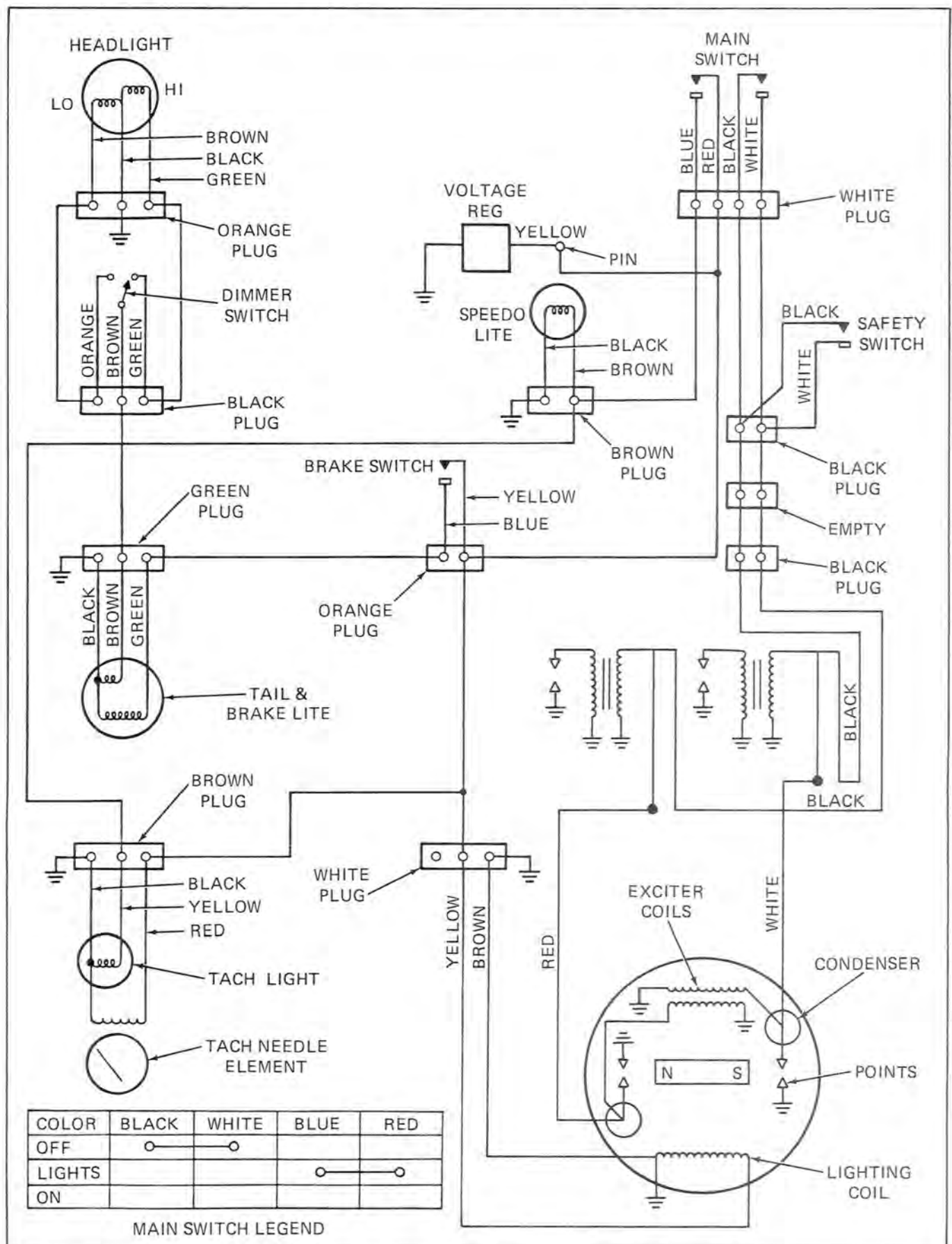
LIST OF ABBREVIATIONS

ABDC.....	after bottom dead center
ATDC.....	after top dead center
BBDC.....	before bottom dead center
BDC.....	bottom dead center
BTDC.....	before top dead center
cc.....	cubic centimeters
cu. in.	cubic inches
fl. oz.	fluid ounces
ft.	foot, feet
ft-lbs.....	foot-pounds
gal.	gallon, gallons
hp.....	horsepower
in.	inch, inches
in-lbs.....	inch-pounds
kg.....	kilogram, kilograms
kg/cm ²	kilograms per square centimeter
kg-m.....	kilogram-meters
km.....	kilometer
kph.....	kilometers per hour
lb., lbs.	pound, pounds
lbs/sq.in.	pounds per square inch
ℓ.....	liter
m.....	meter, meters
mi.	mile, miles
mm.....	millimeters
mph.....	miles per hour
oz.	ounce, ounces
psi.....	pounds per square inch
qt.	quart, quarts
r.p.m.	revolutions per minute
sec.	second, seconds
SS.....	standing start
TDC.....	top dead center
".....	inch, inches

Special Service Tools



340 AND 440 ASTRO WIRING DIAGRAM



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